Exciting Weather Forecasts

Results 1 - 10 of about 27,900,000 for cloud computing. (0.15 seconds)

Results 1 - 10 of about 77,900,000 for barack obama. (0.44 seconds)

Results 1 - 10 of about 1,550,000 for credit default swap [definition]. (0.15 seconds)

Even if it's not good news, it's good news to know. See where and why customers leave your site.

Amazon Stretches Into Elastic Computing

Times Online

News Site of the Year | The 2008 Newspaper Awards

Utility Computing

Independent industry information for the IT utility

Will the Real Utility Computing Model Please Stand Up
[Leif Erikson, Founder and Principal, Industry Insights 2003/7/30]
Commercial Cloud Formation

Amazon Elastic Compute Cloud (Amazon EC2) - Beta

TAP INTO THE POWER OF NETWORK.COM
What is a cloud?

---

- SLAs
- Web Services
- Virtualization
Cloudy issues

- Public clouds are opaque
  - What applications will work well in a cloud?
- Many of the advantages offered by Public Clouds appear useful for “on premise” IT
  - Self-service provisioning
  - Legacy support
  - Flexible resource allocation
- What extensions or modifications are required to support a wider variety of services and applications?
  - Data assimilation
  - Multiplayer gaming
  - Mobile devices
Open-source Cloud Infrastructure

• **Idea:** Develop an open-source, freely available cloud platform for commodity hardware and software environments
  – Stimulate interest and build community knowledge
  – Quickly identify useful innovations
  – Act to dampen the “hype”

• **First-principles cloud implementation**
  – Not a refactorization of previously developed technology

• **Linux or Anti-Linux?**
  – Linux: open-source platform supporting all cloud applications changes the software stack in the data center
  – Anti-Linux: transparency of the platform makes it clear that clouds do not belong in the data center
On a clear day…

- **Globus/Nimbus**
  - Client-side cloud-computing interface to Globus-enabled TeraPort cluster at U of C
  - Based on GT4 and the Globus Virtual Workspace Service
  - Shares upsides and downsides of Globus-based grid technologies
- **Enomalism (now called ECP)**
  - Start-up company distributing open source
  - REST APIs
- **Reservoir**
  - European open cloud project
  - Many layers of cloud services and tools
  - Ambitious and wide-reaching but not yet accessible as an implementation
What’s in a name?

- **Elastic Utility Computing Architecture Linking Your Programs To Useful Systems**
- Web services based implementation of elastic/utility/cloud computing infrastructure
  - Linux image hosting ala Amazon
- **How do we know if it is a cloud?**
  - Try and emulate an existing cloud: Amazon AWS
- Functions as a software overlay
  - Existing installation should not be violated (too much)
- Focus on installation and maintenance
  - “System Administrators are people too.”
Goals for Eucalyptus

- **Foster greater understanding and uptake of cloud computing**
  - Provide a vehicle for extending what is known about the utility model of computing

- **Experimentation vehicle prior to buying commercial services**
  - Provide development, debugging, and “tech preview” platform for Public Clouds

- **Homogenize local IT environment with Public Clouds**
  - AWS functionality locally makes moving using Amazon AWS easier, cheaper, and more sustainable

- **Provide a basic software development platform for the open source community**
  - E.g. the “Linux Experience”

- **Not designed as a replacement technology for AWS or any other Public Cloud service**
Requirements

• **Implement cloud abstractions and semantics**
  • Must be a cloud (inarguably)

• **Simple**
  – Must be transparent and easy to understand

• **Scalable**
  – Interesting effects are observed at scale (e.g. not an SDK)

• **Extensible**
  – Must promote experimentation

• **Non-invasive**
  – Must not violate local control policies

• **System Portable**
  – Must not mandate a system software stack change

• **Configurable**
  – Must be able to run in the maximal number of settings

• **Easy**
  – To distribute, install, secure, and maintain
Open-source Cloud Anatomy

- **Extensibility**
  - Simple architecture and open internal APIs
- **Client-side interface**
  - Amazon’s AWS interface and functionality (familiar and testable)
- **Networking**
  - Virtual private network per cloud
  - Must function as an overlay => cannot supplant local networking
- **Security**
  - Must be compatible with local security policies
- **Packaging, installation, maintenance**
  - System administration staff is an important constituency for uptake
Architecture

Client-side API Translator

Cloud Controller

Database

Walrus (S3)

Cluster Controller

Node Controller

Storage Controller
Notes from the Open-source Cloud

• **Private clouds are really hybrid clouds**
  – Users want private clouds to export the same APIs as the public clouds

• **In the Enterprise, the storage model is key**
  – Scalable “blob” storage doesn’t quite fit the notion of “data file.”

• **Cloud Federation is a policy mediation problem**
  – No good way to translate SLAs in a cloud allocation chain
  – “Cloud Bursting” will only work if SLAs are congruent

• **Customer SLAs allow applications to consider cost as first-class principle**
  – Buy the computational, network, and storage capabilities that are required
Cloud Myths

- Cloud computing infrastructure is just a web service interface to operating system virtualization.
  - “I’m running Xen in my data center – I’m running a private cloud.”
- Clouds and Grids are equivalent
  - “In the mid 1990s, the term grid was coined to describe technologies that would allow consumers to obtain computing power on demand.”
- Cloud computing imposes a significant performance penalty over “bare metal” provisioning.
  - “I won’t be able to run a private cloud because my users will not tolerate the performance hit.”
Operating System virtualization (Xen, KVM, VMWare, HyperV) is only apparent for IaaS
- AppEngine = BigTable

Hypervisors virtualize CPU, Memory, and local device access as a single virtual machine (VM)

IaaS Cloud allocation is
- Set of VMs
- Set of storage resources
- Private network

Allocation is atomic

Each user gets an SLA
- Server consolidation must respect SLAs given to users

Requires more than A set of Hypervisors
Datacenter Virtualization

Virtualization Control
A Cloud

Cloud Services
Clouds vs. Grids

- **Rich’s assertion: Clouds and Grids are distinct**
- **Cloud**
  - Individual user can only get a tiny fraction of the total resource pool
  - No support for cloud federation except through the client interface
  - Opaque with respect to resources
- **Grid**
  - Built so that individual users can get most, if not all of the resources in a single request
  - Middleware approach takes federation as a first principle
  - Resources are exposed, often as bare metal
- **These differences mandate different architectures for each**
Cloud Speed

- Extensive performance study using HPC applications and benchmarks
- Two questions:
  - What is the performance impact of virtualization?
  - What is the performance impact of cloud infrastructure?
- Tested Xen, Eucalyptus, and AWS (small SLA)
- Many answers:
  - Random access disk is slower with Xen
  - CPU bound can be faster with Xen -> depends on configuration
  - Kernel version is far more important
  - Eucalyptus imposes no statistically detectable overhead
  - AWS small appears to throttle network bandwidth and (maybe) disk bandwidth -> $0.10 / CPU hour
Comparing TCP Performance between EC2 and EPC
Comparing ICMP Ping Performance between EC2 and EPC

TCP RTT

-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
ICMP Ping RTT ms

EC2 1 Zone
EC2 2 Zones
EPC 1 Zone
EPC 2 Zones
Four Instance Start-up Time (CDF⁻¹)

- EC2 4 instance
- EPC 4 instance
Uptake – 55K so far

Downloads (excluding Ubuntu 9.04)

- Monthly

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<th>Month</th>
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</tr>
</tbody>
</table>
No Eucalyptus in Antarctica (yet)
Open-source Distribution

Linux Distribution: *Ubuntu* and Eucalyptus

- Jaunty Jackalope “Powered by Eucalyptus”
  - April 23, 2009
  - Complete build-from-source
- Karmic Koala
  - October 23, 2009
  - Full-featured Eucalyptus
- Fundamental technology
  - “Ubuntu Enterprise Cloud” ecosystem surrounding Eucalyptus
- 10,000,000 potential downloads
- *Debian* “squeeze”
  - Source release packaging under way
- Packaged for *CentOS, OpenSUSE, Debian*, and *Ubuntu* as “binary” release as well

Make Eucalyptus the open source reference implementation for cloud computing.

Simon Wardley (head of cloud strategy), Canonical
Eucalyptus Ecosystem
Open-source Roadmap

- 5/28/08 – Release 1.0 shipped
- 8/28/08 – EC2 API and initial installation model in V1.3
  - Completes overlay version
- 12/16/08 – Security groups, Elastic IPs, AMI, S3 in V1.4
- 4/19/09 – EBS, Metadata service in V1.5.1
- 4/23/09 - Ubuntu release
- 7/17/09 – Bug fix release in V1.5.2
- 10/23/09 – Karmic Koala release
  - 10^7 downloads from “main” archive
- 11/5/09 – Final feature release as V1.6.1
  - Completes AWS specification as of 1/1/2009
- 1/1/09 – Final bug-fix release V1.6.2
  - “core” opens for community contribution
PHASE 1 – Services and Consulting
Bootstrap with high profile product and service agreements
• Enterprise credibility
• Market validation for product development
• Develop sales leads
• Current customers

PHASE 2 – Enterprise Products
Enterprise cloud products leveraging open source base
• Customized resource allocation and SLA’s
• Enterprise cloud management tools
• Go to Market: Direct sales and download conversions
Thanks!

• Thanks to our original research sponsors…

UCSB  VGrADS  NSF

• …and to our new commercial friends

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www.eucalyptus.com
805-845-8000
rich@eucalyptus.com