

Moving to the Cloud: An Introduction to Cloud Computing in Government

By David C. Wyld

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What Is Cloud Computing?

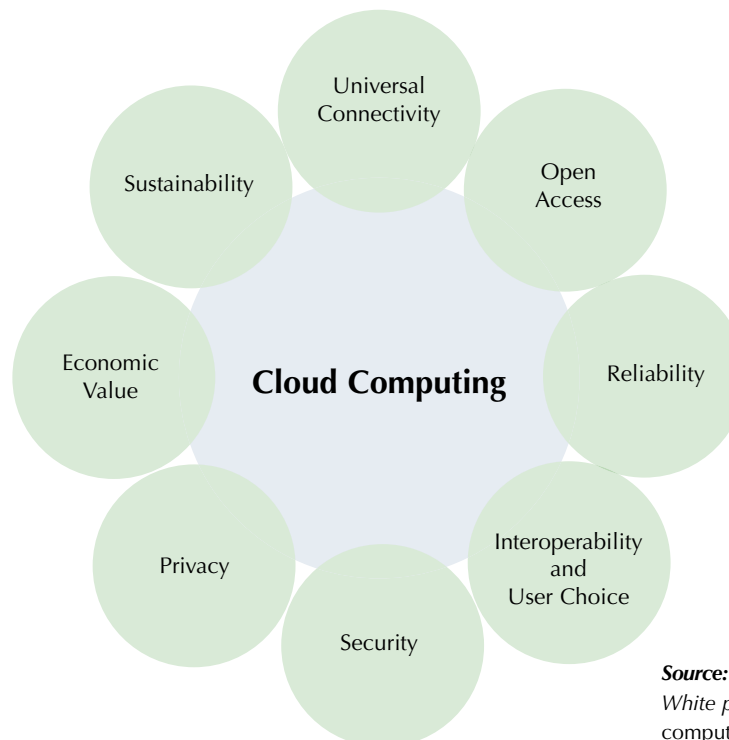
Cloud computing is an emerging concept. It has many names, including grid computing, utility computing, and on-demand computing. Indeed, one of the hindrances to the development and adoption of cloud computing is the lack of understanding of what it is—and isn't—among both private- and public-sector leaders.

The term "cloud computing" has at its core a single element: computing services are delivered over the Internet,

on demand, from a remote location, rather than residing on one's own desktop, laptop, mobile device, or even on an organization's servers. For an organization, this would mean that, for a set or variable, usage-based fee—or even possibly for free—it would contract with a provider to deliver applications, computing power, and storage via the web.

In a nutshell, the basic idea of cloud computing is that computing will become location- and device-independent—meaning that it increasingly will not matter where information is housed nor where computation/processing is taking place. This enables computing tasks and information to be available anytime, anywhere, from any device—so long as there is access to the Internet. The cloud concept also means that, for individuals and organizations alike, computing will increasingly be viewed as an infinite, not a finite, resource. This is because

The 8 Fundamental Elements of Cloud Computing



Source: Based on Rayport and Heyward (2009).
White paper: Envisioning the cloud: The next computing paradigm, a marketspace point of view.

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computing is taking on an on-demand, scalable form, as additional network bandwidth, storage, and computation capacity can be added as needed, much as people simply use—and pay for—more (or less) electricity as their energy needs change. For this reason, many—even in the industry—refer to this as the utility model of computing.

If industry analysts are correct, we are at an inflection point—a true paradigm change—in the evolution of computing. The history of computing consists of a series of such shifts, from the era of the mainframe to the advent of the personal computer (and now, to mobile devices and netbooks), from the client-server model to the networked model, and from the age of isolation to the age of the Internet. While there are many uncertainties regarding the speed and ultimate reach of cloud computing, one thing that does appear very certain is that “business as usual” is soon going to be very different in our work and personal lives because of the advent of cloud computing.

What Are the Benefits of Cloud Computing?

Cloud computing offers a number of benefits, including the potential for:

- Rapid scalability and deployment capabilities (providing just-in-time computing power and infrastructure)
- Decreased maintenance/upgrades
- Improved resource utilization—elasticity, flexibility, efficiencies
- Improved economies of scale
- Improved collaboration capabilities
- Ability to engage in usage-based pricing, making computing a variable expense, rather than a fixed capital cost with high overhead
- Reduced information technology (IT) infrastructure needs—both up-front and support costs
- Capacity for on-demand infrastructure and computational power.
- Green-friendly—reduced environmental footprint.
- Improved disaster-recovery capabilities

All who are working in government IT—and in government itself—need to be aware of cloud computing and consider the possibilities it holds, along with the people, technology, procurement, and governance issues raised by its advent. Cloud computing undoubtedly changes how we individually and collectively will approach IT.

We already use aspects of cloud computing in our personal lives, and we are migrating to the cloud model in our work lives. The shift to cloud computing will also change how perhaps billions of dollars of IT spending are directed. The challenge, as the chief information officer of the United States, Vivek Kundra, has framed it, is to have the government IT work as well as IT does for ourselves in our own personal lives.

Challenges in Moving to the Cloud

The Economist stated in 2008, “[T]he rise of the cloud is more than just another platform shift that gets geeks excited. It will undoubtedly transform the IT industry, but it will also profoundly change the way people work and companies operate. It will allow digital technology to penetrate every nook and cranny of the economy and of society.”

IT executives must decide whether the cost savings and flexibility/scalability to be gained through shifting data and functions to the cloud are worth the trade-off in terms of control and security. One analyst points out that many IT executives in both the private and public sectors have been reluctant to jump on the cloud computing bandwagon due to “traditional corporate computing concerns like the security of data, reliability of service and regulatory compliance.”

Indeed, many public-sector IT executives like the idea of shifting data and applications to public clouds, but control, access, security, and interoperability issues will need to be resolved before their organizations could make use of public clouds.

Following are 10 major issues facing government leaders in the shift to using cloud computing:

The Need for Scalability. In today’s environment, IT resources will need to become more flexible, agile—in other words, scalable—for all organizations. Cloud computing turns the economics of IT on its head, due to an unprecedented elasticity of resources.

The Need for High Reliability. Cloud providers invest a great deal in their systems to provide for reliability and assure that their services—and user data—will be available on demand. However, even for private-sector IT executives, there is a reluctance to shift core, mission-critical data storage or applications to public cloud environments, even if the cost savings and efficiency arguments are there, over concerns about the reliability and security of cloud offerings.

The Need for Securing Data in the Cloud. IT executives stridently believe that their own hosted systems are far more secure than cloud-based resources and public sector IT managers stridently believe that their internal operations are more secure than those that a private-sector vendor could provide. However, analysts have stated that one of the benefits for small companies is that they may, in fact, be able to raise the level of their computing security by moving more data and applications to the cloud. This is simply because cloud providers will have more resources to spend on security for their operations than most individual firms.

The Need for Open Standards and Interoperability. One of the primary concerns regarding cloud computing that government IT executives consistently express is a fear of being locked into vendors, due to the high switching costs—both in dollars and in time and effort—that would be incurred when switching between cloud-computing providers. One of the principle ways that government can help foster the overall growth of cloud computing is to support the establishment of standards that will ensure common architectures and portability of data and files.

The Need to Revise Procurement Practices. Some have suggested that, with federal contracting currently not geared toward purchasing IT on an “as-needed” basis, it will be incumbent upon cloud providers to educate lawmakers as to cloud computing’s benefits and the changes in contracting rules that will be necessary to facilitate such procurements. Current federal guidelines are not geared toward purchasing computing on a pay-as-you-go, as-needed basis.

The Need to Resolve Potential Legal Issues. Congress will need to streamline decades-old electronic privacy and data protection regulations to conform to today’s computing realities—and to prepare for tomorrow’s. As Bernard Golden points out in his article “Cloud computing meets Washington: Lots of data security and privacy questions” in the March 26th 2009 edition of CIO, inaction will not only inhibit governmental use of cloud computing, but wider adoption of cloud-based models in the private sector as well.

A Sampling of Cloud Computing Definitions

Author/Organization	Definition
The <i>Open Cloud Manifesto</i> Consortium	The ability to scale and provision computing power dynamically in a cost-efficient way and the ability of the consumer (end user, organization, or IT staff) to make the most of that power without having to manage the underlying complexity of the technology.
The University of California, Berkeley Reliable Adaptive Distributed Systems Laboratory	Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the Data Centers that provide those services. The services themselves have long been referred to as Software as a Service (SaaS), so we use that term. The Data Center hardware and software is what we call a Cloud.
Gartner	A style of computing where massively scalable IT-related capabilities are provided “as a service” using Internet technologies to connect multiple external customers.
Michael Brown	A data-processing infrastructure in which the application software—and often the data itself—is stored permanently not on your PC but rather a remote server that’s connected to the Internet.
Jaeger, Lin, Grimes, and Simmons	An emerging model of computing where machines in large data centers can be dynamically provisioned, configured, and reconfigured to deliver services in a scalable manner, for needs ranging from scientific research to video sharing to e-mail.

Ten Predictions for the Cloud-Enabled Future of Government

1. Cloud computing will take off at the local and state levels through mostly rogue, “under the radar” initiatives over the next few years.
2. At the federal level, there will be a coordinated move to cloud computing, but with inevitable tension between agencies.
3. There will be two to three incidents a year worldwide with potentially massive security breaches, involving much media attention and attendant calls for greater regulation and oversight of cloud providers.
4. There will be much cooperation between private sector firms (seeking to be cloud service providers) and government agencies, with far more data and applications than expected today transitioning to the cloud over the next decade.
5. Budget pressures will continue to drive more and more government IT to hybrid and even public clouds, as more and more former internal IT functions—and assets (hardware, software, data, and support personnel)—are outsourced, with billions in procurement dollars shifting to the cloud.
6. There will be greater use of cloud computing, in everything from healthcare and education to the military and national security.
7. Free cloud offerings—even beyond the e-mail, storage, and application functions found today—will be a significant part of IT portfolios in most governmental agencies.
8. The spillover effect of government use of cloud computing will include faster agreements among major cloud providers on standards and cloud interoperability protocols.
9. There will be significant legal action arising out of governmental uses of cloud computing, and legislation addressing both IT and business needs and consumer fears and protections will be a major focus over the next decade.
10. The “democratization of technology” brought about by cloud computing will impact the quality of our individual online lives, the growth of businesses, and the pace of innovation, benefiting us all.

The Need to Regulate the “Cloud Market.” Consolidation in the emerging cloud-services industry could be harmful—even threatening—to the economy, and, as such, must be monitored by governmental interests.

The Need to Redefine the Roles of the IT Workforce. The nature of IT jobs and the skills required to perform them will change markedly over the next decade. There will be less manual work needed, both in data centers (“racking and stacking”) and in the field (doing installations and upgrades). At the same time, there will be a greater emphasis on the negotiation, conceptual, and people skills needed to manage contracted cloud services. This will, of necessity, lead to changes in how IT and IT managers are evaluated for their performance.

The Need to Assess the Return on Investment of Cloud Computing. Most analysts have projected that cloud computing can deliver cost savings by outsourcing IT operations—perhaps as much as three to five times more cheaply than in-house data centers and hosted applications.

The Need for Government Cloud Coordination. As federal agencies establish their own private cloud environments, analysts have forecast that we are likely to see agencies sharing data centers and cloud services to facilitate collaboration and to share costs. It is vital that cloud adoption be government-wide, and not done on a piecemeal basis, in order not just to prevent more information silos from developing, but to provide the scale that will make the concept work even better than in an agency-by-agency framework. ■

TO LEARN MORE

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The report can be obtained:

- In .pdf (Acrobat) format at the Center website, www.businessofgovernment.org
- By e-mailing the Center at businessofgovernment@us.ibm.com
- By calling the Center at (202) 515-4504
- By faxing the Center at (202) 515-4375