



Cloud Computing

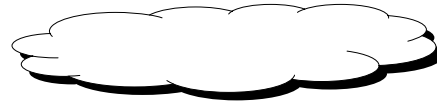
A Discussion of this New Mystery

Sponsored by
ISACA North Texas Chapter
September 9, 2010

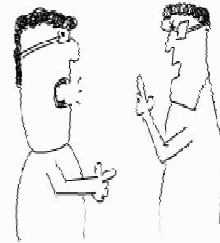
Presented By
Rick Link, CISA, CISSP, CISM, CGEIT
IT Governance Executive and Leader

Cloud – Agenda

- I. What is Cloud Computing?
- II. Cloud Services – SaaS, PaaS, IaaS
- III. Cloud Deployments – Private, Public, Hybrid, Community
- IV. Companies Leading in Cloud Computing
- V. Governance and Control Issues
- VI. Supplemental Information



WHERE THE HECK
IS MY DATA?
IT'S THERE, UP
IN THE CLOUDS.



Perseus.com

Cloud – Learning Objectives

Attendees will be able to:

- Better understand “What is Cloud Computing”
- What are the various XaaS service offerings and the deployment models available
- Learn who are some of the key industry players
- Audit, security and control issues to be aware of in industry and your organization
- Where to get more information

Cloud – Disclaimer Statement

The information contained in this presentation is for the sole purpose of information and education.

Every effort has been made to ensure accuracy of information presented; however, errors may exist.

Any reference of a vendor or product is NOT an endorsement and/or recommendation.



I. What is Cloud Computing?

Cloud – NIST Definition



NIST and the Cloud Security Alliance defines Cloud Computing as “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

Source: National Institute of Standards & Technology (NIST) & Cloud Security Alliance

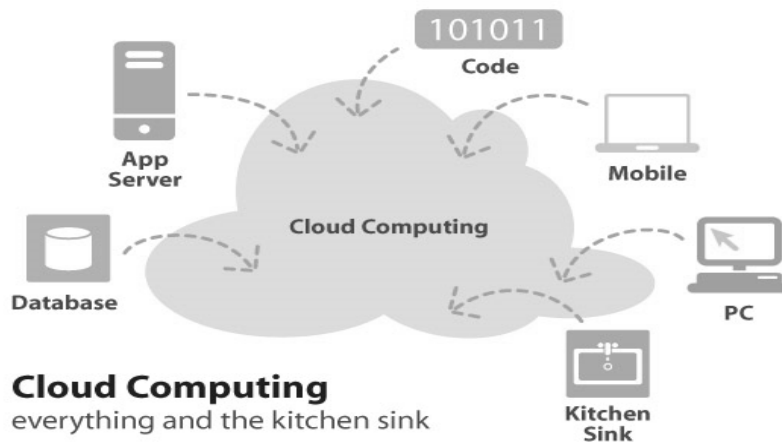
Cloud – Demystified



Michael Sheehan, June 24, 2008
blog.gogrid.com/2008/06/24/the-cloud-pyramid/

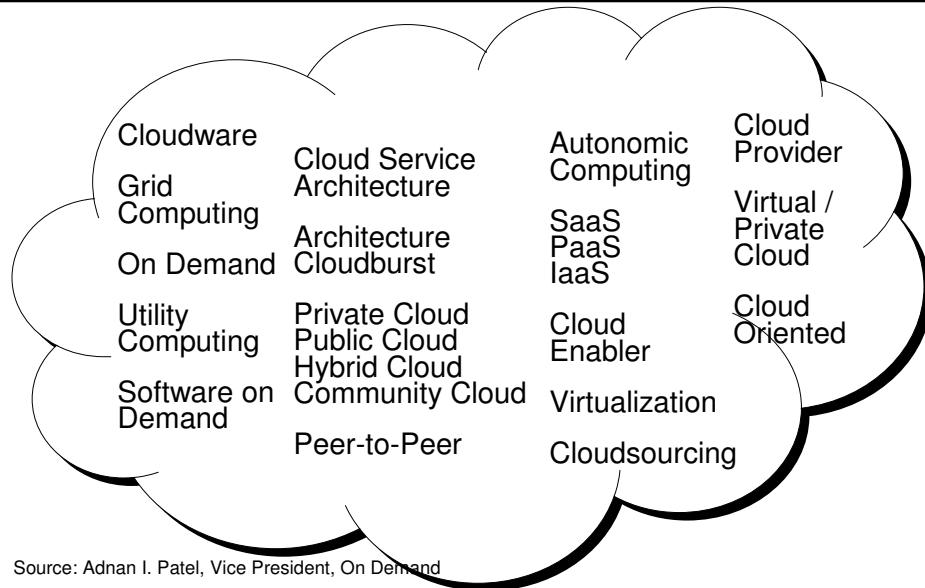
- **“Cloud” is simply a metaphor for the Internet...**
- Users do not have or need knowledge, control, ownership in the computer infrastructure
- Users simply rent or access the software, paying only for what they use
- Example is like using a taxi, train, airplane, etc. where you do not own and/or operate the vehicle as you are renting it for a period of time.

Cloud – Demystified



Source: CloudTweaks – www.cloudtweaks.com/2010/05/cloud-computing-demystifying-saas-paas-iaas/

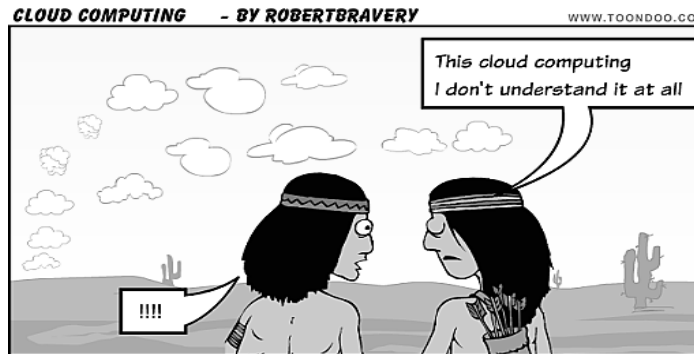
Cloud – Terms



Cloud – A Plain English Video

YouTube video by Tim Wayne and Michael Sheehan at GoGrid discusses IaaS and Cloud Hosting in a way that everyone can understand!

<http://www.youtube.com/watch?v=QJncFirhJPg>



Cloud – Some History

- Concept dating back to the 1960's by John McCarthy, a computer scientist, brought up the idea that "computation may someday be organized as a public utility".
- First cloud around networking (TCP/IP abstraction).
- Second cloud around documents (WWW data abstraction).
- The emerging cloud abstracts infrastructure complexities of servers, applications, data, and heterogeneous platforms.
- Idea that revolutionized Cloud Computing: Moving from clustering computing to grid computing:
 - Clustering, whereby the most efficient computer is accessed and used.
 - Grid-Utility Model, whereby users only pay for what they use, i.e., electricity usage.

Cloud – The Newest Platform

**The
Newest
Platform**

CLOUD – Late 2000s & Future

Cloud Computing, Social Networks
Products > Solutions > Services



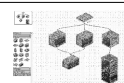
INTERNET – Mid '90s

Browsers, Email, eCommerce,
Hosting, WiFi, Web 2.0



CLIENT/SERVER – Mid '80s

Distributed Computing



PC & APPS – Early 80s

Word Processing, Spreadsheets,
DOS, GUI, Windows



MAINFRAME – '60S & 70S

Financial, MRP
Reservations



Source: Microsoft Tech Days, United Kingdom April 2010

Cloud – Layers / Stack

| | |
|--|--|
| BUSINESS PROCESS | Hardware and software that relies on CC for application delivery. Examples include computers, phones, operating systems, browsers. |
| SOFTWARE (APPLICATION) (SaaS) | SaaS is where the vendor offers the customer the ability to run business applications hosted by the provider. An example would be an Application Service Provider (ASP). |
| PLATFORM (PaaS) | PaaS delivers more than infrastructure. It delivers what you can call a "Solution Stack" for a software development, testing and more recently life cycle management. |
| INFRASTRUCTURE (IaaS) | IaaS is the delivery of a compute foundation including servers, network devices, storage, and data center space as a service. It also includes the delivery of operating systems and virtualization technology to manage the resources. |

Cloud – Key IT Elements

Primary Technologies

- Virtualization
- Grid Technology
- Service Oriented Architectures
- Distributed Computing
- Broadband Networks
- Browsers
- Free and Open Source Software

Other Technologies

- Autonomic Computing (i.e., self management)
- Web 2.0
- Web Application Frameworks
- Service Level Agreement for metrics and reporting



Cloud – Essential Characteristics

- On-Demand Self-Services
- Broad Network Access
- Resource Pooling
- Rapid Elasticity
- Measure Service



Source: ISACA White Paper – Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives

Cloud – Leading Researchers' Comments

- Gartner predicts the worldwide market for Cloud computing is increasing from \$45B in 2009 to \$150B in 2013. And, by 2012, "20% of businesses will own no IT assets."
- IDC points to security as the #1 challenge for Cloud service providers and thus "remains the top opportunity for IT suppliers to tackle as they position themselves as market leaders in the Cloud era."





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Cloud – Leading Researchers' Comments

- ISACA – The promise of cloud computing is arguably revolutionizing the IT services world by transforming computing into an omnipresent utility. (Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives October 2009).
- Forrester Research advises CFOs to take a closer look at Cloud Computing for messaging and collaboration and enterprise applications. The payoffs could be noticeable during current economic downturn.







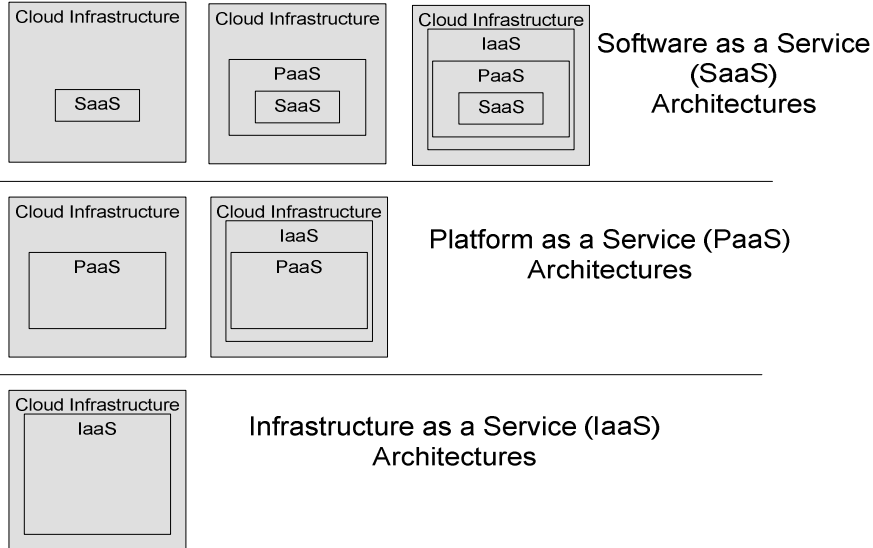
II. Cloud Service Models (SaaS, PaaS, and IaaS)

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Cloud – Service Model Architectures



Source: National Institute of Standards & Technology (NIST)

Cloud – SaaS Service Model

| Service Model | Definition | Issues To Consider |
|--|--|---|
| <p>Software as a Service (SaaS)</p> <p><u>Key Point:</u> <u>Vendor Rents</u> <u>Software</u> <u>Applications</u></p> | <p>Capability to use the provider's applications running on cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser.</p> | <ul style="list-style-type: none"> Who owns the applications? Where do the applications actually reside – even the backups? |

SaaS Examples: Customer Relationship Management (CRM), Enterprise Resource Planning (ERP) for Financial Applications, Electronic Mail, Retail Point of Sale, Word Processor, Spreadsheet, Database Applications.

Using an Internet Service Provider (ISP) for email is SaaS.

Cloud – PaaS Service Model

| Service Model | Definition | Issues To Consider |
|---|---|--|
| Platform as a Service (PaaS) <u>Key Point:</u> <u>Vendor rents hardware, OS, storage & network capacity and overlay with IaaS</u> | Capability to deploy onto the cloud infrastructure customer-created or acquired software created using programming languages and tools supported by the provider. | <ul style="list-style-type: none"> ▪ Availability ▪ Confidentiality ▪ Privacy and legal liability in the event of a security breach (as databases housing sensitive information can be hosted offsite) ▪ Data ownership ▪ Concerns around e-discovery |

PaaS Examples: Google App Engine; Salesforce.com; Force.com; Microsoft Azure; Bungee Connect; Wavemaker; Longjump, Metrisoft.

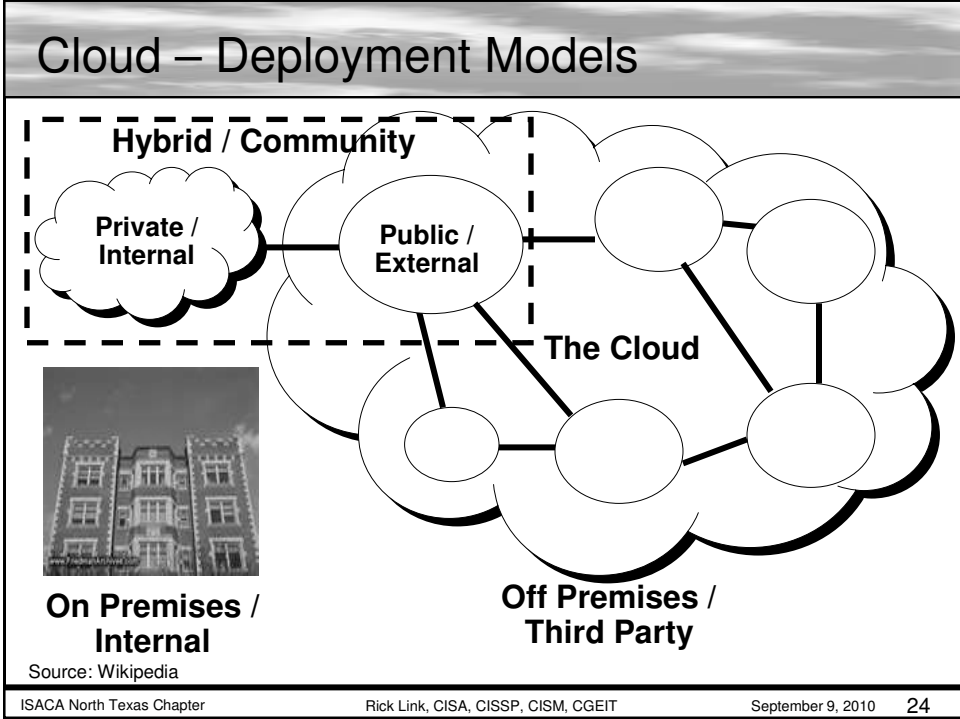
Cloud – IaaS Service Model

| Service Model | Definition | Issues To Consider |
|--|---|---|
| Infrastructure as a Service (IaaS) <u>Key Point:</u> <u>Vendor Rents Hardware (Servers) – Does Overlay with PaaS</u> | Capability to provision processing, storage, networks and other fundamental computing resources, offering the customer the ability to deploy and run arbitrary software, which can include operating systems and applications. IaaS puts these IT operations into the hands of a third party. | Options to minimize the impact if the cloud provider has a service interruption |

IaaS Examples: Hosting web sites of organizations including Amazon, Rackspace, Joyent, Fujitsu, and ElasticHosts (UK).

Basically, IaaS is relocating your hardware to a service provider.

III. Deployment Models (Private, Public, Hybrid, and Community)



Cloud – Private Deployment Model

| Description of Private Cloud Infrastructure | Issues To Consider |
|--|---|
| <ul style="list-style-type: none"> ▪ Operated and maintained solely for an organization on a private network. ▪ Could be managed by the organization and/or a third party. ▪ Could exist on-premises and/or off-premises. | <ul style="list-style-type: none"> ▪ Cloud services which has internal risks including data security, reliability, governance... NOTE: ISACA states “Cloud services with minimal risk...” ▪ May not provide the scalability and agility of public cloud services. |

Source: ISACA White Paper – Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives

Cloud – Public Deployment Model

| Description of Public Cloud Infrastructure | Issues To Consider |
|---|--|
| <ul style="list-style-type: none"> ▪ Made available to the general public or a large industry group. ▪ Owned by an organization selling the Cloud services. ▪ May be managed by the organization or a third party. ▪ Exists off-premises. | <ul style="list-style-type: none"> ▪ Same as Private and Community Clouds (data security, reliability, governance), plus: ▪ Data may be stored with the data of competitors. ▪ Data may be stored in unknown locations and may not be easily retrievable. |

Source: ISACA White Paper – Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives

Cloud – Hybrid Deployment Model

Description of Hybrid Cloud Infrastructure

- A composition of two or more clouds (Private, Public, Community) that remain unique entities but are bound together by standardized or proprietary technology.
- Typical for most companies.
- May be managed by the organization or a third party.
- May reside on-premises or off-premises.

Issues To Consider

- Aggregate risk of merging different deployment models.
- Classification and labeling of data will be a significant consideration.

Source: ISACA White Paper – Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives

Cloud – Community Deployment Model

Description of Community Cloud Infrastructure

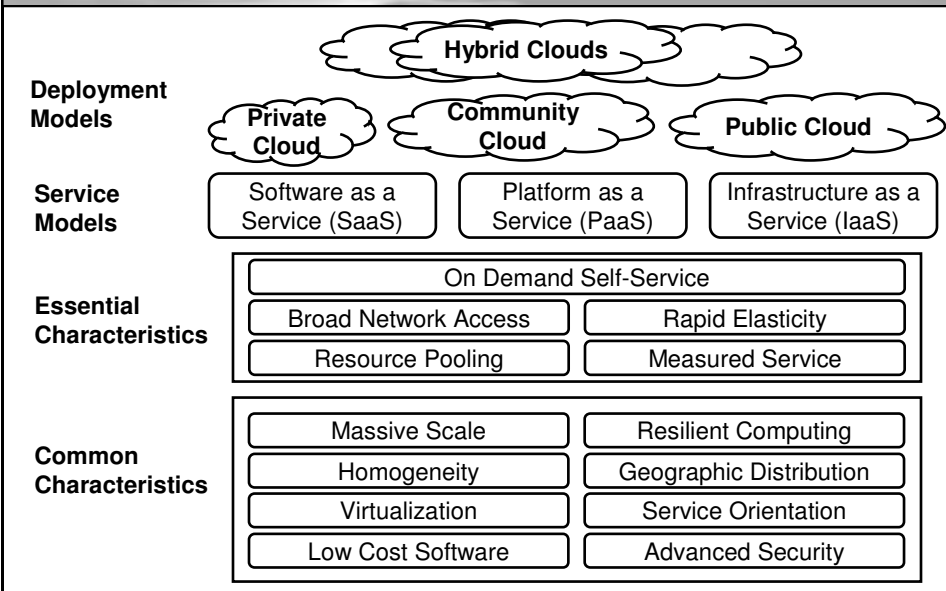
- May be established where several organizations have similar business, legal, and regulatory requirements and seek to share infrastructure so as to realize some of the benefits of Cloud Computing.
- Examples include automobile, government, media and healthcare industries.
- Non business-critical information and processing can be sourced to the public cloud, while business critical services are kept in-house or in a Private Cloud.

Issues To Consider

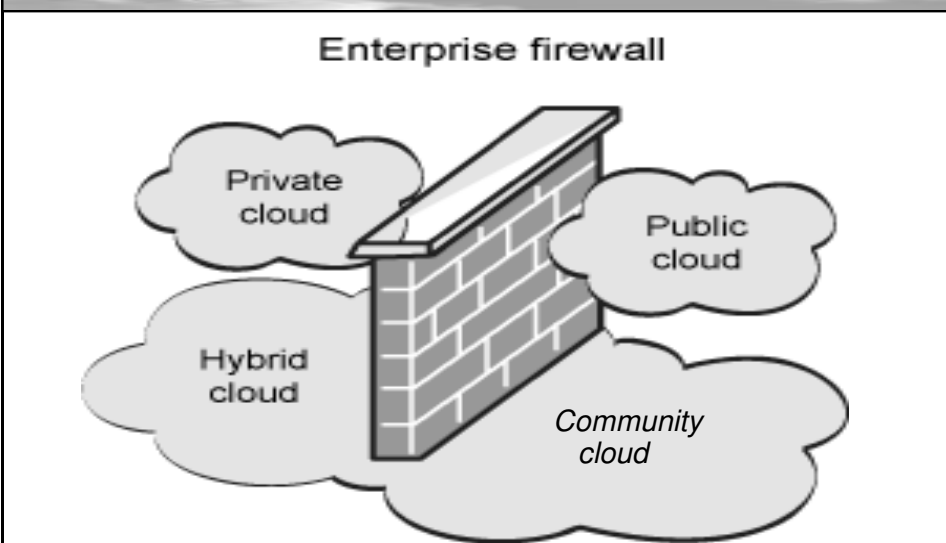
- Costs are spread over fewer users than a Public Cloud.
- Data may be stored with the data of competitors.

Source: ISACA Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives

Cloud – The NIST Definition Framework



Cloud – Private, Public, Hybrid, Community

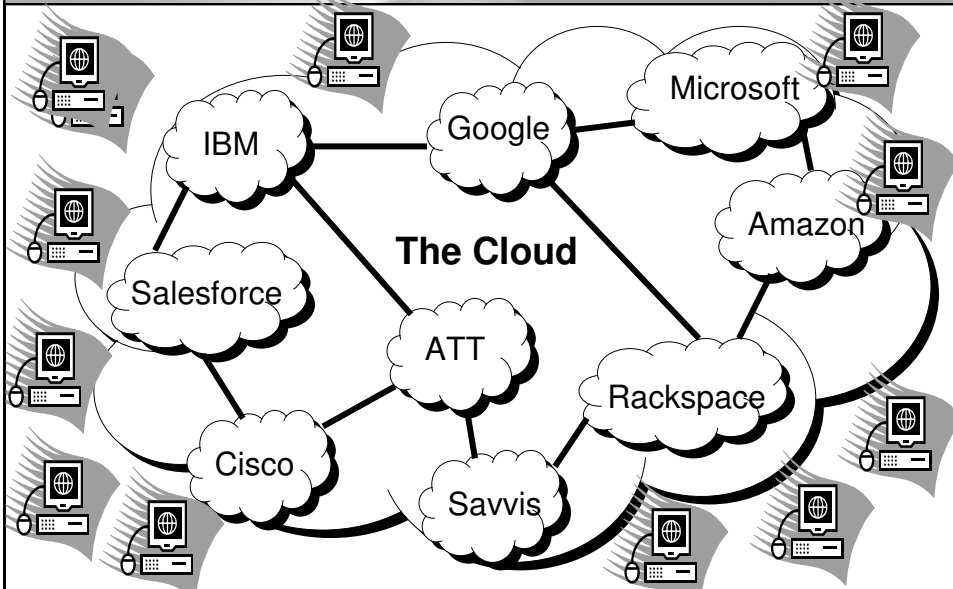


Source: Rice University



IV. Companies Leading in Cloud Computing

Cloud – Vendors





“Google 101”

- Network made up of millions of cheap servers, that would store staggering amounts of data, including numerous copies of the world wide web
- Makes search faster, helping ferret out answers to billions of queries in a fraction of a second
- Google has invested more than \$2 billion a year in data centers for cloud computing.
- By far the leader in the technology
- Controls 500,000 systems, 1 million CPUs and provides 1,500 GB/second of Internet broadband connectivity.



Amazon Elastic Compute Cloud “Amazon EC2”

- Web service interface that provides resizable computing capacity in a cloud
- Designed to make web-scale computing easier for developers
- Reduces the time required to obtain and boot new server space from weeks to minutes
- Allows developers to pay only for capacity that they actually use
- Controls 160,000 systems, 320,000 CPUs and 400 GB/second of Internet broadband connectivity.



“Azure”

- Internet-scale cloud computing and services platform hosted in Microsoft data centers
- Provides a range of functionality to build applications that span from consumer web to enterprise scenarios
- Designed to help developers quickly and easily create, deploy, manage, and distribute web services and applications on the internet.
- Controls 560,000 systems, 1.27 million CPUs and 500 GB/second of Internet broadband connectivity.

Cloud – Commercial



Cloud – Scalable Pricing

- 1) Free – Does not provide technical support so not a business option for mission-critical systems...
- 2) Subscription Model – Pay a fixed periodical fee typically on an annual basis for infrastructure software.
- 3) Pay Per Use – more flexible then subscription model as it gives you higher granularity based on CPU or bandwidth utilization (Amazon EC2 uses this model).


Cloud – Scalable Pricing

- 4) Perpetual License – Used to buy licenses in advance and pay for support separately. Most commonly used model with commercial software product.
- 5) Enterprise Unlimited License - Enables you to pay premium price in advance and gives you the freedom to use the software without any limit. This fits to an environment where it is anticipated that over a fairly short period of time the usage of the product will become wide and therefore the others above may be more expensive.

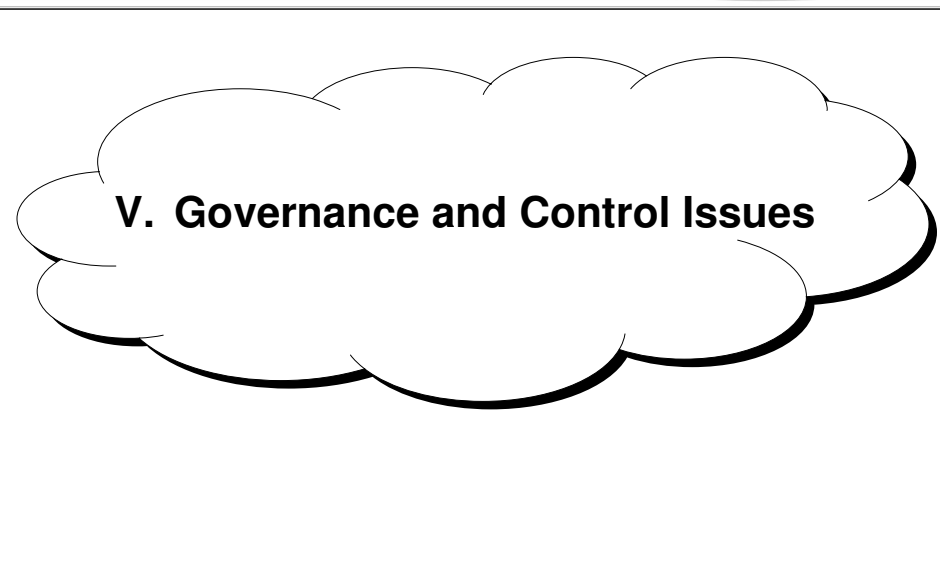
Cloud – What Do These Services Offer?

Cloud computing will lead to an increase in the following categories:

- 1) Virtualization – Hardware and software cost savings as additional computers no longer needed.
- 2) Usability – End user are not required to necessarily understand the computer power and architecture to meet their business goals.
- 3) Standardization – Allows for newer software to work on the same infrastructure so less interoperability issues.
- 4) Scalability – Allows for easier provisioning and implementation so faster to meet client value.



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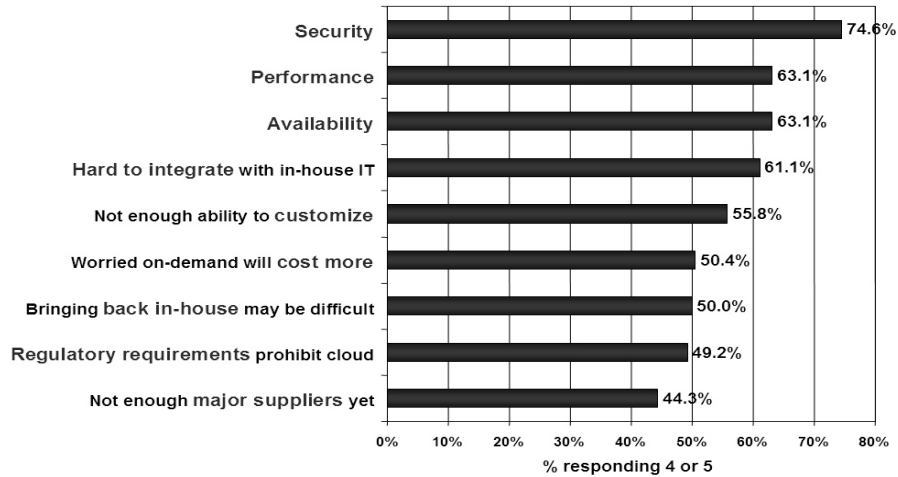


V. Governance and Control Issues

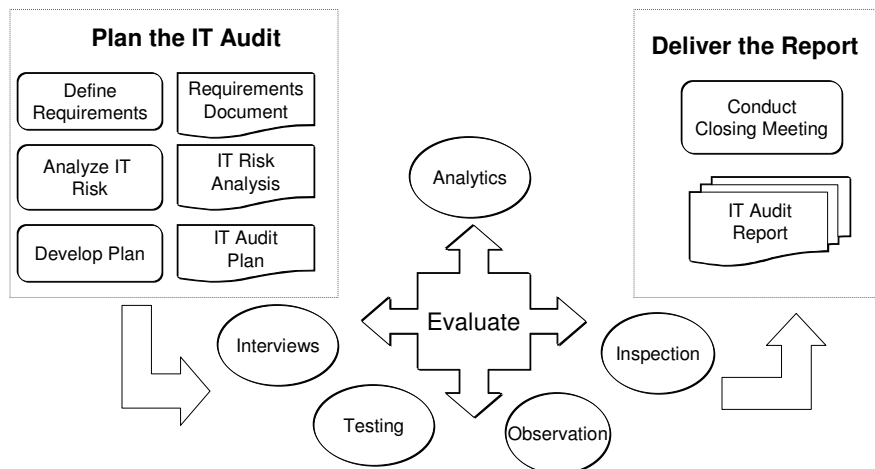
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Cloud – Issues Noted in Aug 2008

Q: Rate the challenges/issues ascribed to the 'cloud'/on-demand model
 (1=not significant, 5=very significant)



Traditional IT Audit Process



The traditional audit process still works!

Cloud – Why Important to Auditors?

- It's changing the topology of business & IT!
- The new belt-tightening economic models for computing has found fertile ground in cloud technology and is seeing massive global investment.

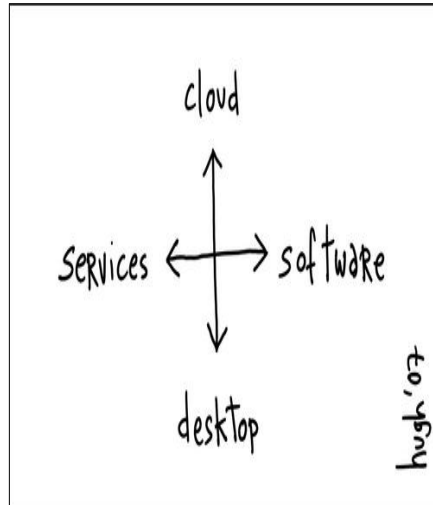


Cloud – What Issues are Important and Why?

- Regulatory and Compliance Implications
 - Gramm-Leach-Bliley Act of 1999
 - Sarbanes-Oxley Act of 2002
 - Health Insurance Portability & Accountability Act (HIPAA) of 2006
 - Payment Card Industry (PCI) Data Security Standards of 2004...
 - Family Educational Rights & Privacy Act (FERPA) of 1974
 - SAS70, PCI, etc. etc. etc.
 - Cloud Computing Certification?
- Reputation
 - Your company's and your business partners

Cloud – New Problems, New Complexities

1. Board level education i.e., cost vs. benefits vs. risks.
2. Contracts, terms & conditions, penalties, SLAs (uptime, throughput, response time), vendor exit strategy, audit clauses.
3. System and application migration issues.
4. Security, Security, Security, Security.



Cloud – Top Security Benefits

- Benefits of Scale – The same investment buys better protection.
- Standard Interfaces for Security Services – Creates a more open market for security services.
- Rapid, smart scaling of resources – Dynamic reallocation of resources improves resilience.
- Audit and Evidence Gathering – Provide dedicated, pay-per-use forensic images of VMs.
- Better updates and defaults – Default VM images with best configuration and patches.

Source: European Network and Information Security Agency (ENISA) Cloud Computing -Benefits, risks and recommendations for information security <http://www.enisa.europa.eu/act/rm/files/deliverables/cloud-computing-risk-assessment>

Cloud – Security Alliance Top Threats

1. Abuse and Disreputable Use of Cloud Computing
2. Insecure Interfaces and APIs
3. Malicious Insiders
4. Shared Technology Issues and Vulnerabilities
5. Data Loss and/or Leakage
6. Account, Service & Traffic Hijacking
7. Unknown Risk Profile of Provider

Source: Cloud Security Alliance – Top Threats to Cloud Computing V1.0
www.cloudsecurityalliance.org/topthreats/csathreats.v1.0.pdf

Cloud – Managing Risk

- Due Diligence by Customer
 - Ask Questions
 - Fully specify Security Service Levels
- Clear Division of Liabilities
 - Example: Customer = Data Controller, Provider = Data Processor (External)
- Clear Division of Responsibilities
 - Depends upon Service Model (SaaS, PaaS or IaaS)
- Certification of Providers

Cloud – Your Opportunities

- Cloud Computing – It's inevitable.
- You're already doing it...
- There will be challenges.
- Not overnight and not everything.
- Your role is to help assess risks and communicate.



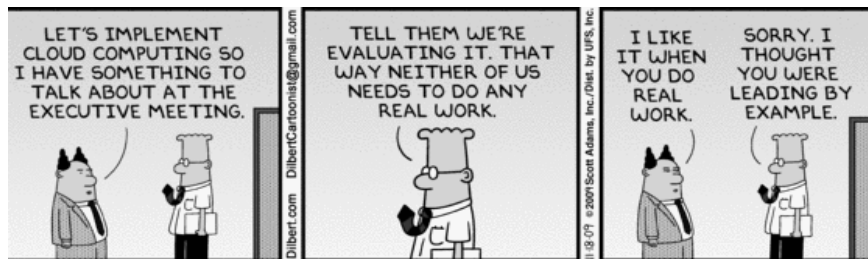
Same job, different technology...

Cloud – Your Opportunities

- Opportunity for you to engage with the IT and business to help manage risk.
- Clouds are just starting and build on/are related to Grids.
- Clear need for best practice in use and technology.
- Likely to be need for new standards and novel use of existing/projected standards.
- New ISACA NTx Cloud Forum SIG?
 - Chairs, participants?
 - Share experiences and issues

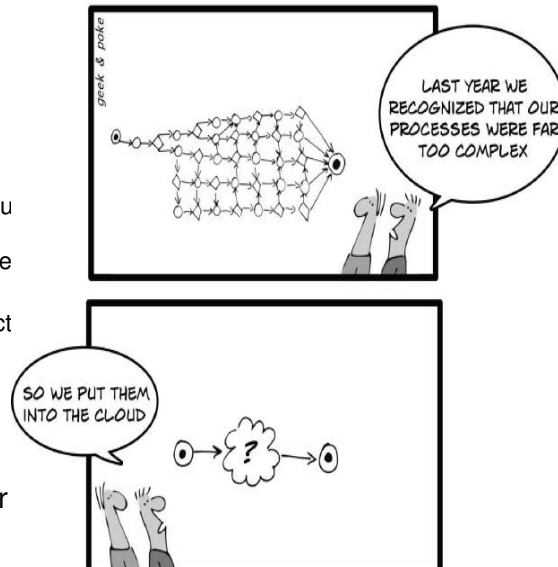
Cloud – Issues for 2010 & Beyond

- Deliver strategic value in addition to measurable cost-savings.
- Move core business operations to the Cloud.
- Fight off escalating security threats.
- Address growing integration complexities.
- Focus on international growth.




Cloud – Other Challenges

- New ones emerge as services become more distributed:
 - ✓ Who owns the Cloud?
 - ✓ Everyone uses the Cloud
 - ✓ Each individual, autonomous system is responsible for securing their section of the Cloud
 - ✓ Each system has an impact on everyone – even more than before
- Bottom-line – things that impact you and your business don't end at your gateway anymore...

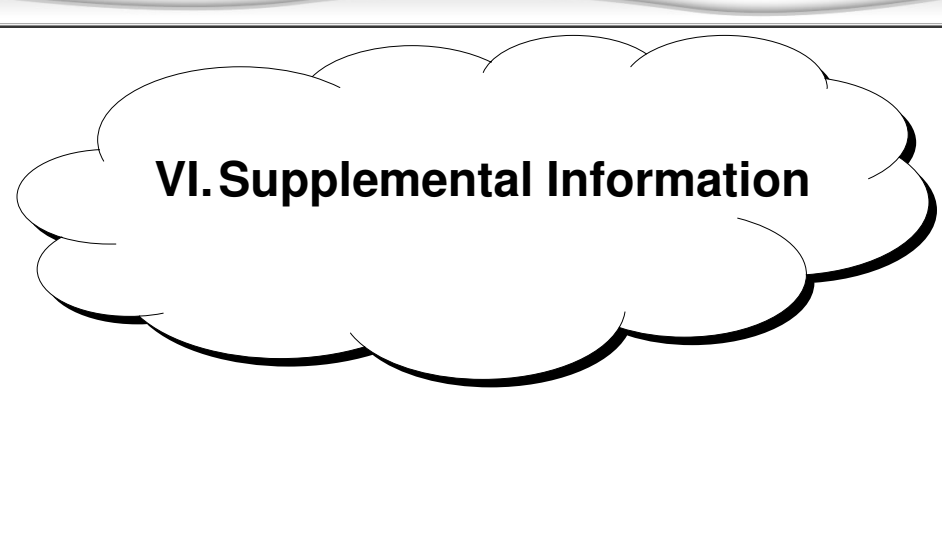


Cloud – Summary Comments

- Clouds inject yet another layer of:
 - ✓ Technology
 - ✓ Configuration
 - ✓ Controls
- Multi-Tenancy → Multi-Attestation...
- Global Location & Regulatory Concerns
- Legal Questions & Issues
- Security Innovation Requirements



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VI. Supplemental Information

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Cloud – Supplemental Information

ISACA

- “Cloud Computing: Business Benefits With Security, Governance and Assurance Perspectives”; An ISACA Emerging Technology White Paper. Source www.isaca.org/cloud (October 2009)
- “Risk Perception and Trust in Cloud”; ISACA Journal V4 2010; by Fariborz Farahmand, Ph.D., Center for Education and Research in Information Assurance and Security at Purdue University. Source: www.isaca.org/Journal/Past-Issues/2010/Volume-4/Documents/jpdf1004-risk-perception.pdf
- “Security, Privacy, and eDiscovery in the Cloud” eSymposium; Source: www.brighttalk.com to register and receive 3.0 CPEs (August 2010)
- “Cloud Computing Management Audit/Assurance Program”. Source: www.isaca.org/knowledge-center/ITAF-IT-Assurance-Audit/Audit-Programs (August 2010)

Cloud – Supplemental Information

National Institute of Standards Technology (NIST)

“NIST Definition of Cloud Computing” (v15) by Peter Mell and Tim Grance (October 7, 2009) <http://csrc.nist.gov/groups/sns/cloud-computing>.

Dummies Store

“Cloud Computing for Dummies” by Judith Hurwitz, Robin Bloor, Marcia Kaufman, ISBN: 978-0-470-63881-1 (November 2009) www.dummies.com.

Wikipedia – The Free Encyclopedia

“Cloud Computing” http://en.wikipedia.org/wiki/cloud_computing

The Cloud.com CloudStack 2.0

The CloudStack is an open source software product that enables deployment, management, and configuration of multi-tier and multi-tenant infrastructure cloud services.

Cloud – Supplemental Information

LinkedIn Groups

- “Cloud Computing” with over 39,000 members.
- “Cloud Security Alliance” with over 11,000 members.
- “Cloud Computing, VMware, Virtualization and Enterprise Group 2.0” with over 33,000 members
- Go to LinkedIn.com to see the others – some 725 more...

Contact Information

