



Education

# Enterprise Architecture and the Cloud

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.**

- ◆ 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)



## ➤ 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

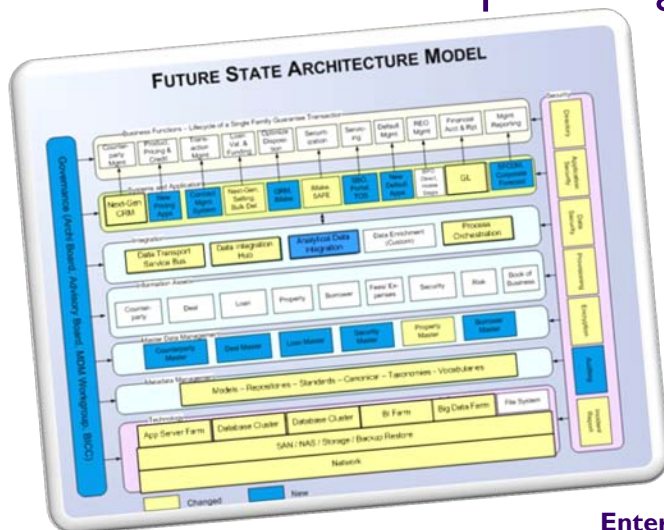
### 4 Deployment Models

- Public Cloud
- Private Cloud
- Community Cloud
- Hybrid Cloud

Source: DRAFT "NIST Cloud Computing Definition", NIST SP 800-145

## ➤ 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](http://en.wikipedia.org/wiki/Enterprise_architecture)



## ➤ 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.

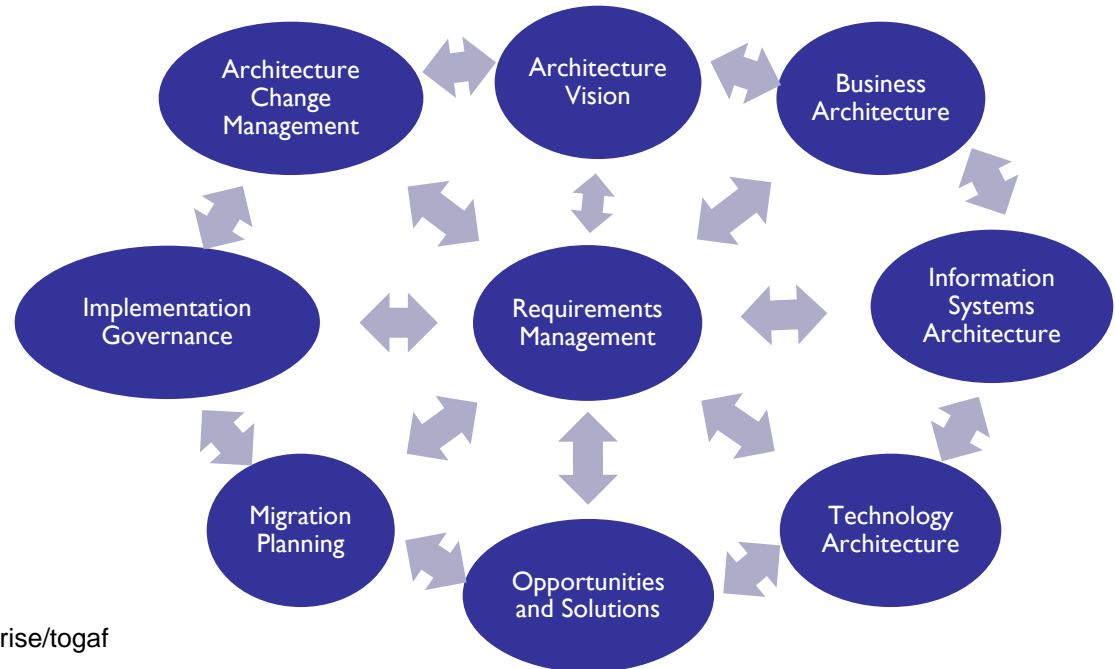
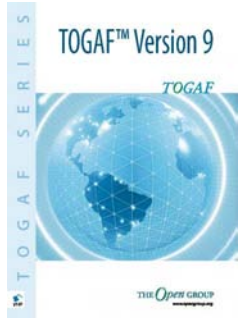
<http://www.opengroup.org/togaf/>

- ◆ 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/fea>

# TOGAF – EA Methodology Example

- TOGAF is a detailed framework and set of supporting practices developed by The Open Group Architecture Forum
- Leverages industry and vendor best practices

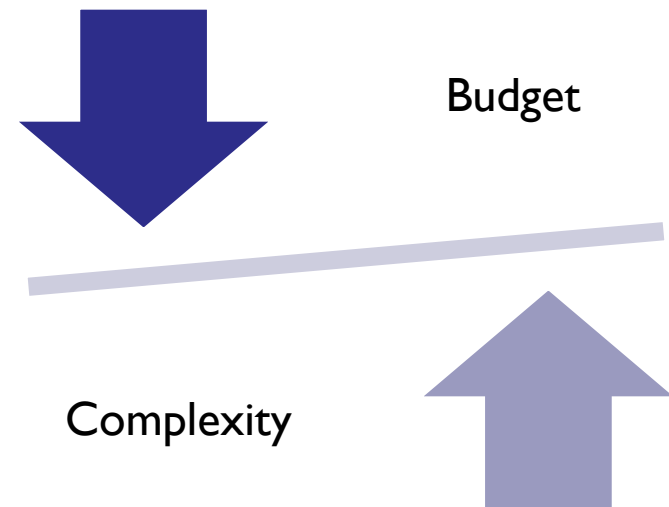
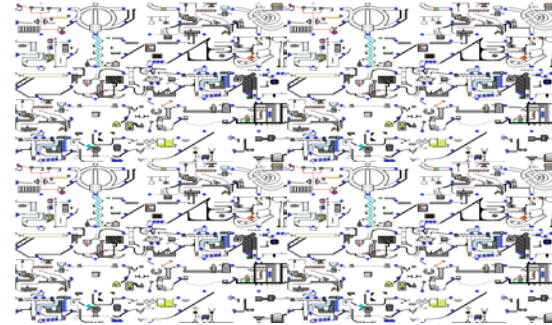


Source: <http://www3.opengroup.org/subjectareas/enterprise/togaf>

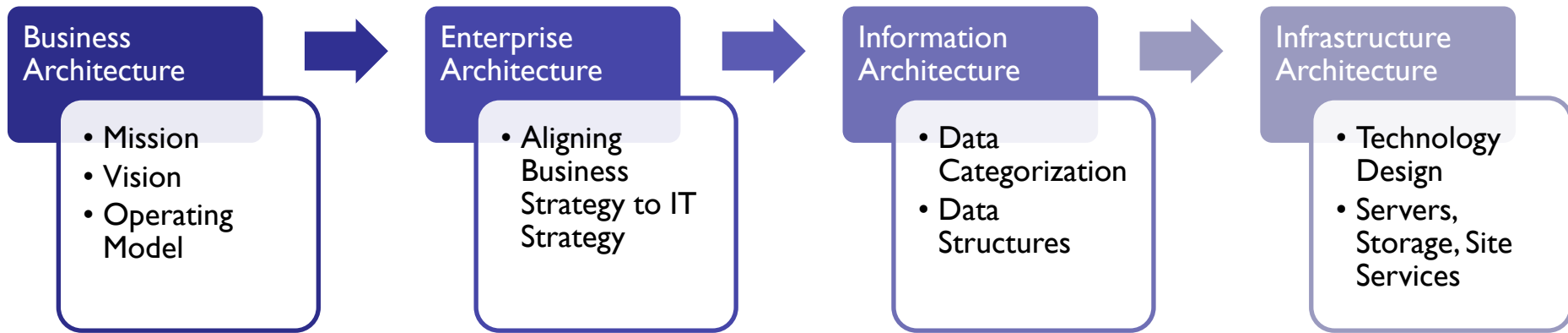
- IT organizations exist to service customers
- Users look to IT to:
  - ◆ Provide essential services
  - ◆ Provide applications
  - ◆ Provide IT Security
- Are your users expectations aligned with what they pay?



- 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



- Technology, IT, Cloud strategies best developed in Enterprise Architecture
- Seeing the forest for the trees

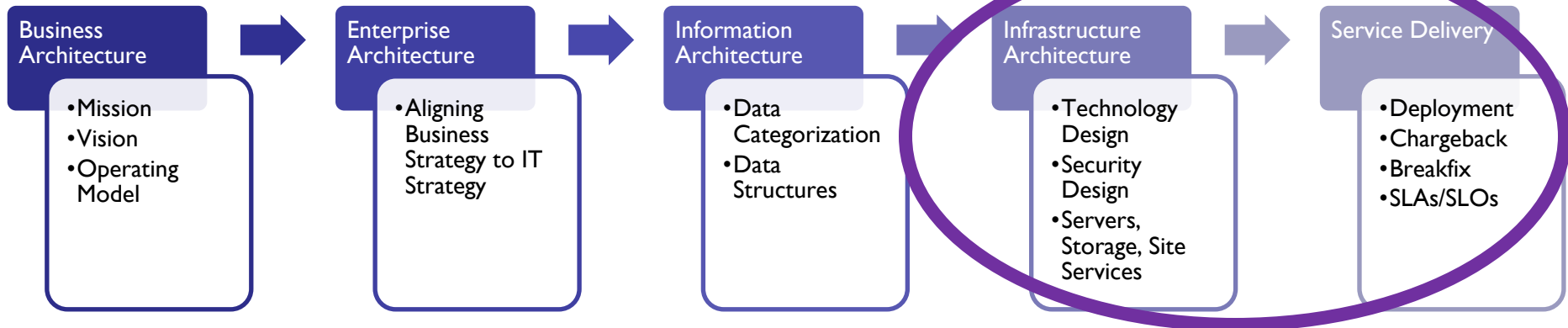
# Enabling Your Enterprise



- 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

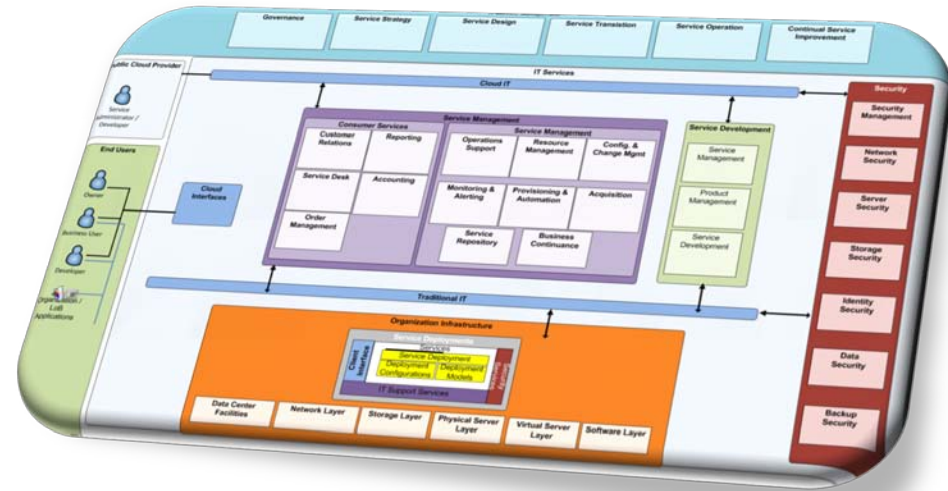
# Where Cloud Fits



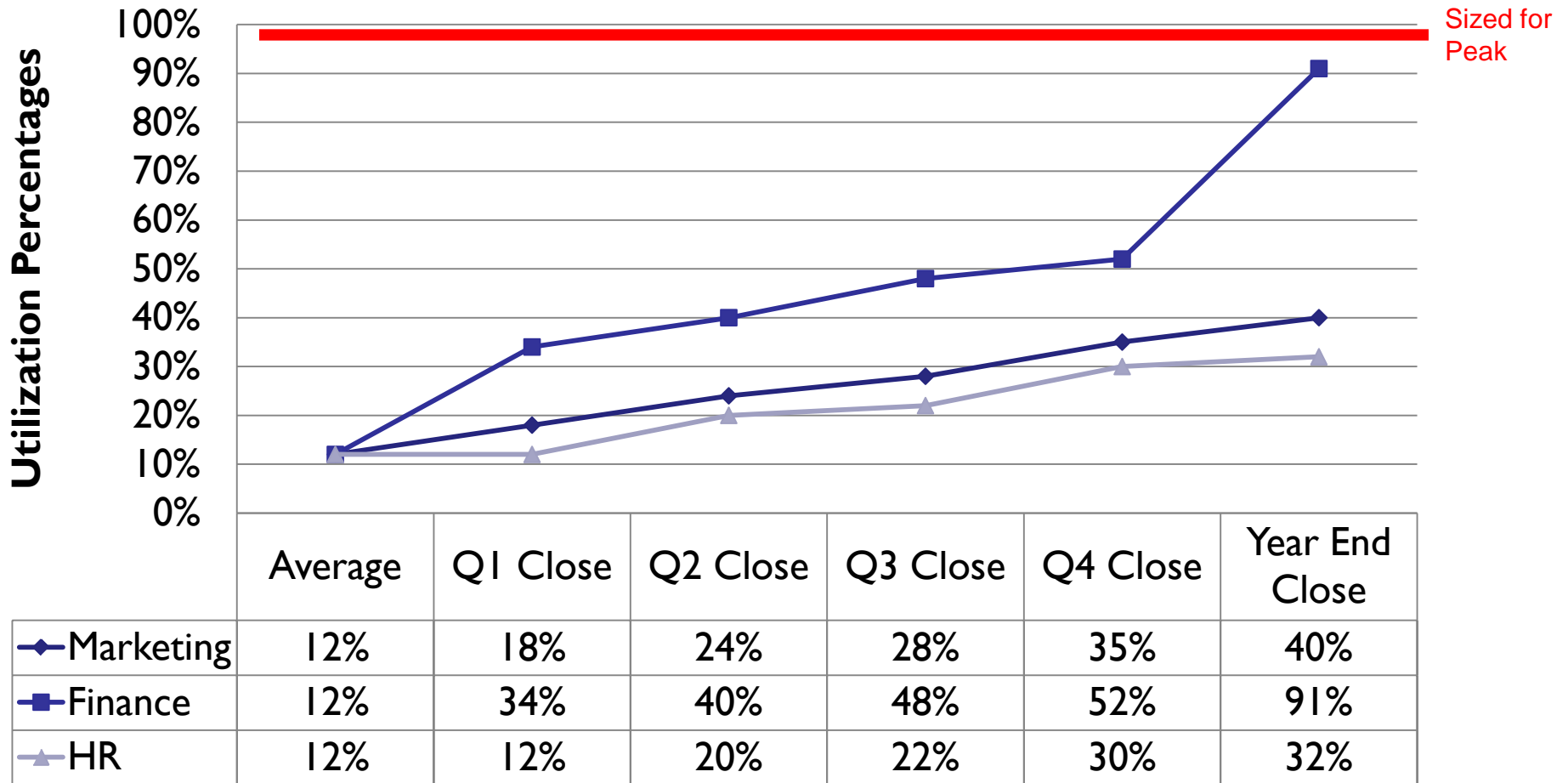
➤ Cloud will not necessarily help map IT to the business but...

➤ Cloud can:

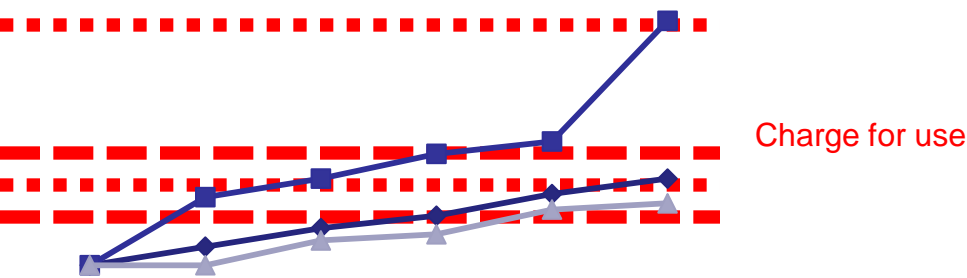
- ◆ Speed deployments
- ◆ Implement chargebacks
- ◆ Provide SLAs/SLOs
- ◆ Ease break fix support



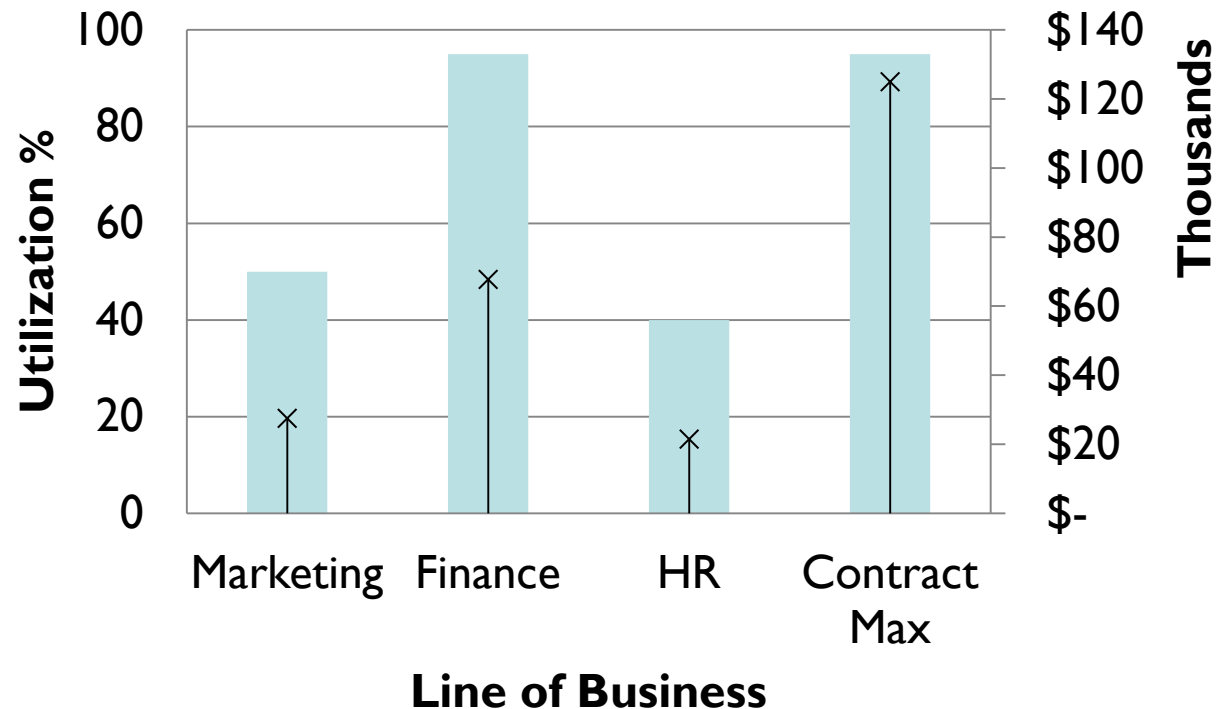
## Sample System Utilization



# The Promise of the Cloud

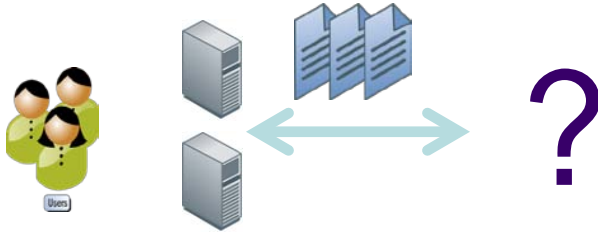


## Hypothetical Cloud Billing Model



# A Backup / Restore Example

- Where should your backup or archive data be stored?



- IT centric view: What are the requirements? What standardized solution offering meets requirements.  
VS.
- Enterprise Architecture centric view: What business value is derived from backup / restores?
  - ◆ Data protection – what does higher protection enable?
  - ◆ Data availability – what does higher availability enable?
  - ◆ Lower cost solution than competitors – what does lower cost enable?

# A Backup / Restore Example (Continued)

➤ Where should your backup or archive data be stored?

## Tape Based

Pro

Con

- | Pro   | Con  |
|---|--|
| <ul style="list-style-type: none"><li>• Proven protection</li><li>• Low TCO</li></ul> | <ul style="list-style-type: none"><li>• Lower availability</li></ul> |



## Disk Based

Pro

Con

- | Pro   | Con   |
|---|---|
| <ul style="list-style-type: none"><li>• High availability</li></ul> | <ul style="list-style-type: none"><li>• TCO</li></ul> |



## Cloud Based

Pro

Con

- | Pro  | Con   |
|--|---|
| <ul style="list-style-type: none"><li>• High availability</li><li>• <b>New industry capability</b></li></ul> | <ul style="list-style-type: none"><li>• New = risk</li><li>• TCO questions – pay by the drink</li></ul> |






Is using a new industry capability a value add or value detractor for your organization?

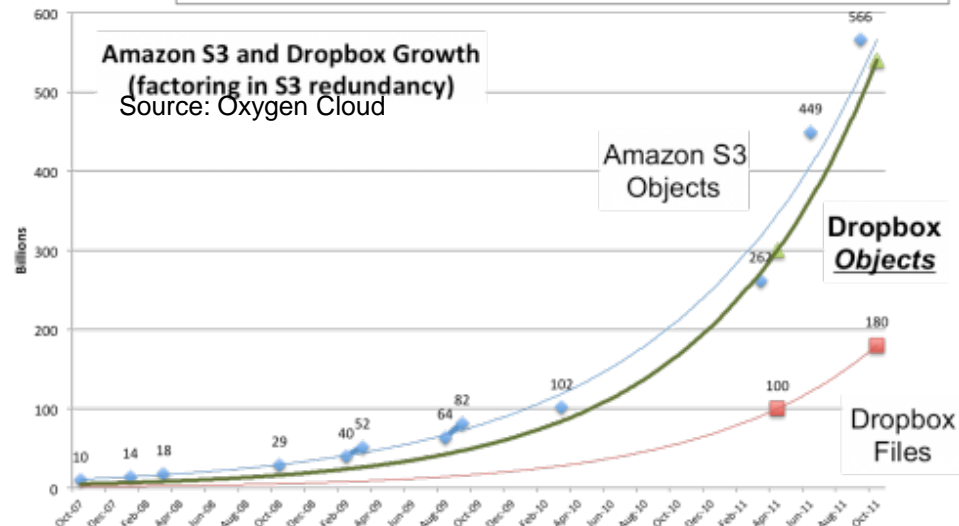
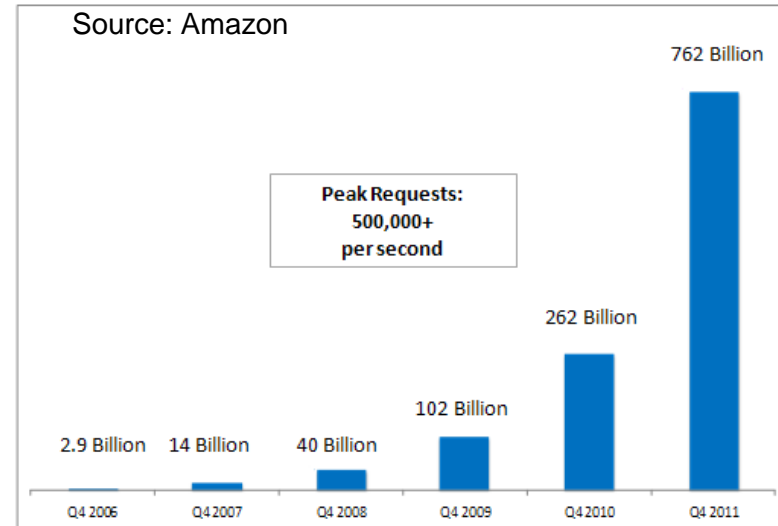
Note: simplified hypothetical decision criteria - real world mileage will vary



# 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 the storage cloud!
- Your corporate data could already be in the public cloud and unmanaged/protected
  - What level of protection / security has your organization purchased?

Total Number of Objects Stored in Amazon S3



# Build Your Own Storage 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



**Check out SNIA Tutorial:  
Interoperable Cloud Storage  
with the CDMI Standard  
(Tuesday, 11:10 - 11:55 a.m)**

# BYOD Data Storage Example

➤ Where should your users BYOD data be stored?

## On-Premise

Pro	Con
<ul style="list-style-type: none"> <li>• Control of security</li> <li>• Data integration / re-use</li> </ul>	<ul style="list-style-type: none"> <li>• Cost</li> </ul>

## Off-Premise Cloud

Pro	Con
<ul style="list-style-type: none"> <li>• Maybe control of security</li> <li>• Data integration / re-use</li> </ul>	<ul style="list-style-type: none"> <li>• Maybe not as much control of security</li> </ul>

## Wherever They Put It

Pro	Con
<ul style="list-style-type: none"> <li>• Low / No Cost</li> </ul>	<ul style="list-style-type: none"> <li>• Data at risk</li> </ul>

Is the cost of building your own storage cloud for end user devices worth the benefits?

Note: simplified hypothetical decision criteria - real world mileage will vary

# How do you find data?

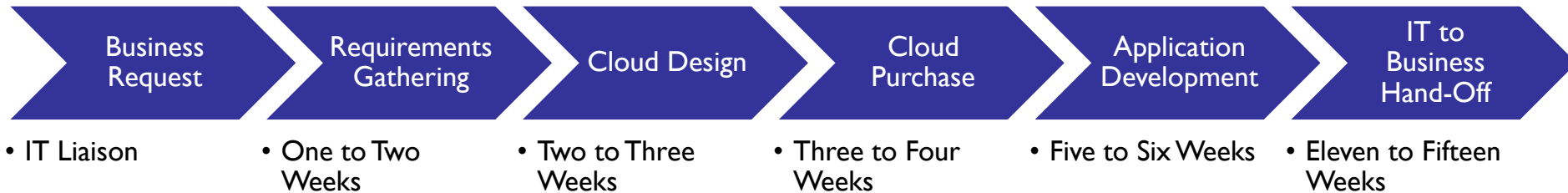
- Most popular data access application today?
  - ◆ Email! Data is saved chronologically, searchable via metadata
- Email attachments come with rich metadata
  - ◆ Subject, Sender, Recipient, Date, Thread, Priority
- Future Data Storage Interfaces will leverage this concept for general file/object storage
  - ◆ 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



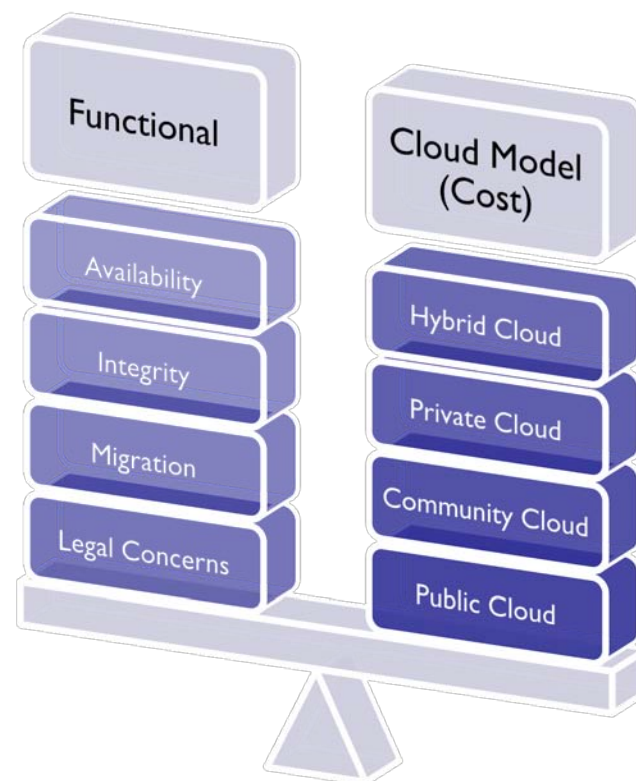
## First Cloud Deployment



## Additional Cloud Deployments

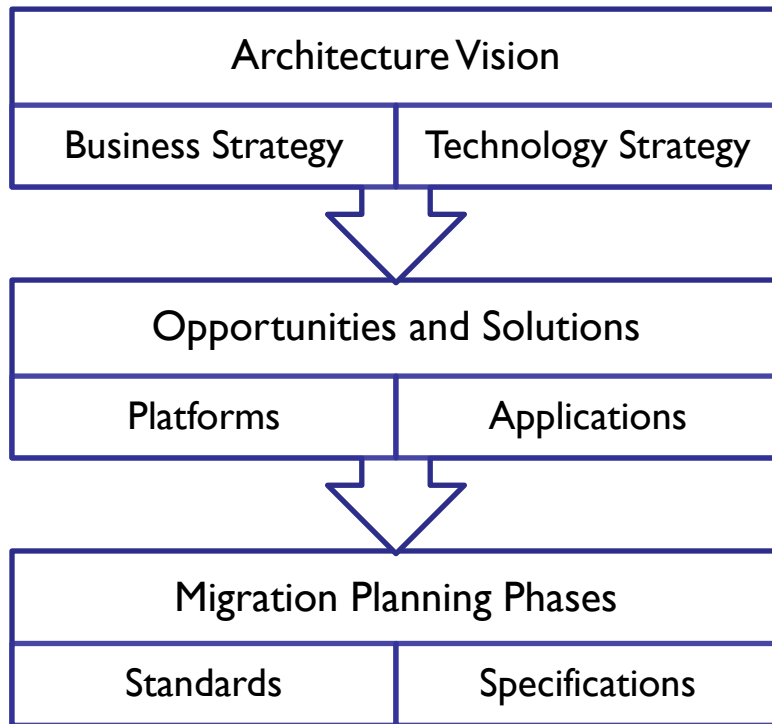


- Time To Market
  - ◆ Provisioning, deployment, self service
- Simpler Scalability
  - ◆ Predictable cost / performance
- Predictable Performance
  - ◆ SLA/SLO
- Avoiding Vendor Lock-In
  - ◆ CDMI
- Balancing Trade Offs

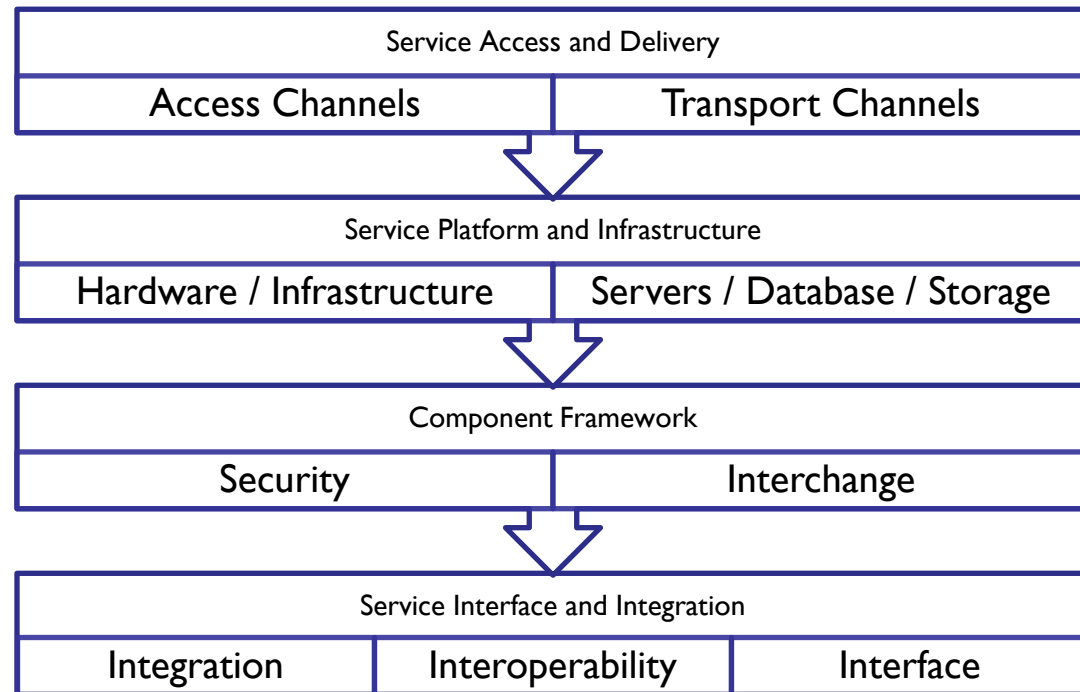


## ➤ Some aspects of existing EA frameworks change

### TOGAF

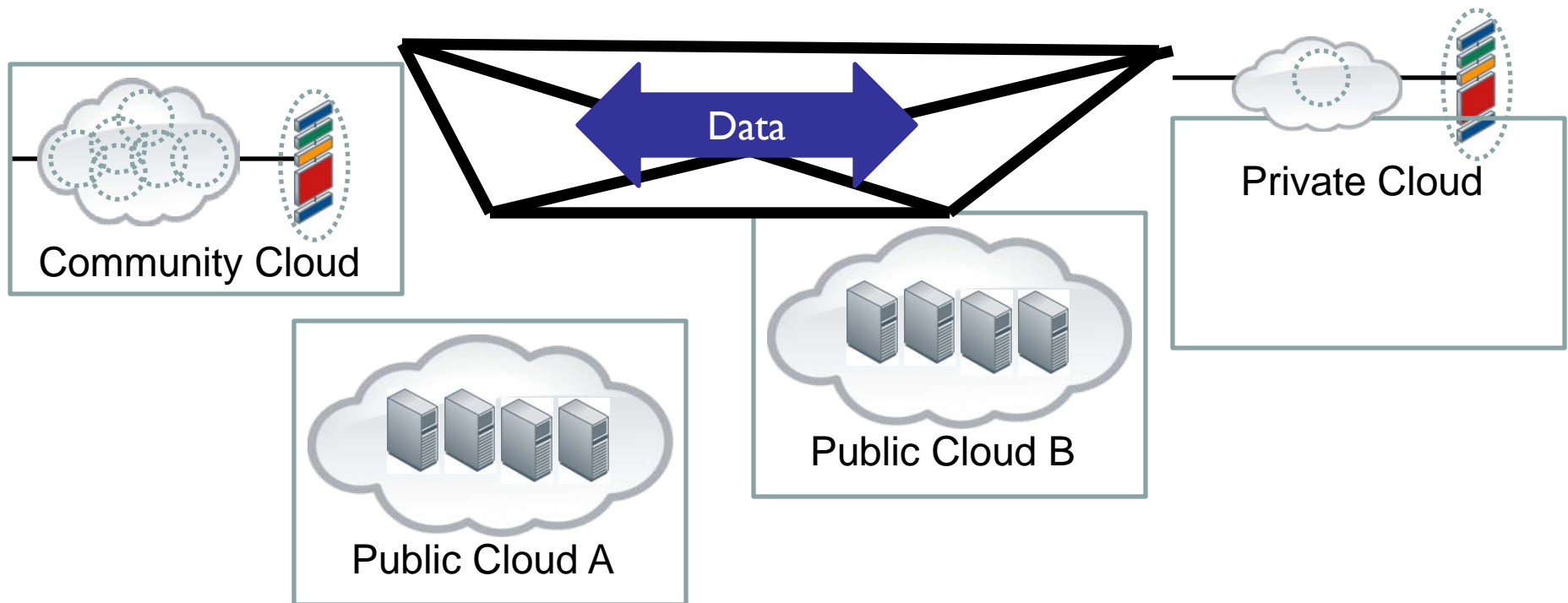


### FEA



# Availability Federating Data

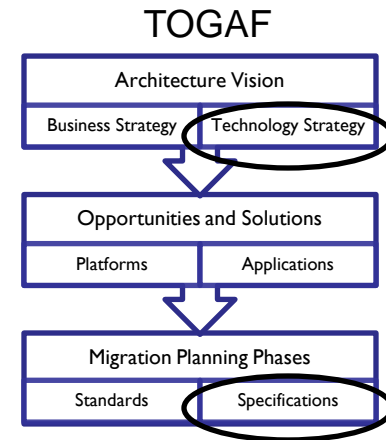
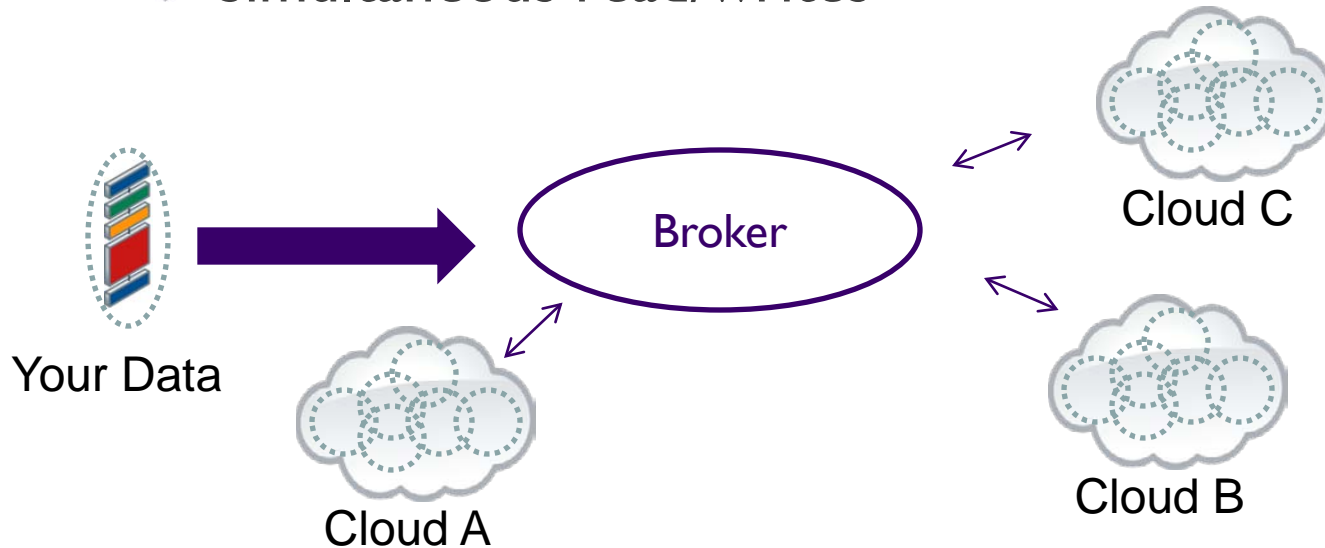
- Federating Services between Public, Private, and/or Community Clouds to create a Hybrid Cloud





➤ 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



- 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/cdm-container  
Content-Type: application/cdm-container  
X-CDMI-Specification-Version: 1.0  
{ "metadata" : { } }
```

```
HTTP/1.1 201 Created  
Content-Type: application/cdm-container  
X-CDMI-Specification-Version: 1.0  
{  
  "objectURI" : "/MyContainer/",  
  "objectId" : "0000706D0010D538DEEE8E38399E2815",  
  "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](http://cdmi.sniacloud.com/CDMI_Spec/6-Common_Operations/6-Common_Operations.htm)

## Security Concerns

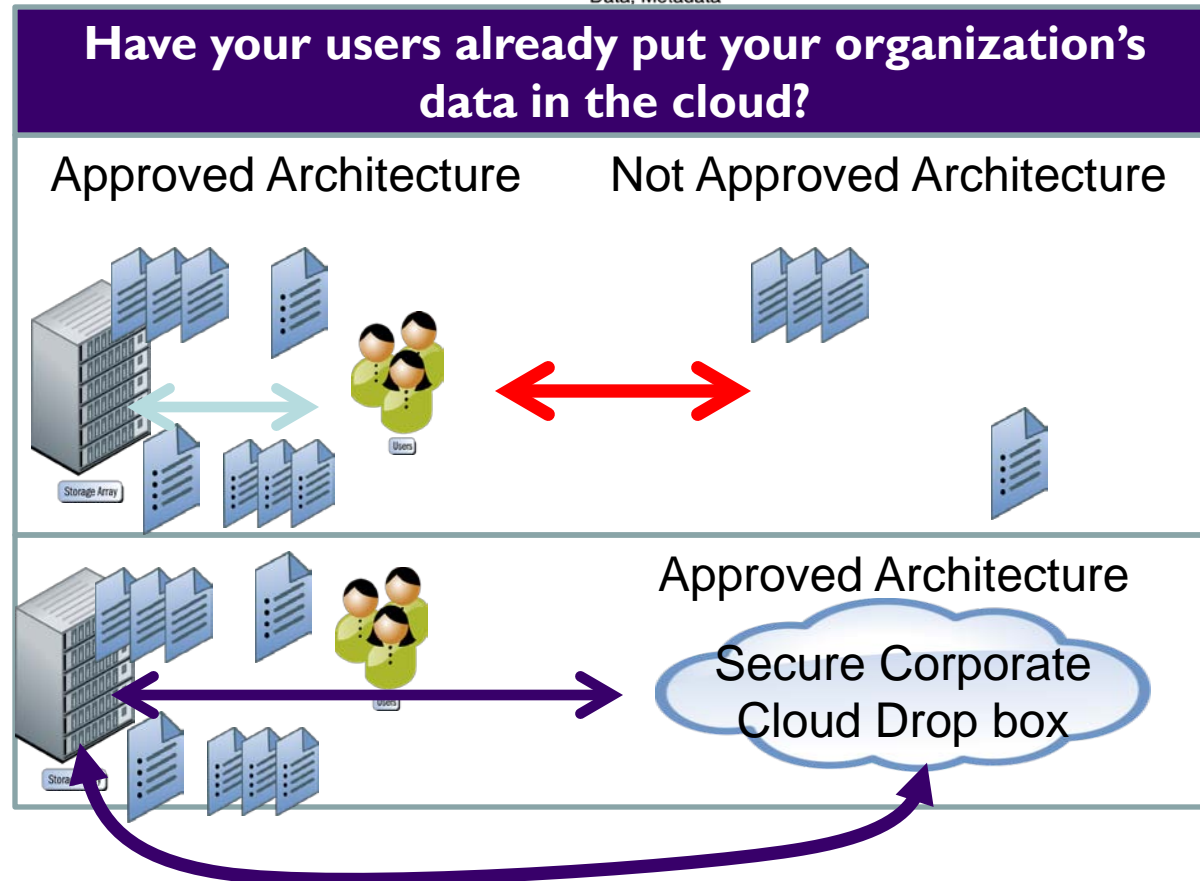
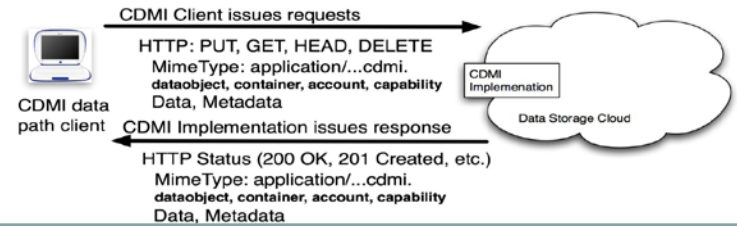
- ◆ Encryption
- ◆ Data Access
- ◆ Management Access

## Data Governance

- ◆ Integrity
- ◆ Classification
- ◆ Regulation / legal

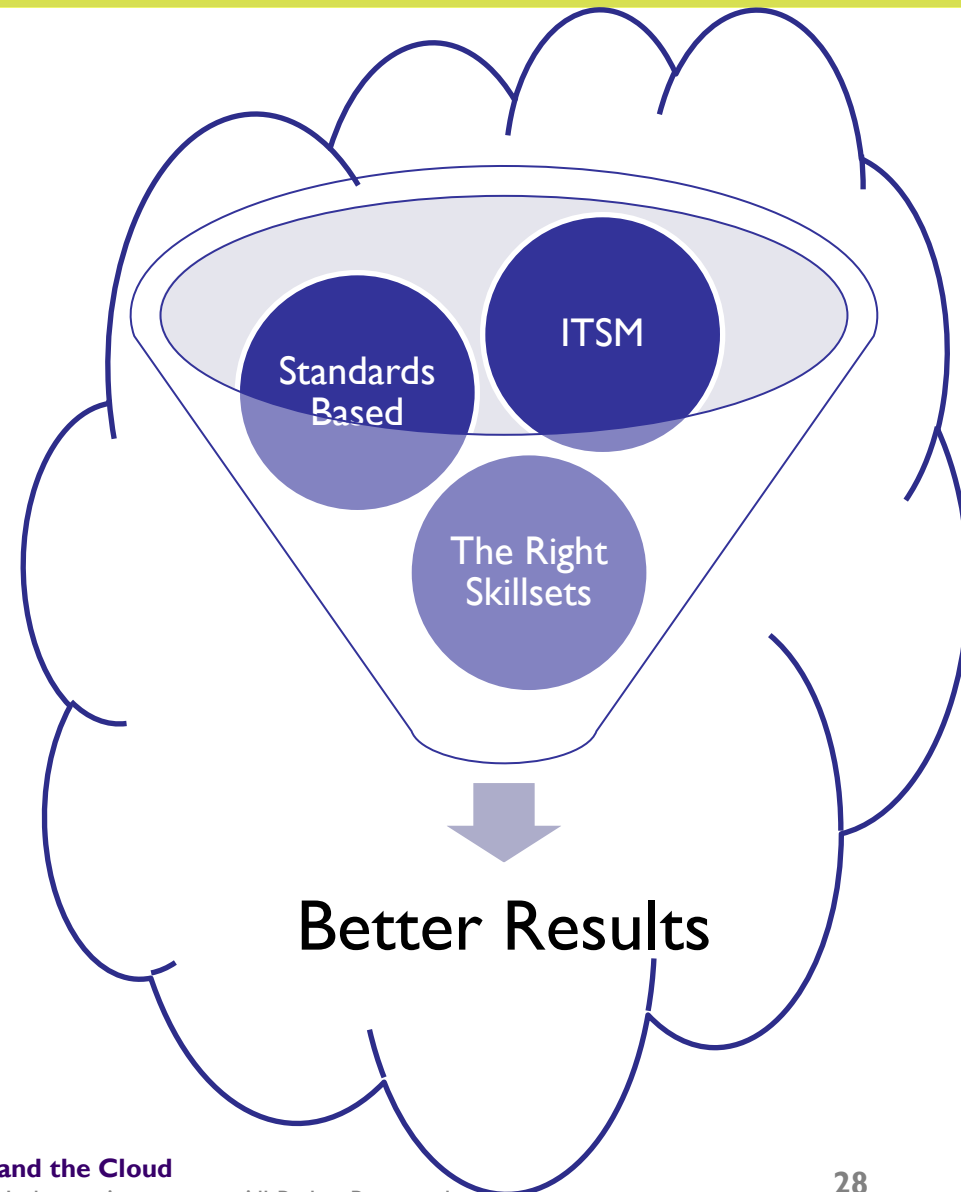
## Audit

- ◆ Forensics
- ◆ Legal Jurisdiction
- ◆ Regulations
- ◆ Compliance



# Don't Re-implement Past Mistakes

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



## ➤ 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

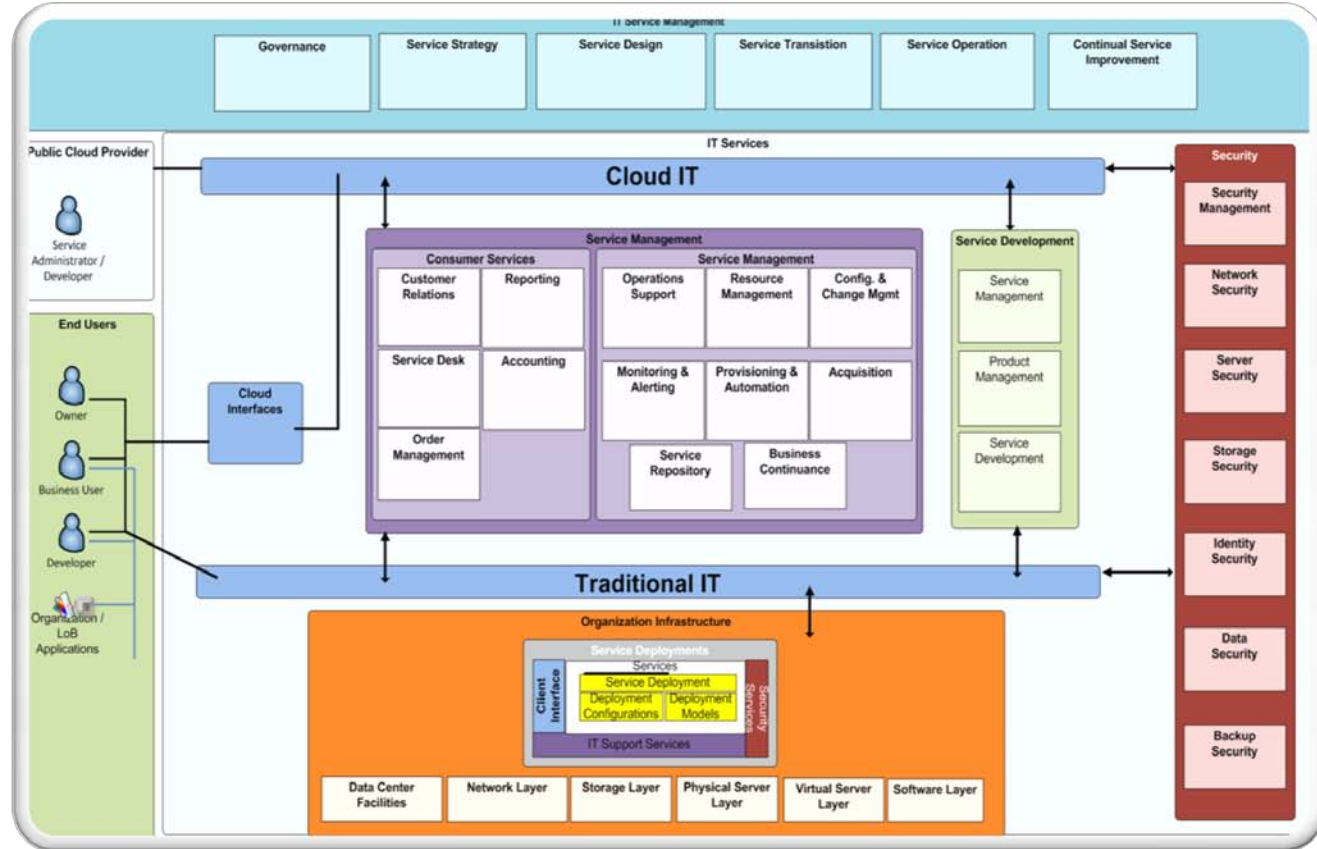
## ➤ Interoperability

- ◆ CDMI, Open Virtualization Format

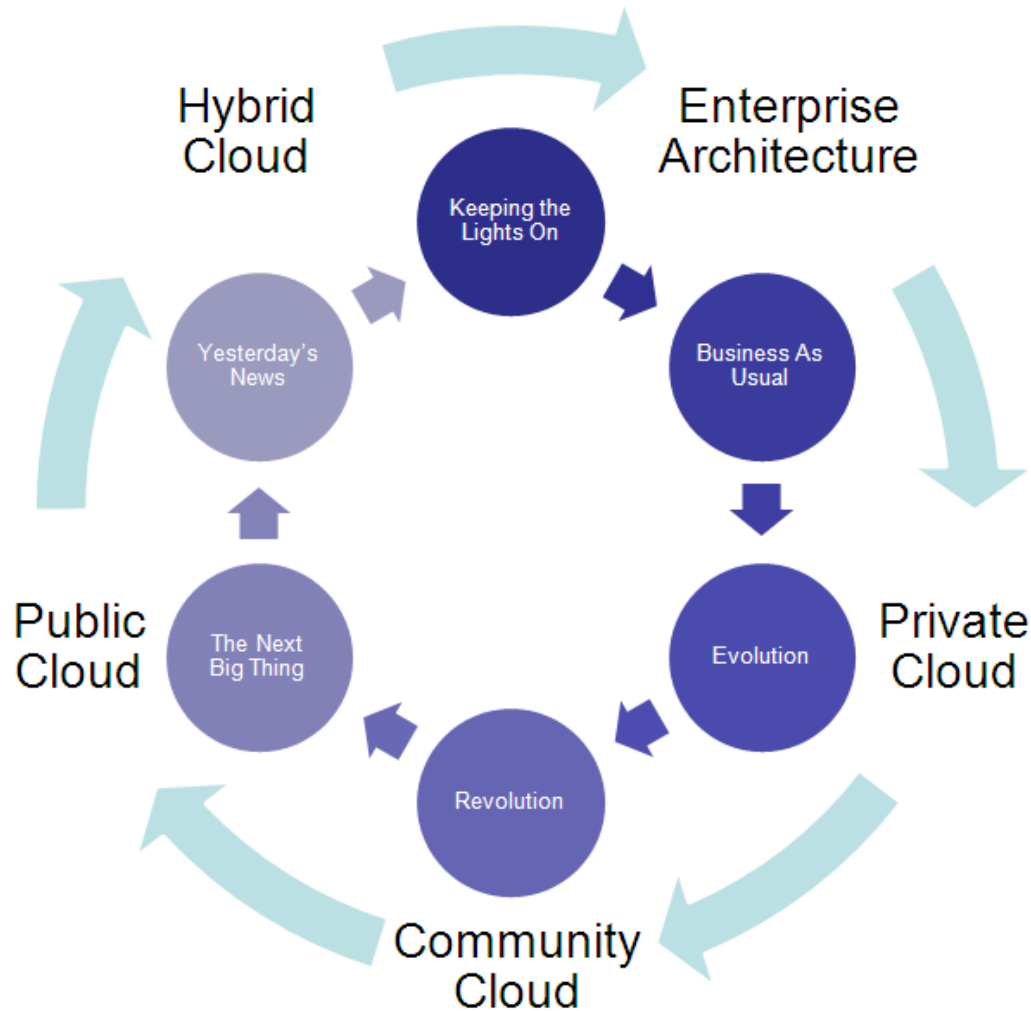
- My organization has contracted directly with a cloud provider without consulting with IT
  - ◆ If your IT organization is perceived to be broken by your customers they now have more options to side step you
  - ◆ Who will manage your organizations data in a Cloud if IT didn't put it there or doesn't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





The SNIA Education Committee would like to thank the following individuals for their contributions to this Tutorial.

## Authorship History

**Name/Date of Original Author here:**  
Marty Stogsdill 2011

**Updates:**  
Marty Stogsdill 2012

## Additional Contributors

Mark Carlson  
Alex

Members of the SNIA Cloud Storage Initiative  
Education Committee

*Please send any questions or comments regarding this SNIA Tutorial to  
[tracktutorials@snia.org](mailto:tracktutorials@snia.org)*