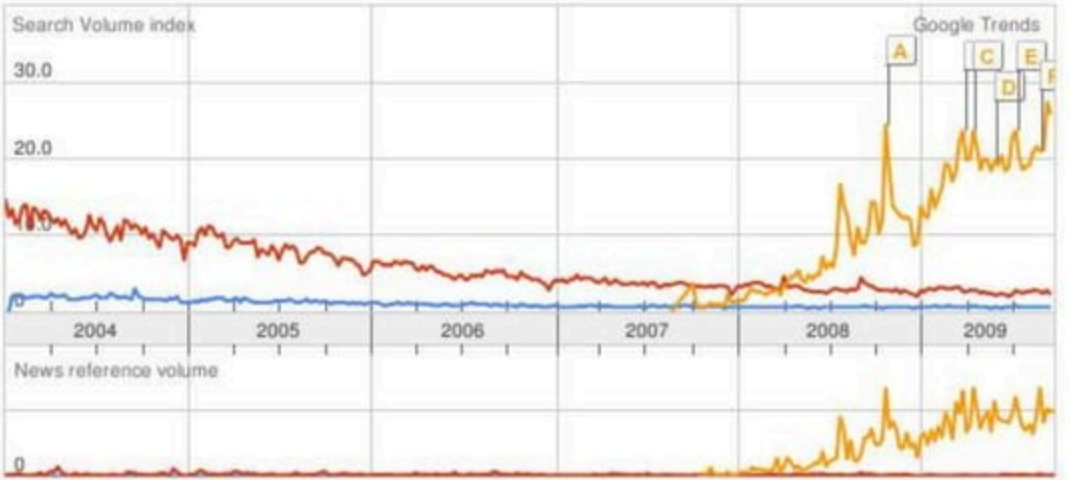
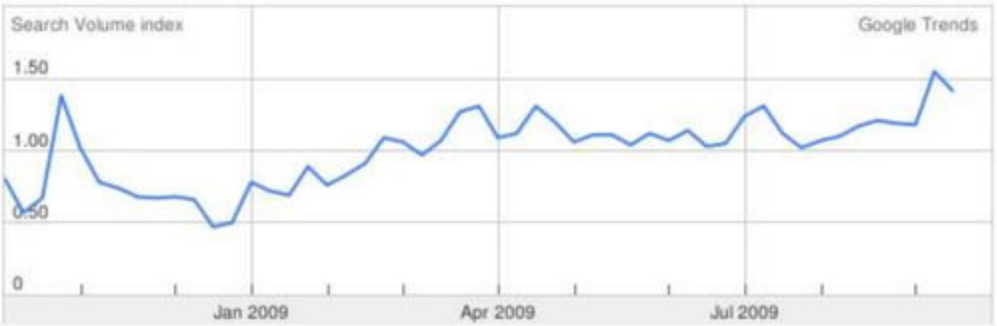
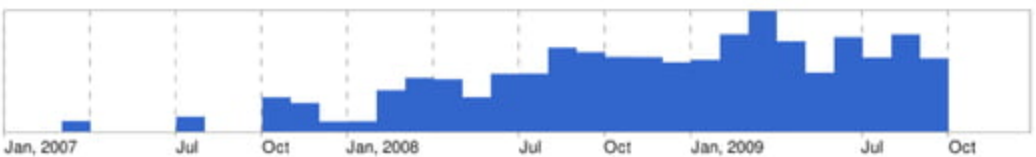
Ninh V. Nguyen
ninh.nv@gmail.com

The Hype



Cluster Computing
Cloud Computing
Grid Computing





Google news "cloud computing"


"Computing is not about computing anymore. It's about living."
Being Digital (1995) by Nicholas Negroponte (p.6)
"What the hell is Cloud Computing?"
- Larry Ellison

5th Generation of Computing

1970s	1980s	1990s	2000s	2009+
Monolithic	Client-Server	Web	SOA	Cloud Services
				

Wikipedia's Definitions

Cloud computing is a computing paradigm shift where computing is moved away from personal computers or an individual server to a "cloud" of computers.

– 12/2007

Cloud computing is Internet-based ("cloud") development and use of computer Technology ("computing"). The cloud is a metaphor for the Internet, based on how it is depicted in computer network diagrams, and is an abstraction for the complex infrastructure it conceals.

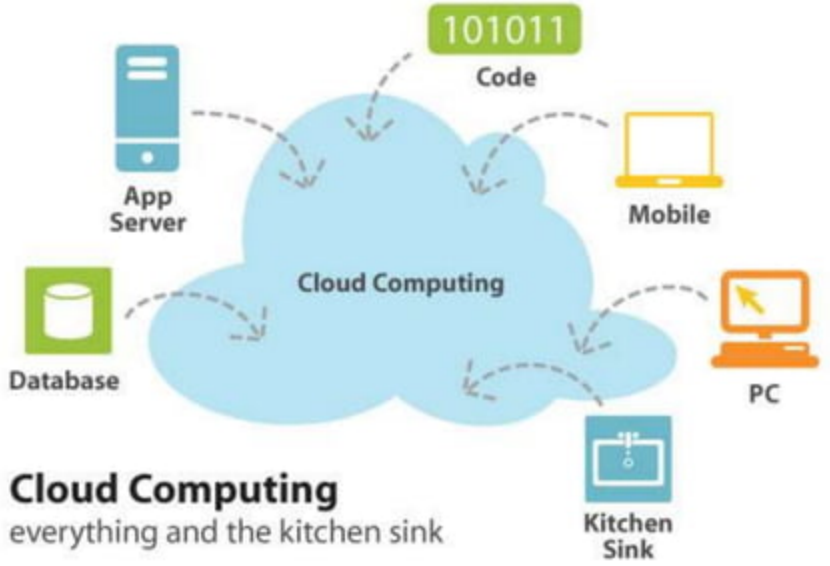
– 12/2008

Cloud computing is a style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet.

– 6/2009

Cloud computing is an example of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet.

- Now



Common implies multi-tenancy, not single or isolated tenancy

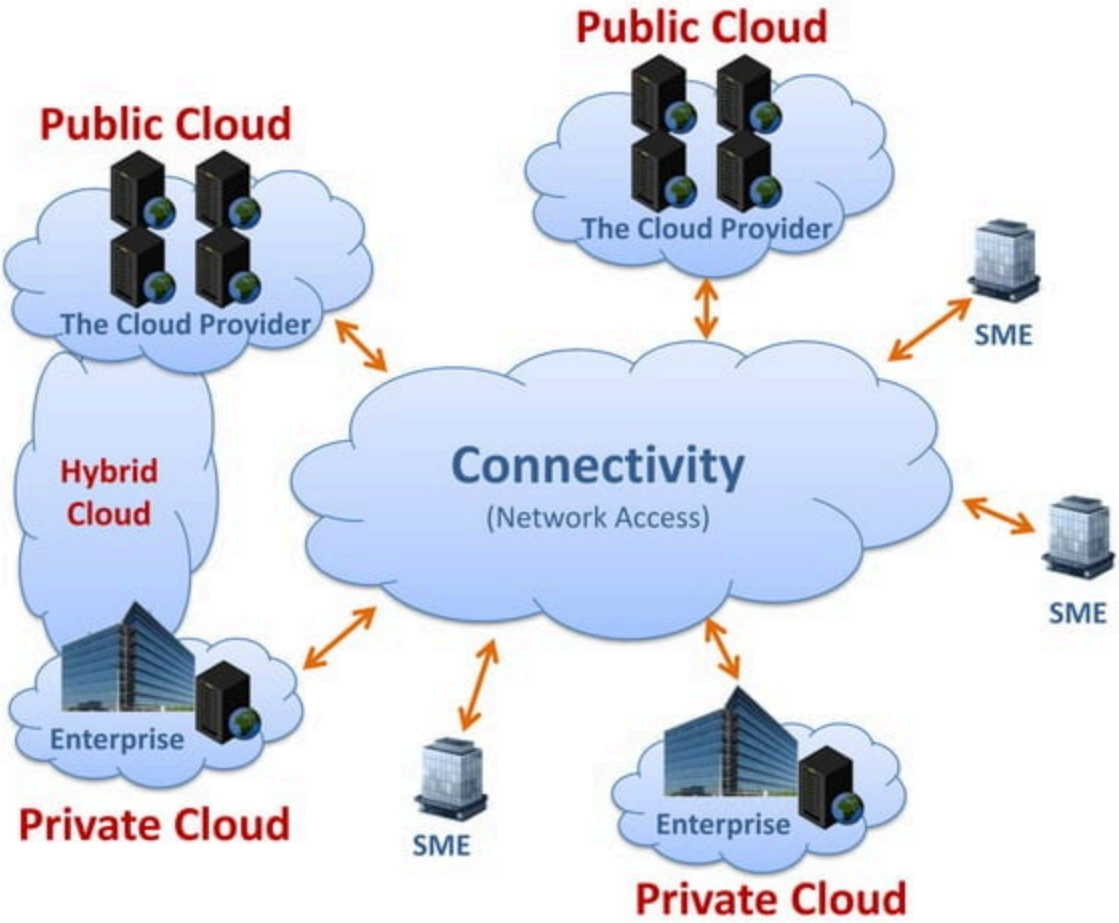
Location-independent

Online

Utility implies pay-for-use pricing

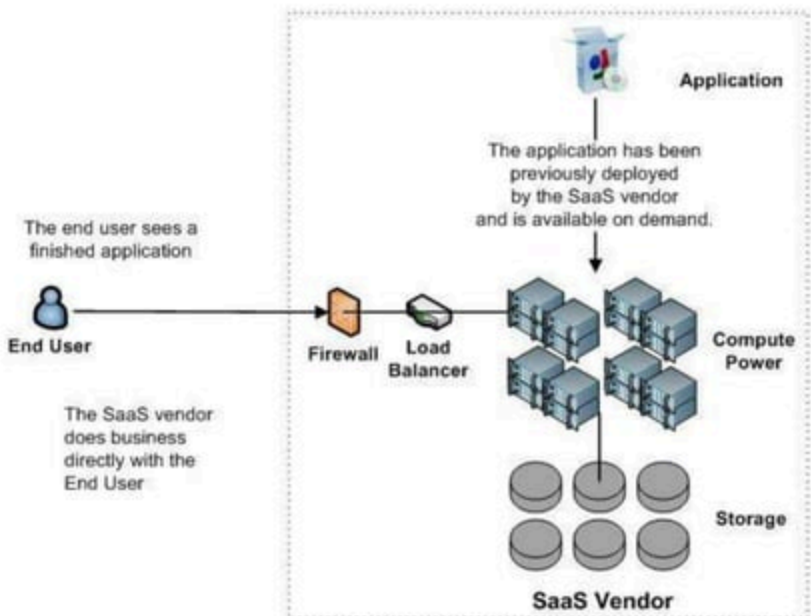
Demand implies ~infinite, ~immediate, ~invisible scalability


Cloud Computing Infrastructure Models


Public Cloud
The Cloud Provider
Public Cloud
The Cloud Provider
SME
Hybrid Cloud
Connectivity
(Network Access)
SME
Enterprise
Private Cloud
SME
Enterprise
Private Cloud


Architectural Layers of Cloud Computing

Software as a Service (SaaS)



salesforce.com
Success On Demand.

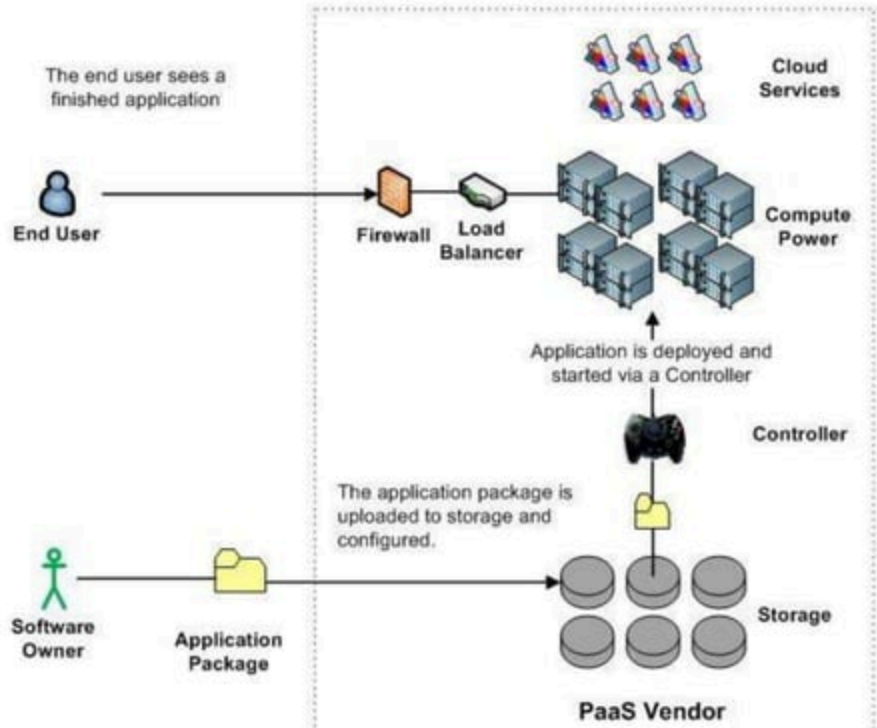
ZOHO
Work. Online

sliderocket

clarizen
Projects Made Real

Google Docs

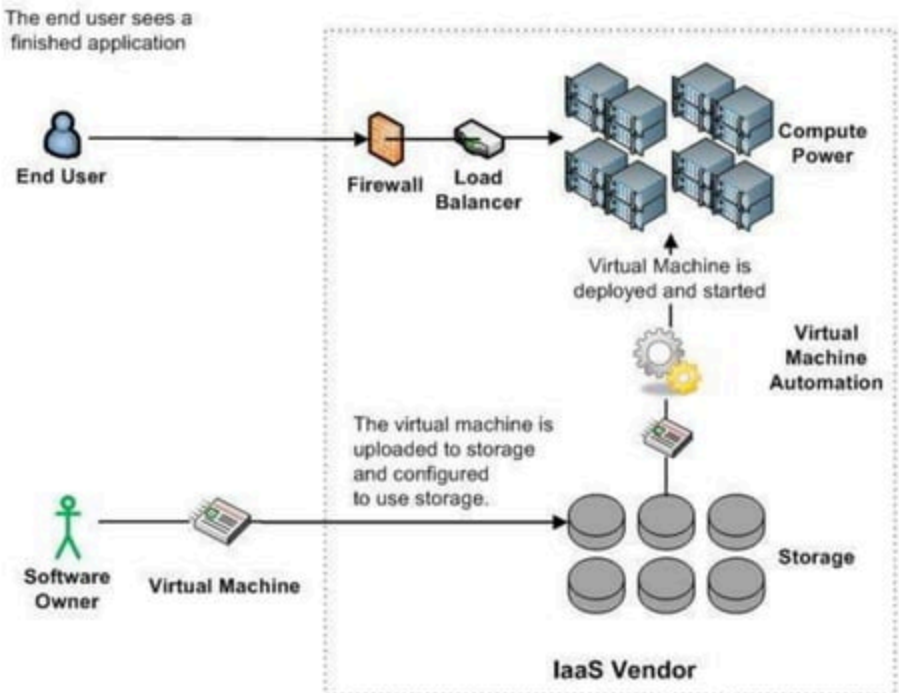
Platform as a Service (PaaS)



Google App Engine

Windows Azure

Infrastructure as a Service (IaaS)

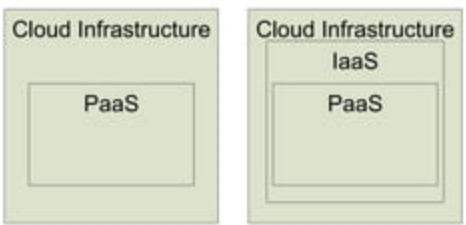


amazon web services™

rackspace

ServePath

Software as a Service (SaaS) Architectures



Platform as a Service (PaaS) Architectures

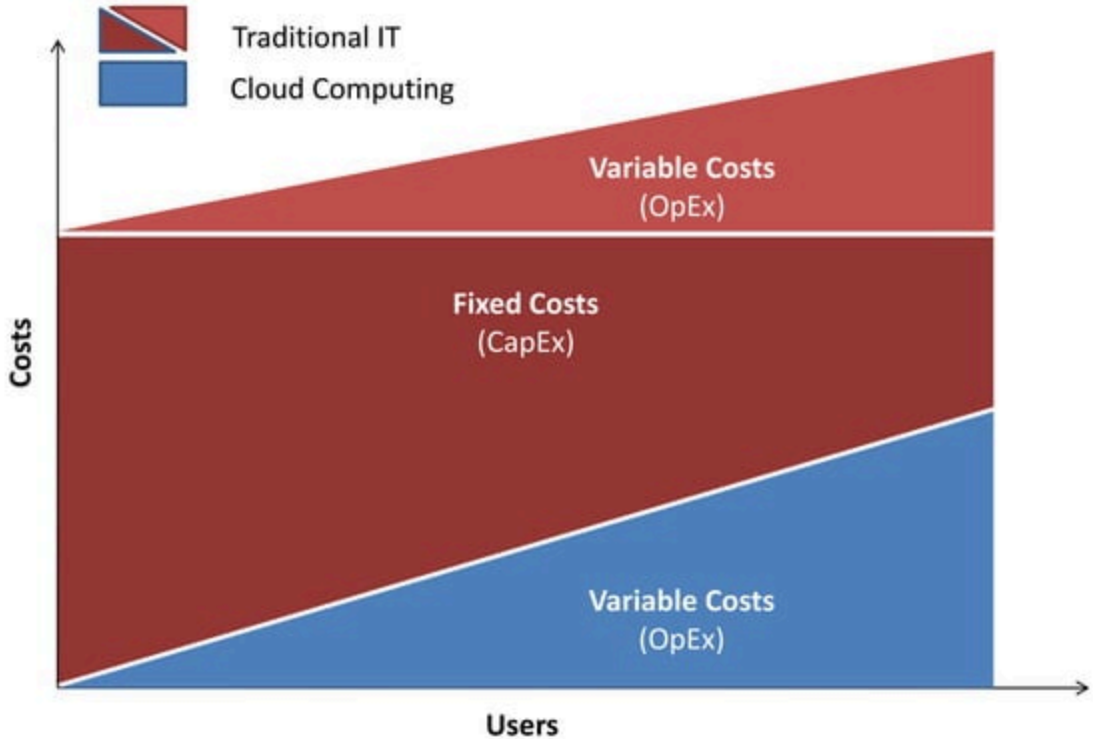
Infrastructure as a Service (IaaS) Architectures


Cloud Computing Characteristics

Comparisons

Grid Computing	Utility Computing	Autonomy Computing
• A form of distributed computing • A "super and virtual computer" is composed of a cluster of networked • Loosely coupled computers acting in concert to perform very large tasks	• Packaging of computing resources, such as computation and storage • A metered service similar to a traditional public utility, such as electricity	• Computer systems capable of self-management

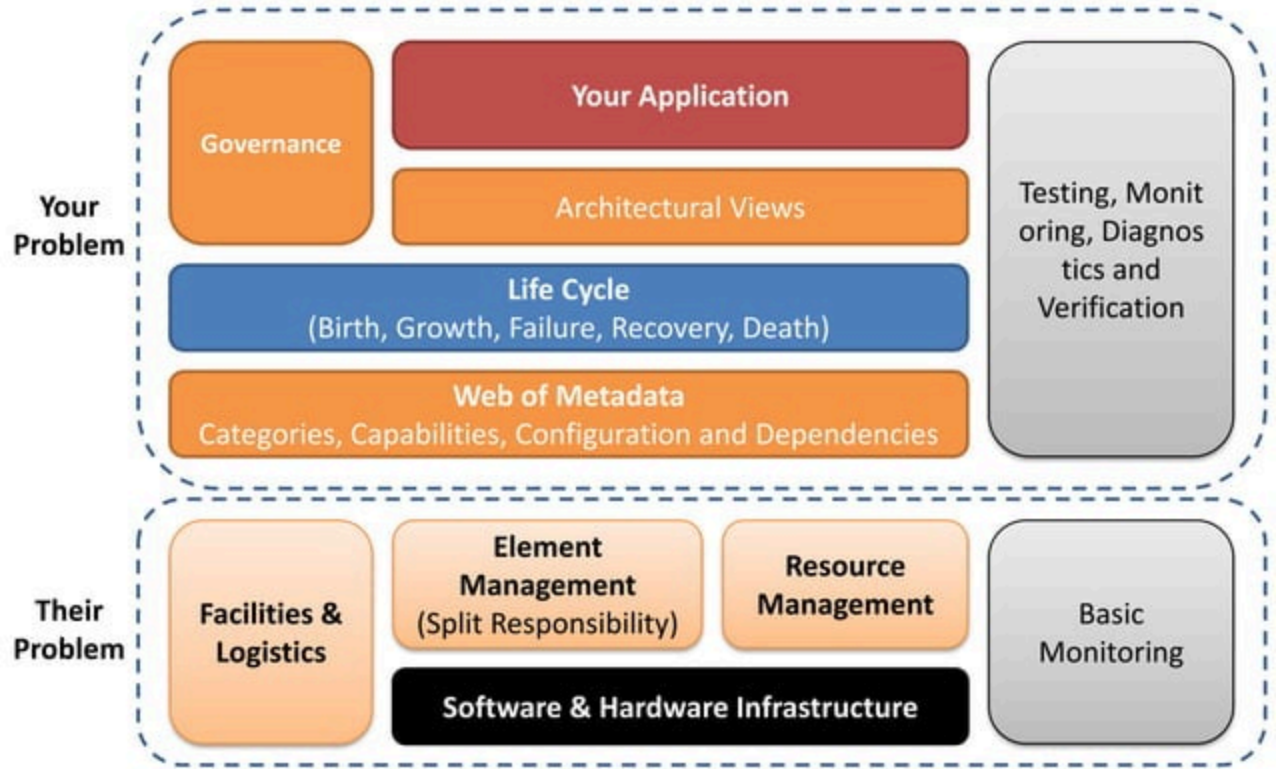
Cloud Computing Economics



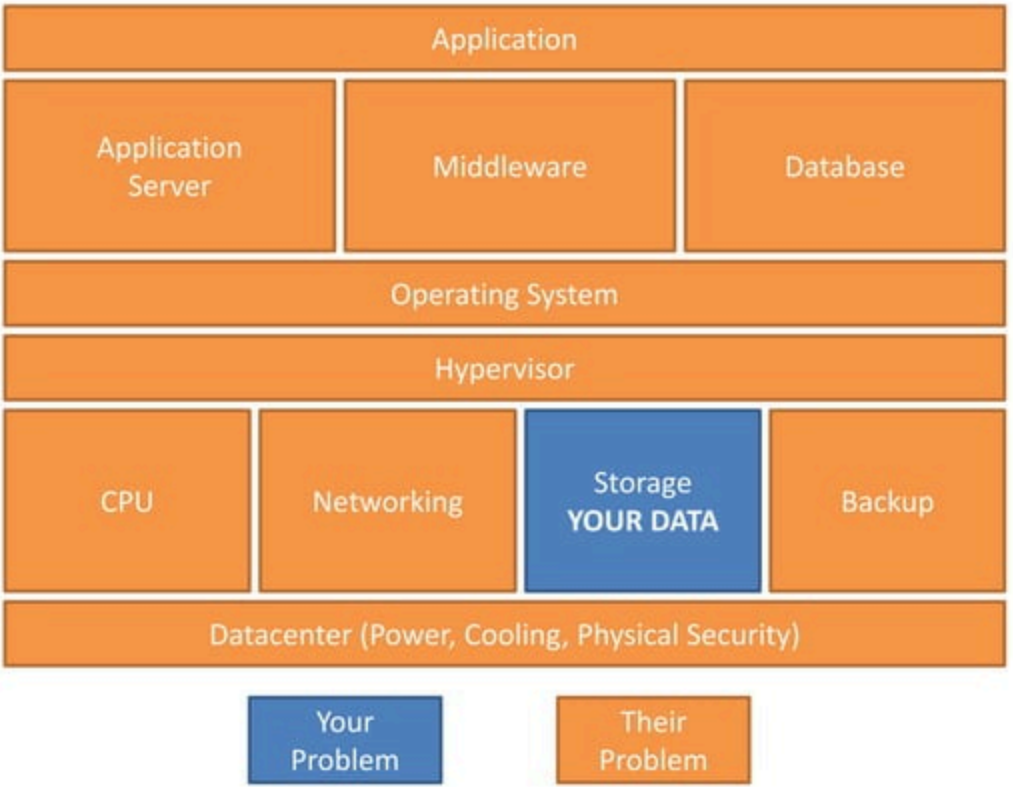
Pros and Cons


Cloud Computing Security

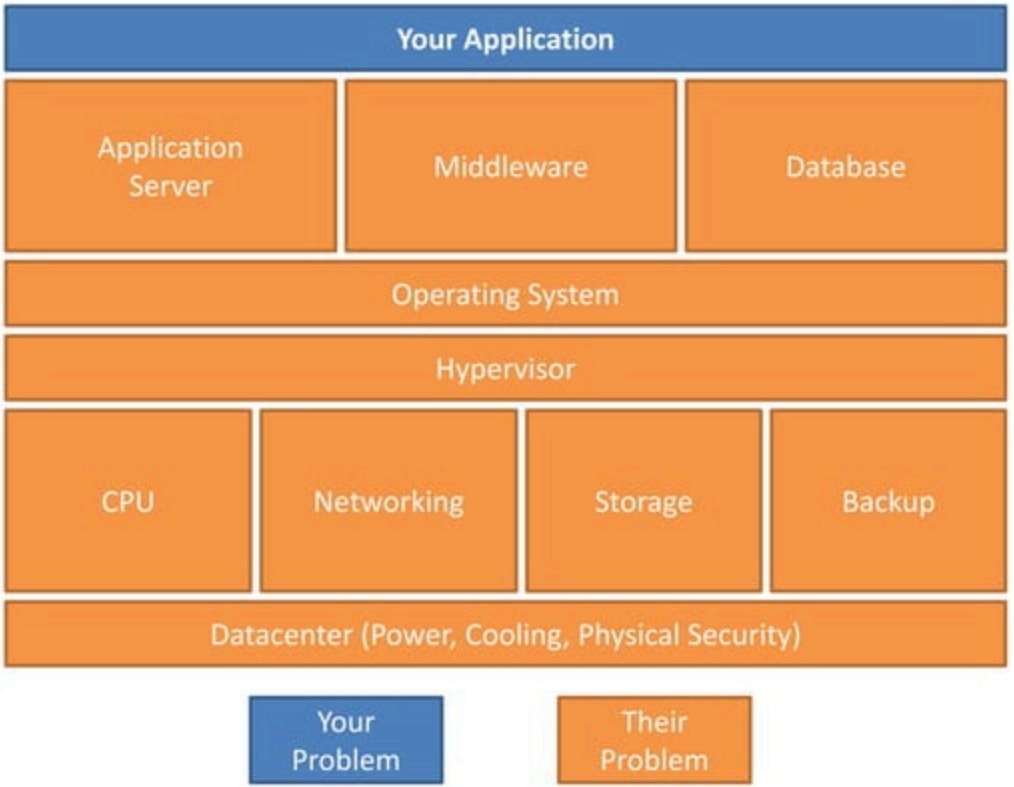
A Cloud Technology Reference Model



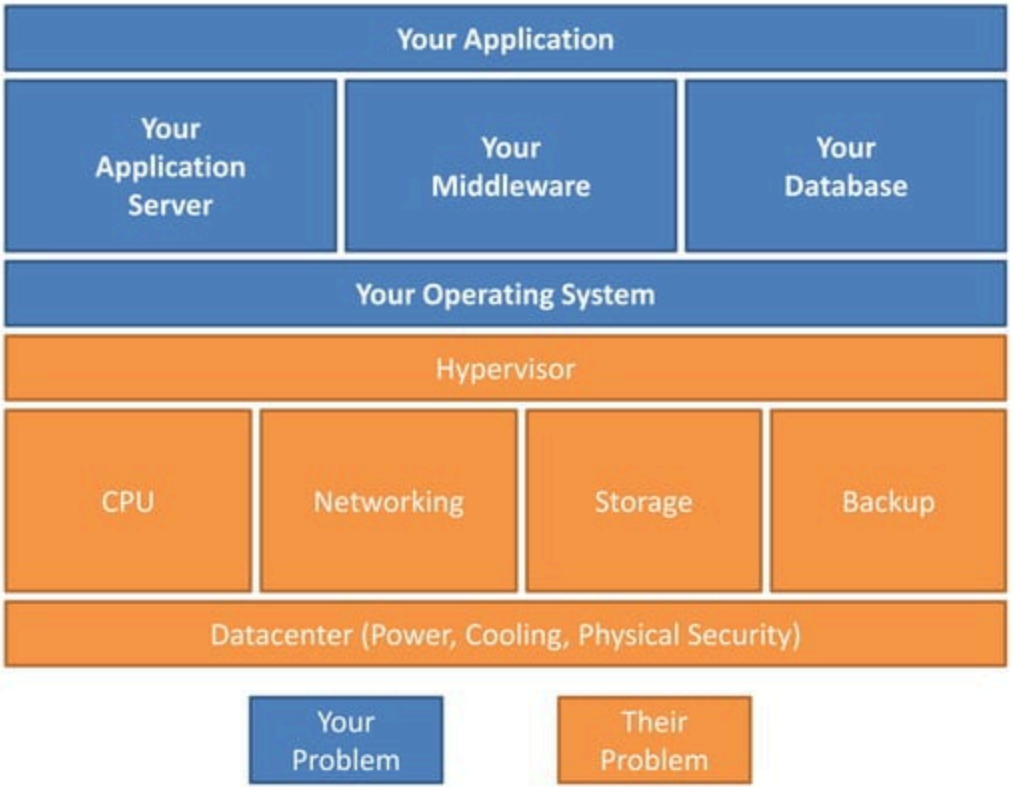
Software as a Service



Platform as a Service



Infrastructure as a Service



Security Issues

Overview

Governing in the Cloud

- Governance & Enterprise Risk Management
- Legal
- Electronic Discovery
- Compliance and Audit
- Information Life Cycle Management
- Portability & Interoperability

Operating in the Cloud

- Traditional Security
- Data Center Operations
- Incident Response
- Virtualization
- Identity & Access Management
- Storage
- Application Security
- Encryption & Key Management

Selected Issues

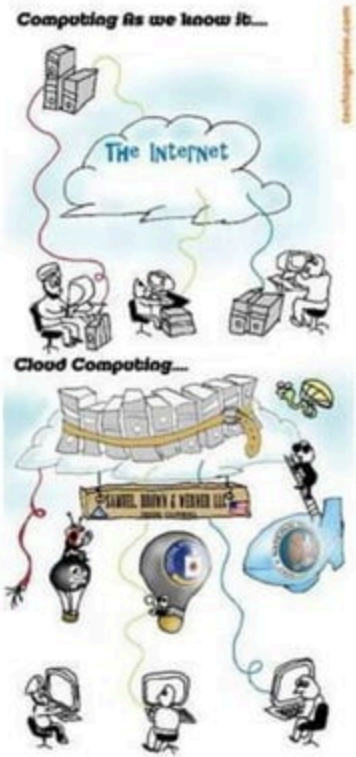
Governing in the Cloud

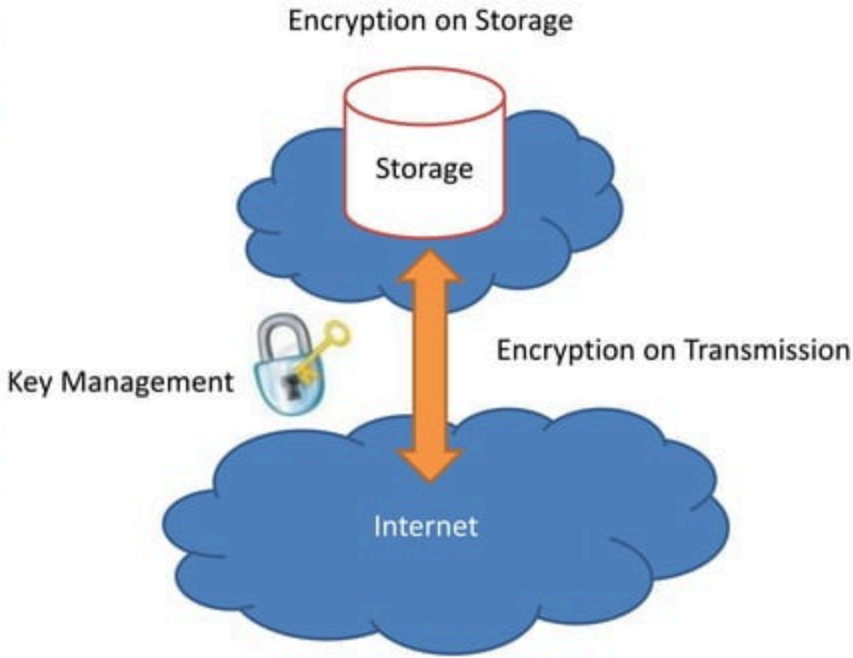
- Governance & Enterprise Risk Management
- Legal
- Electronic Discovery
- Compliance and Audit
- Information Life Cycle Management
- Portability & Interoperability

Operating in the Cloud

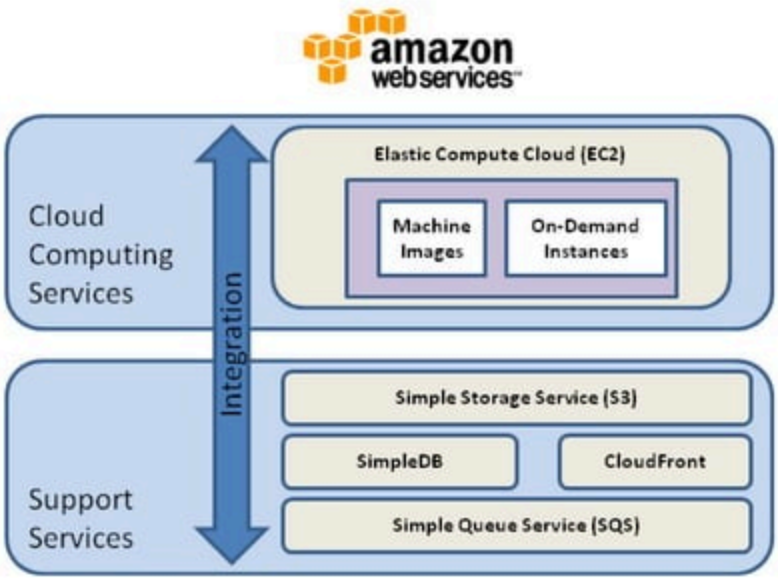
- Traditional Security
- Data Center Operations
- Incident Response
- Virtualization
- Identity & Access Management
- Storage
- Application Security
- Encryption & Key Management

Encryption & Key Management





Case Study
Amazon Web Services (AWS)



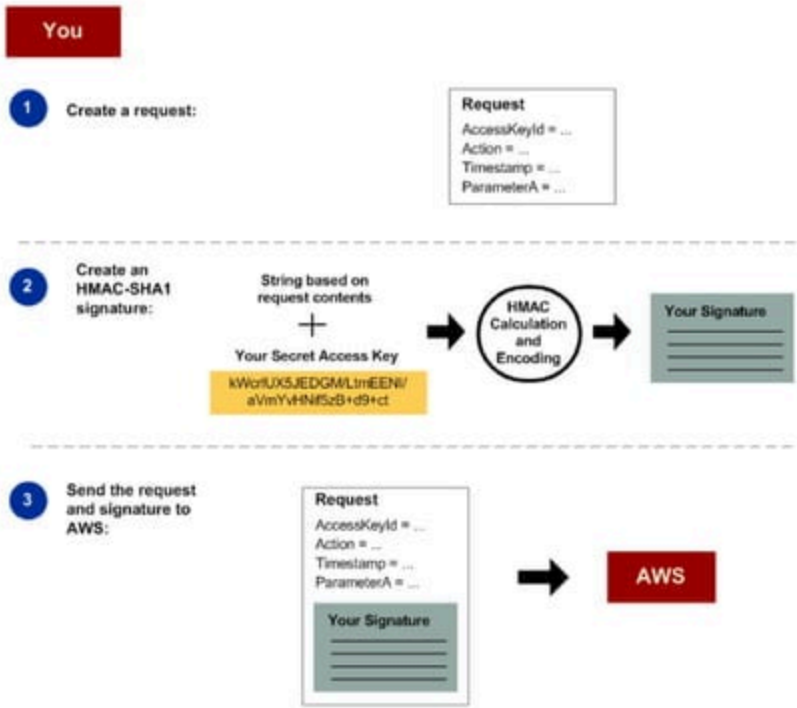
AWS Registration and Security

X.509 Certificate

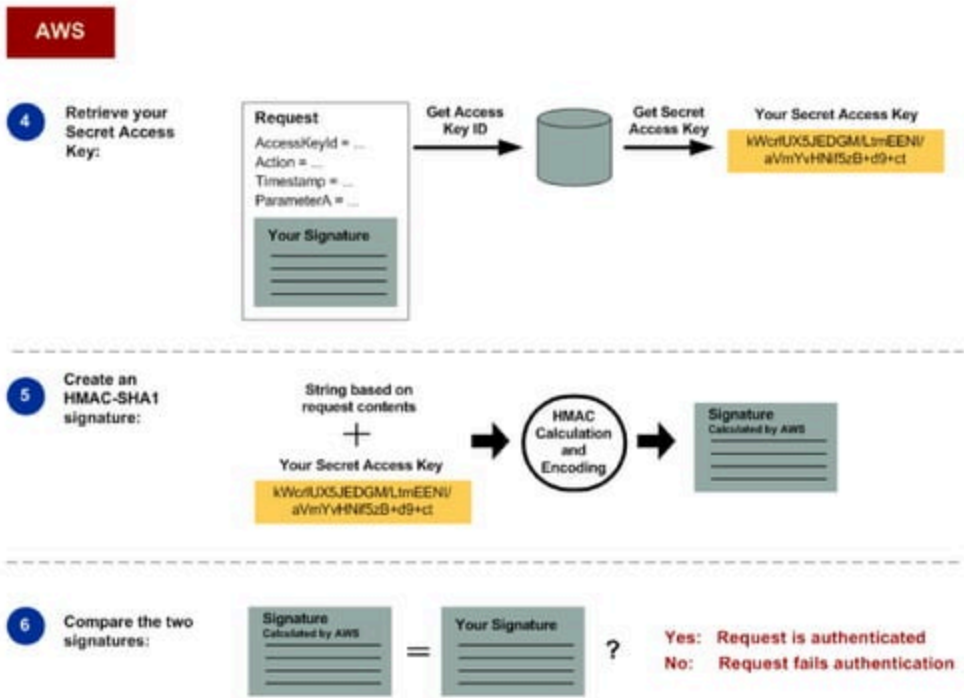
Multi-Factor Authentication

AWS Multi-Factor Authentication (AWS MFA)

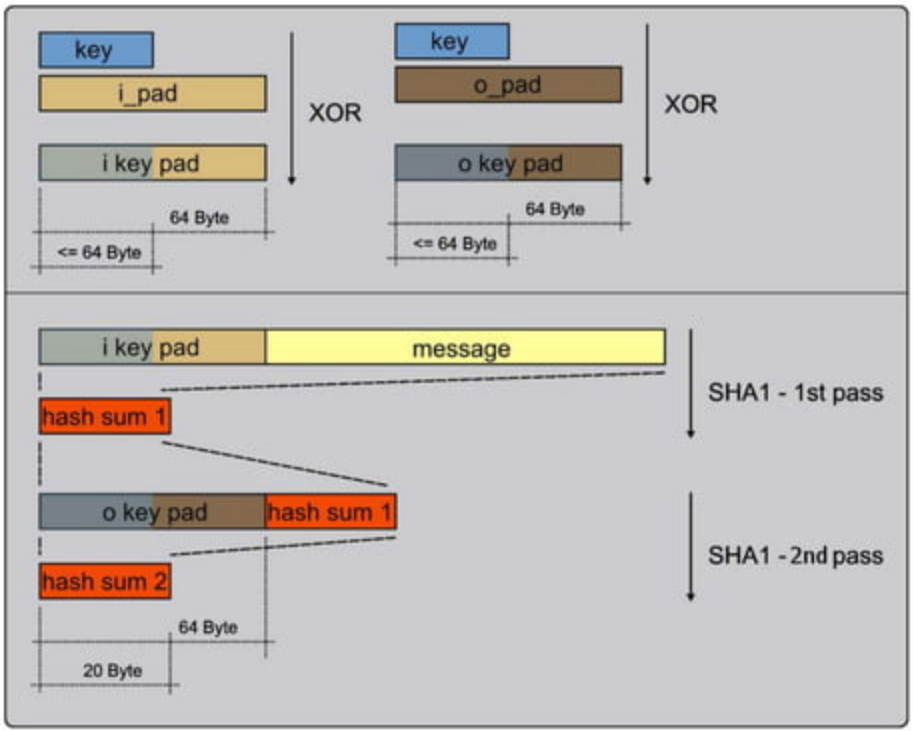
Request Authentication with HMAC-SHA1 (1)



Request Authentication with HMAC-SHA1 (2)



HMAC-SHA1


key
i_pad
XOR
i key pad
64 Byte
<= 64 Byte
key
o_pad
XOR
o key pad
64 Byte
<= 64 Byte
i key pad
message
SHA1 - 1st pass
hash sum 1
o key pad
hash sum 1
SHA1 - 2nd pass
hash sum 2
64 Byte
20 Byte

Summary & Predictions

.. We think everyone on the planet deserves to have their own virtual data center in the cloud ..

- Lew Tucker

.. Cloud Computing Will Be As Influential As E-business ..

- Gartner

.. one of the most important transformations the federal government will go through in the next decade ..

- Obama's TIGR Team

.. Who knew that the concept of security in cloud computing was even possible to imagine?..

- Scott Bradner

Thank You