Storage Directions, Trends and Solutions

Cloud Computing

Raymond A. Clarke
Sr. Enterprise Storage Solutions Specialist, Sun Microsystems - Archive & Backup Solutions
SNIA Data Management Forum, Board of Directors
What do end users expect of Cloud Computing?

The illusion of infinite compute resource
The elimination of up-front commitment
The ability to pay-as-you-go

"Above the Clouds: A Berkeley View of Cloud Computing" (February, 2009)

&

Low barriers to entry and exit
Business Models

Public

You don’t know who else is on the same server, network or disk that you are.

Private

You own the server, network and disk, and decide who gets to run on it with you.

Hybrid

You own some parts and are sharing some parts, though in a controlled way.
## Cloud Computing Layers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software as a Service</td>
<td>Applications offered on-demand over the network (salesforce.com)</td>
</tr>
<tr>
<td>Platform as a Service</td>
<td>Developer platform with built-in services (Google App Engine, Microsoft Azure Platform)</td>
</tr>
<tr>
<td>Infrastructure as a Service</td>
<td>Basic storage and compute capabilities offered as a service (Amazon web services, Microsoft’s Cloud Infrastructure Services, Mosso)</td>
</tr>
</tbody>
</table>
Openness Promotes Interoperability

DMTF – Open Cloud Standards Incubator


http://www.opencloudmanifesto.org

http://www.ogf.org/

http://www.sun.com/cloud

http://www.snia.org/forums/csi/
Cloud Storage Reference Model

Clients acting in the role of using a Data Storage Interface

- Block Storage Client
- Filesystem Client
- Object Storage Client
- XAM Client
- Database/Table Client
- iSCSI LUNs, Targets
- POSIX (NFS, CIFS, WebDAV)
- Multiple, Proprietary Interfaces

Data Storage Cloud

Clients acting in the role of Managing Data/Storage

Data/Storage Management Client

Source: SNIA CSI
Cloud Architecture – Future

User Apps and Services

Internet Accessible APIs and UIs
- Database Service
- Queuing Service
- Identity Service
- JavaEE Service
- Virtual Datacenter Management Console
- Accounting, Billing and Metering
- etc.

User Web Site
- Application Catalog, Forums, Docs

Virtualized Datacenter Management Layer
- Servers
- Storage
- Network

Partner and Build
Benefits of Cloud Computing

Q: Rate the **benefits** commonly ascribed to the 'cloud'/on-demand model

(1=not important, 5=very important)

- **Easy/fast to deploy** 63.9%
- **Pay only for what you use** 61.5%
- **Less in-house IT staff, costs** 57.0%
- **Low monthly payments** 53.3%
- **Offers the latest functionality** 50.0%
- **Encourages more standard IT** 46.3%
- **Sharing systems/information simpler** 43.4%
- **It's the way of the future** 29.1%

Source: IDC Enterprise Panel, August 2008  n=244
Introducing the Sun Cloud
A Peek Behind the Sun Cloud

Products and Technologies

Expertise and Services

Partners

Open Communities

VirtualBox®

Sun xVM

Q-layer

MySQL™

zmanda
Open Source Backup

RIGHT SCALE®

KickApps™

amazon web services™

ORACLE®

NetBeans

TACC

glassfish.dev.java.net

Java®

OpenOffice.org

ZFS

Eucalyptus

lustre
Comprehensive OPEN Portfolio Delivering Customer Choice

<table>
<thead>
<tr>
<th>Services</th>
<th>Developer Environment</th>
<th>Database/Storage Platform</th>
<th>Application Infrastructure</th>
<th>Virtualization</th>
<th>Operating System</th>
<th>Systems</th>
<th>Microprocessor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NetBeans</td>
<td>MySQL</td>
<td>PostgresSQL</td>
<td>xVM</td>
<td>Solaris</td>
<td>OpenSparc</td>
<td>OpenSPARC</td>
</tr>
<tr>
<td></td>
<td>eclipse</td>
<td>ZFS</td>
<td>bea WebSphere</td>
<td>VirtualBox®</td>
<td>opensolaris</td>
<td>AMD Opteron</td>
<td>AMD Sparc</td>
</tr>
<tr>
<td></td>
<td>Visual Studio</td>
<td>lustre</td>
<td>bea WebSphere</td>
<td>VMware</td>
<td>Suse</td>
<td>Intel</td>
<td>ULTRASPARC</td>
</tr>
</tbody>
</table>
Open Storage/Open Archive Anatomy

Storage Servers:
- SunFire X4240
- SunFire X4540
- CMT Servers

Open Storage Arrays:
- Storage J4200
- Storage J4400
- Storage J4500

Open Storage Appliances:
- Sun Storage 7110
- Sun Storage 7210
- Sun Storage 7310
- Sun Storage 7410

SAS HBA's

Open Storage Flash:
- F5100 - SSD

File-Systems:
- ZFS
- Lustre
- SAM/QFS
- pNFS

NFS, CIFS, FCP, SAS, iSCSI, IB, VTL, OSD, CAS, XAM, Web DAV

Replication
Security
Mirror/Snap
Search
Encryption
De-duplication
Migration
Backup
Compliance
ZFS Turbo Charges Applications
The Hybrid Storage Pool Data Management

ZFS automatically:

- Writes new data to a very fast SSD pool (ZIL)
- Determines data access patterns and stores frequently accessed data in the L2ARC
- Bundles IO into sequential lazy writes for more efficient use of low cost mechanical disks
- Now shipping in OpenSolaris and coming soon in Solaris 10
ZFS Hybrid Storage Pools
Faster, Cheaper, Less Power

100 Enterprise HDDs

Hybrid Storage Pool

1 SDDs

30 High Capacity HDDs

More IOPS
Lower $GB
Lower Power Consumption
Less Rack Space

Capacity: 30 Tbytes
Performance: 30K IOPS
Cap/Op-: $55,000 - 1.75kWhr

Capacity: 30 Tbytes
Performance: 30K IOPS
Cap/Op-: $6.040 - 0.392kWhr

For more on HSPs, see Adam Leventhal’s article in the Communications ACM Magazine [link]
Thank You for Your Time and Attention

Raymond.Clarke@Sun.com
(212) 558-9321