Accenture Technology Vision 2011

The technology waves that are reshaping the business landscape

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Foreword

What's next? That's a simple question to ask, but it's not so simple to answer. Our clients and our own company are constantly looking around the corner to see what's coming, and what the future will hold for our business and our lives.

The Accenture Technology Vision for 2011 represents our look toward the future of technology. But as you will see in this report, technology trends are not isolated and are intimately intertwined with business and societal trends. Our Technology Vision is as important for business and government leaders as it is for IT.

Technology touches everyone in the modern world. It's no longer on the sidelines in a support role, but instead is driving business performance and enriching people's lives like never before.

We encourage you to take the time to read this important piece, reflect on what the future of technology means for you and your organization, and then take all the steps necessary to deliver on technology's enormous potential to create value.

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Introduction

The 1969 moon landing required radical, back-to-the-drawing-board ideas about everything from earth orbit to life in zero gravity. The entire program called for exceptional innovation, willingness to shed old dogma, unprecedented teamwork, and great boldness.

Just as the U.S. space program could not have put a man on the moon using conventional aviation technology, IT leaders and business executives cannot use yesterday's approaches to realize tomorrow's objectives. Their long-held assumptions are being turned upside down as three forces converge. First, price-performance ratios keep improving; we have access to a superabundance of computing power, network bandwidth, and storage capacity, all at lower and lower price points. Second: The expectations of consumers are changing dramatically because they are being exposed to technology choices that empower them as never before. And third: New technology trends put IT in position to drive innovation and growth rather than focusing on cost-cutting and efficiency improvements.

Many changes are under way in parallel. Some, like cloud computing, have been talked about and debated for years but only now are able to deliver their potential. Others, like the strategic recognition of the importance of data, are just now becoming apparent. Still others, like data privacy, are being propelled by a worldwide wave of concern about individual rights and the greatly expanded potential for abuse of those rights in an information age.

So this year's Accenture Technology Vision report tells a story of discontinuous change. That story is apparent in the trends that comprise the core of this report—the trends that will have the greatest impact on performance in the future.

Three threads run through the report:

1. Things will be distributed
The obvious and immediate realization is that data today is spread far and wide. Data is also dispersed across many more locations, and under the control of far more owners. At the same time, services will be distributed more widely. Analytics will follow data and services, and will become distributed too. All of which accentuates the importance of factors such as master data management, secure communications, and federated identity.

2. Things will be decoupled
Technology today enables decoupling of entities and layers once deemed inseparable. Data representation is being decoupled from data access. Software layers can be addressed separately. Application interfaces no longer need to be tied to physical interfaces. Decoupling on such a scale promises unprecedented agility and flexibility. But it also calls for a very different mindset—and skills set—and for wise governance disciplines.

3. Things will be analyzed
Since everything from keystrokes to consumer behavior can now be tracked and studied, analytics will become the super-tool with which to drive more agile and effective decision-making. Business processes will have to keep pace if those super-tools are to be effective. There are a host of positive implications, in categories as diverse as customer intelligence and threat detection. But there is no shortage of negative implications—among them the risks to data privacy and the over-optimization of business processes.

IT and business leaders who see and understand the significance of the technology changes now under way will be those who are best placed to help their organizations outperform. They will root their observations and actions in nine core capabilities essential for the effective operation of all IT departments. And while they will continually sharpen the skills specific to their roles, they will never limit their perspectives to their areas of specialty.

Data Takes its Rightful Place as a Platform

The age of viewing everything through an application lens is coming to an end. Coming next: a world in which the quantity, processing speeds, and distribution of data compel IT leaders to see the world through a data lens.

Generations of programmers and architects have grown up thinking in terms of applications—seeing the world through the lens of the functions that the business has needed and with data being the object, not the subject. That thinking will change. Although a focus on applications will continue to be important, it will give way to an emphasis on data. It is our belief that in the near future, platform architectures will be selected primarily to cope with soaring volumes of data and the complexity of data management—not for their ability to support this or that application.

Whereas traditional databases are designed to keep track of where the data is stored and how it can and should be accessed, data platforms will provide a layer of abstraction that hides the data's location, and is not concerned with the form in which the data is stored or how its consistency is maintained. So in effect, the data representation architecture will be decoupled from the application. Data architecture, much like today's application architecture, will refer to abstraction layers and separation of concerns, and not just to data models.

Recognizing three catalysts

Three factors will drive this shift in perspective: dramatic increase in the quantity of data; sustained processing requirements in the context of growing data volumes; and widening distribution of data. Let's look at each factor in turn.

To start with, there are enormous increases not only in the volumes but in types of data—more and more transactional data, a surge in meta-data, an explosion of sensor data, and a staggering rise in the volumes of unstructured data such as e-mails, tweets, blogs, video clips, and more. Second, because organizations want to do more with the data in service of their business processes, there are very strict performance requirements for analyzing the vast new data volumes. As a result, new processing architectures emphasizing horizontal scaling will be increasingly deployed to help meet the performance requirements.

The third factor is that data is no longer "contained" in an enterprise data center—nor is it necessarily "owned" by the enterprise. The adoption of cloud computing will lead to corporate data being distributed across the enterprise boundary and potentially among several cloud providers. Further—publicly available information as well as data from third-party data service providers is rapidly becoming a crucial part of the mix.

Distributed data is the new normal

While it is true that data today is already distributed among different data centers and application silos, we are talking about distributed *ownership* and *control* of data, which requires a different approach to management of the data as well as its security and governance. If IT leaders are not already

facing up to the fact that they must deal with data that resides outside their enterprises, they will very soon have to do so.

The distribution of ownership will have a host of consequences. For a start, distributed data will be more frequently shared across applications. For instance, one process, say, involving an asset tracking application, may produce data and require only a basic level of data storage. But if another process, like an inventory management or supply chain application that uses the data and now needs to use that data in a mission-critical application, the new demand completely changes the storage and access requirements for the data.

At the same time, master data management (MDM) will become considerably more complex than it is today. Specifically, MDM needs to keep track of the origin and location of data, access policies, backup frequencies, degrees of redundancy, location of ownership of meta-data, etc. We expect that this will create big headaches because MDM will become crucial when already scarce MDM skills will become scarcer.

The shift toward a data platform mindset will turn the spotlight on alternative databases. The trusted relational database is not about to be retired, of course. But it will soon start to make way for other types of databases—streaming databases, for instance—that mark a significant departure from what IT departments and business users have relied upon for decades. Naturally, not all of the new database technologies will be right for every user in every circumstance; cost, flexibility, reliability, and speed will be key motivators. It is essential for IT leaders to start thinking beyond conventional constructs in terms of how data is organized, accessed, and managed.

Then there are the questions about backup and recovery, which become far more complex in a world where data may reside with several cloud vendors. Each vendor is likely to have its own backup frequency, compounding the difficulty of taking snapshots of the data and of managing recovery from disaster consistently. And there is the challenge of recombining data dispersed among different providers into a single view of the truth.

Related to this point is the question of how to ensure the destruction of sensitive but old data and handle destruction audits. How does an organization now confirm that data has been destroyed according to its policies? And when auditing data destruction, it must be possible to audit the data paths too—tracking all of the places where the data may have left a trace along the way.

Our prediction is that these factors will lead to new value-added services from cloud providers or will become part of future service-level agreements (SLAs) that differentiate cloud providers.

Distribution will also affect data quality. How can we effectively detect duplication and inconsistent data when it is distributed across different silos, vendors, and providers? And how can we tell when data duplication is beneficial—and should be planned for—as opposed to accidental and potentially unsafe? Therefore it is necessary for IT leaders to reframe the whole concept of data quality more broadly around the idea of data value and utility.

We believe that more and more organizations will come to see data as something that can bestow a competitive advantage, and begin to view application services and algorithms as utilities that can be procured off the shelf. In other words, the roles of application and data will be reversed, with data becoming the platform that supports application services.

Action step

Begin to reframe IT's perspectives around the idea of data platforms—and start the conversations and workshops that enable those perspectives to take hold quickly.

Think data utility, not just data quality

The concept of data quality will soon give way to the idea of data utility, which is a more sophisticated measure of fitness for purpose. This will get IT departments away from often-fruitless discussions about the cleanliness of data and toward productive talks about what can be done with the data on hand. Importantly, it will allow them to apply semantic and analytic tools to extract useful insights from inaccurate data and to integrate data silos more easily.

We characterize data utility in eight ways:

- **Quality:** Data quality, while important, will be one of the many dimensions of data utility.
- **Structure:** The mix of structured and unstructured data will have a big impact, and will vary from task to task.
- **Externality:** The balance between internal and external data will be important, with implications for factors such as competitive advantage (external data may be less trustworthy, yet fine for certain analysis or tasks).
- **Stability:** A key question is how frequently the data changes.
- **Granularity:** It is important to know whether the data is at the right level of detail.
- **Freshness:** Data utility can be compromised if a large portion of the data is out of date.
- **Context dependency:** It's necessary to understand how much context (meta-information) is required to interpret the data.
- **Provenance:** It is valuable to know where the data has come from, where it has been, and where it is being used.

Analytics Is Driving a Discontinuous Evolution from BI

Analytics is emerging as a major differentiator and value creator for businesses. But to reap the real benefits, companies must see analytics as a discontinuous change that will involve several different architectures and deployment models.

Analytics drives insights; insights lead to greater understanding of customers and markets; that understanding yields innovative products, better customer targeting, improved pricing, and superior growth in both revenue and profits.

That's why farsighted companies are viewing analytics as essential for creating value. In contrast, their peers who think about analytics only as a simple extension of business intelligence (BI) are severely underestimating the potential of analytics to move the needle on the business. For one thing, they overlook the fact that traditional BI does not address the wealth of unstructured data that is now available.

So what does the future of analytics look like for IT organizations? First of all, despite a steady drumbeat calling for the integration of data across an organization, there will be no such thing as an integrated analytics platform, technology, or deployment model. The emergence of technologies such as cloud computing is changing how data is generated, collected, and stored across an organization. In practice, this will require a distributed approach to analytics.

This distributed approach will require different ideas about who is best at doing what. In general, we expect to see some companies sourcing from third parties the deep analytics skills required for, say, customer segmentation, route planning or process optimization, and keeping in-house the even deeper skills for the interpretation of the results.

As analytics becomes integrated into the underlying technology platforms, one existing challenge will ease. ETL (extract, transform, and load), the process of retrieving data and preparing it for analysis, has traditionally been the most time-consuming element of any analytics project. But ETL will become easier as data quality tools improve, analytics applications become more tolerant of "noisy" data, and ad hoc capabilities are replaced with integrated platforms.

However, new challenges will appear. As distributed data becomes the new normal, we will see the emergence of distributed ETL—that is, the need to extract data from multiple on-premise and off-premise platforms in order to run centralized analysis. Call it the price of progress.

The quest for closed-loop nirvana continues

The ultimate goal for analytics-savvy organizations is complete integration of analytics with business process automation, leading to a true "closed loop" capability that integrates analytics with automated responses to the results of the analysis. While this analytics nirvana won't be achievable anytime soon, we will begin to see less complex and more pragmatic levels of integration between analytics and business logic embedded in IT systems.

Leading IT organizations will go through a progression, moving from traditional BI (reporting) to business activity

monitoring (BAM) to measure specific business activities and report business metrics. From there they'll proceed to predictive analytics, in which business rules and processes are adjusted to address business changes – a peak sales period, for example, or a market disruption.

This move to predictive analytics will drive the use of analytics to acquire new data to fill knowledge gaps – which will further improve analysis and decision-making. Think of how the combination of additional data can provide deeper context to improve the quality of analysis. A sales team for a retailer could compare regional point-of-sale data with local weather, for example, to gain better insights into customer behavior.

To truly take advantage of analytics, businesses need to integrate their analytics capabilities into their business rules and processes to connect the relevant insights across all stages of decision-making. Business processes involve a series of discrete decision points: demand prediction, pricing, promotion, etc. Today, businesses tend to apply analytics to these decision points in isolation. While this approach can certainly improve decisions at each step, it can also lead to problems.

Consider, for example, the well-known bullwhip effect, which shows that even if each stage of a process is optimized based on the data that's available at that stage, the overall process will still be suboptimal because different decision points are not coordinated and do not have visibility into the entire process. Because every decision in a process generally is predicated on the outcomes of prior decisions, analytics must integrate all decision points to provide an understanding of the larger decision process.

As decisions across the process become apparent, companies can eliminate undesirable side effects and optimize business processes enterprise-wide, leading to better results. The best way to head down this path is to start decoupling processes and rules from applications to define the primary decision points.

The need for analytical literacy

The growing sophistication of analytics capabilities and supporting technologies will open up the risk of "oversteering"—of making increasingly frequent, fine-grained decisions. That's especially so because business users will be tempted to "get value" from these powerful tools. However, too-frequent optimization can be counterproductive when the decision-making time scale is not appropriate for the process to which it is applied. For example, just because a utility can gather real-time data on fuel (e.g., oil, gas, coal) pricing from the markets doesn't mean it should be changing its generation mix every 30 seconds – especially if its business processes are tuned for long-term fuel contracts.

So how can companies avoid analytics-induced course corrections that do more harm than good? Effective use of analytics will require considerable analytical literacy. Remember that real-time data does not necessitate real-time decisions. Decision-making with analytics requires an understanding of the sampling rates of different events and their interdependencies, because decision-making must be consistent with the time scale of data. The business process should dictate the analytics; not vice versa.

Action step

Determining the right approach to analytics involves many critical decisions; IT executives should work closely with business leaders to identify where analytics and insights can be leveraged most effectively as well as the proper mix of services required to optimize analytics capabilities across the enterprise.

Brute-force improvements

Don't expect sophisticated, handcrafted analytical models to drive performance improvements in analytics. A more likely driver: brute force computational power applied to larger data sets.

Traditionally, analytics solutions have been constrained by computing performance and limited availability of data. Improvements often stemmed from meticulous program optimization, better algorithms, simplified assumptions, and other methods for milking limited data for all it was worth.

Increasingly, however, analytical improvements are coming from the availability of greater computing power applied to more data. Utilizing machine learning techniques instead of handcrafted rules, analytics teams will gain the scale needed to match the increasing complexity of business problems.

Cloud Computing Will Create More Value Higher up the Stack

The current focus on infrastructure cloud doesn't help organizations differentiate themselves. Together, SaaS and PaaS rather than IaaS will enable IT to create value through a combination of cost reduction, speed to market, agility, and the ability to gracefully integrate business processes with partners and suppliers.

There's no denying the momentum of cloud computing. Accenture's research shows that enterprises are already moving applications into the cloud. [1,2] The demand is anything but an IT fad; it is coming from a host of business functions. And it is truly a global phenomenon; companies everywhere from Brazil to China are moving ahead rapidly with adoption. It's clear that IT and business executives should expect cloud computing to become ever more pervasive– to the point that the term "cloud computing" itself becomes superfluous.

But what's needed now is a shift in thinking from obvious but non-differentiating benefits such as cost reduction through cloud infrastructure to where the cloud will have its real impact. When we look at the different facets of cloud computing – Infrastructure-as-a-Service (IaaS), Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and so on – it is easier to see that most of the current emphasis on cloud is focused on the lower levels of the technology stack. For many large enterprises, the logical next step after virtualizing their data centers has been to leverage IaaS to augment those centers.

However, IaaS is becoming a commodity. We see much greater value in SaaS and PaaS, higher up the stack. That is where tomorrow's leaders will find real differentiation. Hybrid clouds – i.e., SaaS and PaaS in combination with internal applications – will help organizations accomplish tasks that they cannot accomplish today and will cement IT's role as a driver of business growth.

The reason? Unlike IaaS, which is driven mostly by cost-management objectives, the migration of applications and application development to the cloud will be based more on business need. SaaS-based applications reduce concerns about the infrastructure and help organizations get to market quickly. When SaaS also provides a platform, it makes it easier to customize and to tap into an expanding ecosystem of third-party applications. Service providers will begin to provide targeted vertical solutions as a way to entice more enterprises to move their applications to the cloud.

Hybrid solutions will emerge as the dominant model

Cloud computing deployments will take many forms. More organizations will deploy virtualized desktop infrastructure (VDI) for high-security or highly standardized desktop environments to manage sensitive data centrally and keep it out of the individual's control. Private clouds will also be utilized for development and testing, along with "transient" applications, such as product demonstrations for customers, that can be set up and retired quickly. Public clouds will be leveraged more for non-differentiating applications or for "cloudbursting" – a computing-on-demand model for processing heavy, short-term workloads.

But we expect hybrid clouds – mixing public and one or more private services – to emerge as the dominant model in most enterprises. As data and services

are spread across a variety of service providers, hybrid models will provide the best balance of flexibility while managing risk. In such an environment, IT will focus on orchestrating the business process while treating everything else as a service. This will force service providers to compete less on price and more on how well they can differentiate their offerings based on factors such as quality of service and robust application catalogs.

Economics of the cloud: a new game

As cloud services proliferate, conversations about cost will have to change. We expect the shift to move from the cost of discrete IT components to a discussion about the total cost of ownership (TCO) of cloud solutions. Although IT TCO constructs are well known and well accepted, measuring TCO in the cloud is a mystery. It's fair to say that currently, there are no recognized models for cloud TCO. The current emphasis is on economies of scale from volume, automation, commoditization, and consolidation.

But cloud hosting is not merely a summation of compute hours, storage bytes, and network bandwidth. There are many implicit cost elements, involving quality of service, staff and skill requirements, the granularity of licensing costs and charge backs, the unknown costs of skills loss, the implicit and explicit insurance cost to offset downtime, and the unpredictability of operating expenses compared with capital expenses.

In the future, companies will need to examine the full life-cycle cost when considering public, private, or hybrid cloud services. For example, a short application life span may not warrant an investment in supporting infrastructure, making a case to move the application to the cloud. Load elasticity is another consideration; the ability to reduce utilization when demand is low makes costs variable as well. Cost decisions will need to be built into architecture planning and provider selection – traditionally the realm of architects, not finance professionals. As a consequence, the technical sourcing of cloud providers will become a new skill that organizations have to acquire and master.

Many technical and business challenges remain

Before the full potential of cloud computing can be realized, companies and their service providers have plenty of technical and business hurdles to cross. Technologically, IT teams will have to develop strategies for implementing and managing federated identities, which are necessary for enabling consistent permissions, roles, and traceability across multiple service providers. Organizations' IT leaders will have to work with cloud service providers to determine the right federation rules for their communities.

Federated identities are but one of many technical challenges. Concerns for providers include: platform-level version management activities (the ability to manage local patches, versioning, and upgrades without introducing risk to cloud consumers); and richer application programming interfaces (APIs), which are necessary for more sophisticated cloud applications. Concerns for users involve: consistent policy enforcement across cloud providers; access to event meta-data, which is critical for analytics; governance over applications and data that is stored in third-party data centers; better fault tolerance for application architectures; and network latency.

In addition to the technical problems, several business issues in deploying cloud solutions need to be solved as well. IT teams will have to ensure that any cloud services contain facilities for e-discovery and disaster recovery – processes made more complex by the distributed nature of cloud-based information. They will need new processes and procedures for tracking user activities and data paths across cloud-based and on-premise systems. While license management may become easier, SLA management will become far more complex when incorporating cloud providers into the mix.

Action step

Deploying infrastructure cloud today should not distract from planning for the transformational, differentiating opportunities that SaaS/PaaS offer tomorrow. The main focus should be on developing a cloud strategy that drives business transformation by delivering increased functionality and flexibility using a mix of public and private cloud-based application and platform services.

The lock-in problem

Cloud-based solutions have low barriers to entry. There is no procurement or development lead time; getting into the cloud needs nothing more than a credit card.

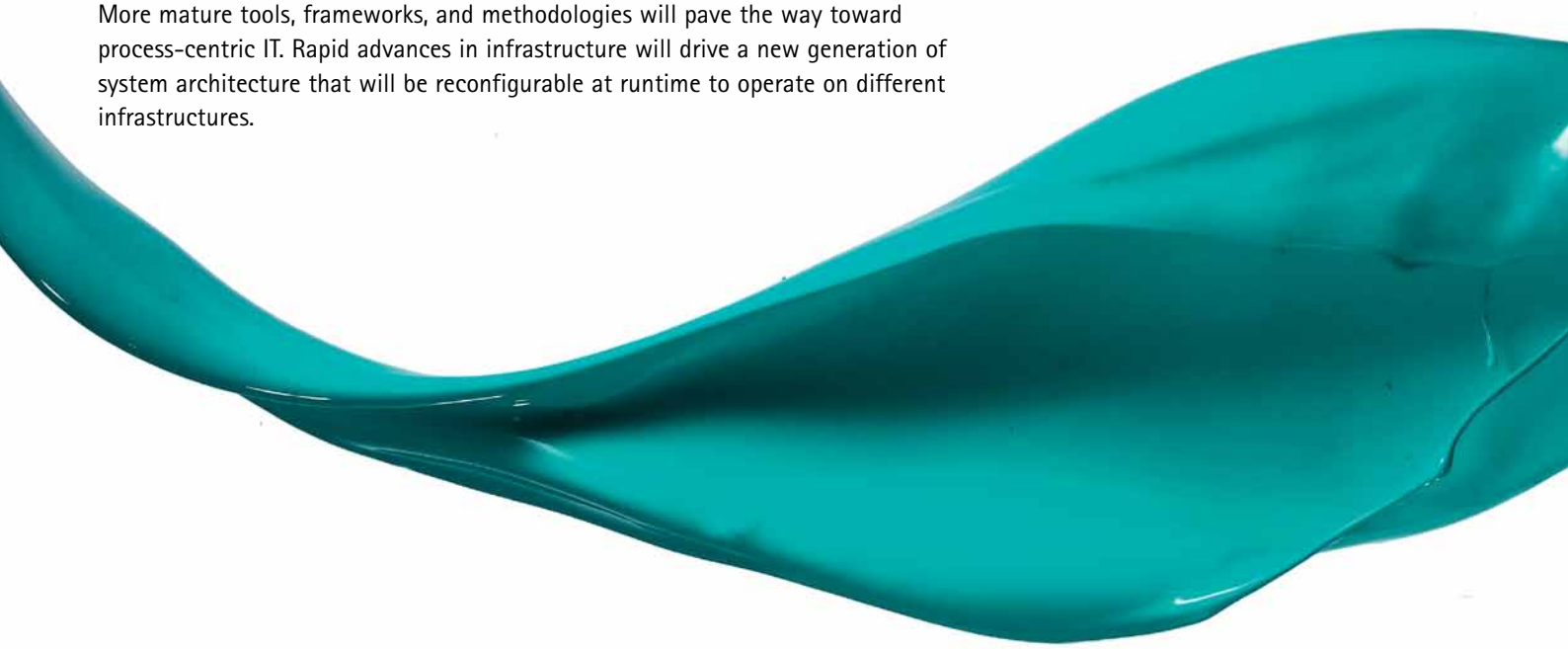
But getting out of the cloud will be a lot harder than getting in—especially with SaaS. SaaS vendors have their own styles for implementing data models, meta-data, user group administration, etc. The same issues apply to security domain models, proprietary scripting and markups, and proprietary meta-data schemas. So taking all of the data back will require a full IT migration project.

Cloud lock-in can occur along several dimensions: app stores, data migration schema, and skills. Further, if the cloud service provider finds itself in trouble, needing to raise prices to stay in business, its customers will have little bargaining power because they need the provider to remain viable for the sake of their own business continuity.

So the selection of a service provider must come with the realization that a shift to another provider will call for re-implementing the application or expending considerable effort to migrate to a new provider.

Architecture Will Shift from Server-centric to Service-centric

More mature tools, frameworks, and methodologies will pave the way toward process-centric IT. Rapid advances in infrastructure will drive a new generation of system architecture that will be reconfigurable at runtime to operate on different infrastructures.



Information technology is evolving from a world that is server-centric to one that is service-centric. Companies are quickly moving away from monolithic systems that were wedded to one or more servers toward finer-grained, reusable services distributed inside and outside the enterprise.

The evolution is being driven by the ongoing maturation of supporting tools, frameworks, and methodologies. There is still much to be done to decouple infrastructure, systems, applications, and business processes from one another. This shift has major repercussions for all levels of the enterprise architecture stack, from infrastructure to applications. Decoupling will enable components to operate independently while making software architectures reconfigurable during run time to adapt to various environments and design objectives, which will increase the flexibility of application deployment and maintenance. Although dynamic reconfiguration is not a new concept in academia, advances in cloud technology at all layers of the stack create a burning platform for such architecture.

Dynamic reconfiguration will take place at the business process level – in which processes can switch to an alternate service provider in response to an outage or promotion – and at the infrastructure level, in which servers or nodes can be added through cloudbursting and similar techniques to handle temporary, peak processing needs, or discrete projects. In the future, business processes, not technology functionality, will dictate how or when you use these scaling mechanisms. Business rules will help make this a reality.

The most interesting part of this movement is that infrastructure – commonly viewed as a constraint to application functionality – will become the primary driver of architectural change. Infrastructure (e.g., computing, storage, and network connectivity) and applications have always been tightly coupled, even though their architectures evolve at dramatically different paces. The life span of an enterprise application is measured in decades – most mature companies have 45 years or more of intellectual property locked up in custom-built applications and data structures[3] – while dozens of start-ups promising infrastructure innovations pop up every month.

As a result, applications that are tightly coupled to their infrastructures often restrict access to new innovations in infrastructure. An application that relies on a single instance, for example, cannot take advantage of horizontal scaling technologies.

The case for decoupling

Why is it imperative that the application architecture be decoupled from infrastructure? Application design typically makes assumptions about certain characteristics of the infrastructure required to run it.

These assumptions tie the application architecture to the architecture of the infrastructure for which it was originally designed – assumptions that must be preserved even as the infrastructure improves. This is the curse of backward compatibility, in which support for new functionality must be sacrificed for the applications to continue to run reliably.

New architectures, on the other hand, allow – or even require – companies to relax many long-standing assumptions about application and infrastructure. For example, no longer will developers be restricted to a single box with fixed capabilities, a single instruction or processing stream, pure vertical scaling, or the co-location of processing and data. Instead, infrastructure is being provided as services that can be chosen, procured, and configured based on application requirements.

We are already seeing horizontal scaling at the chip level, the grid architecture level, and the server level. Parallelism and new processing mechanisms such as MapReduce, non-relational databases, virtualization, and fabric computing are rapidly becoming the mainstream today. There is a reverse trend as well, as evidenced by the rise in special-purpose appliances where complete stacks have been collapsed into an appliance, effectively creating a service in a box. For example, SAP released SAP HANA (High-Performance Analytic Appliance) recently, optimized for in-memory execution of applications such as its BusinessObjects offering.[4]

Going forward, architectural heterogeneity will only increase as hybrid clouds, distributed data, parallel algorithms, non-relational databases, service-centric applications, and specialized appliance-based applications all coexist, and new processing paradigms emerge. Application architectures will continue to be decoupled from infrastructure and from business processes, resulting in applications that are self-describing, self-correcting, self-scaling, and self-modifying.

In this new paradigm, applications will be immune to any underlying changes in data representation or infrastructure, resulting in scalability, increased performance, and cost reduction thanks to the adoption of new advances in infrastructure. This will speed the adoption of new technologies and enable companies to upgrade or migrate at will.

To fully reap the benefits of cloud-based infrastructure and service orientation, system design will have to adhere to well-established best practices that will enable systems to be dynamically reconfigurable. Some examples include: using parallelization frameworks for flexible scaling; avoiding explicit assumptions regarding service configuration in the service design; using intermediaries like a service bus to avoid direct communication between services and data stores; and isolating the stateful and stateless components of an application from each other.

Ultimately, this means that a large part of what used to be hardwired into the system during design must be made configurable at run time so the system can adapt to the highly dynamic operating environment. The system may have to be designed around the possibility of more frequent failures, requiring more attention to managing state in order to recover from failures with a consistent state.

Innovations must trickle up the stack

IT organizations have been excited by the agility that service orientation, business process management, and other emerging technologies have provided to date. But they are seeking even greater agility. Innovations in lower levels of the stack require flexibility in the higher levels to deliver the true potential of service-centric IT.

As layers of the architectural stack are decoupled from one another, languages and notations for formal communication between the layers will become necessary. Today, an advanced

Software engineering becomes more science than art

Watch for software development to become a lot more predictable and easier to measure and manage. New and highly sophisticated tools, exploiting analytics and standardized instrumentation, are already becoming integral to the tooling used by leading developers.

Instrumentation is starting to provide richly detailed information across the entire development process. And analytic techniques, applied across multiple teams and projects, will allow longitudinal tracking and benchmarks against which new projects can be measured and evaluated.

Examples of tools that enable instrumentation and analytics include Rational Jazz, a framework for connecting to underlying tools such as ClearCase and Subversion, Microsoft Visual Studio's Team Foundation Server, and Hackystat, an open source instrumentation framework.

These advanced tools make it possible to measure software development processes in systematic, consistent ways. As a result, software project managers will be able to estimate and plan development projects more precisely and with more predictability—for example, tracking team and individual productivity, or monitoring the quality of code over time. And when necessary, the new approaches will help managers to take corrective action much earlier.

application might have logic embedded in it that triggers other actions as the application approaches peak capacity, for example. Tomorrow, communications between layers will alert higher levels of the stack to the fact that the application is approaching capacity, and a combination of business rules and business processes will handle the issue rather than the infrastructure layer making a decision in isolation. Better inter-layer communications will enable dynamically reconfigurable architectures to be self-monitoring – meaning that they can generate events based on changes to the environment. These changes may take many forms. They may involve new demand—for instance, when the infrastructure is reaching capacity, as would be the case if a cloud provider has an outage. They could be configuration changes, such as new capabilities in underlying services, and organizational, as in the case of adding a new outsourcing provider. Business processes will have to respond to these events appropriately: by executing existing services differently or switching to new services, by invoking different business rules for evaluating decisions, or by modifying the underlying business process itself.

The approach to system and enterprise architecture will fundamentally change as we go from applications that are tightly coupled to infrastructure to those that are infrastructure-agnostic and, eventually, infrastructure-aware. Ultimately, applications will control the infrastructure instead of being constrained by it. These types of dynamically reconfigurable services are a key element of the next generation of software architecture that will increase IT's agility – and thus boost its ability to innovate and deliver business value.

Action step

Explore ways to begin decoupling applications from infrastructure as part of your life-cycle management strategy.

IT Security Will Respond Rapidly, Progressively—and in Proportion

In the past, IT has architected everything around the idea of "100 percent" security. This fortress mentality must now give way to a realistic and practical approach to IT security. What's needed now is a cascaded, reflex-like security architecture that responds proportionately to threats when and where they happen.

There is no such thing as watertight IT security. Yet for years, business and technology leaders have acted as if the only alternative to a "fully secure" state is an unacceptable "fully breached" state.

This "fortress mentality" is outdated—and no longer realistic or practical. Leading security specialists are devising reflex-like systems whose responses step up with the severity of the breach. In extreme cases, counterattacks may even become part of an organization's repertoire of responses.

We believe that new security solutions and architectures will, like human reflexes, respond instinctively to the growing speed, scale, and variety of attacks. This implies that for the first line of defense, people will not be part of the decision loops; the speed and frequency of attacks dictate that human responses must make way for automated capabilities that detect, assess, and respond immediately. And the increasing "attack surface"—across more devices, more systems, more people, more business partners, and broader physical infrastructure—supports the case for automated capabilities that detect, assess, and respond to external threats immediately.

Leading organizations will understand the consequences of inevitable data leaks. For example, they will know that the leak of data about a major retailer's transportation routes does not automatically mean that rivals can replicate the retailer's supply chain. They will be able to think beyond the simple binary notion that their organizations are either secure or have been breached.

Those organizations will know 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. More sophisticated responses will also place a premium on using intelligence-gathering and forensics techniques to learn about adversaries.

Overall, it will be essential to step up the organization's collective understanding of what "security" really means. That will involve moving away from simple low, medium, and high brackets and assessments at the level of the individual object and toward the security of a network of interconnected objects. In essence, security will become a fluid continuum across the network.

The bottom line: Automation will quickly become a "must-have" component in the overall security strategy of every IT organization. There is simply no other way to detect threats swiftly enough, let alone to contain the damage and recover from it.

Teaming up to fight back

In extreme circumstances, it may be necessary to actively fight back. Given the speed and scale of today's cyber-attacks and the growing significance of the inflicted damage, organizations can no longer stay only in defensive mode. Cyber crime accounts for an estimated $1 trillion in annual losses to businesses around the world.[5] Counterattacks, then, are likely to become part of the strategy for augmenting IT security. Organizations are likely to collaborate to counterattack their assailants, not least because few organizations have the resources needed to defend themselves.

Efforts are underway to develop the systems that can enable countermeasures. One example: Sypris Electronics recently unveiled plans to create an international "cyber range." The company hopes the "range" will become the preferred practice battlefield for digital warfare where military, government agencies, and, later, businesses running critical infrastructure services can test their defensive – and offensive – firepower against cyber enemies. The range is expected to be operational by the first quarter of 2011.[6]

In parallel, offensive "weapons" are being explored and tried out. Researchers successfully demonstrated counter-hacking techniques at the 2010 Black Hat security conference. They reverse-engineered a bot and looked for flaws in the bot itself to exploit, in the same way that the bot uses flaws in commercial software. From there they were able to retrace and, in theory, take control of the botnet itself.[7] At the same time, Microsoft and others have partnered to attack malware spread by registering domain names necessary for continuing the exploits exploit. A pseudorandom technique generates a large number of domains per day that the worm looks for in order to connect to the command-and-control structure. The team is either pre-registering, or at least flagging, those domains to block the spread of malware.[8]

The importance of being able to prove you're you

Identity will become even more important in the future. And biometrics—already established as a security tool – will augment and steadily replace other methods of identification and authorization. The importance of identity will drive biometrics adoption in two very different directions: high-security uses in government and business, and convenience-driven uses for average individuals.

The catalysts for these twin tracks are clear. There is certainly a growing emphasis on identity for consumer and enterprise needs; mobility, health, and e-commerce all require strong forms of authentication in the face of increasing security threats. At the same time, biometrics solutions are becoming more affordable as deployment of high-value solutions brings down unit costs, enabling other business processes to take advantage of the technology. In short, organizations will have more options for acquiring and implementing biometrics at differing investment levels.

In the high-security realm, we expect biometrics to evolve from a high end, James Bond–type specialist technology to the primary tool for high-volume applications with a strong security requirement – for instance, border control, voting, or police applications. We also anticipate that biometrics solutions will proliferate in the private sector, used everywhere from online banking and payments to securing electronic medical records and to help prevent clinical errors, prevent fraud, and protect patient confidentiality.

For consumers and individuals, biometrics will be used increasingly in less security-centric domains and developing countries to access benefits or services, from healthcare or food subsidies to unemployment benefits or banking. They will also help make things more convenient in low-security situations—for example, providing easier access to a gym or library. As device costs continue to fall, the technology will be increasingly integrated with products and processes – for fingerprint unlocking of laptops, for instance.

As a consequence, we predict that average citizens will soon start to see biometrics less as an intrusion on their privacy and more as a means of enhancing their privacy—securing their bank accounts or health records, for example.

The idea of counterattacks is fraught with policy and governance headaches. To begin with, the amorphous nature of the Internet makes it very easy for attackers to hide – and makes it equally easy for counterattacks to harm the innocent. Jurisdictions will complicate matters further. Whose laws apply if a Japanese company counterattacks a Latvian hacker who is using botnet computers in Norway?

Making sure every router and every chip is secure

We also believe that IT security will soon expand beyond just securing information systems to securing critical business processes. Think of this as a continuation of the conversation about closer alignment between IT and the business, so that IT staff have a better understanding of what's important about key business processes and are able to quickly identify the security vulnerabilities of those processes and build defenses against them.

This more holistic view will use "integrity measurement" tools to reach into every corner of the IT realm. The tools will be used to gauge the trustworthiness of everything from processor chips to software to smartphones to servers and entire clouds. Already there are warnings that most cyber attacks are enabled by programming errors—and consequent calls from security experts of technology vendors to work within a strict set of software development security standards.

Counterfeit IT products

This far-reaching view of security extends to the proliferation of counterfeit products. As far as IT security is concerned, a worrying question is: "If we do discover fake products, how do we know they aren't exporting data to a hacker cartel somewhere?" The counterfeiting problem is very real. For example, fake products--particularly counterfeit network equipment—have been the target of enforcement initiatives across several countries, leading to seizures worth more than $100 million.

Recognizing that people are the weakest security links, more and more enterprises will shift a large part of their security spend to training and cultural change programs. The motivation is as profound as it is trivial: the recognition that people are the weakest link when it comes to security. We expect that organizations will make "security fluency" central to their corporate culture; in those organizations, even job interviews are likely to involve ways of gauging candidates' security consciousness.

There is one other facet of IT security that is worth touching on. We expect leading organizations to revisit their approaches to federation of identity—to start thinking in terms of federated identity that extends beyond the boundaries of any one organization so that an employee or contractor's identity can follow him or her from place to place.

Action step

Stop thinking in terms of watertight security—there is no such thing. Instead, begin planning for cascaded, reflex-like security systems that rely heavily on automation to respond immediately and locally—and then step up their responses as the severity and scope of the threat increases.

Data Privacy Will Adopt a Risk-based Approach

Complete data privacy is a myth—all the more so in the WikiLeaks era. Leading organizations already know that. They will be attuned to regulations governing privacy and will develop a risk-based approach to data privacy.

In an age when WikiLeaks has become a household name, every business leader is right to be even more paranoid about data privacy. Just as leading organizations now realize there is no such thing as 100 percent IT security, so complete data privacy is being exposed as a myth.

In one study, the *Wall Street Journal* assessed and analyzed the cookies and other surveillance technology that companies use on the Internet. The study found that the nation's 50 top web sites on average installed 64 pieces of tracking technology onto the computers of visitors, usually with no warning. A dozen sites installed more than a hundred each.[9]

If you think privacy protection is important today...

It will not be enough simply to accept the reality of data leaks. It will require very proactive responses from organizations to understand the risks surrounding the use and misuse of personal data. And it will require constant vigilance because things are changing so fast.

To begin with, it will call for close attention to regulation—worldwide. Just one example: Authorities recently found that Google committed a serious breach of the U.K. 's Data Protection Act when its Street View mapping service collected personal information from unsecured wireless networks in England.[10] The U.K. was the not the only nation whose privacy policies Google violated.

We predict that individual privacy will take center stage as a result of increased regulation and policy enforcement. Privacy outcries are getting louder. And governments are becoming considerably more active in enforcing compliance and investigating the flexibility of current policies in adjusting to emerging capabilities and business models.

The public is clearly becoming more sensitive: November 9, 2010, marked the two millionth consumer complaint filed with the Internet Crime Complaint Center (IC3) in response to suspected or actual online criminal activity. This milestone is especially notable because it took seven years for the IC3 to receive its first million complaints between May 2000 and June 11, 2007. The second million arrived in less than half the time – just under three and a half years.[11]

The privacy challenges may well become even more burdensome. In the United States, some politicians are proposing to fine technology companies up to $100,000 a day unless they comply with directives imposed by the U.S. Department of Homeland Security. The new bill is called the Homeland Security Cyber and Physical Infrastructure Protection Act (HSCPIPA).[12]

Privacy by design

At the same time, the concept of "privacy by design" will become much more prominent; U.S. and European regulators expect technology companies to incorporate data privacy in the design of their products and services. But it will be some time before enterprises are rewarded for proactive privacy controls. The converse applies: They can expect to be punished for what is deemed to be poor privacy practices.

We expect that leading players will develop superior levels of understanding, enterprise-wide, about the distinctions between being a data processor—broadly, handling the personal data of others—versus being a data controller, thus lowering their risks of unwitting breaches of privacy regulations and perceptions of privacy breakdowns. We also expect the privacy exemplars to deploy the kinds of cascaded, reflexive, automated systems that the leaders will use as the backbones of their overall IT security strategies.

Action step

Given the difficulty of securing data long term, the questions to consider are how to plan the right responses to leaks, and whether the data should be created or acquired in the first place.

Social Platforms Will Emerge as a New Source of Business Intelligence

Social networks will evolve into "platforms" for reaching customers, tapping into their social identity, and gaining information about them, and about competitors and the market as a whole.

The rapid growth of social media has been eye-popping—especially so in the last few years. Facebook, founded in 2004, now has more than half a billion users and is spending heavily to accommodate more. Twitter's service generates billions of tweets per month. Social networks are not just a product of and for the young consumer: Many of the world's Internet users aged 50 and over are active users of social media. And increasingly, businesses and government organizations are using social media to connect their constituents in an effort to improve collaboration.

This is just the tip of the iceberg. The evolution of social media will continue to disrupt the way companies do business, posing new challenges to IT as it attempts to harness social media in the enterprise. The key driver of this change? The transformation of social networks into social platforms, each with its own ecosystem to fuel increasingly deeper levels of interaction.

Social platforms have three major dimensions: functionality, or the basic capabilities these platforms offer; community, or the groups of people who belong to them; and user identity, the unique name and associated information that characterizes an individual.

A virtuous cycle of growth

Only a small number of social communities will emerge as true social platforms with a large ecosystem of services built around them. We believe that social networks evolve through a virtuous cycle of growth: More features attract more customers, in turn attracting even more customers and making the whole ecosystem appealing for third parties to support with additional features, and so on.

Among the many candidates – Facebook, MySpace, Yahoo Groups, Google, Orkut, Twitter, LinkedIn, and Renren, to name some – we believe that Facebook has already made the final short list and provides a classic case study. By opening up its development platform, the company has encouraged third parties to build applications that augment its basic services. Facebook Connect, a mechanism that enables users to log into a number of other online communities with their Facebook identity, has made it doubly attractive for third parties to support and for users to join.

The cycle will eventually lead dominant players to squeeze out smaller networks and make it increasingly difficult for new social networks to join the space, and companies will look for ways to connect to these dominant platforms using APIs such as Facebook Connect and Google's OpenSocial. Already, more than 250 million people are using Facebook Connect on third-party sites every month, and 10,000 new sites are adding Facebook Connect every day.[13] Companies are also "fishing where the fish are" by launching targeted communities inside Facebook's

walls, giving them access to the rich information and activities that flow through the platform.

Disintermediation is a good thing

One of the vaunted business beliefs has been that companies should own the relationship with their customer and never let any third party disintermediate between them and the customer. Social platforms will overturn that belief.

The rich history of information that individuals leave in social networks through their interaction with others will be a much more valuable form of identity – a "social identity" – than name, physical address, social security number, tax file number, driver's license number, and other such isolated forms of identity. Through APIs, social identities can now be linked across the Web, providing a consistent and comprehensive view into individuals' preferences, interactions with peers, and other activities.

For this reason, social identities will become much more valuable to businesses than getting an individual to register on the corporate web site. Social identity not only provides authentication (just like registration), but also a wealth of additional data about that person. That's why more web sites, including leading media sites such as Reuters, CNN, and ABC, are allowing visitors to log in with various social accounts.

A better source of business intelligence

The same wealth of information created by users and businesses in the social platform is also a valuable source of business intelligence. Think of it as an ongoing focus group, in which any interaction between users tells you something about your customers, the market, even your competitors. This customer intelligence – mined and analyzed at aggregate or individual levels – will help companies monitor their brands, develop more targeted promotions, and measure their performance more effectively against competitors.

The integration points that social platforms provide for this information will enable companies to communicate by design instead of by opportunity. Combinations of social platforms, devices, mobile apps, etc., mean that corporate web sites will lose their primacy as online destinations. As such, companies will begin placing less emphasis on search engine optimization and promotions designed to bring people to their sites, shifting their resources to programs for engaging users where they congregate online – that is, on social platforms.

Enterprises should be looking at these "social identity providers" to connect all of their interaction channels into a cohesive, multichannel customer experience. The winners will be those who recognize and serve both the short-term whims and the long-term goals of individuals and establish an ongoing relationship that transcends any single interaction.

Process-oriented collaboration inside the enterprise

Today, collaboration in enterprises is evolving from communication and channel integration (also known as unified communication) into process-based platforms where the underlying collaboration technology has knowledge of the business process in which the collaborating individuals are engaged and is specifically tuned to support it.

Architecturally, process-based collaboration will evolve in two distinct directions, making it necessary for IT organizations to develop clear and careful guidelines for when to adopt which direction. For mission-critical processes (say, CAD design in a high-tech company or software development in an IT organization) where the process burden outweighs the collaboration needs, niche, vertical solutions that support the end-to-end process will be the preferred solution. However, for most simple processes, the collaboration burden will outweigh the process burden, making it both necessary and simpler to standardize on a corporate collaboration platform (such as Microsoft SharePoint or Lotus Notes) on which many specific processes can be implemented.

The pros and cons are obvious. Too many vertical solutions will lead to a proliferation of platforms that need to be licensed and supported, and users trained. Using a generic collaboration platform for complex, mission-critical processes like design or pharmaceutical drug approval may be architecturally simpler, but will require considerable custom development and may suffer from poor usability due to the fact that it's built on a generic, lowest common denominator. Essentially, social platforms call for clear guidelines about when to use which type of solution.

Collaboration platforms and analytics

Lessons learned from social platforms will lead to fresh perspectives on collaboration models inside the enterprise as well, eventually enabling more sophisticated and optimized process-oriented collaboration. Analytics, in combination with knowledge of the collaborative process, can help measure, reengineer, or tune the processes. As with social platforms, internal collaboration platforms will provide more visibility into user activities. By analyzing this data, companies will be able to gain more intelligence and insights about their internal communities and collaborative processes. Extracting "employee intelligence" or "process intelligence" in the same manner that marketers use to extract customer intelligence from external communities will also enable companies to capture and preserve the organizational knowledge that is created and exchanged through these communities.

The next stage of the evolution of social networks—as they become social platforms—will bring users new levels of engagement and interaction. At the same time, it will transform the way in which businesses must think about social media. The changes will be much too important to ignore.

Action step

Build a case for accommodating social identities in your web site registration process, based on the additional insights your business will be able to capture. And begin designing the frameworks for next-generation enterprise collaboration models.

User Experience is What Matters

The ability to create experiences by deeply engaging the user, using natural interfaces and integrating processes and devices, will be what differentiates leading companies and systems from the rest.

Today, business process design is driven by the need for optimization and cost reduction. But tomorrow it will be driven by the need to create superior user experiences that help to boost customer satisfaction.

But in the future, great user experiences will require more layered approaches than what is typical today. Leading IT providers are thinking way beyond the next great touch-screen interfaces or gesture-driven devices. They are preparing to address three specific factors: the integrated user experience, with no cognitive cost of switching from one context to another; a compelling experience, which minimizes tedium and boredom; and a natural device interface – one that involves little or no learning time. Apple has mastered all three factors; for instance, its iPhone and iPod products can be used right out of the box, with little need to resort to a user manual.

Let's look at each factor in turn. We expect that integrated experiences will be created by minimizing the context-switching cost for the user. Put another way, there will be further synchronization around a single identity—a customer-centric, follow-the-user approach as seen today in Facebook Connect that allows users to maintain their identity as they browse.

We predict that leading providers will offer ways to synchronize across multiple devices, multiple services, and multiple processes. For example, it will be possible to unify the user's experience on Amazon.com's Kindle platform across devices – the Kindle e-reader as well as the iPhone, iPad, etc. Similarly, it will be possible to participate in computer gaming across mobile devices and consoles.

At the same time, the application interface and the physical interface will gradually decouple. So, for example, a game on a mobile phone will not be constrained by the physical keys; it could be controlled by a blend of voice, touch, and gesture.

Design will be a multidisciplinary exercise: Typically handled today by IT architects and business owners, tomorrow it will involve optimization from the perspective of the process actor, with the emphasis on simplicity and on removing inefficiencies. As such, it will call for the talents of sociologists and social anthropologists, among other less typical professions. Today, these talents, in connection with the user experience, are neither recognized nor easily available.

Experiences that truly engage

Second, leading providers will concentrate on experiences that "hook" the individual. That implies personal engagement—customizing the experience to that person's interests, sense of what is fun, responsiveness to challenge, and social connection.

The customization aspect is crucial. Tomorrow's leading providers will devise ways to reflect back the user's sense of self—perhaps his reputation among his peers or an amusing aspect of her personality—and will ensure the right levels of socialization, teaming users with people they like. Similarly, it will be essential to emphasize the fun aspect, providing immediate gratification, appealing to the senses or to the desire for escapism, perhaps. Just one example: Pop quizzes on airlines' frequent-flier sites that provide participants with a few minutes of entertainment and the chance to win a prize.

Also important to engagement is the idea of a challenge with tangible goals and incentives and a gauge of progress. Challenges invoke competitive spirit and provide a sense of accomplishment. Interestingly, some features such as avatars or 3D space will be loosely translated as a focus on identity or structure while others, like clear story lines, currency to drive incentives, or feedback that measures progress, will be more directly visible.

Highly entertaining

The entertainment industry will be the trailblazer in terms of user experience. To a large extent, it already is. More and more consumers worldwide are using their TV sets not just for broadcast and cable viewing but to watch movies on demand—and to stream what's on their computers to a bigger screen.

At the same time, entertainment is now free of the constraints of the home theater setup. The episode of your favorite comedy that you missed last week is seen as easily on your Motorola Droid phone as it is on your laptop or TiVo. North American and European consumers are getting used to the idea of decoupled content, broadcast, and device. Many of their counterparts in South Korea, Japan, and now China are already quite familiar with the concept.

The decoupling is moving fast. Already, Google TV promises "a full Web browser on your HDTV screen." And more and more entertainment-center products—not only the TV set itself—can now connect to the Internet for fast access to movies, music, and more.

The point is that entertainment experiences will span more and more devices and tap into more and more sources of content. Increasingly, we will have to rethink our concept of "the TV" so that we separate the device from the service and the service from the process of streaming content. Broadcast as we know it will fade away, edged out by personalized services. The idea of watching football games or Formula One races, with surrounding advertising matched to your profile, is not so far away.

It's clear that as the TV set, the content, and content-delivery processes become more digital, TV will become more Web-like. We are not talking about Web pages and hyperlinks; we mean "Web-like" in the sense of optimization, personalization, and advertising focused on what will appeal to you.

Interacting through more than touch

Third, more and more consumers will expect natural interfaces that require little learning and have few or no barriers to use. Touch screens, of course, have become familiar as standard interfaces for phones, airport check-in terminals, ticket vending machines, and tablet computers. Now we see touch screens migrating rapidly into laptops, desktops, and panel displays in public places. As a next step, we expect multiscreen interfaces—for instance, pairing an iPhone or iPad with a personal computer for additional input.

Gestures comprise a logical extension to touch interfaces. They are already becoming common on phones and tablets. And in the consumer realm, Nintendo's Wii gaming system set the bar—and raised the kinds of "Why can't we do that here?" questions that will help us use waving and pointing and more of these natural forms of expression to control our devices.

Possibilities that are being explored include tilting, rotating, or waving a device to turn it off or on or to switch screens. Gestures will also be used to control common user-interface tasks such as scrolling and switching windows. And they will involve interesting combinations of intuitive and learned behavior—for instance, flicking left to right to move through lists.

Voice is the great hope for tomorrow. While voice inputs do well with limited vocabulary sets and are usually good enough for common command sets and simple scripted interactions, the technology still has not developed to the point where it is good enough for, say, dictation.

We are confident that in a few years we will be able to use a broader range of voice-controlled inputs to control our phones and car communications systems. But for several years to come, most of us will still be struggling to make ourselves understood when calling "customer service."

Action step

Start planning for superior user experiences that help to boost customer satisfaction—experiences that have little or no cognitive cost of switching from one context to another, that are very engaging, and that are entirely natural, requiring little or no learning time.

Seeing Beyond the Walls: The Process of Change Begins Here

The trends discussed in this report will have profound impacts on IT inside the enterprise. But if they are to realize their full impact, they must not be addressed in isolation.

The themes discussed in this report will have profound impacts on IT inside the enterprise. Faced with change on so many fronts, IT specialists have to be prepared to change too. When faced with many changes all at once, they can't afford to become overwhelmed. Nor can they afford to haphazardly reap the benefit of one trend or other in isolation.

Instead, a more effective planning approach starts by actively looking for connections among the themes inside one's own organization. The cloud, for instance, pervades several of the themes. It is a major influence on the distribution of data, it raises questions about information security, and it presents new ways to conceive of IT architecture. So the relevant question for an IT leader might be: How do your cloud strategy and your data strategy collide?

Essential IT capabilities

A useful next step is to understand how the trends apply when mapped against the capabilities that should be part of the fabric of every IT organization—capabilities in which high-performance IT groups excel:

IT governance
Perhaps the most significant changes requiring a reevaluation of IT policies are related to security and privacy. These can no longer be seen as black-and-white issues, but rather as shades of grey. IT governance thus should set clear policies and guidelines around risk tolerance, so that the IT organization can understand where it is positioned along the security and privacy continuum – and where it should be positioned.

Architecture
New infrastructure architectures will continue to emerge. That means system architecture should be decoupled from infrastructure architecture as well as data architecture. You want your system to run on any architecture and to become reconfigurable. The goal is to set the enterprise on a course toward greater agility.

Information management
Distributed data requires good master data management, which is the foundation for better analytics and for managing data privacy – two crucial differentiators. Converting data to data services will also help you decouple the data from applications – the first step to achieving a true data platform.

Workforce and resource management
New and advanced skills will be needed for data management, architecture, security, and analytics. Obtaining these skills will require a clear workforce and compensation strategy that emphasizes hiring, training, retaining, or outsourcing to the best talent available. Just as importantly, your people must be willing to embrace change.

Security
The new challenges include the cloud, the consumerization of IT, and the complexity of cyber threats. High-performing organizations will take a practical rather than emotional approach to the new devices and new IT reality, informed by their tolerance for risk and policies on risk management. Threat complexity, for its part, merits coordinating responses with partners in industry and government.

Solutions delivery
Business needs should motivate adoption of new technologies in your solutions. For example, a practical approach to security and privacy, and therefore cloud adoption, will help your businesses speed time to market. Focusing on decoupled architecture will increase agility, so that you can respond to market shifts quickly. And a focus on analytics will help the IT organization to become a close partner with business units in making better decisions that lead to improved business outcomes.

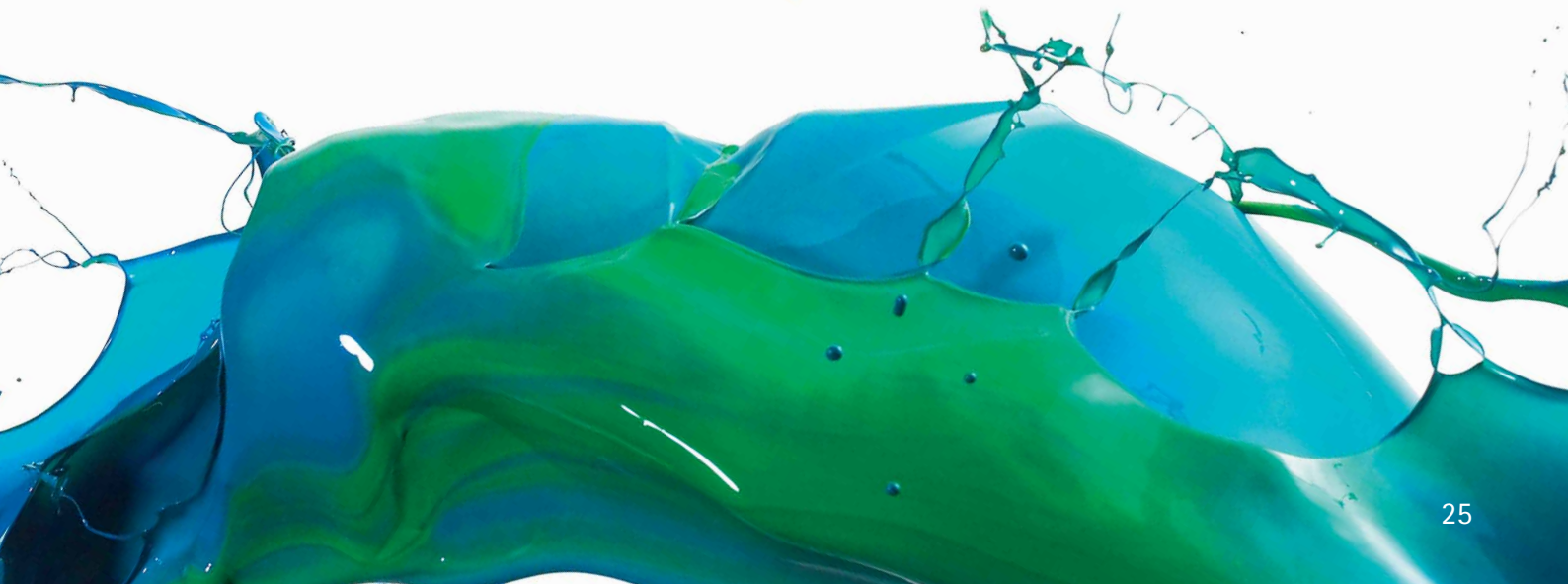
Service management
Although most technology trends are raising user expectations, the reality is that IT specialists actually have less control over the technology universe. As a result, it pays to understand user expectations, to improve the user experience with processes and interfaces, and to obtain the right providers motivated by the right incentives.

Outsourcing
Buying services involves different skills than buying products. In addition to the traditional emphasis on technology features, what matters in services are the viability and business practices of the provider. You need to understand the economics of sourcing, the trade-offs involved, and the strengths of various providers. Outsourcing has moved beyond commodity functions to include a partnership with organizations that provide sophisticated skills in security, analytics, architecture, and other crucial activities. Sourcing and vendor management thus have become critical skills.

Strategic IT alignment
In the past, alignment referred to how the IT organization served the business's needs. The new trends discussed here, and their accelerated pace, shift the alignment emphasis to educating the business about what new technologies can do and how IT can help improve execution of the chosen strategy. In that way, the IT function can move from its focus on service-level agreements and costs to being a creator of value. That is the next frontier of high-performance IT.

Accenture's Technology Vision 2011 report describes discontinuous change and explains why IT leaders and their business colleagues now need to recast their approaches to technology in the context of these capabilities. Specifically, they must accept that everything – hardware, software, applications, data – will be distributed. They must accommodate the fact that everything – data from data representation, infrastructure architecture from application architecture, business processes from applications – will be decoupled from everything else. And they have to recognize that everything will be analyzed – structured data, unstructured data, meta-data, and even keystrokes on a web site.

The organizations whose IT and business leaders are quick to grasp those realities will be those that rapidly pull away from the pack.



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Additional Resources

Mind the Gap: Insights from Accenture's third global IT performance research study.

▶ Register to Download PDF

Computing in the clouds.

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Cloud Computing – Where is the rain?

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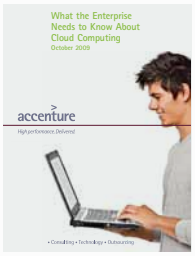

What the enterprise needs to know about cloud computing.

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Research Methodology

For this year's Tech Vision report, we cast the net wider and deeper than before. In late 2010, the Accenture Technology Labs developed hypotheses about information technology developments that will have a significant impact on Accenture's clients in the next five years.

At the same time, a wide range of other sources was scanned to add ideas to the mix. The sources included the recent activities of commercial R&D labs, the flow of venture capital funding, trends highlighted by IT analysts, key themes at industry conferences, and the academic literature.

We also drew on Accenture's High Performance IT research and on the findings from our annual IT Executive Forum. And we tapped the expertise of Accenture practices in areas such as analytics, IT security, and Innovation.

The response—approximately 400 hypotheses with input from scientists, architects, and engineers—covered topics as well publicized as cloud computing and mashups along with many others much less familiar, such as text mining and sensor fusion. The team then worked with the R&D groups to look for overlaps and redundancies, and to test each hypothesis against these six criteria:

- Certainty of transformational impact on corporate IT departments
- Velocity and scale of technology change
- Impact beyond any one IT "silo"
- More than a "one for one" replacement of an existing solution
- Being actively explored today and considered practical for the near future
- Transcends any one vendor or discrete "product" technology

Out of this process came more than 50 defensible hypotheses that were synthesized into the themes presented in this year's report.

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About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with approximately 211,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world's most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US$21.6 billion for the fiscal year ended Aug. 31, 2010. Its home page is www.accenture.com.