

# Technologyforecast

Jornal trimestral  
Setembro de 2008

Bem-vindos  
ao nosso novo  
**Technology  
Forecast!**

*Nesta edição*

**04**

1998: Globalização...  
2008: Mudanças contínuas

**28**

Gestão da complexidade  
de TI nas organizações

**40**

Novas tecnologias  
nascidas na Web 2.0

**60**

“Plataforma de gestão  
inteligente de negócios”

Caro Executivo de TI,

É com satisfação que encaminhamos a edição de lançamento do novo formato de nossa publicação **Technology Forecast**: agora mais *light* e com frequência trimestral. O objetivo permanece o mesmo: prover perspectivas e pontos de vista avançados que ajudem nossos clientes a entender as últimas tendências na aplicação de tecnologias emergentes, de forma a obter vantagens competitivas em seus negócios.

O **Technology Forecast** é o resultado de pesquisas coordenadas pelo nosso **Center for Advanced Research**, que analisa complexos problemas de negócios em busca de soluções eficazes e inovadoras. A equipe de consultores de TI da PricewaterhouseCoopers no Brasil participa desses estudos globais e está à sua disposição para conversar mais sobre os temas aqui tratados ou outros de seu interesse.

Nesta edição abordamos a contribuição de alguns direcionares de TI nos últimos 10 anos (Y2K, e-business, ERP's) para o surgimento de novas questões a serem consideradas nas agendas estratégicas das organizações, tais como:

- (i) **gestão da crescente complexidade de TI nas organizações** (aquisições, integração entre plataformas, novas tecnologias, outsourcing, etc.);
- (ii) incorporação de **novas tecnologias nascidas na Web 2.0** de redes relacionais sendo aplicadas no ambiente corporativo (*blogs, wikis, mashups, tagging, etc.*), e;
- (iii) fusão dos conceitos de *business intelligence, business process management* e *business rules management* em uma única suíte de funções combinadas, conhecida como uma **“plataforma de gestão inteligente de negócios”**.

A partir de agora o **Technology Forecast**, abordará um tema por edição, com uma matéria inicial mostrando a perspectiva de negócio sobre o assunto, uma segunda matéria, contendo mais detalhes técnicos, e estudos de casos que demonstrem diferentes visões sobre o tema em questão.

Bem-vindos ao nosso novo **Technology Forecast** e boa leitura!

Ricardo Neves  
Líder de Consultoria em Tecnologia da Informação  
no Brasil e América do Sul

# Technologyforecast

A quarterly journal  
Summer 2008



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# Message from the editor



Welcome to the relaunch of PricewaterhouseCoopers' *Technology Forecast*. To our former readers who valued past publication of *Technology Forecast*, we welcome you back. Our goal remains the same: to provide insight, forward-looking perspective, and points of view that can once again help you understand, anticipate, and deliver the competitive advantage to be gained from new and emerging technologies. To a new generation of readers, we look forward to engaging with you in conversation—and debate—about the future of technology in the enterprise.

Experienced readers of *Technology Forecast* books will immediately notice a difference. We've lost weight! More specifically, a journal format will allow more frequent publication and will bring more immediacy to the topics we cover.

Commencing with the next issue of the new *Technology Forecast*, the focus will be on one theme per issue. We'll explore that theme first in one article at the level of the general business audience and in more technical detail in a second article. And then, case studies will provide additional perspectives on that overarching theme.

A print publication can cover only a small portion of the enterprise technology landscape. For additional perspectives and for greater depth on individual topics, our Web site will contain a growing collection of associated material, including white papers, case studies, interviews, and quick-hitting perspectives on late-breaking developments. We hope you'll want to take time to visit [www.pwc.com/techforecast](http://www.pwc.com/techforecast).

This first issue of the new *Technology Forecast* looks at today's enterprise from two perspectives: (1) the combined impact of Y2K remediation, e-business, and enterprise-resource-planning (ERP) adoption from their emergence 10 years ago through to the present day and (2) how today's business imperatives and technologies will transform enterprises during the next 10 years. The article "**1998: Globalization . . . 2008: Continuous change**" describes how enterprises are currently in the early stages of more effectively leveraging technology so as to enhance their agility around strategic decision making. Business leaders are recognizing that responding to multiple simultaneous changes in the business environment is now the norm.

We see strong parallels today between Y2K remediation and IT-complexity remediation and between e-business adoption and Web 2.0 adoption in the

enterprise, together with ERP suite adoption and the emergence of a suite that comprises business intelligence, business process management, and business rules management. Vendors are providing new tools in support of a new model of management: a collaborative, distributed model of accountability and of authority to act, complemented by more-comprehensive approaches to managing risk. The opportunity is there to greatly enhance the quality of decision making throughout the enterprise. Will your enterprise engage with that opportunity? Will it leverage the risks and rewards in proper proportion?

Two of our interviewees in this issue offer context for and perspective on trends in enterprise technology and discuss the lessons they've learned about technology adoption patterns. **Henning Kagermann**, chairman of the executive board and CEO of SAP AG, contrasts fast-moving startups with what his customers expect from SAP, with a clear role for both. **Lakshmi Narayanan**, vice chairman of Cognizant, discusses the emergence of the global delivery model that originated with Y2K remediation and how productivity in services is extending the life of offshoring.

The three articles that follow then break down the individual themes that compose the foundation for enterprise transformation. The article "**Making complexity manageable**" describes IT complexity, analyzes what's driving it, and covers the approaches enterprises are taking to move from its episodic remediation to ongoing management.

The article "**Operational Web 2.0**" focuses on the rise in enterprise use of Web 2.0. Even though Web 2.0 is still in its early days, every person we interviewed for this issue was sure it would have a huge impact on the enterprise. We offer a narrative of the ways that Web 2.0, combined with the other trends described here, can enhance management decision making.

To back up our focus on Web 2.0, **Richard Rosenblatt**, cofounder, chairman, and CEO of Demand Media and former chairman of MySpace, is interviewed on the rise of user-created content. And **John Crupi**, chief technology officer of JackBe, takes Web 2.0 fully into the enterprise context by describing the increasing importance of mashups.

Finally, the article "**Bringing order to chaos**" looks the furthest out. In this article we describe the adoption patterns of business intelligence, business process, and business rules software and the potential to consolidate those three tools into a packaged suite.

I welcome you to these pages dedicated to understanding the future of information technology in the enterprise. And I want to hear from you! Do share your own thoughts and experiences with us as together we accept the ongoing challenge to leverage technology to create more-competitive, more-innovative, and more-customer-friendly enterprises.



Paul Horowitz  
Partner  
Technology Leader

# 1998: Globalization...

## 2008: Continuous change

Are agile management approaches the recipe for success in the face of change? How can IT contribute to making management more agile?



Globalization. Business-IT alignment. Today, they're givens, but 10 years ago, not so much. In 1998, new forces of globalization were reshaping the business environment, generating new competitors, and demanding new sourcing strategies and markets. At the same time, three other trends were at work: Y2K readiness and e-business initiatives dominated IT spending plans. And "big-bang" enterprise-resource-planning (ERP) deployments defined new roles and departments for business and IT while making others obsolete.

It was a perfect storm that for many companies resulted in improved alignment between business and technology. IT systems ultimately redefined business models, culminating for successful companies in the extended virtual enterprise, an outcome that most did not fully anticipate when they started. Arriving at a successful outcome was often a long, drawn-out process.

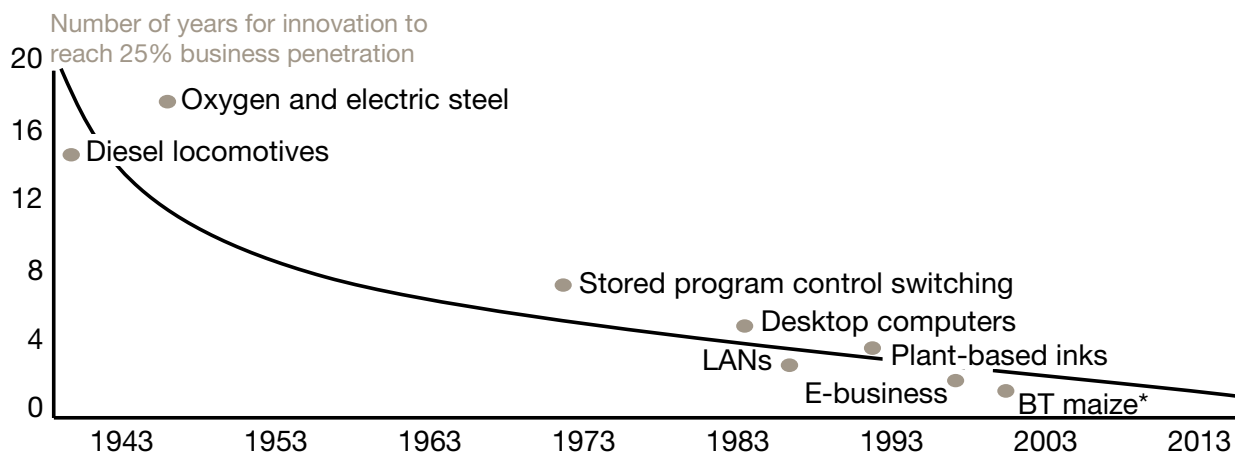
Today, we find the enterprise on the cusp of a similar shift. Major business forces are fueling strategic IT investments that promise to transform the enterprise. Instead of a specific change agent, such as globalization or Y2K, the emerging business driver is change itself and the continuous nature of change. And instead of e-business and ERP packages, new business performance platforms and interactive Web technologies are the tools of choice.

Ten years ago, the enterprise and with it the IT organization viewed enterprise transformation as a short-term, tactical process: define requirements, design a solution, implement the change, and retire the project. Even though these projects would usually run for multiple years, the assumption was that requirements set in year one would still be viable at the conclusion of the project in, say, year four.

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The new imperative of managing continuous change is the business driver that, together with key technology trends, will fuel the next enterprise transformation. Initiatives that improve management of IT complexity, leverage Web 2.0 capabilities, and adopt more efficient business performance platforms will be the key technology drivers. They will enable agile enterprise management and spur the development of new business models, organizational designs, and competitive responses.

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\*Transgenic maize (corn) has been deliberately genetically modified to have agronomically desirable traits. Traits that have been engineered into corn are resistance to herbicides and incorporation of a gene that codes for the *Bacillus thuringiensis* (Bt) toxin, protecting plants from insect pests. Hybrids with both herbicide and pest resistance have also been produced. Transgenic maize is currently grown commercially in the United States.

### 1. Years for innovation to reach 25% business penetration

Source: Technology Futures Inc., *Journal of Business Strategy*, 2002

Today change is happening at a rate that does not afford organizations the luxury of managing one major change at a time. Evidence is all around us, but a telling example can be found in the companies making up the annual Fortune 500 list. If your company was on the list in 1980, there was a 56 percent chance that it was still listed in 1994. But if you were listed in 1994, there was only a 30 percent chance of still being on the list in 2007. Better yet, look at the rapid rate at which enterprises are adopting new technologies. Figure 1 shows that over the last 65 years, the time it takes for 25 percent of enterprises to adopt a technology relevant to their business has dropped considerably.

How does relentless change redefine the nature of management and the structure of an enterprise? And what role should information technology play in re-shaping the enterprise?

### Managing continuous change

The days of multilevel command-and-control organizational hierarchies are gone, flattened by cost pressures and the ability of IT to manage information flows that were once the domain of middle management. And now, with change so endemic to the business environment, these flat organizations must be redesigned to have the agility to deal with continuous change.

We define enterprise agility as the ability to respond to market challenges and opportunities fast enough to enhance or maintain enterprise value. We believe the best way to create an agile business infrastructure is to explicitly define those processes that should be standard to create efficiencies, instead of processes that should enable value-creating flexibility. The decisions about where to allow flexibility are informed by customer willingness to pay a premium for customization and by the anticipation of future business scenarios. Enterprises create agility once they've designed and deployed an

operating model that addresses valued customization and can rapidly adapt to disruptive future scenarios.

Today's business environment continuously raises issues of flexibility at many levels of the enterprise. Even topflight C-suites are challenged to address decisions quickly, resulting in a lack of agility, lost opportunities, and poor corporate performance. To achieve enterprise agility, management itself must be agile.

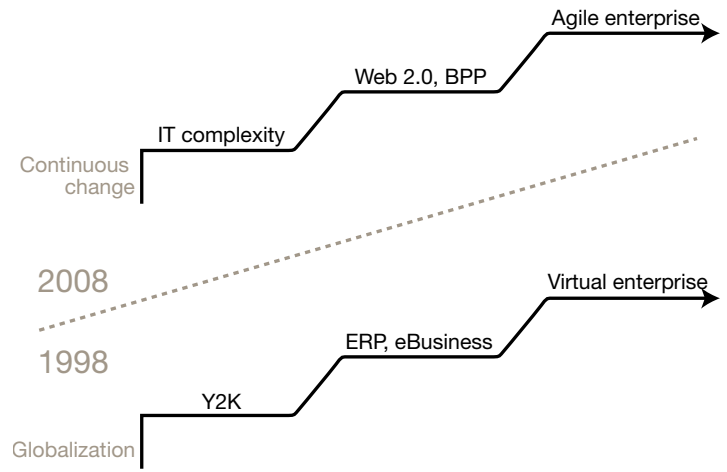
Agile management structures are those that result in highly distributed power and the authority to make strategic decisions. To succeed, this distributed decision making requires three functions from an infrastructure:

- Routes information rapidly to where it is needed
- Provides governance
- Supports instant access to communities of experts

A foundation that enables instant communications to provide decision makers with the best talent, analysis, and insight is a must. The agile management possible with current technology empowers managers to modify business processes as business contexts change.

The new imperative of managing continuous change is the business driver that, together with key technology trends, will fuel the next enterprise transformation. Initiatives that improve management of IT complexity, leverage Web 2.0 capabilities, and adopt more efficient business performance platforms will be the key technology drivers. They will enable agile enterprise management and spur the development of new business models, organizational designs, and competitive responses.

Figure 2 shows the parallels between the previous 10-year cycle and the current cycle. The most important driver today is continuous change instead of globalization, and IT complexity is today's equivalent of the Y2K challenge. New information technologies are available to lift organizations to a higher level of agility.



### 1. Parallels between 1998 and 2008

Source: PricewaterhouseCoopers, 2008

### Agile enterprise management: Not your father's IT

Dealing with continuous change and uncertainty is becoming the fundamental driver of business strategy. While most companies accept the need to define a change-friendly strategy, today's management structures are still heavily influenced by the more stable business environment of the past.

Management has relied on command-and-control hierarchies, appropriate for stable business conditions. But for companies operating in today's dynamic market environments, the top-heavy command-and-control approaches do not perform well. Too many factors are in play: too much information to analyze; too many pricing, positioning, and other product strategy decisions to make; and too many competitors to understand and anticipate. Difficult decisions will no longer be made exclusively in the C-suite, but by business-unit managers and with as little delay as possible.

### How agile management could work in practice

Fluid Nozzles Inc., a fictitious \$3 billion aerospace supplier, is in the process of completing the integration of a \$1 billion company it recently acquired.

At the same time, a patent infringement case is about to go to trial, and a negative judgment could cost Fluid more than \$500 million. Meanwhile, an opportunity for a joint venture in China has emerged, and because of several other possible suitors, the opportunity must be addressed within 10 days. In the past, Fluid would have had to pass; senior management would have had insufficient bandwidth to assess the opportunity and make a decision.

But Fluid determined that success in its market required an agile management approach that moved more decision making to the field. Fluid's vice president for China now reaches out to his internal social network, comprising an international group of lawyers, business development staff, and other business-unit managers, for help.

Senior management has established a set of principles for joint ventures, but this VP needs help with contract language, analytics for revenue sharing, and information about the joint venture partner. He sets up a circle of interest within FluidFaceBook (the company's internal social network) and hosts multiple real-time videoconferences to rapidly come up to speed.

One member of the circle points him to a mashup he developed that combines the internal profitability analytics for Fluid's products and market data for different companies in the sector. (See "Operational Web 2.0," page 40, for more on mashups.) The VP reuses the mashup and within four days determines that better joint venture partners are available in China. He successfully negotiates a contract with a better partner and informs senior management of the transaction.

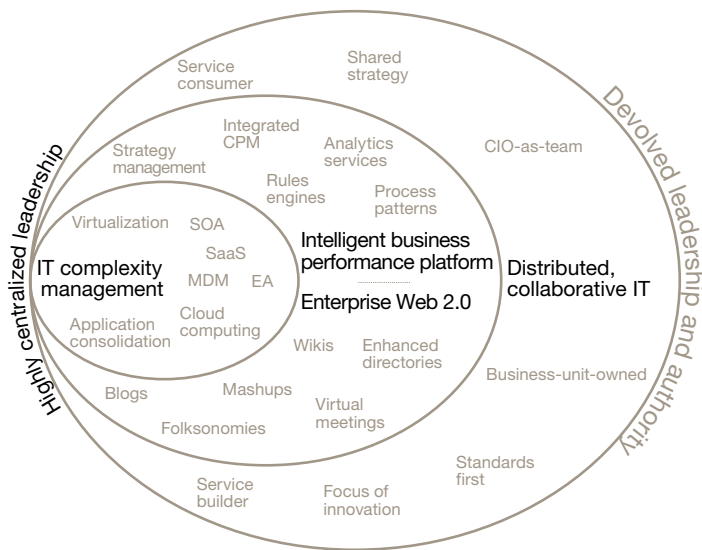
### Agile management, IT infrastructure, and devolved leadership

In an agile enterprise, leadership will be collaborative as strategic planning and strategic action become a shared responsibility between the C-suite and the business-unit managers. New models of governance will be needed that define the degrees of freedom expected for corporate decision making. Corporate culture needs to change as senior leadership and business-unit managers adjust the balance of power, authority, and accountability.

Existing business processes, research tools, analytics, and information consolidation capabilities are not designed to scale up to support scores of newly empowered business-unit leaders in this new model. The infrastructure must shift to three primary technology strategies: reducing IT complexity, leveraging enterprise Web 2.0, and implementing intelligent business performance platforms (IBPPs). It's essential that executives grasp the nature of continuous business change today, how agile enterprises that respond to continuous change operate, and what it takes to enable an agile enterprise. Figure 3 illustrates this big picture and how a business infrastructure can evolve to make management's goal of enterprise agility through devolved leadership and authority possible.

Complexity management is the core challenge. (See "Making complexity manageable," page 28.) Strategies such as server and storage virtualization can help minimize data center complexity. As software is increasingly available as a service, the IT organization can outsource to meet selected IT requirements.

Around the core is an intelligent business performance platform. (See "Bringing order to chaos," page 60.) It contains integrated business intelligence components such as analytic services and rules engines. Web 2.0 capabilities round out the emerging technologies that enable management agility. (See "Operational Web 2.0," page 40.) IT complexity management, enterprise Web 2.0, and intelligent business performance platforms are each important individual trends. But no trend is an island; they interact, resulting in a set of synergies and interdependencies that amplifies their collective impact.



## 1. Overview of agile management infrastructure

Source: PricewaterhouseCoopers, 2008

For example, IT complexity frames all discussions of new technologies. The potential benefits that enterprises can generate from Web 2.0 and an intelligent business performance platform depend on the degree to which an enterprise has come to grips with IT complexity. The intelligent business performance platform will support Web 2.0 technologies such as mashups by exposing data and reports as Web services. Large quantities of user-generated data on company blogs and third-party “advisor” Web sites will be useful only if business intelligence analytics can make sense of the data.

### IT complexity and business processes

IT infrastructure was never simple, but several forces have amplified complexity in recent years. Mergers and acquisitions, the drive for early adoption of strategies such as virtualization, wireless and remote IT deployments, and other factors have contributed to complexity. Reducing IT complexity begins by addressing the unintended consequences of past

investments in technology. The haphazard accumulation of IT assets that have become complex and inflexible is the biggest roadblock to a distributed organizational leadership and authority scheme.

IT complexity will only increase as enterprises take on new initiatives such as the adoption of service-oriented architectures or master data management techniques. The key for enterprises will be to move from IT complexity remediation to ongoing complexity management. This will demand an explicit plan of attack for sampling, adjusting, promoting, and standardizing on innovative technologies.

Historically, CIOs have had a rough time making a purely business case for reducing IT complexity. But the push for management agility in response to continuous change will move enterprises to the tipping point. When time to market is weighed as a part of the business case, then agility can be measured as a return on IT investment. With a proper IT complexity management strategy in place, the stage is set for adoption of innovations like Web 2.0 that promise to add value to the organization.

One of the main causes of IT complexity is the lack of enterprise maturity in understanding its business processes. IT complexity rarely operates in a vacuum; rather, IT systems can be no more orderly than the processes they enable. It is not uncommon for large enterprises, especially those created from many mergers and acquisitions, to maintain small but significant differences between fundamentally identical business processes. These differences are then reflected in the applications supporting them. The result is a growing mountain of applications that must be maintained, even though the differences in process create no actual business value.

Here IT can help clear the way for change. An intelligent business performance platform provides suites of tools to model and modify processes, to measure those processes, and to analyze what the measurements reveal. Leading companies today use business analytics and business process modeling tools to identify the highest performing business units, correlate value to a

specific process, and standardize on these proven processes. Inevitably, these process redesigns allow enterprises to retire redundant applications, a key contributor to IT complexity.

## Inside Web 2.0

The adoption of Web 2.0 and its host of social technologies has been a phenomenon few could have missed. What hasn't been fully established is how enterprises will define and measure the business value of blogs, wikis, social networking, mashups, tagging, folksonomies, and other hallmarks of Web 2.0.

Web 2.0 technologies help mitigate two important challenges in achieving agile management:

- Web 2.0 capabilities address the need for cultural change by enabling more open, multiway conversations across the enterprise and beyond.
- Web 2.0 capabilities help meet the challenge of communicating with a large number of business-unit leaders who are typically geographically dispersed.

Agile management requires high levels of communication and collaboration. In enterprises that have hundreds or thousands of business-unit leaders all over the globe, traditional meetings for analysis, planning, and decision making would be overwhelmed. Virtual meetings, internal blogs, enterprise-equivalents of MySpace or Facebook pages for connecting and sharing business-relevant documents, and widget environments for quick development and sharing of business analytics are some examples of how Web 2.0 will support agile management teams. However, the multiway, public nature of blogging, wikis, and other new social technologies will require a shift of mindset at the senior management level before enterprise Web 2.0 can have an impact.

Beyond blogging and other communications-oriented Web 2.0 technologies is an emerging user-generated programming technique called the mashup. Mashups typically rely on Web services to combine multiple sources of information and process logic to create new

Web applications. Some of the most useful mashups for agile management will combine business information and analytics. The intelligent business performance platform will support mashups by exposing data and reports as Web services. Mashups will be most useful when they allow business analysts to combine business intelligence analytics with other, perhaps external sources of data.

Once a valuable management tool has been pulled together as a mashup, an agile management team can use the self-publishing capability of social networks and blogs to share it widely—both the information and the business logic. Others in the organization can then build on or adjust the business logic for their own purposes. (See the sidebar “How agile management could work in practice” on page 8.)

Dealing with this plethora of internal communication and collaboration, of comments and requests from customers, and of blogging reviews by outside experts is likely to be one of the challenges for command-and-control-style management. Business-unit leaders at the edge of the enterprise will need a platform to assess these ideas, will need the ability to test them against the constraints of the higher-level strategy, and mechanisms for directly introducing process changes in their organizations. In short, they will rely on an intelligent business performance platform.

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An intelligent business performance management platform combines centrally created business analytics services, business process analysis tools, business process design, execution, monitoring capability, and business rules engines.

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Business intelligence and business analytics are key components. Intelligent business performance platforms not only encourage a company to formalize its business policies but also can execute those policies automatically, rapidly, and consistently, thereby allowing staff to focus on creative solutions to exceptional circumstances.

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### The role of intelligent business performance platforms

An intelligent business performance platform supports applications that monitor and manage critical business processes and outcomes. An intelligent business performance platform is a way to characterize the emerging suite of functionality combining business intelligence, business process management, and business rules management. This emerging platform will focus on automating and enhancing dynamic, knowledge-driven processes rather than low-level transactions. Examples include merger integration, strategy management, budgeting, enterprise risk management, governance and compliance, and many industry-specific activities.

Business intelligence and business analytics are key components. Intelligent business performance platforms not only encourage a company to formalize its business policies, but also can execute those policies automatically, rapidly, and consistently, thereby allowing staff to focus on creative solutions to exceptional circumstances.

An intelligent business performance management platform combines centrally created business analytics services, business process analysis tools, business process design, execution, monitoring capability, and business rules engines. This is an area where the IT organization can add value by standardizing and supporting these tools.

The fundamental reason for pursuing an agile management strategy is to increase the overall agility of the enterprise. Agile management will not succeed if

business units have complete flexibility to simply do as they please. Making sure managers at the edges of the enterprise are making the best decisions can be immeasurably enhanced by leveraging business performance management tools. Business-unit leaders must have access to comprehensive information about internal processes, business outcomes, partner processes, customer preferences, and broader market conditions and forecasts.

Additionally, if these informed and empowered business-unit leaders determine a change in course is warranted, they need the tools to make business process changes directly. Putting in a request to an overwhelmed central IT department will only result in delays that threaten the success of the business opportunity.

### Looking forward: Enterprise adoption and risk management

In the next five years, several indicators suggest that IT spending will be constrained, especially when compared with spending a decade ago. IT organizations are often told “do more with less.” And global economic conditions in the near term will forestall new capital investments.

The investments in technologies needed to support improved agility will be gradual and predominantly funded from IT cost savings that accrue from efficiency gains. New pricing and provisioning models, such as software as a service and cloud computing, will augment the outright purchase of IT assets. The big-bang implementations associated with ERP adoption—with associated high costs—will not be repeated.

IT trends for managing complexity, Web 2.0, and building out intelligent business performance platforms show different adoption patterns.

A substantial percentage of enterprises are already reducing the complexity of their IT systems. The problem is widely recognized, and the value proposition for taking on complexity is becoming increasingly clear. What's less clear is how far along enterprises are in addressing complexity as an ongoing management priority rather than as a series of onetime projects.

Enterprise adoption of Web 2.0 technologies and the collaborative, open environments Web 2.0 really represents, such as blogs, wikis, mashups, and other social technologies, is accelerating. Unlike complexity remediation projects, the connections between Web 2.0 investments and enterprise value creation are not yet well established. As a result, the adoption patterns for Web 2.0 in the enterprise are more experimental and departmentally focused rather than enterprisewide. Not all risks are well understood. For example, how should an enterprise monitor public blogs for storms of negative comments about enterprise products or services?

Further out still is the trend toward adoption of an intelligent business performance platform. In fact, the consolidation of tools defined by business intelligence, business process management, and business rules management has not yet occurred. However, the investments by such companies as IBM, Oracle, and SAP to acquire and develop the full range of capabilities described later in this forecast demonstrate that this trend is already in place. (See "Bringing order to chaos," page 60.)

### Rate of change and risk

Will the business case for addressing continuous change drive adoption of these new IT services and solutions? Or will the perceived risk of attempting a significant transformation of the enterprise outweigh its perceived benefits?

Vendors may focus on sophisticated use-cases for the distributed management of strategy, authority, and accountability. They will develop compelling virtual environments that support management teams in



### PricewaterhouseCoopers and technology forecasting: An interview with Sheldon Laube

Sheldon Laube leads PwC's Center for Advanced Research, where he directs research and development of business problems that have no known solution in the marketplace. Laube first joined us in 1984 and later became CIO. He left the firm in 1995 to found two successful startups and returned to lead the Center for Advanced Research in 2003. Laube discusses the reason why technology forecasting became important to us 20 years ago and the challenges that technology forecasting presents.

#### ***PwC: You were there at the beginning when management decided to publish the Technology Forecast book. How did this idea get started?***

SL: It goes back to the late 1980s. The consulting business figured out that success came from larger engagements, but larger meant higher levels of complexity, with major technology and systems integration components. The focus of our practice at that time was around mainframe solutions; new technology architectures based on UNIX and client/server caught some parts of our practice by surprise. This raised a concern among our practice leaders: How do we keep our consultants informed about the latest trends in technology?

At the time, we had a research group in Menlo Park, California, staffed with PhDs in computer science. I suggested they be given the task of producing an annual publication—to be used for internal training and knowledge development—that would describe "what's coming next" in technology. We called it the *Technology Forecast*. After the first issue came out, it was quickly recognized as having external as well as internal value. The *Technology Forecast* was a great mechanism for telling our clients that we cared about

the future of technology, that we spent our own time and energy and money developing a perspective on the future of technology. (See Table 1.)

Other firms have their own ways of signaling the market that the topic is of interest to them. Coming from an accounting firm set a different context. CPAs as certified professionals have a public responsibility to invest in extending knowledge of accounting. We published thought leadership as a sort of public responsibility, an effort to perfect accounting principles and practice by contributing to public knowledge. It was a natural extension for us to want to do the same with technology knowledge, especially if it had a goal of being objective. And the process that created the content was an aggregation of many points of view in an effort to have an objective perspective.

It was really a learning process. Having a point of view based on bringing together a wide range of expertises and synthesizing them into a coherent whole has tremendous value. That's because the issues being dealt with, the impact of technology on business and society, are not diminishing in any meaningful way. You can search on the Web and retrieve a thousand separate individual perspectives. But editorial voice is still important; it was the synthesis in juxtaposition of what we chose to talk about and not talk about that defined value for clients. Each year there was a different set of issues.

***PwC: Looking at the issues chosen for attention, clearly the Internet was a key topic. How did your perspective on the Internet at the time define where you looked for value, and what has surprised you in terms of how the Internet has evolved?***

SL: In terms of the Internet, at USWeb our insight was that if there's gold in the hills, the money will be made in tools and services to the miners. We believed every business would have a URL [uniform resource locator]. And that's come to

pass; that vision we got right. The thing we didn't catch, as many didn't, was the rise of personal Web sites and the notion of social networks and things of that nature. We didn't understand the notion of social interaction through the Web and that it might be the driving force now going forward for the next 10 years, the Web 2.0 world. All of these, it's just unreal, MySpace and Facebook, they're very different ideas. And even the phrase "social interaction" doesn't really capture it. You're not really replicating a phone call on the Web; what's striking is that you are capturing or recording in some sense your interactions and publishing them for others, even the public, to read, including a public you will never actually know personally. It really does represent a whole new way of interacting in the same revolutionary way as we thought of Web sites as revolutionizing the enterprise. Web 2.0 is now revolutionizing social interaction, and no one even knows where that's going to go.

***PwC: How have these latest developments in the Web 2.0 world impacted the way you think about technology forecasting?***

SL: I think the really interesting thing about the world of forecasting is to try to understand the things that you can actually predict and then realize that just because you can see the logic of that, the range of possibilities of what might happen next because of it are beyond any normal person's ability to extrapolate, to make the right choices about what will happen. That means you have to be very aware. You've got to keep watching for the trends of how those fundamental changes that technology enables get created and then instantiated in very clever and very unusual ways. I mean, just the transition of Facebook, for example, from an education-only to a commercial enterprise was not operationally predictable.

## PricewaterhouseCoopers and technology forecasting

Our previously published books sought broad perspectives on trends of the day. We and our collaborators usually got it right, notwithstanding a number of surprises.

Focus area	On-the-mark forecasts	Biggest surprises
Internet	<ul style="list-style-type: none"> <li>Steady growth for Internet access overall</li> <li>Total dollar size of the business-to-business Internet far surpassing the business-to-consumer market</li> </ul>	<ul style="list-style-type: none"> <li>Lack of success of wireless broadband, including low-earth orbit satellite services</li> <li>Emergence of Web 2.0 and the importance of user-generated content</li> <li>Paid search fundamentally altering Web business models</li> <li>Impact of vertical Web products and services not constrained by their information content</li> </ul>
Hardware and infrastructure	<ul style="list-style-type: none"> <li>Smart handheld devices and cell phones rationalizing into a single device</li> <li>Importance of software applications in data center management and lowering total cost of ownership</li> <li>Linux operating system redefining cost of computing</li> </ul>	<ul style="list-style-type: none"> <li>The ubiquity of the personal computer, which did not decline in favor of more manageable, appliance-like devices</li> <li>Seriousness of the growing problem of IT complexity</li> </ul>
Software	<ul style="list-style-type: none"> <li>The rise of enterprise suites for financial systems, product management and manufacturing, customer and supplier relationships, and sales and marketing automation</li> <li>Addition of e-business support and Web portal functionality to suites</li> <li>Integration of platforms and component architectures</li> </ul>	<ul style="list-style-type: none"> <li>Failure of knowledge management systems to achieve broad adoption in the enterprise</li> <li>Massive vendor consolidation in many areas</li> <li>Failure of the application service provider model in absence of a multitenant architecture</li> </ul>

Table 1: **Technology Forecasts 1998 to 2004: Highlights and surprises**

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Organizations today must commit to managing the constant change that's come to dominate global business. In the end, success will come to those who recognize and mitigate the risks as part of an overall strategy that unifies intelligent business performance platforms and Web 2.0 technologies while managing complexity.

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hypercollaborative structures. But that does not guarantee market adoption.

The most significant barrier to the transition toward agile management techniques is the management of risk. Imagine, for example, how a large bank would react to the proposal that decision making be further devolved. But let's face it: For most companies today, the imperative is to become more agile at decision making or face ever more daunting competition. New risk management investments must be linked to agility enhancement initiatives.

Today's governance, risk, and compliance planning parameters reflect the existing top-heavy command-and-control structures in place in most enterprises. As the tools that enable more distributed-yet-coordinated management of strategy improve, a parallel development of how the activities of governance, risk management, and compliance are conceptualized and ultimately distributed will need to happen as well.

Without effective controls in place, the steps to develop more agile management are likely to be seen as too risky.

However, organizations today must commit to managing the constant change that's come to dominate global business. In the end, success will come to those who recognize and mitigate the risks as part of an overall strategy that unifies intelligent business performance platforms and Web 2.0 technologies while managing complexity.

In fact, the key to managing that risk may lie in the new technologies themselves. A collaborative, distributed model of accountability and of authority brings with it a more-comprehensive approach to managing risk.

Says Henning Kagermann with SAP, "If you have this more agile strategy and if you do it right, it's even better. The risk is higher, but the reward is as well."

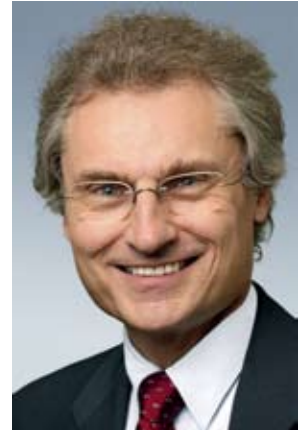
*For more information on the topics discussed in this article, contact Paul Horowitz in the US (+1 646 471 2401) or Robert Scott in Canada (+1 416 814 3215).*

# Where to find bedrock

Henning Kagermann of SAP discusses IT's dual role of providing a stable foundation while enabling innovation.

Interview conducted by Bo Parker

Henning Kagermann has been CEO of SAP since April 2008 jointly with Léo Apotheker. He joined SAP in 1982, initially overseeing product development in the areas of cost accounting and controlling. He has been on the executive board of SAP since 1991 and became CEO in 1998 until 2003 jointly with SAP cofounder Hasso Plattner. In this broad-ranging interview, Kagermann discusses the interdependencies of transactional and business intelligence systems, and he weighs the pros and cons of Web 2.0.



**PwC:** When you look back 10 years and recall the excitement of the time, with e-business and the huge investment in ERP [enterprise resource planning] suites, what conclusions can we draw today regarding the promise and potential for technology to contribute to business success?

**HK:** I have always been a little more conservative than the other players, particularly the players in the Silicon Valley. If I look back, the status of e-commerce was obviously overhyped. Collectively, all players together caused a lot of damage to our industry by promising clients things they couldn't fulfill, and I doubt we have recovered from that. In particular, the overhyped rip-and-replace messages were not good. At the end of the day, many of the topics turned out to be the right ones, but from a perspective of timing, it was by far too early. What I experienced—and I was sitting there sometimes, asking, “What about the customer?”—was that CEOs of key clients felt forced to do something because of all this hype, and then they did the wrong thing. They made

investments because of technology hype, not because of business need.

We are in a situation now where we have learned our lesson. First of all, there is stickiness of legacy code and stickiness of clients, and that will not go away. Second, business has taken power away from IT. It's about business and having a good business case. The good news is that we can now deliver the functionality and capabilities promised by the earlier e-commerce hype, but we must continue to manage or hide the complexity.

**PwC:** So despite the hype 10 years ago, you see that the vendor community has pretty much finally delivered the technologies needed to transform companies into the virtual, networked enterprises promised by the e-commerce hype? Is there anything you would describe as unfinished work from that era?

HK: I feel the legal context is a barrier to the virtual enterprise. Obviously, there is more openness, more collaboration, more networking of businesses—all fine. On the other hand, we have more regulation, more rigid compliance frameworks like Sarbanes-Oxley and more apparently little things where, if you make a mistake, you can put your company at risk. So integrity, reputation, sharing IP [intellectual property] appropriately—these topics are getting trickier and trickier. As long as you're doing things within your own enterprise, it's in a closed shop in terms of legal and integrity. You can change many things; to some extent you're flexible. But if you move to a business network model with shared processes outside your enterprise, now legal complications can quickly multiply. You have to do business in a way so that you are not, let's say, violating the rights of other partners. So this is, for me, one of the most urgent questions about how far we will go with the networked economy. Will regulation, will society push back here?

PwC: Do you see any specific technology trends that will drive enterprise transformation in the next 10 years?

HK: Many, many trends are coming, not one, whether you look at software as a service, open source, cloud computing, pervasive computing, next-generation Internet, in-memory databases, and others. Not one single trend will be the dominating one; transformation comes from the variety.

PwC: Has anything surprised you about Web 2.0 as it has developed thus far in the enterprise context?

HK: Web 2.0 is important, but not the next big thing. We should resist the tendency to overhype again. I must

admit that communities are taking off more than I thought. We have our SAP Developer Network with more than one million participants. But if I look to the Business Process Expert community, where 280,000 people share knowledge about processes: that's the real surprise to me. I thought it would work in the engineering world because that's their nature, but I assumed consultants would not share knowledge, because it's not their nature. So it was my litmus test that I said, OK, if consultants start sharing knowledge, then something is happening. There are not just new ways of collaboration, but they can even change the character of collaboration. That is a trend that's surprising, and this is something with Web 2.0 that really adds value.

PwC: You mentioned the hype from technology innovators around the rip and replace of legacy IT. Hasn't the add-on strategy led many enterprises to unmanageable levels of IT complexity? How is the industry going to resolve that, and how is SAP going to participate?

HK: There is only one low-risk option: You have to link system landscape consolidation to a business case. For example, if a company moves into new business fields, it can build the future platform in that new area. Start fresh, grow the platform, and then over time consolidate the other areas on that platform. That is a compelling business case and makes sense. So, pick an opportunity where you have a case, and then build the future. That is much easier to do today, because the new technologies are far more open. You can consolidate the legacy at your preferred pace. And many companies are doing it that way. They consolidate the landscape over time and combine it with a business case.

**PwC:** How will companies avoid running into this creeping complexity problem again?

**HK:** I'm afraid it's the nature of business and IT. It's always the same pattern. Customers look for an IT partner who is reliable, a long-term partner who has a high profile of engineering excellence, integration, globalization, quality, and support. That's what companies are looking for—assurance that their investment will be safe for the next 10 to 15 years.

So let's assume we are such a partner, and I really believe we are. In that case, you give up some speed and entrepreneurship by definition. Why? If you have this reputation and work hard to deliver on your clients' expectations, you cannot quickly offer a great new product that is not integrated or proven and works only in North America and the UK and nowhere else; it damages your reputation, your brand. So in order to ensure the reliability and high quality customers expect from their long-term partner, in certain areas you will be slower than some startup in the Valley.

Now, say you have these nimble, quick guys, 200 people, very innovative. Nobody complains if they come up with a solution that is not localized. No one expects it from them. Great. And because it appeals to the users, in some departments they will say, "I need it. I want it. Give it to me now." So they increase the complexity of the internal IT partner, and two years later, they will look and say, "Gosh, why have I done this? Do I really want this?" At the end, they will turn to their long-term partner to take care of it. They come to you and ask you, and then you say, "Yes, we can do it, but it will take a little longer," because they want you to localize it for Costa Rica, for Nigeria, for China. You cannot say, "Look, this is not a market for me." They will answer, "But you are a global company with products for the global economy."

**PwC:** So are you saying there's been a failure to look at the total cost of ownership? Companies look at the project cost, but not the total cost for the whole enterprise? Are companies becoming more aware of this as they are adopting new technology this time around?

**HK:** No, it's once again going in the other direction. This has to do with the need, demand, and push for businesspeople to be successful. Most of them are still looking to their silo and saying, "I need this in order to do my job." In certain areas the CEO will give up and say, "Let them do it and consolidate later." It's a tricky situation. Only a few companies are extremely disciplined and do not allow it, but that's mostly companies that go for efficiency and operational excellence. If you look at the companies that are focused on being customer relationship masters or that want to be innovators, they adopt technology without considering the whole cost picture.

**PwC:** For some companies, then, it's a tradeoff. They cannot afford to wait for the fully engineered, globally localized, highly reliable innovations without being challenged by competitors. So should they proceed with their eyes open and then have the discipline, two years later, when the opportunity is there, to clean up, to remove the complexities that have ceased to be associated with value add?

**HK:** You have to clean up. That's the key point. Of course, you have to innovate, and if you do it fast, you will add complexity. But in parallel, you have to clean up those things where it's not worth it any longer to differentiate yourself against others. This is a kind of sedimentation approach to technology, where you allow for complexity where it pays off, but after some time everyone will have the same capability. Then you have to clean up, so that your nondifferentiating processes are supported by a very clean backbone, because there's only a certain level of complexity you can master, and it's something companies need to be aware of. Some companies can master a little more, others less, but it's not endless.

**PwC:** We've been talking about IT complexity as if IT was off on its own building these complex systems, when in fact, IT is responding to business units wanting to support a process in a

new way or do a new process. Do you see a focus on process excellence and process modeling capability? Do you see executives actually engaging with business process modeling tools and making that the driver of innovation? Because that's a way to reduce complexity in IT, to start by reducing complexity in the process, right?

HK: We see two trends. One is to bring the knowledge about processes closer to the business by using business process management with integrated modeling tools. We are in the process of switching from purely descriptive models to active models. You can simulate the impact of a business process change immediately and include the business expert in the design process. Of course you cannot change everything, but you have a sufficient level of flexibility built into the process model. In navigating through the model, you can see what you can change and what you cannot change because of regulatory or business integrity reasons.

For example, if somebody tries to change the revenue recognition process, the built-in compliance will ensure that the change conforms to accounting standards. If you have a modeling environment that knows these constraints but still allows process flexibility without violating these constraints, it will be highly valued by business units. Especially if, when businesspeople ask, "Why are we doing this?" the model explains the constraints but also shows that they have some process options. They can ask, "Let's see what happens if I take another option," and you can show it without any development effort or delay.

PwC: But most executives today are not conversant with business modeling terminology and notation.

HK: I think it's not necessary that you as an executive understand the model and work with it. The key is the speed. A consultant may give you an overview and use it. You can ask questions and then the consultant translates it into change, and you see the results immediately and make your decisions. Customers like this approach. They feel like codesigners.

Maybe businesspeople of the future read models like books or instead of a 400-page MBA-type book. It's due to education. There are people who understand mathematics and can read formulas very fast; other people can read music the same way. It's a similar concept. Models are abstractions; they are condensed—a kind of language that describes business processes and rules. If you're educated this way, I think you're pretty quick to see if a model is different or not. If you see it the first time, you say, "OK, why should I do that?"

PwC: But there's also the level of granularity, where the model you're looking at is appropriate to the role you have in an organization. Do you see this also as an opportunity?

HK: Yes, because a lot of people speak about semantics these days. You have the semantic Web and all those things coming. From my point of view, that'll really be a breakthrough—more than Web 2.0—because it tries to give things a meaning, which will greatly facilitate collaboration. What happens if you get two drawing files

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If you have a modeling environment that knows these constraints but still allows process flexibility without violating these constraints, it will be highly valued by business units.

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We always believed that you cannot define one set of metadata for transactions and another set of metadata for business intelligence, because they are interconnected.

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from two engineers, let's say from Daimler and BMW, for example, and they want to collaborate. Can they interpret each other's drawing files?

If the semantics are the same, the meaning, you understand it immediately. Mathematics is like this. If you have a mathematician from India and another from China or Germany, they would understand a mathematical formula, although it has taken centuries to get there. And music is the same. But we don't have it on this level for business process modeling, so first of all, a universal modeling language is required. This is something people are working on. In the world of service-oriented architecture, we manage business connectivity with services. However, it will take some time until we evolve a collection of services into a lingua franca of business.

PwC: There seems to be wide recognition today of the value of standardizing on a single ERP platform and a single instance of that platform. How far does this go as you focus more on business intelligence platforms?

HK: We always believed that you cannot define one set of metadata for transactions and another set of metadata for business intelligence, because they are interconnected. Software will continue to replace work that is routine in an enterprise. The way people work will be more and more driven by exceptions, by insight, by analytics, and not by just doing transactions. That's behind us. The more routine the work is, the more it can be described by rules, then the more we can replace people work by software. We minimize human

interaction in this area as much as possible, because it's not value adding.

When do you need human interaction? If there are failures, first of all, and we hope we have few of those. Second are exceptions: something unexpected happens, and you have to solve it. This is when collaboration is needed, where, for example, a supplier couldn't deliver, but production has to go on. What to do now? And even here you can have some rules and templates to support teams. And finally it's about the unforeseen, or what we call intelligence, where people look for new upsell opportunities into their customer base, turn strategy into operational plans, or prepare for entering new business opportunities.

When you automate all the other stuff, people have time for this. That means intelligence, and business intelligence is initiating transactions more and more. So transactions might be at the end, where you say, "I made up my mind, and I'm going to make these price changes in these territories to maximize margins." You cannot divide transactions always from intelligence. Therefore, over time it will be more integrated. In the future, designers also must have analytical options in mind if they create new applications. This is a kind of convergence, and the same will happen for the collaborative aspects of applications.

PwC: Right now there really are three different markets for the technologies we have been discussing: the business intelligence market, the business process management market, and the business rules engine market. Where are you seeing the transition to a consolidated platform of all of those coming together? Is it going to be driven by the need for semantic consistency, or is something else going to be driving it?

HK: We promote this concept of closed loop, where we say these things will be loosely coupled for a while. Returning to the concept of big-bang versus evolutionary consolidation, to drive it into large clients, you can't come in and say, "I have a great new idea, but first, you have to rip and replace all the stuff you already have."

Companies will answer, “Look, I have all these processes in place. I don’t want to replace, but please augment them with analytics, give it to me, and connect it.” Therefore, you need the decoupling, but I think you have to connect them in a way that generates more value for the clients. We are saying, “If you have a very modern, consistent, and complete business intelligence platform, for example, you can continue to extract data from everywhere, from your data warehouse—it’s all fine. But you could also improve the underlying process platform by firing exception events into this platform and saying this has to be solved, and trigger those things more real time.” This is a loosely coupled integration, but it’s very worthwhile. If you want to be smart in doing it, you have to understand both sides: the process platform and the intelligence platform. So we see some connectivity, some kind of integration, but it’s a different way. I’m not talking about everything in one big box.

PwC: As enterprise software moves forward, solving semantics problems, dealing with complexity at a business process level and not just a technology level, and as we move toward more collaborative and open environments—what Web 2.0 really represents—how do you see the SAP platform evolving?

HK: I think there’s been an interesting reversal of sorts in technology. In the last 10 or 15 years, if new technology changed for example, your programming language or your database language or your operating system, then the application adjusted. Now it’s more the opposite, that the applications live longer than parts of the technology. More and more it’s becoming like an aircraft where you, let’s say, have the same aircraft flying 20 years, but the engines are different. In the meantime, you have Internet inside, and so you constantly incorporate new technologies. And we feel that’s the way larger applications in businesses will evolve, becoming more adaptive to new technologies. That means they have to be more modular and have better interfaces. I believe that’s the trend. If you view it this way, and if you drive in this direction, then you avoid the surprises of new technologies that you can’t see today. This is very important. I believe we cannot

anticipate everything that’s coming in two years, but I can assure my clients that whatever happens, I can take advantage of it in a way that insulates them from disruption, no sleepless nights. This is a better approach. So many things are happening, we shouldn’t assume we can anticipate them all.

PwC: So it’s a new sense of agility, is what I’m hearing you say. Not only do companies themselves need to be agile. Obviously, that’s been increasingly the case, and you are a company, so you need to be agile, but the product you give companies needs to be agile.

HK: Yes.

PwC: And that is a different way of thinking about a product, because in many ways there’s been great value for technology companies to make products not agile, because that creates customer stickiness.

HK: Yes, and that’s a big mistake. We came to the conclusion a few years ago that you have two choices. You can select a lock-in strategy, which has given many companies a high return in the past, so it’s OK that some people believe this might be a better strategy. I don’t agree, because it’s more a question of whether you feel you’re strong enough to survive in a truly open world. But if you have this more agile strategy that we’re just discussing and if you do it right, it’s even better. The risk is higher, but the reward is as well, because you have no lock-in; you invite others to play around and take business away from you. On the other side, it keeps you agile. You always have a second chance. If competition is faster or better, eventually the innovation becomes standard fare, and clients want it in their stable platform. If you are a trusted partner and not complacent, you can do the sedimentation and come up with a robust and long-living solution even two or three years later. ■

# The era of CIO accountability

Lakshmi Narayanan of Cognizant looks at the global delivery model and the CIO's blended business and IT role.

Interview conducted by Vinod Baya and Hari Rajagopalachari

Lakshmi Narayanan has been with Cognizant since 1994: He joined as chief technology officer and was CEO and president from 2003 until 2006. Now as vice chairman, Narayanan travels extensively in the United States and Europe to meet with clients of Cognizant. He is a member of the board of the US-India Business Council and, until recently, was also chairman of the board of the National Association of Software and Services Companies (NASSCOM). In this interview, Narayanan offers insights on IT developments in the past decade, from the Y2K phenomenon, to the rise of the global delivery model, to the impacts of enterprise 2.0 trends.



**PwC:** As you think about the evolution of IT during the past 10 years, what aspects really surprised you?

**LN:** What surprised me, first and foremost, was the mobility of data and information. We really didn't anticipate mobility in the manner in which it is happening today. We knew that the signs were there: credit mobility, capital mobility, commodities mobility, and, to some extent, time mobility. But the data and information that corporations were using pretty much resided in specific locations. Then that started moving about. So people had access to both proprietary and public data, which could be put to use in an enormous number of ways. That is a significant difference. Combine that mobility with the new technology of computing power—the solid-state physics of process memory and the iPod type of way you can carry 20 gigabytes of data. It's conceivable that you can carry your corporate database on your laptop every day.

The related surprise was the ability to carry or deal with data from anywhere in the world. It really surprised us, as did the many ways of putting it to use. For example, today's cardiogram machines and CT [computed tomography] scan machines have such a huge capacity to store images, and, once collected, these images are available for telediagnosics from anywhere in the world. Just as there are Internet kiosks today, it's conceivable that in the near future you will have some of these clinical kiosks at roadside corners. You just walk in, get your scan done, and then be diagnosed by a doctor sitting somewhere in the Philippines or India or China.

**PwC:** Do you foresee any changes that might have a similar impact in the next 5 to 10 years?

**LN:** It's essentially the extension of what I have already said. Some equipment in an automobile, for example, has a chip that is communicating. If it doesn't perform properly or if it doesn't complete a task in a certain

amount of time, it transmits a message. In India, particularly, if you look at the rate of growth in automobile sales, you have to ask, “How are all these cars going to be serviced?” The new method will direct the automobile diagnostics to a central place, allowing one to control and monitor the state of the automobile. The same thing applies to medical equipment and other such segments. All functioning equipment will be able to communicate constantly.

The other change is the miniaturization that’s happening. What’s happening to storage will happen to processors. It’s already in the works: startup companies are looking at servers that use only 55 percent—or even 15 percent or 20 percent—of the energy that they consume today. These efforts will yield compact servers or green tech machines. With less power requirement, you no longer need huge data centers and centralization. This will lead to new applications using the massive computing power that will be available. The only bottleneck that I see is bandwidth: you have the storage, you have the computing power, but the communication bandwidth is not expanding as rapidly as it should.

PwC: That’s interesting, because the story of the past 10 years has been about deployment of broadband. So you’re saying that it is not good enough—particularly compared with the advancements in storage and computing power.

LN: Correct. Today, everybody is streaming. Streaming video is common. Most people want to sit in an office and monitor their home, or sit at home and monitor the office. All these require constant inputs. Insurance agencies in the United States, for example, have these devices on automobiles that track every 30 minutes and keep writing over the recorded data. Anytime there is an accident—boom—the video is available for everything:

for evaluation, for damage estimation, for calling up the body shop, for processing the insurance, and things of that nature. That capability requires a lot of streaming, and we don’t have sufficient bandwidth today for such applications. It’s not a technology constraint. Unfortunately, it’s an issue involving government, telecom, bandwidth, and spectrum—not only here, but all over the world.

PwC: Talking about the industry Cognizant operates in, the global service delivery model has made robust progress during the past 10 years. How much of this growth were you expecting, and how much of it is a surprise?

LN: The global or remote delivery model has been in the world for the last 20 to 25 years, and it was growing at a rather slow pace. In the last 10 to 12 years, the pace has really picked up, primarily because of the talent shortage elsewhere. That’s been one of the driving forces behind the expansion of this particular industry. Now, the element that contributes to rapid growth—apart from the availability of talent—is the outcome. Successful delivery of solutions to businesses the world over—the consistency with which it has been delivered, the high quality and the lower cost—has significantly contributed to the rapid growth.

What we didn’t anticipate was how long we could push out the cost advantage. In 1994 and ’95, it was predominantly a labor arbitrage kind of model; that was the primary reason. And people asked how long the cost advantage would continue. Even then there was wage inflation, and not enough people were available. The best guess then was that we definitely would not have any challenges for the next four to five years, but not so thereafter. By 1997 and ’98, the answer to that question was still the same, but it was increasingly apparent that

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While we are setting up finishing schools and while new universities are emerging in order to meet this demand, there is a revolution in progress where these 1.6 million people in the industry are also getting more and more efficient, like that 80-member team reducing to a 30- or 40-member team. We are getting a certain relief on the base that we've already established as an industry. That is working in favor of the industry, taking some pressure off. The people available are not necessarily suitable for the task. However, that suitability gap is being bridged by the increased efficiency and productivity that we're deriving on the basis of that workforce.

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it would be difficult to sustain that kind of advantage for long because the costs were increasing.

Now, after about 12 years, if you asked me the same question, the answer would be the same: we would not face any challenges for the next four to five years. So, we have been able to push the cost advantage outward. We thought it would last for only about four or five years, or, at best, 10 years. It has been pushing out.

**PwC:** So you don't think we've passed the limits of supply-side elasticity on the labor yet.

**LN:** It's not due to supply-side elasticity. There are various factors that complicate this. In terms of newer, better tools, productivity and efficiency have improved. The ability to put together a different type of model to tackle a problem has improved. Getting talent from different places to work in a highly collaborative way—almost a global collaboration—is something we had not anticipated. All those factors of global collaboration—whereby minds from different parts of the world are collaborating on a single problem, and tools are available to implement the solution far more rapidly today—have led to the sustainability of this kind of advantage—the cost advantage—although wages in India have been increasing 10 percent to 15 percent in

the last 10 to 12 years, and the corresponding wage increases in the markets we serve, such as the United States and Europe, have been no more than 3 percent to 5 percent every year. So just mathematical logic will tell us that at some point, these two curves will have to meet. But they seem to be going on almost in parallel in our area, primarily because of the productivity improvements and the tools and the technologies that have become available.

**PwC:** Global IT service delivery has obviously matured a lot more than business process outsourcing, or BPO. Can you talk about the development of the BPO market, vis-à-vis IT services? What needs to be done to make it more mature? What are the barriers? What do you see after that?

**LN:** The BPO industry is clearly not as mature as the technology industry, but in the limited time that the industry has existed, it has made tremendous progress. The BPO industry is just about four or five years old. It started in the captive mode and then transformed into an industry of third-party service providers. To that extent,

these companies have done well. The processes have been streamlined and so on.

For this industry, serving customers—whether internal customers or external customers—is the mantra. But the customer orientation of BPO companies and the impact of their work are not very well understood, because the context is not very clear. People are very unfamiliar with the markets that they’re dealing with. The way things operate in the US, for example, is not clear. Here, people are providing contact and customer service support, which is a very process-driven approach. They will deliver on SLAs [service-level agreements], but they will not deliver a unique customer experience. As a result, you will have challenges if the industry is to scale to the next level, to meet all customers’ challenges and service requirements. Companies that have demonstrated that kind of mind-set and history have not come out into the open yet, which is the biggest challenge.

**PwC:** How much of a bottleneck is the fact that companies have not yet started investing in domain competencies—for example, F&A [finance and accounting]?

**LN:** That would be a fair assessment. Under normal circumstances, you can categorize, say, F&A as a horizontal activity in that you’re doing the receivables, payables, accounting, bookkeeping, and those types of activities, but the moment a company is engaged in an M&A [mergers and acquisitions] activity, there is a certain level of domain specialization that has to come about.

For example, we do alternative fund accounting for one of our customers. That’s highly specialized. It’s not something that can be done as part of your regular accounting work. You have to set up a separate team, and you have to have qualified people who understand that business. That is the point about domain-specific competencies.

Are there projects that are under way right now that leverage domain competencies? Yes, but not as high in number as those in the horizontal BPO space. However, the sustainable opportunities are in this area. In my view, horizontal BPO will eventually get automated out. That’s the purpose. For example, you might start with a 100-member team, but with the application of technology, finally, you are no more than a 10-member team. All you’re doing, in addition to delivering the service, is shrinking that team—you’re making it more efficient, you’re automating the processes. On the domain side, some amount of shrinking is possible, but then newer applications are going to come about because the growth will constantly be there. The migration from this horizontal BPO to domain-specific BPO has been gradual, because horizontal BPO is clearly the low-hanging fruit.

**PwC:** In the past you have been vocal about shortage of talent in India also. How do you see that impacting the global delivery or BPO trends?

**LN:** Let me share an anecdote. One of the customers of a BPO company doing F&A work told the company representative: “You have a team of about 80 people working on this problem for me. I could do it with 40

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The BPO industry is clearly not as mature as the technology industry, but in the limited time that the industry has existed, it has made tremendous progress. The BPO industry is just about four or five years old. It started in the captive mode and then transformed into an industry of third-party service providers. To that extent, these companies have done well. The processes have been streamlined and so on.

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There are so many open-source products and stacks that have been developed and put out there. Very smart people collaborated on the fly and created these products. So why can't that context be created within the company so that all these smart people can collaborate from within? That is exactly what we have done now and put together as the Cognizant 2.0 platform, a platform that provides the ability for global collaboration, where a developer in China, a tester in Hungary, a designer in Chennai [Madras], and an analyst in the US can collaborate in real time using this platform to execute a project. That's already becoming available.

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people in my country if I had the right 40 people, but unfortunately I don't have them. Why is it that you are not as efficient as the 40 people?" The company representative's answer was: "In the USA, you could do it with 40 people. If I had the 20 or 30 right people, I too could do it with them. The fact of the matter is that neither you nor I have access to those 20 or 30 right people. We have to accept that all we have is these 80 people. Three or four years down the line, out of these 80, I'll get the right 30 or 40, and those are the people who will be working on it going forward. But today's context is different." That captures the situation quite well. Things are taking a lot more time and entailing larger teams. As a result of this, there is a greater demand today for a larger number of people. The IT industry here in India provides employment for 1.6 million professionals, and that number is expected to go to about 2.4 or 2.5 million by 2010. We're talking about a shortage of close to 400,000 people because we don't have enough people.

While we are setting up finishing schools and new universities are emerging in order to meet this demand, there is a revolution in progress where these 1.6 million people in the industry are also getting more and more efficient, like that 80-member team reducing to a 30- or 40-member team. We are getting a certain relief on the base that we've already established as an industry. That

is working in favor of the industry, taking some pressure off. The people available are not necessarily suitable for the task. However, that suitability gap is being bridged by the increased efficiency and productivity that we're deriving on the basis of that workforce.

**PwC:** Obviously, in your work with global service delivery and BPO, you deal with CIOs a lot. And as IT has evolved, so have CIOs. How has the role of the CIO changed from 10 years ago to now, and how do you see that role changing in the next 5 to 10 years?

**LN:** It has changed in two ways. One, CIOs understand the business a lot more today than they did about 10 years ago. Then, they were almost not expected to understand the business, whereas today, if you don't understand the business, you cannot be a CIO. Two, the accountability has shifted: No longer can they say that they delivered a technically superior project or a product to the business, but the business has not reaped any benefit out of that system. That is not the business's fault; it is the CIO's fault. There is a total alignment between business and technology, which is expected, and the outcome is not a technology outcome but a business outcome.

We see that, and it directly translates to our being partners with CIOs. Now, CIOs expect us to understand the business a lot more than before. And whatever work we do, we are accountable for the business outcome—such as customer satisfaction or improving market share—rather than the project or the technology outcome. There's no point saying, "I gave you code on time and on budget, and that code has only four defects in a million lines." This doesn't carry very far these days. That's a big difference.

**PwC:** Does that affect how you price your services?

**LN:** Yes, it affects how we price and staff our services. For example, about six years ago, we never put much emphasis on having MBAs and business analysts in the company. Today, we are saying our target is one MBA for every 25 technical people in the company, and they have to work together on teams. It's almost mandated. That's a big shift, because you need to understand technology and also the business. Our efforts to make technology people business savvy weren't as successful as envisioned. It's not possible for hard-core technical people to embrace business the way an MBA or a business analyst would do. And because of the MBA dynamics—these are clearly higher-priced people capable of doing more for the business efficacy of the project—the pricing has changed.

**PwC:** The emergence of enterprise Web 2.0, mashups, and Facebook-style application programming interfaces is making programming accessible to more and more users even business users. You have thousands of programmers in your company, so how does that impact your business?

**LN:** Yes, I agree, it is becoming easier. It has to become easier. I'll give you the example of open source. There are so many open-source products and stacks that have been developed and put out there. Very smart people collaborated on the fly and created these products. So why can't that context be created within the company so

that all these smart people can collaborate from within? That is exactly what we have done now and put together as the Cognizant 2.0 platform, a platform that provides the ability for global collaboration, where a developer in China, a tester in Hungary, a designer in Chennai [Madras], and an analyst in the US can collaborate in real time using this platform to execute a project. That's already becoming available. As we speak, we have beta customers, where we have inducted the customer team into this development environment. It's almost like the open-source development, except that it is a defined project, there are deliverables, and they have to follow a particular process. So the concepts of social networking sites have been applied to this collaborative platform.

**PwC:** What form does it take with respect to a particular client?

**LN:** We'll open this up to those clients who are receptive to this idea and want to be a part of this platform. We'll then see the challenges that confront us. For example, once I open it up to one client, you cannot open it up internally to a whole bunch of other people that you're partnering with. There are certain restrictions there. ■

# Making complexity manageable

What do you do when complexity *can't* be avoided?



Agile management teams need new technologies to support smarter and faster decision making, but capitalizing on opportunities to innovate with new technologies is difficult in today's enterprise environment because of the overwhelming complexity created by generations of previous technology investments.

To confront the costs of complexity, organizations are approaching it in sophisticated new ways. When enterprises successfully manage that complexity, their appetite for innovation through technology investments will accelerate.

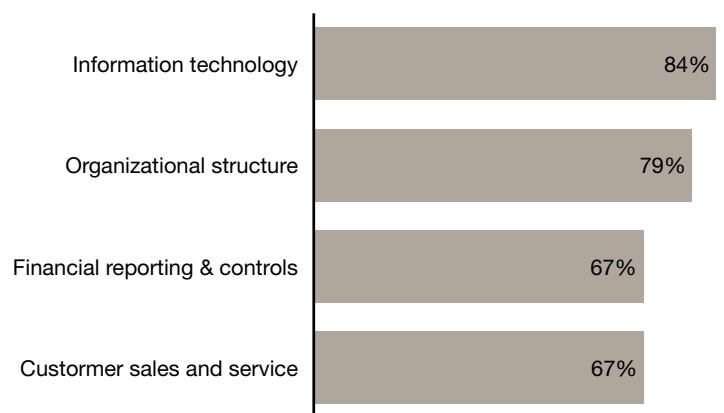
More than 75 percent of about 1,400 global CEOs surveyed by PricewaterhouseCoopers in 2006 said the level of complexity in their organization is higher than it was three years earlier. (See Figure 1.) Some level of complexity is an inevitable by-product of doing business today, so the challenge becomes how to keep complexity at a manageable level.

What creates this complexity? Expansion into new territories, mergers and acquisitions, and the launch of new products and services have been the primary sources, according to these CEOs. Moreover, complexity creates such a drag on enterprise performance that

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For many, it's no surprise that the IT function is the highest-priority complexity challenge.

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**1. Primary focus areas for CEOs to reduce complexity**

Source: PricewaterhouseCoopers survey of 1,400 global CEOs, 2006

nearly 80 percent of the CEOs said that reducing unnecessary complexity was a personal priority.

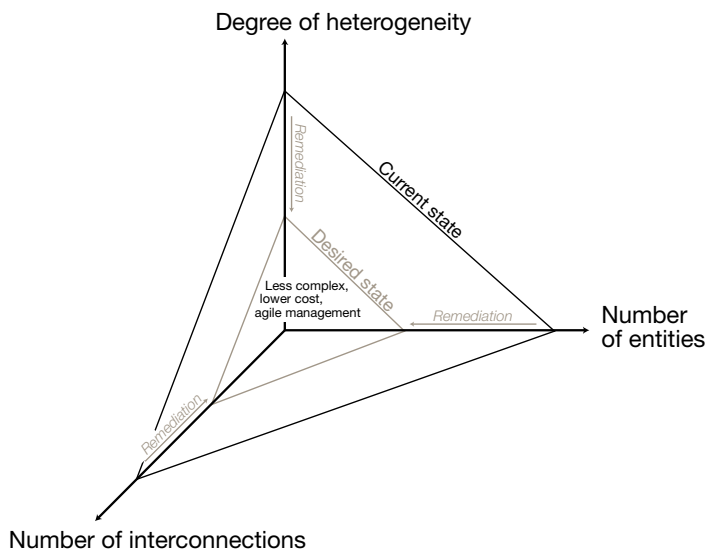
The CEOs' primary focus areas were information technology (84 percent), organizational structure (79 percent), financial reporting and controls (69 percent), and customer sales and service (69 percent).

For many, it's no surprise that the IT function is the highest-priority complexity challenge. First, IT echoes business because it is now integral to all business functions. As businesses and business processes have become complex, so has IT. Second, IT complexity occurs not only in the operations, but also in the architectures, applications, and data solutions deployed in the IT environment.

## The three dimensions of IT complexity

In IT, complexity can be seen as a result of three principal dimensions, as shown in Figure 2. They are:

- **Number of entities.** The large number of products and solutions, either hardware or software, that make up the overall IT system. The larger the number, the more complex the system. Monitoring, managing, and maintaining a large number of IT entities takes considerable human and specialized resources.
- **Degree of heterogeneity.** The lack of standardization among the various entities as they are sourced from several vendors and by different parts of the enterprise. This means that entities behave differently and require specialized knowledge and skills for their implementation, integration, and operation.
- **Number of interconnections.** The frequency with which the entities are integrated or interconnected to each other for the purposes of automation or other needs. Integration among these parts means they have unique dependencies and connections, making it onerous to introduce changes or quickly diagnose the system if a problem occurs.



### 1. Three dimensions of complexity

Source: PricewaterhouseCoopers, 2008

As a result of these dimensions, complexity increases when enterprises interconnect a large number of nonstandard heterogeneous parts (infrastructure or applications or data) to carry out necessary business functions.

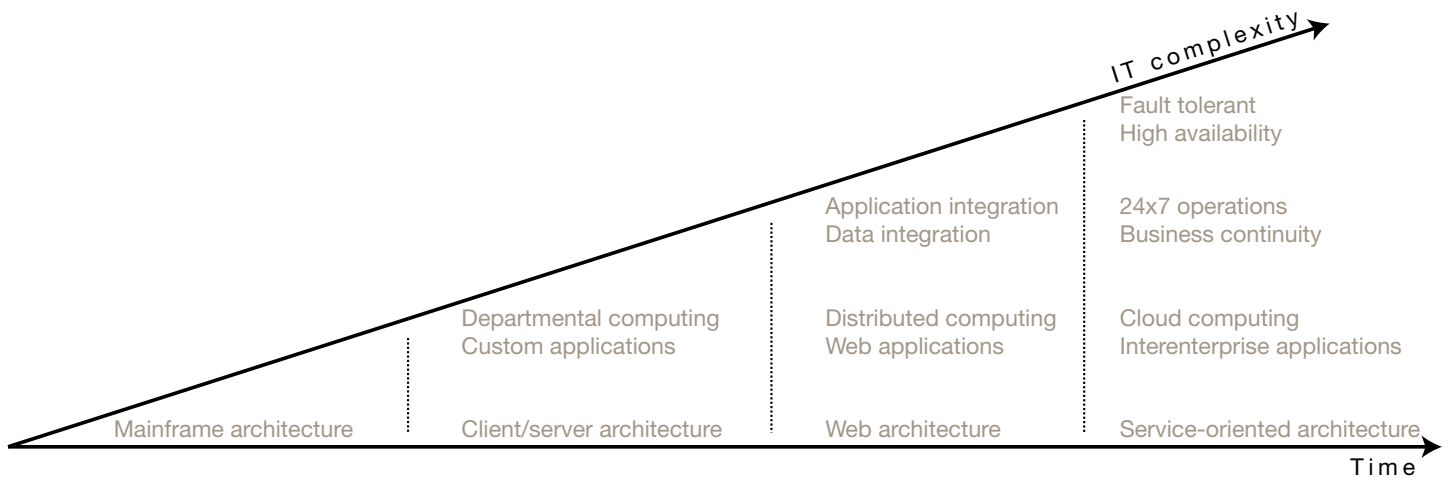
Many trends have contributed to the complexity within IT environments. (See Figure 3.) Enterprises have adopted several generations of architectures and solutions over the years, thereby adding layers of technologies from many vendors.

Those technologies and solutions often duplicated functionalities in different business units and spanned various operating systems, hardware platforms, and versions. Complexity increased as most systems became subsequently integrated for business efficiency and process automation. Complexity increased further as enterprises increasingly extended their IT systems to suppliers, partners, and customer IT environments.

Additional complexity stems from incompatible, duplicated, and poor-quality data that applications store and share. Furthermore, business continuity requirements and rising customer demands forced data centers to focus on nonstop operations, including hot-swap backup data centers. This trend has multiplied the number of IT assets that must be integrated and managed.

For competitive reasons, enterprises often developed custom innovations in-house, especially those that used emerging technologies. Competition or market conditions required fast action that couldn't wait until technology solutions were standardized or simplified, and as a result, complexity increased further.

“Of course, you have to innovate, and if you do it fast, you will add complexity. But, in parallel, you have to clean up those things where it's not worth any longer to differentiate yourself against others,” suggests Henning Kagermann, CEO of SAP. (For more of Kagermann's thoughts, see the interview on page 16.) While most enterprises have embraced technology as part of their efforts to differentiate themselves, they have not been serious about the cleanup that Kagermann is talking about.



1. **IT complexity over time: the adoption of new architectures and the imposition of new business requirements have continued to increase complexity.**

Source: PricewaterhouseCoopers, 2008

*Business impact of IT complexity*

Years of technology absorption have steadily worsened the complexity problem. This complexity has an undesirable impact on business in two principal ways:

- **Higher cost.** The continual management of patches, upgrades, new versions, and complex interfaces in the environment requires specialized skills. Industry estimates suggest that more than 70 percent of IT budgets are spent on ongoing operations and maintenance, leaving few funds for innovations and adoption of more-efficient and emerging solutions that drive enterprise competitiveness.
- **Lack of agility.** The ability to respond quickly to changing business requirements and market opportunities decreases. Many IT infrastructures are now brittle because of numerous integrations and associated dependencies. Most changes are onerous, require exhaustive testing to initiate, and take too long. They also increase the risk that a critical function may not work as before or may have an unexpected effect on another part of the system.

Despite those impacts, most organizations have not addressed the issue directly because more-compelling areas for IT spending have taken priority. For example, regulatory compliance, new process automation, and new business opportunities have higher priorities. Additionally, fear of breaking what is already running has also kept enterprises from addressing the issue.

As awareness and the impact of IT complexity grow, however, some companies are beginning to address complexity directly. Hewlett-Packard Co. (HP), for instance, is working hard to reduce complexity in its own IT operations and plans to cut ongoing operations and maintenance costs from 70 percent of its total IT budget to 20 percent, according to Forrester Research. HP intends to simplify IT on multiple dimensions: from 85 data centers to 3; from more than 5,000 applications to 1,100; from more than 21,700 servers to 14,000; and from 762 data marts to a single view of the enterprise.

## Complexity remediation

Although there is no off-the-shelf solution to address complexity, many of the emerging technologies and architectural approaches can mitigate IT complexity when implemented appropriately. The adoption of those new technologies and approaches will accelerate during the next decade.

In broad terms, IT systems consist of infrastructure, application, and data layers, as detailed in Table 1. The three layers of IT face different challenges and will benefit from different approaches to complexity remediation. Because managing IT across these three layers is a responsibility shared among the business units, so is complexity remediation. The following discussions explore the approaches that enterprises adopt to reduce complexity.

## Reducing complexity with virtualization and cloud computing

Virtualization is the aggregation of IT resources and their physical characteristics so as to make them available to applications and users in an on-demand manner. Virtualization helps organizations optimize resource utilization. The resources can be servers, storage, or other network components.

In a nonvirtualized environment, servers typically are dedicated to specific applications. Server utilization can average below 20 percent or 30 percent depending on the hardware platform. Declining hardware costs encouraged IT organizations to overprovision in order to accommodate peak loads. Dedicating additional hardware to an application was easier than optimizing utilization. However, while hardware costs were flat or declining, operations

Remediation focus	Organizational groups involved	IT complexity remediation approach	Applies to
Infrastructure layer	Can be pursued by enterprise IT alone	Virtualization and cloud computing	Servers, storage, networking, operating systems
Application layer	Business unit and enterprise IT	Application rationalization and application portfolio management (APM)	Legacy applications, vendor applications, middleware, Web services
Data layer	Business unit and enterprise IT	Master data management (MDM)	Databases, business intelligence solutions, data warehousing solutions

**Table 1: The three layers of IT face different challenges and will benefit from different approaches to IT complexity remediation. Note that Table 1 highlights only some of the approaches to complexity remediation. Other approaches and technologies not listed here can also be brought to bear in each of the layers.**

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*In many ways, virtualization of IT infrastructure is a return to the mainframe era, when computing was offered as an on-demand, centralized service coupled with a system of controls and usage-based charges.*

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and management costs rose significantly as the number of servers to manage increased.

Virtualization software eliminates the tight coupling that had existed between applications and the IT assets that support them. By pooling hardware resources, standardizing operating systems, and dynamically allocating resources according to application demands, IT organizations can deploy fewer servers. Average utilization across them can reach optimal levels without sacrificing either availability or performance.

In many ways, virtualization of IT infrastructure is a return to the mainframe era, when computing was offered as an on-demand, centralized service coupled with a system of controls and usage-based charges. All major systems vendors—including HP, IBM, and Sun Microsystems—as well as software vendors—such as Citrix Systems (which acquired Xensource in 2007), Microsoft Corp., and VMware—are offering virtualization solutions.

Cloud computing—server resources made available by third-party services over the Internet—leverages and extends virtualization technologies. These shared computing, storage, database, and networking resources typically are hidden behind standard interfaces that multiple businesses and users access in a multitenant environment.

Cloud computing is a continuation of the vision of utility computing, which suggests that IT capabilities will be accessible as a utility—much like electricity and telephony. The utility approach means that enterprises need not maintain and manage their own IT infrastructure and data centers. Instead, they access Internet services as needed.

Collectively, these technologies challenge the existing economics of IT infrastructure and, over the long term, offer lower cost and simpler operations.

Cloud-computing strategies are being actively pursued by vendors that already own and operate large data centers, such as Amazon, Google, and IBM. Amazon's service, called Amazon Web Services, brings together computing, storage, and database functionality over the Internet and enables enterprises to create and operate Web applications without owning any IT infrastructure.

#### **Benefits: Lower cost and agility**

Virtualization reduces operating costs by increasing asset utilization. According to a 2007 Data Center survey by Symantec Corp., more than 66 percent of data center managers say that server consolidation and server virtualization are the two strategies they are currently deploying to cut data center costs, followed by other approaches, such as automation of routine tasks and data center consolidation. Virtualization reduces costs and complexity because IT staffs require training in fewer technologies, replication of best practices from one area to another becomes easier, and IT organizations can source products from fewer vendors.

In addition to lowering costs, virtualization also brings flexibility to the IT infrastructure. The provisioning of IT assets to fluctuating workloads is more efficient. For example, on-demand scalability can speed the deployment of a new application, since no new hardware needs to be installed and configured by either IT or the end user. Also, in fast-growing businesses, the infrastructure can scale for new or existing applications by provisioning more capacity dynamically. And in turn, resources that support applications taken out of service can be put to new uses.

Cloud computing's benefits are similar to those of virtualization, but cloud computing is more comparable to utility or telecom carrier service-level-agreement (SLA)

situations. By giving the responsibility for the IT infrastructure to a service provider who specializes in managing multitenant infrastructures, enterprises pay to have someone else manage the complexity for them. This realizes a clear benefit, but one that incurs a cost of some flexibility and customization capability.

### **Mainstream adoption**

Adoption of virtualization solutions is expected to accelerate for the next few years. According to Forrester Research, half of surveyed enterprise IT organizations were using x86 server virtualization in early 2008, increasing to two-thirds by 2009. Among enterprises using virtualization, 24 percent of servers are virtualized today, and that percentage is expected to reach 45 percent by 2009.

Because virtualization is an emerging technology, most of the applications running in the virtualized environments thus far are non-mission critical. However, as the technology matures, adoption will spread to mission-critical applications. It will also spread from large enterprise data centers to small and midsize businesses and desktops, thereby continuing the momentum for the foreseeable future.

Emerging concerns about the power requirements of data centers are also fueling the adoption of virtualization and cloud computing. Fewer servers mean less power to run the data centers, which helps IT comply with an increasing number of green initiatives.

### **Challenges**

Although virtualization and cloud computing reduce complexity and cost, they also create new challenges. Because servers are not dedicated to particular applications in virtualized environments, IT departments will need robust capacity and priority management processes. And they'll need controls and protocols to ensure adequate performance for specific applications. Business users accustomed to having dedicated resources will need to understand and negotiate SLAs.

The prevailing licensing practices of most software vendors that sell packaged applications are not suitable for virtualized environments. Applications are typically

tied to a specific hardware or operating system. Over the long term, software licensing and pricing must evolve toward value-based pricing. (For more information on pricing models, see "Software pricing trends: how vendors can capitalize on the shift to new revenue models," available at [pwc.com/cti](http://pwc.com/cti).) Over the shorter term, however, virtualization is challenging existing licensing practices that depend on a strong coupling between application software and the hardware platform it runs on.

With respect to the three dimensions of complexity in Figure 2, virtualization reduces complexity primarily by reducing the number of IT entities that the IT organization needs to manage. Additionally, by standardizing on a few selected hardware platforms, virtualization also reduces the heterogeneity in the infrastructure layer. Cloud computing reduces complexity even further by taking away the need for managing an IT infrastructure altogether.

### *Reducing complexity with application rationalization*

In most enterprises, the number of applications—whether sourced from vendors or custom developed in-house—has increased steadily over the years. It is not uncommon for large enterprises to have several thousand applications that need to be maintained, managed, and supported.

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*According to a study by the BPM Forum, 78 percent of enterprises larger than \$500 million in revenues say they maintain and support redundant, deficient, or obsolete applications. They also estimate that more than 20 percent*

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*Emerging delivery models such as software as a service—as popularized by Google Enterprise, NetSuite, Salesforce.com, and other vendors—also reduce application-specific complexity by eliminating an enterprise’s need to manage,*

According to a study by the BPM Forum, 78 percent of enterprises larger than \$500 million in revenues say they maintain and support redundant, deficient, or obsolete applications. They also estimate that more than 20 percent of the IT budget goes toward such applications.

In the same vein, according to the 2007 data center survey by Symantec Corp., more than 67 percent of IT managers claim their data centers are getting too complex and that they have too many applications to manage. All of these applications require version control, patches, upgrades, bug fixes, feature enhancements, and related support, which make for substantial administrative burdens on the overall IT function.

At the same time, an organization may no longer need all the applications it has. Although enterprises keep creating new applications to respond to competitive dynamics and market opportunities, most enterprises do not have a structured or mature process for retiring or modernizing older or outdated applications.

Application rationalization is the process of consolidating, streamlining, and simplifying the application portfolio. Applications that do not support an enterprise’s business objectives or those that are redundant get weeded out. Required functionality gets consolidated in a core set of applications with standardized interfaces or modular services. Application rationalization also brings forth a governance structure that ensures enterprisewide visibility, so that new applications get added in light of

existing applications and aligned with emerging business needs.

A leading technique that can help with application rationalization is application portfolio management (APM). APM uses portfolio management techniques to track, measure, and justify the benefits of a particular application to its costs. This usually requires that enterprises aggregate pertinent information about applications and integrate it with business information to create intelligence and visibility into applications.

According to IDC, the worldwide APM market in 2006 was about \$1.81 billion, and IDC expects it to grow to about \$2.44 billion by 2011. Tools available from software vendors to support rationalization include IBM Rational Portfolio Manager, Planview’s application portfolio optimization solution, and Serena’s Mariner APM.

### **Trends facilitating application rationalization**

Consolidation in the enterprise software industry is reducing the number of vendors from which enterprises will source applications. At the same time, vendors are providing preintegrated solutions, thereby reducing an enterprise’s need for custom integrations. Less custom integration means fewer resources that the enterprise must allocate to support the integrations.

Moreover, emerging delivery models such as software as a service (SaaS)—as popularized by Google Enterprise, NetSuite, Salesforce.com, and other vendors—also reduce application-specific complexity by eliminating an enterprise’s need to manage, maintain, or upgrade applications and their infrastructure. System integrators and professional services providers also offer solutions for application rationalization. Active service providers include PricewaterhouseCoopers, Accenture, IBM, Infosys, and Wipro.

Application rationalization reduces IT complexity by addressing all three dimensions in Figure 2. It reduces the number of entities by eliminating duplications and retiring unwanted applications. It reduces degree of heterogeneity by driving the standardization of software platforms and vendors. Finally, with fewer applications, there are fewer resulting interconnections that need to be managed or maintained.

## *Reducing complexity in data*

Applications both create and consume data. As applications have proliferated over the years, so have data and databases. Data exists in departmental silos and is often duplicated, mischaracterized, or inaccurately stored.

The proliferation of data creates a major problem with regard to data quality and integrity. A survey by the Data Warehousing Institute found that 83 percent of organizations suffer problems with data because of inaccurate reporting, internal disagreements, and incorrect definitions. Problems with data quality and integrity have a negative impact on enterprises' productivity, decision-making processes, and overall market competitiveness. Such problems are critical enough to cause a surge of interest in adopting solutions and approaches that address those concerns.

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*According to IDC, the worldwide market for MDM software will grow at a 20.2 percent five-year CAGR, advancing from \$1.25 billion in 2006 to \$3.12 billion in 2011. The associated professional services market is projected to more than double*

A leading approach to reducing complexity with data is master data management (MDM). The goal of MDM is to provide an approach to creating a single, unified view of an organization's data—in other words, a single version of the truth. MDM gets at the heart of the data problem by creating a trusted source for data quality, data integrity, and data consistency.

Master data consists of information about critical resources, such as customers, products, employees, and other business assets. Critical business operations and processes depend on such data. Master data is usually centrally managed, is subject to enterprise governance policies, and is distributed and used across all systems. Vendors and service providers are actively offering solutions and services to help enterprises benefit from master data management.

### **The MDM market**

MDM products aggregate data from disparate systems and then clean and normalize the data. The result is a single view of the data—one that can be synchronized and can be shared throughout the enterprise. Other functions include support for workflow, business rules, data models, and integration capabilities to make the right data available to the right resource at the right time.

Solutions are offered by established platform vendors such as IBM, Oracle Corp., and SAP as well as smaller niche vendors such as Informatica Corp., Initiate Systems, and Purisma. MDM-oriented professional services are offered by many of the large systems integrators as well as outsourcers such as PricewaterhouseCoopers, Accenture, IBM, Infosys Technologies, and Wipro Technologies.

According to IDC, the worldwide market for MDM software will grow at a 20.2 percent five-year compound annual growth rate (CAGR), advancing from \$1.25 billion in 2006 to \$3.12 billion in 2011. The associated professional services market is projected to more than double from \$3.03 billion to \$6.08 billion in 2011, a 15 percent CAGR.

### **MDM adoption**

Many current business imperatives influence the robust growth prospects for MDM. Regulatory compliance requirements, for example, are encouraging enterprises to invest in systems and processes that validate and ensure appropriate controls on sensitive customer and financial data.

## Remediation in action

Many new-product rollouts taught a large multinational consumer product company that complexity in its IT environment was delaying the time to market for new products and services.

This negatively affected the company's performance in a highly competitive marketplace. To improve the speed to market of new products, the company launched a remediation initiative that targeted its infrastructure, application, and data layers.

Currently, this global enterprise has more than 2,000 applications—the result of mergers and acquisitions, rollup of companies, expansion into new territories and markets, custom development, and other factors over many years. Often, the enterprise has multiple instances of a product—such as enterprise resource planning (ERP) and customer relationship management—from the same vendor. In some cases, the enterprise has different versions of the same product, and in other cases, it has the same product on different platforms.

Application portfolio management will help the enterprise to rationalize the application portfolio from more than 2,000 to a final target of about 800. It will achieve its goal by retiring nonstrategic and unused applications, removing redundancies, and standardizing on versions and platforms.

For instance, all ERP solutions are being consolidated into a single, central ERP environment using minimal customization and simple integrations to other applications. In some cases, data from older applications will be transitioned to modern architecture, and older applications will be retired.

These efforts are concurrent with the architectural transition to a service-oriented architecture to promote modularity and standard interfaces. In addition to the focus on packaged applications, a few work streams are examining the adoption of software as a service for noncore functions. The transition is likely to span four to five years.

Parallel to the application rationalization tasks are efforts focused on the creation of master data and the governance policies for managing its integration and distribution. Data about customers and products is being aggregated from the existing systems and rationalized to remove differences in definitions, accuracy, and completeness. The enterprise is performing this rationalization by creating a unified view in a master data hub with a persistent relational data store built on open standards using Java 2 Platform, Enterprise Edition.

Upfront work in application rationalization and master data management will improve the infrastructure consolidation work stream. These efforts will shrink the infrastructure footprint by reducing the number of servers by about 25 percent.

By leveraging virtualization technologies, the utilization on the x86 servers will jump from about 8 percent now to 25 percent to 30 percent in the future, and utilization on the UNIX servers will increase from 30 percent now to about 65 percent in the future. Consolidation in servers is initially directed at non-customer-facing functions in the back office, such as Dynamic Host Configuration Protocol and Domain Name Service. Over time, consolidation will spread to other back-office and some front-office functions.

Integration of data after mergers and acquisitions requires the migration and aggregation capabilities of MDM to extract the synergies necessary for achieving financial returns.

Finally, enterprises are investing heavily in business intelligence solutions to leverage the large amounts of data that enterprises generate and store. That effort benefits from a trusted source for the data that gets processed, a key value proposition of MDM.

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*To succeed with MDM, many organizations will need to change their existing practices. Most important, MDM requires that IT managers and business managers agree on the semantics of the data and the underlying information. These managers need to resolve all of the inevitable internal disagreements about the definitions of data describing*

Other IT initiatives also benefit from MDM solutions. For instance, the service-oriented-architecture (SOA) approach promotes the development of services that provide data in a standardized form. These solutions provide real-time transactional and business analysis data delivered through Web services technologies that feed relevant business processes and applications. Like MDM, SOA initiatives also benefit from an enterprise-level look at data that has common definitions and is not duplicated.

Business process management systems (BPMs) take the information feed and bring the right information to important decision-making processes in a timely manner. (See “Bringing order to chaos,” p. 60.) Incorporating MDM functionality into an SOA or BPMS investment means that trusted, high-quality data and information will be available to applications and processes.

To succeed with MDM, many organizations will need to change their existing practices. Most important, MDM requires that IT managers and business managers agree on the semantics of the data and the underlying information. These managers need to resolve all of the inevitable internal disagreements about the definitions of data describing customers, products, employees, and other business assets. In addition, the managers must build a governance structure and establish processes for maintaining consistent definitions, avoiding duplication of records, and resolving variances among data sources.

An effective MDM strategy can alleviate the complexity related to data by managing metadata in a central location and improving data quality and consistency for all applications.

Although enterprises can use MDM to reduce the costs associated with managing data, the key benefit in the future will be the responsiveness of IT. A centralized repository of master data means changes can be made easily and propagated efficiently across the enterprise. Effective governance practices would mean that the duplication and proliferation of bad data would be contained or eliminated.

Returning to our dimensions of complexity in Figure 2, MDM reduces IT complexity by reducing the number of data entities that need to be managed. It also reduces heterogeneity by developing common definitions and standards for data integrity. The number of connections is reduced as well, as a single version of the data eliminates the need for point-to-point connections for accessing that data.

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*Complexity is a double-edged sword: Complexity creates value by bringing rich new functionality and higher levels of automation to business operations. However, it can cripple an organization by causing management burden, lack of responsiveness, and out-of-control costs. Complexity also creates value when it is hidden away from the end users and accessed with simple, standard interfaces.*

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### *Hiding complexity*

Virtualization, application portfolio management, and master data management consider IT needs at the enterprise level: across all silos, departments, and functions. As a result, IT assets and resources are optimized globally, with a view toward overall enterprise needs and strategy, in addition to meeting local requirements. When done right, these approaches bring the current IT house in order and prepare it for absorbing future waves of technologies and solutions in a manner that can keep complexity in check.

Complexity is a double-edged sword: Complexity creates value by bringing rich new functionality and higher levels of automation to business operations. However, it can cripple an organization by causing management burden, lack of responsiveness, and out-of-control costs. Complexity also creates value when it is hidden away from the end users and accessed with simple, standard interfaces. “Any simplification needs to focus on the user experience; that is where maximum breakthroughs will also occur,” points out S. Ramadorai, CEO of Tata Consultancy Services. (To read more of Ramadorai’s comments, see the interview at [www.pwc.com/techforecast](http://www.pwc.com/techforecast).)

For instance, an automobile is a complex piece of machinery that has evolved in quality and convenience over the years. When automatic transmissions were introduced in automobiles, they no doubt increased complexity of the car from that of manual transmission.

But the complexity of the overall driving experience was reduced because of the standard interface and automation. Most of the automobile’s complexity either is not visible or is abstracted with dials and messages appearing on the dashboard.

IT environments need to evolve in a similar manner. Unnecessary complexity must be avoided, and value-creating complexity must be harnessed and hidden behind standardized processes or interfaces. The incentives—in terms of either cost savings or increased flexibility—are in place for enterprises, vendors, and service providers to encourage this evolution.

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# Operational Web 2.0

Finally, enterprise-class tools and methods are emerging to create informal online networks. Already, business users are collaborating to deliver better decisions.



Tech book publisher Tim O'Reilly coined the term *Web 2.0* in 2003. In the process, he identified a common thread that connects many seemingly separate things such as blogs, wikis, and mashups.

The term *Web 2.0* refers to social software that enables people to interact and share information in new ways. It is the interactivity of Web 2.0 services that distinguishes the services from those of Web 1.0. If Web 1.0 was a one-way broadcast, then Web 2.0 is two-way conversation. Web 2.0 provides a way for users to add their own input directly and instantly to what someone else has posted on the Web. (See Figure 1.) This form of persistent interaction converts what used to be a one-to-one or a one-to-many information flow into a many-to-many information flow.

Web 2.0 is associated with familiar public online services such as blogs, wikis, social networking, bookmarking, and mashups. Web 2.0 describes interactive social networking platforms such as MySpace, Second Life,

and Facebook, as well as standalone services such as Blogger, Wikipedia, Bloglines, Google Maps, Digg, and Yahoo! Pipes.

### Web 2.0 and agility

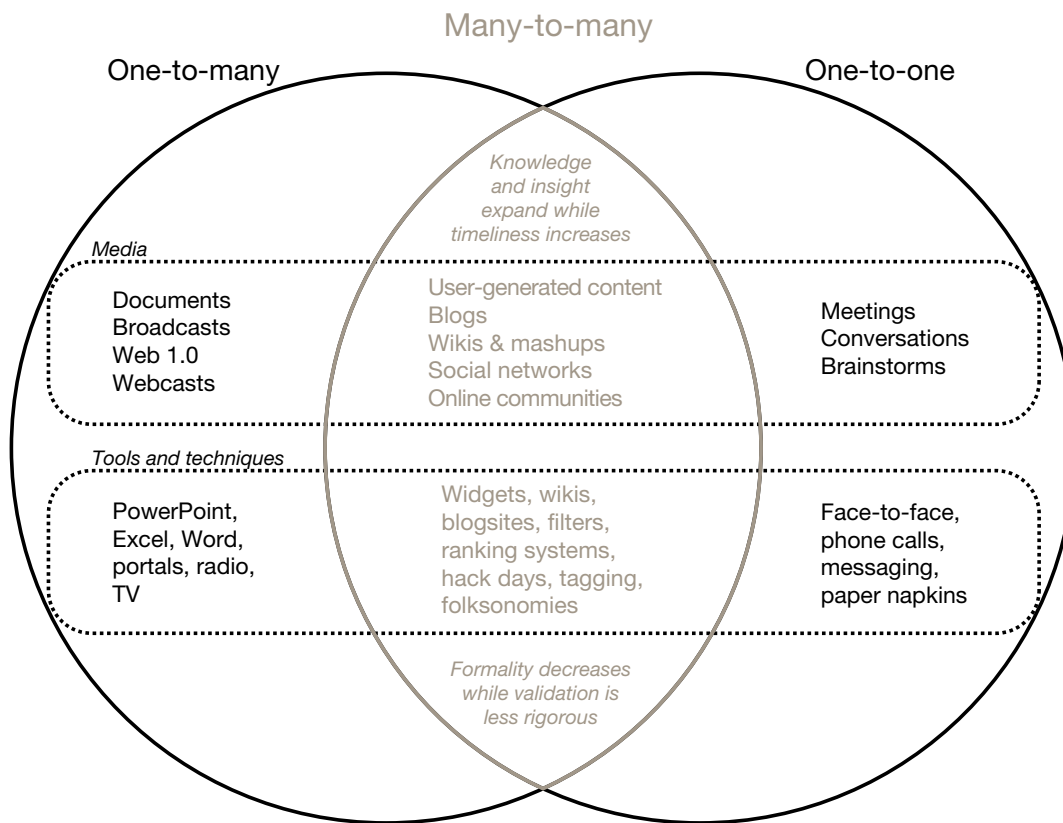
Agile management demands the kind of decision-making support that Web 2.0 offers. With Web 2.0, decision makers can use virtual-presence technologies to facilitate instant access to networks of subject-matter experts. Additionally, smart enterprise search can locate the knowledge trails those networks of experts leave in blogs, wikis, and mashups.

In the process, the art of business communication is being redefined. Informal channels within and among organizations have always been important, and Web 2.0 is rapidly becoming the communications backbone for those informal channels.

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### 1. Many-to-many aspect of Web 2.0

Source: PricewaterhouseCoopers, 2008

#### Beyond wikis and blogs

Interactivity and personalization are what have made Web 2.0 so popular for consumers. For enterprises, it's about more than just interaction; it's about tools that can help devolve authority, empower the workforce, and build bridges between organizational silos.

Transformation of this sort is possible only for established enterprises focused on the cultural shift that must accompany the technology adoption. This implies a long road and a steady course for those who want the real benefits the interactive Web promises for enterprises.

A recent surge in media coverage of the topic makes it seem new, but Web 2.0 concepts have been around for more than five years now. During those years, Web 2.0 has altered the landscape of the consumer Web and changed how people exchange information. By December 2007, MySpace and Facebook were ranked fifth and ninth, respectively, in audience share among the top 20 Web sites in the US, according to Hitwise. Neither service existed six years ago: MySpace began service in late 2003, and Facebook, in early 2004.

By January 2008, hundreds of millions of people worldwide had joined the current generation of social networking sites:

- MySpace led the rest, with more than 200 million users.
- Chinese site 51.com had more than 90 million.
- Facebook reached 63 million.
- Bebo, popular in the UK, claimed 40 million.

Given the sheer numbers, the current generation of Web 2.0 services is a communications phenomenon with implications beyond the online communities that preceded them.

So how do they fit in? And where are they leading us?

### Online social networking: Sharing experience online

Electronic capabilities improved our ability to share experiences by orders of magnitude—to the point that global, instantly available multimedia are taken largely for granted. Those improvements have become more frequent via the mass availability of computer technology and high-bandwidth telecommunications.

In the 1950s, the professional media elite dominated television. By the mid-2000s, many of the most popular videos on YouTube were being made and posted by amateurs. The popularity of YouTube rivals or exceeds that of any single television channel. As early as 2006, 22 percent of the UK population watched YouTube at least occasionally, and 2 percent of those surveyed indicated they consequently watched less television, according to the BBC.

At that point, YouTube was serving up a total of 100 million videos a day to all of its worldwide audience. As of March 2008, the most-watched video on YouTube—made by an amateur—had been viewed 107.5 million times since its posting a year earlier—an average of 293,000 views a day.

Much of this public information sharing deserves attention, but what about the enterprise side? True, many of the same people who've registered on MySpace or Facebook are in the workforce. (For example, the PricewaterhouseCoopers network on Facebook reached 15,500 users in June 2008.)

Recent college graduates who are coming of age with tools like Facebook find e-mail a less desirable way to communicate. As they enter the workforce, they will expect comparable tools inside the enterprise.

Much of the activity on the consumer Web is frivolous, and some of the companies experimenting with social software seem preoccupied with superficial aspects of it. Enterprises are right to be skeptical, which raises a question: What value do Web 2.0 and the methods behind it actually provide for enterprises?

### Business value of social media

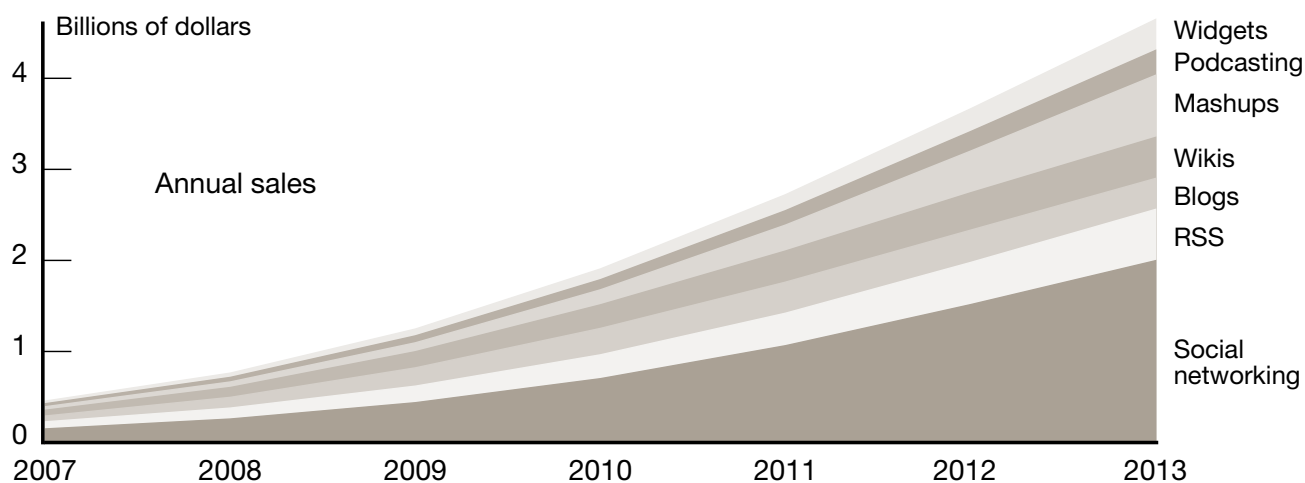
The value of the Web is tied to the content that results from the interaction itself. Ideas created during conversations used to be ephemeral—lost to those not present at the time of the conversation. Social networking means these informal conversations get captured in a persistent way and are broadly accessible. The reusability of conversations between smart, engaged employees in unanticipated contexts defines a new dimension for information communications.

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Once information becomes part of the aggregate, recommendation engines can assess the preferences of users and retrieve more relevant results. For example, the collaborative filtering technology behind recommendation engines (already in use at call centers to help customer service representatives suggest products to customers) can be used to suggest relevant content to employees.



## 1. Spending on social media

Source: Forrester Research, 2008

By reading directly about the experiences of others, employees can learn from each other. BT Design managing director J. P. Rangaswami observed in a 2007 blog post, “Knowledge management is not really about the content; it is about creating an environment where learning takes place.”

Enterprise search tools are beginning to make it possible to analyze free-form text and mine for facts that can be exported. Other tools—like Really Simple Syndication (RSS) enable information to be pushed from a platform such as Facebook into places on the company intranet or into an enterprise application.

Still other tools encourage interaction and become destinations for users to share and respond to ideas. IDC analyst Rachael Happe says she uses Twitter—a microblog platform that many people use to let others know what they’re doing—to post ideas instead.

With a circle of like-minded acquaintances online, Happe gets quick feedback on each idea. The ideas get scrutinized not only by people she’s interacted with before but also by others who happen to find the discussion thread.

Certainly, there are privacy issues, but giving employees the option of sharing what is ultimately related to their

work product anyway won’t always be an issue. Most may decide to share at least some information. The benefits include increased connectedness, reuse of lessons learned, and elimination of the duplication that results when experiences are shared.

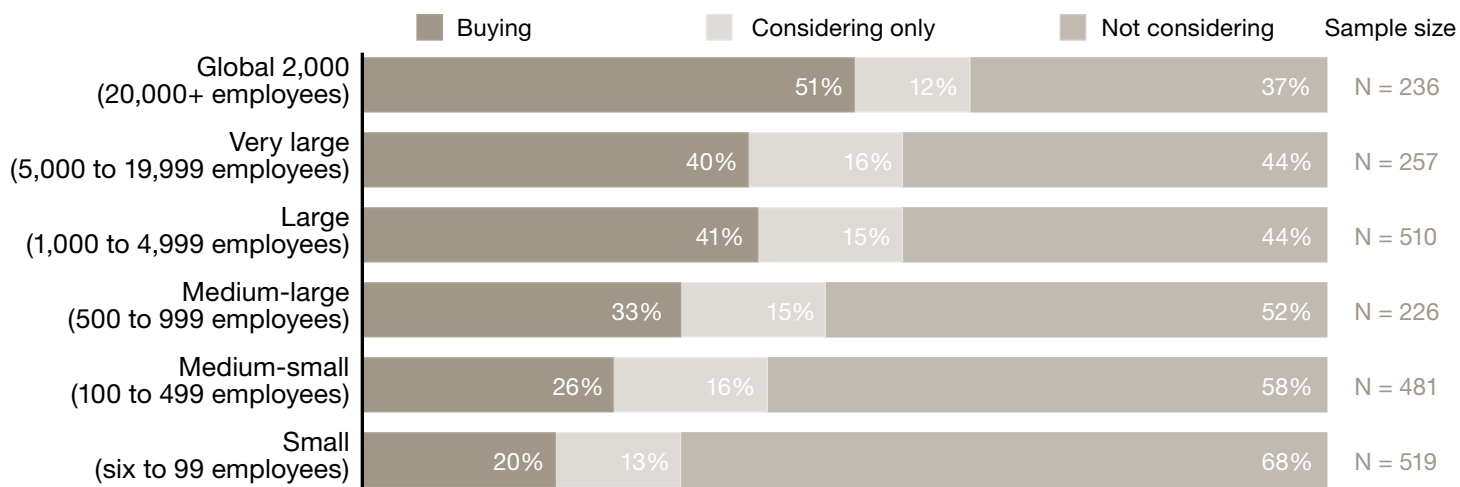
These benefits have not gone unnoticed. Enterprise spending on social networking alone is forecast to rise to 66 percent annually from 2007 to 2013, according to Forrester Research. (See Figure 2.) As Figure 3 shows, 51 percent of Global 2000 companies expect to buy Web 2.0 tools in 2008.

Essentially, Web 2.0 media promise an additional communications channel for types of information exchange less easily facilitated by other media.

### Mashups

While Web 2.0 technologies assist in capturing and bringing information online, mashups help aggregate it, help analyze it, and help users understand what the information means.

Mashups address the ad hoc analysis and display needs of enterprise users. They simplify the process of retrieving and aggregating data quickly from multiple



### 1. Web 2.0 adoption in 2008

Source: Forrester Research, 2008

Web sources by partially automating the process. And they make it possible to repurpose the use of information on-the-fly inside a browser.

Mashups make rapid development of browser-based, rich Internet applications possible. Users—as opposed to programmers—can develop, refine, and share highly customizable views of data from disparate sources both internally within the enterprise and externally.

To a greater extent than before, users are able to specify how they'd like their data presented. Mashups encourage higher levels of customization and more-pervasive use of internal and external information. The resulting applications are thus very user-centered.

At the same time, content developers are using more standardized, semistructured data such as microformats in Web pages. Microformats make it easier to reliably extract contact information or geographic location information, for example, which leads to improved ability to aggregate and integrate data derived from separate sources of data on the Web.

Such companies as Denodo Technologies, IBM, JackBe, Kapow Technologies, and Serena Software have offered enterprise mashup platforms since 2005 or so. JackBe's examples of how organizations are using

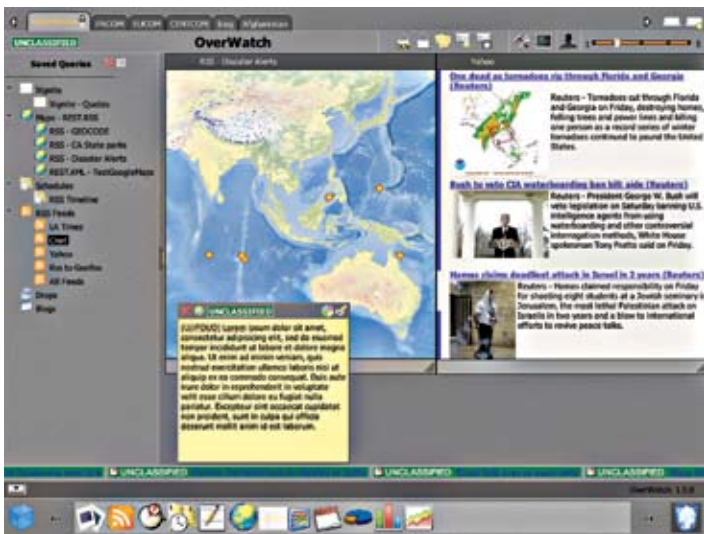
its mashup platform provide some insights into what the platforms enable.

JackBe's chief technology officer John Crupi noted during a briefing that the US Defense Intelligence Agency (DIA) has the ability to do scenario-based risk analysis of military assets in real time. (See "The dos and don'ts of mashups," page 56.) Instead of using dated, PowerPoint slide snapshots of these scenarios, DIA analysts wanted to pose the scenarios during the briefings and display the results the system presented. JackBe helped the DIA create a portal that displayed scenario results that analysts could present visually to others, as well as bookmark and share online. (See Figure 4.)

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## 1. DIA's scenario mashup

Source: JackBe, 2008

### Limitations of enterprise mashups

While mashups represent a powerful technique, they can be only as good as the information on which they rely. Mashups provide an additional layer of analysis and presentation capability on top of service-oriented architecture (SOA) and Web-enabled data sources. Being at the top of the stack, they depend on each layer beneath them.

Without consistency at each layer—especially consistency in quality, governance, and uniform semantics at the data layer and sufficient, consistent services and application programming interfaces—mashups that aggregate and analyze data across silos are ineffective. Thus, enterprises that encounter inconsistencies when building business intelligence applications are likely to encounter similar problems when developing mashups.

Users may encounter more access complexity with mashups. Enterprises implement access control in many different ways, and current identity management infrastructures can create a complex maze of

permissions. Facilitating mashups means adding to that complexity and revising access control wherever it imposes a barrier.

Like many other legacy technologies, most of the existing identity management mechanisms did not anticipate mashups. Moreover, information technology organizations struggle whenever users request reports from data sources that cross silos. For example, it might be a good idea to develop a mashup of internal vendor data combined with external data about vendor creditworthiness, but it presupposes that the different units have agreed on a single definition of a vendor.

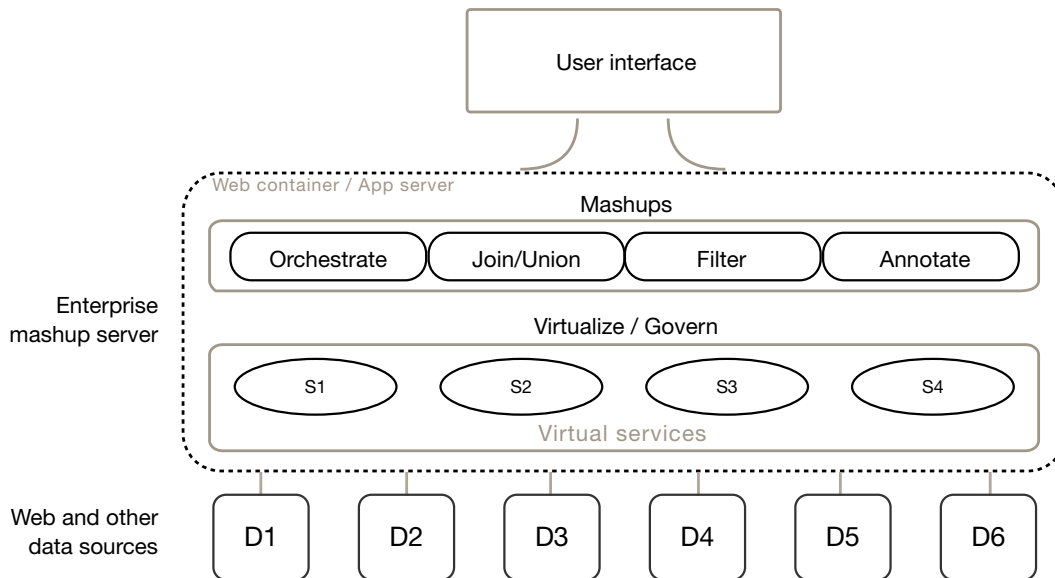
Reuse of mashups developed by others is another big potential win, but reuse hinges on proper version control, design, and metadata—hardly a given when end users are developing mashups. Enterprise 2.0 consultant and blogger Dion Hinchcliff alluded to the version control problem in a list of mashup issues that he posted in 2007. Some bona fide enterprise mashup platforms with version control exist, and others are in development.

Design and metadata issues speak to governance of mashups themselves: How well are they tagged and otherwise designed so that a person in one department can use a mashup created by a person in another department or in another organization?

### Mashup application environments

Although some claim that users themselves can create true applications, it's more accurate to say that a mashup application environment provides an additional layer of end-user aggregation capability and configurability. The platform acts as a bridge—with flexible application functionality—between SOA services or databases and an AJAX (asynchronous JavaScript and XML)-enabled browser client. By contrast with the composite applications available in suites, mashup functions are essentially more malleable and more ad hoc.

Users can produce mashups in a way that can preserve data integrity: they can avoid the equivalent of uncontrolled growth, because the data aren't duplicated or decoupled from the sources and because the logic



### 1. A sample mashup architecture

Source: JackBe, 2008

stays and can be modified in one place. Enterprise mashup platforms mediate between the data source layer and the presentation layer in a way that's consistent with the underlying SOA governance framework that enterprises are building, as in the JackBe architecture. (See Figure 5.)

### Value propositions for mashups

There are four key value propositions that support the use of mashups.

#### Data analysis efficiency

- Knowledge workers are investing many hours of effort in desktop tools such as Excel and PowerPoint, pulling data from separate enterprise systems, combining it, analyzing it, and charting it.
- Enterprises can optimize that labor by making the logic and presentation configuration sets created with the tools directly sharable on the Web. The sets then become reusable assets, and should the logic need to change, they provide a single place for making those changes.

#### Improved database utilization

- Mashups are well suited for the kind of perishable information that now exists in often-underused databases, such as those that contain customer contact records. They can serve as a mechanism for increasing the utilization of this kind of resource generally.
- Enterprise mashup platforms can combine internal databases with public data (geolocation data, for example) and at the same time adhere to the access control rules of the internal data sets.
- Previously stranded, ad hoc databases can be accessed and used in more powerful ways. Once information from several places gets linked and becomes more useful, it becomes more important to maintain and add to it.

## Knowledge transfer efficiency

- An effective mashup platform based on sound governance principles can result in more of the benefits of broad information sharing without risking information compromise. Such sharing then allows more knowledge to cross functional lines—so that research and development can leverage the mashups in operations, for example.

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The viability and ease of use of these media controls consistently lag behind technological advances in media.

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## Power-user leverage

- Mashups are a natural fit for people who can develop Excel macros, a new way to tap into the skills of this group of workers.

Mashups are not replacements for high-volume enterprise applications. Fundamentally, a mashup platform provides a configurable way to link live data; to integrate, filter, and analyze it; and to share the persistent result visually or in tabular form.

Crupi made this observation: “We get a lot of customers asking if we can mash up a million records. We say you would never want to mash up a million records. You have access to your database, which knows how to manage a million records; the mashup addresses the small subset of records that you need to get to the user.”

## Enterprise media controls

Because user-created content and ubiquitous shared media are new, businesses are still trying to make sense of them. Clearly, they understand the value of capturing what Rangaswami calls watercooler information. Making watercooler information persistent with the help of social networking tools is now feasible.

As Rangaswami points out, it’s the kind of information that enterprises have wanted to capture for decades now. Who people are specifically, what they’ve done, what they’re talking about that’s work related, and who and what they know are all pieces of information of high value to enterprises once such information gets networked, becomes searchable, and is tagged.

There are many different business, legal, and personal reasons to impose controls on data. Any company has its own closely held information, such as intellectual property, trade secrets, business processes, and personal information. The viability and ease of use of these media controls consistently lag behind technological advances in media.

By analogy, e-mail has existed since the mid 1960s and has been common in the business world since the 1990s, but until recently, most e-mail controls were procedural rather than technical.

Technical access control of electronic documents such as e-mail attachments, offered by enterprise rights management software vendors, has only within the past year or two seen adoption outside of highly regulated verticals such as healthcare, telecommunications, pharmaceuticals, and the public sector.

Out of a \$41-billion global security software and services market, IDC estimates that only \$1.1 billion was spent in 2007 specifically on information protection and control—that is, on products providing enterprise rights management and content-filtering software. The research firm forecasts that market will grow to \$3.2 billion by 2011.

Because Web 2.0 media and mashups further democratize information; because they span boundaries between departments, divisions, and enterprises; and because they introduce security vulnerabilities in the process, they demand procedural controls similar to the procedural control of e-mail 20 years ago.

However, many enterprises do not yet see the value propositions of social media as clearly as they did those of e-mail. While e-mail supplanted most regular mail, social media seem to merely augment information already on hand. At a tactical level, the benefits don't always seem to warrant the apparent risks. In spite of those perceptions, enterprises' social media adoption is on the increase.

To manage risks effectively, enterprises will again need to stress more-elaborate procedural controls that make use of what's available from a technical standpoint. In some ways, some forms of Web 2.0 media allow better risk mitigation than e-mail does, because the information is more visible and thus more easily moderated.

Content filtering is also possible. Companies can either screen each item before it's posted or monitor the traffic

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with tools that detect and stop anomalous behavior. Other aspects of Web 2.0 content security, however, are murky at this point.

Some organizations provide places internally where employees can store personal information. Others take advantage of public social networking tools and link to profiles stored at Facebook or LinkedIn. This technique raises the question of whether Facebook profile information is appropriate for internal audiences.

### Outlook: Transformations enabled by Web 2.0

To be able to use this Web 2.0 information effectively, enterprises will need to:

- Facilitate dynamic blending and display of information to improve its utility
- Invest in text mining and filtering to identify and retrieve the most-valuable information

This must be done quickly and cheaply enough to exploit the information before it loses significant value.

Six hypothetical examples illustrate how enterprises might use Web 2.0 to gain competitive advantage.

**Example 1:** A company records a human resources (HR) orientation session and segments, tags, and indexes it using an automated tool.

- Reuse of the same session over and over is an immediate initial benefit.
- Segmentation means the information can be repurposed and customized as well. HR can add segments for different roles and departments over time.
- At any time in the future, any employee can retrieve the most-relevant and most-needed portion of the information provided.

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In general, improved interconnectedness will mean that work that used to get done in isolation can be done more effectively together. The degree of effectiveness will depend on how well enterprises can make the cultural changes necessary to result in true interconnectedness—something the tools alone cannot accomplish. With a high degree of interconnectedness, much more of the power of the informal organization can be brought to bear.

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**Example 2:** With the right mashup infrastructure, an employee who struggled to understand what a time-reporting system requires could annotate a standard orientation video and combine it with self-made videos showing mistakes being made and corrected.

- Engineers optimize an entire process flow by capturing the information in each part of the process at one plant. They then can more easily replicate the same process in multiple plants with the help of interactive Web tools that encourage, rather than restrict, sharing.
- Segmenting the process into subprocesses helps make it possible for users to optimize the workflow processes they are responsible for. The Web tools automate the reintegration of these subprocesses so that the entire revised flow becomes visible to all users.

**Example 3:** Through blog searches, workers find out about nearly identical projects taking place in two different locations and decide to pool resources.

- More generally, Web 2.0 technologies can provide a backbone for distant collaboration. Finding colleagues with needed skill sets and relevant past experiences is facilitated by Web 2.0 infrastructure.

**Example 4:** Once the contents of a meeting become persistent and accessible, virtual-meeting participants can continue the conversation by adding comments as well as capturing input from those who couldn't attend in real time.

- Global companies will find examples like this helpful in serving employees and managers in different time zones.

**Example 5:** Purchasing agents take advantage of the interactive Web to develop mashups that serve as custom catalogs. For example, the procurement mashup will cut the time required to compare and contrast pricing information from suppliers.

- More generally, custom access to select information applies to many disciplines. For instance, a physician might want to know when new articles appear in select journals or when US Food and Drug Administration findings become available.

**Example 6:** An executive can take advantage of a business intelligence report mashup that evaluates the tax ramifications of shifting the balance of operations from one group of countries to another.

- Similar applications could be developed for currency hedging, commodity trading, and other tasks that track shifting data.

## Conclusion

Ease of use is not yet in place. In many cases, building mashups will be nonintuitive, often requiring the skill of power users. But ease of use should improve quickly. By the end of the decade, casual enterprise users will themselves become used to simple mashups. Already today, casual users can construct consumer (versus enterprise) Web 2.0 applications with such tools as Intel Mash Maker, Microsoft Popfly, and Yahoo! Pipes.

Web pioneer Tim Berners-Lee predicted in March 2008 that electronic documents such as bank statements and calendars would acquire enough intelligence on their own that users could create mashups simply by dragging one document on top of another. He offers the example of dragging a calendar on top of a bank statement to be able to remember where and when money was spent.

While there may be value even in simple mashups like the one Berners-Lee describes, the fact remains that many of the business-value benefits of mashups, social networking, and other elements of Web 2.0 will remain intangible for some time, but as that time approaches, the workplace will become friendlier because employees can personalize their own profiles. Ad hoc working arrangements will be able to come together more quickly. And documents, services, and databases will see greater reuse and interconnectedness.

In general, improved interconnectedness will mean that work that used to get done in isolation can be done more effectively together. The degree of effectiveness will depend on how well enterprises can make the cultural changes necessary for true interconnectedness—something the tools alone cannot accomplish. With a high degree of interconnectedness, much more of the power of the informal organization can be brought to bear.

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# The freedom to connect

Richard Rosenblatt of Demand Media describes how to borrow ideas from the consumer Web for enterprise benefit.

Interview conducted by Alan Morrison

Richard Rosenblatt cofounded Demand Media in 2006. Previously, he had been CEO of Intermix and chairman of MySpace. Demand Media takes a vertical approach through a single platform for Web content development and distribution. In this interview, Rosenblatt discusses how the Web has evolved and how enterprises can take advantage of the interactive aspects of it.



**PwC:** You've been involved with the Web for quite a long time—all the way back to its progenitors. What did the Web look like as an opportunity for you at that point? Can you think back to '94?

**RR:** Absolutely. It's great to talk about it because remember, the World Wide Web didn't even start until 1994. Before then, there was no GUI [graphical user interface] that allowed you to put up HTML [hypertext markup language] pictures, photos, and all the stuff that everyone just takes for granted as the Web. Before then, it was e-mail, and you weren't able to really do anything commercially interesting unless you were a hard-core techie. So, the invention of the World Wide Web was the first time that it really became a media opportunity. Before that it was just a technology opportunity.

After I was introduced to the World Wide Web, I thought, "Wait a second, you can put up text and some pictures and it's free as long as you know how to program HTML." Now, if you combine that with the Internet's global reach, you have a new, exciting commercial opportunity.

It was really just a static billboard type of ad. Then, in 1995 and until we sold the company in 1999, we tried to figure out a way to make the Web site more interactive—a place where you could actually sell stuff online. That's what iMall was; it was the first online shopping mall and e-commerce solution to let small businesses sell products through the Web.

The Web has gone now from a very flat, more utilitarian type of communication vehicle to a multimedia experience that has the potential to replace television.

**PwC:** As you were doing this in the '90s and the early 2000s, were there any aha moments with implications beyond what you might have assumed previously?

**RR:** There were. With iMall, we first created what you might call a business software business. It was a traditional service where we talked to clients and tried to sell them Web sites with a pretty simple pitch: "We are going to build new Web sites for you and put it on iMall, which has traffic, just like shopping malls."

That approach is very difficult to scale because you need lots of people to build many Web sites, and people want lots of changes to their Web sites and new features—all the different things that make it very difficult for very client-centered types of business.

So in about 1995 or 1996, we built a set of tools that allowed the small business to use a very simple template, and the business itself was able to build the Web site. So the aha to me was that the Internet allows you to turn the power over to the small business to build its own Web site, and you just take a recurring fee. That was a beautiful model.

That model for the small business allowed me to focus and invest heavily in MySpace, the next generation. It wasn't for the businesses; it was for individuals. So now individuals could build their own space, connect with their friends, put up their own information, do everything that they wanted to do through the Web. The aha for the last 13 years has been to enable the users to do what they want with it and then figure out the business model as you are giving them that power.

PwC: Demand Media seems like a logical extension of that.

RR: Yes, but vertically focused. When we started Demand Media, we knew social media was becoming more vertical and more personal. That presented a business opportunity because it's very easy to sell to advertisers that are interested in reaching golfers, for example. So we have Web sites and domains from birding to paintballs, and they get more microfocused like sports cars to green-friendly sports cars.

As you go more and more vertical, you can manage on one platform an infinite number of verticals, and they are very apt for targeted advertising because you know why the people are there.

PwC: On the Web now, things are getting more and more fragmented. Where are we headed?

RR: For a long time now, I have been talking about what I call the portable profile. It's like a passport where if you log into golflink.com, there is all your stuff. If you log into trails.com, there is all your stuff, if you log into any Web site. We are able to do all this on our platform, and because all the sites are on the same platform, user information is automatically retrievable from any site or domain. So if you are a member on any of our Web sites, you are a member on all of our Web sites if you so choose. Or, you may not want to be the same person on golflink.com as you are on trails.com.

I do believe at one point your content will be aggregated in what I think ends up being your own domain. At Richard.tv, for instance, I will log in, and it will suck in all my different information from all my profiles around the Web. And I do think that's the future. It will be very interesting to see who does that.

PwC: What about other consumer developments that will affect the enterprise? Take mashups, for example. Companies have so many databases that are pretty much stranded internally: A few people know about them, and others don't. If you have the means of aggregating and presenting that information internally, that would be powerful. Are you working at all with mashups?

RR: We announced in March that we bought Pluck. One reason we did was for its SiteLife social media platform—Guardian News and Media and others in the publishing business, for example, have been using that platform to add interactivity and online community

capabilities to their Web sites. The Pluck APIs [application programming interfaces] could present some interesting mashup possibilities. Otherwise, when we do mashups, it's more on the consumer side. We have a partnership on the video side, where people can come and get everything from Star Wars clips to all kinds of professional clips and music and mash that into their own personal video. So they could create whatever they chose with their own Star Wars rendition of something related to another hip-hop song, all legal content. The main thing here is giving users the ability to grab lots and lots of content from what we call the studio and build up their own Web site, which we monetize.

**PwC:** Do you think that licensing in general is sort of opening up a bit more because of all the video mashup activity on YouTube?

**RR:** It is. We've talked to lots of publishers. When I sold MySpace to Fox, I spoke about this with Rupert [Murdoch] and Peter [de Monnink] and the whole crew. I talked about the need to set their content free. People were stealing it anyhow. They should put their content on the Web and include ads, because if it's streamed, you can't skip the ads. When you let people do what they want, they can put the clip on their home pages, send it around to their friends, do whatever that takes. Hulu leverages the ability to take all this professional content and give it to the MySpace and Yahoo! users and all these people in the world. So people don't steal it. That's a big move. When people ask me what Web 3.0 is, I really think it's Web 2.0 with Web 1.0. It's the traditional media model of producing great content with the low-cost distribution of the Web. And I don't mean re-creating expensive content. I mean taking these libraries that these media companies have had for a hundred years and literally starting to figure out new ways of content integration—starting to figure out a digital way of distributing it.

**PwC:** Another aspect to this involves widgets and the modularization of content frames that you can embed anywhere. Does that present an

opportunity we haven't thought of before? I mean, something beyond what's already happening in sites like Netvibes, for example?

**RR:** I am very excited about widgets because widgets let you do what I mentioned previously about being able to grab content. So by wrapping your text, your video, your applications—anything you want—in a widget, someone can just click on it and put that right on their page. It's the ultimate syndication opportunity. As long as the quality of the widgets is high, people are going to want to pass those widgets around, and there can be advertising embedded in those widgets. And you may have found another form of advertising—a widget business model, in other words. That's why we are investing so heavily in video. We want to have as much inventory as possible, and we believe we are the largest Internet-created library of video content on the entire Web. We are the largest supplier of content to YouTube right now. We receive over 600,000 views of our videos per day on YouTube alone.

**PwC:** Let's put this in an enterprise context. Where many enterprises are internally is still Web 1.0, especially those that have a lot of history. They have a lot of legacy systems, and one of the problems they're facing has to do with their intranets: people don't go there; they are not interested in them. So how do we make this legacy approach to the Web more dynamic? Are there things you could suggest that enterprises do to enliven their existing Web sites internally?

**RR:** The best thing would be to add social media. Seventy percent of people on the Internet are interested in interacting with the Web sites they visit. So, whether companies start with just adding simple blogs or they start with something like the ability for people to post comments, being open and allowing people to publish content about the company—good and bad—will get them enormous credibility.

The fear companies have is: What if the community decides to put down one of their products or services? Well, they are going to do it anyhow. And the fact is that

if you have a product or a service at a company, people will rally to your defense—to defend you. And it won't be behind the scenes. It will be right out in front of everybody. And you could use it to dispel lots of rumors and hopefully motivate the team, but you have to be open, and you have to let them do what they want to do and just be ready for some good and some bad. In the end, it's going to work out. Companies should let people comment on their jobs and what they think about the company.

**PwC:** Speaking of social networking, how far do you think we are from having just about every meeting that could be useful to larger audiences actually recorded and posted on the internal Web for these companies? Is it simple enough for most companies to do that now?

**RR:** It is so simple. I can't believe companies are not doing that already. That's shocking to me. From an efficiency perspective, you should have all the general questions and answers on the Web. So everything from your vacation policy to standard stuff—which, in an enterprise, thousands or tens of thousands of employees need—should all be recorded and available in a video archive. Let people go through it.

**PwC:** So how are you doing that inside your company? Are you tagging your videos for those purposes?

**RR:** Yes. We have an internal network where employees can find everything and manage everything related to their business life right there. We then gave all of our employees their own free dot-tv domain. They are able to create their own personal Web site to do whatever they choose, to build a persona. And on that channel they can record their own video, their own chat, or whatever they want. Right now, we are just finishing up a group of videos for employees—everything they need to know about Demand Media. The only reason we have hesitated is because our business is changing so fast. And we are worried for competitive reasons that we just needed to make sure our network was secure enough

so that we can preclude someone from sending those videos somewhere outside the company. And that technology is available.

**PwC:** What about searching on video? Enterprise search is something that's way behind what's available on the public Web, for example. Are you able to search on your internal videos?

**RR:** In a very basic way. There are video search products that you can license, but video search has not really been figured out yet—whether from the consumer or business side at all. There are still technical hurdles to overcome. For example, we had to go through a whole process to understand why, when searching on a topic for video, some thumbnails show up and some don't. So video search is still at an embryonic stage.

**PwC:** If you had to name one essential thing companies could do to improve their intranet user experience now, what would it be?

**RR:** Giving employees the freedom to personalize their profiles—and personalization, generally—is a big deal. It's not going to be clean and white and always exactly the same, but personalization is one of the most important things to people. They really believe the profile is an extension of them. Allowing them to use technology to connect to related job duties, related projects, even related ads, or, you know, related things about the company they love or hate is a big deal. Now they have a reason to go to the intranet. There is a whole discovery process that people love about social networks: the ability to discover new people and new things that they didn't even know existed, to say, "That person lives 10,000 miles away, and he cares about the things I care about."

So it's about communication, it's about connecting, and it's about giving them the freedom to update as much as they want. ■

# The dos and don'ts of mashups

John Crupi of JackBe clarifies what enterprise mashups are capable of, what they aren't, and where their power lies.

Interview conducted by Vinod Baya, Alan Morrison and Bo Parker

John Crupi joined JackBe in April 2006 and brought Deepak Alur and Dan Malks with him from Sun Microsystems, where Crupi had been chief technical officer of the Enterprise Web Services Global Practice. Together, Crupi's team has helped JackBe develop a mashup platform called Presto that includes the governance, security, and user interface capabilities necessary for the enterprise. In the process, Crupi has discovered quite a bit about how a mashup ecosystem might function, as well as how the development role of business units is expanding.



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**PwC:** How did JackBe get started?

**JC:** JackBe started in 2001 as a technology company trying to enable call centers to make orders online using the browser. IE [Internet Explorer] back in the late '90s would allow asynchronous communications, which has now become AJAX [asynchronous JavaScript and XML]. Because of that, they could offer specialized applications that were very interactive, but only in IE at the time. They were able to solve a lot of the business problems call centers had getting a Web browser to behave more interactively.

This thing was so popular and so powerful, that they decided to sell off the company and actually take the technology and build a company based on that. That technology is called AJAX and is now ubiquitous in the browsers, but really, it was more or less the starting point. JackBe made the transition from an AJAX company to an enterprise mashup company in late 2005.

**PwC:** We've seen the term enterprise mashup for a couple of years now. How has the concept evolved during that time?

**JC:** If you think about a mashup as combining data or taking data from disparate sources and putting it together in a way that you can use it and interact with it in various different forms, that really sounds like what we do every day in Excel by copying and pasting and then manipulating it and running formulas and macros on it and maybe showing graphs. But what we do in the enterprise with cut and paste in Excel wastes a ridiculous amount of time.

The way we collaborate with that end product is that we e-mail a spreadsheet. So if you think about it, the Excel sheet might serve just one campus or destination. But if you automate or allow users to integrate and mash it up themselves and feed it into Excel or feed it to a portal or feed it to a Web app running on iPhone, then the enterprise really starts getting excited because they have been trying to do this for years. IT is just way overburdened to do that.

PwC: You're describing a single, online, persistent version of a macro that everybody has access to. So are we avoiding the problem of spreadsheet hell by making it persistent online and avoiding the version problem, or is there still going to be some of this aspect of a lack of control?

JC: If you talk about governance and you say, "We don't have governance; we don't know how to govern something," basically that's a showstopper: IT can stop any type of deployment or any type of application. They say we don't have governance in place to do that.

But then you say, "Well, wait a second; I see that I have 5,000 spreadsheets that are going throughout my organization every day; how is that governed?" IT doesn't govern that, and that's true, right? It's completely ungoverned. So in some sense, by introducing mashups and providing automatic connectivity into Excel as a point of destination, you actually have more governance around the data, because it's almost as though you are controlling the data that they can get out into the spreadsheet. And not only that: you are also able to push it out.

So if I have data in my worksheet and I select an area that can be data—a data service that's pushed out—then I can attach its entitlements to that, so that others in my group can have access to that information. You actually get around sending spreadsheets for people to just view it or look at separate cells. Now you can start treating spreadsheets as a service because of enterprise mashups.

PwC: Are you envisioning that you would see a mashup capability in portals—or in a software as a service platform?

JC: If you think about it, in the last 10 years, not a lot of innovation has happened on the user side, especially in terms of UI [user interface]. The innovations were in the browser or desktop application. So what we found was that this ecosystem of many UIs was already formed and that organizations didn't want to be forced into one destination to see these mashups. So, we completely pulled out of providing a tool kit of our own. Instead, we are looking at existing front ends as a publishing destination.

We have a concept called Mashlets, which is our terminology for an enterprise widget or a mashup widget. It's a wrapper and it's a black box around whatever mashup I create. I can put a face on a mashup via a Mashlet, and I can publish that Mashlet to my portal as a portlet; I can publish it to a Web page; I can publish it to my iPhone and just consume it as a Web page; or I can push it into some of the next-generation portals like Netvibes and Pageflakes.

This is the trend that's happening; I want mashups to be small pieces of data integration, but I also want to be able to push that data wherever I want to.

PwC: Are you making Mashlets available to Web developers rather than end users?

JC: No, actually it's to the end user. A Mashlet is an autogenerated UI. A mashup in the enterprise is data that's been integrated or combined; whether it's merged or joined or filtered, it's just data. We could get that data to the browser or to the spreadsheet. It's just data. We can put all different types of faces on it, and that's what we give the user.

People are kind of sick and tired of hearing about SOA [service-oriented architecture] when it comes to the business unit because they have been hearing about this for five years or so. It's going to be agile; it's going to give you your ROI [return on investment]; and so on. Well, in our experience, business units don't see that SOA has really brought them too much. As a matter of fact, business isn't even asking for SOA. But why are they asking for mashups? Because they see mashups as a way to get data integrated, whether they do it themselves, or they use a tool, or they have an analyst do it for them. Ultimately, it's getting closer to them. This is a nonthreatening way for them to talk about what SOA should have given them before. So, we put a face on the SOA with mashups, and you can show them the mashup very quickly, and if in fact that mashup is incorrect, or is not visualized correctly, or doesn't have all the data they want, they can see that quickly. They could see it in a matter of hours versus months or weeks. So mashups are SOA for the ultimate end user.

PwC: It sounds like there is a very strong connection between user spreadsheets and mashups. Both tend to take data from sources, combine it, and analyze it, but then use it for reporting or charting, not to collect new data. Is that a fair way of thinking about it?

JC: That has been the way that we've been used to doing things. And it's been part of the problem, if you look at the BI [business intelligence] tools. A lot of them—once you get all the data models and analytics done—are fancy reporting engines. End users are used to doing creative, customized reports, but the reports are relatively dead; you can't do much with it other than look at it and print it. The same thing with Excel. It turns out that Excel is a great place; it's almost an enterprise canvas for enterprise users to take data and put it somewhere so that as soon as they get it, they can put it there, and they can do something with it and integrate it. And we know that users want to get at more and more data faster and faster, so it's kind of a hybrid model.

You have a core piece of data you are always getting, but the real need is to connect it to other data, whether it's siloed internally, maybe in an SAP system and in PeopleSoft where the systems won't talk together. So you have pull it out to different UIs or external data. You want to be able to integrate or combine that data and see it in a much faster, dynamic way that doesn't require you to go to an IT and be put on a wait list for a year or two.

PwC: One of the things about consumer mashups is that they have a wisdom-of-crowds quality about them. The crowd—with the help of search engine algorithms or recommendation systems—acts as a filter to surface mashups like the original [chicagocrime.org](http://chicagocrime.org), for instance. Now millions of people have heard about it. An enterprise tends to cover a smaller area. Do enterprises have the scale to mimic mass filtering?

JC: That's a great question. The good news about being a startup or at least solving problems in an emerging space is that you start hearing people's horror stories and dirt about what they have been doing in the past to solve problems or do workarounds. And one of the things we hear all the time is that a given company spent a ridiculous amount of time filtering through log files just to find out what its users are doing and then starting to invest in semantic analysis engines, ontologies, taxonomies, and all these tagging things that are looking at unstructured data. It would just be too hard to build an infrastructure to support that.

Now, what enterprise mashups give you—and what JackBe's mashup platform supports—is a two-step process. We know that IT has to govern all the services that are being consumed. So all the services that will be mashed up or exposed to the user or the business are actually registered or, as we say, virtualized first in the system. Whether it's a database, a WSDL [Web Services Description Language] SOA service or REST [representational state transfer service], it actually gets

registered with our mashup server. Then it becomes exposed for mashups. Because we act as an intermediary and all data is flowing between our mashup server and the service—which may be internal or external—we know what services are being used; we allow users to tag any service they are consuming, and they can apply tags to any mashup you create. You can rate services; you can rate mashups; you can do all these sorts of things and put and attach metadata to the services you are consuming and the mashups that you are creating. And we push it all out in what we call the mashup hub. Also, instead of connecting into people, people connecting to people, we drive the interest and have interest-driven networks, so that when people are potentially consuming a mashup or creating a mashup, then this may be around an area of interest. That's how we start to create these informal or organic networks. If I could see mashups that were around my area of research and I wanted to attach myself to a network that exists, that is a whole bunch of people. I don't really care too much about the people; I care about the artifacts and the systems, the things that they are mashing up. That is the more natural fit, we think, than just doing tagging and ad hoc searches.

**PwC:** Would you say that mashups that bring together structured and unstructured data will be more successful than mashups that rely primarily on structured transactional data?

**JC:** Yes, because users have a continually growing need to get at data, and much of that data is very unstructured, and a lot of it has to do with the way that data is created. We have a multitiered process. If we create mashups that are consuming unstructured data and providing more structure to it, that itself can be tagged by the user. So by adding more structure to that data so it can be consumed, we are not only betting on the fact that systems will be making data more and more structured, but in fact, users will participate in adding structure to this information. I think the unstructured side will exceed the transactional side of data integration.

**PwC:** Do your developer communities still consist primarily of people from the chief information officer's organization? They may be linked in to business units, but they are basically people who know what XML [extensible markup language] is. Or are you seeing people who would be thinking, "I can do this with Excel, or I can do this with mashups; which one do I want to use?"

**JC:** We do have to go through IT in many instances, but we are also noticing that the business is getting much more savvy in funding development themselves.

They don't go to IT and say, "Build the systems for me." They really go to IT to say, "We need the systems, and we need access to these services, and provision me some boxes. I will fund the developers or I have my own developers that are going to build this. But ultimately, I need this built for my business."

**PwC:** So are mashups defining a boundary line that allows safe things to happen without having to use internal IT resources?

**JC:** That's really the big trend here. Not only are the business units trying to get things done; they are trying to look for new revenue opportunities. Mashups also create new revenue opportunities, because now you can get data out in ways you weren't able to before—not big pieces of the information in terms of large apps, but data. We get a lot of customers asking if we can mash up a million records. We say you would never want to mash up a million records. Mashups are intended to get to the user. You have access to your database, which knows how to manage a million records; the mashup addresses the small subset of records that you need to get to the user. This little pocket is being built and funded by the business. It looks like software as a service, but it's internal. The business usually has developers who do nothing but create wrappers and service interfaces to these siloed systems. Then the business starts building these applications on top. So this is the trend; that's what's starting to happen. ■

# Bringing order to chaos

The next suite — an intelligent business performance platform — blends business intelligence, rules, and process management, linking knowledge with the processes that need it.



Improving business prospects is not easy. It fundamentally requires insight derived from a combination of knowledge about how business processes work and sound business performance measures.

This insight can lead to new and improved business processes, which then can encourage the creation of business value. In today's complex, global enterprise, the needed alignment is rare.

Information technology can help. Vendors are developing and early adopters are implementing what PricewaterhouseCoopers calls intelligent business performance platforms. These platforms support and integrate applications, and they monitor and manage business processes and outcomes. The three core components of this emerging platform are:

- Business intelligence applications, which collect and interpret business events. The percentage of visitors making a purchase at a Web site is a simple example.
- Business process management applications, which monitor and manage the company's workflow. The automated routing of claims at an insurance company is an example.

- Business rules management applications, which automatically and consistently apply business policies. Exception handling in a financial transaction system is an example.

Today, with heroic effort, these applications can be stitched together to guide management and facilitate process enhancement. Enterprises that create value through rapid process changes are beginning to define a market opportunity for a preintegrated suite of tools that supports intelligent business performance management.

### Drivers for improved business process insight

IT departments in today's enterprises are being squeezed by three important pressures from the business:

- Internet business activities have real-time requirements that are crucial factors in maintaining customer loyalty, in supporting business partners, and in managing key business processes.
- The constant pressure exerted by globalization means that any competitor—whether local, domestic,

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Enterprises that create value through rapid process changes are beginning to define a market opportunity for a preintegrated suite of tools that supports intelligent business performance management.

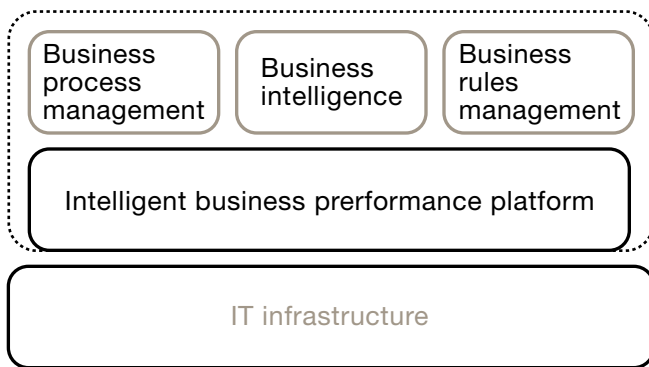
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or abroad—poses a threat. As a result, organizations must compete effectively on service and product quality, responsiveness, and price—often, all three at once.

- Integration with partners adds additional pressure for business efficiency. Companies that are part of a supply chain no longer have the luxury of improving business processes at their own pace. Because of the integration with systems belonging to partners and customers, operations must be performed as quickly as the external systems require.

To compete, businesses must be more efficient than ever, and the focus on efficiency must remain an ongoing priority. All competitors will be constantly upgrading their own abilities to run processes optimally in the context of changing market conditions.

One of the principal solutions to the need for optimized business processes has been the use of business intelligence (BI) and business process management (BPM). BI helps companies identify key events and developments in different areas of operations, while BPM enables companies to streamline their business processes. Done right, BPM increases efficiency and effectiveness—including the appropriate handling of exceptional events.



**1. The IBPP stack**

Source: PricewaterhouseCoopers, 2008

BI and BPM are frequently combined with business rules management systems (BRMSs), which perform analysis and help coordinate processes. BRMSs also provide complex decision making—that is, the ability to automate decision making on the basis of extensive sets of rules and constraints.

Taken together, the three technologies of BI, BPM, and the BRMS must be integrated with each other by an intelligent business performance platform (IBPP) and atop the enterprise IT infrastructure, as shown in Figure 1. Often, however, enterprises implement only some of the technologies and grow organically toward the adoption of the others, as needs dictate.

As Figure 1 shows, the IT infrastructure is the foundation for intelligent business performance applications. The IT infrastructure provides access to information about business processes and outcomes. Enterprise Web applications, for example, provide necessary information for business intelligence applications.

*Distinguishing characteristics of IBPP*

IBPP technologies have a set of common characteristics that define their role in the enterprise. Most often, they help organizations achieve better business processes. These characteristics include:

- Better use of real-time data from business processes. These technologies use monitoring tools that watch business activities, compare performance against established thresholds and targets, and identify exceptional events. Real-time data can result from the minimal monitoring of performance parameters or from highly complex analysis that looks for meaningful patterns in enterprise data.
- Reporting of the real-time data in user-friendly presentations such as portals or, more frequently, executive dashboards. These tools are designed to have straightforward top-level interfaces, so that users can tell at a glance the general state of a given process.

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Whether companies go so far as to set up a corporate performance office and appoint a CPO, they will need professional managers trained in the use of performance metrics to analyze the data and to recognize how the data tracks to specific events in the business processes. To do this, companies will first need to have good IBPP tools in place.

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Managers review the real-time data and regular reports to further optimize a process and enhance responsiveness. Organizations strive to establish a cycle of process optimization followed by monitoring and a new round of optimization.

When successful, an organization's ability to execute this optimization cycle on a consistent basis will be a defining competitive advantage.

- Implementation of IBPP processes as a series of loosely coupled, highly configurable services using common semantics. Taken together, they form a complete and efficient business process.

To achieve the component modularity as well as the needed integration, the business activities are implemented as Web services.

Usually, the IBPP architecture is service oriented. This is not an absolute requirement; however, the IBPP design works best when rigid, proprietary, command-and-control workflows are migrated to flexible, open, standards-based Web services.

These changes represent a significant shift for many organizations. Fortunately, BPM and BI technologies can be implemented slowly. They are not rip-and-replace solutions but approaches that can be added incrementally to an IT infrastructure and serve as targets for the migration of existing business processes at a pace determined by the company's need for business process efficiency.

The focus on business performance is fostering the creation of a new management position: chief

performance officer (CPO). The CPO is in charge of consolidating, analyzing, and presenting analyses to senior management and to the board regarding the current state of companywide operations and identifying where performance deviates from expectations and from industry benchmarks. In addition, the CPO has responsibility for designing and helping implement key performance indicators for a given business within the context of a specific industry.

Whether companies go so far as to set up a corporate performance office and appoint a CPO, they will need professional managers trained in the use of performance metrics to analyze the data and to recognize how the data tracks to specific events in the business processes. To do this, companies will first need to have good IBPP tools in place.

## Business intelligence

Business intelligence (BI) is the discipline of gathering data about the results of specific business processes. BI is often combined with business process monitoring; however, BI does not so much relate to the management of the business process's internal operations. It shows how a given process operates within the context of the larger business model.

For example, a BI product can track the sales of a certain item by region for a certain time period. In contrast, a business process monitoring product can track how long it took for an order to be completed.

Because BI products track metrics that relate to distinct areas of activity, they tend to be specific to various business departments and lines of business in an organization. Human resources (HR) and marketing are typical areas of focus for BI products.

According to analysis by Gartner, BI has represented one of the largest areas of investment in business improvement during the last few years. This surge is attributable to several factors:

- Greater acceptance of the need for real-time metrics and dashboards to measure business activities
- The growing importance of providing guidance for operations based on analysis of patterns in enterprise data (detection of fraud, money laundering, unusual customer patterns, and so forth)
- Regulatory compliance (demonstration of compliance with Sarbanes-Oxley, the Health Insurance Portability and Accountability Act [HIPAA], and so forth)
- Availability of better tools for data transformation and data mining

Another key reason for the greater adoption of BI is its own increasing maturity. For years, BI often was synonymous with expensive solutions that generated numerous reports containing little real value. However, improvements in the tools have made it easier to customize reports, view real-time data in dashboards and portals, and obtain relevant information in a timely fashion.

IT departments can deploy BI solutions incrementally without disrupting existing systems. However, this flexibility does not imply that BI requires no changes. BI must have clean data to provide useful results, and the challenge of establishing single, consolidated, and clean

(so-called gold version) instances of data records is a persistent issue that IT departments must tackle before they can consider BI.

The primary approach to this problem is master data management (MDM). According to a 2007 survey performed by InfoWorld magazine, IT managers reported that the two largest challenges to implementing BI were the problem of data quality and, to a lesser extent, integrating BI with operational system data sources.

Going forward, one of the biggest changes in BI will be the transition currently in progress toward active business management based on the use of real-time data. BI is evolving from a pull activity, in which data is obtained only when specifically asked for, to a push activity, in which constant updates of real-time business data are pushed to dashboards and portals.

As business line managers assume greater control of specific business processes and therefore manage closer to the business operations, this demand for real-time data on a push basis is expected to accelerate.

## BI market

The BI market is dominated by a few enterprise-tools vendors, which spent much of 2007 acquiring smaller, market-leading BI companies. These major vendors are Business Objects (acquired by SAP), Cognos (now part of IBM), Hyperion (now part of Oracle but with a suite of products different from Oracle), Microsoft, and Oracle.

A second tier of independent BI vendors includes Information Builders, MicroStrategy, SPSS, and to a lesser extent, SAS. As market consolidation continues

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Going forward, one of the biggest changes in BI will be the transition currently in progress toward active business management based on the use of real-time data.

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during the next few years, these independents are likely to be acquired or to merge to remain competitive with the larger, established vendors in this market. Demand for BI solutions is expected to expand the market for these tools at a compound average growth rate (CAGR) of 8.6 percent through 2011, according to Gartner. Reasons for this growth, in addition to those listed previously, include the following:

- A newfound appreciation by senior management of the value of data derived from business processes and operations
- Greater familiarity with quantifiable measures by business analysts within organizations
- The projected adoption of BI by midsize companies

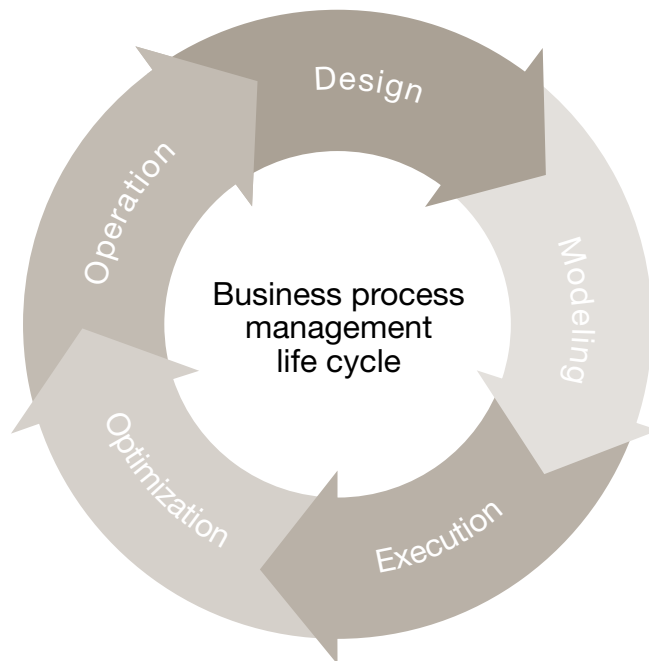
Some of the prospective midsize customers, however, might opt for open-source solutions, such as Pentaho's Open BI Suite.

Longer term, BI may begin disappearing as a stand-alone product category. The acquisitions of BI vendors in 2007 have so far not resulted in any notable integration of product lines. However, that integration is almost certain to come to pass, probably starting with SAP.

At that point, BI products simply will be another module in a larger enterprise tools suite. This suite will be characterized by a common shared metadata that all tools can interact with intelligently.

This shared metadata design is sometimes referred to as a closed-loop approach. It's clear, however, that closed-loop integration must not destroy the loose coupling between modules, so that organizations are still able to adopt parts of the BI or enterprise resource planning (ERP) suites without having the entire suite imposed upon them.

BI may disappear in another direction as well: BI tools may be subsumed by BPM suites. Already, BPM tool kits have strong reporting capabilities, including dashboards and portals. Integrating those technologies with the data management and data analysis strengths of BI would begin that cycle of consolidation.



**1. A typical BPM activity life cycle**

Source: Adapted from IDC, 2008

Business process management

Business process management (BPM) focuses on the optimization of business processes. Many organizations are actively pursuing BPM for two principal reasons:

- The need for leaner business processes
- The demand for agility in regulatory compliance

Although the need to be lean is well understood, the demand for agile compliance is less evident. As companies have been forced to tighten record keeping and more closely manage their processes to ensure auditability and compliance (particularly with Sarbanes-Oxley and HIPAA), they've come to realize that existing processes are not easily adapted to the new requirements.

Managers are increasingly targeting business activities impacted by regulation for increased transparency and control. Many regulated activities have been poorly documented and left to evolve without sufficient management oversight. BPM is one solution to this challenge.

The foundation of BPM is the view that a business process is an asset—a single coherent and tangible entity that can be managed as a unit made up of numerous activities.

This view underlies the series of optimization-oriented activities that are the core elements of BPM. These include modeling the process, designing and implementing changes that better deliver on the goal of optimization, monitoring the business process by using real-time data, and finally, using the derived data to create the potential for additional cycles of optimization.

This cycle is shown in Figure 2. Different BPM vendors and analysts have slightly different names for the various stages, but the basic cycle of activities is constant.

These BPM activities are frequently grouped into a higher-level cycle:

- Business process modeling
- Implementation
- Business activity monitoring

Each of these three phases has its own set of tools. Occasionally, as in the case of Oracle, for example, these tools are integrated so that outputs generated by the modeling tool can be used as inputs directly in the implementation stage, and later, they can help dictate the monitoring stage.

## Getting started with BPM

Organizations considering BPM as an optimization strategy need to take certain preliminary steps to ensure success. The first and perhaps most important is to have stable business processes that can be modeled and mapped. If a company has not reached this level of maturity and so does not understand its operations in terms of defined processes, it is not ready for BPM.



## SAP's vision of a business performance product suite

PricewaterhouseCoopers sat down with Doug Merritt at SAP's research labs in Palo Alto, California, to discuss the emerging category of business performance applications and how SAP plans to introduce the technologies to new and existing customers. Merritt is a corporate officer and member of SAP's Executive Council.

***PwC: How are you framing these new categories of applications that integrate process flows, business intelligence, and business rules to your client base so that they feel compelled to adopt a new suite of applications similar to the ERP [enterprise resource planning] adoption pattern?***

DM: I don't think that big, broad-based market categories like ERP start as big, broad-based categories. What we now call ERP began as a series of application modules in related but separate functional domains: financials, HR, manufacturing, materials management, sales, and distribution.

Over time, it made more sense to even more tightly package and integrate these offerings into a unified ERP suite, but for the first three, four, five years after we named it ERP, people were still buying the offering for specific functionality, such as financials or HR [human resources] or manufacturing. The way that we've framed our new category of applications—what we're loosely calling business user apps or performance optimization apps—is by targeting specific pain points around knowledge-centered work that is relatively chaotic and unstructured today. We chose to start our focus on the "office of finance" within the organization, but that was simply based on our understanding of need and market opportunity. That is why you saw governance, risk, and

compliance (GRC) first and then financial performance management next, which will quickly be followed by other performance management and new applications focused on a line of business. Within the performance optimization apps category, we're creating minicategories that are for specific needs.

***PwC: Do you anticipate an evolving application suite?***

DM: Absolutely. We've been trying to focus on discovery of the business-critical categories that are top imperatives within organizations. Compliance was pretty obvious. That wasn't a hard one to pick. But the real challenge is understanding where, within compliance, is the burning platform? That is, what is the most ubiquitous and horizontal business pain?

We then have to choose the relevant package of complementary business solutions that we could assemble. It needs to have a high-level business purpose, so that the CFO [chief financial officer] feels strong value in buying an entire GRC suite.

Our starting point was our Access Controls offering. This was our primary value proposition. Almost every prospect we've approached says, "I have to have a way of understanding segregation of duties and conflicts within segregation of duties." What makes the suite concept work is that closely tied to access-control issues are process controls, and closely tied to those is the need for a risk management framework.

And we broaden the suite a little bit and say, "What about trade compliance?" and "What about environmental compliance?" We wrapped that suite together and said, "Here's our GRC offering." And it has gotten great traction. We had more than \$200 million of license sales just in that category last year, and it was only its first full year of production.

***PwC: Where else have you used this approach?***

DM: We took a similar approach with financial performance management (FPM) gain, trying to redefine the category. For a long time, the market has been focused on delivering budgeting and consolidations solutions, but very closely related to these is the need for profitability management and strategy management. So, we took a next-generation approach to a truly usable and fully integrated planning and consolidation solution, and we tied a profitability and strategy management message with it to create a bigger and more compelling bundle. The value proposition remains the pain point that planning and consolidation solutions don't address for the business user.

***PwC: What's next at SAP?***

DM: We've had a team working for almost a year on other integration scenarios between GRC and FPM—such areas as risk-adjusted planning, compliant consolidations, compliant close, and strategic risk management. And we keep looking for other line-of-business pain points where we can find a unique angle to meet an unfilled need. We are asking, "What is the compelling, must-have functionality needed to optimize performance for sales, marketing, supplier, procurement, and human resources management?"

The key point is that these are not highly scripted, standardized applications similar to ERP. To be successful with this next generation of applications, we are positioning the user as the control point, offering guidance and tools that anticipate the knowledge aggregation process. The next applications focus heavily on supporting collaborative, creative activities that leverage business intelligence and an on-the-fly ability to modify processes that support the teams that span the functional hierarchy of an organization, or even work outside of the organization.

For this reason, many organizations begin by deploying BPM at the departmental level. In some cases, the deployments begin at subdepartment levels in which a single business process is mature enough for modeling and can be isolated sufficiently to serve as a first deployment of the process. The intention is that if the project works successfully, it will be expanded to the full department and then to larger portions of the organization.

In some organizations, the desire to implement BPM has provided the impetus to clean up business processes and make them amenable for modeling by defining them clearly and identifying activities that are nonessential. These activities, in theory, are among the items that the organization will remove in the BPM implementation process.

Thereafter, monitoring is installed to obtain real-time data that is made available using the standard reporting mechanisms portals, dashboards, and reports. Data gleaned from these sources then fuels a new cycle of optimization.

It should be noted that few organizations today are sufficiently mature to repeat this cycle on a continual basis. More often, an organization completes the BPM process and a lengthy time gap ensues before a new cycle is undertaken.

As corporate performance becomes a defining aspect of a company's competitive differentiation, cycle times will decrease. The role of a CPO is key to championing the changes necessary for this strategy to work successfully.

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Demand for BPM tools is expected to exceed that of BI tools. Gartner predicts the market will grow from \$1 billion to \$2.6 billion by 2011, a CAGR of 23.8 percent. To put this number in context, IDC projects that of the \$100 billion spent on process automation software in 2007, only \$1 billion went to BPM tools. So, BPM is still a small niche, but as the projected CAGR indicates, it's one that should grow quickly during the forecast period.

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Once processes at an organization are mature, or at least well defined, BPM becomes possible. The first step is to model the process or processes using any one of several standard notations. The organization then analyzes the processes for inefficiencies, and makes changes to the process models.

After appropriate review, implementation begins, almost always relying on a Web services architecture to provide the underlying infrastructure. The shape of the implementation is determined by formal process definitions generated from the modeling stage, including the definitions of needed services and, in the case of Web services, the Business Process Execution Language (BPEL) to make sure the services follow the proper sequence.

## BPM market

The BPM market is dominated by a small number of vendors that have true end-to-end solutions. These include EMC Documentum, IBM, Microsoft, and Oracle. A large number of niche vendors provide key parts of the BPM solution for companies that have specific needs.

Vendors without end-to-end enterprise tools but that offer BPM packages include Lombardi Software (which recently began offering BPM software as a service), Pegasystems (which integrates a high-end business rules engine into its product), and Savvion.

In the open-source market, the leading BPM vendors are Intalio and the JBoss division of Red Hat.

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One emerging trend that might fuel that growth is the closer collaboration between BPM vendors and enterprise content management (ECM) systems vendors. This trend is driven by the basic fact that much of the workflow in business processes today is based on the movement of documents. This trend is especially evident in the case of Documentum, an ECM vendor that is now the BPM division of the software and storage vendor EMC. Likewise, such alliances as the recently announced product integration between Intalio and ECM vendor Alfresco Software are further examples of this trend.

## Business rules

Business processes, in whatever form they take, depend heavily on business rules. Rules drive the activities, coordinate data movement and workflow, and provide decision automation in complex situations.

In the past, business rules were hard-coded into applications by developers; today, rules are discrete components that encapsulate logic. They are commonly developed by business analysts—rather than IT staff—and they are executed inside a business rules engine (BRE), which is a high-performance tool that can test thousands of individual rules or rule sets that have been bundled for a specific business purpose.

Most BPM vendors commonly provide both a basic BRE and rules-development tools as part of their solution. And the design of modern BPM systems around a Web services structure typically extends to the BRE components. This makes the rules accessible to other software designed to make use of Web services.

The use of a BRE rather than hard-coded rules gives BPM tremendous agility. A change in corporate policy or a new regulation usually can be implemented quickly by

simply adding or changing the rules, so that a process treats a business event differently.

Organizations that have complex process requirements, however, need rules support beyond what is found in BPM product suites. These companies rely instead on business rules management systems (BRMSs), which are comprehensive, standalone, high-volume, business rules design and execution systems.

Financial services companies, for example, use BRMS products to process loan applications. The data is analyzed via rules, and a decision is made regarding the applicant's suitability for different loan products. The analysis, triage, and decision automation often involve the testing of hundreds of rules, sometimes thousands, before a tailored offering (including terms and rates that match the applicant's situation) is formulated. BRMSs can make these decisions in a matter of seconds.

This automation of decision making provides significant benefits as well as guarantees that decisions are made consistently and impartially. Most BRMS products have built-in auditing functions so that in the event of a complaint or inquiry, the financial institution can show exactly which rules were applied and why. For this reason, BRMSs are also useful for ensuring and demonstrating regulatory compliance.

For enterprises, BRMSs provide great agility not only because they automate decisioning but also because they enable organizations to modify policies or implement new programs quickly. For example, to provide a new loan offering for select applicants, a financial services firm needs only to add rules to the rules repository. Likewise, heavily regulated industries can quickly implement new regulations and requirements.

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## Business rules market

The BRMS market is smaller than either the BI or BPM segment, and it is dominated by vendors of smaller size. The principal vendors of pure-play BRMSs include Corticon, Fair-Isaac, ILOG, and Pegasystems. In open-source software, the leading package is Drools, which was recently folded into Red Hat's JBoss product line.

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The incursion of the Web deep into the heart of corporate operations has already demonstrated that the rate of change of technology is increasing and that IT departments must keep up. To do so, they need lean processes coupled with infrastructure that is reconfigurable and adjustable, so that the overall organization can leverage the new technologies to respond effectively to customer needs and competitive pressures.

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The small size of these vendors has led to continual speculation that they would be bought by larger BPM or enterprise vendors. However, that projection has not materialized, although as discussed later, the interest of acquirers might be satisfied through other means.

The BRMS market is a mature market with established vendors and solid products. In 2006, IDC estimated the market to be \$230 million and projected it to grow at a CAGR of 19.3 percent through 2010.

Although most rules vendors sell BRMS packages as standalone products, they are increasingly working with BPM vendors to bid together on requests for proposals (RFPs) and to offer solutions that integrate their

respective products. This has been particularly evident in the co-marketing between ILOG and EMC Documentum, as well as similar relationships between ILOG and other BPM vendors.

In the near term, the BRMS market segment is unlikely to be subject to the consolidation that has occurred in the BPM market; rather, BRMS vendors will continue as standalone companies. Most BPM tools already have rules engines, so a BRMS acquisition would provide only incremental lift.

The major BRMS vendors offer products and services unrelated to BPM—thereby making an acquisition expensive. In addition, the good prospects for growth in the BRMS sector, particularly in industries where decision automation is critical—banking, financial services, and insurance—suggest that the BRMS vendors would be resistant to acquisition overtures.

The quality of rules engines in BPM solutions will likely emerge as a competitive differentiator for BPM vendors; as a result, BPM vendors will pursue original equipment manufacturer relationships or other close alliances with BRMS vendors.

## Effects on enterprises

For enterprises to improve business efficiency by using intelligent business performance products, they need to have achieved a specific level of IT maturity. Two milestones, in particular, must have been reached:

- The organization, or at least the department, must have defined business processes. This step is the sine qua non for optimization to deliver much benefit. Some industries—such as manufacturing, healthcare, and financial services—have attained this level. Other industries are still behind the curve and must address the lack of formal process definitions first.
- The IT organization must be capable of deploying and using a service-oriented architecture (SOA). Even though SOA is not required, it is emerging as one of the best technology architectures for designing a highly responsive and efficient enterprise.

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Although the IBPP will take some time to come together, its advent is likely to push the constituent technologies into a much higher rate of adoption.

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Most IT departments have some Web services experience and therefore have practice with Web services implementation. However, for some organizations, the shift to the new model and away from monolithic, highly integrated approaches represents a difficult cultural and technological change.

Until these organizations can move toward greater acceptance of services-based architectures, business process-oriented solutions will not deliver the expected benefits.

Most analysts say process-based business optimization will continue to grow because of a track record of effective implementation and because a process focus does not use technologies that require rip-and-replace change. Instead, software packages can be folded into existing IT infrastructure and, once installed, can lead to continually improved processes within the context of a single business process, a department, or even an entire enterprise.

For this reason, some departments have implemented some of these technologies without the participation of IT. Due to the flexibility of services-based implementations, integrating these projects—whether done by IT or the business units—is not terribly difficult or expensive.

The incursion of the Web deep into the heart of corporate operations has already demonstrated that the rate of change of technology is increasing and that IT departments must keep up. To do so, they need lean processes coupled with infrastructure that is reconfigurable and adjustable, so that the overall organization can leverage the new technologies to respond effectively to customer needs and competitive pressures. Intelligent business performance technologies provide exactly that capability while fulfilling the mandates for efficiency, agility, and regulatory compliance.

### Outlook: Intelligent business performance platform

Enterprises use three key technologies to be more agile and more responsive in the face of changing competitive pressures and market vagaries. These solutions fit together naturally:

- Both BI and BPM generate reports as a key benefit, although they report on different domains.
- Both technologies also depend on business rules—BPM more so than BI—so there is an undeniable linkage between these technologies.

Moreover, in many scenarios, the same enterprise, or even the same division within an enterprise, would use all three technologies. Vendors of BI and BPM tools are well aware of these possibilities, so it is fair to expect that eventually, the major enterprise vendors—especially IBM, Microsoft, Oracle, and SAP—will formulate integrated, end-to-end product suites that contain substantial products from all three categories.

Although the IBPP will take some time to come together as an integrated suite of software, its advent is likely to push the constituent technologies into a much higher rate of adoption. Likewise, in small and midsize businesses, a similar consolidation among open-source products will do much to introduce these technologies to companies unaccustomed to focusing their IT efforts on business process optimization.

*For more information on the topics discussed in this article, contact Steve Cranford in the US (+1 703 610 7585) or Marcus Messersmidt (+49 211 981 4872) in Germany.*

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**Paul Horowitz**

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**Tom Craren**

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## Special thanks to

Randy Churchill, Victoria Huff,  
George Kennedy, Don McGovern,  
Christof Menzies, Jacqueline Olynyk,  
Sohail Siddiqi

## Industry perspectives

During the preparation of this report, we benefited greatly from interviews and conversations with the following executives:

John Crupi, CTO, JackBe

Henning Kagermann, chairman of the executive board and CEO, SAP

Sheldon Laube, partner and director,  
PricewaterhouseCoopers Center for  
Advanced Research

Doug Merritt, president, SAP Labs North America

Lakshmi Narayanan, vice chairman, Cognizant

Glenn Ricart, managing director,  
PricewaterhouseCoopers Center for  
Advanced Research

Subramanian Ramadorai, CEO,  
Tata Consultancy Services

Richard Rosenblatt, cofounder, chairman,  
and CEO, Demand Media

# Subtext

The intelligent business performance platform

Business intelligence, business process management, and business rules are piece parts, but converged, they can accelerate knowledge-driven activities.

Agile management

In an era of continual change, the leading edge has embraced the need to push authority and accountability to lower levels of management. But a devolved management approach in fast-changing markets implies the need to tackle risk first and then governance, all of it with the help of the best information available.

Web 2.0

The most important business aspect of social networks isn't that they're social—it's the networks. How can enterprises use these to tap into the power of the informal organization?

IT complexity

Cars have evolved to be internally complex but simple to operate. Why can't IT be the same way?

Privacy

The expression "You have no privacy—get over it" has been replaced with "You *can* have privacy—enforce the policies you've set with the IBPP rules engine."

Application

Instead of functions given to the user, they're functions the user has more control over.

Decision-making support

Support now means the lowest-level decisions get automated. Instead of information, the ability to act on information. Instead of passive automation, active.

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# Missão e equipe

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