Casting a Ray of Sunshine on Cloud Computing

By Jim Cooke and Shaun Kirby, Innovations Practice,
Cisco Internet Business Solutions Group

Executive Summary

KEY TAKEAWAYS

- Cloud services are in their infancy, and while many advances are required to realize their full potential, they present a paradigm shift that can transform the enterprise of the future.
- Organizations should stay informed about the evolution of cloud services and re-evaluate their potential benefit periodically as they evolve.

CUSTOMER IMPACT

- Cloud services can benefit customers by empowering them to:
  - Introduce new products and services quickly
  - Increase market share and revenue
  - Improve customer satisfaction
  - Increase innovation
- Customers must understand which aspects of cloud services they should adopt to avoid both the pitfalls of adopting too early and the danger of missing opportunities.

CISCO'S ROLE

- Cisco, a leading provider of cloud services enablers, plays a leadership role in defining the open standards that will govern cloud services of the future.

IBSG OPPORTUNITIES

- Any customer struggling to become more agile or to increase ICT efficiency should consider whether external cloud services make sense. IBSG can guide Fortune Global 100 customers in how to prepare for and take advantage of cloud services in the future.

Summary

There are a number of considerations executives at large enterprises need to know about cloud services, and what actions they should take today and plan for tomorrow so that they do not miss opportunities or commit too soon. This point-of-view paper focuses on providing insights to large enterprises that may be considering a cloud services strategy. It presents a framework that defines cloud services and their essential elements, examines their benefits and challenges, discusses where they are applicable today, and provides a roadmap for their potential uses, both now and in the future.

Introduction

It comes as no surprise that the buzz around "cloud computing" is getting louder. The volume of web searches on the topic of cloud computing has risen by a factor of 10 in the past 12 months, according to Google Trends.

Everyone from the boardroom to the mail room is talking about cloud computing, but a precise definition remains elusive. As a metaphor for the Internet, "the cloud" is a familiar term, but when "computing" is appended, the meaning becomes muddled. In research conducted by the Cisco IBSG Transformational Technology Team, we found numerous definitions for "cloud computing," ranging from the narrow definition of an "updated version of utility computing"—basically servers available over the Internet—to broader definitions asserting that anything consumed outside the firewall is "in the cloud," including conventional outsourcing.

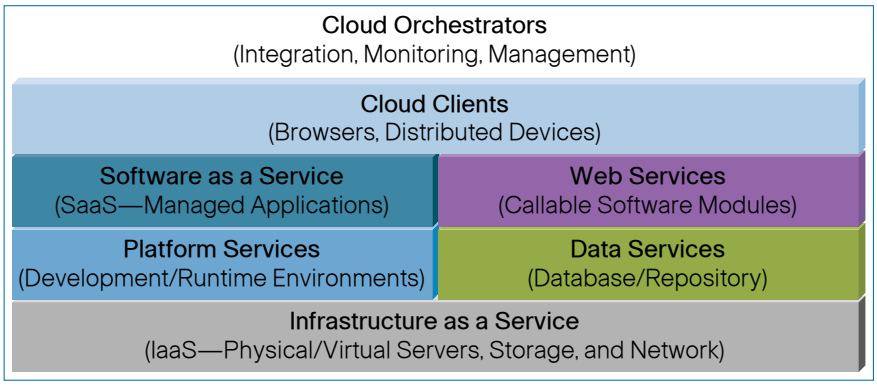
However it is defined, cloud computing is creating quite a furor. The excitement over cloud computing stems from the belief that it could represent the dawn of a new era in IT, enabling unprecedented business agility and efficiency. At the same time, healthy skepticism abounds, given both the uncertainty surrounding the definition and the frequent reports of outages, performance issues, and security risks associated with early efforts to achieve it.

Although cloud computing is the name most commonly used to describe this potential paradigm shift, we prefer the term "cloud services" because there are many more services offered in the cloud than simply computing.

What Are Cloud Services and Why Should You Care?

As mentioned previously, we view cloud computing only as a narrow subset of a broader paradigm we call cloud services. In our model, cloud computing is typically a combination of infrastructure-as-a-service (IaaS) and software-as-a-service (SaaS) categories (see Figure 1).

Figure 1. Cloud Services Stack



Source: Cisco IBSG, 2008

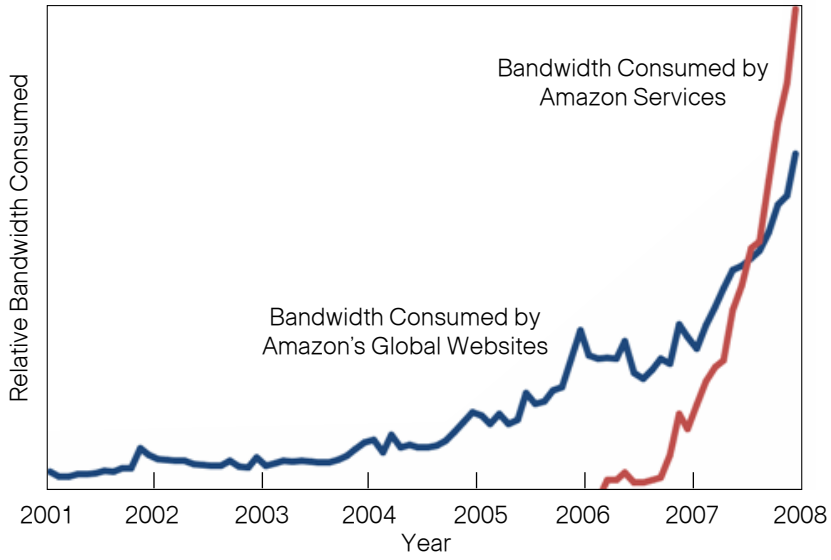
Cloud services can be broken down into seven main categories of services accessible via the network:

1. **Infrastructure Services—**hardware services, enabling customers to pay for usage of servers (cloud computing), storage, and networks.
2. **Platform Services—**standardized application deployment and runtime environments for development and production.
3. **Data Services—**structured storage and database environments for housing data.
4. **Web Services—**self-contained, open modules of targeted application functionality.
5. **SaaS—**applications hosted by a provider and offered as a service.

6. **Cloud Clients**—hardware and software that rely on other cloud services to deliver data or functionality specifically designed for administering cloud services to the end user.
7. **Cloud Orchestrators**—tools for integrating, monitoring, and managing cloud services, combining them into a complete business solution.

Some pundits argue that cloud services are nothing new and are just another instantiation of outsourced computing. We disagree and are confident that, inevitably, cloud services will offer organizations fundamentally new options for implementing information systems, along with unprecedented agility and freedom to focus on the business instead of on the details of the underlying systems. These services have the power to transform the enterprise of the future, and their meteoric rise can be seen in some cloud services such as Amazon Web Services (see Figure 2).

Figure 2. Relative Bandwidth Consumed by Amazon Web Services and Amazon Global Websites

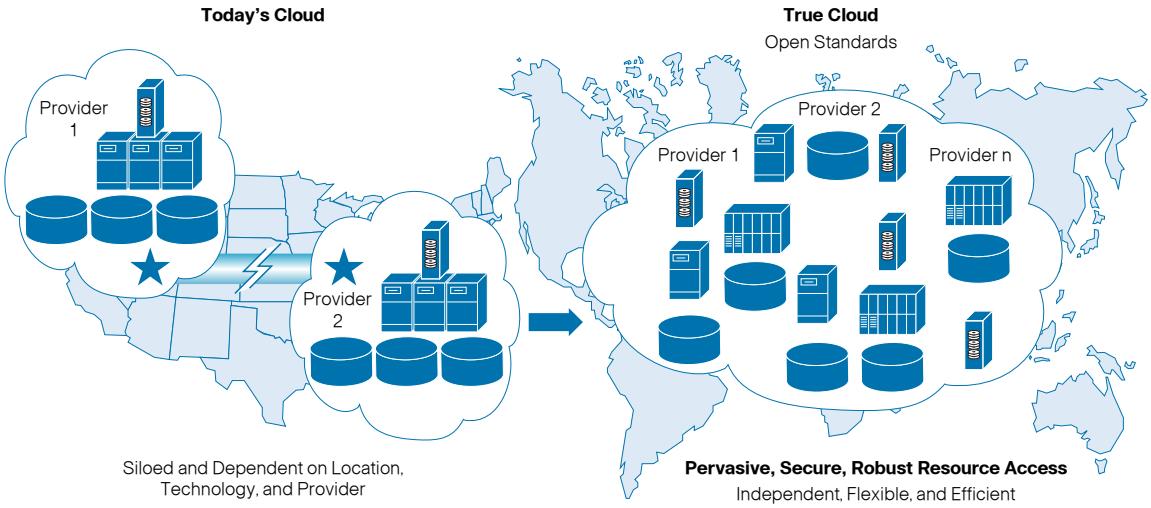


Source: Amazon Web Services Blog, January 2008 (http://aws.typepad.com/aws/2008/05/lots-of-bits.html)

While many examples of cloud services have been cited to date, and many technology leaders posit that they are on the brink of becoming mainstream, we believe that the vision for what they *can* be, which we term "true cloud," has not been achieved and that the field is still in its infancy.

We envision that true cloud will provide enterprises with the ability to establish and use information systems resources independent of location, technology, and provider. This vision is detailed in Figure 3.

Figure 3. Cloud Services Transformation



Source: Cisco IBSG, 2008

While this concept may sound simple, the ramifications are profound and impact every major aspect of the way organizations design, use, and manage information systems to fulfill business objectives. IT assests that are location-independent empower organizations to reconfigure their IT architecture rapidly to respond immediately to new business opportunities and run systems wherever and whenever it is most advantageous. Likewise, independence of specific technology (such as .NET or Java) makes it possible to add flexible new business capabilities unfettered by proprietary implementation requirements. This independence also allows enterprises to adopt new technologies more seamlessly.

Finally, provider independence allows organizations to reap the benefits of competition among cloud services providers and establish optimal distribution of systems for performance, cost-effectiveness, and fault tolerance—all with seamless interoperability among providers.

Across the board, this level of independence gives enterprises the freedom to implement information systems in a way that maximizes their advantage through greater flexibility and efficiency. With increasing flexibility comes the power to introduce new products and services quickly, which ultimately leads to business benefits such as increased market share, customer satisfaction, revenue, and profit. Increased efficiency also leads to improved margins, making money and resources available for innovation and revenue growth.

While all this may sound too good to be true, many experts believe that the cloud services industry is already on the path to delivering true-cloud services. What is currently under debate, however, is timing. Some believe true cloud will be available

to the enterprise within two or three years; others say it is decades away. Our view is that true-cloud services will be available for enterprise consumption in seven to 10 years. We do, however, see these services becoming prevalent in small and medium-sized businesses in the next three to five years due to lower levels of complexity and less-stringent service-level-agreement (SLA) requirements for those environments.

To understand this evolution better, it is worth taking a look at where cloud services are today and what the future framework looks like.

The Current State of Cloud Services

The state of cloud services today is very fluid, with a large number of small providers vying for a foothold in the various service categories. Although these services achieve some of the goals discussed earlier, today's approaches to cloud services fall short in achieving the independence characteristics of the true-cloud vision. Service-Oriented Architecture (SOA), web services, computing on demand, storage on demand, and outsourcing all have played a key role in today's approaches to cloud services, but no single solution—or combination of solutions, for that matter—has approached the true-cloud vision for independence and flexibility.

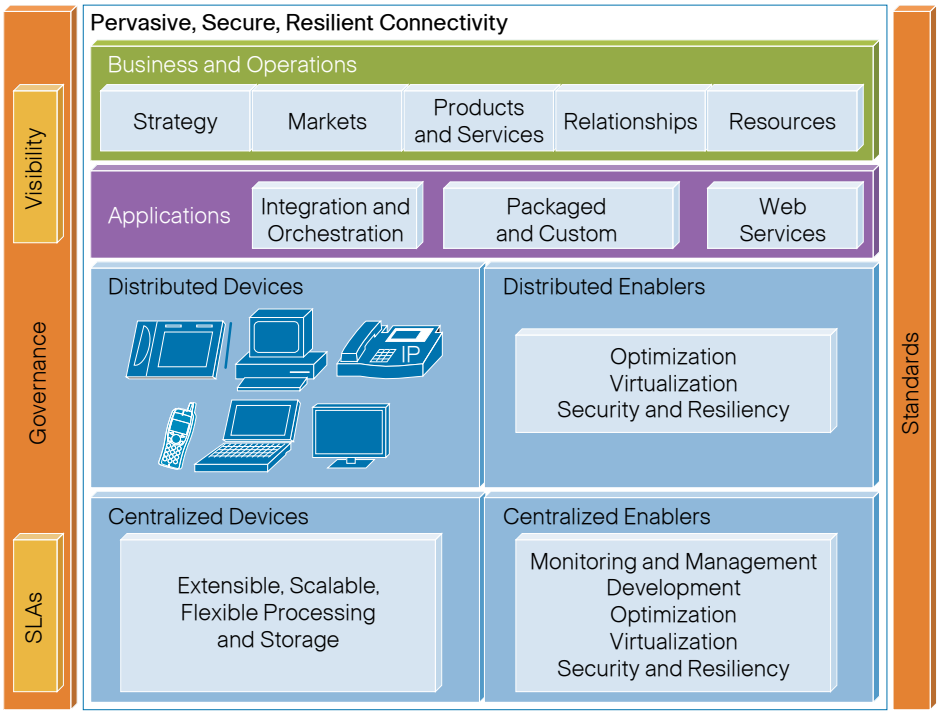
For example, computing and storage on demand may remove some of information systems' dependence on location. In today's instantiation, however, they do not offer independence from technology, and, consequently, it can be difficult to migrate from one provider to another. Likewise, components of SOA and web services, while offering some measure of independence from specific technologies and providers, are often managed in fixed locations and are not always easily scalable, transportable, or replicable. Outsourcing, on the other hand, can achieve some degree of location-independence, but often it is highly dependent on technology and provider. In short, the degree to which today's cloud is open, flexible, extensible, scalable, and standardized is relatively low.

As is typically the case, when a new technology or set of technologies progresses through the early part of its lifecycle, there are no standards; rather, many proprietary implementations fight for dominance. It is only after a technology-vetting cycle occurs that the major players emerge and eventually agree on a set of standards typically driven by customer demands. It is our expectation that cloud services will follow a similar pattern of evolution and remain fluid for some time. Given this fluidity, it is important to define an architecture framework to better understand the key components of true cloud and what the enablers are. At this stage in the evolution of cloud services, we believe it is more important to align with the long-term architecture principles of true cloud than to place bets on a particular set of cloud services vendors.

True-Cloud Framework

What is required to achieve the true-cloud vision, and what are the architecture principles likely to be most important to adopters in the future? A framework outlining the key enabling architecture elements of true cloud is shown in Figure 4. The framework is intended to help answer these questions, provide a mechanism to assess the applicability of current cloud services, and address the challenges of achieving the ultimate vision. Because of the importance of distributed capabilities in making cloud services flexible and scalable, organizations that embrace network-based services are likely to be aligned properly to take advantage of true cloud in the future.

Figure 4. Cloud Services Architecture Framework



Source: Cisco IBSG, 2008

The framework begins with the organization's business and operations objectives, which the information systems must support. The foundation comprises a combination of centralized and distributed devices and enablers upon which applications can be built and run in a fashion that achieves the desired independence characteristics required to support the business' needs. Critical components of the centralized enablers are cloud-oriented monitoring and management and development tools. Optimization, virtualization, security, and resiliency are the critical distributed enablers. Key to achieving that independence are pervasive, secure, and resilient connectivity combined with standards that make cloud facilities universally accessible, interoperable, and interchangeable. Finally, governance is required to provide alignment between the capabilities implemented in the cloud and the business and operations objectives.

An example of how the framework enables true-cloud services will help bring this concept to life. A retailer wants to achieve a breakthrough by offering a differentiated customer experience. To accomplish this, the retailer must not only create breakthrough experiences today, but also be agile enough to evolve those experiences faster than rapidly increasing customer expectations and changing business conditions.

With true-cloud services, the retailer could define a new product or service to fulfill a business and operations need, create a technology-independent application to support the goals for that product or service, and deploy the application across the appropriate combination of centralized and distributed devices, depending on the nature of the application.

With the necessary governance methodology and tools, including universal SLAs and utilities to provide visibility into the process and the success of the implementation, the retailer can choose the optimal provider or combination of providers to maintain the service. Then, when the business landscape changes, customer expectations shift, or new opportunities arise, the retailer can evolve the application seamlessly, changing how it works (technology-independence), where it is deployed (location-independence), or who maintains it (provider-independence), as appropriate.

While today's attempts at cloud services exhibit some of the characteristics of the framework, many advances in the enablers, standards, and governance layers will be required to realize the long-term vision of true cloud. In addition, organizations that take advantage of existing cloud enablers will need to mature in the way they utilize cloud services to realize their full potential.

Understanding the current state of cloud services and how they can best be used by different organizations is critical not only to avoiding costly pitfalls of improper use, but also to gaining maximum advantage from cloud services.

Should an Organization Pursue Cloud Services?

Once an organization understands cloud services, what they are, where they have been, and where they are going, the next step is to ask, "Should I take advantage of these services?" Developing an understanding of the potential impact cloud services have on the business is the first step in answering this question. The immediate relevance of cloud services for large enterprises will depend on the answers to several other key questions:

1. Is there an economic benefit to using cloud services?

Perhaps the most important question to ask is not about the technology, but rather about the economics. "Will the business benefit from using cloud services as opposed to the traditional model?" That depends. For a service to have economic benefits, it would need to a) save costs, b) create some kind of sustainable competitive advantage that could be monetized—such as reliability, speed, features, or flexibility—or c) accelerate time to market for new services that create market-share advantage.

There will be some cases where cloud services may be a better alternative than traditional delivery models. The hurdle that large enterprises must overcome to realize an economic benefit, however, is much higher than it is for their small and medium-sized counterparts. Most large enterprises have massive investments in existing technologies that make it difficult to justify accommodating new demand by going outside the enterprise and paying a higher per-unit cost for CPU hour, gigabyte, or user. While many would argue that these investments are "sunk"[1] costs and should not be considered in an economic model, many of these assets are highly underutilized and have the capacity to absorb additional demand if architected and managed appropriately. If this is the case, enterprises can accommodate new demand without having to incur additional per-unit costs for hardware, which will be less expensive than purchasing external services, regardless of their costs.

Economic incentives for using external clouds may be reduced further by focusing on internal efficiencies and creating internal clouds, also known as "private clouds," consisting of cloud services implemented within the enterprise. If, however, internal resources are fully utilized, cloud services may be very price-competitive when evaluating new demand.

2. Will services be provided by an internal or external cloud?

If the service is provided by an internal cloud, it inherently introduces less risk, as elements of the architecture—such as security and resiliency, infrastructure, and support processes—will not differ significantly from the current environment. What *will* change are the efficiency and speed with which the service can be delivered. The new service will be more cost-effective and significantly more agile than the previous implementation, but this will come at the expense of some transparency into the supporting architecture because the interface to the internal cloud will be based on an SLA rather than specific technologies. The service also will be less elastic than one provided externally because its ability to scale will be limited on the upside by how rapidly new equipment can be provisioned and put into service. It also will be less cost-effective in the event of a reduction in the need for capacity, as equipment procured and provisioned to manage spikes in demand becomes underutilized.

If the service is delivered by an external entity, the risks will be greater in terms of security, resiliency, transparency, and performance predictability, at least in the near term. Nonetheless, there will be benefit from tremendous elasticity—both on the upside and downside—since the cloud provider services many enterprises, and pooling resources creates greater elasticity than a single enterprise could create alone. Finally, although external cloud services are saddled with higher per-unit costs than their internal cloud-services counterparts, there are circumstances in which they are advantageous.

1. In economics and business decision making, sunk costs are costs that cannot be recovered once they have been incurred.

3. Where can cloud services be used today?

Cloud services, both internal and external, can be applied to several situations. For example, R&D projects that need a temporary "sandbox" for testing applications are great candidates for an IaaS or platform-as-a-service (PaaS) cloud services. The latter is a combination of multiple cloud services offered in a complete system environment package. The time and cost required to provision and manage resources for these types of projects is prohibitive when done traditionally. Highly standardized applications that need significant elasticity may be good candidates as well, depending on their security and availability requirements. Highly standardized applications that require minimal customization or integration with other applications may be implemented more efficiently as SaaS solutions rather than as major internal development and implementation efforts, assuming that availability and security requirements can be met.

There also are many potential uses for an internal cloud. First and foremost are the efficiencies that the architecture can offer, such as greater utilization of existing assets, faster provisioning and deployment of resources, and higher resiliency and performance of applications. These all are attributes for which large enterprises should already be striving in their current environments. The development of processes and architectures that improve an organization's ability to transition to external cloud services over time is yet another argument for pursuing cloud services internally—this is something that many organizations lose sight of in the midst of discussions about how wonderful the technology is.

4. Is the organization prepared to adopt cloud services?

For IT, the movement to cloud services is not just a technology shift, but a cultural shift. This is a critical point to understand because cultural shifts take time. They also involve more than just the technology; they involve people, process, and organization. As such, they should be well-considered before jumping in too quickly.

Traditional IT organizations with siloed technology are not properly prepared to adopt cloud services broadly; these organizations tend to be fragmented and focused on individual technologies as opposed to delivering the resulting service. This type of model also creates organizational problems when it comes to supporting services because metrics and SLAs are aligned with technologies, not services, further complicating potential adoption.

Additionally, the ability of the business to adopt cloud services without involving IT presents some challenges because the business will expect integration between internal systems and cloud services, thereby placing unexpected and potentially unachievable demands on internal IT. Therefore, it is important to understand the current state of the IT environment prior to adopting cloud services.

Getting Started

Depending on how an organization answers the above questions, cloud services offer different degrees of fit for different organizations—some may want to adopt several elements immediately; others may find it best to wait until cloud services mature; and still others may fall somewhere in between. For any organization, it is important to stay informed about the evolution of cloud services and to re-evaluate periodically their potential benefit for the organization as they evolve. A flexible and evolving cloud services strategy will be important to maximizing the benefits of this new paradigm.

For organizations ready to adopt cloud services in the near term, there are several ways to get started. This simple five-track roadmap will help organizations embark on the most essential threads of a cloud services program:

1. Optimize the current IT environment with the goal of providing an internal set of cloud services and enabling the incorporation of external services. This will be the services roadmap.
2. Identify cloud services opportunities based on business needs, value proposition, and the ability to adopt/support those services. This will be the services portfolio.
3. Communicate with the business units about cloud services and the roadmap and process for incorporating them into the architecture, whether the services are internal or external. This will be the communication plan.
4. Experiment with and pilot various services, both internal and external, to identify where the real issues will arise. This will be the lab.
5. Designate a cross-functional team to monitor continually which new services, providers, and standards are in this space and determine if they affect the roadmap. This will be the sensing and strategy-evolution function.

These tracks do not have to be undertaken sequentially; we encourage organizations to undertake as many of them in parallel as possible. We also encourage organizations to iterate and refine their operating model constantly as it relates to consuming, delivering, and supporting cloud services. This will allow them to develop quickly a set of competencies around cloud services that will serve as a strong foundation for broader adoption as the marketplace for these services matures.

CB/LW15236 1008