Cloud Reference Model -

Cloud Infrastructure

- Core Middleware
  - Virtual Machine (VM), VM Management, and Deployment

- System Infrastructure
  - Computes, Databases, Server etc.

Cloud Applications

- Social Computing, Enterprise ISV, Scientific Computing, CONG

Cloud Programming, Environment, and Tools

- Web 2.0, Mashups, Concurrent & Distributed Programming
- Workflows, Hibernate, Struts

Cloud Hosting Platforms

- QoS Negotiation, Admission Control, Pricing, SLA Management
- Monitoring, Security Management, Metering, Accounting

THE CLOUD COMPUTING ARCHITECTURE

There are major categories used to classify cloud computing solutions:

1) SaaS:
- Characteristics: Customers are provided with applications that are accessible anytime and anywhere.
- Product Type: Web applications and services (Web 2.0)
- Vendors and Products: Salesforce.com (CRM), Clarizen.com (Project Management), Google Apps

2) PaaS:
- Characteristics: Customers are provided with a platform for developing applications hosted in the cloud.
- Product Type: Programming APIs and frameworks development systems
- Vendors & Products: Google AppEngine, Microsoft Azure, DataSynapse, ManageSoft Anaka

3) IaaS/HaaS:
- Characteristics: Customers are provided with virtualized hardware and storage on top of which they can build their infrastructure.
- Product Type: Virtual Machine Management, Infrastructure Storage Management, Network Management
Types of Clouds -

There are four types of clouds -

1. Public Cloud -

The cloud is open to the wider public. They are a realization of the canonical view of cloud computing in which the services offered are made available to anyone, from anywhere, and at any time through the Internet.

A fundamental characteristic of public cloud is multitenancy. A public cloud is meant to serve a multitude of users, not single customers.

Eg - Amazon EC2, Google AppEngine, Salesforce.com

2. Private Cloud -

The cloud is implemented within the private premises of an institution and generally made accessible to the members of the institution or a subset of them.

Key advantages of using a private cloud are -
- Customized Information Protection
- Infrastructure enabling SLAs (Service Level Agreements)
- Compliance with standard procedures & operations.

Eg - Databricks, Zimmy Pools, Elastix and Anka -> PaaS

Eg VMware, vCloud, KVM, Xen, OpenPXE, Integrid -> IaaS (M)

3. Hybrid Clouds / Heterogeneous Clouds -

The cloud is a combination of public cloud and private cloud. It is meant to identify a private cloud that has been augmented with resources or services hosted on a public cloud.

Key characteristics of hybrid cloud is dynamic provisioning which refers to the capability to acquire on-demand virtual machines in order to increase the capability of the resulting distributed system and then release them.

Eg - OpenNebula, Integrid, Anka, Elastix, CloudBeaver, and Zimmy Pools
4 Community Clouds:

The cloud is characterized by a multi-administrative domain involving different deployment models (public, private, and hybrid), and it is specifically designed to address the needs of a specific industry.

Benefits of community clouds are openness, community, graceful failure, convenience, and control and environmental sustainability.

E.g. Media Industry, Healthcare Industry, public sector, scientific research, energy and other core industries etc.

3 Cloud Interoperability and Standards:

Cloud computing is a service-based model for delivering IT Infrastructure and applications like utilities such as power, water, and electricity. To fully realize this goal, introducing standards and allowing interoperability between solutions offered by different vendors are objectives of fundamental importance.

Vendor lock-in constitutes one of the major strategic barriers against the seamless adoption of cloud computing at all stages.

Open Virtualization Format (OVF) is an attempt to provide a common format for storing the information and metadata describing a virtual machine image.

A standardization process has been made by few organizations that are Cloud Computing Interoperability Forum (CCIF), the Open Cloud Consortium, and the DMTF Cloud Standards Incubator.

2 Open Challenges for Industry and Media

1 Flexibility and Fault Tolerance:

The ability to scale on demand beyond the limits of the existing in-house IT resources is known as cloud scalability. Various dimensions are performance, size, and load.

The challenge in this case is designing highly scalable & fault-tolerant systems that are easy to manage & at the same time provide competitive performance.
CLOUD SOLUTIONS -

1. Cloud Ecosystem -
   It is a term used to describe the complex system of interdependent components that work together to enable cloud services. In cloud computing, complex includes not only traditional elements of cloud computing such as software and infrastructure but also consultants, integrators, partners, third parties, and anything in their environments that has a bearing on other components.

<table>
<thead>
<tr>
<th>BUSINESS PROCESS (SOA)</th>
<th>Consultants, Integrators, partners,黄山 partners,</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLICATION SERVICES</td>
<td>Information, Visualization, Commerce, Accessibility</td>
</tr>
<tr>
<td>INFRASTRUCTURE SERVICES</td>
<td>Standards, Tools, Server, Storage, Network</td>
</tr>
</tbody>
</table>

CLOUD COMPUTING ECOSYSTEM

2. Cloud Business Process Management (CBPM) -
   CBPM governs an organization's custom functional, customer-focused, end-to-end core business processes. Its objective is to design and deploy processes that adhere to the organization's core processes that create customer value.

   Saas APP

   PRIVATE CLOUD

   ENTERPRISE APP

   HUMAN WORKFLOW

   The cloud environment can help BPM by -
   (1) Integration of core processes (2) Value-focused efficiency (3) Continuous Improvement (4) Cultural

3. Cloud Service Management -
   It includes all of the service-related functions that are necessary for the management and operation of these services required by or preferred to cloud consumers. It can be described from the perspective of -
(1) Business Support

It involves the set of business-related services dealing with client and supporting processes. It includes Customer Management, contract management, inventory management, accounting and billing, reporting and auditing and pricing and bidding rating.

(2) Provisioning and Configuration

It includes rapid provisioning, resource changing, monitoring and healing, metering and SLA (Service Level Agreement) Management.

(3) Portability and Interoperability

Portability - Customers are interested to know whether they can move their data or applications across multiple cloud environments at low cost and minimal disruption.

Interoperability - Users are concerned about the capacity to communicate between or among multiple clouds.

Cloud Offerings

1. Cloud Analytics

It provides users with better forecasting techniques to analyze and optimize the service lines and provides a higher level of accuracy. These are six elements of analytics that is data sourcing, data model, provisioning applications, computing power, analytic models and sharing or storage of results.

Cloud analytics is also called SaaS-based Business Intelligence (BI).

eg - hosted data warehouses, cloud-based social media analytics etc.

Cloud analytics combines some or all the source models of cloud in delivering the solutions.
Cloud Business Analytics Competencies are:

1. Cloud Business Analytics Strategy
2. Business Intelligence and Performance Management
3. Analytics and Optimization
4. Enterprise Information Management

Testing Under Cloud - 98

Testing under the cloud environment gives a good insight by reducing the manual intervention and reducing the process in typical testing environments. By enabling access to resources and also when required, it reduces the cost, reduces test cycle, rationalize the testing environment and improve the source quality.

Four major objectives of cloud testing are:
1. To assess the quality of cloud-based applications
2. To validate SaaS in a cloud environment
3. To check the provided automatic cloud-based functional testing
4. To test cloud compatibility and interoperability between SaaS and applications

Advantages of Cloud Based Testing are:
1. Cost reduction regarding the quality of cloud.
2. Test cycle time can be minimized.
3. Less time spent on test environment creation.
4. Helps to perform large-scale and real-time online validation for internet-based software in clouds due to on-demand test services.
Virtual Desktop Infrastructure (VDI) -

VDI provides end-user virtualization solutions. This is
designed to help transform distributed IT architectures into virtualized,
open-standard-based framework leveraging centralized IT services.

The notion behind the virtual desktop infrastructure is to
run desktop operating systems and applications inside virtual
machines that reside on the servers in the data center. This is
called virtual desktop. Users access a virtual desktop through their
desktop PC.

The VDI architecture consists of endpoint devices, the
connection broker and VM hosting servers.

Advantages of VDI are:

1. Cost Reduction
2. Flexibility
3. Security
4. Availability
5. Efficiency
6. Rapid client development

VDI provides a enterprise level or grade solution. It
introduces a new method of delivering and managing user desktop
environment:

Virtual Desktop Manager (VDM) helps users to connect their
desktop to servers.