

Demystifying the cloud

A guide to understanding cloud computing



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Introduction

Half of respondents

in a Wakefield survey, including a majority of millennials, said they believe that

stormy weather can interfere with cloud computing.



There's really no reason why cloud computing should be shrouded in fear, fog or mystery — but it is, even for some of the more technically savvy among us:

- In a Wakefield survey, a high percentage of millennials said they believe that stormy weather can interfere with cloud computing.
- Twenty-two percent admitted that they pretend to know how the cloud works.
- A quarter of active cloud users said they did not use the cloud when, according to an ACMA survey, all of them did.

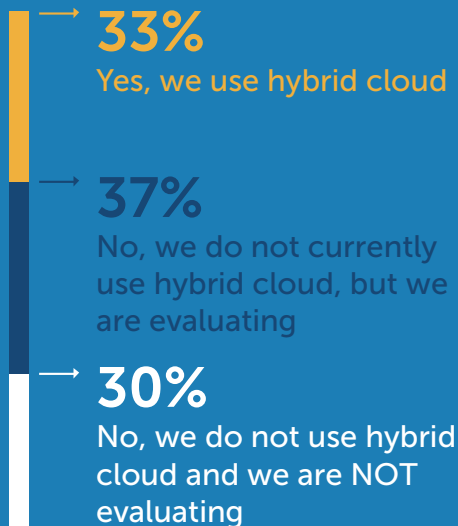
It's not surprising that there's a lot of confusion about cloud computing. To start with, there's nothing soft and fluffy about the technology and it doesn't happen in the sky.

This guide will attempt to remove any doubt or uncertainty about cloud computing because no one should feel diminished or inadequate by computing technology. Read on to learn what it is, what it isn't and why you should care.

Chapter 1

What makes cloud so mysterious?

Hybrid cloud implementation or evaluation



Most people know that ☁ represents cloud computing, but that's where the confusion begins.

The symbol for cloud technology got its start in telephony schematics. The symbol was used to hide low-level detail that wasn't relevant to the bigger picture. Later, the symbol came to represent the internet in computing diagrams, according to Wikipedia. However, the technology behind cloud computing is not as simplistic as its name suggests.

As one CEO observed, "That symbol never helped to explain anything to anyone who didn't already know what it represented."

What is cloud computing?

From a physical point of view, the cloud is a bunch of servers, storage, networking hardware and software connected to the internet.

But even as cloud computing continues to gain popularity across the world, many in the technology business still have difficulty explaining what makes cloud computing special and how it's different from earlier computing models, such as the grid, virtualization or software as a service.

Widespread "cloud washing" hasn't helped. Companies have been using the term to describe anything remotely associated with technology in an effort to cash in on cloud popularity.

Cloud computing has been compared and sometimes equated to the following:*

- **Client-server computing**

In the client-server model, client computers and server computers communicate with each other over a network.

This model is similar to cloud computing only in that clients interact with servers to request resources. There are many other characteristics, such as on demand self-service and elastic scalability that distinguish cloud from client-server computing.

- **Mainframe computing**

In both the mainframe and cloud models, you log on to a virtualized resource to get access to your applications and data, but that's where the similarity ends.

The mainframe is a virtualized monolithic host for computing resources; whereas the cloud pools compute resource from multiple independent computing devices.

- **Grid/distributed computing**

Grid computing loosely couples heterogeneous, often geographically-dispersed computer networks. A cloud can incorporate a grid, but a grid is not a cloud. Cloud computing enables you to self-serve and meter on-demand services to pay only for what you use.

- **Utility computing**

Utility computing describes a computing model that delivers resources, such as compute cycles and storage, as a metered service.

Utility computing, also called measured services, is one of five essential cloud characteristics defined by the National Institute of Standards and Technology (NIST). However, the cloud is much more than a subscription service.

- **Managed services**

Managed services describes the outsourcing of IT service management to a third party. Those services can include cloud services.

- **Software as a Service (SaaS)**

In the SaaS model, you can subscribe to applications that run on cloud infrastructure. However, SaaS is just one of the cloud computing services you can subscribe to. Others include infrastructure as a service (IaaS), platform as a service (PaaS) and desktop as a service (DaaS).

Cloud computing shares characteristics with all of the above, but none of them — by themselves — completely describe cloud computing.

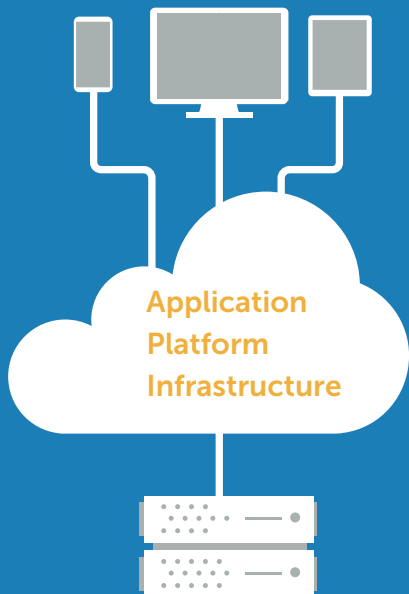
NIST essential cloud characteristics

The National Institute of Standards and Technology (NIST) provides a definitive

A technology model must possess **all five of the following characteristics** to be considered a cloud.



1. Measured service
2. On-demand self-service
3. Elastic scalability
4. Resource pooling
5. Broad network access



description of cloud computing. NIST states that a technology model must possess all five of the following characteristics to be considered a cloud:

- **On-demand self-service:** Anyone with a browser can subscribe to cloud services. This is a technology first.
- **Measured service:** Monitoring and reporting capabilities enable cloud providers to offer services by subscription, pay-per-use and other pricing models that are based on usage.
- **Elastic scalability:** Cloud subscribers can increase or decrease computing resources rapidly.
- **Resource pooling:** Virtualized servers, storage, and networks are pooled together within a single location or from many locations across multiple geographies to create a seemingly infinite supply of cloud computing resources.
- **Broad network access:** Cloud technology requires broad network access to support efficient service acquisition and delivery. Today, the internet provides a standard protocol for connectivity to public clouds with additional options, such as MPLS (Multiprotocol Label Switching), available for private clouds for improved performance and security.

Cloud deployment models

Today, there are three mainstream methods for consuming cloud services:

- **Public cloud:** Cloud started out as a public, multi-tenant service similar to the electricity utility model. Public clouds enable you to tap into a pool of shared resources and pay only for the resources you actually consume. You don't need to know where or how the services are created.
- **Private cloud:** Private clouds offer similar capabilities to public clouds, but they run on dedicated IT only. The private cloud evolved to support companies that needed tighter control over their data and processes. As a private-cloud consumer, you don't share the underlying IT with any other company.

Many companies build private clouds on company property to ensure all the transactions take place behind the company firewall. Some companies host their private clouds on dedicated, third-party IT. Either way, as long as the IT, applications and data are not shared, companies can maintain strict IT controls and satisfy compliance regulations.

- **Hybrid cloud:** Hybrid clouds combine private and public cloud services to offer the security of private clouds and the enormous scalability of public clouds. You can use them to port data and applications between clouds.

Types of cloud services

You can attach the words "as a service" to anything delivered over the Internet. And people do. But that doesn't help if you're struggling to figure out the difference between Workspace as a Service and Infrastructure as a Service.

There are three basic cloud services and everything else is a branch off of one of the three. It helps to think of the three basic cloud services as layers — where Infrastructure as a Service (IaaS) provides the foundation layer, Platform as a Service (PaaS) sits on the IaaS and Software as a Service is the top layer.

- **IaaS:** Server, storage and networking computing capability delivered as a service.
- **PaaS:** IaaS combined with middleware and development tools, such as programming languages and libraries — delivered as a service. PaaS offers a validated and integrated environment for creating applications.
- **SaaS:** IaaS and possibly PaaS combined with software applications and delivered as a service. Users get access to those applications with a browser, web-based email or an application user-interface.

Chapter 2

Why cloud technology is miraculous



65% of companies cited the cloud's ability to provision new capacity when demand increases and to reduce it when demand drops off as one of the most compelling reasons for moving to the cloud.

Cloud technology delivers on its promise to revolutionize computing by simultaneously reducing IT costs and increasing business agility.

In the beginning, many industry watchers dismissed cloud computing as just the latest buzz words for pre-existing computing models. The cloud model does incorporate technologies that predate it, such as metered computing, virtualization and hyper-scalability, but the sum of those parts supports businesses in ways not previously possible.

On-demand self-service, one of the five defining cloud elements, is unique among computing delivery models. Self-service differentiates cloud from anything else, but even that doesn't tell the whole, amazing cloud story.

No more waiting

In the past, you had to ask an IT administrator to fulfill your computing needs — then your request would enter the administrator's queue. With cloud computing, there's no wait time. You just need a browser to acquire the resources you need. You can provision a platform stack with just a few clicks. Cloud APIs and an orchestration engine do the rest.

What you need, and not a cycle more

With cloud computing, you can acquire just enough compute capacity. IT shops have been trying to figure out how to do this since the beginning of data center history. In the past, organizations often overcompensated to avoid a shortfall by paying for much more than they used.

Cloud technology enables you to provision new capacity when your demand increases and to reduce it when demand drops off. Sixty-five percent of the companies surveyed for InformationWeek cited this as one of the most compelling reasons for moving to the cloud.

Goodbye Hardware Silos. Hello Innovation.

You don't need a data center to run your business when you run your IT in the cloud. That new paradigm may represent cloud's most radical departure from traditional computing models.

Traditional data center startup costs are staggering, according to the Wall Street Journal. Companies often employ fleets of in-house specialists to install, configure, integrate, test, tune and run their IT. Data center floor space is almost always the most expensive floor space in the company, often by a large margin. And once a data center is up and running, companies typically spend about 80 percent of their yearly IT budgets on maintenance.

In the cloud model, a considerable portion of this maintenance shifts to the service provider:

1. You subscribe to a service.
2. Your provider delivers the appropriate interface.
3. You log in, and you're up and running.

You can save the cost to build and maintain onsite infrastructure by running your IT in the public cloud — but there are other consequences to consider.

When you run your IT in the public cloud, you are trusting your IT needs to third-party providers. You still need to monitor and manage the process to ensure your provider meets the requirements outlined in your service agreement (SLA). Many companies are finding it difficult to put SLAs in place that address all of the associated risks. For this and other reasons, they are choosing to keep their IT processes closer to home — and still get the benefit of cloud efficiencies — with private cloud solutions.

Private and hybrid clouds

Multi-tenant clouds aren't for everyone. Some companies have requirements that restrict their ability to participate in a shared, multi-tenant environment. Private clouds, which run on dedicated IT, enable those companies to take advantage of cloud benefits.

It is regularly estimated that most organizations spend

70%-80% on maintenance



20%-30% on innovation

If computers knew everything about things—using the data they gathered without help from people—we could track everything and reduce waste, loss and cost ...



The Internet of Things could change the world the same way the Internet did. Maybe even more so. '

Kevin Ashton, That "Internet of Things" Thing

Multi-tenant and single-tenant private clouds both offer on-demand self-service and elastic scalability, but private clouds enable much tighter control over the IT environment.

Hybrid clouds enable you to supplement private cloud capacity by using public cloud multi-tenant services to accommodate occasional spikes in demand. Hybrid clouds offer both the security of private clouds and the enormous scalability of public clouds.

A solution for every problem

Individual cloud providers specialize in particular services, and each provider has different strengths. This makes it easier to find a service that addresses your specific IT infrastructure or business problem.

One service provider might excel at web applications, another at storage applications and still another at compute-intensive applications. You can benefit from all of them if that suits your needs.

You can access almost every kind of business application, from customer relationship management programs (CRM) to advanced bookkeeping, without investing in new infrastructure or paying up-front software costs. You just need a browser and a credit card.

Step up to the big questions

1. Do your business demands fluctuate sharply at different times of the year?
2. Are you always running out of storage space?
3. Do you want to create a more sustainable business environment?
4. Do you need to support a growing mobile workforce?

You can address all of these challenges by taking advantage of cloud computing.

Answers: 1. Respond dynamically with elastic, on-demand cloud services. 2. There's always more room to store your data in the cloud. 3. Shrink your carbon footprint with service-delivered IT. 4. Offer secure, any time, any place access in the cloud.

Cloud gives rise to the internet of things

If you still aren't convinced that cloud opens extraordinary opportunities, consider the Cloud of Things, also called the Internet of Things (IoT).

The IoT refers to a near-infinite ecosystem of wirelessly connected devices — from smartphones and laptops to heart-monitoring devices, home thermostat systems and even living things (animals and people can be wirelessly connected with embedded biochip transponders). In the not-too-distant future, you'll be able to use the IoT to manage everything from home appliances to your carbon footprint, transport, factories and space exploration.

Kevin Ashton summarized the possibilities in his seminal 2009 article, "That 'Internet of Things' Thing, 'If computers knew everything about things—using the data they gathered without help from people—we could track everything and reduce waste, loss and cost ... The Internet of Things could change the world the same way the Internet did. Maybe even more so.'*

Chapter 3

Multi-cloud challenges

Those easily-acquired, amazing services can accumulate quickly, and if left unchecked, they may unleash chaos across your company. Plan for the big picture before you jump in.

A new paradigm raises new questions

Public and private clouds each present different challenges and require up-front planning. Start with a company-wide vision for your cloud computing environment.

- Do you want to transition to a fully service-centric environment? Consult with experts, and conduct a cost-benefit study to create a plan that addresses your IT needs.
- Application migration is a huge undertaking. General Electric had to decide whether to move, consolidate or delete each of the company's 9,000 applications before migrating to the cloud.*
- You might want to start by mixing cloud services with your existing data center solutions and migrate your applications to the cloud gradually.
- Do you want to transform your existing data center into a private cloud or host your private cloud on co-located, dedicated IT? If so, you'll get the best results by virtualizing your entire data center as much as possible. Engage a trusted partner to support you throughout the transformation process.
- You will have to give up some control over your IT processes. With public cloud services, you share control of the processes, data and service levels with your provider.

The service-level is in the contract details

It can be challenging to match your expectations with your provider's description of service levels. Assess the service levels outlined in your contract from both a quantitative and qualitative point of view.

Quantitative performance includes the following:

- **Service availability:** What kind of availability does your provider guarantee? Expect to pay less for 99 percent availability (7 hours of unplanned downtime per month) than for 99.9 percent (43.8 minutes per month) or 99.99 percent (4.4 minutes per month).*
- **Service utilization:** Typically, utilization is measured in terms of CPU, memory, disk, network bandwidth and application usage.
- **Application performance:** What response time does the provider guarantee for transactions, batch jobs, etc.?

Qualitative performance includes the following:

- **Security:** Does your provider apply different security measures to different types of data? How does the provider authenticate users?
- **Escalation processes:** Ensure you understand the escalation processes. How many breaches can you tolerate within a given period? What are the consequences to the provider for failing to meet commitments?
- **Disaster recovery:** What plans are in place to recover from security breaches as well as man-made and natural disasters?
- **Support:** Does your provider offer support 24/7 all year long? How quickly do problems get solved?
- **Exclusions:** Be sure you understand specific exclusions to the service level agreement.

Take back control of your multi-cloud environment

Your employees may already be subscribing to public cloud services without explicit permission, and you really can't blame them. In all likelihood, they just want to solve business problems. It's up to you to take steps to ensure those good intentions don't leave you with silos of cloud solutions, known as shadow IT.

The cloud model doesn't come with built-in governance or accountability. As a result, the self-provisioning capability enabled by cloud technology can give rise to



The main difference between public and private cloud is the underlying infrastructure.



In the public cloud, infrastructure is shared;



In the private cloud, it is not.

unnecessary risk and complexity. This ad hoc approach can lead to:

- Unnecessary and costly duplicate solutions
- Orphaned clouds that continue to consume resources long after serving their purpose
- Solutions that violate security policies and compliance directives

Set boundaries and communicate your policies to keep your employees informed. Progressive Insurance managed shadow IT issues by providing a portal employees could use to request services. You can restore control to your multi-cloud environment by enacting policies that support both IT management and employee productivity. Include anything your workforce needs to know about acquiring and using cloud services, such as:

- Service and contractual obligations
- Technology, application and data requirements
- Compliance restrictions
- Security guidelines

Create a secure, integrated cloud environment

The same integration issues of the past still apply to multi-cloud scenarios. Your programs need to communicate with each other and so do your clouds. The good news is that today's service providers are applying standard web services and RESTful connections that simplify information exchange among processes. You still need to ensure that your cloud services are compatible with your private cloud/on-premise VM (virtual machine) technologies and that your cloud and traditional on-premise data are in sync. There are many tools available to assist you, including:

- Traditional software-based, on-premise integration tools from IBM and Oracle
- On-premise, appliance-based integration servers from Cast Iron Systems
- Cloud-delivered integration tools from Dell (Boomi)

Security and privacy remain two of the most critical cloud computing concerns. In addition to the usual threat of cyber-attacks, you are adding a layer of exposure when you subscribe to public cloud services. Most public providers can assure the highest levels of reliability and security available, but there are still issues associated with trusting your data and applications. Consider the following when choosing a provider:

- How does your provider segregate data? Can you control where your data resides? Will it be stored in another country?
- Do you know what technologies your provider uses to ensure security? Many cloud providers don't expose their infrastructure to customers.
- What happens if the provider suddenly goes out of business?
- How difficult is it to terminate a contract and retrieve all of your data?
- Do you have legal recourse if necessary?

Maintain strict control with private clouds

You can maintain strict control over your data and applications and still enjoy many public cloud advantages (elasticity, self-service, IT efficiency) by running your cloud on dedicated infrastructure. The main difference between public and private cloud is the underlying infrastructure. In the public cloud, the infrastructure is shared; in the private cloud, it is not.

In the private cloud, your data and applications run under your roof or on dedicated hardware in your provider's data center. You can build your own private cloud or run a private cloud in a provider's data center. Either way, the infrastructure is dedicated to your use only.

Private cloud enables you to get the benefits of a service-centric IT model without giving up IT control. You can:

- Customize your IT and operations

Shadow IT:

Employees subscribe to public cloud services without permission

creating silos of cloud solutions.



- Maintain the strictest level of security and compliance
- Deliver improved service levels
- Create a sandbox for applications you intend to run in the public cloud

Unlike the public cloud, on-premise private cloud implementation typically requires significant investment of time and money before you can start accruing benefits. Even if you already maintain a data center, you should take steps to virtualize and integrate your IT as much as possible to get the best results.

You can avoid private capital expenditures by engaging a provider to host your operations on dedicated IT, but not without altering some of the characteristics that define the public cloud. You don't have the sense of location independence that's built into the public cloud or access to what seems like infinitely scalable resources. With private cloud, you can scale up only as much as your dedicated IT allows.

The best of both worlds with hybrid clouds

You can enjoy the security of private clouds as well as the enormous scale of public clouds with hybrid clouds.

Hybrid clouds enable you to add public cloud capacity when spikes in workload demand exceed your private cloud resources. Hybrid clouds also enable you to move applications or parts of applications into the public cloud to take advantage of pay-by-the-hour resources.

To successfully implement a hybrid cloud model:

- Evaluate private cloud vendors to understand their strengths and weaknesses.
 - Which vendor offers the computer hardware, management tools and VM technology that best suits your needs?
 - Can the vendor support you throughout the solution life cycle and help you avoid any pitfalls?
 - Does the vendor make it simple to implement a hybrid cloud model?
- Be sure to observe compliance, software licensing, and security and service-level policies when you move applications in and out of the public cloud.

Summary

The important takeaway is that cloud implementation presents some challenges, but the results are worth the trouble. You can overcome most challenges by planning ahead. Start by forming your own vision for a multi-cloud environment.

Conduct a cost-benefit study. Include hardware acquisition, operating costs, application development and migration in your estimates. This study will tell you how long it will take to realize a return on your investments.

To create a fully unified cloud environment, bring in a cloud broker to handle cloud acquisition and integration challenges. Learn more about cloud brokers in the next chapter.

Chapter 4

You know you need a broker if...

89% 

are apprehensive about moving to the cloud, with concerns about data governance demonstrably slowing or completely halting migration projects altogether.

44% 

of respondents indicated they have “mature” data governance practices in the cloud.

From a survey of 153 US federal government IT professionals



A cloud services broker (CSB) acts as an intermediary between a cloud provider and a cloud consumer.

A good CSB can eliminate the expensive trial-and-error approach by helping you acquire the right services for your company the first time.

If your organization is taking advantage of IaaS, SaaS and PaaS, consider using the skills of an experienced cloud broker to help you manage cloud complexity.

Keep your clouds (and your sanity)

Shadow IT, integration and security represent only part of multi-cloud environment challenges. A big chunk stems from the sheer amount of choice you have.

Companies are recognizing that cloud providers have a wide variety of strengths. To find the services that best address your business challenges, you have to mix it up a bit — unfortunately, that’s how you can end up with overly complex, dysfunctional cloud environments.

There’s a better way. You can acquire public, private and hybrid clouds from a wide variety of providers, such as Amazon, Google and Dell, without putting your business at risk.

Consider hiring a cloud services broker (CSB). CSBs can simplify cloud acquisition and unify your environment. They can turn your overly complicated multi-cloud environment into manageable re-discoverable service offerings.

What is a cloud services broker (CSB)?

A broker is a third-party that acts as an intermediary between two or more parties. A cloud services broker acts as an intermediary between a cloud provider and a cloud consumer.

CSBs are knowledgeable about the cloud services available on the market. A good CSB can eliminate the expensive trial-and-error approach by helping you acquire the right services for your company the first time. Depending on your needs, CSBs can:

- Act as your trusted advisor
- Simplify your cloud purchasing process
- Aggregate disparate cloud services
- Integrate public and private cloud services, including software as a service (SaaS)
- Centralize governance
- Unify and manage billing
- Enhance existing service offers

In short, they can improve your overall experience. You can choose a CSB that acts as your single cloud-entry point—a virtual easy button for all things related to cloud acquisition and management.

You know you need a CSB if you want to:

- Restore control lost to the self-service cloud
- Speed up access to cloud services without taking on additional risk
- Use cloud services and stay compliant
- Customize the cloud services available to you
- Eliminate cloud silos across your company
- Standardize service levels
- Simplify services consumption across your company

Forbes calls CSBs a must-have for all companies that use cloud services. They can unify your cloud engagements, vendors and platforms to help you meet the widest variety of requirements.

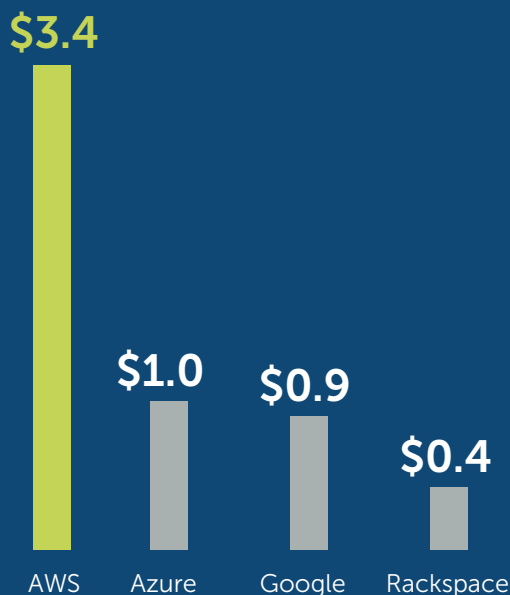
Make the complex look simple

In a multi-cloud environment, complexity will still exist, but it doesn’t have to keep you from business innovation and growth. Enlist the help of a cloud services broker that can provide choices, including private and public cloud services from leaders such as Amazon, Google, Dell and Microsoft.

Chapter 5

Cloud computing providers

AWS vs. competition on 2013 revenue



When it comes to evaluating cloud vendors, everyone seems to have a different take on which companies belong in the top five or ten.

The lists of cloud vendors and solutions described in this chapter are by no means definitive or exhaustive. The reasoning behind identifying specific providers is simply to provide some real-world examples of a snapshot of time. No doubt five search results for top performers would each turn up a different list. A performance evaluation that may be true today is likely to change by tomorrow.

The major cloud providers offer a wide range of services, including Infrastructure-as-a-Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

Most top IaaS providers also deliver PaaS, and the descriptions of the following popular IaaS providers offer both.

Amazon

Amazon Web Services (AWS) easily tops the list as the highest revenue earner (see revenue graph). AWS harvests almost 50 percent more revenue than Azure (Microsoft), Google and Rackspace combined. Amazon's IaaS capabilities range from the simplest pay-as-you-go capability to sophisticated cloud configurations.

In 2013, AWS controlled an estimated 37 percent of the \$9 billion IaaS market. And while the IaaS market grew by about 45 percent, AWS grew by about 60 percent.*

Amazon set the standard for everyone else, and the company has continued to strengthen its position within the industry by constantly expanding its service offerings and reducing its prices.

Amazon PaaS software development kits (SDKs) include Android, iOS, .NET, Java, PHP and Ruby as well as the Visual Studio Integrated Development Environment (IDE). In addition, Amazon offers a big data warehouse capability with RedShift.

Azure (Microsoft)

Microsoft Azure, called the cloud layer over Windows Server systems, deploys and manages applications and services through Microsoft-managed data centers.

Azure supports many different programming languages, tools and frameworks, including both Microsoft-specific and third-party software and systems. Microsoft PaaS services are particularly strong, including support for .NET, Node.js, PHP, Python, Java and Ruby. Microsoft PaaS also integrates with Microsoft Visual Studio, Git and Eclipse.

Cisco Systems

Cisco Systems emphasizes workload portability for private and hybrid clouds with UCS Integrated Infrastructure. The company specializes in services that support disaster recovery, desktops and collaboration in the private cloud.

IDC put Cisco second to IBM in a recent study that states that 28 percent of surveyed customers believe that Cisco can effectively provision IaaS, whether private or public.

Dell

Dell offers an end-to-end portfolio, with public, private and hybrid cloud IaaS. The company has partnerships with the most popular providers to deliver a wide variety of public cloud services.

Dell specializes in private cloud delivery, offering on-premise and co-located private cloud services as well as the consulting services and infrastructure required to build your own cloud.

Dell focuses on simplifying and unifying multi-cloud management with cloud broker services and provides support throughout the solution life cycle, regardless of the cloud vendor or platform.

Google

Google owns a huge chunk of public cloud market share. A successful partner

Spending on public IaaS alone is expected to drive **17% of IT spending**, reaching **\$107 billion** by 2017.



program enables Google to deliver a full range of cloud computing services, including storage, big data and management.

The Google Compute Engine (Google IaaS) scales automatically to meet server demand and enables you to launch virtual machines (VMS) on demand.

The Google App Engine (Google PaaS) is a sandbox for developing Web applications. The App Engine supports Java, Python, PHP, Go, an SDK for all four languages and a plugin for Eclipse.

HP

HP was quick to enter the cloud arena, and the company's BladeSystem Matrix plays a big part in private cloud. HP leverages strong brand recognition and a diverse cloud portfolio.

HP markets its cloud products and services as Helion. Helion offers a full array of cloud services, including Public Cloud Compute, Public Cloud Console (based on OpenStack Horizon), storage and management services.

IBM

IBM is an established and trusted service provider. The company's continued acquisitions and ongoing research and development have enabled IBM to create a broad portfolio, called SmartCloud. SmartCloud includes public and private IaaS and PaaS cloud options that support a variety of business applications.

Rackspace

Rackspace offers both public and private clouds. Low entry prices invite initial IaaS experimentation. Rackspace is known for what the company describes as fanatical customer support.

Rackspace (along with NASA) originally launched OpenStack, an open-source cloud platform for building public or private clouds. Since then, it has added Solum to this platform to create a PaaS environment.

The top SaaS vendors form a mixed collection

You can find SaaS applications for everything from productivity to security, application monitoring and customer relationship management. Compare the lists in Tom's IT Pro to evaluate their services.

This is a list of SaaS leaders in order of revenue from PricewaterhouseCoopers:

Salesforce: Customer Relationship Management (CRM) and business application services

Intuit: Financial management services

Cisco: Network and application performance services

Microsoft: Business application services

Symantec: Security services

Google: Internet-related services

Oracle: Database services

Adobe: Media, publishing and business application services

Blackboard: Education, government and business application services

Compare the Cloud360 list of SaaS vendors. Several companies are worth mentioning (in alphabetical order) for their monitoring and deployment strengths:

Chef builds IT and automates deployment and management of infrastructure using time-tested configuration and operations management processes.

Cloudyn provides optimization, analytics, governance and reporting tools for public, private and hybrid clouds and brokers' financial operations for MSPs, resellers and system integrators.

Cloudability delivers a financial management tool for monitoring and analyzing all cloud expense across any organization. Cloudability identifies cloud resource spending and aggregates expenditures into reports to help reduce costs and increase efficiency.

Dell delivers Boomi and Dell Cloud Manager to ensure reliability and security. Boomi's extract, transform and load (ETL) capability together with its master data management (MDM) capability enable full cloud integration, improving performance and reducing costs. Dell Cloud Manager efficiently deploys and manages virtual machines and applications across private, public and hybrid clouds.

Informatica provides a host of products from information life cycle management applications to procurement. The service scales from individual users to departmental workgroups and the entire enterprise.

Mulesoft offers its Anypoint Platform, a broad set of integration capabilities that cover SOA and SaaS integration and allows connection to a very wide range of APIs.

Puppet Enterprise automates repetitive tasks and application deployment and proactively manages infrastructure over the entire solution life cycle from discovery or provisioning to orchestration and reporting.

RightScale emphasizes a portfolio approach to cloud portfolio management, helping you manage, govern and optimize resources across public and private clouds.

ServiceMesh, recently acquired by CSC, automates the deployment and management of applications across private, public and hybrid cloud environments. It also enforces cloud security, governance and compliance across the full life cycle and provides application release automation across the Software Development Life Cycle (SDLC).

Conclusion

It's safe to say that cloud technology will continue to drive IT industry transformation as well as healthy competition. Spending on public IaaS alone is expected to drive 17 percent of IT spending, reaching \$107 billion by 2017, according to IDC. Learn more about what's ahead for cloud in the next and last chapter.

Chapter 6

What's ahead?



Home energy management, traffic flow optimization, traffic cameras, automated car system and municipal command & control center.



Intelligent digital signage, hospital optimization, connected ambulances, intelligent medical devices and smart grid.



Comms network optimization, factory and logistics optimization and responsive store.

Think of 2014 as the year cloud technology moved from the realm of hype to embraced technology.

In the early years of cloud computing, many were reluctant to take it seriously. But companies have steadily traded fear and suspicion for significant cloud investments. eBay and Coca Cola are prime examples. Today, eBay runs the company's website on a private version of the OpenStack cloud, and Coca Cola plans to run their mission-critical ERP systems in a private cloud, according to Computer Weekly.

The current private, public and hybrid cloud trajectory is pointing in the direction of healthy growth. Research and Markets expects cloud revenue to reach \$209.9 billion by the end of 2014. And Gartner finds that IT spending on public cloud services is growing more than five times faster than growth in IT spending across all categories¹. RightScale underscores those findings in the company's annual State of the Cloud survey:

- Cloud consumers are happier than ever with cloud services. Respondents gave a thumb up to higher availability, increased geographic reach, better cost savings and improved business continuity.
- Security remains an issue, but the more people use cloud services and become aware of security options, the more comfortable they become with public cloud services.
- Compliance, cost and performance were cited most often as the biggest challenges.
- Looking ahead, OpenStack will give VMware a run for its money with regard to private cloud. OpenStack came in first in interest and second in current usage. Microsoft System Center took third place among enterprise users.

All of this healthy momentum is sure to stimulate exploration and innovation, but don't be surprised if cloud weaknesses, not strengths, inspire some of the most fascinating developments in the year ahead.

Bandwidth availability is not keeping pace with demand

Communications bandwidth enables traffic to the cloud. As cloud usage grows, so does bandwidth demand. When there's not enough bandwidth to accommodate demand, information delivery slows to a crawl. This is referred to as bandwidth latency, and anyone who has experienced it knows it's a big problem.

Alternatives are on the rise

Inverse cloud models, also called machine-to-machine computing, have been popping up around the industry as an alternative to the bandwidth-intensive cloud approach. Companies have been coming up with their own branded versions. Cisco has been promoting "The Fog," and IBM has something similar called "Edge computing."

Like the cloud, machine-to-machine computing provides data, compute, storage, and application services to client endpoints. Unlike the cloud model, machine-to-machine computing can distribute some data transmission among routers and endpoints, rather than sending them to a server and back. The data doesn't have to travel as far, so the job can process faster. This model is particularly suited to the IoT and could provide a less bandwidth-intensive path for IoT traffic, which is likely to increase dramatically in the coming years.

Cloud delivery takes to the sky

Perhaps cloud delivery will take place in the sky after all. As far out as that might sound, this idea is gaining considerable traction.*

- Angel Technologies is working on technology called High Altitude Long Operation (HALO). HALO deploys lightweight planes to provide DSL-quality data delivery.
- AeroVironment and NASA are working on a solar-powered, unmanned version of HALO.

¹ Gartner Forecast: Public Cloud Services, Worldwide, 2012-2018, 3Q14 Update, 29 September 2014



2/3rds
of the world's
population doesn't
have Internet access.

Facebook's Connectivity
Lab will test using drones,
satellites and lasers to
spread Internet access to
remote locations.



Research and Markets
expects cloud
revenue to reach
\$209.9
billion
by the end of 2014.

- Sky Station International is doing something similar with blimps instead of planes.
- Facebook is working on a version of the solar-powered option.

Google has Project Loon in place, which floats solar balloons into the stratosphere to spread internet connectivity to remote locations.

Who will win the bandwidth wars?

Broadband, an abbreviated term for broad bandwidth, is currently at the center of a controversy, known as the Network Neutrality debate, about who should have access to it.

Ostensibly, everyone is supposed to share the internet equally, and all internet data is supposed to get the same treatment, without broadband bias. The problem is that all data is not the same — at least that's the complaint to the Federal Communications Commission (FCC) from service providers.

In the U.S., the FCC is charged with regulating interstate communications, including the internet. That's why the agency is trying to establish guidelines for bandwidth usage.

Companies such as Google and Verizon are asking that broadband distinctions be made for different types of data, such as data applications and voice applications. Google CEO Eric Schmidt thinks Net Neutrality should treat all the players equally, but not the data. He'd like to give data with low latency requirements, such as voice data, higher broadband priority than video data. In May 2014, the FCC proposed these two options:*

- Create a fast and slow lane for broadband. This would compromise net neutrality.
- Take broadband out of the internet arena and reclassify it as a telecommunication service, which would preserve net neutrality.

As the debate continues, network providers are creating arrangements among themselves. Look for new decisions in the coming year.

Looking back to look ahead

In the 1960s, J.C.R. Licklider expressed his vision for an intergalactic computer network. His work led to the first iteration of the Internet (called ARPANET for Advanced Research Projects Agency Network). Today, the internet supports cloud applications that run the gamut from managing email to simulating human-robot collaboration.

We came closer to realizing Licklider's vision when Astronaut T. J. Creamer posted to his Twitter account from the International Space Station. But it might take a few years before cloud computing becomes intergalactic.

In conclusion

In the beginning, many considered cloud computing as hype, but over the past few years, that perception has evolved. Companies are recognizing that cloud computing is a game changer. Even some of the more hesitant companies are ready to move to the cloud.

It's important to note that some cloud benefits come with a price. Governance is not built into the cloud, and without that, unchecked acquisition can turn your environment into silos of risky, isolated clouds. Cloud brokers and good management tools are likely to take center stage in the year ahead to help companies cope with their newfound cloud freedoms.