Cloud Computing

A Break in the Clouds: Towards Cloud Definition

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Seminar Web Information Systems Technology
What is The Cloud?

- Documents
- Software
- ....
Managing Delivery
Own Delivery Problems
Own Delivery Problems Cont.
Delivery Contract

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Delivery Contract Cont.
Business Growth
Managing Technology Inside
Managing Technology Inside Cont.
Cloud Computing Services

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Cloud Computing Services Cont.
What is Cloud Computing?

- Potter Stewart might say « Cloud Computing is hard to define ….. But I know it when I see it »

- Confusion about definition of the cloud computing

- Paper: More than 20 definitions have been studied
  - Cloud characteristics
  - Proposed Definition
Cloud Characteristics

- User Friendliness
- Virtualization
- Internet Centric
- Variety of Resources
- Automatic Adaptation
- Scalability
- Resource Optimization
- Pay Per Use
- Service SLAs
- Infrastructure SLAs
Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized SLAs.

Vaquero et al.
Cloud Actors

Service Users

Service Providers

Infrastructure Provider

Infrastructure Interface

Virtualization Layer

OS
HW

Virtualization Layer

OS
HW

Virtualization Layer

OS
HW

Virtualization Layer

OS
HW

Virtualization Layer

OS
HW

Infrastructure Provider
Cloud Scenarios

- Infrastructure as a Service (IaaS)
  - Managing computing resources, such as storing and processing capacity by IPs
  - Dynamic scaling
  - Pay-per-use utility model
  - Examples:

  ![Amazon](amazon.png)
  Amazon Elastic Compute Cloud (Amazon EC2)

  ![Rackspace](rackspace.png)
Amazon EC2

- Largest IaaS provider and was launched in August 2006
- Customers can rent computers or virtual machines
- Elastic Block Storage (EBS)
- Amazon EC2 pricing:
  - Hourly charge per virtual machine
  - Data transfer charge
Cloud Scenarios

- **Platform as a Service (PaaS)**
  - Providing the software platform on which the systems run
    - Operating systems, Platform to create applications
    - No maintenance efforts are required for the infrastructure
  - Dynamic scaling
  - Pay-per-use utility model
  - Examples:

```
Windows Azure Platform
```

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Google App Engine lets you run your web applications on Google's infrastructure.

Features:
- Write code once and deploy
- No servers to maintain
- Easily integrate with other Google services

Google App Engine pricing:
- No charge for a developer to build an application
- The charges begin to add up after deployment
- The customer pays for storage and bandwidth
Cloud Scenarios

- **Software as a Service (SaaS)**
  - Software is provided to end users in an “On-demand” fashion
    - No hardware or software to manage
  - Use new technology easily
  - Pay-per-use utility model
  - Examples:
    - Gmail
    - salesforce.com
What is Grid Computing?

- A system that coordinates resources which are not subject to centralized control, using standard, open, general-purpose protocols and interfaces to deliver nontrivial qualities of service

Ian Foster, 2002
## Grid vs. Cloud Computing

<table>
<thead>
<tr>
<th>Feature</th>
<th>Grid</th>
<th>Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resource Sharing</strong></td>
<td>Collaboration (VOs., fair share)</td>
<td>Assigned resources are not shared</td>
</tr>
<tr>
<td><strong>Resource Heterogeneity</strong></td>
<td>Aggregation of heterogeneous resources</td>
<td>Aggregation of heterogeneous resources</td>
</tr>
<tr>
<td><strong>Virtualization</strong></td>
<td>Virtualization of data and computing resources</td>
<td>Virtualization of hardware and software platforms</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>Security through credential delegations</td>
<td>Security through isolation</td>
</tr>
<tr>
<td><strong>High Level Services</strong></td>
<td>Plenty of high level services</td>
<td>No high level services defined yet</td>
</tr>
<tr>
<td><strong>Architecture</strong></td>
<td>Service oriented</td>
<td>User chosen architecture</td>
</tr>
</tbody>
</table>
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<tr>
<td>Software Dependencies</td>
<td>Application domain dependent software</td>
<td>Application domain independent software</td>
</tr>
<tr>
<td>Platform Awareness</td>
<td>The client software must be Grid-enabled</td>
<td>The SP software works on a customized environment</td>
</tr>
<tr>
<td>Software Workflow</td>
<td>Applications require a predefined workflow of services</td>
<td>Workflow is not essential for most applications</td>
</tr>
<tr>
<td>Scalability</td>
<td>Nodes and sites scalability.</td>
<td>Nodes, sites, and hardware scalability</td>
</tr>
<tr>
<td>Self Management</td>
<td>Reconfigurability</td>
<td>Reconfigurability, self-healing</td>
</tr>
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<tr>
<td><strong>Centralization Degree</strong></td>
<td>Decentralized control</td>
<td>Centralized control</td>
</tr>
<tr>
<td><strong>Usability</strong></td>
<td>Hard to manage</td>
<td>User friendliness</td>
</tr>
<tr>
<td><strong>Standardization</strong></td>
<td>Standardization and interoperability</td>
<td>Lack of standards for Cloud interoperability</td>
</tr>
<tr>
<td><strong>User Access</strong></td>
<td>Access transparency for the end user</td>
<td>Access transparency for the end user</td>
</tr>
<tr>
<td><strong>Payment Model</strong></td>
<td>Rigid</td>
<td>Flexible</td>
</tr>
<tr>
<td><strong>QoS Guarantees</strong></td>
<td>Limited support often best-effort only</td>
<td>Limited support, focused on availability and uptime</td>
</tr>
</tbody>
</table>
Convergence of Grids and Clouds

- **Vision**: underpins the evaluation of Grid from a tool to solve compute and data-intensive problems towards a general-purpose utility infrastructure. *NGG*

- The Grid needs to:
  - Accelerate the incorporation of virtualization
  - Provide easier entry points

- Combine Clouds and Grids
Review

+ Defining cloud computing from two perspectives:
  - End user perspective
  - Provider perspective

+ Provides good technical comparison between grid and cloud
  - The proposed definition does not stress the integration of hardware with SaaS in sufficient manner

- Does not refer to cloud deployment models (public, private, hybrid cloud)

- Does not consider the business model when comparing grid and cloud computing

- Not enough examples
Conclusion

- They analyzed the available Cloud definitions to provide integrative Cloud definition
- Virtualization, usability, and security are the most important issues of Cloud
- Grids and Clouds are different
- QoS and SLA are important for building confidence in the Cloud
• Questions ??
• Comments !!