



Update on the Cloud Demonstration Project

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Joint Techs Summer 2011
13-July-2011

BACKGROUND

- **Project Participants**

Twelve Universities: Caltech, Carnegie Mellon ,Cornell George Mason, Indiana University, Penn State, Stanford University, UC Berkeley, University of Michigan, University of Utah, University of Virginia, University of Wisconsin

- **Objective**

A technical and business model for the provisioning of multi-vendor cloud services leveraging the Internet2 Network and InCommon Federated Authentication and encouraging of an interoperable marketplace for services where individual institutions might procure services from a wide range of cloud services providers.

- **Initial Outreach**

Solicitation in the Fall of 2010 was sent to over 40 vendors (primarily Internet2 corporate members)

Motivation

- **Capacity on Demand**

Commercial cloud infrastructure services a major step toward a cost-effective, utility computing resources on demand much like the electrical power grid

- **Large-scale adoption hampered by price, performance and portability**

- Can we leverage Internet2 resources, ability to aggregate demand to lower costs?
- Can we work with vendors to meet performance, usability and security requirements?
- Can we work collaboratively to develop sustainable solutions that support the migration of mission-critical services to the cloud?

- **Approach:**

- Establish partnerships with those interested in a developing a multi-vendor cloud
- Explore alternative specifications, interoperability requirements, user and program interfaces, service level definitions, business services and pricing models
- Initial emphasis on utility compute and storage, then platform and application services.

Objectives

- To better understand the management challenges for both service providers and institutional users
- Address known challenges and hopefully lead to the identification of new challenges
- The scope of known issues includes:
 - 1) Integration of institutional “private” clouds to multiple cloud services providers;
 - 2) Management of security, privacy, data replication and protection;
 - 3) Systems monitoring and auditing requirements under multi-tenancy and with multiple vendors and services locations;
 - 4) Business continuity exposure and mitigation challenges;
 - 5) Service-level-agreements to ensure the portability of services; and
 - 6) Technical specifications, requirements and recommended technical architectures.

LESSONS LEARNED

What we learned about Cloud Providers

- Lots of interest, many flavors
 - Each vendor has approached the cloud from a slightly different perspective
 - There are many “public cloud” providers and “private cloud” builders
- “Community cloud” is easily said and widely accepted, but...
 - No one has a business and provisioning model to support a multi-enterprise, multi-vendor cloud
 - More like building a marketplace for cloud than a point solution
 - Lots and lots of challenging questions
- Infrastructure-as-a-Service is an important starting point, but
 - Understanding future growth depends on emerging needs for PaaS and SaaS offerings
- We will get “there” in fits and starts
 - Faster than we expected for some things
 - Slower than expected for others

Models that have Emerged

- Leveraging the Internet2 Network, federated authentication
- Four potential roles for Internet2
 - Contract Intermediation (master contracts)
 - Demand aggregation (pre-commitments to volume)
 - Value-added reseller (provisioning and procurement services)
 - Direct services provider (provisioning services)
- Roles are not mutually exclusive
 - Cloud providers are not the same
 - Tend toward different types of partnerships with Internet2
 - For some corporate partners, role is in optimizing network performance to enhance the quality of services

Technical Challenges

- Options for providing connectivity
 - Alternative models for extending university data center networks to a remote cloud
 - Need to ensure multiple paths to services
 - Use cases will drive the decision on connection paths
- Interoperable and integrated clouds
 - Transparent extension of campus cloud services to an external cloud
 - Extending university VMware environments to include community cloud services*
 - Replicating/extending local policies (e.g., security, privacy, compliance)
 - Extending local identity management – understanding the roles of Shibboleth/InCommon in supporting ubiquitous authentication
- Other challenges
 - Data storage, protection and availability requirements
 - How ready are we for
 - 'True' HPC in the cloud?*
 - Building cloud-aware applications?*



THANK YOU

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