

Perspectives on Cloud Computing and Standards

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Citation Note: All sources for the material in this presentation are included within the Powerpoint “notes” field on each slide

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A Perspective on Cloud Computing and Standards

- Cloud computing is a convergence of many technologies
 - Some have their own standards
- This convergence combined with massively scaled deployments represents “**revolutionary**” capabilities
- We have a choice
 - Proprietary stovepipe clouds
 - Development of an expensive cloud integration market
 - Standards based clouds

Standards are necessary to achieve full adoption and to reap the full economic benefits

Cloud Standards: Concerns

Major concerns to be addressed by standards:

- Vendor lock-in
- Limitations of developing for proprietary models and APIs
- Lack of cloud integration
- Proprietary integration with internal data centers
- ...

Cloud Standards: Needed focus

- Needed focus of standards:
 - Standardized cloud control interfaces
 - Payment systems
 - Processing
 - Application hosting
 - Storage
 - Security service / Logging
 - Cloud application and workload portability
 - ...

So where are we?

- Today cloud specific standards don't exist
 - Good vendor APIs (e.g., cloud interfaces) and protocols (e.g., for virtualization and application mobility)
 - Some patents are held in this space
 - Standards from participating technologies don't solve the problem (e.g., GRID, SOA/WS)
- Cloud computing will progress without standards
 - Possible resulting scenarios
 - Standards may take years to develop
 - A single vendor could dominate and everyone integrates with them
 - Cloud integration vendors may ease problem

Hurdles to Standardization



- Hurdle 1: Many organizations embarking on standards creation
 - Lack of large formal standards bodies
 - Need balanced representation of interests
- Hurdle 2: Over specification inhibits innovation
- Hurdle 3: Many models of cloud computing
 - Need a definition and to work on standards for particular models
- Hurdle 4: Patents and intellectual property
 - Will vendors give their cloud APIs and protocols to the community?

Solutions for Industry



- 1: Work together on complementary standards
- 2: Agree on the models of cloud computing that will be the focus of specific standards
- 3: Collaborate on identifying a minimal subset for standardization
- 4: Avoid using patents to inhibit the progress of standards

Everyone will benefit as the cloud computing industry grows

A idea: The Cloud Interoperability Profile

- We need to define minimal standards
 - Enable cloud integration, application portability, and data portability
 - Avoid over specification that will inhibit innovation
- Could there be a blueprint for cloud design?
 - “Cloud Interoperability Profile (CIP)”
 - Specifies versions of standards
 - Separately addresses different cloud models
- Example: WS-I Basic Profile for SOA

A Working Definition of Cloud Computing

- Cloud computing is a pay-per-use model for enabling convenient, on-demand network access to a shared pool of configurable and reliable computing resources (e.g., networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal consumer management effort or service provider interaction.
- The cloud model is comprised of five **key characteristics**, three **delivery models**, and four **deployment models**.

5 Key Cloud Characteristics

- On-demand self-service
- Ubiquitous network access
- Resource pooling
- Rapid elasticity
- Pay per use

3 Cloud Delivery Models

- Cloud Software as a Service (SaaS)
 - Use provider's applications over a network
- Cloud Platform as a Service (PaaS)
 - Deploy customer-created applications to a cloud
- Cloud Infrastructure as a Service (IaaS)
 - Rent processing, storage, network capacity, and other fundamental computing resources
- To be considered “cloud” they must be deployed on top of cloud infrastructure that enables the key characteristics

4 Cloud Deployment Models

- Private cloud
 - enterprise owned or leased
- Community cloud
 - shared infrastructure for specific community
- Public cloud
 - Sold to the public, mega-scale infrastructure
- Hybrid cloud
 - composition of two or more clouds
- Two types: internal and external

Common Cloud Characteristics

- Cloud computing often leverages:
 - Massive scale
 - Virtualization
 - Free software
 - Autonomic computing
 - Multi-tenancy
 - Geographically distributed systems
 - Advanced security technologies

Foundational Elements of Cloud Computing



Primary Technologies

- Virtualization
- Grid technology
- Service Oriented Architectures
- Distributed Computing
- Broadband Networks
- Browser as a platform
- Free and Open Source Software

Other Technologies and Important Issues

- Autonomic Systems
- Web application frameworks
- Service Level Agreements
- Patents/Intellectual Property
- Role of data location

Migration Paths for Cloud Adoption

- Use public clouds
 - Option 1: as is with multi-tenancy
 - Option 2: no multi-tenancy of servers or storage + enhanced organization defined security
- Develop private clouds
 - Procure an external private cloud
 - Migrate data centers to be private clouds (fully virtualized)
- Use hybrid-cloud technology
 - Leverage a private and public cloud architectures
 - Workload portability between private and public clouds
- Build or procure community clouds

Planned NIST Cloud Computing Publication



- NIST is planning a series of publications on cloud computing
- NIST FY09 Special Publication
 - What problems does cloud computing solve?
 - What are the technical characteristics of cloud computing?
 - How can we best leverage cloud computing and maintain or enhance security, privacy, and transparency?

Questions?

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