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

Proprietary Email Client

Proprietary Email Client
A Profound Breakthrough, Again

Proprietary Computing, Storage Client

Interoperable Server Side Protocols and Formats

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

Proprietary Computing, Storage Client

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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

- **Amazon Web Services**
  - The Leader with Huge Footprint already built and tremendous developer acceptance

- **Oracle**
  - Delivers SaaS and Hosted Applications

- **IBM**
  - Great Vision
  - Well Along with Huge Build Out

- **Google**
  - Big Network
  - Announced Huge Azure Build Out and Virtualization Thrust

- **Microsoft**
  - Announced Consortium and Very large “Research” Build Out

- **Network.com**
  - Utility Computing Platform called

- **Red Hat Linux**

- **OpenSolaris**

- **MySQL**

- **HUAWEI**
  - New Entrant

- **VMware**
  - Unified Computing

- **EMC2**
  - Cloud Storage

- **Big Network**

- **Vcloud Initiative**
Is This the Future of Cloud?
Carriers Mobility drive will accelerate adoption of Cloud Computing as a back end

Open Wireless Networks

4G/LTE – All IP network design for Wireless
A Likely Long Term Outcome

The Leader with Huge Footprint already built and tremendous developer acceptance

Well Along with Huge Build Out

Great Vision

Intercloud

Announced Huge Azure Build Out and Virtualization Thrust

Delivers SaaS and Hosted Applications

Utility Computing Platform called Network.com

Open Source Virtualization and Cloud OS

HUawei New Entrant

Unified Computing

Vcloud Initiative

HUAWEI TECHNOLOGIES CO., LTD.
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 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

Clouds which are Intercloud Enabled

protocols, formats, processes, practices, governance

Standards, Industry Associations

University Funded work and Partnerships

Public Testbed

Intercloud Exchanges

Gateways which are Intercloud Enabled

Intercloud Root
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**

- **Virtual Machines - DMTF OVF**

- **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
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 meetings include a Cloud Standards Coordination group and a proposal for a Cloud Standards Roadmap Process.
Thank You

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