

Staying aloft in tough times

Why smart, innovative businesses are turning to cloud computing



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Introduction

Digital technologies are transforming business. From the manufacture and sale of goods to energy conservation and financial services, business processes across the industry spectrum are being digitized, infused with unprecedented speed, capacity and intelligence. While such progress creates exciting new business opportunities and paths toward competitive advantage, a company's underlying IT delivery model must be resilient and flexible enough to support the associated and often dramatic business changes.

Cloud computing is one possible answer to the need for such flexibility, providing a highly automated, dynamic alternative for the acquisition and delivery of IT services. Today users are tapping into public and private clouds for computing resources and services without having to address the underlying technology. Companies are leveraging the massive scalability and collaboration capabilities of cloud computing to solve problems in ways that just weren't possible before. They are deploying new services with greater speed and without additional capital investment. As IT budgets continue to be stretched, cloud computing is enabling CIOs to do more with less. Virtualization, standardization and other fundamental features of cloud are lowering the cost of IT, simplifying IT service management and accelerating service delivery.



Such operational efficiency is helping companies capitalize on the globally networked world. It is enabling CIOs to leverage the infrastructure more effectively to support the business goals of their company. By lessening the drag on data center resources, cloud computing is enabling IT to hone in on real value creation, namely innovation. Rapid, technology-enabled innovation is vital to staying afloat in a highly volatile and uncertain economy. Cloud computing provides the platform for optimizing operations while creating and delivering the kind of innovative services that differentiate and propel the business forward.

Cloud computing—a smarter way to work

Cloud computing offers a compelling alternative to current IT delivery models, as IT departments are being driven to create cost efficiencies while providing an improved user experience. Energized by current economics, the proliferation of high-speed Internet connections, and cheaper, more powerful computing technology, cloud computing is already supporting thousands of devices, from mobile phones to cars. It is increasingly becoming an accepted service delivery model for the agile enterprise.

In a cloud computing environment, applications and services are not tethered to specific hardware components. Instead, processing is handled across a distributed, globally accessible network of resources, which are dispensed on demand, as a service. The availability of a highly dynamic infrastructure enables corporate data centers to

Attributes of the cloud

- *Enhanced user experience via a simplified user interface (a selectable catalog of services)*
- *Automated provisioning of computing resources and services*
- *Elastic scalability*
- *Highly virtualized infrastructure*
- *Inherent resiliency and security*
- *Standardized set of offerings, leveraging common software stacks and operational policies*



operate with improved flexibility and scalability, ready to respond quickly to changing business requirements and unexpected opportunities. Such flexibility is essential in the fast-paced, constantly changing, globalized world—and even more so in an economic downturn, where rigid and fragmented infrastructures can severely limit a company’s responsiveness.

The cloud computing architecture enables this kind of flexibility via a highly virtualized, automated and service-oriented design. Companies gain rapid, real-time access to vast computing power, storage and applications. In the process, they become better able to develop and deploy new applications, improve their quality of service and bring their core services to market in response to evolving consumer priorities and market challenges. It is agility that will be the lifeblood of successful business going forward, and cloud computing is one way of gaining agility.

By enabling this kind of dynamic adaptation, cloud computing is helping companies tap into services and information that allow them to work smarter and take advantage of the increasingly digital, networked world in new ways. Consider how cloud computing expedites a European company’s fluid, aero- and thermo-dynamics analysis growth plans. The company provides the resources to its customers for intensive computing analytics, recognizing that to significantly grow the business they would need real-time access to high volume computing capacity from anywhere in the world. Cloud computing provided the company with the needed infrastructure and has fueled a growth rate of more than 100 percent per year for the last four years, enabling the company to expand from a regional to a global enterprise.



Imagine the operational and cost efficiencies made possible by cloud computing's fundamental attributes, including:

- A self-service portal that allows users to request hardware, software and applications from an online catalog with a focus on ease of use
- Self-managing, autonomic systems that enable capacity, provisioning and other IT service management decisions to be made dynamically, without human intervention or increased administrative costs
- Seamless elasticity to scale computing resources up or down, as required, to fulfill changing needs without service interruption
- Highly resilient and secure applications, and an underlying infrastructure capable of meeting expected levels of availability, reliability and integrity
- A highly standardized environment that facilitates simultaneous service deployment and upgrades for all users, no matter where they reside.

This is the essence of cloud computing: enabling companies to work smarter, more efficiently and more profitably; making technology more affordable and easier to use; improving the way business gets done.

Cloud computing helps increase operational efficiency as it relies on a high degree of standardization. Public clouds in particular drive companies to standardize by identifying workloads that can be scaled and managed in mass. Private clouds offer the added bonus of enabling companies to leverage the scale inherent in their existing

hardware by dramatically improving asset utilization (Figure 1). Rather than deploying and maintaining multiple instances of an application, cloud computing enables companies to standardize on a single instance. Standardization on this scale significantly reduces labor and other IT operating expenses while increasing availability. Similarly, cloud computing's highly virtualized infrastructure reduces IT capital expenses, consolidating data center resources and preventing the need for additional investments in hardware and facilities.

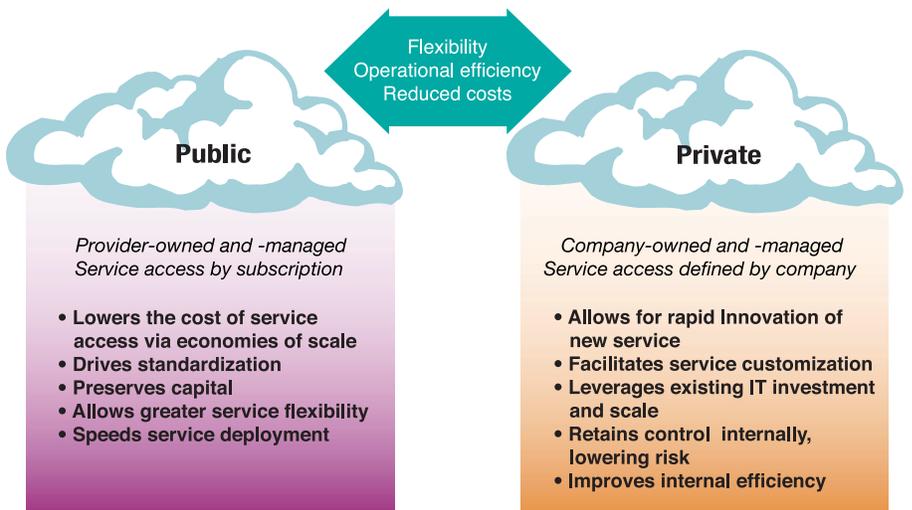


Figure 1. Both private and public clouds drive flexibility, operational efficiency and cost reduction while enabling companies to meet different business requirements.



Furthermore, cloud computing provides a cohesive platform for more rapid, full-scale adoption of virtualization and other business-enabling initiatives such as service oriented architecture (SOA), Web 2.0 and information integration. Cloud computing improves their function and capability by providing the scalability, automation, service management and geographic mobility to make them more robust. Take virtualization, for example. In a typical data center environment, virtualization allows computing resources to be shared among various applications and workloads, but it is limited by the size and resources of the environment. Cloud computing enables these applications and workloads to draw from a massively scalable pool of resources, beyond the borders of a company's own data center. It can migrate the workload to other data centers, even in other countries and continents—wherever computing is accessible, less expensive and more efficient—while adhering to user, business and regulatory requirements.

Innovation fueled by cloud computing

In a troubled economy, companies are pushed to increase their efficiency and eliminate waste. As a result, the very education, research and development activities that lead to new, innovative ways of working are often the first to be cut from the budget. There is tremendous pressure to conserve cash and limit new capital investments. Needless to say, it can be challenging for senior executives to find funding for innovative ideas.

Research has shown that investment in technological and business innovation can greatly contribute to business and revenue growth while the opposite can severely limit a company's ability to stay competitive.¹ The good news is that cloud computing can facilitate innovative activities while conserving cash.

Innovation portal in a cloud

Building and sustaining a highly competitive and skilled workforce is a priority for the Vietnamese government. In 2008 government leaders agreed to launch a technology-based innovation portal to facilitate collaborative relationships with universities and research institutions around the world. The portal, located in IBM's cloud infrastructure, enables Vietnamese educators to develop curriculum for the country's emerging science and research disciplines, and it supports R&D activities among Vietnam's broader academic and business communities.

For example, IBM's internal European Learning Center was struggling to keep up with the demands for new classes in a timely fashion and, therefore, was experiencing budget limitations. It was taking anywhere from 6 to 12 weeks to develop new courses. However, by leveraging cloud computing resources instead of the current fixed IT assets, the Learning Center was able to reduce course creation time to a matter of days, or even hours, thus enabling education to contribute much more to the business than at any time prior using fewer resources.

Clouds can provide rapid access to computing capacity at a lower cost of ownership, enabling companies to perform operations that may have previously been unaffordable or impractical. So it's no wonder that the research and development community is turning to cloud computing for their most data-intensive processing, modeling and analytic applications (see sidebar). This includes solving intricate scientific problems like understanding climate change and pinpointing key enzymes in the development of new drug therapies. For example, cloud computing is enabling innovators to more affordably leverage the technologies required to understand the causes and speed the cures for brain-related illness. The same holds true for overcoming specific business challenges, like risk management. Financial services firms, for example, are using cloud computing technology to affordably access the hardware and software required to perform the complex computations involved in predicting business risk for their customers.

Innovation can most effectively be supported by rapid access to resources, process simplicity and efficiency, and autonomic functions that minimize human error. Cloud computing can provide a company's innovators with just such an environment in which to develop and test their ideas.



In the IT organization or the software lab, the cloud computing ecosystem provides automated access to development tools, application programming interfaces (APIs) and standardized services that developers can use as the basis for innovation. Instead of having to dole out funds for a development server, companies of every size can test new applications or prototypes on virtual machines in the cloud architecture, without procurement and provisioning delays. Instead of focusing on the logistics of finding and managing resources that enable application development and testing, developers can focus on innovating.

Cloud computing also provides the social network infrastructure for innovators to share their ideas with the extended business community. Whether they are scientists, business analysts, software developers or entrepreneurs, innovators can collaborate more easily when they are working in a shared cloud computing environment. The connection between collaboration and innovation has been well documented.² Collaboration provides the energy and emotional support that are critical to getting new ideas off the ground and facilitates the back-and-forth dialog to take those ideas forward.

With so many organizations spread out across international borders, travel budgets dwindling, and more and more personnel working remotely, a shared cloud service can provide an efficient platform for day-to-day collaboration among a company's employees, business partners and customers. For example, a shared application development environment hosted in a cloud would allow access and contributions from any collaborator on any networked device irrespective of physical location, enabling collaboration across geographic and organizational boundaries. It also eliminates incompatibility by facilitating collaboration on a common platform with common tools.



Cloud computing can also bring together innovators from around the world and unite an enterprise. The Sogeti Group, an international IT consultancy of 18,000 employees, used an IBM cloud, Web 2.0 and social networking technologies as the platform for a companywide, 72-hour brainstorming event aimed at developing innovative solutions to improve client service and accelerate growth. Following the event, cloud computing continues to facilitate the creative exchange, enabling employees to refine and implement their ideas.

Reaching into the cloud infrastructure for services

Cloud computing can have a significant impact on companies' financial performance, altering how they operate and enabling them to target new markets and streamline their supply chains. Companies like Google, Amazon.com and eBay are building the future of their businesses with cloud computing, using it to both sustain growth and to bring innovative new services to businesses and consumers. Being able to make these kinds of transformational advances, rapidly and before competitors do, can lead to increased market share and higher margins, especially as business development budgets are squeezed.

In the globalized world, differentiation is imperative but increasingly difficult to achieve. CEOs and other top-ranking business leaders interviewed for IBM's Global CEO Study 2008 believe the answer lies in altering their current business models.³ Many see the necessity of capitalizing on new delivery channels made possible by the Internet. They are rethinking how they acquire and deliver services and where those services reside. Nearly three-quarters are looking to form external partnerships.



Cloud computing can help with all of these things. It enables companies to offload noncore computing functions like password management, dynamic provisioning and data partitioning to external partners. It enables companies to acquire the services or computing capacity needed to enter new markets or cross over into new industries.

A quicker path to market

Acquiring cloud computing services is only half the opportunity. Forward-thinking companies will *deliver* cloud computing services as well. Today the number of private enterprises delivering services from their own cloud or a provider's cloud is growing. Cloud-based service delivery changes the way companies interact with their customers, employees and business partners. It changes the dynamics of the supply chain and enables companies to profit from their core competencies in new ways, with new customers.

With business leaders under mounting pressure to compress the time-to-market for new services, cloud's ability to marshal cost-effective, optimized computing resources in a matter of hours or days versus weeks and months is a real advantage. Cloud computing's loosely coupled, services-based architecture enables companies to assemble desired services rapidly in mashups and composite applications based on specific work needs or market demands. Being able to do this independent of the underlying systems invariably improves workforce productivity and market delivery speed.

Business as usual following Hurricane Ike

Houston was plagued by floodwaters that downed trees and power lines following 2008's Hurricane Ike, but Neighborhood Centers, a nonprofit, human-services agency in Houston, didn't suffer a single business disruption due to data loss at any of its 20 facilities. Using the cloud to back up server and PC data reduced the risk of loss. When the hurricane hit, Neighborhood Centers' data from locations across the city was securely stored offsite. Following the storm, the agency was back to business, providing support to families in need.

The availability of affordable resources can also be vital to the speed of service delivery in the aftermath of a natural disaster, when federal, state and local agencies must act quickly to help affected individuals. Cloud computing services could enable insurance providers, for example, to address peak requirements for the resources needed to conduct damage assessments and file claims, while allowing them to pay only for the resources they use when they use them. Cloud computing can also be used preemptively to shift proprietary files for temporary storage, preventing loss and accelerating recovery (see sidebar). In this respect, cloud computing can be an excellent addition to a company's enterprise business continuity and resiliency strategy.

Security strength in public and private clouds

Security is a major concern for cloud computing, as it is for any new technology. Reliability, data security and compliance are the most frequently discussed risks. The external nature of public clouds brings additional concerns about loss of control and sharing data outside the firewall. Still, with careful planning and a strong understanding of the security controls and practices built into service providers' cloud offerings, organizations can reduce risk and reap the rewards of a cloud-based environment.

To determine the appropriate cloud environment for specific business and IT functions, organizations need to take the time to properly identify the data and workloads that require a higher degree of resiliency, isolation and control. Clearly, private clouds reduce risk by keeping cloud services in-house, while public clouds are an excellent fit where loss of control is not an issue. With both options, organizations have a responsibility to understand how to properly integrate, deploy and manage security.



Security issues are well publicized, and the reality is that there is a difference in the way in which security needs to be administered in the cloud. In the cloud, it's difficult to physically locate where data is stored. Security processes, once visible, are hidden behind layers of abstraction. The most significant difference stems from the sharing of infrastructure on a massive scale. Users spanning different corporations and trust levels often interact with the same set of computing resources. Layer on top of that the dynamic and transient aspects, the desire to continually load balance and optimize for performance, energy, availability and other service level objectives that customers pay attention to and the problem becomes further complicated, creating more opportunities for misconfiguration and malicious conduct. This calls for highly automated end-to-end security across the threat spectrum of information security. Cloud providers will need to provide security at a level comparable to—if not better than—the levels companies can provide for themselves in traditional infrastructure environments.

Interestingly, cloud computing could actually make leading security technologies more accessible, especially for companies that already struggle to effectively implement them or justify their cost. In a cloud environment, security can be delivered as a service, at a scale commensurate with both the user's needs and the level of threat, requiring little or no security device investment or maintenance. In-the-cloud mail security, vulnerability assessment services, and 24x7 security event monitoring are some prominent examples, allowing vendors to leverage purpose-built infrastructures and portals to provide security for a wide variety of customers. The result is a smarter, enterprise-caliber risk management at a much lower expense for private and public clouds than for traditional infrastructure environments.

Automating energy management

Even in heterogeneous work environments, cloud computing makes it possible to consolidate workloads to save power.

For one company, that meant migrating its J2EE™ work from its IBM System p® servers to IBM System z® mainframes that were not fully utilized on weekends. Workloads handled by the Linux®-based System p servers during the week were automatically shifted to Linux partitions on System z during the weekends.

The System p machines would gracefully power down every Friday evening and power up again every Monday morning, triggered automatically by timers and server utilization levels.

The environmental impact of cloud computing

Another compelling reason to consider adopting cloud computing may be its potential to reduce enterprise energy dependency. After years of business-driven expansion, it's no surprise that many of today's data centers are overcrowded, consuming a substantial amount of energy resources. Cloud computing employs a highly virtualized, shared dynamic infrastructure that will enable companies to evolve to a greener, more holistic approach to data center management via greater economies of scale, workload balancing and the integration of IT services with power and facilities management.

Within the data center, workloads can also be dynamically reallocated from hot spots to cool spots (see sidebar). Technologies like Live Partition Mobility and VMotion can shift work autonomically between host servers in a homogeneous environment, without the disruption of a reboot. IBM Tivoli® Service Automation Manager can provide a similar service management function in multivendor and multiplatform environments.

With its focus on resource conservation, cloud computing encourages good service management practices like enterprise content management, which helps keep the volume of active data under control via regular archival and disposal of redundant data. With less data to manage, it is possible for companies to increase their processing speeds while decreasing their carbon footprint. That is smart computing, to be sure.



Today more than two-thirds of business leaders report using corporate social responsibility as a platform for growth.⁴ Contributing to the well-being of the societies and environments in which they operate has been shown to have a positive financial return. For example, companies and government agencies are using cloud computing to make services and applications accessible and economical for emerging nations—providing the means to improve their agriculture production, healthcare, education systems and, in short, their way of life. And with mobile devices becoming increasingly ubiquitous in these areas of the world, more people will be able to tap into cloud infrastructures for real-time services and information. The effect on their standard of living and the global economy could be considerable.

Readying the enterprise for cloud computing

With many cloud services available over the Internet, with payment by credit card, it's easy for individual business units to get some base experience with cloud computing. However, preparing the enterprise to leverage cloud computing as an IT delivery method for its own services requires a methodical and strategic plan. By taking a measured, step-by-step approach to transition, establishing interim milestones and introducing new variables only as appropriate, CIOs can drive the migration to cloud without putting budgets, projects or personnel at risk. IBM recommends that companies put in place three fundamental prerequisites in order to accelerate enterprise adoption and optimize return on investment: dynamic infrastructure, IT services affinity assessment and cloud strategy.

Mapping your company's path to the cloud

IBM's cloud consulting services are designed to prepare the enterprise for cloud computing. Services include:

- *Assessing the total cost of ownership for building and integrating cloud computing capability using economic modeling*
- *Developing a cloud strategy, based on your business and IT objectives*
- *Planning, configuring and testing the servers, storage and technologies necessary to deploy cloud services from inside your own data center.*

Learn more at ibm.com/cloud

A dynamic infrastructure is foundational to cloud computing. It's the underlying technology that automates and simplifies the IT operation, enabling IT to respond with ease to changing business conditions. A dynamic infrastructure integrates capabilities like virtualization, SOA and Web 2.0 with service management automation and standardized system images and processes to radically improve operational efficiency. Certainly, implementing these capabilities alone can transform the IT operation, but it can also speed the move to cloud while delivering important near-term benefits like reduced cost and complexity.

CIOs need to carefully assess their IT services and identify those that are most compatible with the attributes of cloud computing. It is often too risky or too costly to continually shift mission-critical services to new environments to keep up with growth. Therefore, many companies today are leveraging the elastic scalability of cloud computing to support these applications in an ongoing fashion. Additionally, some of these applications have regular occurrences of capacity need, and therefore cloud computing can be used to supplement a traditional IT deployment.

Other IT services really lend themselves to cloud computing, with the potential to be delivered at new levels of standardization, automation and cost. These services can be differentiating for the business—like Web applications or development and testing environments. Or they can be applications like e-mail and collaboration that are highly standardized and, so, easily automated. Lastly, there are extremely complex services that demand substantial resource capacity, such as scientific modeling and simulations. These stand to reap the greatest benefit from cloud computing, which makes their processing more affordable and practical. Companies that understand their IT services' affinity for cloud computing and can make cloud implementation decisions accordingly have the ability to lower the risk and increase the payoff of cloud computing.



Finally, and above all, it is important to have an overarching strategy for cloud computing—a phased, pragmatic approach that provides a business context for the enterprise’s cloud investments and anticipated returns. Since cloud computing is not just about technology, the plan should factor in the role of people, processes and services. The enterprise needs to be prepared culturally and organizationally as well as technically. Similarly, IT needs to understand all aspects of service delivery: applications and business processes, as well as infrastructure services. Much of cloud’s promise is predicated on a holistic view of delivery and the experience it creates for end users.

Cloud’s ease of use will clearly drive more self-service, helping to increase user satisfaction. For IT, that will mean a new level of discipline and process standardization across the interrelated services that it currently supports. For example, standardization will enable formerly siloed sales systems to become integrated with inventory and manufacturing systems, further enhancing the user experience.

As cloud extends the boundaries of the IT operation, it will also demand a new kind of IT accountability. Implementing and managing a hybrid cloud environment—with public clouds for the enterprise’s less critical, low-risk services and private clouds for mission-critical core applications that define the business—as well as managing cloud sprawl, will necessitate a strong governance framework. Governance not only sets the policies and puts the tools in place to manage security, service levels, regulatory compliance and other delivery issues, it also helps ensure alignment between cloud strategy and the enterprise strategy.



Conclusion

The continuing demand for business expansion, profitability and an enhanced user experience is clearly accelerating the move to cloud computing. Cloud answers the enterprise's need to simplify and to use the best resources from the best devices, wherever they happen to reside on the network. For CIOs, it's an opportunity to reduce operational complexity and focus on delivering greater value to the organization.

Enabled by near ubiquitous network access, cloud computing stands to significantly improve IT's ability to deliver technologies like SOA, Web 2.0 and virtualization by reducing technical complexities and simplifying deployment. But cloud computing's real potential lies in the opportunities it can create for the business. By connecting people to information and the vast array of services available to them, it can spark new opportunities for working smarter and accelerating innovation. By making massive computing resources available and affordable, cloud computing provides a platform for collaboration, business differentiation and sustainability. It enables companies to focus on the business, not the infrastructure supporting it. It is a tool that should be considered as an important aspect of an organization's IT strategy.



For more information

To learn more about cloud computing and IBM's vision for a smarter planet, please contact your IBM representative or visit:

- ibm.com/cio
- ibm.com/cloud
- ibm.com/think

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