

Accenture Technology Vision 2013

Every Business Is a Digital Business

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Foreword

Technology is intertwined in nearly every aspect of business today, with information technology fast becoming a primary driver of market differentiation, business growth, and profitability. That is why we believe that understanding the technology trends that are changing the world as we know it extends well beyond the realm of IT executives—to COOs, CMOs, and CEOs. As leaders, it is our collective responsibility to grasp the importance of technology and to use it to deliver tangible business results for our stakeholders.

The theme of this year's Accenture Technology Vision is *Every Business Is a Digital Business*, and we see it as a forecast for business, not

merely technology. We describe the important technology trends affecting organizations in both the public and private sectors, and we suggest that these changes signal a broader transformation in the role of technology and in the business models that will be required for success.

We further propose that the time is now for leaders to act, in terms of understanding the power of new technologies and having the foresight to adopt them. Around the world, we see organizations using the technologies described in the Accenture Technology Vision to adapt to a rapidly changing environment, to transform their relationships with

consumers, to further differentiate themselves in the marketplace, and to expand their global footprint.

We hope that you find the Accenture Technology Vision insightful as you consider strategies for making your organizations even more relevant in a digital world. We wish you all the best in your journey.



Pierre Nanterme
Chairman & CEO
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Every Business Is a Digital Business

Technology is changing the game

Enterprises have spent the last 25 years working to peel away the nonessential pieces of their businesses; focus on the core, outsource the rest. But in this push to simplify, many companies have relegated IT to “keeping the lights on.” Without information and technology, a business is blind in today’s digital world. You must change the way you think about IT to map a clear path forward.

Every business is now a digital business.

The world has already changed around us, and IT is driving much of the transformation. IT is a minimum standard for how we effectively run

our enterprise, but it's gone further than that. IT has become a driving force, in many situations the driving force, for how we effectively grow our companies. Every industry is now software driven; as such, every company must adopt IT as one of its core competencies. By this we mean that software is absolutely integral to how we currently run our businesses as well as how we reimagine our businesses as the world continues to change—how we redesign and produce things, how we create and manage new commercial transactions, how we begin to collaborate at unprecedented levels internally and with customers and suppliers. In the new world, our digital efforts will be the key to how

we innovate and expand our business.

There is a higher order of thinking—a digital mindset—that will, we believe, separate tomorrow’s most able organizations from their lesser rivals. Accenture observes that increasing numbers of farsighted organizations are recognizing IT as a strategic asset with which they can renew vital aspects of their operations—optimizing at least and innovating at best. As such, they are investing in the digital tools, the capabilities, and the skills to more easily identify useful data, evaluate it, excerpt it, analyze it, derive insights from it, share it, manage it, comment on it, report on it, and, most importantly, act on it.

We no longer have to look far for examples. Here is Nike using wireless sensors and Web technology to create a performance-tracking system that allows it to create new services to monitor, and to improve and create new training routines for athletes. There is Ford, using sensor data to monitor both how a car operates and the driver’s behavior, and seeking to apply analytics to improve the experience for the next generation.¹

These companies, and many more like them, clearly see digital as a strategic imperative—a tool of competitive intent. They aren’t waiting for new technologies to be developed or to mature before they act. Nor should you.

The obligation for action is all the more pressing because the technologies to transform your business are here and now. They are already good enough. Mobile, cloud, social, virtualization, big data—many of the items continuously listed as “hot trends”—are quickly becoming part of the current generation of technology; they are well past the point where they should be areas of exploration and experimentation and are quickly becoming the tools with which companies can craft fast, cost-effective solutions to some of their toughest problems—and greatest opportunities.

As it has always done—as is its charter—our Technology Vision looks

over the horizon at the emerging developments in technology that should be added to the list of technologies the enterprise should be prepared to take advantage of, from data visualization solutions and software-defined networks to moving-target-defense security systems. Just as importantly, though, this year’s report communicates why every organization has to adopt a digital mindset. At the very least, it is necessary in order to anticipate and respond to ongoing technology-driven disruptions. Amazon.com has disrupted retail sectors far beyond books and changed the whole discussion about who “owns” IT. Similarly, Airbnb is sparking a transformation in the traditional

hotel business. But ideally, a digital mindset will enable enterprises to launch preemptive strikes of their own.

It is incumbent upon the executive leadership team to be stewards of this new mindset. They must recognize that it’s no longer possible to separate “the technology” from “the business”; the two are too tightly intertwined. IT helps redesign the company’s products and supports its processes; it drives its supply chains; it becomes part of the products themselves and creates new ones; it allows access to new consumers; it provides the frameworks to create net new services. An organization cannot be

the best in its sector unless it excels at understanding and using technology.

Your stakeholders may not yet be probing into how your top team views IT. But it won’t be long before they do.



Relationships at Scale

Moving beyond transactions
to digital relationships

Relationships at Scale

Businesses need to rethink their digital strategies to move beyond e-commerce and marketing. Although mobile technology, social networks, and context-based services have increased the number of digital connections with consumers, most companies are still just creating more detailed views of consumers, consumer attributes, and transactions. Individually, these connections may represent new types of user experiences, even new sets of sales channels—but that's not the real opportunity. Taken in aggregate, digital represents a key new approach to consumer engagement and loyalty: companies can manage relationships with consumers at scale.

It is time for businesses to return their attention to their relationships with consumers. Business success has always been built on relationships and on the relevance of products and services to buyers' needs. Just a few generations ago, consumers were often friends—and certainly neighbors—of the local grocer, pharmacist, and everyone else who provided the things consumers needed. But that model changed with large-scale industrialization

and with the introduction of IT. Handcraftsmanship was replaced by mass production. Advice delivered over the counter was replaced by global call centers. A human face making a sale was often replaced by a Web page.

That might imply that a growing distance between companies and consumers is inevitable—and over the last few decades, many consumers might agree that they have been

treated with greater indifference and far less personal attention.

Yet now, the opposite is true: technology is finally at a point where buyers can be treated like individuals again. Consumers are more than faceless digital transactions, more than a cookie file or a transaction history or a demographic profile; they're real people with real differences. Companies now have rich channels through which to communicate with consumers in a much more personal way. Farsighted organizations are seeing a golden opportunity to use mobile communications channels, social media, and context-based services to create truly personal relationships with consumers—but *digital* relationships this time—and to leverage those relationships to drive revenue growth.

Specifically, enterprises are customizing the experience for every interaction they have with consumers regardless of the channel. This mass personalization includes not only the interactions that companies have with consumers but the interactions that consumers have with each other. The potential payoff is two-pronged: a relationship with the consumer your competitors don't have and a differentiated brand.

Learning more than ever before

Businesses now have new ways to learn about consumers based on increasingly digital interactions, whether through e-mail, social media, Web pages, online chat, mobile apps, or tweets. And it's not just online interactions that benefit

“Consumers are more than faceless digital transactions, more than a cookie file or a transaction history or a demographic profile; they're real people with real differences.”

from those insights; by maintaining integrated communications across both physical and virtual channels, enterprises can use insight from digital channels to improve service in in-store situations as well. For instance, Catalina, a global marketing company, is using consumers' in-store location, determined by the product QR codes they scan, along with consumers' profiles to generate offers as they shop for groceries.¹ With the understanding of exactly where

shoppers are in the store, offers can be personalized in such a way to provide not just a digital offer but an offer that is relevant to what shoppers are looking at in the physical store at that moment.

These digital interactions allow companies to capture, measure, analyze, and exploit social interactions in new ways. By simply being digital in nature, the interactions allow enterprises to actually measure the results of

their sales and marketing efforts, scaling them when they succeed and scotching them when they fail.

Using analytics can also establish deeper consumer insights, allowing companies to create more compelling user experiences. This concept of mass personalization enables businesses to customize every interaction. Essentially, they can begin to establish a relationship with consumers, using

past transactions to inform current conversations, using context to move from transactions to interactions, and ultimately using their consumer insight to infuse the interactions with greater engagement and intimacy.

“Using analytics can also establish deeper consumer insights, allowing companies to create more compelling user experiences.”

Consumers aren't just buyers any longer

Key to making this transition is understanding that consumers aren't just buyers anymore—they've evolved into connected consumers. They're connected to social networks. They're connected to like-minded consumers. They're connected to brands. That means they also have the potential to be your advertisers. That's a powerful constituency to tap into.

Thanks to social media, consumers have more opportunities than ever before to express likes, dislikes, and recommendations. They aren't simply purchasing a product or service—they are doing a lot more. On Yelp, they're detractors or cheerleaders. On delivery.com and Menuism, they're reviewers and advertisers. On Spotify, they're DJs offering music recommendations. On TripAdvisor,

they're travel guides. And, thanks to mobility, they can do it where they want, when they want.

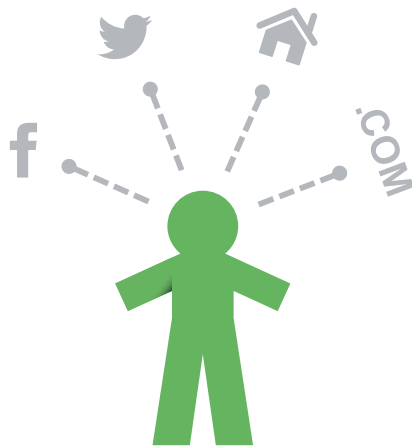
The Cleveland Indians, a Major League Baseball team, is actively working to use its relationships with its most avid fans to create a group of evangelists to promote the team.ⁱⁱ The Indians' Social Media Club incents fans to create a buzz about the team through a myriad of social channels, from Facebook to Tumblr. More than just pointing fans to social forums, they are actively incenting them to participate, offering ticket discounts and, for active posters, chances to be invited to a special Social Suite in the ballpark and to share their comments about the game.

This paradigm brings immediacy to social conversation—consumers have the ability to bring friends together

to share experiences and to report on those experiences. These technologies have permanently altered the ways in which consumers share information, collaborate, interact, entertain themselves, inform themselves, and maintain awareness of events around them. Enterprises need to recognize the change and begin to harness it.

All of this contributes to a new standard among consumers: they expect the mobile and social experience

to be highly personalized. They expect to be given the ability to get pertinent, contextual information that relates to their lives, their friends, their needs, and their pursuits. And because the experience is personalized it's also more powerful. Ninety-two percent of consumers globally say they trust earned media, such as word-of-mouth endorsements or recommendations from friends and family, above all other forms of advertising.ⁱⁱⁱ



Even watching TV is changing. Accenture research shows that more than 40 percent of consumers are showing increasing "second screen" habits, using a smartphone or tablet while watching TV such that they are accessing multiple streams of information at the same time.^{iv} This could mean tweeting on a smartphone while watching a TV drama or viewing players' statistics while watching sports. For the 2011–2012 season, the National Hockey League deployed an online game to be played while watching the Stanley Cup finals; fans won points by correctly predicting outcomes on the ice, like the result of a face-off.

Based on these new behaviors, businesses face several related opportunities: Because many of these networks are public, companies have an unprecedented opportunity to track what people are saying about

them. More important, they have the opportunity to use these new attitudes and technologies to create relationships, which will result in customer acquisition and, for current customers, repeat sales.

Moving the mindset from transactions to relationships

The goal is to use insight to change communication with consumers from transactions to interactions to an unprecedented level of relationship and loyalty—the equivalent of frequent-flier programs on steroids. The problem is that, until now, most enterprises have viewed online channels primarily as a way to reduce costs, not improve relationships. It's time to shift that mindset.

Consumers are already having conversations about enterprises among themselves. Fueled by every new consumer service and every new user experience, consumer behaviors have changed far faster than businesses. Facebook, eBay, Yelp, Foursquare, and many other companies in effect continue to train huge segments of consumers to communicate among themselves, outside the purview of businesses, coming back to a business site only to conduct final transactions.

Companies may not be able to, and frankly shouldn't, take complete control of the conversations their consumers are having in these new electronic storefronts and plazas. But they do need to figure out how to become participants, react with relevant offers, and respond to concerns.

It's time for enterprises to reimagine their consumer engagement strategy. Too many are still stuck in the days of ads and focus groups. When they want to communicate to consumers, they broadcast a message through their marketing channels, and when they need to hear back, they bring together a representative group from which they can extrapolate insights.

Today, the channels are increasing (think YouTube, Twitter, customer service chat) and consumer insight can come from a much wider sample of consumer and information sources: the Web, mobile technology, social-media sites, and others. But it's important to remember in this scenario that technology is only a tool. Reimagining a consumer engagement strategy is not based solely on technology.

“It's time for enterprises to reimagine their consumer engagement strategy.”

That new consumer-engagement strategy will require aggregated insight across applications so that each channel feeds information into a holistic view of consumers. That means more collaboration across sales and marketing and across digital and physical sales channels, and even the ability to track and acquire information beyond the business's own channels. Businesses should break down the internal barriers that segment consumer interactions by channel in order to create a

unified consumer strategy across all channels. Siloed approaches erode the value of integrated customer interactions. Burberry, for example, jointly developed an application with SAP that places all the consumer information Burberry has from its separate customer channels in the hand of its sales associates.^v In the store, they can use an iPad to access a shopper's profile that pulls together contact details, transactional history, lifetime spending statistics, recommendations based on

purchases, and social-media comments regarding the brand.

An omnichannel relationship strategy

Jettison the idea of a single subgroup within the enterprise that is responsible for the entire “digital” channel. Instead, the enterprise must figure out how all the groups will work in concert. Each group should work together toward an overarching, omnichannel relationship strategy, one that promotes collaboration and sharing among channels to manage relationships with consumers in an ongoing fashion.

Enterprises must find out how and where consumers are most comfortable interacting with them. That may depend on circumstances

as varied as demographics or proximity to a buying decision; one customer may prefer a digital interaction whereas another may prefer to speak to a live customer-service agent. Unfortunately, businesses can’t automatically replace some channels in favor of others; they must allow the consumer to choose from among a portfolio of channels, depending on the consumer’s needs at any given time.

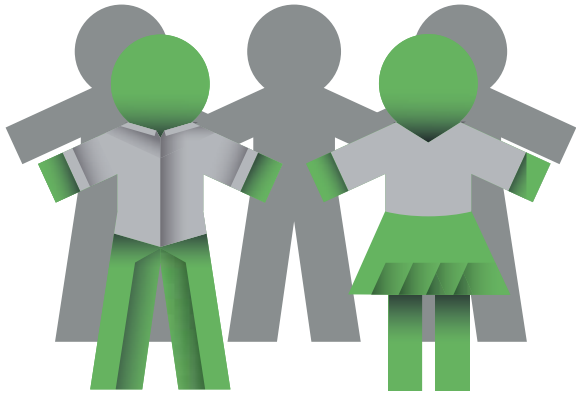
For example, Virgin America is offering customer service through Twitter and Facebook. Customer support monitors tweets and Facebook posts to the airline for indications that someone needs help, allowing consumers to make simple requests, like reserving a wheelchair for a flight, without waiting on hold for a call center rep.^{vi}

“Savvy companies understand that different channels represent opportunities to create different experiences that truly leverage each channel. Having a portfolio of channels creates the opportunity to give a consumer the right interaction at the right time.”

That said, every challenge reveals an opportunity. These new channels—whether through mobile apps on smartphones, through social-networking capabilities such as Pinterest, or through corporate websites—allow new ways of communicating with the consumer that help increase the quality and utility of interactions. It’s not a question of replacing channels or even weaving them all together into a single interface. Savvy companies understand that different channels

represent opportunities to create different experiences that truly leverage each channel. Having a portfolio of channels creates the opportunity to give a consumer the right interaction at the right time.

Consider the way a retailer interacts with a customer: a discount delivered in an e-mail is often considered “spam,” while that same discount delivered as a consumer scans a product QR code is just good service. Understanding how, when, and



where businesses should contact consumers can create a brand connection that rivals the face-to-face relationship associated with the small-town general store.

At the same time, businesses should recognize that social and mobile are not just a set of new channels for pushing information to consumers. It's about changing the channel's function from push—ads, for example—to services and value. Businesses must coalesce on a variety of new

capabilities beyond social media (such as analytics and mobile technology) in order to reboot efforts to engage consumers in ways perhaps imagined but not implemented. For example, Guatemalan shoe store Meat Pack looked to mobile interactions to pinch customers from competitors through a mobile app called Hijack.^{vii} When potential customers entered a rival's store, they were detected using the app and offered a promotion at Meat Pack. A discount countdown was displayed, starting at 99 percent

and ticking down by 1 percent every second until the consumer entered the Meat Pack store. When a discount was redeemed, the person's Facebook status automatically changed to inform the world.

Similarly, businesses will have to disrupt the mindset that says "relationships" equate to "marketing." This means that IT must forge close links with other groups that touch consumers and reach out to business units, such as product development, that manage interactions with other communities.

Insight leads to increased consumer satisfaction

With deeper interaction, businesses can more quickly understand what consumers like—and what they

don't. Better insight into customer preferences allows businesses to iterate product development faster, to scale up production or kill a feature or a service before too much is invested. They can build future business cases on a more substantial and substantiated information base.

Higher customer satisfaction equates to repeat customers and higher revenue through increased volumes and lowered cost of customer acquisition. But companies also gain from a better understanding of consumers. The deeper the relationship with the customer, the more reliable the metrics the customer provides. Again, it's the difference between the vagueness of a focus group and the specificity of actual consumer behavior—the importance of tracking what consumers do, not what they say.

Your 100-day plan

In 100 days, refresh the mindset of your consumer channels to move beyond transactions to, in addition, drive consumer interactions and relationships.

- Catalog your consumer interactions, tools, and channels.
- Educate your internal teams on the tools and channels currently available.
- Determine the questions to be answered to create a holistic view of your customer.
- Identify metrics for tracking the success of your social and communication channels in terms of a consumer relationship.
- Begin "social listening" to build momentum toward your larger strategy.
- Propagate current tools and channels across business units where applicable.

With consumers changing their attitudes about sharing and accessing information and becoming willing to be more transparent, forward-thinking enterprises are realizing that they can benefit from an unprecedented granular view of consumers—not just what they bought, but when, and where, and what they were doing before and while they made the purchase decision. Businesses can do this by taking advantage of internal data sources (that is, instrumentation and quantification of decision making captured by their own software) and external data sources (such as social-media sites and information gathered by resellers and partners).

The goal, to use a term that may sound contradictory, is *mass personalization*—using technology to provide resort service at a motel cost. That is, using what you know

about the consumer from the communications channels he uses to better understand his behavior and needs. Consumers newly accustomed to accessing account information in corporate databases to transact and interact have ratcheted up their expectations about how businesses will communicate and respond. But companies now have the ability to make the consumer feel special, to increase engagement, and to develop intimacy, as never before.

A new level of customer intimacy

Companies that embark on this voyage of mass personalization can expect a variety of new benefits. Because shoppers can move—quickly and entirely digitally—from awareness to recommendation to purchase after interacting on blogs, Twitter, Yelp, and other social sources, it's actually possible to compress the sales cycle. Offering on-the-spot promotions through digital channels also potentially increases impulse purchases. Providers that are better at controlling that experience will benefit by lowering the costs of sales and marketing and generating greater sales volumes.

Personalization also creates a virtuous loop. The more you personalize the experience, the

richer the data collected becomes. Companies can boost the quality of data in much the same way that night-vision goggles amplify available vision: to shine a light on data and behaviors, already present, but previously undetected.

A new level of intimacy with consumers is now possible. But effectively scaling meaningful relationships represents a real change in the way companies need to approach their consumer strategies. This shift is being enabled by technology; however, implementing it will require a new, unified approach across IT and the business. Now is the time to take the next step. The customers are out there; it's time for the enterprise to get to know them.

This time next year

In 365 days, reimagine your consumer strategy across the enterprise as a consumer-relationship strategy and create the cross-organizational ties to drive it.

- Create a cross-functional team responsible for reviewing, updating, and improving your consumer-relationship strategy.
- Standardize your methodology around how consumer interactions are shared throughout the organization.
- Redesign your organization's communication-channel strategy in light of the holistic consumer-relationship strategy.
- Establish an environment to test and then deploy technologies that will support your consumer-relationship strategy.
- Review your metrics and data to improve your consumer interactions and update your consumer-relationship strategy.

Sidebar: Gauging the Value of Trust

During its bankruptcy proceedings in 2011, Borders, the bookstore chain, won judicial approval to sell its intellectual property, including a customer database, to Barnes & Noble. The issue at stake: shoppers' data privacy.ⁱ

Anticipating privacy concerns, Borders' lawyers persuaded the court to appoint an independent third party to consider the privacy impact on the 48 million Borders customers whose personal information would be transferred with the sale of the intellectual property. In the end, the customers were given the chance to opt out of the transfer.

The bookseller's readiness to tell customers how their data could

potentially be used and, crucially, to give them a choice in the matter shows how companies and consumers may interact in the future on issues of privacy. It's also a prime example of the mobility of data these days—and a good indicator of the importance of establishing, let alone maintaining, accountability for such data.

A decade ago, Accenture asked whether enterprises could differentiate themselves based on consumer trust.ⁱⁱ We flagged five dimensions of trust—safekeeping of personal information, control over the data, personal access to one's data, accountability, and the benefits of letting corporations use one's

data—and we spelled out practical steps that would help companies move toward operating models based on trust. Even before the age of social media and big data, our recommendations were clear: companies must seek ways to use knowledge about their customers to provide better services to them, doing so in ways that increase trust, not suspicion.

Ten years on, plenty has changed: the entities collecting information are savvier than ever about data, and they have more channels through which to gather it (think "big data") and more powerful tools with which to extract insights from it. For their part, individuals are far more

sensitive about the use of their data, even though more and more data is sought from them and more is given by them, both willingly and unwittingly.

In general, individuals are more likely to think in terms of what's in it for them if they give out personal data. "When you put information about yourself out there, that's a transaction," Margaret Stewart, Facebook's director of product design, told *Fast Company* recently. "But you need to feel that you're getting something back in return. When we start to provide things that feel valuable to people, it will make that transaction make sense."ⁱⁱⁱ

Accenture's recommendations for businesses are even more relevant today, and the stakes have gotten higher—with consumers' greater sensitivity being just one of the factors in play. Accenture believes that a vital component is still missing from the privacy debate: a proactive business perspective focused not just on compliance with laws that protect privacy but also on the notion that companies can generate business value by earning consumer trust.

To date, few businesses convincingly demonstrate that they grasp the notion that they need to go beyond just collecting information about consumers. The company

that can build a reputation for providing valuable services while using consumers' personal data in trustworthy ways will have a big advantage over competitors. Its brand will be more valuable, it will have more opportunities to attract and retain lifetime customers, and it can become a preferred partner in a larger value chain of goods and services.

Implicit in this idea is the belief that trust has an economic value and, as such, can be used to win competitive advantage. In that respect, thinking of trust as an economic asset is not different from how a bank views and manages its customers' accounts.

Of course, a critical aspect of trust building is the assurance that all of the business partners in an organization's value chain abide by the same high principles. If a person using a supposedly trust-based solution is suddenly deluged with unwanted phone calls and e-mail from related companies, you can bet that's a customer lost forever.



Design for Analytics

Formulate the questions, and design for the answers

Design for Analytics

Business intelligence. Data analytics. Big data. Companies are no longer suffering from a lack of data; they're suffering from a lack of the *right* data. Business leaders need the right data in order to effectively define the strategic direction of the enterprise. The current generation of software was designed for functionality. The next generation must be designed for analytics as well.

Predicting the future isn't difficult. Predicting the future with some degree of accuracy is. Businesses are under the impression that the more data they have, the easier it will be to predict the future and thus secure competitive advantage.

Collecting more data points makes it easier to discern trends, patterns, opportunities, and competitive advantage. That's one of the reasons companies are focusing so heavily on big data and the ability to utilize

unstructured data from previously unplumbed sources (such as social media, call center transcripts, and e-mail). They are working under the assumption that "more data" is equivalent to "better data." They are only partially correct.

The problem is no longer the absence of enough data. In fact, enterprises are now being flooded with new data, big-data tools mine countless new unstructured-data sources, social media now

provide unprecedented information about consumers, and sensors and embedded devices expand the ability to gather data into areas where computing power has never been before. The problem now becomes the absence of the right data.

The IT world we live in today revolves around software applications. Businesses have developed data models to support application functionality, which is necessary

for the application to do its job. If an e-commerce application needs to know what device a consumer is connecting from in order to authenticate the consumer, it captures that information; if the application doesn't need to know, and knowing doesn't support the user experience, it doesn't. Most companies have also taken the next step—for example, they recognize that consumer information is valuable for future insight, so they

capture more of it where they can. But generally they have not done this with any specific question in mind.

So, when this data is repurposed as an input to make strategic decisions—such as entering a new market or pricing a new service—glaring information gaps often arise. The goal isn't to amass data. It's about enabling the business to answer a question, to create insight, and to use that insight to

help the company achieve its most basic goals. With every data gap, enterprises miss an opportunity to make better decisions or improve how they run their business. To move forward, to answer the question, you have to adopt a data-first strategy and plug the data gaps.

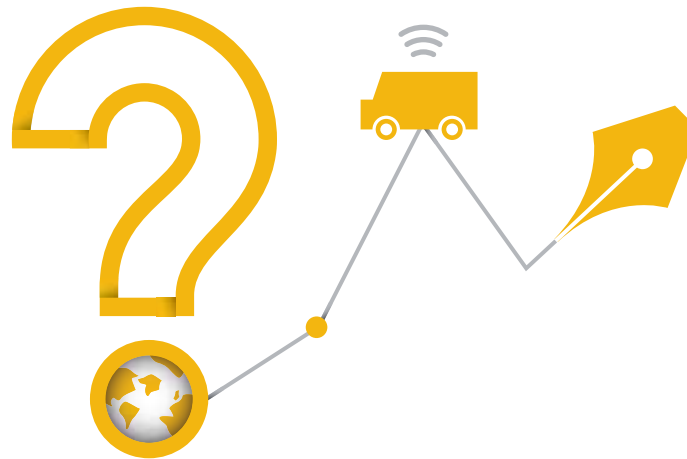
Plugging these data gaps—that is, getting the right data—requires a fundamental shift in design philosophy for how new applications

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are built and existing applications are configured, instrumented, and updated. Applications still must meet users' functionality needs, but applications now must also be designed to specifically produce data that answers more of an enterprise's questions. Technology is no longer the barrier. The barrier is strategic business foresight to formulate the questions.

To get the right data, you have to design applications to explicitly capture the specific data needed, update user interfaces to get new pieces of data, and add data collection as a new set of requirements within the software procurement process. These capabilities become a piece of the upfront processes for how you lay out road maps for your systems, not something that is added on after the fact.

The result is the first stage of a data supply chain, where applications serve not only their users but also the business as it looks to applications' data for answers to the questions most important to the business.



The minimum mindset: data as a strategic asset

Businesses have the right idea: data is a strategic asset. Data (good data) makes you smarter. A recent study of 179 companies, led by an economist at the MIT Sloan School of Management, suggests that companies that adopted "data-driven decision-making" have productivity levels 5 to 6 percent higher than can be explained by other factors, including investment in technology.¹

Savvy companies are working to discern more about transactions and events than ever before. They're looking for context and ways to make the insights they gain actionable. They're trying to understand not only what happened but why. And, when did it happen?

What transpired before it happened? What transpired afterward? It could be a purchasing scenario that reveals the associated items that customers buy. But it could also be a failed online purchase. Did someone get a coupon from Starbucks but go next door to Dunkin' Donuts anyway?

The desire to get these answers is why companies are investing so heavily in big data, business intelligence, and reporting tools. The fact that they are still investing means that they haven't yet found the solution, even though so much technology is available.

Companies need to start looking for the solution to the problem a different way.



Quantifying the world around us

When enterprises don't have access to the right data, they need to start looking differently at how they go about getting data. Companies can't rely solely on the limited universe of data that they already have. The focus now needs to shift to quantifying the enterprise: capturing the actions, interactions, and attributes of the employees and processes that make an enterprise

tick. They must step out of the box and formulate the right questions that will help the business make strategic decisions. The data that's necessary will become evident. The challenge, then, will be figuring out not only how to collect it, but, in many cases, how to create it.

Many software vendors are already starting to make it easier for enterprises to tackle this challenge. Third parties are increasingly creating Application Program Interfaces to

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allow data to be more easily extracted from software products, including packaged software applications. This further puts the onus on companies to figure out what data they should be gathering from their systems to answer the company's broader questions.

Companies are also increasingly adding instrumentation to their custom applications, designing them to collect and report transactions, activities, or logs. For instance, to

help improve its recommendations engine, Netflix tracks how customers interact with on-demand film downloads. It looks at metrics such as when customers pause the movie and what scenes they watch over again.ⁱⁱ In another example, to continuously improve the quality and effectiveness of its online class materials, Knewton incorporates the ability to track specific data about how students use its software. It tracks not only how long it takes students to complete an assignment

and their ultimate score but also their keystrokes, how long it took them to answer individual questions, and if they stopped in the middle of an assignment or question. “We're physically collecting thousands of data points per student per day,” said founder and CEO Jose Ferreira.ⁱⁱⁱ

Companies are also looking to the blossoming of sensor technology to fill data gaps as they arise. This technology represents a way to create and collect information from physical environments and devices that today represent blind spots in a company's data portfolio. Research company Strategy Analytics predicts that cellular machine-to-machine (M2M) connections necessary to transport the data from distributed sensors to the data center will grow from 277 million in 2012 to 2.5 billion by 2020.^{iv}

The companies that have already defined their top-level strategic questions are striking first. Many companies in logistics, transportation, and energy, for instance, have already clearly defined their need to track the movement of goods and the usage of power.

UPS has developed a system of in-vehicle sensors and handheld computers to track information not only about its shipments but also about its trucks' movements. This is what helped it determine that making left turns slowed deliveries and increased fuel costs as a result of idling; it used the information to create routes that minimized left turns, saving the company 9 million gallons of gas annually.^v In addition, knowing when trucks are going to reach their destinations helps UPS's employees ensure that there are sufficient resources to load

and unload them. Knowing where shipments are in transit (and sharing that information on a website) aids customer service.

In the energy industry, Shell joint venture Petroleum Development Oman (PDO) has deployed a wireless system in its oil field. It is currently wiring 5,000 wells, which technicians remotely monitor and manage, to provide real-time communication and control.^{vi} According to PDO,

the wireless information network enhances well efficiency and reduces operating costs because workers no longer have to physically visit each well to collect operating data and reconfigure the system. This also contributes to personnel safety.

Quantifying the consumer

To date, of course, the ripest area for the collection of data has been

“The ability to cultivate and harvest customer information for sales, marketing, and advertising represents a rich opportunity to grab some of the data that [businesses] need in order to resolve questions about their consumers that have long been left unanswered.”

the quantification of the consumer. Facebook has ingrained a propensity for people to share their likes and dislikes. Businesses have known for years that customers prefer recommendations from known sources. The ability to cultivate and harvest customer information for sales, marketing, and advertising represents a rich opportunity to grab some of the data that they need in order to resolve questions about their consumers that have long been left unanswered.

The aggregation of social and mobile capabilities through applications such as Waze (a crowd-sourced navigation app) and Yelp (online consumer reviews) has heightened the ability for consumers to quantify themselves. But there's also been an associated increase in personal electronic and medical devices, beyond smartphones, that collect

and transmit information, primarily in the personal-fitness space. The Nike+ FuelBand collects data about calories burned, for example, and FitBit collects data regarding users' sleep patterns. Personal fitness and social media also overlap on websites where people track their diets. A lot of consumer data exists today, but companies need to determine the right data for them and then start processes to acquire that data.

Websites already have multiple capabilities for tracking activity, but sometimes what is needed can be gleaned by simply asking customers and prospects for input. However, it's important to note that often it's better to track actual activity than to poll—there's typically a delta between what people say they want and what people actually want.

Businesses also have a newfound ability to utilize pieces of data that they may already possess but that previously hasn't been easily usable: unstructured data represented by free text in e-mail, tweets, and other media; audio files from call center conversations; and video from sites where customers interact with products.

Finally, consider the availability of information that's been collected by others for integration into your analysis. This could come from a variety of sources—service providers, social networks, search engines, even vendor software already running in your data centers. For instance, Intellicorp has developed a software product that can analyze changes within SAP ERP applications; it sells the product to SAP customers for data-management and data-life-cycle uses.

What do these examples portend? Opportunities for consumer data feeds are everywhere. You just need to form the right questions for your business and start strategically quantifying the world around you.

Creating a data supply chain

It's time to start treating your data less as a warehouse and more as a supply chain. Having identified your sources of data, you must corral it for analysis, in the same way that the various components of an automobile from multiple suppliers come together on an assembly line. Recognize that the data won't be static; it will be manipulated as it goes through the supply chain, added to other pieces of data, updated as more recent data comes along, and sometimes transformed

into new products (think insights) as you look at different pieces of data in aggregate. Just as important, companies should be able to feed information back to their suppliers in order to help them incrementally improve the latter's data collection—just as an auto manufacturer must report component failures back to suppliers in order to improve quality.

Once you identify the data supply chain, how do you harness it?

Once you've designed for analytics, how do you actually conduct the analytics? Analytics have always been a challenge, but partially because businesses have often conducted the process in an exploratory fashion—they've collected available data and then analyzed it, rather than assiduously determining what data will aid their business strategy and then ensuring that the right data is collected to analyze. They can derive increased



value by collecting data with the real end purpose in mind. The result: better data, which equals better insight.

Ford Motor Company research logically deduced that the customers of its hybrid vehicles preferred using electric power as much as possible. However, the system was originally designed to deploy electric power based on other parameters, such as amount of battery power remaining. But Ford developed an algorithm using data from the cars' built-in GPS systems to track when drivers were close to home or frequently visited locations close to home.^{vii} Knowing that the vehicles were more likely to be within the range of a battery charge, the engineers were able to adjust the powertrain controls to rely more on electricity than on gasoline in those scenarios. Customers don't see the algorithm

working, but they do see that they're relying more on electric power, which delivers higher levels of customer satisfaction.

In a short time, savvy businesses can create a virtuous feedback loop that allows them to collect, analyze, and respond in an increasingly agile manner, and then revisit their questions on a periodic basis in order to continuously assess new data in the context of changing business conditions and strategies. This will require the integrated involvement of IT with the business, because IT may need to tweak data collection mechanisms, including user interfaces, on mobile apps and enterprise applications in order to acquire additional data points.

Foresight: establishing a feedback loop for insight

What will the feedback loop look like when software is designed for analytics? It starts with setting goals and creating questions that need to be answered. Ask the leaders of organizations within your enterprise if they can clearly articulate the key

specific questions they are trying to answer; many will not be able to, and fewer still will have those questions documented and feeding into teams to answer them. Though obvious on the surface, this task should not be underestimated. It is not trivial. And it is not something for which most companies have a formal process. They need to create one.

“What will the feedback loop look like when software is designed for analytics? It starts with setting goals and creating questions that need to be answered.”

“You will need to distribute the data requirements to your software development team, of course, but also begin working with your partners and software vendors so that they can begin to collect data as well.”

With a process in place, you then need to align the questions with data requirements and disseminate those requirements accordingly. You will need to distribute the data requirements to your software development team, of course, but also work with your partners and software vendors so that they can begin to collect data as well. Finally, think about other sources of data you want to incorporate for analysis.

Then you are ready to close the loop. To whom will the information be distributed so that it can be acted upon? Designing the process so that information flows into the organization is equally important.

The cultural shift to an insight-driven business will also require different thinking about personnel and partners. Corporate developers will need to focus on incorporating methods of data harvesting into user interface designs, making the data

harvesting obvious to the user yet unobtrusive. As part of an update to its online marketplace, eBay posts photographs of merchandise to users, Pinterest style, based on data derived from previous purchases, previous searches, and stated interests. A better user interface, yes, but this design also gives eBay the ability to get deeper insight into its users not only by simply asking them for their preferences but also by looking at how they interact with the pictures shown to them.^{viii}

Developers must use design methodologies that allow rapid testing, updating, and reconfiguring. In that way, businesses can determine which methods work best in acquiring the strongest data. Businesses will also have to rethink their relationships with partner organizations in order to persuade them to become equally insight-

driven or at least to work with them to provide the required data. Procter & Gamble and Walmart actively share supply chain information with each other to help reduce inventories while increasing sales by focusing on rapidly changing customer demands.^{ix}

Businesses must also think about how they can maximize the availability of data sources. Look at currently packaged software applications or SaaS applications for how they can be reconfigured or how APIs can be utilized to supply data. In existing applications, think about how the interface can be updated for better data gathering—for instance, adding new entry points to accommodate inputs about seasonal needs or short-term promotions. In new applications, designing for data capture should carry as much weight as the initial application requirements.

Changing a corporate culture

Designing for analytics is about more than simply adding a few data requirements to a software development cycle or an RFP; it is the next step in transforming the enterprise culture to become insight-driven. It's about blurring the lines between business functions (as the consumers of business data) and IT (as the purveyors of data) to make both more effective.

Pushing these ideas, many enterprises will go so far as to create a prominent new role in the organization, a chief data officer, a data champion whose responsibilities encompass the collection, prioritization, distribution, and analysis of data. But, with or without a data champion, each employee must be tasked with

looking for ways to collect better data, more data, fresher data. It's not just the software that should be refreshed to collect data and conduct analytics—it's the employees, too.

By deploying these capabilities, businesses will move themselves closer to the goal of being *completely* insight-driven, of being the kind of company that systematically uses data at all levels of the organization to become smarter and more successful. It's time to take the next step. It's time to evolve applications and products beyond just user functionality and make them actively feed your analytics. Give the business not just data, but the right data.

Your 100-day plan

In 100 days, define the key strategic questions for the business and the data needed to answer them.

- Update or build your data catalog, identifying what data you have.
- Determine your in-flight analytics projects and what questions these projects are trying to answer.
- Prioritize the existing strategic questions your organization is working on.
- Begin to catalog new data sources (internal and external) needed to fill in critical missing data elements.
- Tap the new data sources where they fill identified data gaps.
- Define the required skills and experience needed to create data champions across the organization.

This time next year

In 365 days, establish your data supply chain across the enterprise, quantifying the world around you to address strategic gaps.

- Create data champions across the organization, for example, a chief data officer.
- Work across the organization to determine and prioritize your future strategic questions.
- Look at your data catalog and determine the long-term gaps.
- Fill these gaps in the data catalog—purchase data, develop new APIs, and ask your partners.
- Embed new data requirements into software road maps and procurement plans.
- Begin designing software to capture new data within custom development and software update cycles.
- Develop a data creation strategy to attain data through the setup of new data sources: M2M, new software, and data creation from partners.
- Put the data cycle in motion, revisiting data needs as new strategic questions arise.

Sidebar: Why the Business Now Needs to Care About APIs

In earlier times, applications (and their data) didn't really travel far in the enterprise. Applications were specific to jobs, and the data they produced remained locked inside, rarely fulfilling its true potential for the enterprise. Data on consumer segments used by the marketing group would rarely have been sought by engineering or manufacturing, say, or even offered to external parties.

Things are different today. It's becoming increasingly important for the underlying data and business functions to be made available for general use—able to be quickly reworked in ways that help shorten cycle times, cut costs, or accelerate revenue elsewhere in the business.

APIs—the “glue” that connects apps with business processes and with each other—have typically been a fairly low-level concern for programmers and architects. But with the business's increasing reliance on data and services—both public and private—and the growing reuse of those building blocks, APIs are rapidly becoming a strategic concern. For example, the car-sharing service RelayRides relies on an API created by General Motors and OnStar to access some of the remote control and telematics elements of the service.¹ Organizations must now consciously manage the proliferation of increasingly important APIs.

The beauty of APIs is that they uncouple the “front end” service—the business access—from the IT mechanisms that support it. As user groups and use cases change, access and management-policy updates don't affect IT implementation, and vice versa: APIs can provide self-serve access for developers—internal, partner, and independent third party—giving others the power to create new and innovative use cases. And IT updates can happen at any time without users knowing it, or needing to know. Managed well, APIs can help enterprises handle complexity as the need to access data and services grows. In an increasingly quantified digital world, API management provides a mechanism to leverage

data and services to meet business goals.

The benefit of discrete API management is that it keeps complexity under control. Specifically, the API management solutions now offered by providers such as Apigee, Layer 7 Technologies, and Mashery make it possible to organize, expose, and monetize APIs. The organization benefit is very real: formal management of APIs deals with the sprawl, redundancies, and inefficiencies that will proliferate as increasingly quantified enterprises begin to share many more data sources and services, both internally and externally.

API management tools help expose a common platform of functionality. They minimize rework. And they accelerate development, which is a key first step when embarking on cloud, mobile, or social roadmaps. Just one snapshot: construction and engineering company Bechtel has an API strategy that provides relevant information to its global teams from the data generated and stored as it executes its projects, thereby enabling the teams to be more agile and better equipped to make informed decisions.ⁱⁱ

Finally, API management makes it possible to measure the value of APIs. Imagine a scenario that involves explicit governance of APIs; you have visibility and control into

who is using your APIs and which APIs are most valuable, as well as traceability of IT capability against business use, ensuring business process alignment and verification against business cases.

A case in point: Accenture is carefully managing APIs as a key step to enable cloud and mobile strategies across our global workforce of more than 250,000 people. With as-a-service and mobile-device models playing larger roles in Accenture's delivery of functionality for activities such as time entry, hotel reservations, and business travel, Accenture's internal IT team realized that integration with disparate systems was going to become challenging. And with a

growing global workforce, it would be increasingly critical for business users to have access to enterprise and application data in real time in order to scale up those applications.

The IT team opted to build an API layer that would make available the various data and business functions for general use and standardize access across users. The APIs could then be used to help implement new services and to provide new user experiences on mobile devices such as tablets and smartphones.

If API management sounds a lot like service-oriented architecture (SOA)—an influential technology concept a decade ago—that's because it is. It

is based on the same core "building block" concepts as SOA, but it has evolved to take advantage of the agility and simplicity of cloud and Web-based approaches.

So the next question is, Who needs to be responsible for API management? Currently, the only people who know or care about APIs are found on the development teams. But there's a need for a centralized function that brings some order and discipline to today's random and informal interactions between business users and IT staff. Does the buck stop on the CIO's desk? Or is this part of the purview of a newly minted chief data officer? In either case, the API management role must be defined.



Data Velocity

Matching the speed of decision to the speed of action

Data Velocity

Business leaders have been bombarded with statistics about the soaring volumes of data that they can mine for precious insights. They have been deluged with articles describing the incredible variety of “external” data hidden in everything from tweets and blogs to sensor outputs and GPS data from mobile phones. But the next perspective on data that deserves attention is data velocity—the pace at which data can be gathered, sorted, and analyzed in order to produce insights that managers can act on quickly. As expectations of near-instant responses become the norm, business leaders will rely heavily on higher data velocities to gain a competitive edge.

It's become an article of faith among business leaders that their data contains a treasury of powerful insights that can help their organizations make money. They're also getting used to the idea that “data” can mean what's gleaned from Facebook postings or remotely located machines just as much as what's in corporate data centers. Just ask Walmart, which deployed a new search engine last fall on Walmart.com that relies on

data from platforms like Twitter, Facebook, and Pinterest to second-guess consumer behavior, increasing sales conversion rates by 10 to 15 percent in the process.¹

But there's another aspect that business leaders have yet to fully grasp: data velocity. That concept by itself is not new; together with “variety” and “volume,” it has been part of the “three Vs” construct for talking about data—a construct

developed in 2001, long before “big data” became such an overused term.ⁱⁱ And at the most fundamental level, there is nothing novel about the idea of faster flows of data helping organizations get more done in less time.

But the notion of velocity has been largely eclipsed by the many recent advances in technologies that have unlocked significant increases both in available volume (zettabyte upon petabyte) and in variety (spanning unstructured data such as pins on Pinterest as well as structured records of supply logistics and customers' purchase histories).

Today, it's increasingly important to match the speed of the organization's actions to the speed of its opportunities. If too much time elapses between acquisition of data and the ability to use the data

“Today, it's increasingly important to match the speed of the organization's actions to the speed of its opportunities.”

to generate actionable insights, the organization will start losing out to more responsive competitors. More worrisome, if the business hasn't begun using data-driven insight to detect and evaluate opportunities in the first place, it runs even greater risks of falling behind. Consumer goods giant Procter & Gamble is acutely aware of what's at stake: CIO Filippo Passerini told *InformationWeek* that if P&G can eliminate the “what” discussions and some of the “why”, and decision-makers can jump right to how to solve a problem, that radically increases the pace at which the

decision makers do business.ⁱⁱⁱ The old model, he said, would mean that analysts would get back with answers in two weeks. “You need to be able to answer that question immediately,” he told the magazine.

P&G is investing in virtual, “instant on” war rooms where professionals meet in person or over video around continuous streams of fresh and relevant data, inviting the right experts as soon as a problem surfaces. P&G's objective is to give these decision-making forums access to data as soon as possible after it has been collected. Passerini

explained that he's not seeking new types of data; what he wants is to get everything from point-of-sale data to statistics on inventories and shipments more frequently and far faster, in more granular form than ever.^{iv}

In all of these discussions about data velocity, note that we're not talking about striving for some real-time nirvana. What's crucial is an improving rate of response, regardless of the rising volumes of data to be accessed and analyzed and irrespective of their proliferating sources. Going forward, it will no longer be about the size of your data—it will be about matching the velocity of your data to how fast your business processes need to act on it.

When fast still isn't fast enough

Irritated that the Web page on your smartphone is downloading so slowly? Remember a time before smartphones? That's just one tiny reflection of the time-starved age we live in, and a clear indication of how much expectations have risen.

Increasing expectations are a primary factor pushing businesses—all of us, actually—to ask for and act on data more quickly. Mobility as a new channel for information has catapulted those expectations far forward; it's addictive to have easy fingertip access to large amounts of data. The more data we have, the more we want—and app developers are happy to oblige us. The Web is literally in hand, wherever we go and whenever we want it, goading us to expect the same responsiveness

and openness on our desktops, TVs, and even our car dashboards. Not to mention that the next generation of consumers is growing up with expectations of instant responses as a way of life.

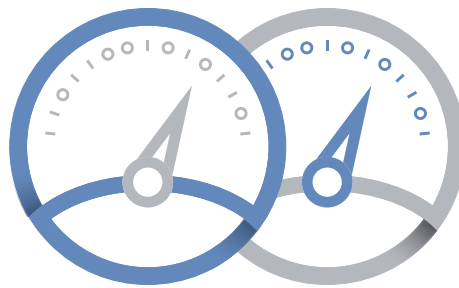
Enterprises have realized that smartphones and tablets are perfect vehicles for making informed decisions anywhere and anytime, based on targeted, personalized information. Hence the fact that SAP and others offer business intelligence software that provides the mobile workforce with the capability to

stay up to date with insights about customers, products, work orders, and more.

Instant, mobile access to data is only one way that expectations about data velocity are changing. We're starting to ask new things of our enterprise systems, too, thanks to the continuing consumerization of IT. Long accustomed to being able to track our Amazon.com orders via the online services of FedEx or the U.S. Postal Service, we now wonder why we can't as easily do the same with our company's inbound supply chain.

Concurrently, the user base for data is exploding. Business users are becoming more technical at the same time that analytics skills and techniques are becoming more accessible to technical users, further increasing the demands on available data. Within living memory, data was the province of the guys in white coats in the air-conditioned mainframe room. Today, everybody who wants to be a data pro can be a data pro.

Yes, for years now almost every business function has had its "power users" of technology, but today, leading companies expect their "regular" business users not only to consume data but also to seek, acquire, evaluate, analyze, and share it. Those organizations consider serious data savvy and analytical skills to be requirements for many more of their employees than ever before.



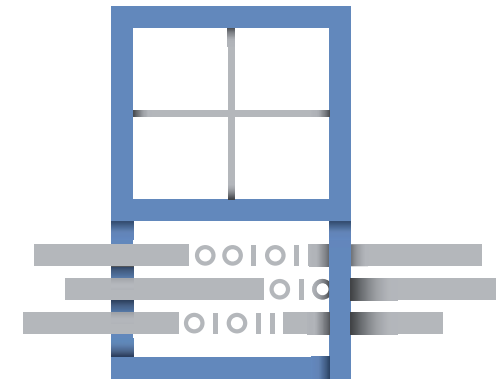
Narrowing windows of opportunity

Another powerful factor pushing the need for more data more quickly is that the windows of opportunity are smaller in almost all business endeavors. The windows have been closing for some time. In the 1980s, *Harvard Business Review* explored the topic, notably with its landmark article on time-based competition.⁵ And decades ago, then General Electric chief Jack Welch was famously preaching about speed and responsiveness.

Speed of response is increasingly important at the functional and transactional levels. Take Web interactions, for instance. Let's say you run a retail company: when a shopper lands on your product page, you've got a few split seconds to give her information that is relevant

and engaging. But we're not talking just about short page-load times. The key is in how to leverage insight to make that experience awesome. You have to be able to *connect* with the shopper—tying the experience together based on past interactions, purchase history, questions she e-mailed to your customer-support team, social links, and any other data or any insight you can muster. The same holds true when you want to bid in real-time ad auctions to try to lure shoppers back to your site from elsewhere on the Web. In the milliseconds available, you need the ability to process the data tidbits at hand so that you can compose a message that is personal, intriguing, and compelling enough to prompt a shopper to click your ad, bringing you the traffic you seek.

Fast data responses and rapid analysis are also crucial in the



maintenance and repair world. At the extreme, a grounded airplane costs airlines as much as \$250,000 per day; an oil rig that isn't drilling can cost \$1 million per day. The sooner an equipment malfunction or imminent shutdown can be detected, and the more detailed the data about the equipment's condition, the quicker it can be repaired and made productive again—and, if captured, the more data there will be to help predict future breakdowns and more effectively plan future maintenance regimens.

The story is similar for dynamic supply chains. Responding to changes in the supply chain with a combination of historical data and brand-new intelligence allows you to create a more responsive, resilient supply chain. If your company was unable to properly see a recent drop in production yields from an aging manufacturing plant, you may have difficulty meeting customers' orders on time. You did not match your speed of insight with speed of action.

In the utilities sector, investments in smart grids are putting more-frequent data updates in the hands of those matching electricity supply to demand to keep the grid stable. But the clearest example of the "need for speed" in data utilization comes from capital markets, where quotes are submitted and withdrawn in millionths of a second. When trading systems can handle transactions in trillionths of a second, they will.

New technologies that put data on skates

As far back as 2008, Accenture's Technology Vision spoke to the growing variety of data relevant to the enterprise—video, audio, blogs, social data—much of it user-generated. We also addressed the technologies that were emerging to process this unstructured data. For the past two years, we've showcased

new technology advances aimed at tackling data variety and volume: platforms, services, *and* architectures. Converging data architectures are reshaping our whole view of data in the enterprise, and industrialized data services help us get that data out into the enterprise, where it can generate new value.

What's happening now is a surge of new technologies that help to accelerate the whole data cycle from insight to action, increasing the enterprise's ability to deal with data velocity.

To start with, a slew of providers have pushed high-speed data storage much further. Appliances relying on solid-state disk (SSD) to speed data input and output—examples include Oracle's Exadata and Teradata's Extreme

Performance Appliance—offer huge speed increases over conventional storage. To squeeze out even faster performance, more attention is going to in-memory techniques that sharply minimize input and output by moving all kinds of data sets into main memory rather than onto (and off of) any form of disk drive.

In-memory technology is already moving into the corporate data center. According to Gartner, the adoption of in-memory computing is expected to increase threefold by 2015 as a result of decreases in memory costs.^{vi} The use of in-memory technology marks an inflection point for enterprise applications. With in-memory computing and insert-only databases using row- and column-oriented storage, transactional and analytical processing can be unified. In-memory data warehousing finally offers the promise of real-time

“What's happening now is a surge of new technologies that help to accelerate the whole data cycle from insight to action, increasing the enterprise's ability to deal with data velocity.”

computing; business leaders can now ask ad hoc questions of the production transaction database and get the answers back in seconds.

SAP's HANA appliance is arguably making the most visible waves. Since its launch in June 2011, HANA has been the fastest-growing product in SAP's history.^{vii} In brief, HANA is a flexible, multipurpose, data-source-agnostic in-memory appliance that combines SAP software components

on hardware provided and delivered by SAP's leading hardware partners. Data can be replicated from SAP in real time and is captured in memory as business happens, where flexible views expose analytic information rapidly. External data can be added to analytic models to expand analysis across the entire organization. Luxury retailer Burberry expects HANA to provide real-time access to customer histories when customers walk into the

store, allowing sales associates to identify opportunities to better serve them and match products to their individual tastes.^{viii}

New exploration methods that will let humans process data faster

Of course, professional users have to be able to interpret what the software is telling them. So several providers are refining visualization technologies that speed up employees' processing of data, shortening the time it takes to evaluate what's being communicated and to make a decision, thereby creating faster "time to insight" and freeing users to deal with more decisions. Nearly all of the leading analytics vendors—including SAS, SAP, and Oracle—have corresponding

data visualization solutions to help users understand complex data. One player—Tableau Software—traces its roots to technology used to help create some of the most successful early computer-generated animation movies, such as *Toy Story*. Another virtuous cycle comes into play here: the faster the data can be processed and analyzed, the more terabytes can be poured into the system.

At the same time, newer low-cost analytical packages decrease the time needed for problem-driven exploration. These tools—mostly open source—greatly facilitate the iterative querying of data, accelerating users' ability to narrow in on the right questions so as to find the best nuggets of insight. Tools such as Apache Mahout, R, and D3.js make it easier for IT professionals who are not analytics specialists to explore and iterate—



essentially realizing more quickly that they didn't ask the right question and promptly circling back to do so. These are really "do it yourself" analytical packages, different from traditional business intelligence reporting software, that make it easy for nonspecialists to write their own algorithms. One solutions provider—Predixion Software—allows developers to create analytical models and "package" them for deployment to others, enabling those other users to leverage the models without being analytics experts themselves.

At certain points, it will be possible to automate decisions. Once the insight has been discovered during exploratory analysis—the earlier part of the data cycle—then the actual decision making can often be mechanized. Consider the example of an electric utility that is seeing

substantial increases in demand as more electric vehicles appear on the streets. Based on the insight that, for a given municipality, registrations of new electric vehicles directly increase the strain on the electric grid—an insight that comes once—then the electric utility can automatically prioritize portions of the grid in certain neighborhoods for equipment upgrades each month based on input from that month's registrations of electric cars.

There are also new moves to take technologies that are designed to handle large volumes of unstructured data—largely batch technologies—and adapt them to work in real time, or as close as possible to real time. The goal is to attain a level of dynamic query-building and execution to match the relative rate at which the underlying data is changing. For instance,

“In practice, speed costs money, and even with new advances in technology we don't expect that fact to change overnight. So it is crucial for IT groups to still rely on non-real-time data where possible.”

SQLstream handles real-time SQL queries against streaming data, leveraging and accelerating existing queries against data warehouses and other SQL-based repositories. Similarly, Cloudera's Impala and the open-source project Storm are both developing modifications of Hadoop to move beyond batch processing to near-real-time MapReduce-style queries. The beauty of transforming tools built for batch work into real-time analytics suites is that it enables users to run huge data

sets without having to resort to notoriously inaccurate random sampling of the data.

Hybrid models for boosting data velocity

In practice, speed costs money, and even with new advances in technology we don't expect that fact to change overnight. So it is

Your 100-day plan

In 100 days, create a data velocity strategy to match the speed of your insights to the window of opportunity available to act on them.

- Survey business units to determine where they have critical decision-making bottlenecks.
- Determine which decisions are data-processing dependent.
- Prioritize opportunities based on the cost-benefit tradeoffs for accelerating the decision. Speed costs money.
- Create tactical deployments based on the prioritized opportunities with current tools and methods.
- Data champions should update the data catalog to incorporate data-processing criteria.

crucial for IT groups to still rely on non-real-time data where possible, blending fast and slow to solve problems cost-effectively. Of course, skilled developers already do this; for some, it harks back to their training in engineering. Enterprise systems are no different. You might, for example, precompute much of your customer analytics. The batch analysis from your weekly churn report may tell you that you're in danger of losing a longtime customer, but discovering that that customer, already identified as at-risk, is currently browsing lower-cost service options on your Web site could give you the hook to find a way to keep from losing your customer altogether.

As the challenges of accelerating data become more sophisticated— involving soaring volumes of unstructured data, for example—the

trick will be to apply "hybrid insight" as often as possible. This calls not only for changes in architecture but for changes in skills as well. It requires that software-engineering leaders seek out and reward developers who demonstrate a definite "speed mindset."

Those who show an aptitude for blending real-time insight with batch insight—and knowing when to use each—will be extremely valuable. For example, take the case of a healthcare-insurance provider that has to meet a tight deadline on a government mandate to predict subscriber attrition. The IT group can run the work in batches to meet the compliance deadline, but over the long term, the group can use the insights from that work to understand and predict "attrition propensity" in every other interaction with insured patients and

use that insight to tailor messages and content that will seek to engage the patient and combat the attrition risk.

In short, we can realistically expect that many organizations will do what they can to push for faster data processing by using non-real-time approaches, weaving in more and more real-time modes as time and funding allow.

A high-velocity opportunity

In a recent letter to shareholders, GE chairman and CEO Jeffrey Immelt nicely summed up his team's perspective on the need for agility and responsiveness: "When the environment is continuously unstable, it is no longer volatile. Rather, we have entered a new economic era... Nothing is certain except for the need

to have strong risk management, a lot of cash, the willingness to invest even when the future is unclear, and great people." ^{ix}

To be sure, the rise of volatility and market turbulence puts more emphasis on the need to get risk management right. But there is more to it than that. Accenture has found that several high performers view ongoing uncertainty as nonstop *opportunity*. More and more of these companies see competitive advantage in "time to insight," and as a result, they are investing not only in the tools that can help them accelerate their data cycles but also in the skills and capabilities that reflect a "need for speed." For them, increasing data velocity isn't just an abstraction or an obscure objective for IT professionals; it is a business necessity that gives them a chance to open up a big lead on their competitors.

This time next year

In 365 days, begin to transform key processes, accelerating the insights where the increased velocity leads to tangible business outcomes.

- Use your data catalog to create a strategic view of the data that creates bottlenecks.
- Determine if current infrastructure already supports a turnkey solution that alleviates these bottlenecks. (e.g., use of HANA for SAP).
- Test and deploy required technologies and sources of data that improve your data-processing bottlenecks.
- Update the IT road map and architecture to reflect additional technologies and data sources.
- Deploy the next set of prioritized opportunities that will leverage the new architecture.
- Measure business outcomes and review the catalog for additional opportunities.



Seamless Collaboration

Right channel, right worker, right job

Seamless Collaboration

It is time for the enterprise to reimagine the way its employees work. The rise in social networking has breathed new life into collaboration. Users' new social behavior and growing expectation that every app will be "social" are pushing companies to create new user experiences. However, to increase productivity, enterprises must move beyond standalone social and collaboration channels; they must begin to directly embed those channels into their core business processes. The new approach: build social, collaborative applications throughout the enterprise.

Enterprises are always pushing to enhance the way their employees communicate with each other. The reasoning is simple: better communication leads to faster and higher-quality work, which, in turn, leads to increased productivity. They see social technology changing the way users interact and collaborate with each other, and they naturally want to harness that proclivity toward communication and

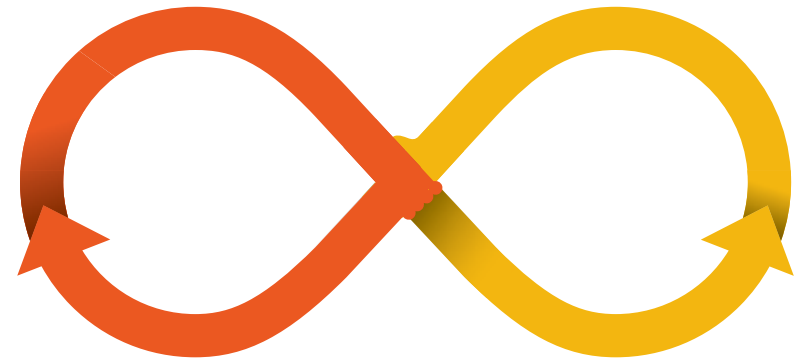
collaboration within the enterprise. But many are looking at it the wrong way. Consumers widely use Twitter, but that does not mean that deploying Twitter to employees will solve the communication challenges a company faces. Facebook is highly social and incorporates e-mail and the sharing of photos and documents, but that doesn't make it appropriate for the corporate world.

Why doesn't it translate? Simply put, motivations and behavior differ in each sphere. In their personal lives, people are internally motivated to want to follow the details of their friends' and family's activities; people are social, and the drive to stay in touch and connected is strong. At work, people have a different motivation: to get their job done as quickly and effectively as possible. However, using social tools as designed today, to follow coworkers en masse, often becomes more of a time sink than a time saver.

That doesn't mean social technologies won't work for enterprises. In fact, companies have been extremely successful at streamlining interactions with consumers—for example, by integrating instant messaging into e-commerce and technical support

sites. But in the consumer setting, enterprises are motivated to adopt the technologies that consumers use to make their lives easier. They now need to do the same for their employees: use these technologies to make employees' jobs easier. Enterprises that want the benefits of a highly collaborative, social workforce must integrate such technology into the systems that employees use every day—and clearly demonstrate to those employees how it will make them better at their job.

Unfortunately, enterprise collaboration today is still a set of siloed communication channels, from e-mail to videoconference to social-activity streams (basically a timeline of activity, similar to what you see on a Facebook page). Users are expected to figure out how to use those channels to



do their job and improve their productivity themselves. Companies need to go beyond what social sites are doing, what they might be offering consumers on websites, and look to new ways to solve the collaboration challenge. They need to use collaboration and social channels in such a way that they have the potential to create specific, measurable productivity gains. The real productivity gains from these technologies will stem from a company's ability to

integrate the social technologies into its business processes and the software that supports them. This means companies can't wait for software vendors to build a bolt-on solution to address strategic needs. To realize these gains, it will be the enterprise's job to actively identify the core processes where improving productivity will drive the most value and then to weave in the tools. For example, in a recent survey of more than 220 CRM decision makers, Nucleus Research found that adding

social capabilities to CRM drives an average increase in sales staff productivity of 11.8 percent.ⁱ

Integrating collaboration channels into business processes has the potential to both streamline the way employees work and make business processes more efficient. Social tools and strategies will provide the mechanisms and metaphors to integrate them effectively.

Why now?

Tackling collaboration now is both easier and more important than ever.

It's easier because employees are already inclined to collaborate; it is the natural way that people work. And with the introduction of social technology into their personal lives, they are looking for that same

kind of effortless communication within the applications that support their jobs. They are becoming more comfortable with sharing information, in essence becoming more transparent about what they do, why, and its importance. By aligning users' newfound tendencies for transparency and social interaction with business goals, businesses have an opportunity to deploy collaboration in a way that their users will actually adopt. Social tools, such as Yammer and Chatter, are rapidly maturing. Both offer APIs that let companies more easily integrate them into their applications. In the open-source world, the OpenSocial API lets developers incorporate collaboration in a similar way.

At the same time, it's important because every worker is increasingly an information worker. Businesses

are demanding more from employees; workers are expected to be constantly informed while producing faster results and better decisions. All the while, the deluge of information being thrown at them is increasing. Keeping up is a challenge as it's estimated that in most organizations the volume of data is expanding by 35 to 50 percent every year.ⁱⁱ

In the face of these competing demands, employees must consume increasing amounts of information and context. They also expect and demand more transparency, not only from their colleagues but also from the business processes and functions surrounding them. They expect a "frictionless" capability so that they can do their jobs faster.

But while the number of different roles that need to leverage

“Every worker is increasingly an information worker. Businesses are demanding more from employees; workers are expected to be constantly informed while producing faster results and better decisions.”

information has increased, the need for employees to share their data has also exploded. The result: the information technologies that have been implemented have forced users to figure out for themselves how to share and distribute information.

Embedding social-driven collaboration into the business process

The problem within enterprises has never been a lack of communication. If anything, there's been a plethora of methods at varying degrees of maturity, each providing a needed element to employees' efforts to share information. From e-mail to videoconferencing to instant messaging to Twitter, employees can always find a way to communicate

with colleagues. Each new channel has allowed organic growth of collaborative interaction between users. While each of the channels is flexible enough on its own, the ad hoc nature limits the ability of any channel to grow into a tool that serves all facets of collaboration.

Nor has there been a lack of effort at collaboration. Companies have spent millions on tools, but the outcomes and benefits have hit their limit.

To move forward from this impasse, enterprises must move beyond tools and integrate social-driven collaboration into the business process. For example, adding the ability to comment, instant message, or follow a product through its activity stream within an order fulfillment application promotes a free-flowing exchange of ideas otherwise absent within a

distributed supply chain. It facilitates dialogue and education, enabling colleagues and business partners to easily share knowledge and learning. This simple concept needs to be writ large across the enterprise.

Some packaged-software developers are already adding these new capabilities to their applications. SAP, with its Jam tool (including elements of its StreamWork collaboration platform), and Oracle, with its Social

Relationship Management platform, now allow companies to connect collaboration tools into their ERP and CRM packages. In addition, Salesforce.com has integrated its Chatter collaboration tool into its PaaS and SaaS applications. Collaboration platform Jive allows companies to layer collaboration on top of specific tasks, such as software development. The ultimate result: embedded channels combining search, knowledge



management, workflow, and collaboration, which deliver the prized ability to help users more easily and effectively do their jobs.

By tying the integrated collaboration experience to business processes, disparate channels evolve from separate applications into a single user experience, one not only easier to use but also better at retaining exchanged information. For example, startup Clearspire is

reimagining how a law firm is built. It has created its own cloud-based platform that embeds the social and collaboration efforts needed between lawyers and their clients, into the processes. Matter diaries, budgets, and task applications are shared seamlessly with those that have access, allowing lawyers and clients to work on their cases collaboratively from any location. The collaboration technology isn't layered onto the process; it has become the process.ⁱⁱⁱ

Even more importantly, businesses can benefit from more effective business processes—conducted more quickly, with stronger outcomes and more transparency. By leveraging the insight of appropriate subject-matter experts (who can now answer questions once rather than repeatedly), employees can increase cycle and response times, while making better decisions. Enterprises can now rely on better insight and expertise—as well as consistency in areas such as sales and marketing.

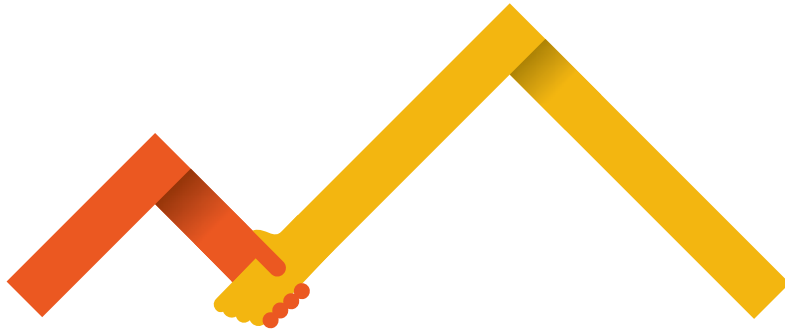
From the standpoint of individual users, such integrated systems deliver a richer experience. Employees' frustration at not being able to find the right information, or having to use multiple applications or methods to do so, will decrease. At the same time, the accuracy of the information they get will increase thanks to better context and

contacts. Integrated functionality delivers more of what a user is trying to accomplish with any given task.

Adoption: bigger is better

The more people who use a collaboration tool, the more benefit everyone derives. However, just making a tool available doesn't mean it will get adopted. If an enterprise focuses on creating a tool solely designed to increase overall company productivity, that tool won't necessarily make the employee's life any easier. (Remember the initial resistance to CRM tools among salespeople?) When enterprises focus on the process without accommodating the employee, adoption will lag. If the usefulness isn't obvious, businesses will never see any ROI.

“By tying the integrated collaboration experience to business processes, disparate channels evolve from separate applications into a single user experience.”



We recommend the following adoption model. Stop thinking about yesterday's siloed collaboration channels that relied on ad hoc usage and general productivity gains. Start with a targeted, user-centric model that supports specific work activities; think about how you would develop such an application if you were rolling it out to customers rather than employees—that is, make it as enticing and easy to use as possible. Drive more job-specific usage and

derive specific productivity gains within specific tasks. In one example from a Salesforce.com customer, the vice president of IT at Enterasys logged into Chatter and noticed that a salesperson was targeting a lower-level prospect at a company where the VP of IT employee knew the CIO. The VP connected the two, and the salesperson closed the deal.^{iv}

This requires looking at two goals: one short-term, the other long-term.

In the short term, job-centric enablement will tie communication and collaboration to specific activities in order to increase their velocity and efficiency and make employees' jobs easier. Done right, this will both entice and delight employees, spurring adoption and productivity gains for the most vital tasks within a company.

In the long term, rising adoption feeds enterprise productivity. Leadership can have better insight into teams, groups, processes, and ultimately the entire enterprise's activities. The potential is a virtuous circle in which individual activities become more efficient, thus triggering overall gains across the enterprise. By moving from ad hoc to business-centric usage, enterprises can better instrument and measure how collaboration helps people do their jobs, as opposed to the general,

sometimes inaccurate, estimates of productivity boosts that enterprises must render today.

Collaboration channels that are more process-specific will also lead to more easily measurable benefits, which in turn can be analyzed and optimized. Such channels also create an opportunity to make data-driven decisions about user productivity, informing both individual and workforce performance assessments.

For example, it may be hard to measure the value of giving technical-support agents the ability to chat through text or video directly with higher-tier support staff. But by tying the collaboration tools directly to the trouble-ticket process, you can more easily measure its effectiveness. Comparing rates of ticket closures with and without the use of chat

sessions, companies can see whether there's an improvement that ties directly back to cost savings. Once the process is instrumented and quantified, an enterprise can use the data to reconsider how it can further optimize the dissemination of such calls.

Instilling a collaborative culture

Embedding collaboration requires a cultural shift within the enterprise to change the way it looks at both its workers and its business processes. It involves new ways of thinking about issues within and beyond technology, including new roles and responsibilities, for IT, for business leaders, and for employees across the enterprise. It will also redefine who—and now, what—people collaborate with. In

this new paradigm, employees will be collaborating with objects too.

First, collaboration becomes a partnership between the business and IT. Currently, it sits squarely under the purview of the CIO, who supports the channels. While IT will still own the channels, how employees collaborate will be the purview of the business, driven by the needs of the business processes.

As part of this cultural shift, IT's role will change. It must provide a flexible platform that will allow the business to integrate the collaboration channels it needs into the applications it uses.

Because the requirements will differ within each line of business, one-size-fits-all collaboration tools will no longer suffice. IT must

partner with the business, taking a business-centric view and actively understanding the business processes. The technologies must work for the process, rather than the other way around. There may still be separate channels for search, knowledge management, and workflow, but IT should work to either minimize fragmented use within the enterprise or figure out how to deploy them as part of a highly flexible collaboration platform.

Enterprises will also need to begin looking at ways to automate sharing. Employees are willing to be more transparent, but taking the time to share information at each step of a process can quickly become a burden, especially when information must be distributed among large groups.

But sharing is not limited to people; social metaphors can also be applied to objects. For example, the new GEnx jet engine—currently

“Because the requirements will differ within each line of business, one-size-fits-all collaboration tools will no longer suffice. IT must partner with the business, taking a business-centric view and actively understanding the business processes.”

Your 100-day plan

In 100 days, redefine your collaboration strategy; prioritize based on business process enablement.

- Catalog the tools that are currently being used (supported and unsupported) to collaborate across the organization.
- Determine a set of quantifiable business metrics to measure the success of your collaboration services architecture.
- Identify and prioritize business processes where increased productivity through collaboration will drive the most value.
- Deploy collaboration to the highest-priority processes to create demand for additional deployments.
- Review and implement preliminary incentives for behaviors, evaluations, and personal metrics to encourage collaboration.

a component of Boeing's new 787 Dreamliner—has the ability to provide newsfeeds to which service teams can subscribe. Allowing the engine itself to automatically share its status allows service teams to more easily maintain it, reducing cost and increasing its lifespan. "The idea of connecting a machine to a social network is really exciting," says GE's CMO, Beth Comstock. "Social will help us deliver a better engine than ever before."v

What collaboration will look like soon

The new face of collaboration will show up first as social interactions are integrated into business processes. When employees are able to chat, share information, identify specialists, get recommendations,

and find the right answers to their questions directly within the context of their work, they'll quickly become smarter, more responsive, and more productive. It will be clear who's participating and contributing, just as it is on social-media sites today, and it will be easy for employees to reach out for information.

But that's just the start of what's possible. As part of the broader movement to consolidate siloed IT capabilities into business processes, we expect to see deeper and more widespread convergence of search and knowledge-management activities that complement collaboration: effectively funneling and filtering large amounts of information to employees. The underlying challenge is to create a user experience that will help employees get the information they need when they need it. The

collaboration platform will capture insights, allowing employees to search an enterprise's collective knowledge from within the platform.

Accenture believes that enterprises that take advantage of converged collaboration have an opportunity to see significant productivity gains. By enabling employees to work smarter, they are more aware of important context for their decisions and actions. Workers will be more likely to identify problems sooner, reliably find the fixes they need, and share the solutions with the right people.

Further, we expect to see a network effect in which increasingly collaborative employees create increasingly productive organizations. As enterprises quantify their collaboration efforts, they will reveal a more complete picture of how their employees and their business

processes actually work—and they'll be able to make them even more efficient going forward.

This time next year

In 365 days, implement your new strategy to weave the collaboration platform into the highest-priority business processes.

- Update your strategy with best practices established in "early adopter" industries.
- Use lessons learned from current implementations and industry best practices to build your collaboration services architecture.
- Establish a cross-functional team to design and evaluate user experiences of the collaboration services architecture.
- Leverage IT and the business to embed collaboration services into a prioritized list of business processes.
- Measure the business impact of your initial deployments to drive demand among other business units.



Software-Defined Networking

Virtualization's last mile

Software-Defined Networking

With virtualization investments already paying off in servers and starting to pay off in storage, businesses must turn their attention to virtualizing the network in order to extend the life of their infrastructure and reap the full value of their virtualization investments. Like other virtualization technologies, software-defined networking (SDN) has the ability to radically change the flexibility with which businesses and IT operate. You may think of networking as a low-level technology, but this aspect of it has the ability to transform enterprises. With SDN, businesses can finally realize the vision of a dynamic enterprise.

Businesses have invested a lot in all phases of virtualization. Those investments were certainly worthwhile, but they have focused primarily on reducing costs. The virtualization effort has resulted in more efficient infrastructures, but it has not contributed to helping the business become more dynamic or more agile. The network, the foundation of the data center and the enterprise, has remained an untapped opportunity because

there's been no easy way to make it dynamic—until now.

When enterprises unlock agility in their data center network using what's known as software-defined networking (SDN), they have the potential to create a dynamic enterprise. In a dynamic enterprise, businesses can deploy new projects quickly and determine just as quickly whether they are successful or not. Enterprises are halfway toward this

goal of agility—they currently use virtualization to spin up servers and storage without having to procure more hardware, and then spin them down again when projects end or fail to meet expectations.

SDN involves decoupling hardware from software for a higher degree of flexibility. By uncoupling the hardware, SDN essentially eliminates the need for applications to understand the internal workings of the routers and switches that connect multiple networks. Software, not hardware, creates the connections that stitch together multiple networks. Suddenly, companies can reconfigure the connectivity of systems without changing their physical characteristics.

This is a radical new way of looking at the network. To the business, SDN

is a key technology for delivering flexibility and agility—a vital component in differentiating the company. In a world that demands constant change, SDN enables IT to unleash the power of virtualization and makes it easier to move to the cloud. Put simply, SDN makes it easier for enterprises to handle change, and change is an imperative for a digital business.

Virtualization off to a good start

To better understand the potential of SDN, let's step back and look at the virtues of virtualization for the data center. Virtualization has been a boon to businesses and governments; for example, the U.S. government saves nearly 20 percent of its annual IT budget through virtualization.¹ These savings enable businesses to do



more while spending less in the data center. Server virtualization spurs consolidation; reduces the associated costs of hardware, space, power, and cooling; and increases the ability to run applications anywhere. It helps improve availability and reliability, by making both disaster recovery and business continuity more flexible than ever before. Done well, it helps reduce the business's dependence on new hardware (and alleviates associated procurement and installation delays), lets IT automate server provisioning,

and streamlines the overall application deployment process.

On a grander scale, virtualization lets businesses take advantage of cloud computing, SaaS, and IaaS opportunities—that is, the ability to move processes and services to virtualized cloud environments. For instance, consider the ability of a retailer to easily add computing capacity to its e-commerce system starting on Black Friday and continuing through the holiday

“The software-defined network, combined with existing virtual infrastructure, is a radical step toward enterprise flexibility.”

shopping season, or the ability of a company to use Amazon EC2 or Microsoft Azure to run a pilot project without actually procuring servers internally. Whether used for long-term offloading of processes or short-term computing needs, virtualization brings an unprecedented level of flexibility.

Storage virtualization, with offerings from VMware, NetApp, and others, is knocking down the barriers between computing and storage. Once data

is decoupled from specific storage devices and protocols, it is easier to access and manage. And desktop virtualization has made the dream of centralized management come true, while still delivering the functionality that users demand.

Businesses have deployed many forms of virtualization, and most of those deployments have been widely successful. But crucially, enterprises are still locked down by the network. The one benefit they seek—becoming

more agile—is still missing. That missing piece is the dynamic network.

Unleashing the full potential of dynamic networks

Enter SDN. The software-defined network, combined with existing virtual infrastructure, is a radical step toward enterprise flexibility.

Until recently, the network has withstood the onslaught of virtualization (the unrelated concept of virtualized local area networks notwithstanding). Having virtualized all the disparate pieces of the data center, the remaining task is to make the connections between them dynamically configurable. The data center's resources may be dynamic, but the communications

between them are still static and brittle. SDN frees applications from having to maintain knowledge of the changing network. While businesses have derived much flexibility from virtualization, SDN helps them handle the increasing complexity of moving parts in a dynamic data center.

What comes of decoupling the control of the network from the physical network? Remember the savings that server virtualization brought? Instead of having to procure and install a server and then deploy the applications on it, a technician (or another reasonably experienced person taking advantage of self-service provisioning) spun up a new virtual machine and the application was available. Now, multiply that simplicity across an entire network. At eBay, according to JC Martin, who oversees the data center infrastructure for eBay's

marketplace businesses, “We’re allowing our people to create virtual environments much like they used to create complete physical networking environments—except they can do it in minutes.”ⁱⁱ

But SDN encompasses more than just the ability to program and manage data center networking activities. It enables the wholesale abstraction of the network layer, in order to take advantage of any network infrastructure. This encompasses not just the private cloud in the data center but also the ability to move data into hybrid cloud deployments.

SDN is the last step in making the promise of the cloud and network interoperability come to fruition.

SDN: the zenith of interoperability

Enterprises have already begun to pay attention to what SDN can deliver. IDC estimated in December 2012 that the worldwide SDN market would grow from \$360 million in 2013 to \$3.7 billion by 2016.ⁱⁱⁱ

SDN provides the foundation for the dynamic enterprise because it

accommodates ongoing flexibility. Its benefits are tangible. One of the hardest aspects of IT is connecting the flow of external data across disparate networks depending on business needs. (How many mergers have failed because of the inability to integrate IT systems?)

Reconfiguring the network is complex, time-consuming, and labor-intensive because it requires focusing on dedicated network hardware, such as routers and switches. By moving beyond the hardware into software, in which changes can be programmed easily, dynamic

networks simplify the connectivity aspect of these configuration changes. By eliminating the need to reconfigure the physical network, SDN delivers a new zenith of network interoperability.

It makes a variety of capabilities more accessible to more enterprises. Consider the scenario of deploying a SaaS-based CRM system. Using SaaS, or public cloud technology, makes it easy to get the system up and running quickly; to be truly useful, though, the system must still connect to other internal systems. To link inventory to customers, it must

“By eliminating the need to reconfigure the physical network, SDN delivers a new zenith of network interoperability.”

“The rigidity of the network takes its toll, because every time you touch the network, you have to ensure that every link of connectivity works properly.”

connect to your ERP's inventory system. To grasp what customers are saying about your product, it must connect to social-media applications. All this connectivity involves reconfiguring the network so that the data flows appropriately. SDN provides the foundation for cloud flexibility—changes associated with swapping out one cloud provider for another are more easily isolated.

The challenge continues when any of these applications has to be upgraded. It isn't as easy as turning on new hardware and powering down the old. You have to migrate

the data and services properly, and then test to make sure that they work on the upgraded system. Here, too, the rigidity of the network takes its toll, because every time you touch the network, you have to ensure that every link of connectivity works properly. It doesn't even have to be a question of application renewal—every time you want to fire up a new cloud application, you have to connect it to your data center, whether for backup or data sharing or simply creating a hybrid cloud.

Without updating your network, you're throwing up your own roadblock

every time you want to deploy a new service, upgrade an old system, improve a workflow, enhance an operation—essentially, anytime you want to employ innovation to gain an advantage. It's hard enough outmaneuvering the competition without diminishing your capabilities. Software-defined networking instead unleashes those capabilities.

The SDN landscape

Who will lead you to the agility of SDN? Not surprisingly, both traditional networking providers and

startups have recognized the value of SDN and are offering options. In addition to opening up access to the software capabilities in its existing products, Cisco Systems purchased SDN startup Cariden at the end of 2012 for \$141 million and funded "spin-in" company Insieme, created by several Cisco engineers, earlier in the year with a \$100 million investment. Meanwhile, VMware entered the market by purchasing Nicira for \$1.26 billion as part of its overall virtualization strategy. Nicira's founders created the open-source OpenFlow network protocol, a key part of many SDN efforts.

“Network virtualization creates a network in the software realm, all the way down to virtual switches and routers. This frees applications from the need to understand the internal intricacies of the physical network.”

As frequently happens with emergent technology, companies generate different approaches; in the case of SDN, some tout “network programmability,” while others promote “network virtualization.” What’s the difference? Network virtualization creates a network in the software realm, all the way down to virtual switches and routers. This frees applications from the need to understand the internal intricacies of the physical network. Network programmability involves centralizing control of the routers and switches in order to reconfigure them as

infrastructure changes. Which path is better? That’s for companies themselves to determine. The result will be similar to other technology battles in the past: both will offer value and viability, and they will coexist depending on circumstances (think Java versus Microsoft’s .NET in application development).

One early adopter of SDN is eBay, which is currently using a solution from Nicira inside the data centers serving its online marketplaces. eBay uses Nicira in conjunction with OpenStack, an open-source platform

for building cloud services. According to eBay executives, the company also uses the two technologies to let workers create virtual networks for running internal applications. eBay’s OpenStack cloud is still limited—a few thousand machines supporting a couple hundred projects—but it is designed to provide a template for how the company will roll out the capabilities more broadly in the future.^{iv}

SDN allows eBay to be innovative faster. Not only can eBay’s developers create and test new network-based products and services faster, but eBay can deploy those services faster.

An added benefit: because SDN allows for better utilization of current resources, companies can save money on new hardware and energy costs (for more on this capability, see the section on network optimization).

Soon, companies may be able to take advantage of this fast ramp-up of networks even before they invest in SDN themselves. Cloud services provider Rackspace, a competitor to Amazon, is starting to use Nicira-based virtual networking services with clients that seek to set up cloud-based networks quickly and efficiently.^v

Nicira is not alone by any means. Other startups, such as ADARA Networks, Big Switch Networks, Contexstream, Embrane, Plexxi, and Vello Systems, are hanging their hopes on the OpenFlow protocol. Many established network providers have aligned their capabilities to OpenFlow as well, while still offering proprietary APIs.

Other early adopters are starting to come forward, too. Although Big Switch Networks lists Fidelity

Investments and Goldman Sachs as customers, neither is saying just how extensively it's using the technology. The ability to move money fast and make transactions faster has always enticed the financial services industry, which can increase revenue through faster trades. The industry also depends on high reliability from its networks. The ability to make their networks more efficient makes them strong contenders for SDN's capabilities.

Picking the winners in this market is still anyone's guess. Established vendors are facing the typical challenge of how to embrace a new technology without cannibalizing their existing products. New companies relying on open-source advances face a different challenge: how do you provide value while waiting for that industry standard to gel? The standardization process

moves notoriously slowly. That's why the market is seeing fragmentation to date. No single player or approach meets the traditional data center's needs for SDN. Companies should prepare for an extensive consolidation and acquisition cycle over the next 12 to 18 months.

What enterprises can expect from SDN

Lest it sound too good to be true, SDN is complex because of all that it touches. It requires tools and frameworks that are still developing. The interim alternative of doing it yourself is time-consuming and expensive. There's a difference between virtualizing your data center and virtualizing your entire network. But on the former scale, the benefits are too tangible to ignore.



According to Technology Business Research's Scott Dennehy, "Customer adoption of SDN will happen quicker at the SMB level, as these customers will be attracted to SDN's promise of networks that are cheap, easy to deploy and simple to maintain."^{vi}

As with server virtualization, SMBs will lead the way not only in the search for agility but also from an incredible focus on affordability. Watching which technologies benefit SMBs never hurts enterprises.

Although SDN ushers in the foundation for a highly dynamic enterprise, it's important to note that a high degree of dynamism is anathema to most businesses. They don't want things dynamic—they want them stable. Change too often equates to something breaking. Nobody—not the business and not IT—wants that. This transition proves once again that sometimes the hardest challenge in technology is not changing the systems but changing the people that run them.

But for both enterprises and SMBs, this is an opportunity to take the advantages and cost savings they've derived from server and storage virtualization and apply them to the data center. Consider the savings from network hardware investments, management, and upgrades.

Best of all, agility comes along for the ride. More than ever before, SDN will deliver the responsiveness that businesses have been demanding from IT for years—the ability to respond quickly, be proactive in integration, and help ratchet up competitive advantage. With SDN, companies demanding innovation from IT and their business units will now have a foundation to build upon, one that allows them to try new projects with less risk, and respond faster to those that promise beneficial outcomes.

Your 100-day plan

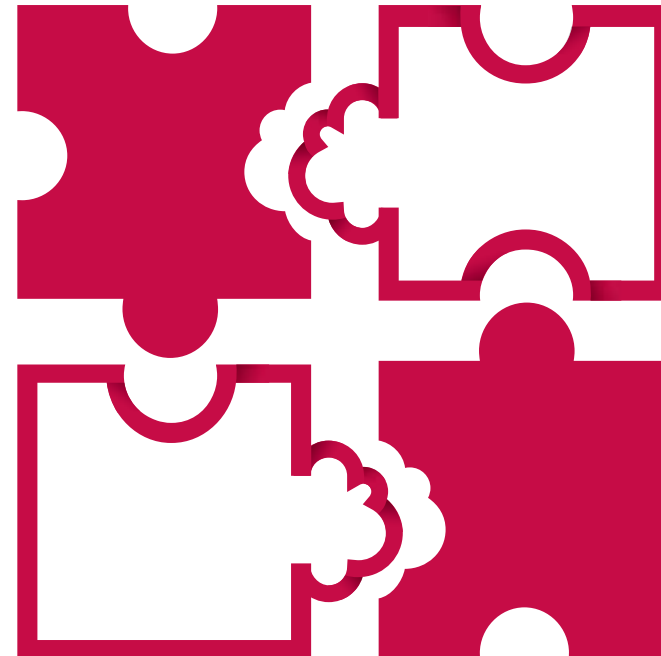
In 100 days, create an SDN mandate that frames value to the business and the impact on IT.

- Assign a champion responsible for SDN trends and technologies.
- Build an initial understanding of the state of SDN.
- Establish a "test kitchen" environment and begin to bring SDN technologies in-house for evaluation.

This time next year

In 365 days, create an SDN strategy defining the business case and the implementation approach.

- Prioritize the areas where SDN will have the largest business impact.
- Create a road map for the SDN deployment plan.
- Prepare the aggregate SDN business case that combines benefits from network agility and cost savings from network optimization.
- Assess IT organizational skill with respect to SDN and train or recruit to fill the gaps.
- Develop a network transformation plan to embed SDN into the corporate architecture.



Sidebar: Network Optimization

Beyond the flexibility that SDN provides to the enterprise data center are its benefits for the network as a whole. It isn't for the faint of heart—no true optimization solutions currently exist, so for now companies will need to build their own solutions. But consider the advantages that businesses could derive from highly optimized deployments of data. These include specialized routing for specific content, such as video for special events—stockholders' meetings, say, or product announcements. IP Infusion is using SDN-based networking gear from Broadcom along with OpenFlow technology to improve the quality of service for mobile video applications.ⁱ

Google has used OpenFlow technology to boost utilization on its internal network. Currently, most companies get only 30 to 40 percent utilization of their networks, but thanks to the programmability of SDN, Google executives anticipate that soon they will approach 100 percent utilization of the company network.ⁱⁱ Like driving up server utilization in the data center, more effective use of the network will unlock huge cost savings. Imagine doubling the amount of available bandwidth—doubling the pipe—without doubling your infrastructure.

Verizon anticipates using SDN to relieve loads on individual

data centers to redirect traffic to other, less-utilized data centers in different time zones. It is also looking at SDN to solve another current problem: the need to filter content based on parental controls. Currently, Verizon must send all traffic through a network filtering device whether it needs to be filtered or not. With SDN, it would be able to route content that needed to be filtered for specific customers (for example, parents with underage children) through a different data center, offloading other networks and creating more throughput efficiency.ⁱⁱⁱ

If those scenarios aren't enticing, consider the ability to replace

wholesale hands-on maintenance of the infrastructure, as well as the ability to unlock latent value in your network.

SDN has the ability, beyond building more resilient systems, to help create more automated systems. Setting up a network is still mostly a manual task, one that involves change every time the business requests something new, from SaaS to upgrades. By introducing programmability into the equation, SDN brings more and costs less. Few technologies can offer that.



Active Defense

Adapting cyberdefenses to the threat

Active Defense

Despite an increasing focus on securing the digital business, IT departments struggle to keep pace with recent advances in security technology. Enterprises know that endpoint security is not enough, but the move to active defense—risk-based approaches to security management, analytics-driven event detection, and reflex-like incident response—isn't yet happening on a broad scale. Although these technologies are maturing rapidly and communities are forming to expose risks, the biggest barrier is slow adoption of solutions that already exist. IT's core challenge: get current with best practices in security while getting smarter about the new active-defense possibilities and getting real about the journey ahead.

Just because your car passes its emissions test each year doesn't mean you're doing great things to slow global warming. Nor are you immune to burglary just because you put timers on the lights in your home before you leave for vacation.

It's much the same story with organizations that are content to work down their security checklists at regular intervals. Perimeter

defense activated? *Check.* Password update routines in place? *Check.* Employees' smartphones shut down remotely in case of theft? *Check.* Payment Card Industry Audit with only minor findings? *Check.* Clearly, it feels good to know that everything appears to be taken care of. But the truth is that when it comes to data security, cybersecurity, network security—just about any kind of corporate information

security—many enterprises can do much more to address the risks that their organizations face.

The burden does not rest solely on the IT department's shoulders. The risks incurred are *business* risks—the harm to intellectual capital when sensitive data is compromised, the operational risk when business is disrupted, the reputation risk when personally identifiable consumer information is stolen, and of course the increasing likelihood of hefty penalties when data security regulations are violated. None of these risks goes away unless business leaders assume responsibility for IT security too.

Although most companies certainly have invested substantially in IT security, they are still not taking full advantage of the maturing tools and services now available to help

blunt today's attacks and plug the many entry points that highly skilled attackers can now exploit.

The information security landscape has become an intimidating and confusing place. Things are harder to keep in order: the IT attack surface keeps expanding across more devices, more systems, more people, more partners, and broader infrastructure. Extensions to the enterprise—think cloud and mobility—have created new places for hackers to probe. Threat levels are increasing as sophisticated, targeted forms of cybercrime emerge. Governments and organized crime groups are on the lists of hackers, while hacktivists and lone wolves are becoming more dangerous because they are benefiting from the established tactics and techniques of these organized groups. And legacy systems that were never designed

for a connected world have been brought online, opening up further weak points.¹

Yet while some alert enterprises are striving to stay abreast of new advances in security, many others—too many—are now further behind than they were a year ago. Compliance has become the comfort zone, but the security "model" based on adherence to standards is flawed—largely as a consequence of rapid innovation in IT. Standards

simply can't evolve fast enough to keep pace. Essentially, enterprises' default mode is perimeter protection when it should be proactive probing, and isolationism when it should be integration.

Enterprises must shift their thinking and begin to expect that 3 a.m. call about a security breach. As a matter of urgency, they have to close the widening gap between their practices and current best practices—they need to undertake regular actions such

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as deploying reflex-like responses to security threats in their midst and leveraging analytics to create a second line of defense around data and services. And on top of that, their IT leaders need to keep eyes and ears open for the next round of advancements, the better to help their organizations prepare more creative and more agile responses and to get more insight into attack profiles.

Managing the risks when attackers *do* get through

In the past, IT has architected everything around the idea of keeping the bad guys out. Today, though, optimal IT security is not about complete prevention; it's about recognizing that attackers *will* get through. In fact, it's no longer just a matter of discovering that someone is trying to penetrate your firewall; it's about acknowledging

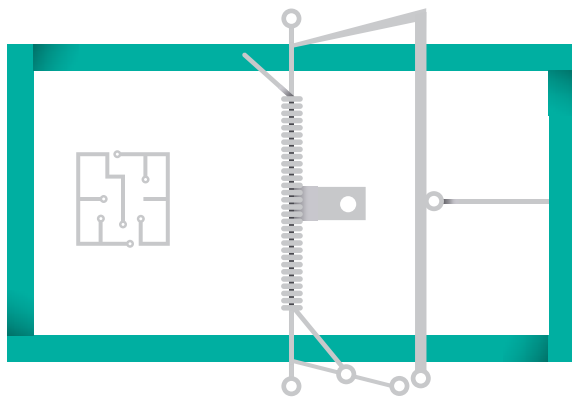
that advanced persistent threats (APTs) have *already* penetrated your organization, often avoiding your perimeter altogether. Few enterprises are truly ready to deal with that alarming reality.

To minimize the damage when attackers *have* penetrated, IT groups must find out how, where, and when they did so. That means that IT's security professionals, working hand in glove with the relevant business staff, must design and deploy processes and systems that allow them to expect and monitor security compromises in the first place and react to them before the attackers can begin to wreak havoc.

This calls for new levels of awareness—keeping abreast of the state of play of threat actors in general—and for new ways to act on what is being learned in the context

of what's known about the breaches that are occurring. In doing so, IT groups and their business colleagues shift from compliance to action; specifically, they put the emphasis on managing risk, matching their responses to the magnitude of the risks posed to the business. Essentially, they are able to think like the enemy at all times.

The keys to mastering risk and figuring out the big security picture for *your* enterprise are in understanding the businesses processes and the strategic assets that you're trying to protect. (If you can't figure out what should be happening, it's hard to say when someone is doing something "wrong.") A manufacturer, for instance, might instrument and protect the specifications for a critical engineering component in order to detect access anomalies



“Leading organizations will understand the *business consequences* of inevitable data leaks and respond proportionally; they get the idea that different levels of attacks require different speed, scale, and types of responses.”

and to require greater levels of authentication in the event of unusual access—say, an employee who is supposed to be on vacation who is downloading complete specifications.

Automation can play a big role here. Ideally, IT should be able to deploy security solutions and architectures that will, like human reflexes, respond instinctively to the growing speed, scale, and variety of attacks. The increasing attack surface supports the case for automated capabilities that detect, assess, and respond to

threats immediately. For instance, in the case of the manufacturer mentioned earlier, the system might automatically lock the engineering database for a period of time and also alert the security team.

It's important to restate that leading organizations will understand the *business consequences* of inevitable data leaks and respond proportionally; they get the idea that different levels of attacks require different speed, scale, and types of responses. A cascade of responses might, for example, involve the

immediate shutdown of one portion of a network coupled with active monitoring, which, if it detects that the threat is large or moving fast, shuts down other parts of the network. Of course, determining the business consequences isn't easy; the organizations that succeed at it know that their security organizations and the business must work together to assess and prioritize the risk.

Putting in place a second line of defense

To cope with these new higher-order security challenges, IT leaders must develop a second line of defense by leveraging new data platform concepts to design, implement, and run systems that shift the security emphasis from monitoring to understanding; from collection of

data to visualization of behaviors and anomalies.

To better understand their risks and to detect attacks, leading security organizations will turn increasingly to data platform technologies—technologies that provide access to and aggregation of data via services. If they are building the system themselves, IT groups are very likely to use Hadoop or Splunk; otherwise, they may turn to a solution such as NetWitness, which is designed to provide enterprises with a precise and actionable understanding of everything happening on their networks.

The data platform, and accompanying analytical approaches, allows security to handle large volumes of fast-changing data—orders of magnitude greater in scale than traditional log analysis. It will

also make it easier to harness new forms of data from the unstructured world, opening up fresh opportunities for security analysis. These platforms will help organizations acquire a new understanding of their risk landscapes, explore their data in new ways, and create more timely detection and responses to improve the confidence of the business.

In one example, DARPA's Active Authentication program is exploring new ways to authenticate users through their "cognitive footprint." ⁱⁱ Gathering and analyzing large amounts of data on your user behavior creates a picture of the ways you use your computer—the ways you move your mouse or the language you use in documents, for instance. Eventually, cognitive footprint software will help your organization's security systems to determine that the person who

signed into your computer really is you. In another instance, a data platform might assist in making real-time decisions about who is allowed access to a patient's electronic medical record, based on the patient's history of care.

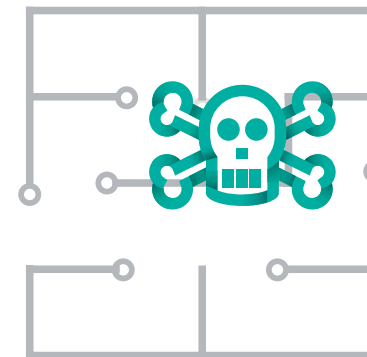
The sharp edge of the latest security thinking

It would be wonderful if these kinds of security approaches were being practiced regularly today by IT departments in every industry. IT departments in many organizations have made big strides in a lot of areas, as we noted in Accenture's Technology Vision 2012. But there is much more to be done. IT leaders need to continue looking ahead, familiarizing themselves with security technologies that

are starting to push conventional security boundaries. Unsurprisingly, over the last 12 months many of the emerging security techniques have revolved around data, albeit in markedly different ways than conventional security approaches. Some of the focus is shifting from studying your systems to studying the people using them—that is, getting to know your intended users and your hackers alike. Even more interestingly, some new systems are geared to keeping hackers from knowing you.

Fingerprinting your enemies...

New technology developments are making it easier to identify who's attacking you. Essentially, they enable security professionals to get closer and closer to potential attackers "in the wild"—helping them identify their tactics, techniques, and procedures earlier and track down signs of compromised security before damage can be done.



Similarly, enterprise architectures are evolving rapidly to include much more capable identity and access management (I&AM) systems. Authentication and authorization technology is becoming increasingly adaptive, context-aware, and risk-based. More and more of the I&AM systems are being strengthened with analytics tools that work increasingly with growing sets of data—unstructured as well as structured. And risk profiles are being used more and more as “trust anchors” for sensitive transactions, based on behavioral and environmental context.

Nok Nok Labs, the new venture from PGP cofounder Phillip Dunkelberger, is a good example of a company helping to simplify strong authentication.ⁱⁱⁱ Because the machines that surround us use are delivered with security embedded—

whether they are smartphones, tablets, or laptop computers—the Nok Nok Labs technology enables companies to recognize these strong authentication capabilities and to leverage them to deliver a more secure experience appropriate to the risk of the transaction or the identity of the user.

Today's usage patterns can also help build smart profiles of users and their computing habits. The idea is that authentication is now less a simple “are you who you say you are”—based on a simple password, say—and more a way of establishing when “authorized access” is out of character relative to a user's normal behavior. For instance, a Texas-based engineer who regularly accesses important design data for a product might be asked for an additional level of authentication when he tries to access that data while on a

“Authentication and authorization technology is becoming increasingly adaptive, context-aware, and risk based.”

business trip to India. Or a customer service representative with access to customer records might be prompted for additional authorization if she suddenly attempts a bulk download of the whole database.

At the same time, a new battlefield is opening up in the field of hacker identification. Security specialists such as CrowdStrike are developing powerful capabilities in “enterprise adversary assessment.”^{iv} CrowdStrike's services help reveal

existing compromised systems while providing counterintelligence and recommendations to help prevent future targeted attacks. Through hunting operations, including host-based detection, threat-specific network analysis, and victim threat profiling, the services identify adversaries and find out what they are after.

Other providers, such as Mykonos Software, specialize in “fingerprinting” hackers' equipment

to identify the machine delivering a script intended to hack a website. Mykonos's tools can also create a profile of the attacker; that profile can then be shared within an industry or within a community of IT security professionals. To our earlier point about proportional responses: fingerprinting in this way allows the defender to get a better sense of the actual threat—who is attacking us and what they are after—and then to properly evaluate it in terms of its risk to the business and mount an

appropriate response to thwart the attack. For instance, after detecting a potential attack, the system might prompt for higher authentication in the middle of a session to thwart a machine-based attack, while throttling bandwidth to the system to reduce impact on other resources. This kind of approach would not be too costly in terms of unnecessary system shutdowns, say, but it would be enough to raise the bar for the attacker.

“By specifically designing for security, an enterprise can increase compliance with security protocols by making it easier for users to do the right thing than to create a clever workaround. The key is to understand how people want to use the system and what they're trying to accomplish.”

...and making it easier for users to do the right thing

At the same time, there is growing acceptance of the idea that better usability can be a powerful mechanism for increasing security effectiveness—consider a biometric reader checking your fingerprint versus having to remember a complex password. By specifically designing for security, an enterprise can increase compliance with security protocols by making it easier for users to do the right thing than to create a clever workaround. The key is to understand how people want to use the system and what they're trying to accomplish. One example: security experts at Schiphol Airport in Amsterdam have designed ways to deploy baggage-screening technologies to upgrade security while improving the customer

experience at the same time—a win for everyone.^v

Research has demonstrated that system design can greatly influence a user's ability to make appropriate security decisions. At the Georgia Institute of Technology, researchers have studied two persistent problems: user authentication and e-mail encryption.^{vi} They described two successful design cases that made it easy for users to achieve their desired security goals, and two flawed ones that made it difficult for even very motivated users to operate securely.

Guidelines for more usable security already exist—Georgia Tech researchers draw on prior work from influential scientist Ka-Ping Yee. The guidelines include factors such as the following: the path of least resistance (matching the most comfortable

way to perform tasks with the least granting of authority), active authorization (meaning the granting of authority to others in accordance with user actions indicating consent), revocability (offering the user ways to reduce others' authority to access that user's resources), identifiability (presenting objects and actions using distinguishable, truthful appearances), and foresight (that is, indicating clearly the consequences of decisions that the user is expected

to make). Collectively, these factors help designers focus on making it easy for users to do the right thing most of the time.

Fooling enemies more of the time...

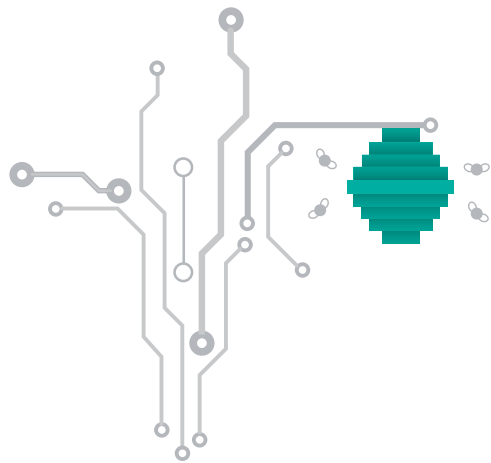
In parallel, there is intense activity—and plenty of venture-capital funding—going into “active defense”; that is, into systems that actually engage the enemy with the

objectives of making it more difficult, more expensive, and less profitable to do their work. (Think of it as the cyber equivalent of a safebox that's full of nothing but costume jewelry, perhaps, or stacks of fake \$50 bills in a folder in an office bureau, for instance.) The systems being developed range from technologies that signal to the intruder that he is being tracked to others that deceive him with electronic “pollution”—cyber smokescreens, if you like.

Misinformation and misdirection systems hold some of the greatest promise. Allure Security Technology is one start-up that is developing decoy documents to defend against data loss, essentially fronting bogus files that may cause damage to the systems of the hacker trying to get at them. The real kicker: as these tools become commonplace, they force attackers to consider the possibility that the files are bogus, and thus to question whether an intrusion attempt is worthwhile.^{vii}

It's important to point out that the emerging developments owe a lot to the momentum seen in several foundation technologies. More granular and more flexible levels of system control are possible because of rapid progress with software-defined networking (SDN) and because of the advances in virtualization across the IT landscape.

Another software provider—DataSoft—has created what it calls its Network Obfuscation and Virtualized Anti-Reconnaissance System (Nova)—a tool developed to detect network-based reconnaissance efforts and to deny the attacker access to real network data while providing false information regarding the number and types of systems



connected to the network.^{viii} Nova is designed to spoof network data to attackers, thus revealing their intentions. Its autonomous agents combine lightweight virtualization, attacker classification, dynamic rerouting for asset protection, and an array of mechanisms for sending false information to attackers.

Such "honey pots" lure attackers to what appear to be more promising targets. The core ideas have been around for at least a decade, but the underlying technologies are pushing these approaches further, spurred by the proliferation of security threats in general.^{ix}

One example: besides developing tools that can "fingerprint" attackers, Mykonos Software has developed deceptive honey pots to detect attackers without generating false positives. Its

Web Intrusion Prevention System inserts instrumentation into a Web application to create an invisible minefield throughout. The honey pots allow you to detect attackers while they're still snooping but before they begin to do damage. Attackers are detected when they manipulate the honey pot parts of the application. So, because attackers are manipulating code that has nothing to do with your website or Web application, you know with absolute certainty that an attack is in progress.

...and preventing them from knowing you in the first place

"Sandboxing" is another technique that is gaining a lot more attention, thanks largely to developments in virtualization. Think of sandboxing

as a way to compartmentalize risks by setting up virtual environments, making it much more difficult for attackers to "see" the contours of what they're trying to access. Putting it in IT security terms, virtualization gives the organization more control over, and more agility in, how it responds to attacks.

The Nova system referred to earlier uses large arrays of virtual machines to detect and prevent hostile

reconnaissance. Another provider, Invincea, relies on virtualization to secure your network against employee mistakes by protecting the employee from all untrusted content.^x Invincea's technology is all about containment: it takes the most highly targeted applications in your network (the browser, PDF reader, Office suite, zip files, executables) and seamlessly contains them in a virtualized environment. Every time the browser is opened, or any time an attachment

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comes from outside the network, Invincea creates a segregated environment for these applications to operate. That way, Invincea contains all malware—whether zero-day or known—and prevents it from attacking the host OS as a pathway for breach and lateral movement in your network.

At the same time, Bromium, another security software start-up, is applying what it calls “micro-virtualization” to secure desktops, allowing untrustworthy desktop tasks to safely coexist with trusted enterprise applications and data. The technology uses hardware-level isolation to stop even “undetectable” attacks without disrupting the user. It automatically, instantly, and invisibly hardware-isolates each vulnerable Windows task so that Windows cannot be modified and so that unauthorized access to enterprise data or network

infrastructure is denied. In one recent experiment, Bromium’s technology almost immediately reduced an attack surface from 1 million lines of codes to about 10,000 lines.^{xi}

The next natural step is toward what are being called moving target defenses (MTDs)—systems that continuously blur the lines between what is real and what is virtual. The driver behind MTD is that static environments enable adversaries to plan and execute attacks over time. Essentially, MTD is a nonstop version of musical chairs; as soon as your systems are truly virtualized, they can be set to change all the time. It is not simply a question of randomizing passwords; it’s about randomizing all the connections. That way, hackers can no longer simply hack in and wait for vulnerabilities to appear in users’ regular patterns. More interesting still: hackers can

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be redirected in many different misleading directions. MTD is still in its earliest stages, but we predict that it will gather momentum rapidly, especially as it converges with new developments in SDN.

There’s at least one example of MTD in action, although it’s early days yet. The technology provided by JumpSoft, an MTD specialist, is designed to respond to disruptions to applications themselves and to any of the preceding layers in the

IT stack.^{xii} JumpSoft uses MTD at the application layer in order to disguise and deflect threats to the OS and network layer as well as at the hardware and system layer.

Don’t wait for the silver bullet

There is no “silver bullet” technology that IT leaders should be waiting for. There never will be. No one tool, no matter how capable, can handle

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the scope, scale, and complexity of the information security challenges of today and tomorrow. The real advantage lies in successfully integrating solutions and approaches—calling for a holistic security architecture—and ensuring that the architecture remains flexible enough to deal with the continual flux in security requirements.

Integration must extend in another direction too—between IT and the business. Information security has

migrated to the CEO's priority list; aside from the obvious business risks of having substandard security systems, the fact is that many more business users are increasingly able to compromise security, knowingly or not. Yet they are also ideally placed to improve it by collaborating with IT to protect the business.

There are many reasons to expand and enrich the security dialog between IT and the business side. Just one aspect: it's not

entirely unlikely that some of your organization's business leaders, burned by information security breaches, might make rash decisions—a knee-jerk response, perhaps—to isolate parts of the organization in ways that could be detrimental to business effectiveness. The IT teams must anticipate and prepare answers for such a scenario.

At the same time, IT leaders need to take a lesson from the world of prudent investment by developing portfolio-based approaches to security—approaches that minimize the risks to the business by enabling responses to all kinds of attacks in all sorts of circumstances. The fundamental emphasis must be on fully understanding their risk profiles and the type of integrated picture that can help them better manage those risks.

Putting a plan into action

It is also vital to have the specialty skills to be able to mount effective defenses. A challenge for many IT leaders is that such specialists are in short supply, partly because many are being hired by the security software vendors. So it is incumbent on every IT leader to budget for finding, competing for, hiring, and retaining the new breed of IT security professionals.

Of course, the skills issue extends far beyond the IT security staff's cubicles. Yes, IT must build up a concentration of force in IT security capabilities, but the security burden has to be shared by the organization's data professionals, by its traditional developers (remembering the need for user experiences that are designed for

security), and by more and more categories of business users.

There should be no doubt about what actions need to be taken to bring data security up to par. Many organizations are already pushing hard in many appropriate ways; they are working overtime to catch up with best practices while proactively exploring the newest information security techniques. Indeed, it's not unrealistic to expect that some IT groups will deploy honey pots or sandboxing or other emerging methods sooner rather than later, especially to protect their most valuable data or services.

The bigger question is whether current efforts are enough. That is the core question that CEOs and their top teams should not be leaving to their IT leaders alone.

Your 100-day plan

In 100 days, solidify security on the C-level agenda and define the plan to close the gaps in your security strategy.

- Work with heads of business to align security strategy with business strategy and update your enterprise threat assessment.
- Reassess the organization's reliability needs for critical business IT systems, processes, and assets.
- Determine how security can support them.
- Develop or revise your security architecture roadmap—include ideas regarding your second line of defense.
- Evaluate your threat scenarios to identify missing perspectives that would improve your security effectiveness.
- Identify the industry sharing communities where you want to participate and generate and share valuable insights.
- Evaluate your ability to respond to new insights or security events.
- Determine whether, with perfect information, you could act on these insights.

This time next year

In 365 days, start addressing the weakest security links.

- People continue to be the softest target. Update your strategy for how malicious or unintentional misuse can be compartmentalized and contained.
- Test and confirm responses to security breaches including the effectiveness of community involvement.
- Implement your second line of defense—begin experimenting and prototyping platforms and technologies for security analytics.
- Identify where techniques such as sandboxing, misinformation, and MTD could better address your first line of defense.
- Identify the skills necessary to stay abreast of emerging security processes and technologies.
- Engage with your chief counsel and chief risk officer on risk tolerances and the evolving threat landscape.



Beyond The Cloud

The value lies in putting the cloud to work

Beyond the Cloud

No vision would be complete without commenting on the cloud. However, cloud computing is no longer an emerging trend. The on-demand, elastic technology needs to be considered in all decisions made today; the key question is not “should we use cloud?” but “how can we use cloud?” More than that: cloud isn’t a single concept. Its individual elements—from IaaS to SaaS to PaaS, from public to private—are as distinct and different from one another as the opportunities for enterprises to use them. So the real “trend” is a shift in focus to the next phase: putting cloud to work and crafting an overarching approach that weaves cloud capabilities into the fabric of the enterprise—with business value uppermost in mind.

There are far more followers than pioneers when it comes to adoption of emerging technologies. That’s one of the findings in Accenture’s latest High Performance IT study, and it’s a truth that is borne out in what we see in many enterprises’ hesitant approaches to cloud computing.¹

It’s easy to see why so many IT leaders hold back. It’s daunting enough to determine the vagaries

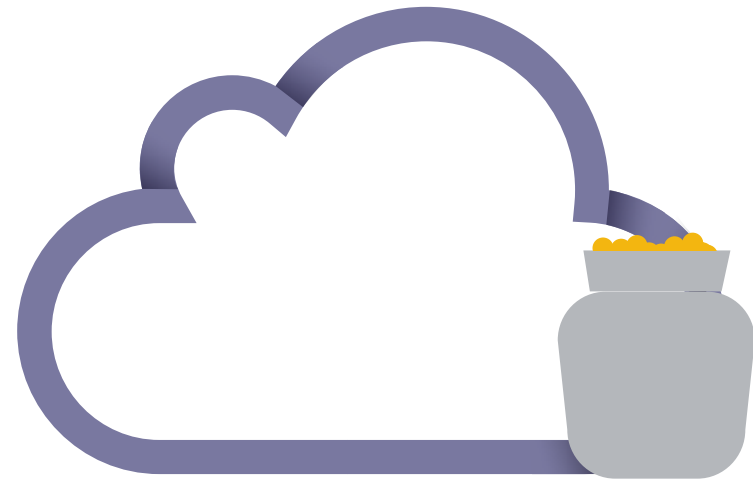
of private cloud versus public cloud without delving into who manages what data where, who’s responsible for security, how cloud deployments affect network infrastructure, and more. Cloud computing doesn’t get its name just because it’s something with wispy edges that you can’t touch. It’s called cloud because it’s big, and no matter what progress you’ve made with it so far, there’s so much more cloudscape to traverse.

Leading organizations already sense that they're still only at the beginning of what they can do with cloud—and what it can do for them.

Lest there be any doubt that the cloud has arrived, it has been 14 years since Salesforce.com was founded, and 5 years since it topped 1 million subscribers. Likewise, finance and HR cloud-services company Workday was founded in 2005. In 2006, Amazon Web Services began offering IT IaaS; it has since begun offering PaaS. Software giants such as Microsoft, Oracle, and SAP have made significant progress in cloud-enabling their applications. Cloud has been so successful, in fact, that while many everything-as-a-service (XaaS) start-ups are already old enough to shave (metaphorically speaking), even newer ones regularly present enterprises with innovative opportunities. It's time to stop

thinking about the cloud as a single concept. It's time to start realizing cloud's transformational impact across the business.

Enterprises must view cloud as an overarching approach that considers the value of PaaS, IaaS, SaaS, and several other as-a-service technologies, and helps determine how they can best become a part of IT's current toolbox. The technology is here, so the conversations should now turn to how these tools can be used to differentiate a company's business, helping it get to market faster and respond more flexibly to opportunities and obstacles. By harnessing cloud skillfully, companies can enter whole new businesses or launch new products in short order. VELUX Group, for instance, was able to launch a new product campaign in just three weeks—from start to finish—using Microsoft Azure.ⁱⁱ



Let's be clear: the opportunity is to use cloud technologies to enable your business. As an integral part of your IT strategy, cloud can make your business more responsive, more flexible, more scalable—more competitive. But the point should not be cloud itself—instead, it is how you embed cloud in your business that will differentiate you.

The cloud opportunity

Accenture estimates that by 2016, enterprises will devote 14 percent of their overall IT product and services spending to cloud, up from 5 percent in 2011. More importantly, by that same time, 46 percent of their new spending will be on cloud-enabled technologies.ⁱⁱⁱ The implementation stories support the data: leading

enterprises are approaching new system architectures with a “cloud-first” mentality—that is, looking at what can be achieved with the different flavors of cloud rather than reflexively considering in-house development or off-the-shelf solutions. The implicit message for companies that have focused on one area of the cloud to date: consider the potential payoffs from other cloud technologies.

Despite all the attention to cloud, the expanse of cloud opportunities remains largely underdeveloped. Accenture’s latest research shows where the biggest gaps lie: more than one-third of large enterprises have yet to implement any cloud technology, public or private, in their infrastructure. For platform cloud technologies, that percentage jumps to one-half. The encouraging part: applications. SaaS continues to lead

cloud adoption in the enterprise. Of large enterprises, 43 percent are at least piloting public SaaS with nearly half of those (19 percent of total) having committed a large percentage of their business to it.^{iv}

Accenture expects areas that have lagged, such as IaaS and PaaS, to accelerate in the next three to five years. Continuing innovation and investment will drive further improvements in areas important to the enterprise, such as cost and security. As a result, IaaS growth will pick up and PaaS is likely to become the primary application development and replatforming approach for the enterprise. It’s hard to ignore the cost savings, flexibility, and faster time to market that PaaS offers. Deutsche Telekom opted for Google’s PaaS offering, Google App Engine, as the basis for Tripdiscover.de—a new type of travel portal that connects

consumers with partners, social recommendations, and other high-quality content. Just 18 weeks after the Tripdiscover project began, Deutsche Telekom had in place a fully deployed, flexible, real-time scalable system intended to inspire and excite its users with a new type of online travel-booking experience.^v

But among the growing ranks of companies investigating a wider array of cloud technologies, a farsighted subset is looking for more sizable benefits from their efforts. They understand that every time they master one element of cloud computing, it’s easier to see the potential of another one. Despite inconsistent rates of adoption across layers of the stack and in some verticals, cloud services have become drivers for many other technology changes—for social media, for instance, and for at least part of the rising

“Despite all the attention to cloud, the expanse of cloud opportunities remains largely underdeveloped.”

popularity of today's data analytics activities. Case in point: BMW Latin America used Microsoft Azure to drive a social-marketing campaign for the launch of two new model lines.^{vi} Another snapshot: Shell is relying on Amazon's cloud to pilot its use of Hadoop for new analytics work.^{vii}

Getting a handle on the hybrid cloud

Given the growing number of mature cloud-computing options, enterprises have tough decisions to make about cloud in the real world. Can they deploy different forms of cloud at the same time, and, if so, how? What's the potential for mixing on-premise and off-premise IT, or for integrating cloud with legacy systems and traditional software, in order to create hybrid capabilities that combine the best

of all of cloud's elements? Imagine, for instance, the viability of a retailer that can successfully use the cloud to hire extra e-commerce capacity for the five weeks at year-end, and then bring all the customer and transaction data back to its internal system in January. The ability to rapidly build capabilities to capture more of the available demand gives the retailer potent advantages.

The hybrid cloud means different things to different people. Whether it means mixing forms of clouds or integrating cloud with existing IT, the real challenge is a new flavor of the perennial one: how will you handle the complexities of service and data integration across systems?

When enterprises first began to rely on the cloud, many cloud systems were siloed applications. Since then, the surging numbers of

cloud deployments, supported by maturing technology, have increased enterprises' confidence that cloud, in many shapes and forms, can create value. Today's cloud projects, even in a private cloud environment, now are less about simple SaaS configuration and more about the complex integration required to weave new SaaS systems into the existing IT fabric—into and around ERP systems

or legacy mainframe applications. When EMC turned to Salesforce.com for an update to its CRM systems, it was far from a standalone deployment. The company integrated the SaaS solution with Oracle E-Business Suite, its own custom campaign-management tool, and its e-mail infrastructure in order to handle financial, operational, and communication information.^{viii}



For the foreseeable future, traditional software systems will continue to play a crucial role in the overall IT landscape. Recognition that the hybrid world of cloud and traditional IT must coexist has important implications for how an enterprise prepares for the future. In many enterprises today, skills are separate and isolated—a Microsoft Azure team here and a SAP team there. A hybrid world demands hybrid skills; the most

valuable talent will be the architect who understands the functions and roles of all the pieces and who knows how they all work together.

Just as important, the governance of the solutions becomes key. The technology organization now needs to design and operate a mosaic of best-in-class capabilities so that the business can take advantage of the capabilities to create new

opportunities. When an enterprise has one or two cloud-dependent applications integrated with the legacy systems in its portfolio, an ad hoc approach can still work. However, even if the number of those applications simply doubles, it suddenly becomes crucial to properly broker those connections and relationships. An architect needs not only the ability to patch together the mosaic of services but also an understanding of the changing implications of the cloud on supplier and vendor management.

The enterprise architecture of tomorrow—e.g., data, integration, monitoring, security—will look very different from its forebear of just a few years ago. To be successful, enterprises need to fundamentally revise their notions of enterprise architecture; for many, enterprise architecture has already been

relegated to a limited role as a management function that keeps technology in check, meaning that those organizations have missed valuable opportunities to use cloud to substantially transform their processes.

Whenever the business undertakes a new project—a business process change or an investment to enter a new business, for instance—it is important to inject the art of the possible into those early decisions and discussions. "Cloud thinking" can help bring out the project's true potential by asking new questions: Can we consume this as a service? Can we sell this as a service? How would we monetize it? If we can scale on a moment's notice, what possibilities does that bring? The goal of using cloud has to be business value; cost reduction is a byproduct, not the answer.

“A hybrid world demands hybrid skills; the most valuable talent will be the architect who understands the functions and roles of all the pieces and who knows how they all work together.”

Choosing the right cloud

The last question, then, is this: public or private cloud? What's most important to note—and what keeps cloud deployment rates on the timid side—is that there's no one right answer. Many IT leaders shy away from public cloud SaaS options, even those that are financially and logistically viable.

However, this is not to say that public cloud is now universally applicable. IT leaders continue to wonder what systems will work best in the cloud. What's clear is that there is no tipping point beyond which public cloud technologies become the default for *all* IT systems. In fact, it's unlikely that companies will move their core systems to a public cloud service anytime soon. For instance, the majority of respondents to Accenture's research felt they would

never move their ERP/finance system (64 percent) or any core industry-specific application (59 percent) to the public cloud—and that may be prudent of them.^{ix} In the near term, the vast majority of Fortune 500 companies will host "in the cloud," but they'll also maintain tight control of their mission-critical systems through private cloud solutions.

Here's one example of where the leading implementers are going. Following a major acquisition, Freeport-McMoRan, the world's largest publicly traded copper company, launched an extensive ERP transformation initiative using a private cloud architecture. The company's existing infrastructure and ERP environment were inhibiting its ability to grow at a critical time, when Freeport was revising its operating model to harness emerging technologies and streamline its

internal processes. The new cloud-based solution, completed in just nine months, simplified operations, accelerated applications, and reduced risk—allowing the copper company to focus on its overarching objective: growth.^x

As cloud technologies have matured, the decisions about when to use public cloud services have become more nuanced—and more important. Although today's public cloud decisions may be all-or-nothing propositions, over time, applications will be partitioned differently, and IT groups will adopt more granular ways to split applications (even inside tiers). For instance, it won't be a question of where the complete customer database resides; it will be a matter of deciding what data belongs where (based on source, scale, cost, and accessibility) and how the services that operate on it can

“As cloud technologies have matured, the decisions about when to use public cloud services have become more nuanced.”

and should be integrated. In short, it's about the emergence of a highly flexible, services-based data layer.

Eventually, business leaders will stop asking questions like, "is the cloud secure enough for storing my customers' personally identifiable information?" Their actual behaviors hint at the ambivalence behind such questions: 77 percent of enterprises say they will never place sensitive customer information in the public cloud, yet CRM is one of the hottest SaaS areas.^{xi} The question will give way to compromise: businesses will figure out how to take customer data—without identification—and partition, protect, and integrate it as appropriate, on the basis of technology capability, security standards, and their users' own comfort levels.

Enterprises are just starting their cloud journey. Although the "safe" option may appear to be private cloud, we expect more and more organizations to start relying on more public options for some business units or geographies. Wireless semiconductor maker Qualcomm took this approach in rolling out a public cloud ERP (NetSuite) to certain subsidiaries while maintaining its traditional ERP system (Oracle) at the corporate level.^{xii}

Over time, then, enterprises will have built up enough success stories about public cloud deployments, and will have captured enough value from them, that they will be confident enough for public cloud to become their "go-to" option whenever public cloud alternatives exist. Few CIOs will be able to match the economies of scale that public cloud providers can deliver—which is one more reason

“The proof that an organization is headed in the right direction is that the term 'cloud' will start to fade out of the conversation.”

why enterprises must prepare for a hybrid world.

maturity of the tools available and the value they can generate today.

Moving beyond the cloud

IT leaders, and to an increasing extent their business colleagues, now need to move "beyond the cloud." The discussions that continue to make headlines are already obsolete topics when reviewed in the context of the

The proof that an organization is headed in the right direction is that the term "cloud" will start to fade out of the conversation. Instead, its use will be described in ways that relate to its business value. Perhaps the CIO will touch on her reliance on on-demand services to socially enable the enterprise, but there won't be explicit discussion about those services—much less any special

mention of "cloud"—unless the CIO's audience requests it.

Put simply, every organization can use cloud now to support its other technologies and to bolster its business processes. Cloud is entirely good enough to help organizations achieve much of what they need to achieve—and it has the potential to deliver much more in the years to come.

Your 100-day plan

In 100 days, agree on a cloud strategy that emphasizes cloud as an enabler of business growth.

- Inventory current cloud deployments across the enterprise—public and private, IaaS and PaaS and SaaS, diversity of cloud vendors, and so on—in order to build awareness among leadership.
- Look at the external marketplace for representative/peer cloud success stories to broaden understanding of the art of the possible.
- Identify and prioritize opportunities to implement services in the cloud within your existing IT road map, particularly in near-term application modernization—challenge yourself to think "cloud first."
- Evaluate the cloud knowledge/skills of your enterprise architects and develop updated training plans as necessary to prepare them to lead the rest of the IT organization forward.



This time next year

In 365 days, execute your cloud strategy; implement it piece by piece as your company buys, builds, and connects to its next generation of IT services.

- Create decision criteria for cloud selection and readiness evaluations.
- Update your cloud strategy to create company standards for procuring and managing cloud services. Extend your operations architecture and services catalog to include private and public cloud services.
- Integrate cloud into your other technology road maps—use cloud to enable social, mobile, or analytics. All your approaches need to be cloud-ready.
- Update your enterprise architecture in preparation for partitioning of data and services across hybrid cloud deployments. Create an architectural review process to evaluate new IT projects for cloud usage.
- Develop cloud skills aligned to your chosen platforms through recruiting or training and embed these skills in your project teams.
- Actively govern your use of cloud—continuously evaluate cloud usage and providers against your plan and standards.

How will *your* digital business take shape?

When U.S. president John F. Kennedy gave his famous “man on the moon” speech to the U.S. Congress in 1961, he did not try to disguise the scale of the challenge. “No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space,” he declared. Kennedy’s grand challenge set an objective that invoked competition and fired imaginations, even though the goal seemed so far out of reach. More importantly, though, it also served as the catalyst to drive innovation to keep the United States from being left behind.

While the scale may be different, enterprises find themselves facing

a grand challenge of their own: relentless and rapid changes in the digital landscape that continue to reshape the business environment around them. The fact that companies need to quickly adapt is well known, but often the direct and obvious impetus to change is absent.

Accenture believes that business leaders must now set out strategic challenges that become the drivers for change for their organizations. The ways in which those organizations recognize and realize their challenges will be unique, but the digital challenge they all share will be to reimagine themselves in the context of an

increasingly software-driven world. In every company, IT will have to become a strategic competency woven through the enterprise—in particular, the ability to derive insights from an increasingly quantified world and leverage the arsenal of constantly emerging software advancements will power efforts to optimize, grow, and innovate.

To be effective, the challenge has to have an imperative. Kennedy called for setting a man on the surface of the moon and returning him safely before the end of that decade. We propose that by the end of your next planning cycle, business chiefs should have issued

their grand challenges if they expect their organizations to outcompete throughout the decade to come.

Hark back to when Kennedy pointed to the specter of the Soviets’ Sputnik satellite to show that the United States did not have the luxury of time in the space race. With as much conviction and vigor, business leaders must cite the volatility and uncertainty of global business to frame their own grand challenges. The technology trends described in this report will become the approaches that help transform those challenges into reality.

The groundwork for such declarations lies in recognizing

the reach of technology in each organization today. Every company is, to some extent, becoming "software-centric"—not in terms of the product or service it sells or the industry it belongs to, but in terms of the impact that software, in all its manifestations, has on the company's fortunes. Yet there is a widening gap between the companies that embrace that reality and seek ways to benefit from it and those that continue to see IT as nothing but support for the business. Software is an essential part of every company and a potential disruptor in every business.

Furthermore, there is a growing gulf between the technologies that are increasingly available to

address business's challenges and opportunities and the capabilities of many organizations to utilize those technologies. The faster that technology develops, the more that gulf widens. The gulf has to start closing. The technologies that until recently were considered cutting edge—from mobile to social, from analytics to virtualization—are accessible and realizable today. The appropriate response now is to acknowledge that the technologies are "good enough" and that the immediate issue is to look inward to prepare the organization to work with them.

To start with, the challenge will call for some soul searching within the

top executive team as its members consider what it means to have technology become an essential part of how they grow their business. They will need to be role models themselves for the changes required before they can expect their business managers and IT managers to begin working in tandem.

Assuming that the company's leaders can and will embrace the new mindset and demonstrate it in their actions as well as their words, one of the first actions toward becoming a digital business will be to retool IT to equip its professionals to understand the business hurdles and opportunities and to do the same with business professionals

so they grasp the implications and possibilities of technology—from designing for analytics and digitally managing customer relationships to shifting to active defense models of Internet security. The necessary follow-on will be to design and implement cross-functional ways of working so that the retooling efforts stick and the silos don't reappear.

Another key action will be to infuse the whole organization with a culture that is driven by insight. This will call for new ways to think about and act on data. For instance, both business and IT professionals will need to develop a sixth sense for value in sources of information previously out of reach or viewed as

irrelevant—social media and e-mails, for instance. And as we mention in this report, they will have to learn to look for insights from data in all three of its dimensions: velocity as well as variety and volume. The next part of the digital challenge will be to quantify everything that moves, and plenty that doesn't, cataloging what is known and what the organization needs to know. That last part is really important: increasingly, organizations will have to design their applications to collect and report transactions, activities, and logs. In short, organizations need to have the right data, not just more data, if they are to extract the insights that can accelerate their performance.

Organizations must then prepare for a state of constant evolution. This is where IT can step up to make the whole enterprise as agile as it can be, leveraging on-demand services (a.k.a. "the cloud"), agile user-experience models, and data platforms and taking a portfolio approach to technology so that many small experiments are constantly in play and those that prove to be winners can scale up fast.

And then there are the issues of skills, capabilities, and incentives—no small matters. The challenge has to include specific measures to enable and motivate according to the behavior and culture required.

That means rewarding for collaboration, for innovation and change, and for experimentation and tolerance of failure. These measures will involve a wholesale reframing of IT's purpose, from cost center to business driver. And they will extend deep into the development of human capital, identifying and helping to implement new criteria for hiring, retaining, and developing data-savvy business professionals as well as IT staff with very different skill sets and aptitudes from their forebears.

Such a grand challenge is no mean feat. It represents a massive change effort in its own right. So is it even feasible?

Of course it is. We all know the results of Kennedy's grand challenge: Neil Armstrong became a household name worldwide. And compelling examples can be found in the business world. General Motors has reaffirmed its position as one of the top-selling auto manufacturers in the world, owing, in no small part, to its reinvention of itself as a leaner, greener, and more innovative company. Big change is entirely possible.

Right now, it's 1961 in the corporate world—at least as far as technology's proper role is concerned. That's the moon up there. Go for it.

Research Methodology

Every year, the Technology Vision team at Accenture Technology Labs, with contributions from the Accenture Research organization, pinpoints the emerging IT developments that will have the greatest impact on companies, government agencies, and other organizations in the years ahead.

This year's research effort began with the collection of nearly 2,000 ideas, trends, and technology hypotheses from the architects, engineers, and scientists across Accenture who see the impact of technology changes every day in their work with clients. Using a social platform to gather the ideas and host the discussions, participants went far beyond simply

posting an idea; they took the time to read, converse, and help improve the ideas as a whole.

These crowd-sourced ideas were then screened against inputs from several other sources, including the recent activities of commercial R&D labs, the academic literature, the flow of venture capital funding, trends highlighted by IT analysts, and key themes at industry conferences. For perspective, we tapped Accenture's High Performance IT research and the findings from our annual CIO Forum.

The ideas that bubbled to the top stood out for their relevance to "real world" business challenges.

Specifically, the Technology Vision team sought ideas that transcend the technologies that already drive change—discrete categories such as social networking, mobility, and "big data"—and concentrated on the themes that will soon start to appear on the C-level agendas of most enterprises.

The Technology Vision team then worked with experts from throughout the company to consolidate, filter, and prioritize the accumulated ideas and to test each idea against the following criteria:

- Certainty of transformational impact on enterprises

- Velocity and scale of technology change
- Impact beyond any one industry "silo"
- Ability to be more than a "one for one" replacement for an existing solution
- Practical actionability within the next 12 months
- Transcendence of any one vendor or discrete "product" technology

These tests produced a handful of robust hypotheses that were synthesized into the seven overarching themes presented in this year's report.

End Notes

Introduction

- i "Ford Looks to Hadoop, Innovative Analytics," *Datanami*, July 6, 2012.
http://www.datanami.com/datanami/2012-07-06/ford_looks_to_hadoop_innovative_analytics.html

Relationships at Scale

- i "Shopper Alert: Price May Drop for You Alone," *New York Times*, August 9, 2012.
<http://www.nytimes.com/2012/08/10/business/supermarkets-try-customizing-prices-for-shoppers.html>
- ii "Sports Fans Online: Examining the Digital Element of the Total Fan Experience," eMarketer, July 2, 2012.
- iii "Global Trust in Advertising and Brand Messages," Nielsen, April 10, 2012.
<http://www.nielsen.com/us/en/insights/reports-downloads/2012/global-trust-in-advertising-and-brand-messages.html>
- iv "Accenture Video-Over-Internet Consumer Survey 2012: Winning the Battle for Consumer Trust," Accenture, April 12, 2012.
<http://www.accenture.com/us-en/Pages/insight-video-over-internet-consumer-survey-2012.aspx>

- v "Burberry: Entrenched in the Digisphere," *Telegraph*, November 24, 2012.
<http://fashion.telegraph.co.uk/news-features/TMG9694181/Burberry-entrenched-in-the-digisphere.html>
- vi "The Navigator: With Social Media, Airlines Have a New Kind of VIP," *Washington Post*, December 13, 2012.
http://articles.washingtonpost.com/2012-12-13/lifestyle/35813170_1_social-media-virgin-america-customer-service
- vii "Case Study: Hijack by Meat Pack," Creative Sandbox, December 11, 2011.
<http://www.creativesandbox.com/case-study/meat-pack-hijack>

Sidebar: Gauging the Value of Trust

- i "Borders to Sell Customer Data to Barnes & Noble Under Privacy Opt-Out Deal," Bloomberg, September 26, 2011.
<http://www.bloomberg.com/news/2011-09-22/borders-intellectual-property-sale-delayed-by-privacy-issue-judge-says.html>
- "Privacy Policy May Sink B&N's Purchase of Borders Name," PaidContent, September 22, 2011.
<http://paidcontent.org/2011/09/22/419-privacy-policy-may-sink-bns-purchase-of-borders-name>

- "Borders's Sale of Personal Information Approved by Bankruptcy Court," *The Secure Times*, September 29, 2011.
http://www.thecuretimes.com/2011/09/borderss_sale_of_personal_info.php
- ii "The Economic Value of Trust," *Outlook*, Accenture, October 2003.
<http://www.accenture.com/SiteCollectionDocuments/PDF/technology.pdf>
- iii "Facebook Director of Product Design Margaret Stewart on Users Deserving an ROI," *Fast Company*, November 26, 2012.
<http://www.fastcompany.com/3003153/facebook-director-product-design-margaret-stewart-users-deserving-roi>
-
- ## Design for Analytics
- i Erik Brynjolfsson, Lorin M. Hitt, and Heekyung Helen Kim, "Strength in Numbers: How Does Data-Driven Decisionmaking Affect Firm Performance?" April 22, 2011.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1819486
- ii "Netflix Analyzes A Lot of Data About Your Viewing Habits," *GigaOM*, June 14, 2012.
<http://gigaom.com/2012/06/14/netflix-analyzes-a-lot-of-data-about-your-viewing-habits/>
- iii "Knewton Is Building the World's Smartest Tutor," *Forbes*, February 22, 2012.
<http://www.forbes.com/sites/bruceupbin/2012/02/22/knewton-is-building-the-worlds-smartest-tutor>
- iv "M2M Cellular Connections to Hit 2.5 Billion by 2020," *Strategy Analytics*, August 3, 2012.
<http://www.strategyanalytics.com/default.aspx?mod=pressreleaseviewer&a0=5263>
- v "UPS Makes No Left Turns in Quest to Deliver Sustainability," *Bloomberg*, September 20, 2012.
<http://www.bloomberg.com/news/2012-09-20/ups-makes-no-left-turns-in-quest-to-deliver-sustainability-q-a.html>
- vi "Redline Communications Announces the Major Expansion of Its Network at a Shell Oil Joint Venture Oil Field," *Redline Communications*, April 9, 2012.
<http://www.rdlcom.com/en/about/news/archive/redline-news-2012/519-expand-shell-joint-venture>
- "Digital Oilfields Special: Got Oman Covered," *Arabian Oil and Gas*, September 12, 2012.
<http://www.arabianoilandgas.com/article/viewArticle/10610>
- vii "Ford Hybrid's EV+ Feature Learns and Automatically Adjusts Powertrain to Deliver More Electric-Only Driving," *Ford*, November 8, 2012.
http://media.ford.com/article_display.cfm?article_id=37344
- viii "eBay Pushes More Personalized Shopping," *PC Magazine*, October 10, 2012.
<http://www.pcmag.com/article2/0,2817,2410811,00.asp>
- ix Rethinking Analytics for the Social Enterprise," *Tapscott Group*, September 2012.
<http://dontapscott.com/wp-content/uploads/Rethinking-Analytics-for-the-Social-Enterprise-1.pdf>

Sidebar: Why the Business Now Needs to Care About APIs

- i "OnStar Gives Volt Owners What They Want: Their Data, in the Cloud," *Ars Technica*, November 25, 2012.
<http://arstechnica.com/information-technology/2012/11/onstar-gives-volt-owners-what-they-want-their-data-in-the-cloud/>
- ii "Bechtel: Improving Workforce Efficiency and Productivity through APIs," Apigee, 2012.
<http://apigee.com/about/customers/bechtel-improving-workforce-efficiency-and-productivity-through-apis>

Data Velocity

- i "Walmart's New Search Engine Increased Conversion Rates Says Its Global E-Commerce CTO," *NextBigWhat*, September 11, 2012.
<http://www.nextbigwhat.com/walmart-search-engine-india-bangalore-297/>
- ii "3D Data Management: Controlling Data Volume, Velocity, and Variety," Meta Group (Gartner), February 6, 2001.
<http://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf>
- iii "Why P&G CIO Is Quadrupling Analytics Expertise," *InformationWeek*, February 16, 2012.
<http://www.informationweek.com/global-cio/interviews/why-pg-cio-is-quadrupling-analytics-expe/232601003>

iv Ibid.

v "Time—The Next Source of Competitive Advantage," *Harvard Business Review*, July–August 1988.

vi "Predicts 2013: In-Memory Computing: Growing Gains, but Also Growing Pains," Gartner, November 30, 2012.

vii "SAP Exec: HANA Customer Count Nears 600, Pricing Tweaks Coming," *Computerworld*, September 5, 2012.
http://www.computerworld.com/s/article/9230936/SAP_exec_HANA_customer_count_nears_600_pricing_tweaks_coming

viii "Early SAP HANA Adopters Describe Analytics Possibilities and Performance," *Data Informed*, May 15, 2012.
<http://data-informed.com/early-sap-hana-adopters-describe-analytics-possibilities-and-performance/>

ix "GE Works: 2011 Annual Report," General Electric, February 24, 2012.
<http://www.ge.com/ar2011>

Seamless Collaboration

i "Mobile and Social CRM," Nucleus Research, March 2012.

- ii "Finding Value in the Information Explosion," *MIT Sloan Management Review*, June 19, 2012.
<http://sloanreview.mit.edu/the-magazine/2012-summer/53409/finding-value-in-the-information-explosion/>
- iii "How Clearspire Used IT to Reinvent the Law Firm," WSJ Blog – CIO Journal, April 9, 2012.
<http://blogs.wsj.com/cio/2012/04/09/how-clearspire-used-it-to-reinvent-the-law-firm>
- iv "The Social Sales Revolution," Salesforce.com, August 16, 2011.
<http://www.slideshare.net/salesforce/the-social-sales-revolution>
- v "Collaboration Helps GE Aviation Bring Its Best Inventions to Life," Salesforce.com, 2012.
<http://www.salesforce.com/customers/stories/ge.jsp>
- iv "eBay Fires Up OpenStack Cloud with Nicira Network Virt," The Register, August 8, 2012.
http://www.theregister.co.uk/2012/08/08/nicira_virty_network_ebay_openstack/
- v "See the Future of Cloud Networking at Interop," Rackspace, October 3, 2012.
<http://www.rackspace.com/blog/see-the-future-of-cloud-networking-at-interop/>
- vi "Software-Defined Networking: Loads of Potential, but It Will Not Cause Cisco's Demise," Technology Business Research, Inc., November 26, 2012.

Software-Defined Networking

- i "Government Virtualization Could Save More Than \$30 Billion by 2015," MeriTalk, January 30, 2012.
http://www.meritalk.com/pdfs/virtualization-vacuum/MeriTalk_Virtualization_Vacuum_Release_013012.pdf
- ii "eBay Goes Live with Virtual-Networking Maverick Nicira," *Wired*, August 7, 2012.
<http://www.wired.com/wiredenterprise/2012/08/ebay-and-nicira/>
- iii "SDN Shakes Up the Status Quo in Datacenter Networking, IDC Says," IDC, December 19, 2012.
<http://www.idc.com/getdoc.jsp?containerId=prUS23888012>
- i "IP Infusion to Showcase OpenFlow/SDN for Mobile Video Applications on Broadcom StrataXGS Switch Solution at Open Networking Summit 2012," IP Infusion April 11, 2012.
<http://www.ipinfusion.com/about/press/ip-infusion-showcase-openflowsdn-mobile-video-applications-broadcom-strataxgs-switch-sol>
- ii "Going With the Flow: Google's Secret Switch to the Next Wave of Networking," *Wired*, April 17, 2012.
<http://www.wired.com/wiredenterprise/2012/04/going-with-the-flow-google/all/>
- iii "Verizon's Elby Outlines Software Defined Networking Plans," TMCnet, May 18, 2012.
<http://www.tmcnet.com/topics/articles/2012/05/18/291031-verizons-elby-outlines-software-defined-networking-plans.htm>

Active Defense

- ⁱ "Traditional Approaches to Information Security Are No Longer Sufficient," Accenture, November 23, 2011.
<http://www.accenture.com/us-en/Pages/insight-security-traditional-approaches-information.aspx>
- "Critical Control System Vulnerabilities Demonstrated - And What to Do About Them," SANS Analyst Program, November 2011.
http://www.sans.org/reading_room/analysts_program/nitro-critical-infrastructure.pdf
- ⁱⁱ DARPA Active Authentication Program.
http://www.darpa.mil/Our_Work/I20/Programs/Active_Authentication.aspx
- ⁱⁱⁱ "PGP Corp. Co-founder's Startup Targets Cloud Authentication," *Network World*, November 26, 2012.
<http://www.networkworld.com/news/2012/112612-dunkelberger-noknok-264526.html>
- ^{iv} CrowdStrike website.
<http://www.crowdstrike.com/services.html>
- ^v "Schiphol Airport Security—New Screening Technologies Designed to Improve Passenger and Luggage Screening," Homeland Security Research, April 2009.
<http://www.homelandsecurityresearch.com/2009/04/schiphol-airport-security-new-screening-technologies-designed-to-improve-passenger-and-luggage-screening/>
- ^{vi} Bryan D. Payne, W. Keith Edwards, "A Brief Introduction to Usable Security," *IEEE Internet Computing*, May/June 2008.
<http://www.cc.gatech.edu/~keith/pubs/ieee-intro-usable-security.pdf>
- ^{vii} "Decoy Documents May Soon Defend Against Data Loss," eSecurity Planet, April 23, 2012.
<http://www.esecurityplanet.com/network-security/decoy-documents-may-soon-defend-against-data-loss.html>
- ^{viii} DataSoft website.
<http://www.datasoft.com/products/nova/index.htm>
- ^{ix} Lance Spitzner, "The Honeynet Project: Trapping the Hackers," *IEEE Security and Privacy*, March 2003.
<http://dl.acm.org/citation.cfm?id=859075>
- ^x Invincea website.
<http://www.invincea.com/make-prevention-possible/detection/>
- ^{xi} "Size Matters: Bromium 'Microvisor' to Guard PCs for Big Biz," *The Register*, September 19, 2012.
http://www.theregister.co.uk/2012/09/19/bromium_vstentry_security_launch/

xii "Next Gen Cyber Defense," JumpSoft, February 11, 2012.
<http://www.jumpsoft.net/2012/02/11/next-gen-cyber-defense/>

Beyond the Cloud

i Accenture High Performance IT Survey Round 4, Preliminary Findings (N=187), 2013. (Survey demographics: 187 CIOs at global large enterprises.)

ii "VELUX: Cloud Microsite Delivered in Three Weeks Supports Product Campaign," Accenture, 2012.
<http://www.accenture.com/us-en/Pages/success-velux-microsoft-windows-azure-platform.aspx>

iii Accenture analysis; IDC base IT spending data from "IDC Worldwide Black Book Query Tool, Version 1, 2012," May 2012.

iv Accenture High Performance IT Survey Round 4, Preliminary Findings (N=187), 2013. (Survey demographics: 187 CIOs at global large enterprises.)

v "Deutsche Telekom: Creating a Customer Portal Using PaaS," Accenture, 2013.
<http://www.accenture.com/us-en/Pages/success-deutsche-telekom-customer-portal-paas.aspx>

vi "BMW Supports Model Launch, Develops Prospects with Cloud-Based Social Marketing," Microsoft, July 10, 2012.
<http://www.microsoft.com/casestudies/Windows-Azure/BMW-Latin-America/BMW-Supports-Model-Launch-Develops-Prospects-with-Cloud-Based-Social-Marketing/710000001091>

vii "Shell Oil Targets Hybrid Cloud as Fix for Energy-Saving, Agile IT," *Computerworld*, April 4, 2012.
http://www.computerworld.com/s/article/9225827/Shell_Oil_targets_hybrid_cloud_as_fix_for_energy_saving_agile_IT?taxonomyId=158&

viii "EMC Improves Customer Visibility with the Sales Cloud," Salesforce.com.
<http://www.salesforce.com/showcase/stories/emc.jsp>

ix Accenture High Performance IT Survey Round 4, Preliminary Findings (N=187), 2013. (Survey demographics: 187 CIOs at global large enterprises.)

x "Freeport-McMoRan Copper & Gold: Global ERP Implementation," Accenture, 2011.
<http://www.accenture.com/us-en/Pages/success-freeport-mcmoran-erp-implementation-summary.aspx>

xi Accenture High Performance IT Survey Round 4, Preliminary Findings (N=187), 2013. (Survey demographics: 187 CIOs at global large enterprises.)

xii "NetSuite Steps Up Large Enterprise Push: Lands Qualcomm, Groupon, Partners with Accenture," ZDNet, May 9, 2011.
<http://www.zdnet.com/blog/btl/netsuite-steps-up-large-enterprise-push-lands-qualcomm-groupon-partners-with-accenture/48496>

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