

Assessing Cloud Computing

Challenges and opportunities for network providers

A growing number of consumers and businesses are turning to cloud services, which offer on-demand, pay-as-you-go software, developer platforms, and storage capabilities — delivered over the Internet. This trend is adding to network providers' ongoing bandwidth challenges, but it also opens doors to new revenue opportunities. To make the most of the cloud computing trend, network providers should consider the following: Switch enterprise hosted services to private or virtual private clouds, which offer better margins and easier management. Develop partnerships with application and content providers who need carrier-grade capabilities to enhance their cloud services. And take advantage of network providers' trusted end-user relations and reputation for reliability when positioning new services in the marketplace.

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Cloud computing is changing the way consumers and businesses purchase and use a wide range of computing capabilities. For decades, hardware and software have typically been installed at the end users' premises — and on individual computer devices. Now cloud computing offers a different approach: Applications, platforms and infrastructure are available “on demand” by using the Internet to connect end users with online services.

WHAT IS CLOUD COMPUTING?

- *Cloud computing* – A flexible, scalable online computing environment, shared among users.
- *Cloud applications* – Real-time services accessed with a web browser. They currently range from business applications for the enterprise, with usage-based pricing, to free communication and social networking applications for consumers.
- *Cloud platforms* – Off-premises development platforms that provide “off-the-shelf” capabilities for content and application developers.
- *Cloud computing infrastructure* – Servers, data storage and processing power that provide on-demand resources for enterprise IT — or the centralized host for cloud services.
- *Cloud computing business models* – Users pay monthly subscriptions — or on a “per-use” basis. Some capabilities are offered free to customers and paid for by advertisers.

As a result of this real-time business model:

- Consumers can access a range of low-cost applications, any time, anywhere, using a web browser installed on a laptop, terminal, smart phone or other connected device.
- Enterprise employees can tap into business applications, at the moment they're needed for a specific task — and often the business pays only for usage.
- Application developers can turn to off-premises cloud platforms that minimize the need to purchase their own hardware and software, when creating and deploying new applications.

Cloud computing services

Cloud computing is focused on offering services — such as “Software as a Service” or “Infrastructure as a Service” — rather than tangible objects like computer hardware or software sold on a disk. This service-oriented approach can simplify delivery and make it easier to scale costs to a purchaser's individual needs. In many cases, customers pay only for usage, or they may take advantage of free services that are paid for by advertisers. In other instances, monthly subscription fees may apply.

- *Consumer cloud services* – Many Internet users are already using cloud services when they send email, edit photos, calculate their income taxes, watch videos, stay in touch with friends or make travel plans. Some of these well known services include: GMail, Adobe Photoshop Express, TurboTax®, YouTube, Facebook and Orbitz.
- *Enterprise cloud services* – At this time, enterprise services are primarily focused on standard business applications, which can be accessed anywhere, any time, using any web-enabled device. Typical offerings include e-mail, instant messaging, calendars, spreadsheets, word processors, presentation and collaboration tools, customer relationship management (CRMs) and data storage.
- *IT support services (i.e., cloud computing infrastructure)* – Cloud services also support the enterprise IT staff, as well as application and content providers. These pay-per-use infrastructure offerings include on-demand computing power, data storage, applications hosting, automated systems management — and cloud platforms for applications developers.

- *Public and private cloud services* – Because cloud computing is still in the early stages of development, the industry has not yet developed standardized definitions for public and private clouds. However, public clouds are generally described as cloud infrastructure that is available to the general public or a large group of businesses. The Internet is the most widely used public cloud. Private clouds, on the other hand, limit access to a single enterprise (or its IT staff). The private cloud infrastructure may be located on or off the organization’s premises — and may be managed by the enterprise or by a third party. Within either a public or private cloud, a virtual private cloud can be partitioned off from the primary infrastructure, and this “subset” of the larger cloud is operated solely for designated users. This partitioning is “virtual,” rather than physical.

Cloud computing is in an early stage of development and might be viewed as simply a new form of outsourcing. However, some key aspects of cloud computing — such as the levels of bandwidth required to support cloud services — could have a powerful impact on network providers. Consequently, the following sections of this white paper:

- Explain the potential benefits of cloud services, for both consumers and the enterprise
- Show current market size and expected growth — and whether the trend will continue
- Define the strategic impact to network providers’ business and infrastructure
- Profile some emerging cloud computing players, along with the services they are launching

Market overview

Technology drivers

Cloud computing has been enabled primarily by three key technological advances — vast increases in computing power, the reduction in storage/memory costs and the pervasive use of high-speed Internet connections. For example, the performance/price ratio for hard drives and processors improved 7500 times and 60 times, respectively, from 1991 to 2006. New technologies have also increased the speed of the Internet backbone 20,000 times from 45 Mb/s to a terabit per second, from 1997 to 2007¹, while allowing network providers to deliver sophisticated new multimedia applications over a growing array of devices. Wireline operators are using converged IP networks to support Internet-based services more cost effectively — and are extending IP closer to the network edge to provide the benefits of distributed intelligence for improved performance and personalization. As wireless operators gradually evolve to 4G networks, they have made effective use of WiFi technology to provide Internet access to laptop computers. And now, they are extending these video and data capabilities to mobile phones through a growing use of femtocells in homes and businesses.

“Virtualization” technologies also play an important role by providing a way to decouple an application from the physical server hardware, so it is not “tied to one specific box.” This flexibility offers certain advantages. First, it reduces IT server costs, because a server can be divided into multiple isolated virtual environments, which support more applications and operating systems at lower cost. It also

¹ “The Cloud Wars: \$100+ billion at stake,” Merrill Lynch, May 7, 2008.

offers a more robust environment, because applications can run on servers in multiple locations, using multiple operating systems. These options make it faster and easier to set up new applications — and provide back up and recovery, if needed.

Reasons for adoption

Cloud computing advocates argue that a strong driver for adoption is IT cost reduction, particularly in retiring data centers. Some cloud computing advocates also claim that flexible online applications can help streamline business processes and maximize the effectiveness of distributed employees. For example, companies responding to a U.S. Mobility and Business Applications Survey said they use cloud services to promote accessibility from anywhere, and 83 percent have adopted some type of Software as a Service.² Another advantage of these centrally hosted applications is that they can be constantly upgraded through a single update that is rolled out to multiple devices. And as technology cycles get shorter, the upgrades may help businesses avoid spending on new equipment.³

Cloud services' usage-based pricing also attracts cost-conscious businesses. Merrill Lynch projects a cost advantage of 3 to 5 times for business applications.⁴ When companies pay only for the capacity they are using, they may be able to reduce their investments in IT facilities, along with management, maintenance and support costs. For example, Figure 1 illustrates the savings that might result when small and medium-sized businesses switch to a cloud solution for e-mail and messaging. Cloud computing skeptics, however, argue that a move to cloud services will not offer cost benefits for most large corporations. Many commentators⁵ cite the findings of a recent McKinsey & Company study⁶ which calculated the monthly cost of operating a typical corporate data center in the cloud. Using Amazon.com's Web service for pricing, the study concluded that the overall cost of data center functions would be \$366 a month per unit of computing output, while the conventional data center would cost \$150 per month.

When consumers turn to cloud services, they are looking for convenience, flexible access and easy data sharing.⁸ For example, consumers can use innovative applications, such as Flickr, Snapfish, Facebook and eBay, any time, anywhere — through any web-enabled device. Many consumers are also attracted by cost savings, when applications are funded by advertisers. In that case, consumers can use them free of charge or pay only a minimal usage fee. Merrill Lynch projects a cost advantage of 5 to 10 times for personal productivity applications.⁹

Figure 1. Annual savings for SMBs who switch to cloud services⁷

One Year Costs of E-Mail and Messaging Operations
75-Employee SMB (all in U.S. Dollars)

Lotus Notes		Google Apps Premier Edition	
On-Premises		Cloud	
\$0	Deployment	\$5,607	
\$6,000	Licensing/Maintenance	\$3,750	
\$60,000	Support	\$0	
\$2,500	Security	\$0	
\$5,000	Mobility	\$0	
\$2,000	Back-Up	\$1,500	
\$1,000	Associated Applications	\$1,500	
\$0	Training	\$615	
\$76,500	Total Cost	\$12,972	

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² Yankee Group, "Energizing the Anywhere Enterprise," January, 2009.

³ "U.S. DOE Exploits the Value of Cloud Computing," Yankee Group, February, 2009.

⁴ "The Cloud Wars: \$100+ billion at stake," Merrill Lynch., May 7, 2008.

⁵ Source: www.thebiblog.com/archives/2009/04/clearing-the-air-on-cloud-computing.html

⁶ "Clearing the Air on Cloud Computing," McKinsey & Company, April, 2009.

⁷ Yankee Group, "CIO's Guide to Cost Cutting: E-Mail and Messaging," February, 2009.

⁸ "Use of Cloud Computing Applications and Services," Pew Internet & American Life Project, September, 2008.

⁹ "The Cloud Wars: \$100+ billion at stake," Merrill Lynch., May 7, 2008.

Market demand

By May 2008, 69 percent of American Internet users had engaged in at least one of the cloud computing activities shown in Figure 2. Forty percent had used at least two of these capabilities.¹⁰

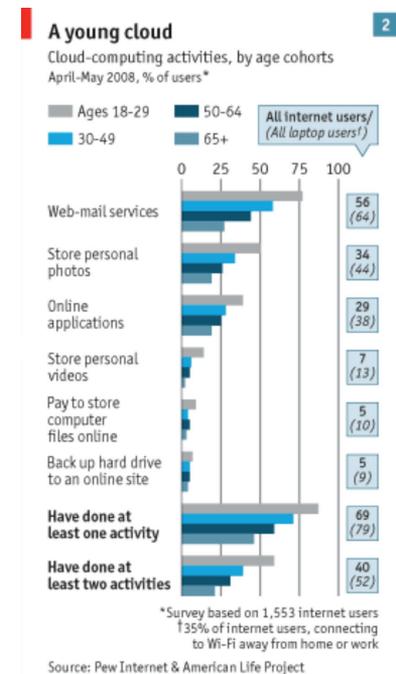
The cloud services market was estimated at \$46.4 billion in 2008 — and is expected to increase to \$150.1 billion by 2013. The overall compound annual growth rate (CAGR) is forecast to be 26.5 percent, but with significant variations across different types of services.¹¹ For example, the estimated CAGR across all infrastructure services is 33.5 percent. However, more specific forecasts range as low as 5 percent for applications integration services, up to 52.8 percent for storage services and 59.5 percent for computing services.

Obstacles to adoption

While cloud computing cost savings may be debated and firm market size estimates elusive due to ambiguity in terminology and what should be included, there are few debates about consumer and enterprise concerns over cloud services. These concerns include:

- *Security and privacy* – How safe is information in the hands of cloud computing suppliers? An ITIC survey found that 85 percent of corporate customers around the globe will not implement a cloud computing infrastructure in 2009 because of fears that sensitive corporate data cannot be adequately secured. Eighty-three percent of respondents would require specific guarantees to safeguard mission-critical data before committing to a cloud.¹² Consumers are also concerned about theft and privacy issues, which could diminish their willingness to adopt new services.
- *Regulatory compliance* – Are cloud services meeting local, regional and national regulations? Highly regulated industries, such as banking and healthcare, need to be sure that cloud service providers can comply with the necessary audits and reporting.
- *Loss of control* – Enterprises are concerned about their loss of control over users, applications and resources. Thirty-nine percent of respondents to a Yankee Group survey said that control of their own upgrades, updates and security patches is a major factor that has prevented them from adopting SaaS.¹³ Consumers are more worried about how their data might be used without their awareness; for example, sold or used for marketing.
- *Reliability and availability* – Can the Internet handle the challenges of high volumes of diverse traffic, including mission-critical applications? Video and multimedia content offered by cloud services must be delivered without interruption to satisfy user demands, and crucial business applications need a high level of technical support. Among IT professionals, 73 percent said they would require a guaranteed rapid response from tech support, before committing to a cloud service.¹⁴
- *Organizational barriers* – Because cloud computing is a form of outsourcing, it could pose threats to existing structure — and people’s jobs. Therefore, many enterprises are faced with internal resistance to adoption.

Figure 2. Usage of selected cloud capabilities (September, 2008)



Source: Pew Internet & American Life Project survey, May, 2008, based on 1,553 Internet users

¹⁰ "Use of Cloud Computing Applications and Services," Pew Internet & American Life Project, September, 2008.

¹¹ "Forecast: Sizing the Cloud; Understanding the Opportunities in Cloud Services," Gartner, March 18, 2009.

¹² IT Performance Trends survey, Information Technology Intelligence Corp. (ITIC), 2009.

¹³ Yankee Group, Anywhere Enterprise – Large: 2008 Mobility and Business Applications Survey, December, 2008.

¹⁴ IT Performance Trends survey, Information Technology Intelligence Corp. (ITIC), 2009.

Ninety percent of cloud service users would be very concerned if their data were sold to another party.

SOURCE: PEW INTERNET & AMERICAN LIFE PROJECT

Strategic implications for network providers

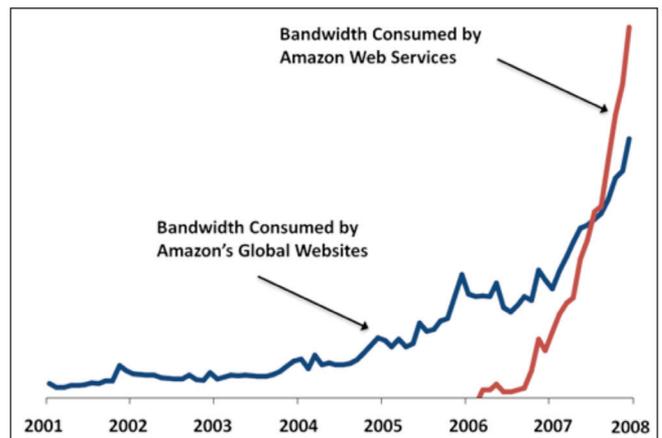
Right now, spending on cloud services is only a small portion of global IT budgets. But if usage of cloud computing increases significantly, it is likely to present some challenges for network providers — along with new market opportunities.

The challenges of cloud services are similar to the issues raised by Internet video. As video traffic has increased, network providers have borne the cost burden of expanding network capacity, but they initially received little income from usage of video services. To understand how even a single service can impact network traffic, consider the iPlayer service offered by the BBC broadcasting company. Launched at the end of 2007, the service provides a 7-day “catch up” capability for people who have missed a program. In just the first 2 weeks of this service, over 3.5 million programs were streamed or downloaded. Currently, people watch 2 programs per day, or an average of about 40 minutes per person. This represents up to 7 percent of all peak Internet traffic in the U.K.

Cloud services currently present similar characteristics: They drive a lot of bandwidth without commensurate compensation going to the network. From a bandwidth perspective, consider that, in January 2008, Amazon cloud computing services consumed more bandwidth than Amazon.com’s entire global network of retail sites,¹⁵ as shown in Figure 3.

So far, network providers are supporting these bandwidth increases. But the revenue from cloud services still flows chiefly to cloud service providers, with little if any going to network providers.

Figure 3. Amazon cloud computing services consume more bandwidth than the entire global Amazon.com network of retail sites.



Opportunities for network providers

How can network providers leverage cloud services to generate additional revenues? With their flexibility and global scale, cloud services present an array of opportunities for cost-effective creation and delivery of innovative applications — while also enabling new business models and partnerships.

New revenue opportunities

Over the next 3 years, 80 percent of the cloud computing opportunity lies in switching current enterprise-hosted services to private or virtual private clouds. Cloud services offer better margins,

¹⁵ Amazon Web Services Blog, January 2008, <http://aws.typepad.com/aws/2008/05/lots-of-bits.html>

and they are also self-service — allowing users to establish their own configuration and management quickly and easily, through a web browser.¹⁶ This is an important advantage over existing host services, which pose complex management challenges.

Exposure of capabilities

Network providers can also increase their revenues through non-traditional partnerships with application and content providers (ACPs). The goal is to combine the speed and innovation of the Web with the strengths of the network — as ACPs look for ways to enhance their services, control delivery and ensure quality. Network providers can provide this and more, enabling innovative new cloud applications that offer greater reliability and privacy, as well as a higher degree of personalization. For example, applications can incorporate presence and location information that make new services more useful and meaningful to end users, while maintaining their privacy. In addition, network providers can ensure the required scalability and QoS to deliver video and voice offerings with a satisfying Quality of Experience (QoE).

These network-based capabilities can enhance existing cloud services as well. Google, Amazon and Microsoft applications and services could all be enriched with context information and QoS capabilities. Such partnerships offer advantages to all parties: End users gain a better QoE. ACPs can deliver unique offerings, backed by the security and performance levels customers demand. And network providers can establish a stronger position in the cloud computing value chain — and generate revenues from a valuable new source.

If network providers begin working extensively with ACPs, they can benefit by formalizing the processes involved in supporting new applications — and automating them as much as possible. These processes can include evaluating which applications to offer, setting appropriate pricing, developing OSS logistics, tracking usage, billing and so forth. By reducing the time involved in each aspect of support, network providers can reduce the cost of introducing new services, accelerate their time to market and enhance the relationship with application developers.

TYPES OF CLOUD SERVICE PROVIDERS

- *Software as a Service providers* – deliver online services to consumers, as well as to the enterprise. The business applications typically include standard messaging, calendars and spreadsheets — or applications tailored to specific business processes, such as sales or customer service. These offerings are commonly known as software as a service (SaaS). They appeal to companies that want “on-demand” capabilities, delivered in a complete form from an external provider, who handles development and hosting. Some application providers own data centers. Others rely on another cloud player to do the hosting.
- *Platforms as a Service (PaaS) providers* – offer open development platforms with the same capabilities as an on-premises application server. They allow application developers (including other cloud players) to build or modify software for their own use — or to offer commercially. By purchasing these ready-made, “off-the-shelf” capabilities, developers can complete their work faster and pay only for the resources they use.
- *Infrastructure as a Service (IaaS) providers* – sell off-premises computing resources on a pay-per-use basis. These players provide the “backbone” of the cloud — the interconnected data centers housing distributed grids of commodity servers, which run cloud applications.
- *Enhancers* – facilitate delivery of services to end users. They provide content delivery networks, network transport and scaling and optimization appliances.

¹⁶ Yankee Group, “Service Providers Should be Making Rain with Cloud,” Yankee Group, April, 2009.

Network providers already offering cloud services

Although application and content providers were the first to become active in the cloud computing marketplace, a growing number of network providers are now launching — or announcing — new cloud services. For example, one Tier 1 operator now offers enterprise services in more than two dozen countries across the globe. The offerings include on-demand virtualized infrastructure with service level agreements, rapid support and management of off-the-shelf applications. The company believes that this level of support will set their capabilities apart from anything else on the market.

Another Tier 1 player is offering a pay-per-use, fully customizable infrastructure, designed for application hosting and storage. This service stands out in the marketplace, because it allows enterprises to meet rapid fluctuations in usage through a choice of virtual infrastructure and traditional physical infrastructure — enabling customers to provision the right server environment for the application being deployed.

Finally, one other global network provider is targeting multinational corporations and public sector agencies by offering virtualized servers, storage and security on a private cloud within the enterprise, rather than using the web. This service uses the network provider's own physical network and data center infrastructure, which they believe can offer greater control and a better service level agreement than that of “pure” cloud players.

Network provider competitive advantages

Although application and content providers have been leaders in the cloud computing market space, network providers have unique strengths that provide a powerful competitive edge. In brief, they have a reputation for maintaining reliable networks and earning customers' trust, which presents key advantages when network providers negotiate creative partnerships with ACPs — or promote their own cloud services.

More specifically, network providers are uniquely positioned to be the dominant players in the enterprise cloud computing marketplace by highlighting the following assets:¹⁷

- *Trusted relationships* – Network providers assign dedicated teams to work with an enterprise throughout the life cycle of a product or service, beginning with sales and continuing through after-sales service and support. These collaborations can provide the enterprise with greater control over purchasing processes and increased responsiveness to their unique needs, including 24/7 service support.
- *Reliable operations that scale* – While some application and content providers maintain services in a “perpetual preview” state (i.e., beta), network providers carry out extensive testing and certification processes before services are launched. Typically, telco services are engineered for 99.999 percent availability or better, while scaling up to tens of millions of users.
- *Service level agreements (SLAs) with real impact* – Network providers also offer truly “meaningful” service level agreements. That is, they are supported by clear metrics, regular performance monitoring — and financial penalties if the SLA standards are not met.
- *Vendor independence* – Network providers tend to be software and hardware agnostic, so they can reach the largest possible market. In contrast, some existing cloud players incorporate at least a few proprietary elements in their platforms.
- *Global presence and market commitment* – Large, integrated network providers can meet enterprise needs anywhere in the world, backed by dedicated sales and support teams. This reliable presence is further enhanced by network providers' commitment to hosting and cloud computing over the longer term, as part of their core network business.

¹⁷ Source: http://www.on-demandenterprise.com/features/10_Reasons_Why_Telcos_Will_Dominate_Enterprise_Cloud_Computing_33745549.html

These network provider strengths are already influencing the marketplace. When a survey of large U.S. enterprises asked — “Globally, which three companies do you believe are best positioned to serve your managed IT and communications needs?” — two of the top three responses were: AT&T and Verizon. In a similar survey of 500 small and medium-sized U.S. enterprises, AT&T and Verizon placed first and second, while Qwest and Sprint placed fifth and sixth.¹⁸

With this public perception, network providers are ideally positioned to benefit from users’ growing awareness of the limitations of existing cloud services.¹⁹ Both businesses and consumers are realizing that public cloud services are neither private nor secure, and private cloud services might not scale well. As these realizations take hold, network providers have a valuable opportunity to position themselves as the “safe” choice for delivering cloud services.²⁰

Conclusion

The growth of cloud services has important implications for network providers. Like Internet video, cloud services currently add to today’s increasing demands for bandwidth, while delivering revenues primarily to application and content providers, rather than to network providers.

- *New revenue opportunities* – network providers can benefit by switching enterprise-hosted services to private or virtual private clouds. This approach offers better margins, along with decreased management demands. A number of leading network providers have already introduced their own cloud services, and they will soon be followed by an array of other operators who have new services in development now.
- *Exposure of capabilities* – network providers can add new revenues through partnerships with application and content providers. As ACPs look for ways to enrich their services, control delivery and ensure quality, network providers can gain a better position in the cloud computing value chain by contributing their unique capabilities.

In addition, as consumers and businesses become increasingly aware of the limitations of existing cloud services, network providers have a key opportunity to promote themselves as the “safe” cloud services provider.

¹⁸ Yankee Group, “Service Providers Should be Making Rain with Cloud,” April, 2009.

¹⁹ Yankee Group, “Service Providers Should be Making Rain with Cloud,” April, 2009.

²⁰ Yankee Group, “Service Providers Should be Making Rain with Cloud,” April, 2009.

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