

Introduction to the Intercloud

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With acknowledgement to my research
colleagues from Cisco: Krishna Shankar, Steve
Diamond, Erik Ludvigson, Monique Morrow

Network Based Value Added

Voice – SS7/IN, CDR

Mobile – HLR, 2G/3G

Internet – OSPF, BGP, AS

Email – SMTP

VPN – MPLS

Cloud – Intercloud

A Profound Breakthrough

Interoperable Server Side Protocols and Formats

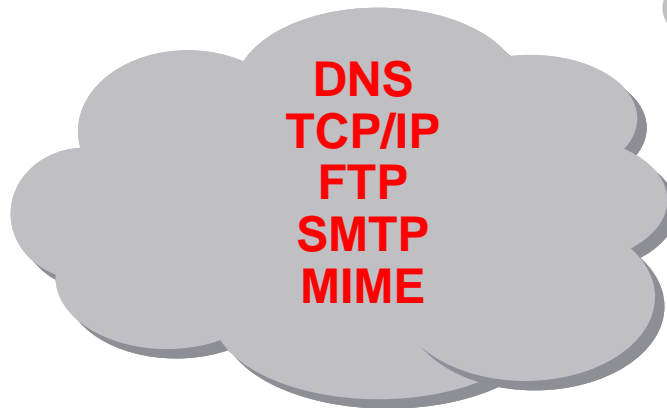
Proprietary
Email Client



Proprietary
Email Client



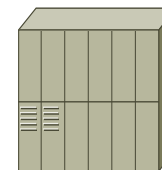
DNS
TCP/IP
FTP
SMTP
MIME



Proprietary
Email Client

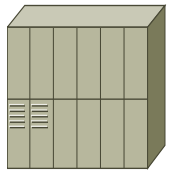


Proprietary
Email Client

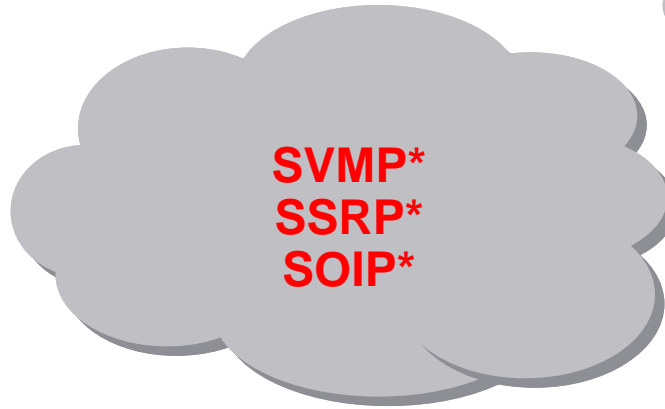


A Profound Breakthrough, Again

**Proprietary
Computing,
Storage Client**



**Interoperable
Server Side
Protocols and
Formats**



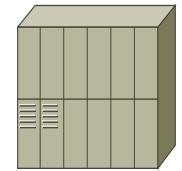
**Proprietary
Computing,
Storage Client**



**Proprietary
Computing,
Storage Client**

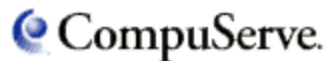


***Simple VM Mobility Protocol
*Simple Storage Replication Protocol
*Simple Other Intercloud Protocols As Needed**



**Proprietary
Computing,
Storage Client**

It Really could be a Déjà Vu



"I'm seeing a possibility of inter-cloud problems mirroring the Internet problems we had thirty or forty years ago,", Vint Cerf, Vice President and Chief Internet Evangelist for Google

Large Cloud Players and Landscape

Notice who is NOT on the chart – the large Telco/Service Providers



The Leader with Huge Footprint already built and tremendous developer acceptance



Well Along with Huge Build Out



Announced Huge Azure Build Out and Virtualization Thrust



Delivers SaaS and Hosted Applications



Announced Consortium and Very large "Research" Build Out



Utility Computing Platform called Network.com



Open Source Virtualization and Cloud OS



HUAWEI New Entrant



Unified Computing



Vcloud Initiative



Cloud Storage



HUAWEI

Is This the Future of Cloud?



Carriers Mobility drive will accelerate adoption of Cloud Computing as a back end

Open Handhelds



Netbooks

Verizon Netbook to hit stores this weekend

updated 11:23 a.m. EDT, The May 14, 2008

By Margie Reardon from cnet

[CNET] — Verizon Wireless will start selling Netbook computers from Hewlett-Packard company said in a statement released Thursday.

As previously reported by the HP blog, the HP Mini 1101NR Netbook, \$199.99 after a \$50 mail-in rebate, is available for purchase on Verizon Wireless Broadband service.

Verizon is offering a \$40-a-month plan with 250 MB of data. However, the \$40-a-month fee of \$83 downloads per GB. The average charge on the network is 13 cents per MB.

July 7, 2008 7:58 AM PDT

Sprint sells Netbook for a buck

By Margie Reardon

If you thought a \$50 Netbook was a bargain, Sprint Nextel's plan to sell Netbooks for a buck to a select group of customers is a real deal.

Sprint has teamed up with mega-retailer Best Buy to sell the Compaq Mini 1100-1040DX Netbook for a two-year service contract. The offer is good at participating Best Buy stores.

Best Buy plans to sell the same Netbook for Verizon Wireless and AT&T for \$199.99 with a two-year Wireless service contract. The Netbook costs \$189.99, according to [Best Buy's Web site](#).

The Compaq Mini 1100-1040DX Netbook features a 1.0GHz processor and 100GB hard drive.

Sprint's 3G wireless service is \$60 a month for 5GB of data transfer, making the true cost of the Netbook with two years of service \$1,440.

Verizon offers two tiers of data service. The \$40-a-month plan offers 250MB of data monthly. And the \$60-a-month plan offers a maximum of 5GB of data. With the current pricing, Verizon Netbook users can expect to spend \$1,189 to \$1,540 during the life of the contract for the service and Netbook.

December 10, 2008 6:08 AM PST

RadioShack sells \$99 Netbook with 2-year AT&T contract

By Dawn Kamenetz

RadioShack is selling an Acer Aspire One 3G Netbook for \$99, with a two-year AT&T DataConnect contract.

The Acer Aspire One grabbed 38.3 percent of Netbook market share in the third quarter, propelling a post industry pioneer Asus and its Eee PC 9G.

Acer's Aspire One normally sells for about \$300.

Open Wireless Networks

BusinessWeek HOME INVESTING COMPANIES TECHNOLOGY INNO

TECHNOLOGY February 1, 2008, 12:01AM EST text size: T

FCC Auction Opens Door to Open Access

With a burst of bids, the FCC's latest wireless auction will be its most profitable ever—and a mobile network open to any device or service is a virtual certainty

by Olga Kharif

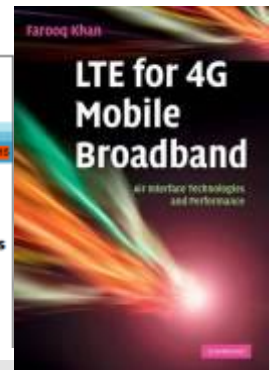
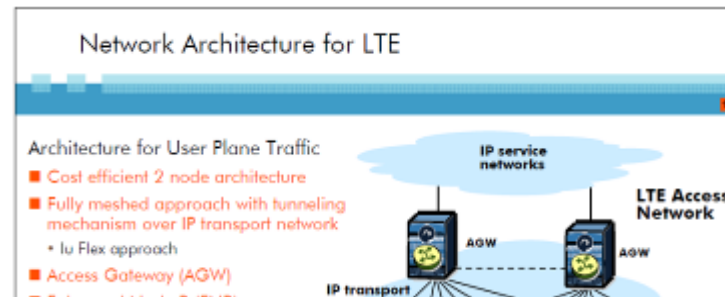
A sudden spurt of bidding has turned what was shaping up as a bust into the most robust auction of wireless spectrum the federal government has ever conducted, salvaging hopes for a new generation of mobile networks that are open to any device and any service.

The weeklong auction cleared a crucial stage on Jan. 31 as

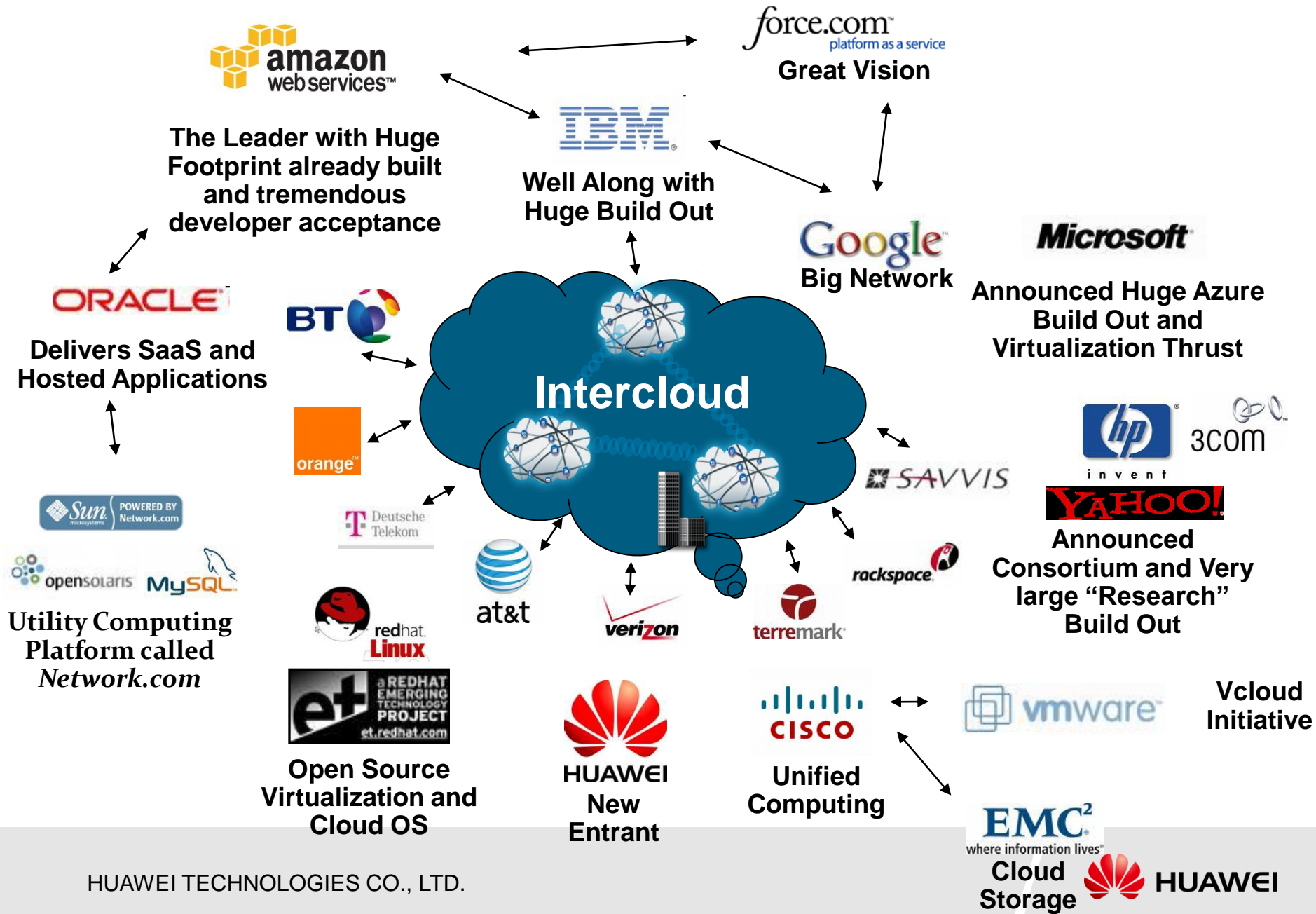
TECHNOLOGY

- Will Windows 7 Reboot PC Sales?
- Why Europe Won't Stop Oracle from Taking Over Sun
- Next Up for Nokia: Netbooks, ...

4G/LTE – All IP network design for Wireless

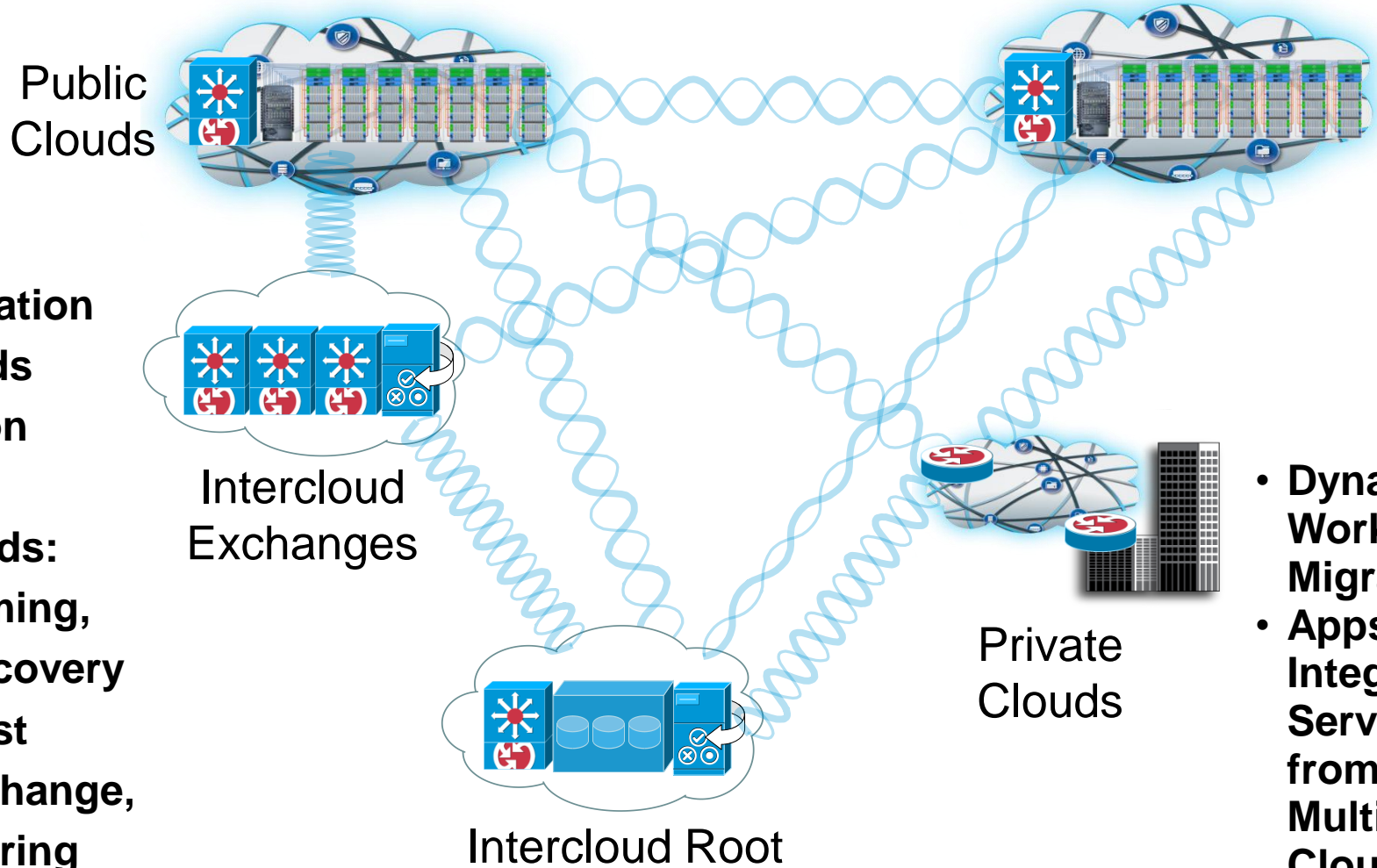


A Likely Long Term Outcome



Vision—The Intercloud

Flexible Infrastructure and a New Application Platform

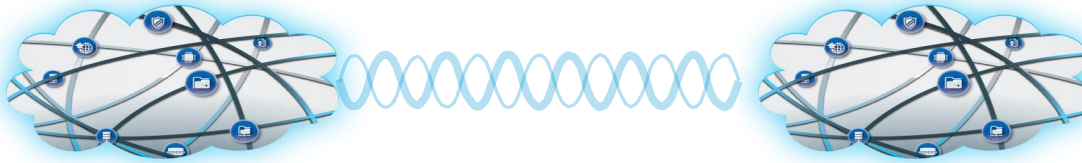


**A Federation
of Clouds
Based on
Open
Standards:**

- Naming, Discovery
- Trust
- Exchange, Peering

- Dynamic Workload Migration
- Apps Integrate Services from Multiple Clouds

Dynamic Workload Migration – Simple VM Mobility



Cloud 1 / Cloud 2 transport
→ **XMPP**

Cloud 1 finds Cloud 2
→ **Naming, Presence**

Cloud 1 trusts Cloud 2
→ **Certificates, Trustsec**

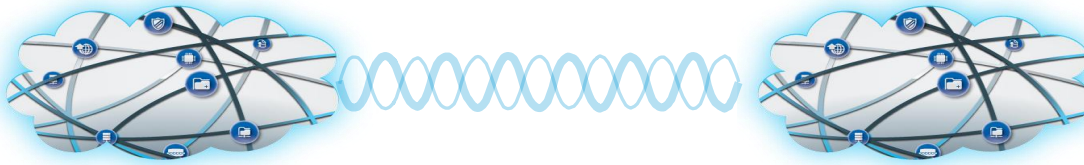
Cloud 1/2 negotiate
→ **Policy, Entitlement, Security, Metering**

Cloud 1 sets up Cloud 2
→ **Placement, Deployment, Format, Motion**

Cloud 1 sends to Cloud 2
→ **Transfer, Management**

VM Runs in Cloud 2
→ **Addressing, VLAN, WWN, Filesystem**

Dynamic Workload Federation – Generalized Service Access



Cloud 1 / Cloud 2 transport
→ XMPP

Cloud 1 finds Cloud 2
→ Naming, Presence

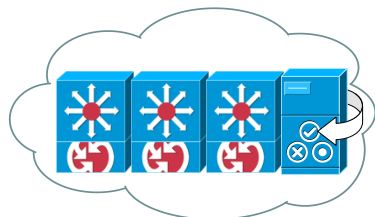
Cloud 1 trusts Cloud 2
→ Certificates, Trustsec

Cloud 1 queries Cloud 2 for Services
→ RDF/SPARQL, OWL

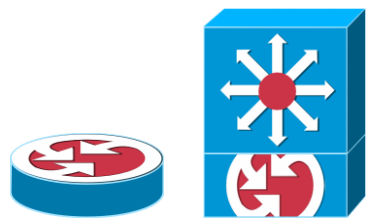
Cloud 1 selects; receives protocols, interface
→ Web Services; REST API

Cloud 1 calls services in Cloud 2
→ Metering, SLAs

Intercloud Elements



Intercloud
Exchanges

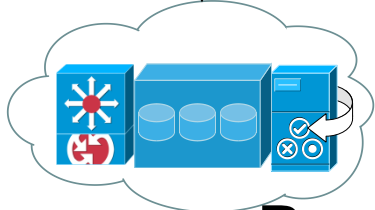


Gateways which are
Intercloud Enabled

Clouds which are
Intercloud Enabled



protocols
formats
processes
practices
governance



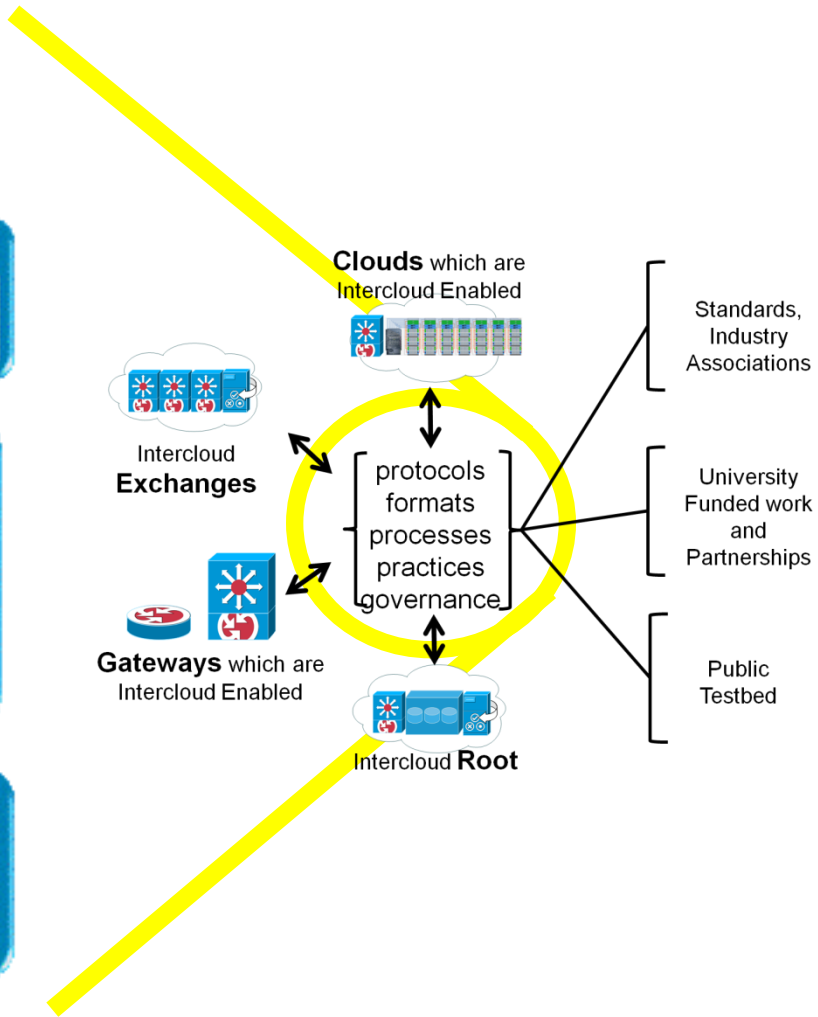
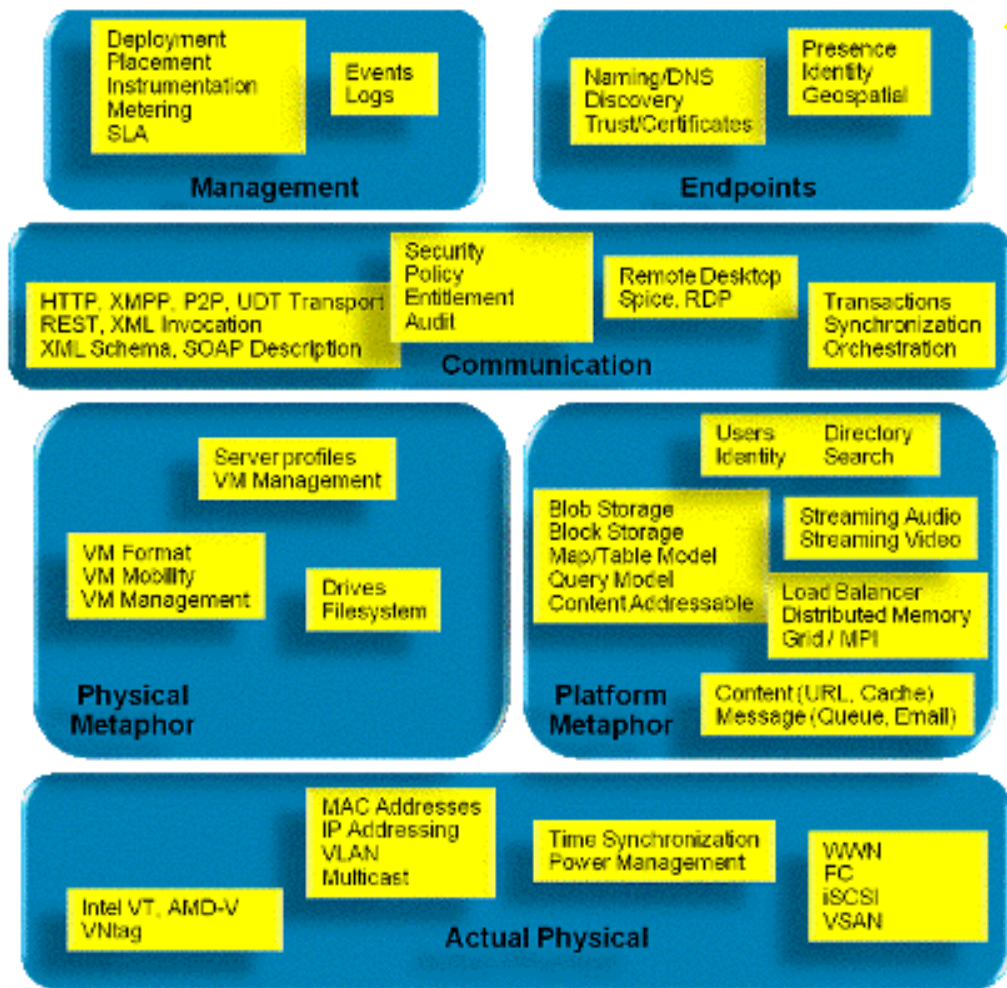
Intercloud **Root**

Standards,
Industry
Associations

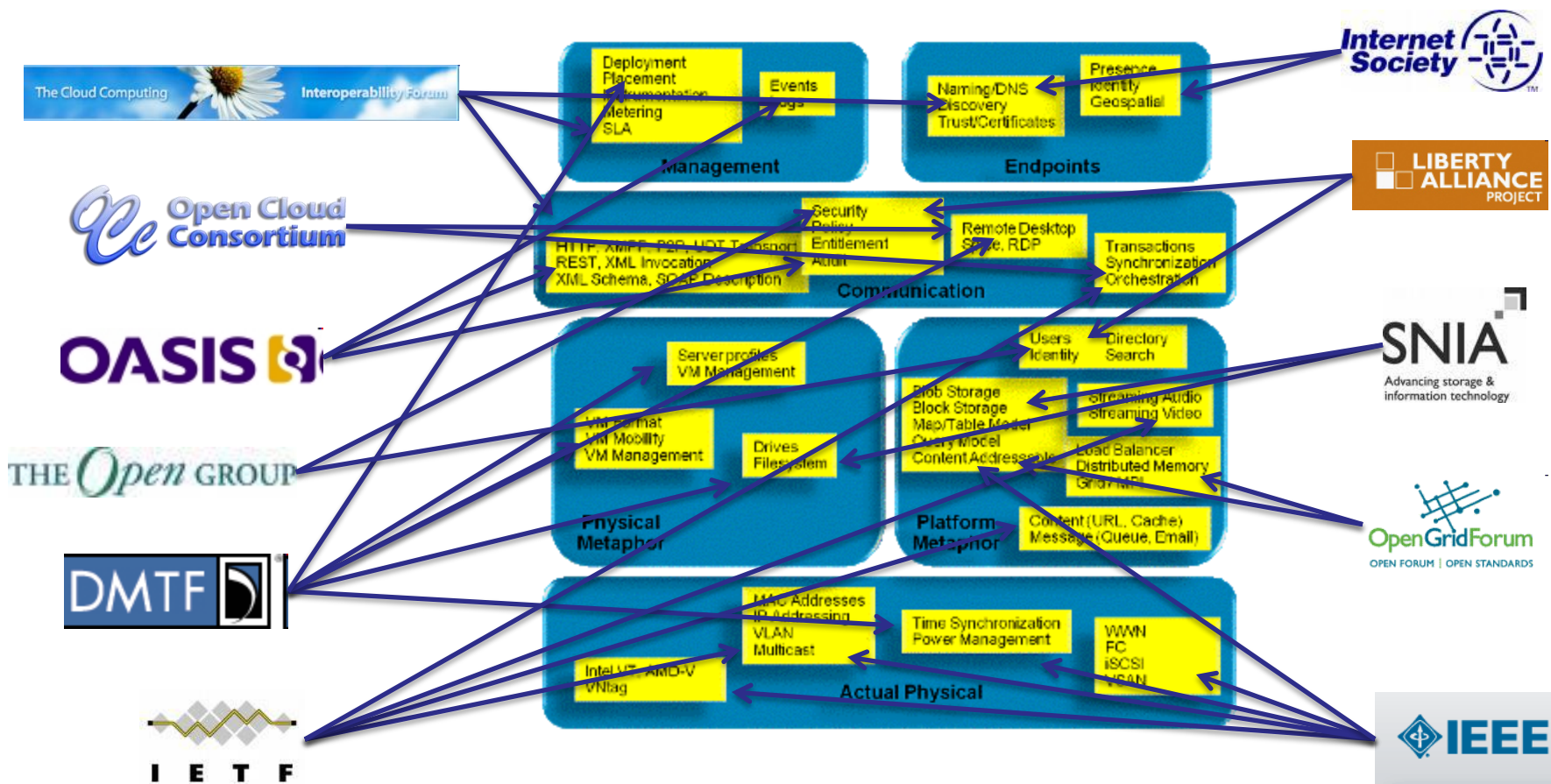
University
Funded work
and
Partnerships

Public
Testbed

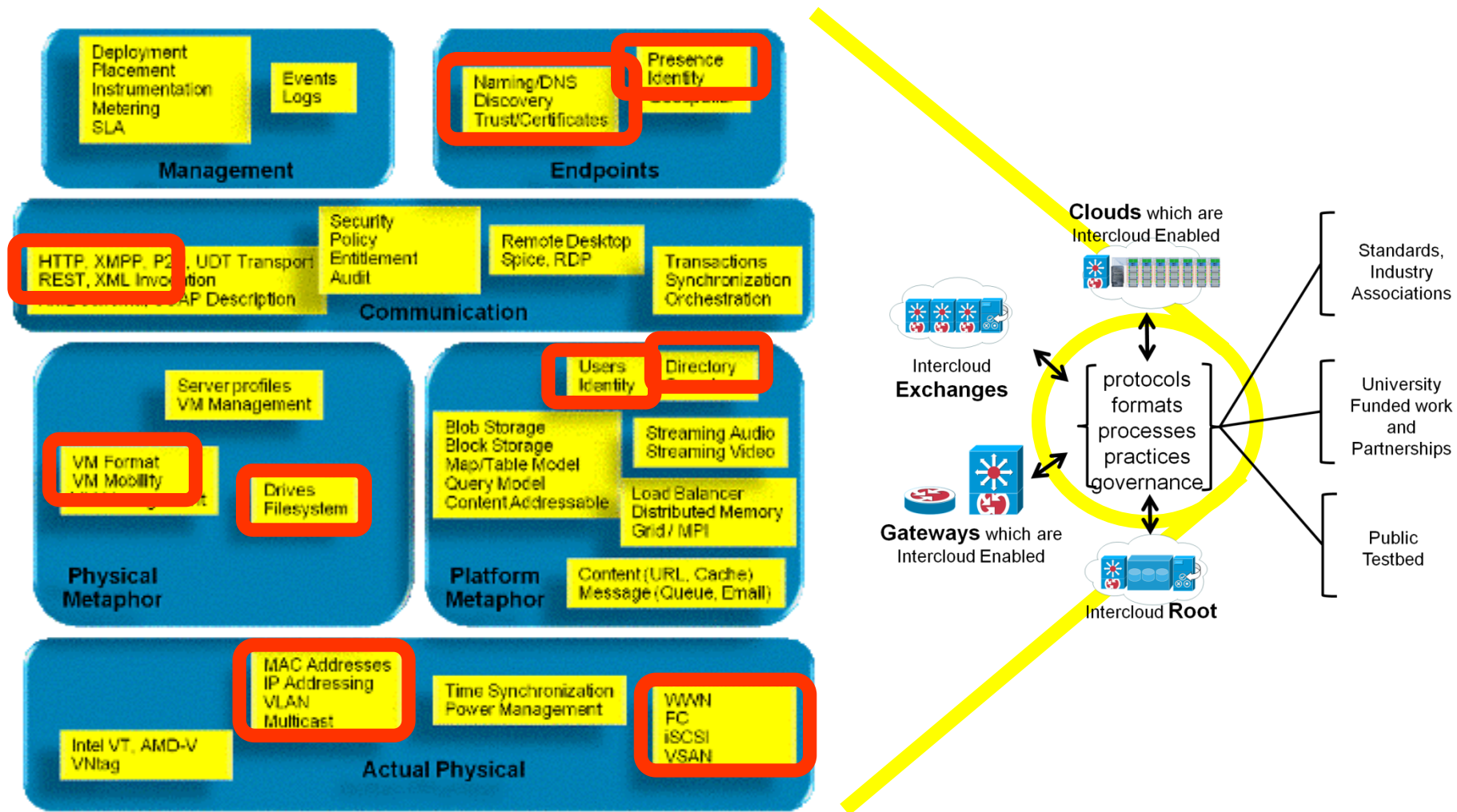
Palette of Standards Areas



Multiple Standards and Associations



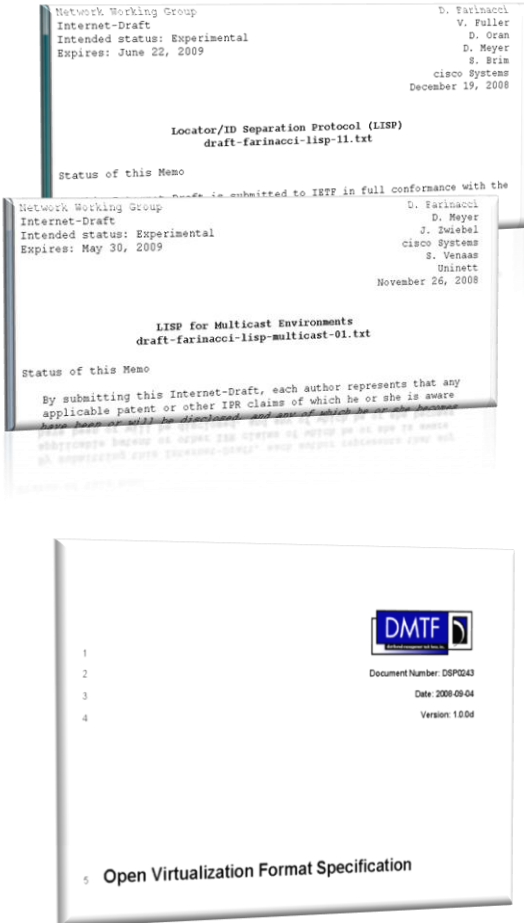
Good Initial Standards Focus Areas



Use Cases: Workload mobility, Service (storage) federation

Specific Intercloud Projects

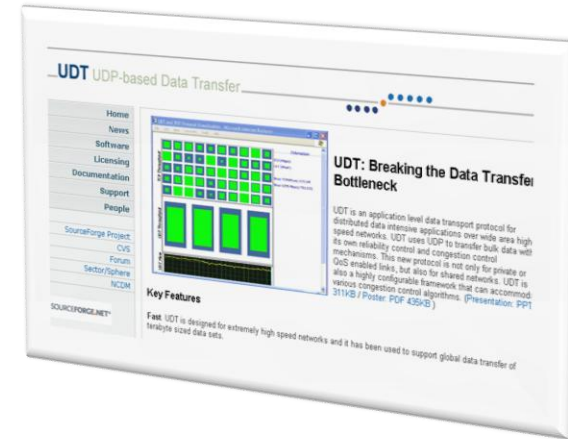
- Addressing – IETF LISP



- Conversations – XMPP.org



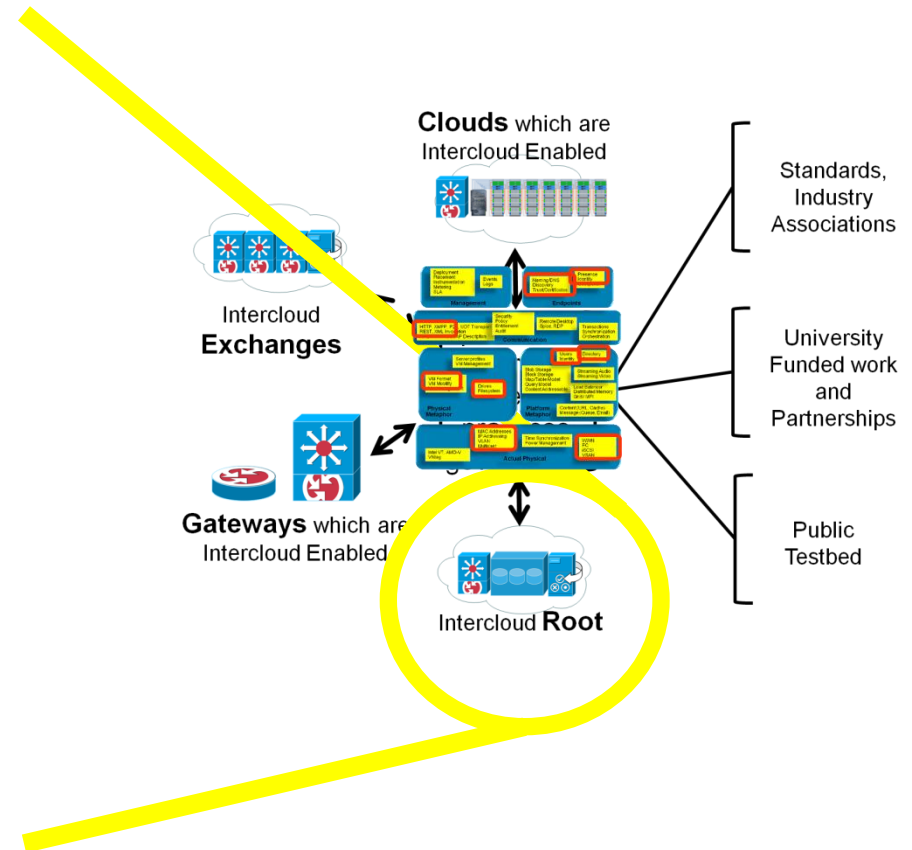
- UCI – W3C, Google Code



- Distributed Storage Acceleration - opencloudconsortium.org, udt.sourceforge.net

Intercloud Root – Design, Specification, Prototype

- Root Cloud DNS, LDAP, and Certificate Authority (FreeIPA?)
 - Cloud Naming/DNS
 - Cloud Presence/Discovery
 - Cloud Identity/Authentication
- Speaks XMPP
 - Is Root XMPP server
- Namespace Manager
 - Root software MAC address space authority
 - Root LISP IP Address DB
 - Root LISP Multicast DB
 - Root software WWN address space authority



Opencloud Testbed = Possible Intercloud Testbed

Open Cloud Consortium

home about working groups testbed software members license

The Open Cloud Consortium (OCC):

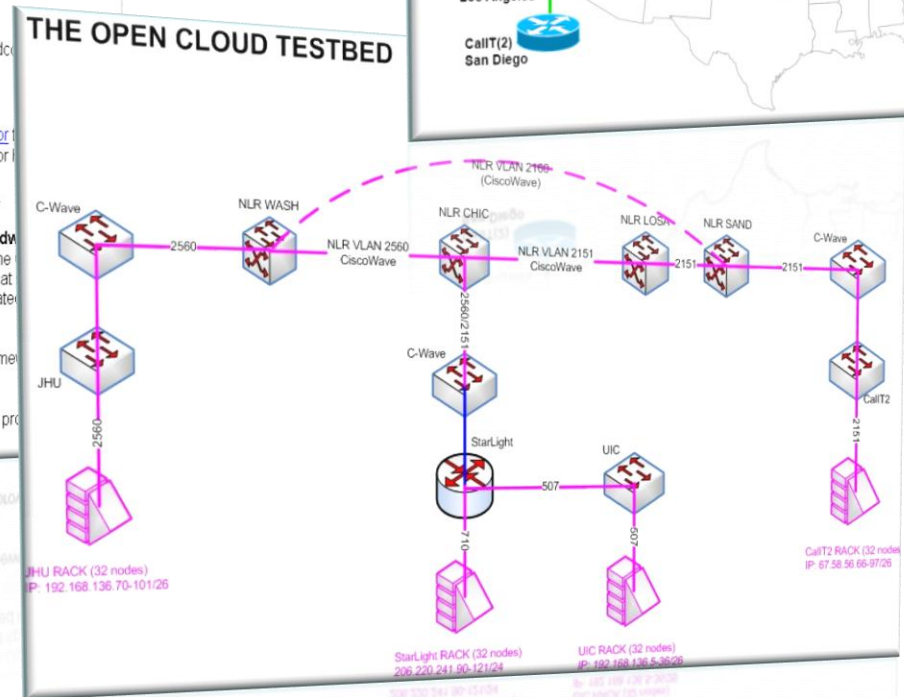
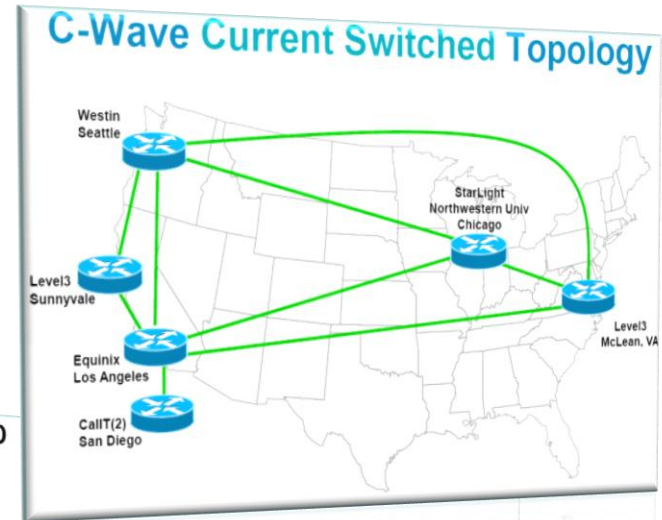
1. supports the development of standards for cloud computing and frameworks for interoperating between clouds;
2. supports the development of benchmarks for cloud computing;
3. supports open source software for cloud computing;
4. manages a testbed for cloud computing called the Open Cloud Testbed;
5. sponsors workshops and other events related to cloud computing.

The Open Cloud Consortium is organized into different [working groups](#).

If you are interested in joining the Open Cloud Consortium, please send email to info@opencloud.org

What's New

- **February 12-16, 2009, Demonstration.** The OCC will be demonstrating a version of Sector applications at the [AAAS Meeting](#) in Chicago. This appears to be the first cloud designed for IaaS applications.
- **January 7, 2009.** An [article](#) about the Open Cloud Consortium appeared in Network World.
- **November 20, 2008, Sector/Sphere and the Open Cloud Testbed win the SC 08 Bandwidth Challenge.** Consortium participated in an entry that consisted of several cloud applications running on the SC 08 Bandwidth Challenge. This included a terasort running on the Open Cloud Testbed that sustained an average throughput of 4.8 Gb/s and a peak throughput of 10 Gb/s. Racks located in San Diego were used in the entry.
- **November 17-20, 2008, SC 08.** Several applications, benchmarks, and interoperability frameworks were demonstrated using the Open Cloud Testbed.
- **November, 2008, Thrift Interoperability Study.** A study was completed that used Thrift to connect several clouds, including the Hadoop DFS and the Sector DFS.



Next Intercloud Activity

The Session is a follow-on to a series of meetings in 2009 among government, industry, and standards groups. These include a [Cloud Interoperability Workshop](#) (March), a [Cloud Standards Coordination Session](#) (July), and a [Government Cloud Initiatives and Standards Roadmaps Workshop](#) (September).

The results of these meeting include a [Cloud Standards Coordination](#) group and a proposal for a [Cloud Standards Roadmap Process](#).

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OMG TECHNICAL MEETING SPECIAL EVENT

Cloud Interoperability Roadmaps Session

December 10, 2009, Long Beach, CA

- | | |
|---------------|--|
| 08:00 - 08:45 | (Rackspace) - Adrian Otto, Cloud Developer, Rackspace |
| 08:45 - 09:15 | (Open Cloud Consortium) - Surenda Reddy, VP of Cloud Computing, Yahoo |
| 09:15 - 10:00 | (IBM) Ginny Ghezzi, Senior Development Manager, Emerging Technologies, IBM
<i>Thinking Dynamically About the Infrastructure</i> |
| 10:15 - 11:00 | (Microsoft) - Mark Ryland, National Standards Officer (USA), Microsoft
<i>Interoperability in the Cloud: Challenges and Opportunities</i> |
| 11:00 - 11:45 | (RightScale) - (TBD) |
| 13:30 - 14:30 | (NASA) - Chris Kemp, CIO of NASA Ames |
| 14:30 - 15:00 | (GICTF) - Hiroshi Sakai, GICTF Secretariat, Supervisor, Global Inter-Cloud Technology Forum
<i>Introduction to Global Inter-Cloud Technology Forum and its Roadmaps</i> |
| 15:15 - 15:45 | (DMTF) - Winston Bumpus, President, Distributed Management Task Force
<i>Will Cloud Computing be Open and Interoperable?</i> |
| 15:45 - 16:15 | (OGF) - Craig Lee, President, Open Grid Forum
<i>An Open Cloud Computing Interface Status Update</i> |

Thank You

www.huawei.com