Trends in Cloud Computing and Data Intensive Networks

PASIG Malta - 25 June 2009

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- Mgr. HPC & Cloud Business, APAC
- Sun Microsystems
All Clouds Share Key Traits

One Service Fits All*
Virtualized Physical Resources
Self Provisioning
Elasticity
Pay Per Use
Programmatic Control

*but expect many service offerings
BUT clouds can also be quite different

- Layers
- Business Models
- Application Domains
## Cloud Computing Layers

### Software as a Service
- Applications offered on-demand over the network (salesforce.com)

### Platform as a Service
- Developer platform with built-in services (Google App Engine, Microsoft Azure Platform)

### Infrastructure as a Service
- Basic storage and compute capabilities offered as a service (Amazon web services, Microsoft’s Cloud Infrastructure Services, Mosso)
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
Application Domains

- HPC
- Medical
- Intelligence
- Finance
- Analytics
- Web

Domains Drive Differences in Hardware and Software Architecture
Efficiency

**Economics**
- Pay per use
- Op-ex vs. Cap-ex
- SLA
- Virtualization

**Developer Centric**
- Rapid, self provisioning
- Faster deployment
- Self service
- API-driven

**Flexibility**
- Standard services
  - Elastic
  - On demand
  - Multi-tenant
It is possible, however, that we could see a newcomer, perhaps Sun, challenge the incumbents with truly open standards. Now would be a good time, given that there is no overwhelmingly dominant cloud vendor.

-Matt Asay, The Open Road, in CNET News
Openness Promotes Interoperability

OCSI – Open Cloud Standards Incubator – under DMTF (Leadership board)
WHY SUN for cloud computing?

Innovation and Choice
What does an end user expect?

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
Sun’s View

Many Clouds
Public and Private
Open and Compatible
Introducing the Sun Cloud

Sun Cloud
A Peek Behind the Sun Cloud

Products and Technologies

Expertise and Services

Partners

Open Communities
Comprehensive OPEN Portfolio Delivering Customer Choice

<table>
<thead>
<tr>
<th>SERVICES</th>
<th>NetBeans</th>
<th>Apache Software Foundation</th>
<th>php</th>
<th>JRuby</th>
<th>eclipse</th>
<th>Visual Studio</th>
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</thead>
<tbody>
<tr>
<td>Database/Storage Platform</td>
<td>MySQL</td>
<td>ZFS</td>
<td>PostgreSQL</td>
<td>ORACLE</td>
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<td>intel</td>
<td>ULTRASPARC</td>
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</table>
Sun Cloud Architecture

**Compute Service**
- Virtual Machines
- Networking
- Storage

**Virtual DataCenter**
- Resources, People, Graphical UI

**Open API**
- Public, RESTful
- Java, Python, Ruby

**Storage Service**
- Volumes
- Objects
- Protocols: WebDAV, S3
Storage Service

➢ **What It is**
  • On-demand, API-based access to storage on the network

➢ **Features**
  • Ability to store and retrieve data as objects or files
  • RESTful API with open, AWS S3-like semantics for object storage
  • WebDAV for file storage
  • Fast and inexpensive cloning of objects and files
  • High availability
  • Detailed metering of storage used, I/O requests, bandwidth, etc.

➢ **Customer Benefit**
  • Scalable, highly available storage without big hardware investments
Sun Cloud Storage Service

Client Applications and Services

- WebDAV and Administration API (Volume/Folder/File based access)
- Storage Object API (AWS S3 compatibility)

Firewall and Loadbalancing

- WebDAV and Administration Services
- Cloud Storage Object Service
- Cloud Storage Resource Manager: Manages access to what and where
- Cloud Storage Agent: Resides on every file system server
- Solaris and ZFS: file system servers
Sun Open Storage
Bringing Simplicity to Cloud Storage

Open Storage and Archive

- Lower costs with general purpose systems and Open Software
- Seamless integration with existing environments
- Open architectures will free users from vendor lock-in
- Flash/SSD accelerates performance
- Simple data administration

Dynamic scale with flexible building blocks

Superior performance

Manage more for less
Compute Service

➢ **What It Is**
  • On-demand, scalable computing infrastructure accessed via APIs or unique Virtual Datacenter (VDC) UI model

➢ **Features**
  • On-demand provisioning of virtual machines of industry-standard operating systems including Linux, Windows and OpenSolaris
  • Control and management with open, AWS EC2-like API or Virtual Datacenter UI
  • Creation of custom VMIs and access to pre-configured VMIs in the cloud
  • Support for persistent and non-persistent virtual machines

➢ **Customer Benefit**
  • Affordable access to highly scalable computing infrastructure
  • Always available
Sun Virtual Datacenter Model

- Design application from pre-built components using drag-and-drop
- Deploy to cloud
- Monitor, manage and reconfigure
- Compatibility with programmatic APIs
- Encapsulate system architecture of an application
- Ability to model, save and deploy entire system
Sun Cloud RESTful API

- Everything is a resource – http GET, POST, PUT...
- Requires only a single starting point - other URIs are discoverable
- Easy to create, save, load, stop, start entire applications
- Released to the public under Creative Commons
Initial Public Cloud Roadmap

- **Q1 2009**: Internal Alpha
  - Storage, Compute

- **Q2 2009**: Early Access
  - Storage, Compute
  - Update 1
    - Storage, Compute
    - Adds Identity, Queuing, Database services

- **H2 2009**: H2 2009
A Robust Partner Eco System
Sun’s Computing Cloud Hosted at SuperNAP, Las Vegas, Nevada, USA

- State of the art facility (Switch)
  - > 1500 watts per sq ft density
  - > 146 MVA generator capacity
  - > 100% heat containment
  - > 7000+ cabinets
  - > 24/7/365 security

- Second to none connectivity
  - > 26 national carriers are physically on-net within the data center
Sun Cloud Strategic Planning Service
Leverage Sun Expertise and Methodology to Evaluate Cloud Benefits in the Context of Your Business

Business Readiness Analysis
Opportunities Evaluation
Cloud 24 Month Roadmap
Supporting Plans and Estimates
Financial Attributes
Examples
US Navy – Data Cloud: Lustre over WAN

- Status
  - Lustre is running well and the principal file system
    - Some file systems have filled up
    - Now able to find problems (3-4 at present) that are due to heavier usage
  - Within CONUS, Lustre performance is excellent
  - Intercontinental speeds are faster than ftp
    - With system tuning, we have achieved very good write performance with Lustre US to USFK via OC-48 IB/Sonet
  - Using Lustre on regular basis in use
    - Updating Lustre to 1.6.7 now on a regular basis
    - Most of the applications use Lustre
  - More work needed on documentation

- WAN Gateway extends the qualities of the local, flow-controlled InfiniBand network across a long haul WAN
- Buffer-to-buffer data transfer over the WAN

James B. Hoffman, NRL, Lustre User Group, April, 2009
Cloud Enabled Applications

• Open Office

• VirtualBox
World’s Largest Academic Supercomputer

- The largest Academic research computing system in the world, #6 on Top 500
- Sun Constellation Linux Cluster and Mass Storage Facility
- 579 Tflops peak performance
The Network is your Computer

http://www.sun.com/cloud
THANK YOU

“I've got Sunshine, on a Cloudy Day”... Temptations

- www.sun.com/cloud
- stephen.perrenod@sun.com
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
Public Cloud Built on Open Source Innovation

- Amazon EC2 expanding customer choice with access to innovative open source software
  - Open Solaris – ZFS and Dynamic Tracing (DTrace)
  - Sun/MySQL – Support for Linux
  - Java
  - Hadoop on Open Solaris
- Enhanced options – quick deployment
**Applications Profile & Workloads?**

<table>
<thead>
<tr>
<th>Suitable for cloud</th>
<th>Not suitable for cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Facing (need web)</td>
<td>WAN sensitive (Big I/O)</td>
</tr>
<tr>
<td>Very Parallel (need more)</td>
<td>Security sensitive (IP, personal data)</td>
</tr>
<tr>
<td>Spiky Traffic (lots of peaks)</td>
<td>SLA sensitive (Mission critical – tied to product cycle)</td>
</tr>
<tr>
<td>Start-up or SMB (need resource)</td>
<td>No support (ISV Will Not Support Cloud Version)</td>
</tr>
<tr>
<td>Proof of Concept (testing)</td>
<td></td>
</tr>
<tr>
<td>Commodity (e-mail, calendaring, collaboration)</td>
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</tbody>
</table>
Cloud Architecture – Phase 1

User Apps and Services

- Internet Accessible APIs and UIs
- Customer Web Site

- Compute Service
- Storage Service
- Virtual Datacenter Management Console
- Application Catalog, Forums, Docs

- Accounting, Billing and Metering

Virtualized Datacenter Management Layer

- Servers
- Storage
- Network

Partner and Build
Cloud Architecture – Future

**User Apps and Services**

- Internet Accessible APIs and UIs
- Customer Web Site
- Application Catalog, Forums, Docs
- Database Service
- Queuing Service
- Identity Service
- JavaEE Service
- Virtual Datacenter Management Console
- Compute Service
- Storage Service
- Accounting, Billing and Metering
- Virtualized Datacenter Management Layer
- Servers
- Storage
- Network
- Partner and Build
Public Cloud Pricing Model

- A la carte: Choose the services you want
- Utility pay-as-you-go pricing model, competitive to market
- Flexible payment options (credit card, purchase order)
- Easy sign-up and self-provisioning