Deploying Public, Private, and Hybrid Storage Clouds

Marty Stogsdill, Oracle
The material contained in this tutorial is copyrighted by the SNIA unless otherwise noted.

Member companies and individual members may use this material in presentations and literature under the following conditions:
- Any slide or slides used must be reproduced in their entirety without modification
- The SNIA must be acknowledged as the source of any material used in the body of any document containing material from these presentations.

This presentation is a project of the SNIA Education Committee.

Neither the author nor the presenter is an attorney and nothing in this presentation is intended to be, or should be construed as legal advice or an opinion of counsel. If you need legal advice or a legal opinion please contact your attorney.

The information presented herein represents the author's personal opinion and current understanding of the relevant issues involved. The author, the presenter, and the SNIA do not assume any responsibility or liability for damages arising out of any reliance on or use of this information.

NO WARRANTIES, EXPRESS OR IMPLIED. USE AT YOUR OWN RISK.
Abstract

Deploying Public, Private, and Hybrid Storage Cloud Environments

Everyone has heard talk of storage clouds but do you know how to deploy one? This session will be a technical dive into implementations of popular storage cloud use cases and how cloud fits into your existing enterprise IT operations.
Definitions

NIST Definition:

- Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.

5 Essential Characteristics
- On-demand self-service
- Resource pooling
- Rapid elasticity
- Measured service
- Broad network access

3 Service Models
- SaaS
- PaaS
- IaaS

4 Deployment Models
- Public Cloud
- Private Cloud
- Community Cloud
- Hybrid Cloud

Source: DRAFT "NIST Cloud Computing Definition", NIST SP 800-145
What is a Storage Cloud?

- **Public Storage Clouds:** “Increase the efficiency of offering storage capacity through the use of multi-tenancy solutions – meaning multiple customers are services at once from the same shared storage infrastructure”

- **Private Storage Clouds:** “Typically exist behind an organization’s firewall and are deployed for internal customers. Private storage clouds can be located in an enterprise data center, but can also be hosted at a collocation facility possibly owned by a third party like a service provider. Designed to take advantage of the elasticity and management simplicity of the cloud model, a private storage cloud implementation allows the customer to set up and manage their own environment”

- **Hybrid Storage Clouds:** “Uses a combination of both public and private storage clouds”

Source: “Managing Private and Hybrid Clouds for Data Storage” SNIA CSI whitepaper
Why Storage Clouds?

- Budgets and staffing are constrained
- Data is growing exponentially
- M&A, Divestitures
- Regulatory, compliance, and legal requirements

Storage Cloud
Is Your Storage Environment:

- More complicated now or 4 years ago?
- Becoming more heterogeneous?
- Getting harder to scale?
- Increasing in operational costs?
- Harder to support?
- Compliance challenged?
How Clouds Help

- Lower TCO
- Faster Deployments
- Leverage service provider’s skill sets
  - Is your operations staff being mandated to grow or shrink?
- Gives you the ability to re-deploy your environment at your own pace and with a thought-out architecture
The Cloud Storage Big Picture

- **Cloud Storage**
- **Clients:**
  - Connect to
  - Manage
  - Interact With

Cloud storage

Clients can be in the cloud and providing additional services (computing, data, etc.).

Management of the Cloud Storage can be standalone or part of the overall management of your cloud computing.

Clients acting in the role of using a Data Storage Interface:

- Block Storage Client
- Filesystem Client
- Object Storage Client
- XAM Client
- SNIA Cloud Data Storage Interface
- Database/Table Client
- Multiple, Proprietary Interfaces

Clients acting in the role of Managing Data/Storage:

- Data/Storage Management Client
- Cloud Data Management
- Information Services (future)

Deploying Public, Private, and Hybrid Storage Clouds
© 2011 Storage Networking Industry Association. All Rights Reserved.
Deployment Steps for Cloud Storage

- Determine your storage cloud use case
  - How use case fits your Enterprise Architecture Strategy
- Diagnose the potential bottlenecks for your deployment scenario
- Define Public, Private, or Hybrid deployment
- Document concerns with cloud deployment style
- Design Deployment
Deployment Steps for Cloud Storage

- Determine your storage cloud use case
- Diagnose the potential bottlenecks for your deployment scenario
- Define Public, Private, or Hybrid deployment
- Document concerns with cloud deployment style
- Design deployment
Determine your storage cloud use case:

- **Backup Cloud**
  - Capacity and cost larger concerns than latency

- **Long Term Archive Cloud**
  - Low cost and high capacity larger concerns than latency

- **Application Data Cloud**
  - Low latency larger concern then high capacity or cost

Separations across use cases normally prioritization of: capacity, latency, and cost
Backup Clouds

- Traditional backup software on local machines pointing to a Backup Cloud

- Central backup server pointing to a Backup Cloud
Archive Cloud as Last Tier in ILM deployment

Direct Archive Cloud
Application Data Cloud

Storage Cloud as Backend Storage

Storage Cloud as a Compliment Environment
Deployment Steps for Cloud Storage

- Determine your storage cloud use case
- Diagnose the potential bottlenecks for your deployment scenario
- Define Public, Private, or Hybrid deployment
- Document concerns with cloud deployment style
- Design deployment
Diagnose Potential Bottlenecks

- Diagnose potential bottlenecks for your deployment scenario
- Does your LAN have available capacity?
  - Do you have 1gb to desktop? Is 1gb enough?
  - SANs and LAN-free backups/storage access was deployed for a reason
Should your cloud deployment look more like:

Evaluate cost/performance trade-offs with:
- Dedicated circuits / Internet QoS
- Caching/Accelerators
Deployment Steps for Cloud Storage

- Determine your storage cloud use case
- Diagnose the potential bottlenecks for your deployment scenario
- Define Public, Private, or Hybrid deployment
- Document concerns with cloud deployment style
- Design deployment
Define Public, Private, or Hybrid

After defining your cloud storage use case evaluate your organization's needs for:

- **Cloud Storage Capacity**
  - High Importance
  - Low Importance
  - Not Important

- **Cloud Storage Latency**
  - High Importance
  - Low Importance
  - Not Important

- **Cloud Storage Cost**
  - High Importance
  - Low Importance
  - Not Important

Most organizations will have trade-offs between capacity, latency, and cost when designing their storage clouds.
Define If Shared Tenancy Is a Fit

What is multi-tenancy:

- “the terms multi-tenant and multi-tenancy are not new; both have been used to describe application architectures designed to support multiple users, resource owners or “tenants” for many years. With the advent of cloud computing, this terminology has simply been extended to include any cloud architecture”

  - Source: “Storage Multi-Tenancy for Cloud Computing” Whitepaper, Paul Feresten, SNIA CSI Member

Secure multi-tenancy:

- Application layer
- Server layer
- Network Layer
- Storage Layer
Isolation/Security/Defense In-Depth:
- Firewall/Edge network security
- Tunneling across network/internet connections
- HTTPs SSL/TLS
- Private volumes, partitions, LUNs, or datastores
- Encryption of data
Deployment Steps for Cloud Storage

- Determine your storage cloud use case
- Diagnose the potential bottlenecks for your deployment scenario
- Define Public, Private, or Hybrid deployment
- Document concerns with cloud deployment style
- Design deployment
Document Concerns - Security

- **Security Concerns**
  - Legal Jurisdiction
  - Regulations
  - Who ensures compliance/privacy?

- **Data Governance**
  - Integrity
  - Classification
  - Regulation / legal

- **Audit**
  - Forensics
  - Data
Other Potential Concerns - Management

- Virtual Machines
  - VMs protected from each other
    - IDS/IPS, VLANs
  - Migration

- Management
  - Migration from Cloud to Cloud
  - Compliance

- Multi-tenancy
  - Economic benefits vs. performance trade-offs
Other Potential Concerns
- Standards

➤ Vendor Lock-In Concerns
  - Can you easily migrate data from one cloud storage provider to another?
  - Once data is moved how difficult is it to re-point your applications?
    ◀ SNIA CSI’s CDMI can help

➤ Standards Concerns
  - Are your potential cloud storage provider’s standards open or proprietary?
    ◀ SNIA CSI’s CDMI can help
A single cloud computing infrastructure can implement both the OCCI and CDMI interfaces.

The infrastructure abstracts the configuration of the networking and virtual machine details and uses the standard interface merely to define connectivity.

A cloud computing client can then utilize the interfaces to both specify the data requirements and then use that data for guests.
Cloud Data Management Interface (CDMI)
CDMI in Simple Archive Cloud

Learn more at snia.org/cloud
Learn more at snia.org/cloud
Deployment Steps for Cloud Storage

- Determine your storage cloud use case
- Diagnose the potential bottlenecks for your deployment scenario
- Define Public, Private, or Hybrid deployment
- Document concerns with cloud deployment style
- Design deployment
Build vs. Buy

Weigh start-up and operating costs of leveraging a service provider / vendor vs. building your own

Source: CDMI Reference Implementation Developers Guide
http://cdmi.sniacloud.com/CDMI_Spec/6-Common_Operations/6-Common_Operations.htm
Deployment Considerations

Think through control, access, administration

- SLA

Diagram:
- Public Cloud Service Provider
- Public Cloud Subscriber
- Public Cloud
- Application Data
- Server OS
- Hypervisor
- Storage Container Data
- LUN
- Server Hardware
- Storage Hardware
- No Access or Control
- No Control
- Control
- Requests / Self Service
- Administers
- Physical Control
CDMI Reference Deployment

Front End and Middle

CDMI Server
- Restful JAX-RS Front-End
  - Java App Server (Glassfish)
  - CDMI Security filter
  - TLS Security
  - Apache CXF
  - Spring Framework

CDMI Mid Layer
- Objects
- Containers
- Capabilities
- Notifications
- Serialize / Deserialize
- OCCI Export
- Logging / Audit
- Encryption
- Hashing
- Query
- Queues
- Retention
- Accounts

Back-End

Source: CDMI Reference Implementation Developers Guide

Learn more at snia.org/cloud

CDMI Reference Implementation Architectural Diagram
Green: SNIA Developed Code
Blue: 3rd Party Code

Date: July 20, 2010
Back-End Reference Deployment

- **Metadata DB**
- **jclouds proxy**
- **File System**
- **Other Clouds**

*File System Naming:
- **Container Objects**: Folders named with the container name
- **Data Objects**: Files named with the object name, if one was given, else the object ID
- **Metadata**: Files named with the same name as the corresponding object with an additional "." in front

Examples:
- **Container**: /mnt/cdni\server/\MyContainer
- **Container Metadata**: /mnt/cdni\server/\MyContainer/.

- **Data Object's Data**: /mnt/cdni\server/\MyContainer/\MyDataObject.txt
- **Data Object's Metadata**: /mnt/cdni\server/\MyContainer/.\MyDataObject.txt

- **Data Object's Data**: /mnt/cdni\server/\MyContainer/0000706D0010B84FAD185C425D8B537E
- **Data Object's Metadata**: /mnt/cdni\server/\MyContainer/0000706D0010B84FAD185C425D8B537E.
Cloud Storage Prototype

Begin with bare-bones secured Cloud and phase in functionality:
Expand into a mature Cloud leveraging common framework/standards:
Please send any questions or comments on this presentation to SNIA:

trackcloudtechnologies@snia.org

Many thanks to the following individuals for their contributions to this tutorial.

- SNIA CSI Education Committee

Marty Stogsdill
Marc Carlson
David Slik