Cloud Computing Paradigm Shift

Jan Šedivý
Business expectations

- Improving business processes
- Reducing enterprise costs
- Increasing the use of information/analytics
- Improving enterprise workforce effectiveness
- Attracting and retaining new customers
- Creating new products or services (innovation)
- Managing change initiatives
- Expanding current customer relationships
- Consolidating business operations
- Targeting customers and markets more effectively
Computing Evolution

1970 IBM 370

1980 IBM PC

1990 Internet

2000 Cloud computing

Internet Users in the World Growth 1995 - 2010

Copyright © 2008, Minixstats Marketing Group
Gartner predicts:
- Virtualization
- Cloud computing
- Web 2.0

IDC, Gartner
$16B – revenue drive by public cloud in 2009
$55B – revenue anticipated by 2014
12% public cloud share in IT spending
25% - new growth in IT spending

Aggressive prediction
$63B - 2010 revenue, public cloud
$148B – 2014 in SaaS, PaaS, IaaS
Agenda - Cloud computing

- Cost - Economy of scale
- Centralized management
- Easy on users
- Access any time any place, compatible browser
- Deployment model
- Elasticity, endless processing power, endless memory
- High service availability
- Security
- Types of applications
Economy of scale

- Cloud data centers with large number of computers
  - Built from computers with minimum number of parts.
  - Bought in massive quantities.
  - Efficient ratio of staff to machines.
  - Electricity cost is decreased 5-7 times in a large center (5MW)
  - Cost advantage, no upfront payment, pay as you go, Freemium

- Global companies => large data centers
- SMBs, SaaS, CAPEX => OPEX
Central administration

- Cloud central administration - fast distribution of new functionality and upgrades
- Employees easier adapt to small improvements than to disruptive changes.
- Traditional software - long learning cycle
Connect Anywhere, Anytime

Cloud, Web-based applications give users full access to their information anywhere, anytime,

- Windows, OS X, Linux
- FireFox, IE, Chrome, Safari ...
- Mobile phone, tablet computer

The data is stored in the cloud – not on employees computers, sharing

Multiple users can access and contribute to projects simultaneously

Employees need only notebook + connectivity.
Deployment models

- Public cloud – internet
Deployment models

- Public cloud – internet
- Private cloud – intranet
Deployment models

- Public cloud – internet
- Private cloud – intranet
- Hybrid cloud – internet + intranet
- Community cloud – intranet
### Public - private center

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Public cloud</th>
<th>Private cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance of infinite computing resources</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Elimination of up front payment by cloud user</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Pay as you use</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Economies of scale due to very large center</td>
<td>yes</td>
<td>Usually not</td>
</tr>
<tr>
<td>Higher utilization by multiplexing resources</td>
<td>yes</td>
<td>Depends on size</td>
</tr>
</tbody>
</table>
Higher Reliability and Uptime

- Service Level Agreement (SLA)
  - Disaster recovery plan
  - Recovery point objective (RPO) design target is zero
  - Recovery time objective (RTO) design target is instant fail over

- Databases NoSQL Data replication - build in redundancy
- Elasticity, virtualization, endless computing power
- Fall back to secondary data center, regions, zones
- This level of reliability with on-premises or hosted technology is tremendously costly and complex
Security

- Browser-based applications do not need to save sensitive data on local devices.

- Lost laptops and memory stick minimize the amount of sensitive data stored on these devices.

- Regular staff training and educating in all aspects of internet safety and security is a must.

- SAS 70 Type II audit
  - **Logical security**: reasonable assurance of providing access to authorized individuals only
  - **Privacy**: reasonable assurance of data privacy, implement proper policies and procedures
  - **Data center physical security**: good protection of data centers and corporate offices
  - **Incident management and availability**: reasonable assurance data centers and applications are redundant and incidents are properly reported, responded to, and recorded
  - **Change management**: reasonable assurance that development and changes are properly tested
Cloud architecture - apps

- **Client**
  - any browser, native app

- **Software as a Service – SaaS**
  - Google,
  - Microsoft

- **Platform as a Service – PaaS**
  - Google app engine
  - Microsoft Azure

- **Infrastructure as a Service – IaaS**
  - Amazon AWS,
  - Rack space
Utilization

- Virtualization

Diagram:
- Resources vs. Demand over Time (days)
- Capacity line at the top
- Peak load provisioning

(a) Provisioning for peak load
Utilization

(b) Underprovisioning 1
Utilization

(c) Underprovisioning 2
Virtualization

- Run several applications on the same box
- Virtualize – use 20% of available resources
- Utilize the whole box 80%
Virtulization
WEB applications - Architecture

- multiple *cloud components* communicating with each other
- 3-tier architecture. Architectonical pattern MVC model
- API application programming interfaces,
- web services software architecture = Representational State Transfer (REST)

View, interaction – browser, native application, different platforms
Cloud applications

- Storage – backup
- General number crunching applications
- Web applications - services

- Autonomic computing
- Client–server model
- Grid computing
- Mainframe computer
- Utility computing
- Peer-to-peer
- Service-oriented computing