Cloud Computing

159.735

Submitted By : Fahim Ilyas (08497461)
Submitted To : Martin Johnson
Submitted On: 31st May, 2009

Table of Contents

Introduction

There is no one agreed upon definition of cloud computing yet. One possible reason could be that cloud computing entails number of different concepts and the standards, benefits and risks are still being defined and discussed among the stakeholders. It is expected that definition of Cloud Computing would evolve as technology gets matured. Below are two definitions of Cloud Computing.

What is Cloud Computing?

"Cloud computing is a pay-per-use model for enabling available, 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. This cloud model promotes availability and is comprised of five **key characteristics,** three **delivery models**, and four **deployment models**." (NIST, 2009)

Key Characteristics

1. **On-demand self-service**
   On-demand self-service gives consumer an access to computing capabilities as needed without any human interaction with the service provider.

2. **Ubiquitous network access**
   Computing capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms such as mobile phones, laptops, and PDAs.

3. **Location independent resource pooling**
   Computing resources are pooled to serve all consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. The customer generally has no control or knowledge over the exact location of the provided resources like storage, processing, memory, network bandwidth, and virtual machines.

4. **Rapid elasticity**
   Capabilities can be rapidly and elastically provisioned to quickly scale up and rapidly released to quickly scale down. To the consumer, the capabilities available

for rent often appear to be infinite and can be purchased in any quantity at any time.

5. **Pay per use**
   Capabilities are charged using a utility computing model in consumer is charged for only what it has used.

Delivery Models

Software as a Service

It provides capability to the consumer to use the provider's applications running on a cloud platform using thin client like a web browser and conceal the lower level details from the consumer. Multi-tenant application is just one single application which generally doesn't require any installation on the consumer's workstation and can be customized for multiple consumers.

Examples:
Gmail, Google Docs and Zoho.

Cloud Platform as a Service (PaaS)

PaaS gives the consumer a capability to create and deploy applications using provider's supported tools and programming languages without worrying about the underlying infrastructure.

Examples:
Microsoft Azure, Google App Engine, Salesforce

Cloud Infrastructure as a Service (IaaS)

IaaS provides the consumer a capability to use computing resources like storage, networks, processing and others as a utility while hiding the details of the underlying infrastructure. Iaas gives consumer a control of choosing operating system and the supported applications and networking components.

Examples:
Amazon EC2, Mosso, GoGrid

Deployment Models

Private Cloud
The cloud infrastructure is owned or leased by only one organization and is operated for that organization only.

Community Cloud
Community cloud is a shared cloud infrastructure by many organizations and a community having a shared concern.

Public Cloud
The cloud infrastructure owned by a company which offers cloud services to public and organizations.

Hybrid Cloud
This cloud infrastructure is a composition of two or more clouds that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability

Each deployment model is either internal or external.

Internal clouds reside within an organizations network security perimeter and external clouds are outside the same perimeter.

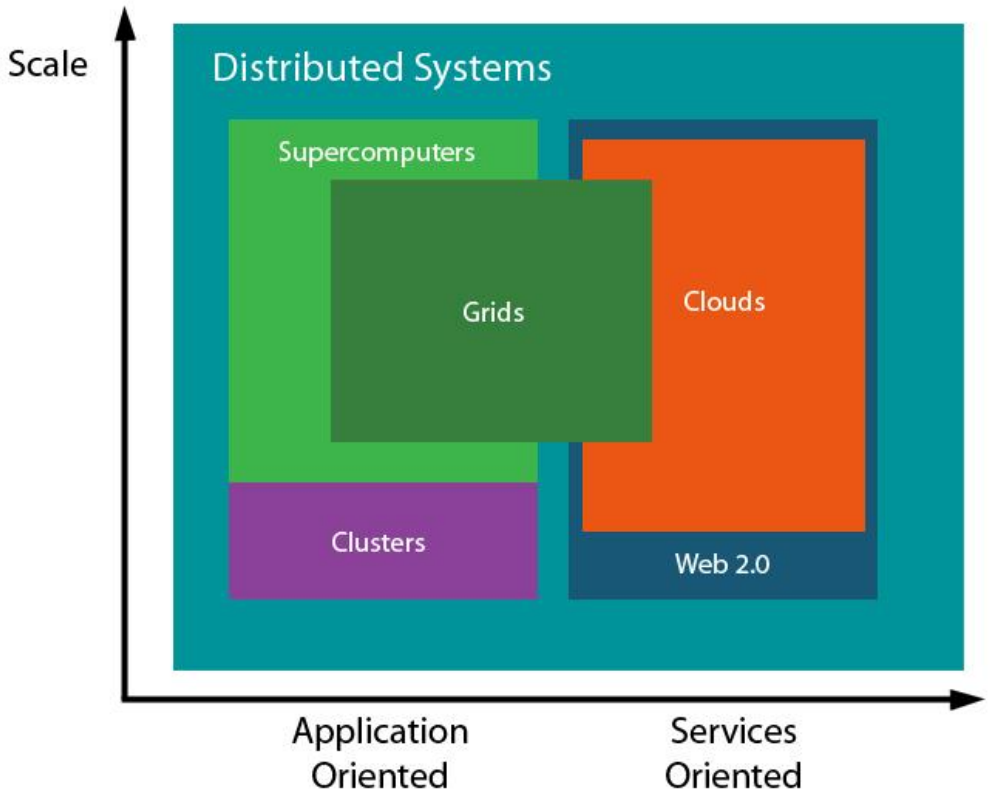
Grid and Cloud
Ian Foster gave a three point checklist to define what is grid. (Foster, 2003)

1. Coordinates resources that are not subject to centralized control
2. Uses standard, open, general-purpose protocols and interfaces
3. Delivers non-trivial qualities of service.

One of the main key differences between grid and cloud is of virtualization.

Virtualization
Virtualization is a layer of abstraction on details of implementation of hardware of software. It replaces the original system interfaces with new virtualized interfaces enabling computing system to acquire and release computing resources on demand (V. Mc Evoy & Schulze, 2008) and storing software profile as an image which makes the computing system more scalable and flexible.

Cloud computing depends upon Service Oriented Architecture and Virtualization more than the grids.



Barriers and Opportunities

There are many barriers in the adoption of cloud computing (Michael Armbrust, 2009). Main barriers are

- Data Lock-In
- Data Confidentiality and Auditability
- Bugs in Large-Scale Distributed Systems
- Software Licensing

Data Lock-In

Cloud Computing APIs are still essentially proprietary, or have not been the subject of active standardization. Therefore, consumers cannot easily extract their data and programs from one site to run on another.

Data Confidentiality and Auditability
Current cloud providers provide public deployment model which exposes the system to hackers. Moreover, some organizations may not like the ability of a country to get access to their data through the court system.

Bugs in Large-Scale Distributed Systems
Cloud Computing faces a challenge of support of ability to fix bugs that can only be reproduced in large-scale distributed systems.

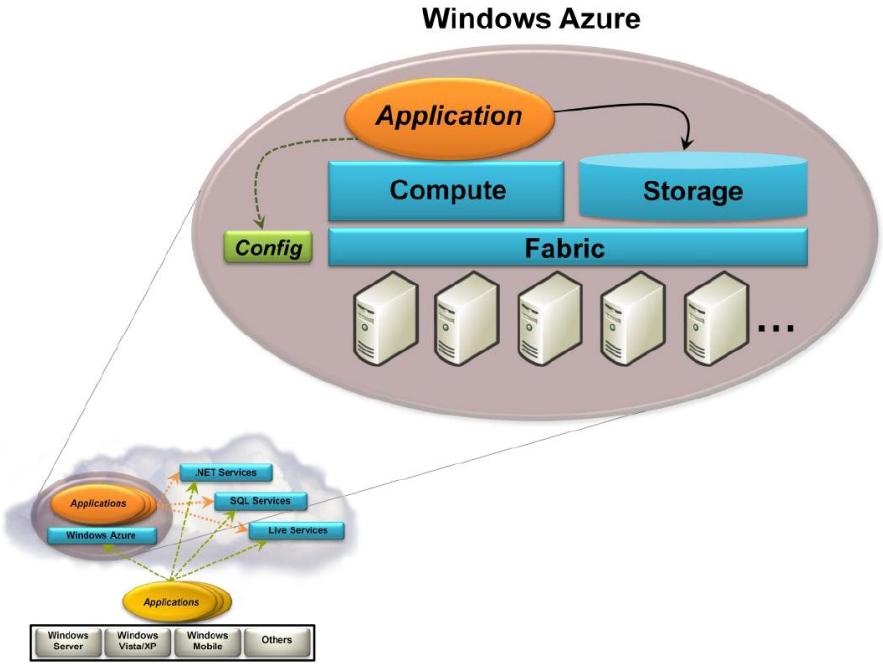
Software Licensing
The provider issues a license for software which is normally restricted to the number of computers on which it can run which is not a good match for the model of Utility Computing.

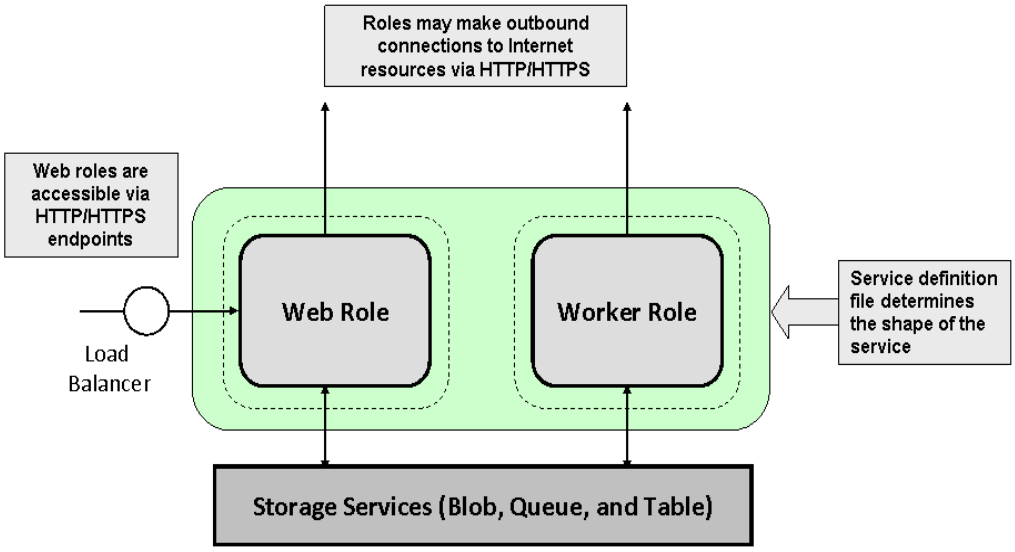
Open source
There are some initiatives from open source community as well to provide cloud services. One of the main projects is Eucalyptus which is an open-source system for implementing on-premise private and hybrid clouds using the hardware and software infrastructure.

Case Study: Setting up cluster on Amazon EC2 and using MPI

- **http://web.mit.edu/star/hpc/documentation/ec2scripts/**

Demo: Developing a simple website on Windows Azure





Service Definition

Works Cited

Foster, I. (2003). *The Physiology of the Grid.*

Michael Armbrust, A. F. (2009). *Above the Clouds : A Berkeley View of Cloud Computing.*

NIST. (2009, May 22). *NIST.gov - Computer Security Division - Computer Security Resource Center.* Retrieved May 31, 2009, from NIST.gov: http://csrc.nist.gov/groups/SNS/cloud-computing/cloud-def-v13.doc

V. Mc Evoy, G., & Schulze, B. (2008). *Using Clouds to address Grid Limitations.*