Deploying Public, Private, and Hybrid Storage Clouds

Enterprise Architecture and the Cloud

Author and Presenter: Marty Stogsdill, Oracle
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Abstract

This SNIA tutorial will explore the impact public, private, or hybrid Clouds will have on existing enterprise architecture and also show ways that established enterprise architecture processes can help align Cloud deployments to business requirements. Cloud technologies have promise for organizations to adopt pay-as-you-use operating models either from service providers (public Cloud), internal customers (private Cloud), or a combination of the two (hybrid Cloud). Enterprise architecture is a tool organizations leverage to ensure mapping of IT solutions to business or organizational requirements. Deployed too loosely an organization may not receive noticeable value and conversely if enterprise architecture is deployed too rigidly it can be actively avoided.

If IT does not alter existing enterprise architectures to allow for Cloud deployments internal users may choose to adopt services from Cloud providers independently of their internal IT departments and organizations without established IT enterprise architectures can receive benefits from not only exploring cloud options but also adopting established best practices.

The Open Group Architecture Framework (TOGAF) and the Federal Enterprise Architecture (FEA) are the most popular enterprise architecture methodologies found in US IT end users and are also the basis for proprietary vendor and consultancy derivatives. Cloud deployments can specifically impact the Architecture Vision, Opportunities and Solutions, Migration Planning, and Implementation Governance phases of TOGAF’s Architecture Development Method (ADM) and the Service Component, Data, and Technical Reference Models in the FEA methodology.

Enterprise architecture’s should leverage vendor neutral standards such the Cloud Data Management Interface (CDMI) that is designed to enable interoperable cloud storage and data management while allowing users to avoid lock-in by proprietary solutions. CDMI can specifically impact an organizations enterprise architecture strategy by:

- Creating the option of federating data across multiple public Cloud providers, or a combination of public and internal/private Clouds (TOGAF Architecture Vision, Opportunities and Solutions, and Migration Planning phases & FEA Technical Reference Model phase)
- Ensure data integrity so an outage at a public Cloud provider does not bring down an organization’s IT resources (TOGAF Architecture Vision and Implementation Governance phases & FEA Service Component and Data Reference Models)
- Allow data to be moved into or out of a public or private Cloud seamlessly (TOGAF migration planning phase & FEA Data and Technical Reference Models)
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
Definitions

**Enterprise Architecture:**

- An enterprise architecture (EA) is a rigorous description of the structure of an enterprise. EA describes the terminology, the composition of subsystems, and their relationships with the external environment, and the guiding principles for the design and evolution of an enterprise.

  > en.wikipedia.org/wiki/Enterprise_architecture
Definitions

Popular Enterprise Architecture Frameworks

- TOGAF is an industry standard architecture framework that may be used freely by any organization wishing to develop an information systems architecture for use within that organization. http://www.opengroup.org/togaf/
- The Federal Enterprise Architecture (FEA) describes ways stakeholders can deliver value to the business and improve results in agency mission areas through architecture concepts, descriptions of the content included in architecture work products, and direction on developing and using architecture. http://www.whitehouse.gov/omb/e-gov/fia
TOGAF

TOGAF is a detailed framework and set of supporting practices developed by The Open Group Architecture Forum

Leverages industry and vendor best practices

Source: http://www3.opengroup.org/subjectareas/enterprise/togaf

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Federal Enterprise Architecture (FEA)

- **Business Driven**
  - FEA aligns government strategic plans and executive level direction.

- **Proactive and collaborative across the Federal government**
  - Public sector EA’s charged with the development, evolution and adoption.

- **Architecture improves the effectiveness and efficiency of government information resources**
  - “No IT investment should be made without a business-approved architecture.”

Performance Reference Model

Business Reference Model

Service Component Reference Model

Technical Reference Model

Data Reference Model
IT organizations exist to service customers

Users look to IT to:
- Provide essential services
- Provide applications
- Provide IT Security

Are your users expectations aligned with what they pay?
IT Trends

- More complicated now or 4 years ago?
- Becoming more heterogeneous?
- Getting harder to scale?
- Increasing in operational costs?
- Harder to support?
- Compliance challenged?
Where Enterprise Architecture Fits

- Business Architecture
  - Mission
  - Vision
  - Operating Model

- Enterprise Architecture
  - Aligning Business Strategy to IT Strategy

- Information Architecture
  - Data Categorization
  - Data Structures

- Infrastructure Architecture
  - Technology Design
  - Servers, Storage, Site Services

▸ Technology, IT, Cloud strategies best developed in Enterprise Architecture

▸ Seeing the forest for the trees
Enabling Your Enterprise

- Entering New Markets
- Merger / Acquisition
- Providing New Services
- More Responsive to Constituents

Rapid Application and Infrastructure Deployments
- Standard Based for Optimization / Consolidation
- Leverage Edge Technologies
Where Cloud Storage Fits

Cloud Storage will not necessarily help map IT to the business but…

Cloud Storage can:

- Speed deployments
- Implement chargebacks
- Provide SLAs/SLOs
- Ease break fix support
What Is Cloud Storage Used For?

- Elastic demand for web based media (video, eBooks, audio)
- Backup to the cloud
  - Restore, Recovery, “Seed” the backup with hard drive
- Sync of files to the cloud and multiple devices
  - Internet “Drive” secondary storage
- Archive/Preservation in the cloud
  - Including Compliance, Retention and eDiscovery
- Storage for Cloud Computing
  - Support for legacy storage interfaces key
  - Self Service Storage Administration
Data Storage Interface Evolution

- Born Digital data is being generated by an ever diversifying set of devices
- 75% of data being generated by individuals (IDC)
  - Amount of Data doubling every two years
- 5 Billion Mobile Phones
  - Tablets on the rise
- Storage space on devices will always be limited (although continues to grow exponentially)
- Device Apps are accessing content/storage via the Internet
  - Cloud Storage largely driven by device based use cases
- Traditional data storage interfaces (filesystems) are not up to this task!
Where are your users putting their data?

With corporate users bringing their own devices (BYOD), where are they putting files?

Devices have limited storage capacity

They are saving them in storage clouds!

Corporate data is already in the public cloud and unmanaged/protected
Distilled Storage Cloud Technical Requirements

- Storage – and lots of it
- Need a Global Namespace for data location
  - FILE handle -> URL + Unique Object ID globally
- Need support for Rich Metadata associated with the data
  - Plus Metadata Query and Index based Search
- Need HTTP access – browser support
- Data Services need to be transparent to the user, but extensible and powerful
  - Driven by Metadata
- Support for large objects, many small objects
- Support for active preservation operations
  - Driven by preservation Metadata
Traditional IT Systems

Sample System Utilization

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<th>Q3 Close</th>
<th>Q4 Close</th>
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<td>12%</td>
<td>20%</td>
<td>22%</td>
<td>30%</td>
<td>32%</td>
</tr>
</tbody>
</table>
The Promise of the Cloud

Hypothetical Cloud Billing Model

Utilization %

Thousands

Line of Business

Marketing  Finance  HR  Contract Max

Charge for use
Build Your Own Cloud

- Corporations already offer their own email (instant messaging, etc.) services to their employees
- Cloud Storage is the next type of service offering for employee devices
  - Enterprise “Dropbox” implementations
- Very different implications if “Dropbox” from public cloud or your own private cloud
  - Public Cloud: If encrypted does the provider own the keys?
  - Private Cloud: data is retained “in house”, protected, available, secured and compliant
How do you find data?

- Most popular data access application today?
  - Email! Data is saved chronologically, searchable via metadata

- Email attachments come with rich metadata
  - Subject, Sender, Recipient, Date, Thread, Priority

- Future Data Storage Interfaces will leverage this concept for general file/object storage
  - Not only for locating data, but for managing it as well

- CDMI provides a standard Data Storage Interface with rich metadata query and global namespace that can be extended with implementations
The Promise of the Cloud

Traditional

- Business Request
- Requirements Gathering
- Infrastructure Design
- Infrastructure Purchase
- Infrastructure Deployment
- Application Development
- IT to Business Hand-Off

• IT Liaison
• One to Two Weeks
• Two to Three Weeks
• Three to Four Weeks
• Three to Four Weeks
• Five to Six Weeks
• Fourteen to Nineteen Weeks

First Cloud Deployment

- Business Request
- Requirements Gathering
- Cloud Design
- Cloud Purchase
- Application Development
- IT to Business Hand-Off

• IT Liaison
• One to Two Weeks
• Two to Three Weeks
• Three to Four Weeks
• Five to Six Weeks
• Eleven to Fifteen Weeks

Additional Cloud Deployments

- Business Request
- Requirements Gathering
- Application Development
- IT to Business Hand-Off

• IT Liaison
• One to Two Weeks
• Five to Six Weeks
• Six to Eight Weeks
Delivering On The Promise

- **Time To Market**
  - Provisioning, deployment, self service

- **Simpler Scalability**
  - Predictable cost / performance

- **Predictable Performance**
  - SLA/SLO

- **Avoiding Vendor Lock-In**
  - CDMI

- **Balancing Trade Offs**
Availability Federating Data

- Federating Services between Public, Private, and/or Community Clouds to create a Hybrid Cloud
Data Integrity

- If Data is in one or many Clouds statically or dynamically with a Broker how can you ensure its Integrity?
  - Immutability
  - Persistence
  - Simultaneous read/writes

Your Data → Broker → Cloud A → Cloud B → Cloud C

TOGAF
- Architecture Vision
- Business Strategy
- Technology Strategy
- Opportunities and Solutions
- Platforms
- Applications
- Migration Planning Phases
- Standards
- Specifications
Data Migration

- TOGAF’s migration planning phase & FEA Data and Technical Reference Models
- Seeding data for initial migration
- Syncing for backup Clouds

PUT /MyContainer HTTP/1.1/
6-Common_Operations Page 1 of 4
Host: cloud.example.com
Accept: application/cdmi-container
Content-Type: application/cdmi-container
X-CDMI-Specification-Version: 1.0
{ "metadata": { } }

HTTP/1.1 201 Created
Content-Type: application/cdmi-container
X-CDMI-Specification-Version: 1.0
{ "objectURI" : "/MyContainer/",
  "objectId" : "0000706D0010D538DEEE8E389E2815",
  "objectName" : "MyContainer/",
  "parentURI" : "/",
  "domainURI" : "/cdmi_domains/MyDomain/",
  "capabilitiesURI" : "/cdmi_capabilities/Container/",
  "completionStatus" : "Complete",
  "metadata" : {
    "cdmi_size" : "0"
  },
  "childrenrange" : "",
  "children" : [] }

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

❖ Security Concerns
  ◆ Encryption
  ◆ Data Access
  ◆ Management Access

❖ Data Governance
  ◆ Integrity
  ◆ Classification
  ◆ Regulation / legal

❖ Audit
  ◆ Forensics
  ◆ Legal Jurisdiction
  ◆ Regulations
  ◆ Compliance

Have your users already put your organization’s data in the cloud?

Approved Architecture  Not Approved Architecture

Approved Architecture
Secure Corporate Cloud Drop box
Don’t Re-implement Past Mistakes

- Best Practices Based
- Proven Methodology
- Service Delivery Standards
- Right Skillsets at the Right Time

Better Results
Cloud Concerns to Ponder

➢ Network Dependence
  - Public Clouds could rely on telecom links that are owned by neither you or the Cloud provider
  - Off-line data synchronization

➢ Cost vs. Security Requirements
  - The more physical isolation is required the higher the cost of deploying and maintaining the Cloud
    ▶ Public vs. Private / Hybrid vs. Private

➢ Cloud Outages
  - Cloud provider, network, or equipment failures

➢ Interoperability
  - CDMI, Open Virtualization Format
Cloud Issues for EA

- My organization has contracted directly with a cloud provider without consulting with IT
  - If your IT organization is perceived to be broken by your customers they now have more options to side step you
  - Who will manage your organizations data in a Cloud if IT didn’t put it there or doesn’t know about it

- My organization doesn’t like my Strategy
  - Mapping IT Strategy to Business Strategy isn’t about reacting or dictating – it’s partnering
One Organizations EA View of Cloud

- Logical Enterprise Architecture Framework
- More than one correct answer
- Organization specific
Delivering Value to Your Customers

- Hybrid Cloud
- Enterprise Architecture
- Keeping the Lights On
- Business As Usual
- Public Cloud
- Yesterday's News
- The Next Big Thing
- Revolution
- Community Cloud
- Evolution
- Private Cloud
Q&A / Feedback

Please send any questions or comments on this presentation to SNIA: tracktutorials@snia.org.

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