

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

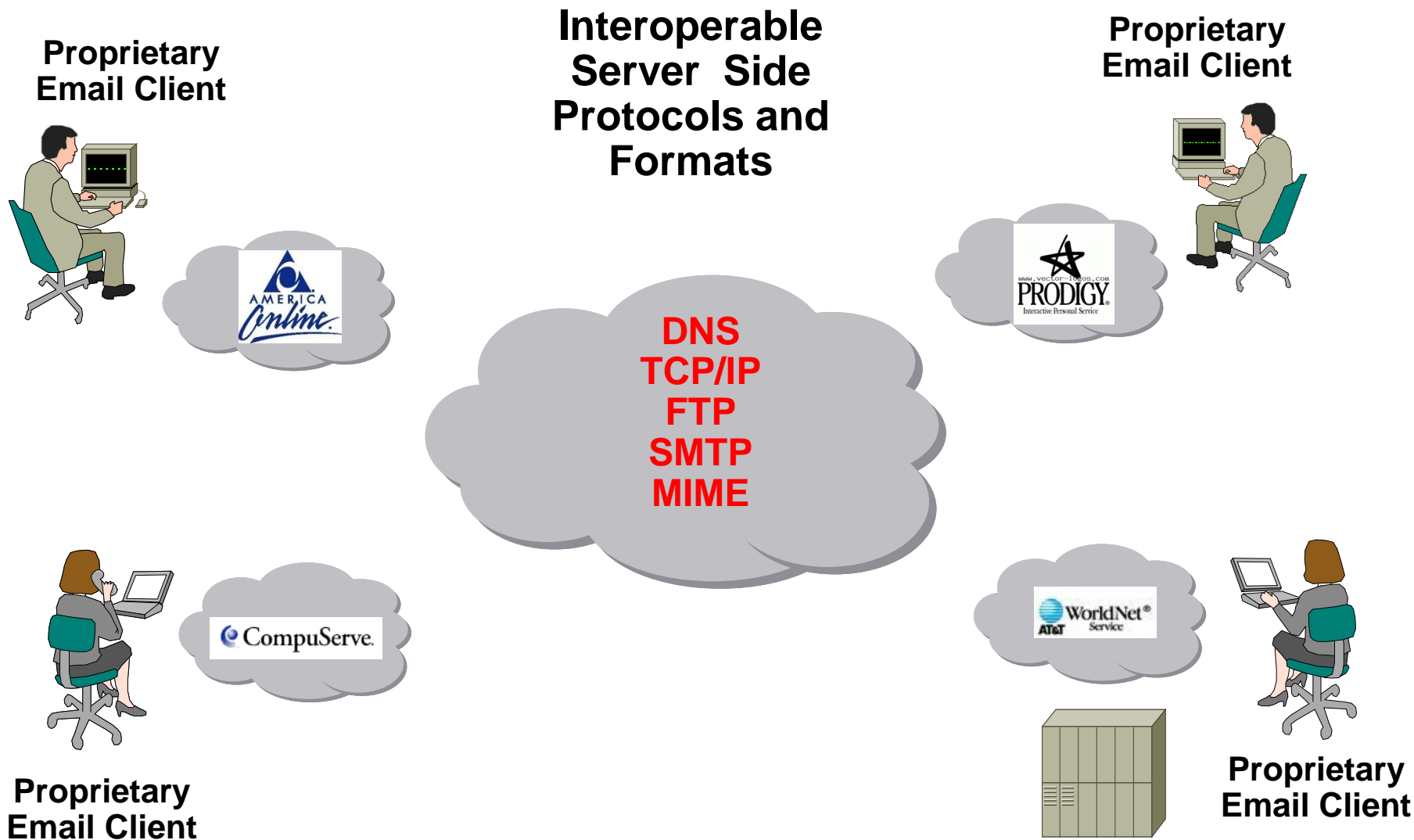
Internet – OSPF, BGP, AS

Email – SMTP

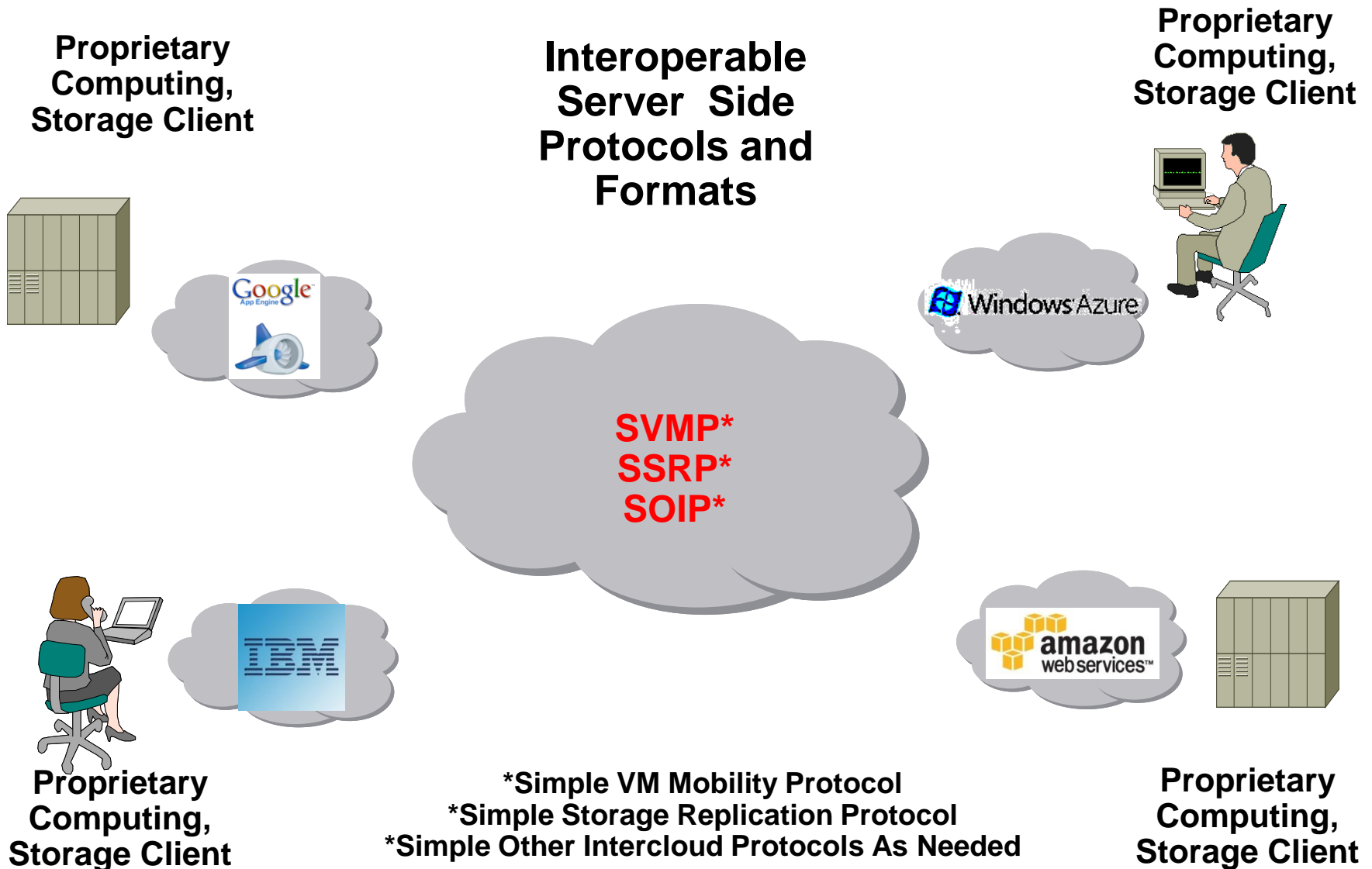
VPN – MPLS

Cloud – Intercloud

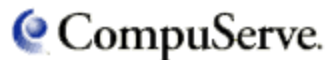
A Profound Breakthrough



A Profound Breakthrough, Again



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

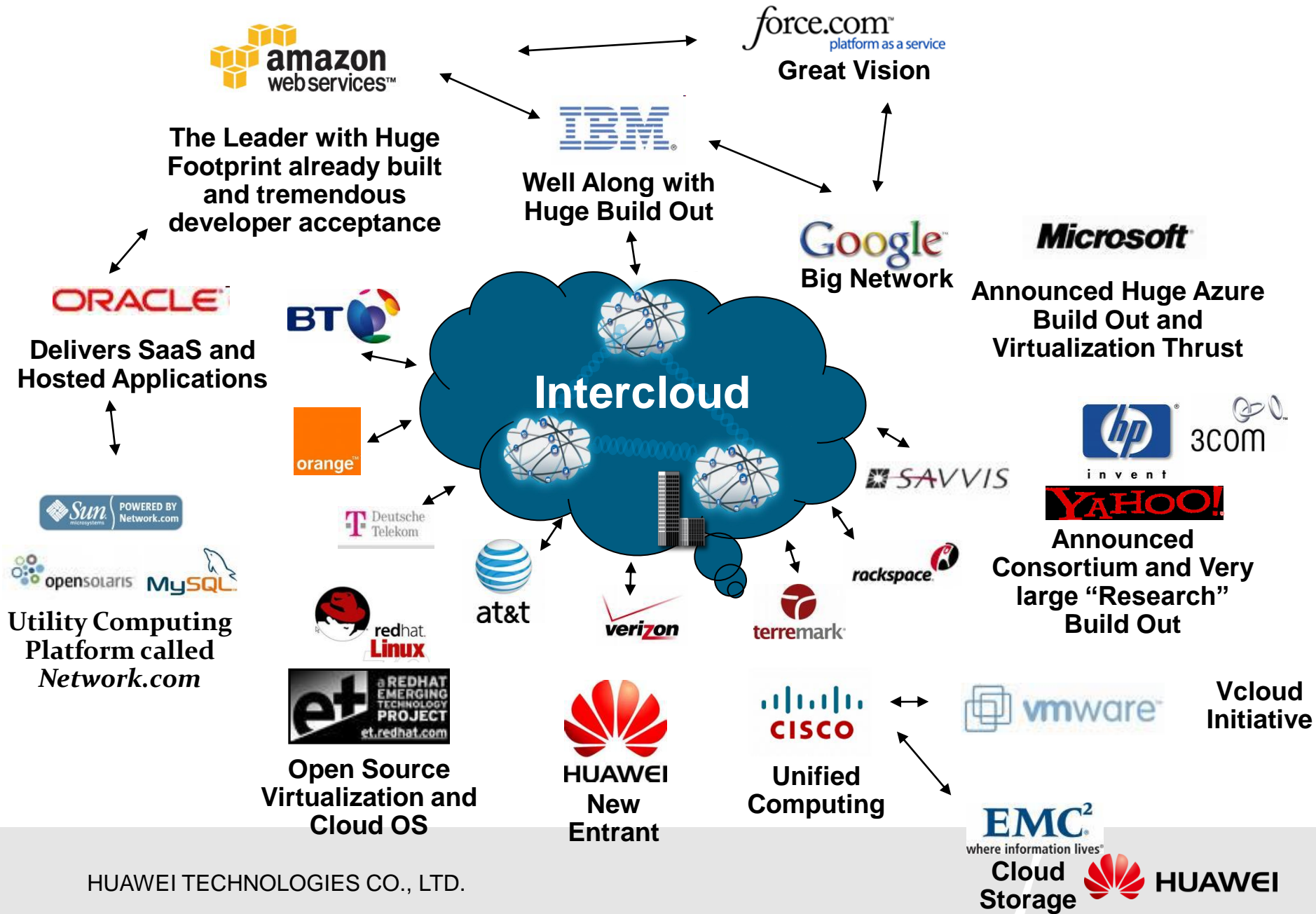


HUAWEI

Is This the Future of Cloud?

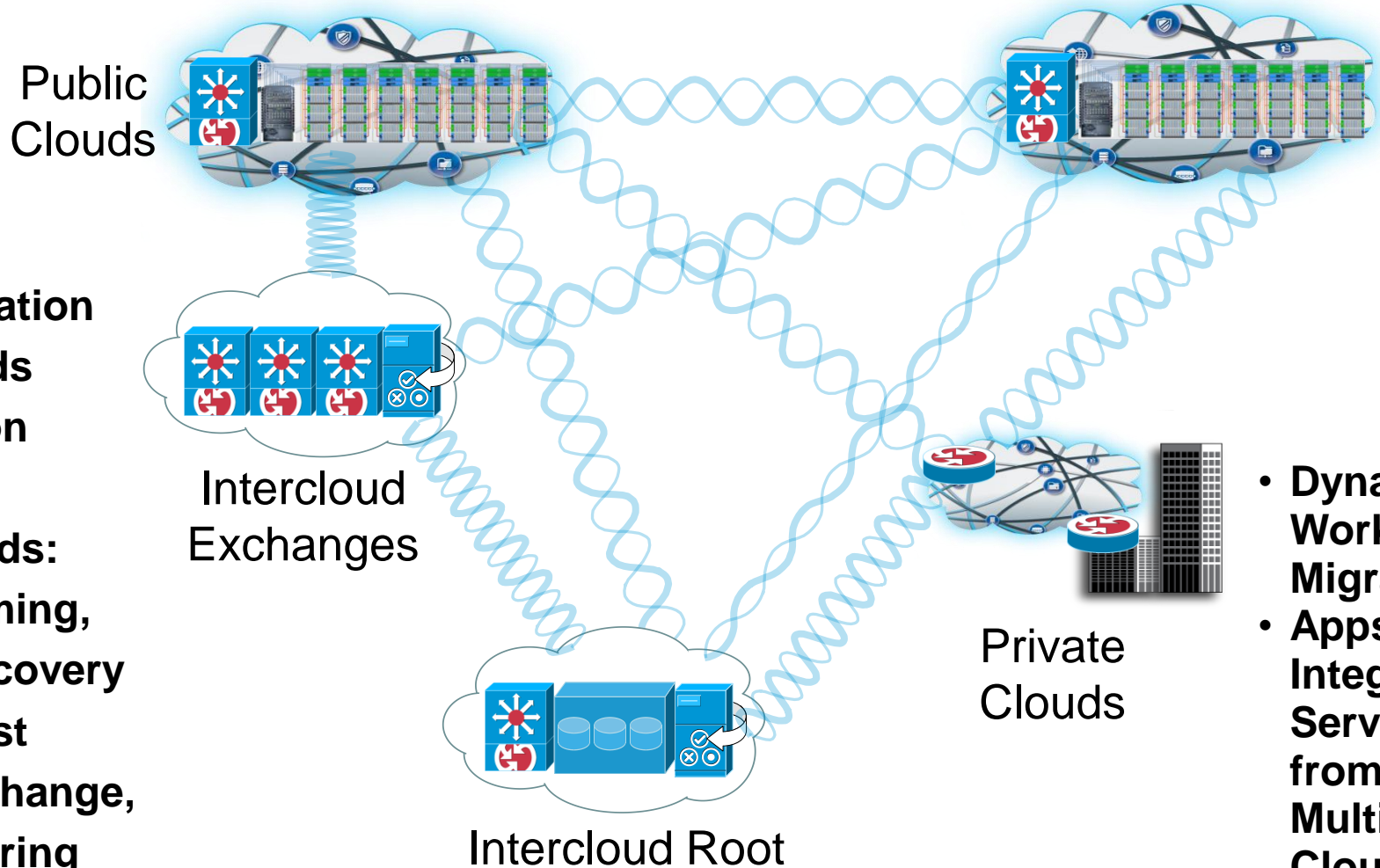


A Likely Long Term Outcome



Vision—The Intercloud

Flexible Infrastructure and a New Application Platform

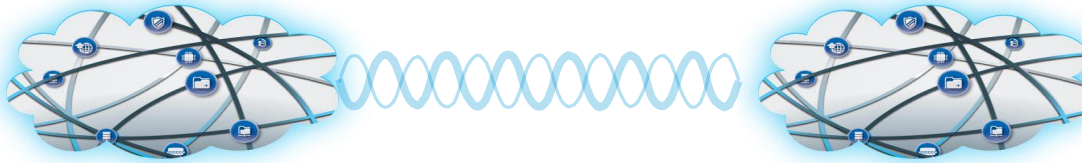


**A Federation
of Clouds
Based on
Open
Standards:**

- 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**

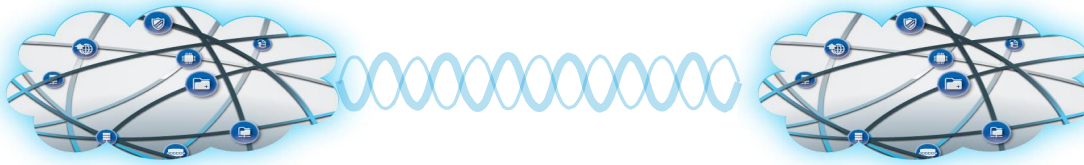
Cloud 1/2 negotiate
→ **Policy, Entitlement,
Security, Metering**

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

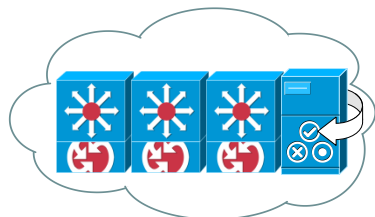
Cloud 1 selects; receives protocols, interface

→ Web Services; REST API

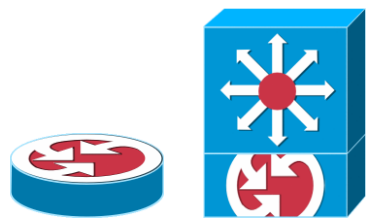
Cloud 1 calls services in Cloud 2

→ Metering, SLAs

Intercloud Elements



Intercloud
Exchanges

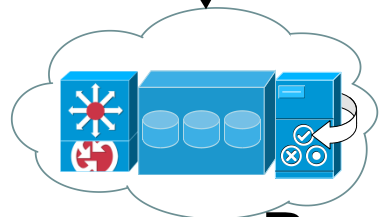


Gateways which are
Intercloud Enabled

Clouds which are
Intercloud Enabled



protocols
formats
processes
practices
governance



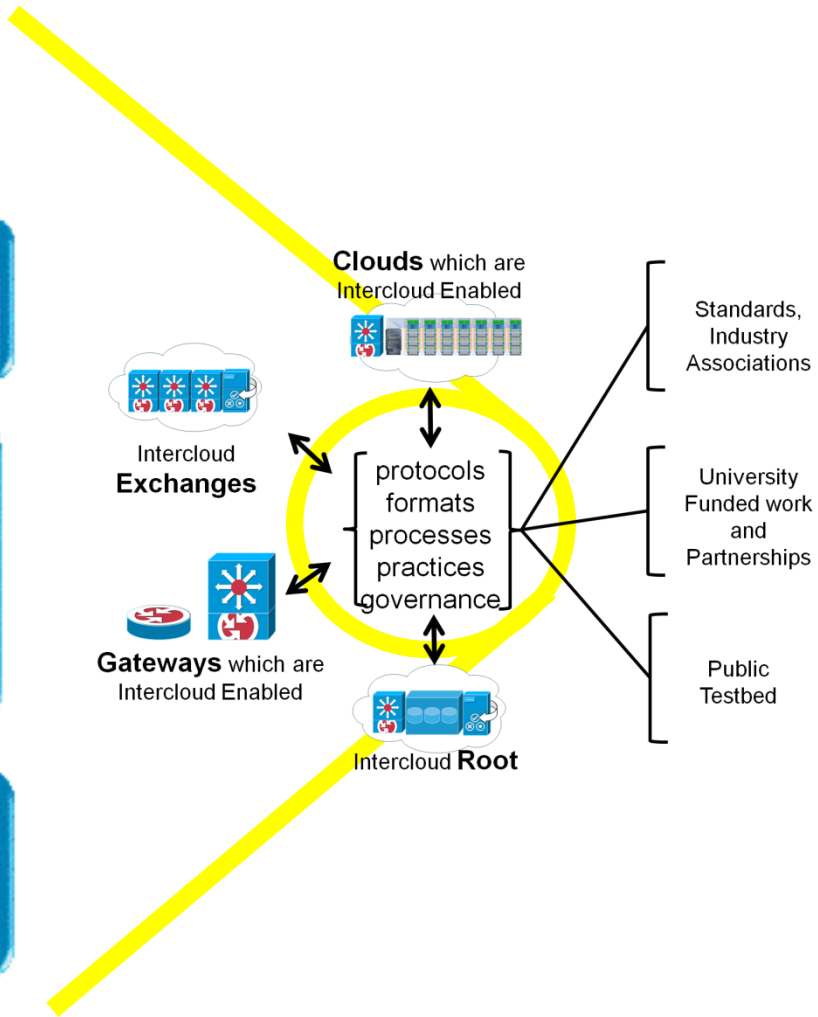
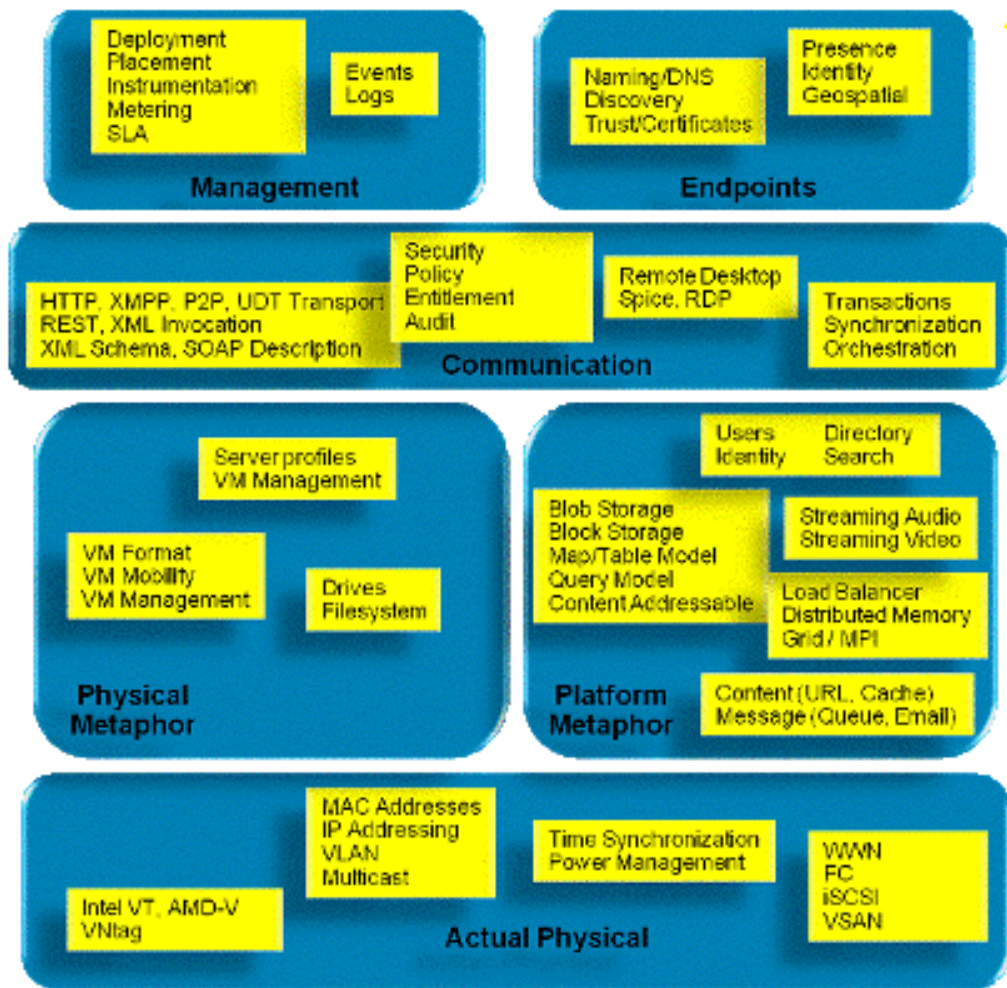
Intercloud **Root**

Standards,
Industry
Associations

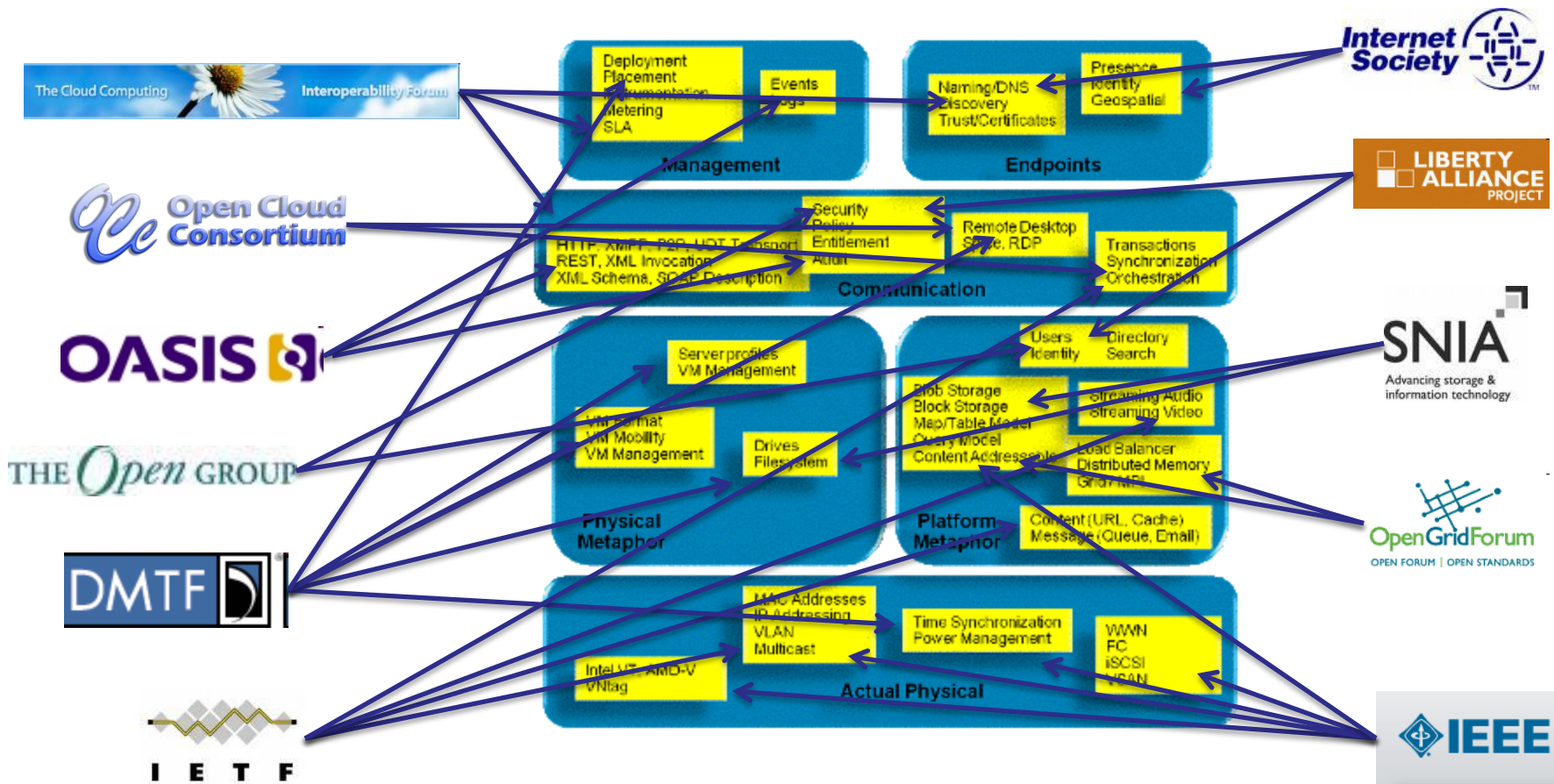
University
Funded work
and
Partnerships

Public
Testbed

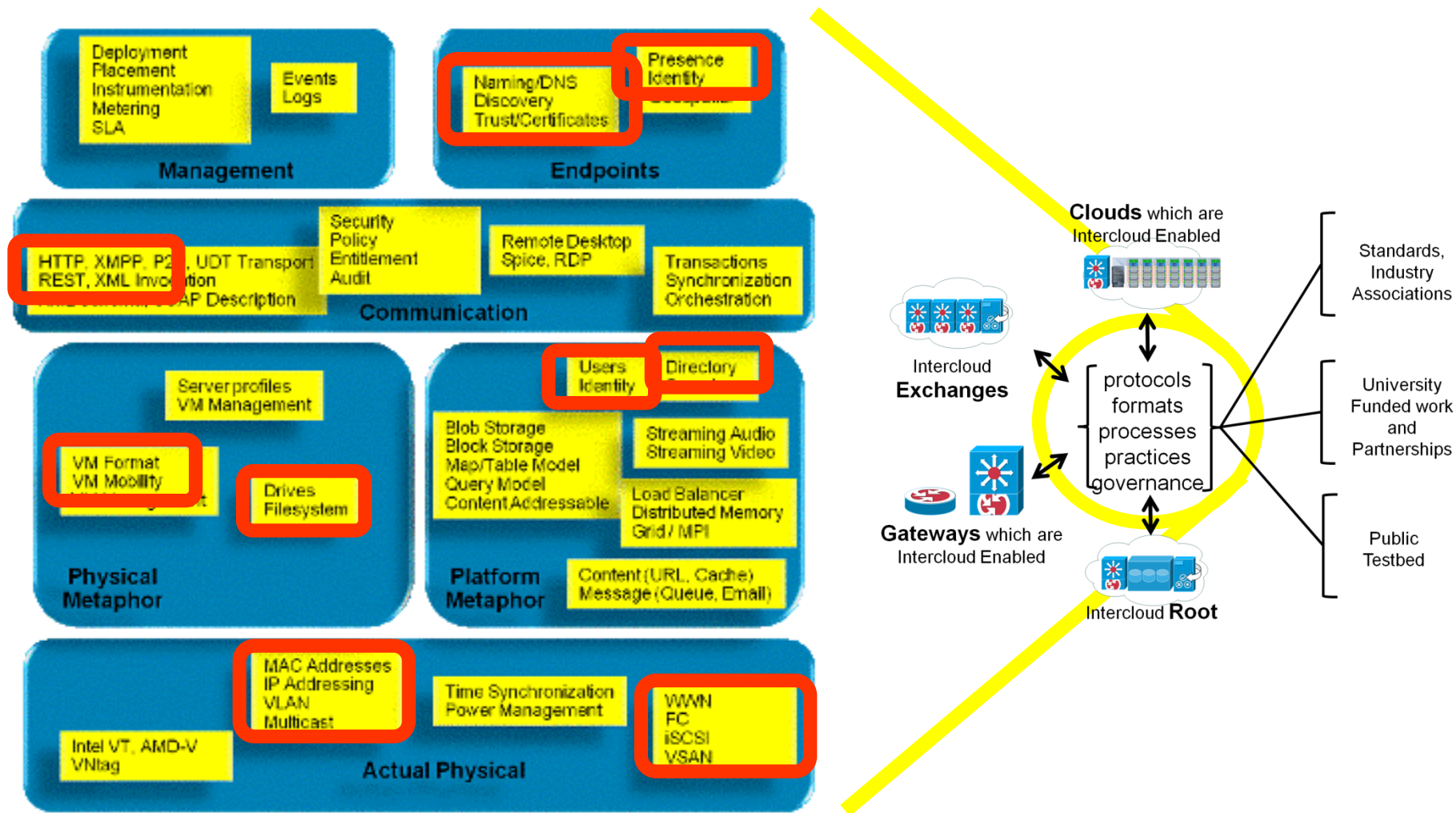
Palette of Standards Areas



Multiple Standards and Associations



Good Initial Standards Focus Areas



Use Cases: Workload mobility, Service (storage) federation

Specific Intercloud Projects

■ Addressing – IETF LISP

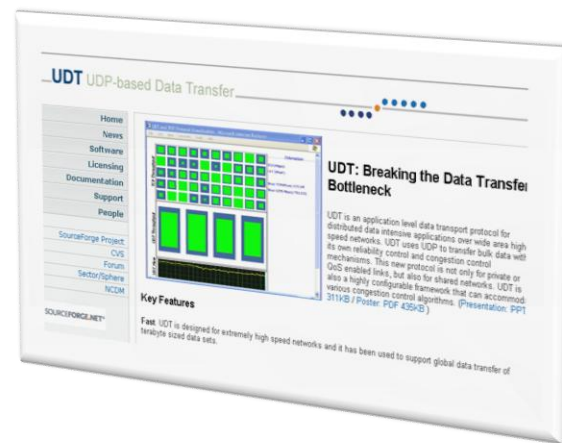
The image shows three document thumbnails. The top one is an IETF draft titled "Locator/ID Separation Protocol (LISP) draft-farinacci-lisp-11.txt" with authors D. Farinacci, V. Fuller, D. Oran, D. Meyer, S. Brim, and Cisco Systems, dated December 19, 2008. The middle one is "LISP for Multicast Environments draft-farinacci-lisp-multicast-01.txt" with authors D. Farinacci, D. Meyer, J. Zwiebel, Cisco Systems, S. Venas, and Uninett, dated November 26, 2008. The bottom one is a DMTF document titled "Open Virtualization Format Specification" with document number DSP0243, dated 2008-09-04, and version 1.0.04.

■ Conversations – XMPP.org

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</iq>
```



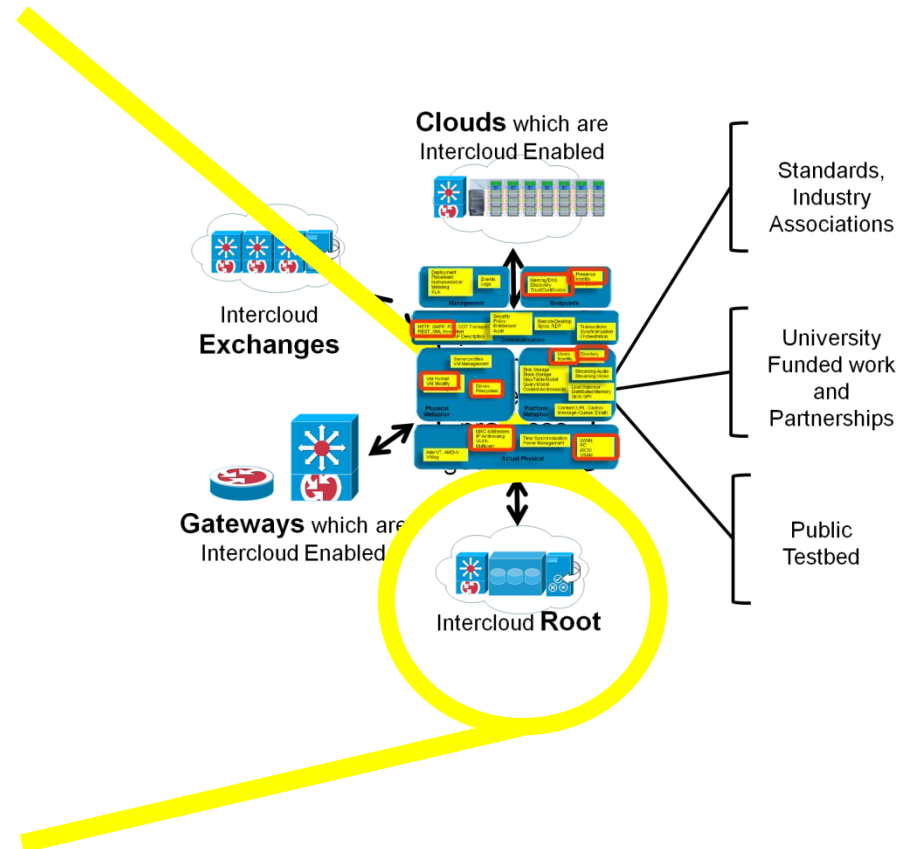
■ UCI – W3C, Google Code



■ 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):

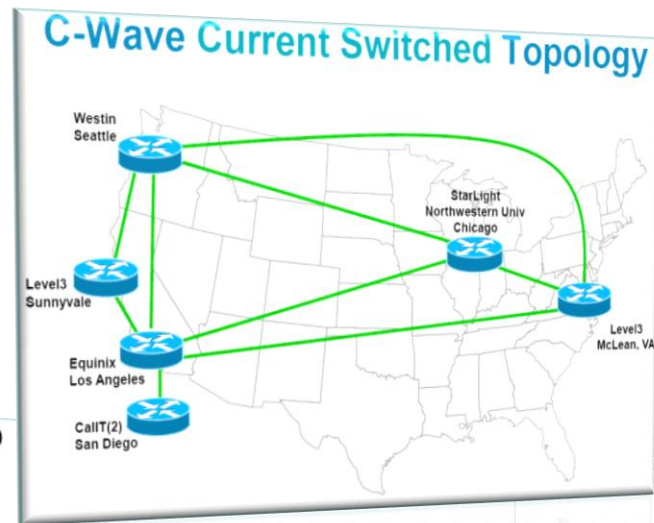
1. supports the development of standards for cloud computing and frameworks for interoperating between clouds;
2. supports the development of benchmarks for cloud computing;
3. supports open source software for cloud computing;
4. manages a testbed for cloud computing called the Open Cloud Testbed;
5.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

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

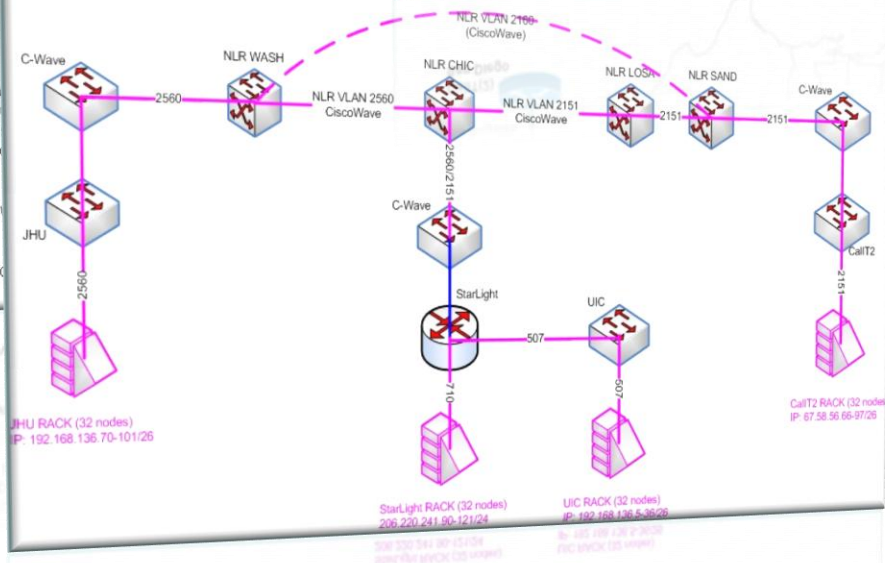
If you are interested in joining the Open Cloud Consortium, please send email to info@opencloud.org

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.



THE OPEN CLOUD TESTBED



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