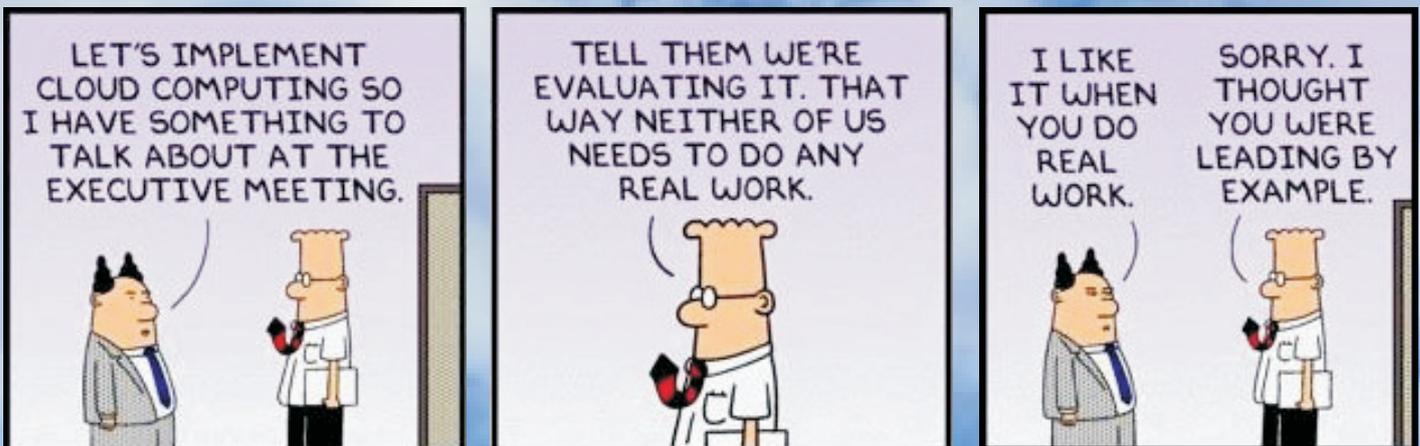


WHITE PAPER

# A CXO's guide to Cloud Computing

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Source: Dilbert.com



## Introduction

In early 2009, the US President held an online town hall meeting where there were 100,000+ questions and about 3.5 million votes. The White House was able to instantly scale its database to support, without worrying about usage spikes. This was a classic example of elastic infrastructure where there was no need to forecast demand or provision extra servers ahead of time.

In a recent survey of 100 CXO's conducted by NetSuite, 44% used the term 'Hosted Solutions' and 11% used the term 'ASP' to describe cloud services. The survey concluded that there is a need to de-clutter and create better go-to-market propositions. In simple terms, cloud computing is a model where IT capabilities are delivered as a service over the internet to many users. It enables an application to get as many services/storage resources/servers as required. Importantly, the resources can be rapidly provisioned and released with minimal management effort or service provider interaction. But this is not an entirely new idea. As far back as 1961, Prof John McCarthy, who invented LISP and coined the term 'Artificial Intelligence', had prophesized that computing power would someday be priced and consumed like a utility (water, electricity). Through the 70's and 80's, this was proven by the mainframe 'time-sharing' concept. But cloud computing varies from time-sharing primarily because of the elastic nature of the underlying infrastructure. Just like electricity, it allows users to only consume what they need, to grow or shrink usage as per their requirements, and to pay for use.

If there is any trend that has created such a buzz in recent times, it has got to be cloud computing. But does this mean that you should provide your software-plus-service from the cloud? Or should you tread with caution and wait for the market to stabilize? This paper attempts to provide Sanity-as-a-Service to ISV's, Software-enabled-businesses and Enterprises on cloud-enabling their software.

## Demystifying Clouds

The cloud is naturally not a technology by itself. Rather, it is an approach to delivering IT/software services that harnesses the twin powers of economies of scale and virtualization. The Cloud market is typically segmented into public clouds (offered over the internet), private clouds (internal to an organization typically spread across geographies) and hybrid clouds (a mix of both). As the name suggests, the private cloud operates within the firewalls of the organization and hence is considered more secure. It is especially suited for large organizations (eg: government, GE etc) that do not yet trust the reliability and cost effectiveness of public clouds. It is also a great way to pilot your cloud strategies and course correct as needed. While there are pundits who argue that private cloud is an oxymoron, the reality is that the public cloud is not yet mature. Another option is to adopt a spill-over or surge-computing approach i.e. outsourcing just the peak loads to cloud. But this increases the complexity of the system.

*Oracle CEO, June 2008: It's hard to point to any software-as-a-service provider that's doing a good job of improving its profitability. If you look at the leader, Salesforce.com, they don't make very much money and they've been at it for almost 10 years*

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The cloud market is often sub-segmented into IaaS (Infrastructure as a Service), PaaS (Platform), and SaaS. IaaS is about underlying resources - remote servers, storage, and computing power. Amazon Web Services (EC2, S3 etc) is the classic example. Costs vary from 10 cents an hour for a small server to \$1.20 for a large windows server. PaaS vendors provide a platform to rapidly build and deploy your software on remote infrastructure. They offer ready-to-use functionalities, typically in the form of services that can be rapidly assembled to build market-ready software. Hence, one need not start development from ground zero. SaaS is the popular trend of delivering software applications over the web. In fact, SaaS triggered the push towards cloud computing by demonstrating that enterprise and consumer services could be easily made available over the Web. SaaS vendors originally did not use the word cloud to describe their offerings and it is generally considered a subset of the cloud computing market.

Cloud includes attributes previously associated with utility as well as grid models. Grid computing is large-scale, distributed, parallel-processing that can be applied to computationally intensive scientific, mathematical, and academic problems. It can be used for such diverse needs as drug discovery, economic forecasting, seismic analysis, and back-office data processing. One can think of Grid as a ginormous computing cloud. Utility is the metered consumption of resources. But it is generally accepted that all these are different shades of the larger cloud computing trend.

## Virtualization, SOA, and Cloud

Virtualization helps organizations consolidate servers, cut costs, increase server utilization, reduce footprints etc. It is a key exercise that needs investments in software and skill sets. Data centers and organizations running in-house data centers have already been investing in this area to optimize their costs. The typical roadmap in large organizations seems to be virtualization, private cloud, and finally public cloud. But start-ups or companies building new applications directly on the cloud (without the baggage of having to move legacy software to cloud) will expect the cloud provider to handle virtualization. The trend is towards deploying cheap hardware and scaling out (horizontally) rather than scaling up (vertically).

Service Oriented Architecture was the buzz du jour until a few years ago and it is currently estimated to be between the proverbial 'trough of disillusionment' and the 'slope of enlightenment' phases. While SOA is an architectural style to compose applications out of loosely-coupled and coarse-grained business services, its realm was earlier confined to the organizational boundaries. But the coming of the cloud has opened up the skies for SOA. It is increasingly getting clearer that most organizations thrive on external services apart from those developed in-house. Hence, SOA can be a good foundation for the cloud because it involves setting up IT Governance processes and stronger alignment of software and business needs. But the reality is that SOA is often perceived to be monolithic and it is already undergoing changes to become more agile and risk-free. While the cloud does not mandate SOA, adopting core service orientation principles (eg: defining the right services, loose coupling) in your software will be beneficial when you eventually transition to the cloud. Both are complementary and not cannibalistic patterns.

*Richard Stallman (open source evangelist), Sep 2008: Cloud Computing is a trap that makes people buy in to proprietary systems that would actually cost more over time.*



## Key considerations for your users

If you choose to provide services from the cloud, your users will typically have questions about the following:

- a. Lack of strict SLA's and interoperability among cloud platforms
- b. Challenges in integrating on-premise software with the on-demand
- c. An evolving market prone to consolidations and lock-ins
- d. TCO
- e. Regulatory, Compliance and Security

While cloud movement is frequently compared with utility grids, it is important to remember that data is the lock-in; and electricity grids don't have data lock-ins! On the other hand, think about how people were initially reluctant to save their money in banks as the prevalent practice was to safeguard them on-premise. Eventually things turned around and people realized the benefits. It is quite possible that history may repeat itself regarding data in the cloud.

## Factors that impact you:

- a. Revenues trickle in over a period of time (instead of upfront license fee) if you offer metered services
- b. Increased focus on operational aspects and service delivery – not just product development and selling
- c. Rapid user feedback
- d. Dependency on your cloud provider (eg: for SLA's)

Now let us look at the opportunities.

## How does cloud benefit your users?

- a. Easy installations and Pay per usage
- b. Better Quality of Service from the provider – in terms of software availability, performance etc
- c. Flexibility and Freedom of choice. Reduced lock-ins compared to licensed software.
- d. For many organizations, opex is more attractive than capex. Hence, they benefit from lesser upfront investment.

## How does cloud benefit you?

- a. Abstraction of infrastructural aspects of running your software – eg: provisioning new resources rapidly as you gain more users. This will help you stay more focused on your core competencies and help get to market faster
- b. Ability to tap the long tail of your customer segment
- c. Economies of scale (eg: operational efficiencies)
- d. Just-in-time infrastructure - possibly lesser reliance on internal IT teams for certain activities.

*Information Week, Oct 2008: The shift to delivering IT through a utility model is poised to change the business computing landscape as we know it.*



## Possible scenarios for providing services from the cloud

Textbook scenarios include applications that are not mission critical or core competencies for your users, that do not contain sensitive data or do not have major dependencies on network latencies and bandwidth. Here are a few others:

- a. Processing Pipelines including functionalities that convert thousands of documents from one format to other, image processing, Data Mining, Searching, Indexing, Log analysis, video transcoding etc. Search/crawlers/e-discovery, intensive algorithms used in certain financial instruments, life-sciences etc are other candidates.
- b. Instant websites (promotion of events/conferences etc), seasonal websites (tax payments, holiday shopping etc)
- c. Rapid Prototyping of your new applications or business ideas. In general, building a 'Minimum Viable Product' is a recommended way to get new applications to market faster, get feedback, and fail-fast at lower costs. The idea is to quickly build a basic set of features that will attract paying customers. A PaaS or IaaS is a great way to try such an approach.
- d. You anticipate/need web-scale for your application but you are not willing to invest upfront on the Capex. The now legendary example is that of the startup, Animoto, that lets customers upload images and music and automatically creates customized Web-based video presentations from them. An initial traffic of about 5,000 people a day suddenly rose to a peak of 25,000 per hour in early 2009. Animoto worked with RightScale and Amazon and did not buy a single new server but expanded from 50 to 3500 servers in 3 days. While there were hiccups — it was a huge spike, even for Amazon — none of them were major. And when demand slowed, Animoto automatically lowered its server use, and its bills. {Animoto also received an unforeseen benefit: in May, Amazon.com decided to invest in it}
- e. If you are an on-premise vendor looking to move to SaaS, there is a lot of work to be done in re-architecting your software, bringing about the necessary changes in your organization culture, marketing etc. An alternative (though much debated) is to deploy your on-premise version as multi-instance software in the cloud i.e. different tenants will run different code base/database. Purists will argue that without multi-tenancy, SaaS is doomed but depending on your context, it may be more rational to test the waters with lesser investments through this approach.
- f. You have a periodic (eg: weekly) need for long running batch processes or compute-intensive algorithms. For eg, when NY Times wanted to convert its 11 million archive articles and images to digital format, they used Hadoop running on Amazon EC2 to complete the work in a couple of days for roughly \$300.
- g. You think you are better-off outsourcing the complexities of server clustering, scaling out, virtualization etc rather than investing to build such skill sets within the org. Typically, such organizations consider product management, marketing, and sales as their core competencies.

*McKinsey, Apr 2009: Cloud Computing is overhyped and it may prove expensive in the long run for large organizations.*

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## When do you choose PaaS?

- Time to market is the most critical aspect. The key is to leverage the ease of development, productivity offered by the vendor
- You have done the due diligence about your chosen PaaS vendor (eg: a sudden demise or acquisition will have a major impact)
- You don't see the lack of portability as a roadblock

*Gartner, July 2009: Cloud Computing is at the 'Peak of Inflated Expectations' and is headed for 'Trough of Disillusionment'*

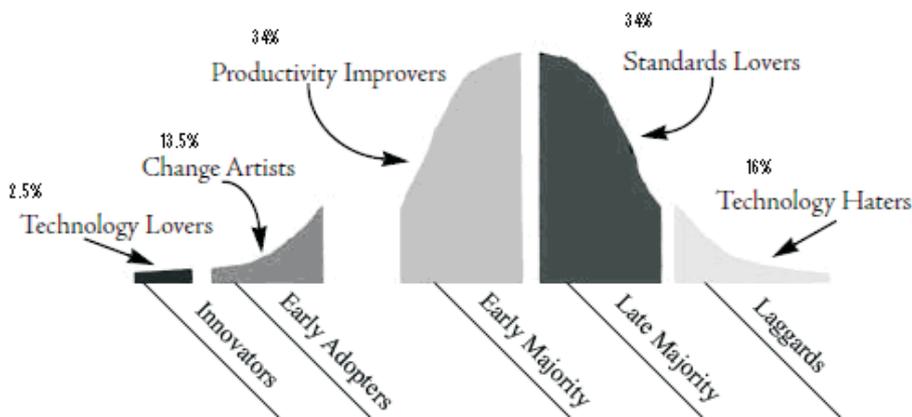
## When do you choose IaaS?

- You need better control of your underlying software platform
- Portability of the application is vital
- You have the necessary technical capabilities to build the software from the ground-up without relying on proprietary PaaS. You also have the necessary people/processes in place to monitor the infrastructure and ensure that the application is running smoothly.

## Four popular theories applied to Cloud Computing

### 1. Crossing the Chasm

The cloud is currently at the 'early adopter' stage. The following popular graph will help you introspect and decide for yourself if you are a pragmatist who will wait for the market to mature or a technology enthusiast who will adopt it early.



### 2. Richard Gabriel's Model

Gabriel is an academic, researcher, entrepreneur and software industry expert whose model of technology acceptance cycle starts with an academic/laboratory innovation after which it takes:

- 2-10 years for a company to adopt the innovation
- 5-20 years for a company to successfully adopt a lab innovation
- 10-25 years for the lab innovation to achieve mainstream adoption

# A CXO's guide to Cloud Computing



As an example, the first windows system was developed around 1976 at Stanford/Xerox PARC.

- First commercial use: Symbolics('79), Apple Lisa ('82), Mac ('84)
- First commercially successful use: Microsoft ('89)
- Widespread acceptance: Microsoft ('95)

He has successfully applied this theory to other innovations as workstations, VCR's and spreadsheets. In fact, the mark-up languages were invented in the '60s, ARPANET formed in the early '70s and WWW became popular in early '90s.

If we assume that the cloud innovation originated around 1996-2000 (think hotmail, salesforce etc), then:

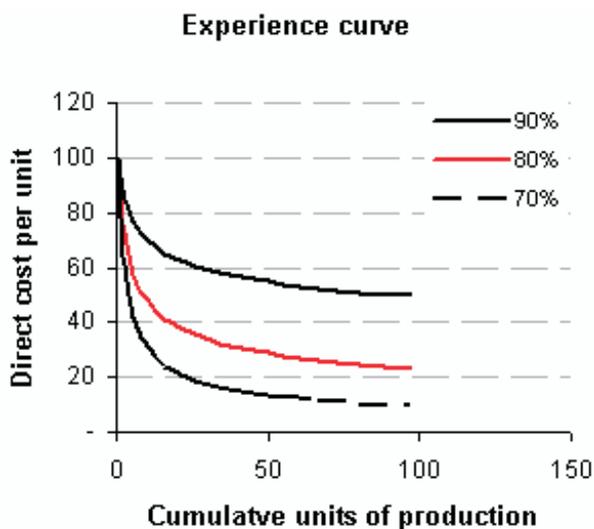
- First commercial use: Amazon, Force.com (~2005)
- Commercially successful use: ~2008-12?
- Widespread acceptance: ~2015+?

### 3. Creative Destruction Theory

The process of creative destruction can be seen in the cassette tape replacing the 8-track, only to be replaced in turn by the CD, itself being undercut by MP3 players, and now by iPod. Nicholas Carr, in his work 'The Big Switch' argued that IT has transitioned from competitive advantage to an also-ran burden – hence IT is a candidate for creative destruction. Already, the approximate cost of a machine year in the Amazon EC2 is less than \$1000 annually while developer costs are much higher at \$300-1000 per day. What if general business eliminated the internal IT or data center with a lower cost alternative? Nicholas Carr wrote "...the biggest upheaval since the invention of the PC....IT departments will have little left to do once the bulk of business computing shifts ...into the cloud."

### 4. Experience Curve

According to this effect, the more often a task is performed, the lower will be the cost of doing it. A 90% experience curve means that for each doubling of production, the marginal cost of producing the next unit decreases by 10%. This is very similar to the Economies of Scale theory.



*US Gov, Sep 2009: Releases [www.apps.gov](http://www.apps.gov), a one-stop source for cloud computing applications – an initiative to modernize IT infrastructure, improve agility, and reduce costs.*

# A CXO's guide to Cloud Computing



By some estimates, in order to gain the same efficiencies as Amazon (which probably operates 50,000-100,000 servers), you need a datacenter with 15000-25000 machines. Obviously, most businesses do not need such numbers and hence it does make sense to outsource the appropriate applications to the cloud after careful consideration of the data security, vendor-lockin and pricing aspects.

## How does cloud impact your organizational DNA?

**Roger The Dodger** first captured public imagination when he won the MVP honors in the 1971 Super Bowl and went on to become a popular quarterback in the history of (American) football. After he retired from NFL, Staubach started working in the Texas commercial real estate business. He saw how frustrated commercial tenants were when they dealt with landlords. The traditional real estate brokers were in general driven by the commission fee that they could collect from both the buyer and the seller. But his philosophy was to build a company that focused on being the advocate of the users of office and industrial space. At that time, it was indeed a pioneering effort in the brokerage business to build a company around tenants. To reinforce his approach, he offered the revolutionary “unconditional guarantee of value” – giving refunds to clients who thought they didn’t get the expected services/benefits.

It will not be an exaggeration to say that companies offering subscription-based SaaS or Cloud offerings require such mindsets. The cloud model puts more focus on the operational aspects of your software - Service Management is as important as Product Management. For enterprises, the willingness of various departments to share infrastructure as against ‘owning their own’ is vital. Also, an effective governance structure is required to guide the overall implementation of the cloud.

## ROI on Cloud Investments

Cloud vendors tout lower costs and conversion of Capital Expenditure to Operational Expenditure as key benefits. The key is to note that although utilities (eg: EC2 machine images) may cost more when they are used, they cost nothing when they are not used. Metrics such as Net Present Value (NPV), Benefit-to-cost ratio (BCR), and Discounted Payback Period (DPP) are useful when you do the ROI calculations. But you should do the math from a medium-long term perspective (factoring in the time value of money principle) to see if you really stand to benefit.

While IaaS makes storage cheaper, there are other hidden factors to be considered such as bandwidth & connectivity costs. If your business requirements are such that you will transfer lot of data (50-100 GB) from the cloud to the users on daily basis, then cloud computing may not be cost effective. Moreover, if you start cloud operations and provide your software in an on-demand model, your revenue may be based the monthly subscription fee and not on upfront licensing. Several financial analysts point out that while this model may be attractive to end-users, the jury is still out in terms of the long-term profitability and sustainability of the provider.

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We think that the real value in adopting the cloud model comes not from cost savings but from increased agility and the ability to seamlessly handle unexpected spikes. Cloud building blocks such as Amazon S3/SimpleDB/SQS, Google's Big Table etc provide the foundation to rapidly convert business ideas to web-scale software by enabling developers to focus on the business logic. Building any of these functionalities in-house is too prohibitive from cost and schedule perspective. Rapid prototyping of new functionalities (Minimum Viable Product), ability to simulate internet-scales, near-seamless provisioning/de-provisioning of resources, and the ability to outsmart competition by bringing in better functionalities faster constitute the true bang for the cloud buck.

## Optimization Services

As you evaluate your cloud strategy, here are a few other services that might be of relevance in easing your transition. (the names of the vendors below are used only as examples)

- a. Cloud Management Platforms - eg: RightScale, Enomaly
- b. PaaS - eg: Giga Spaces, SaaSGrid, Longjump, Heroku
- c. Cloud Brokers – eg: Elastra, Cloud Switch etc
- d. Integration as a Service – eg: Boomi
- e. Billing/Payment solutions – eg: Vindicia

## Conclusion

Christopher Reeve once said "So many of our dreams first seem impossible, then improbable, then inevitable." Cloud computing is one such dream. Experienced CXO's know that achieving tangible benefits early in the technology innovation lifecycle is a difficult but rewarding journey. Just like SOA or mobile applications, cloud computing deserves your attention with a good dose of reality check and economic sense. While the cloud market is rapidly evolving, standards will start to appear and eventually the stack will play as a commodity market. But this is probably going to take more than a decade to play out entirely. As far as adoption goes, there seems to be a general agreement that the question is not IF but rather WHEN and HOW. Organizations need more time to build relevant skills and unearth the hidden traps/costs. So traditional hosting will co-exist with cloud. While start-ups and smaller organizations may have a natural affinity to the cloud phenomena, even larger organizations are already adopting private cloud before embracing public cloud. The forecast is 'partly cloudy, then becoming clear'.

# A CXO's guide to Cloud Computing



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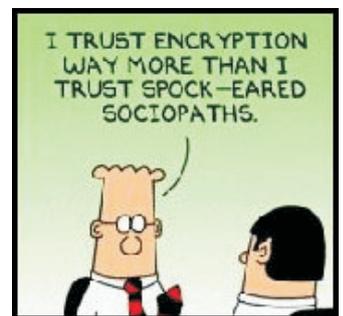
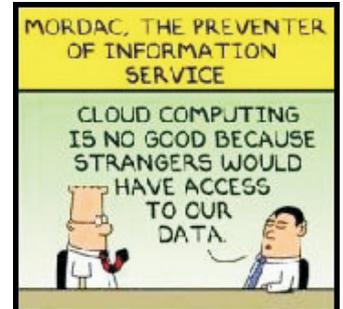
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