# Cloud Standards Overview

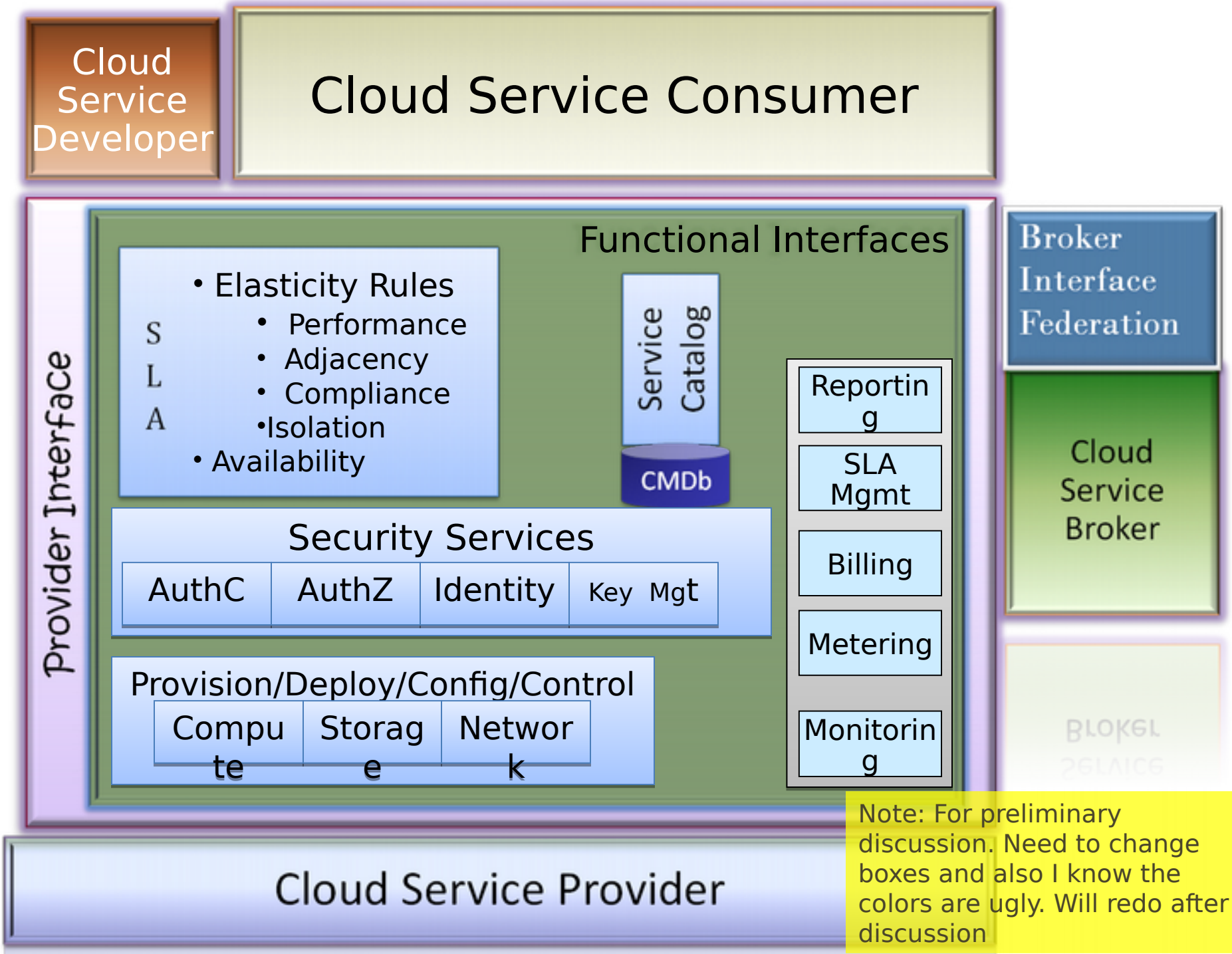
Cloud-Standards.org

# Outline

- Open Standards and Standards Groups
- Cloud Standards Roadmap Process
  - Use Cases
  - Specifications
  - Reference Implementations
- Recommendations
- Backup: Individual Standards Groups

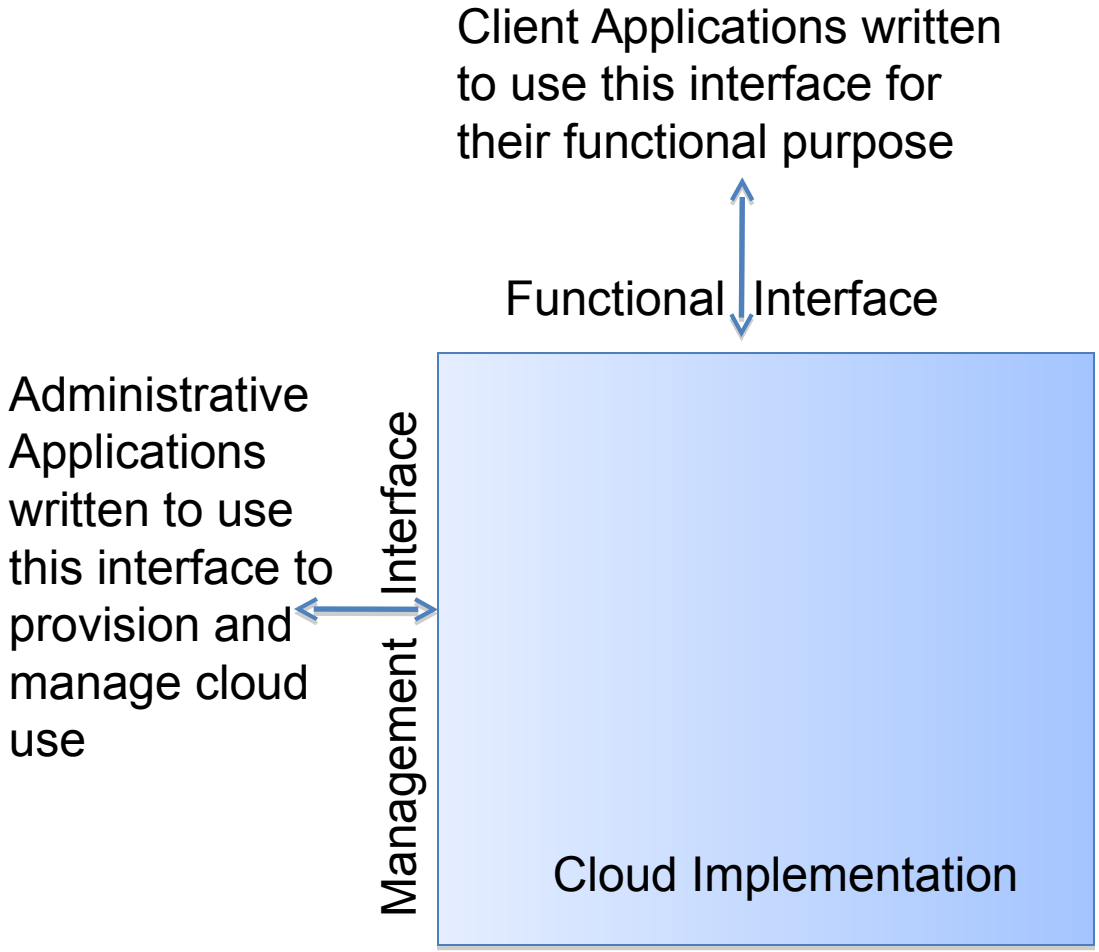
# Open Standards and Standards Groups

Open Standard: a standard developed with a process open to all interested parties and where implementations are free to use the standard.

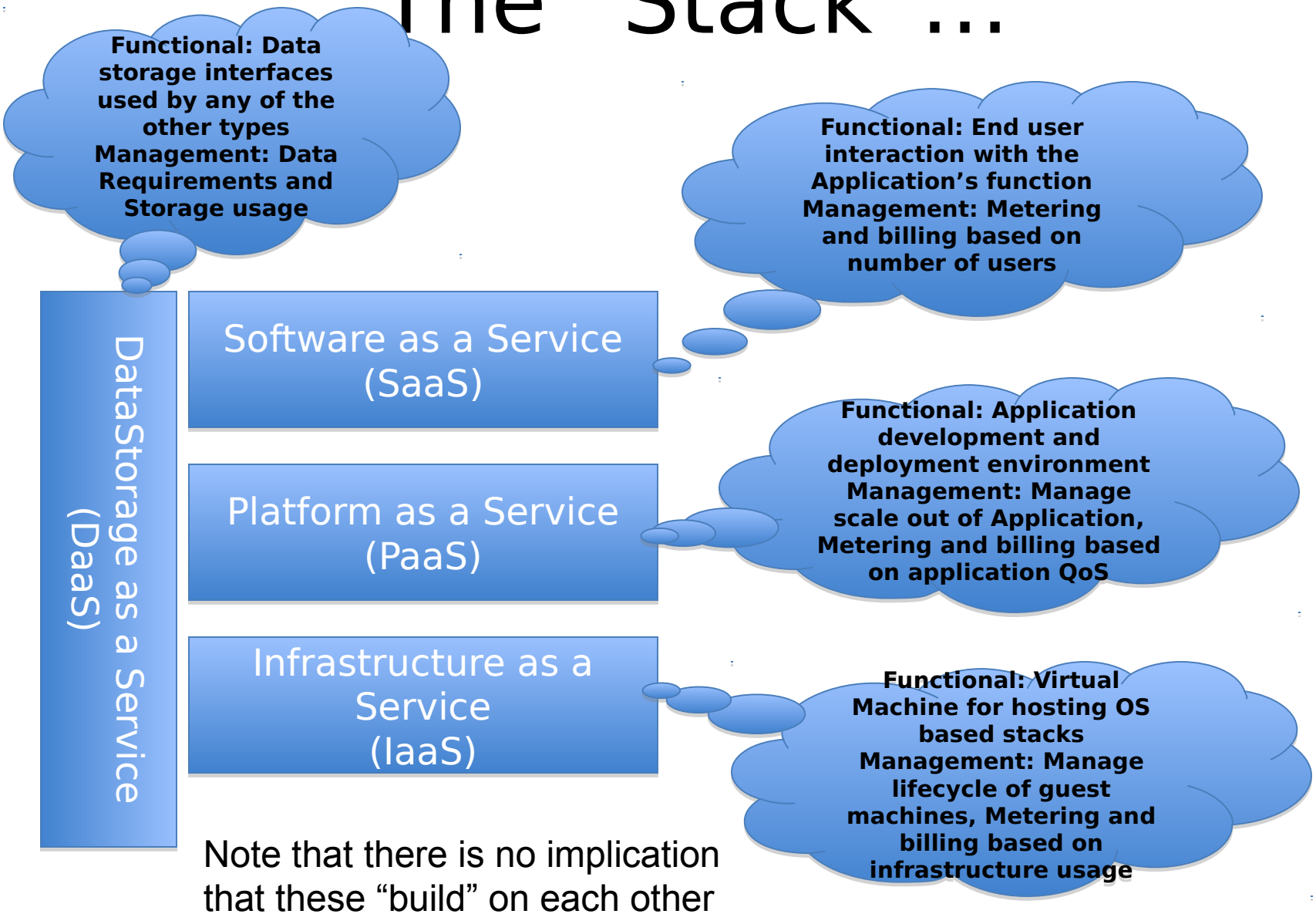

Cloud Service Developer
Cloud Service Consumer
Provider Interface
Functional Interfaces
SLA
• Elasticity Rules
• Performance
• Adjacency
• Compliance
•Isolation
• Availability
Service Catalog
CMDb
Security Services
AuthC
AuthZ
Identity
Key Mgt
Provision/Deploy/Config/Control
Compute
Storage
Network
Reporting
SLA Mgmt
Billing
Metering
Monitoring
Broker Interface Federation
Cloud Service Broker
Cloud Service Provider
Note: For preliminary discussion. Need to change boxes and also I know the colors are ugly. Will redo after discussion

# Taxonomy of Cloud Interfaces

- A Cloud API may provide either a Functional interface or a Management interface (or both)



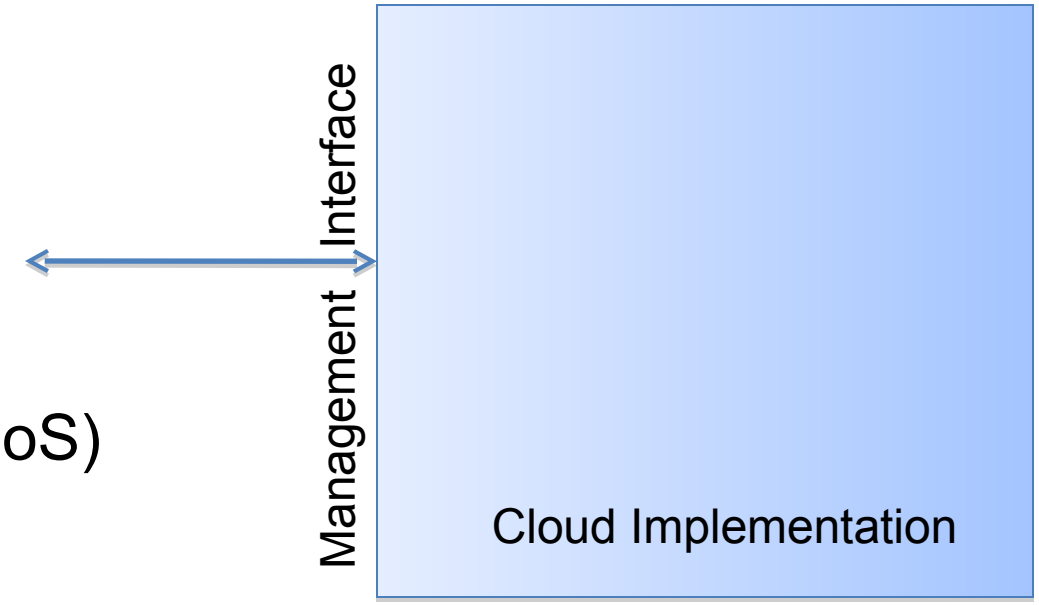
# The “Stack”…




Note that there is no implication that these “build” on each other – and they rarely do.

# Cloud Management

- Cloud Management has multiple aspects that can be standardized for interoperability
- For a given type of cloud (say IaaS) the standards could be split across different SDOs
- Some examples:
  - Provisioning
  - Metering and Billing
  - Security
  - Privacy
  - Quality of Service (QoS)
  - Identity



# Some Possible Standards

- **Federated security (e.g. identity) across Clouds**
- **Metadata and data exchanges among Clouds**
- **Standards for moving applications between Cloud platforms**
- **Standards for describing resource/performance capabilities and requirements**
- **Standardized outputs for monitoring, auditing, billing, reports and notification for Cloud applications and services**
- **Common representations (abstract, APIs, protocols) for interfacing to Cloud resources**
- **Cloud-independent representation for policies and governance**
- **Portable tools for developing, deploying, and managing Cloud applications and services**
- **Orchestration and middleware tools for creating composite applications across Clouds**

# Standards and Test Bed Groups

- Cloud Security Alliance (CSA)
- Distributed Management Task Force (DMTF)
- Storage Networking Industry Association (SNIA)
- Open Grid Forum (OGF)
- Open Cloud Consortium (OCC)
- Organization for the Advancement of Structured Information Standards (OASIS)
- TM Forum
- Internet Engineering Task Force (IETF)
- International Telecommunications Union (ITU)
- European Telecommunications Standards Institute (ETSI)
- Object Management Group (OMG)

# Which Organizations doing What?

| | SaaS | PaaS | IaaS | DaaS |
|---|---|---|---|---|
| Provisioning | | | OGF/DMTF | SNIA |
| Metering and Billing | | | | SNIA |
| Security | | | OGF/DMTF/CSA | SNIA (IETF) |
| Privacy | | | | |
| Quality of Service | | | DMTF | SNIA |
| Identity | | OASIS | | |

Standardization of Cloud Management

# Which Organizations doing What?

| | SaaS | PaaS | IaaS | DaaS |
|---|---|---|---|---|
| Client Application Interface | | | | |
| Development Platform | | | | |
| Virtual Machine Interface | | | DMTF | |
| Data Storage Interface | | | | SNIA |

Standardization of Functional Interfaces

Note: Preliminary - Need to map all known SDOs.

Cloud Service Developer

Cloud Service Consumer

Provider Interface

SLA

- Elasticity Rules
- Performance
- Adjacency
- Compliance
- Isolation
- Availability

TMForum

Functional Interfaces

Service Catalog

CMDb

Reporting

SLA Mgmt

Billing

Metering

Monitoring

Security Services

AuthC | AuthZ | Identity | Key Mgt

OASIS

Provision/Deploy/Config/Control

Compute | Storage | Network

CDMI

DMTF

Broker Interface Federation

Cloud Service Broker

Cloud Service Provider

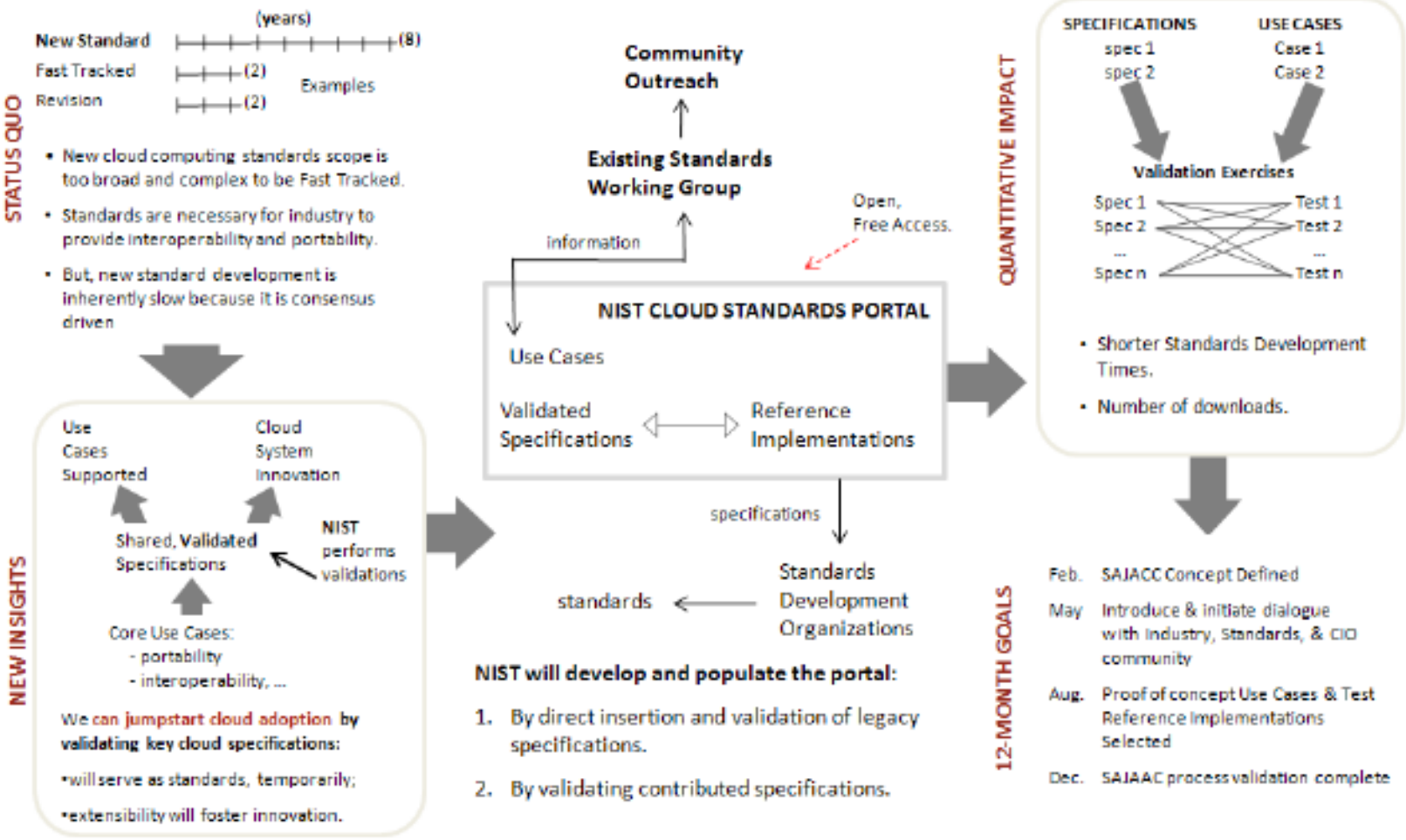
Note: For preliminary discussion. Need to change boxes and also I know the colors are ugly. Will redo after discussion

# NIST Cloud Standards Roadmap

- We need to define minimal standards
  - Enable cloud integration, application portability, and data portability
  - Avoid over specification that will inhibit innovation
  - Separately addresses different cloud models

Initial proposal from a talk by Peter Mell of NIST in 2009
**http://federalcloudcomputing.wik.is/@api/deki/files/105/=Mell_Cloud_Standards_Roadmap.pdf**

# Standards Strategy




From Vivek Kundra

# Centralized Certification

**Government-wide Risk Management Program**

- Provides security authorization and continuous monitoring
- Agencies participate by leveraging the results for covered products

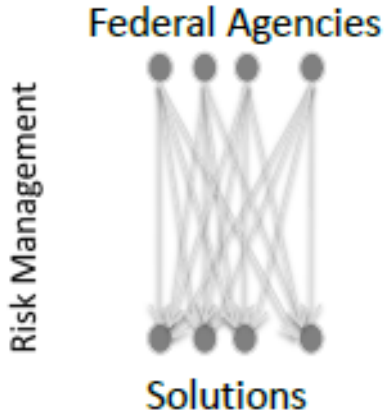
**Vendor Benefits**

- Government-wide authorization and security compliance cost reduction

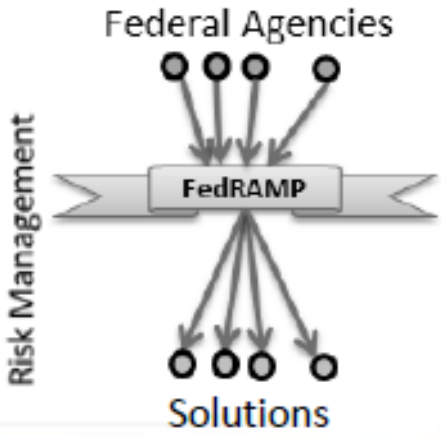
**Agency Benefits**

- Cost savings through reduced duplication
- Rapid acquisition
- Increased security assurance

**Problem:** Independent agency risk management has inefficiencies




**Solution:** Unified risk management eliminates inefficiencies




From Vivek Kundra

# Use Cases

# Existing Use Cases

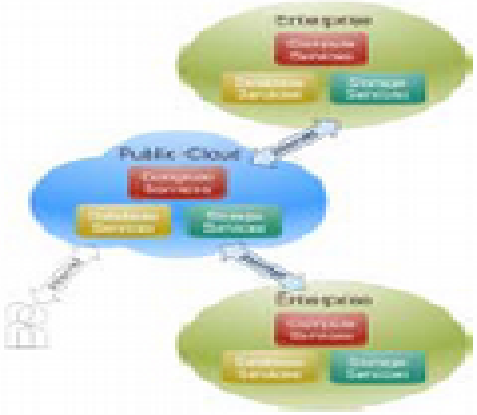
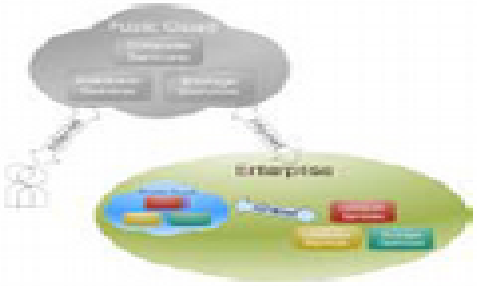
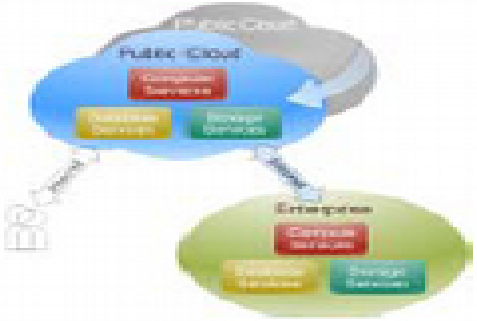
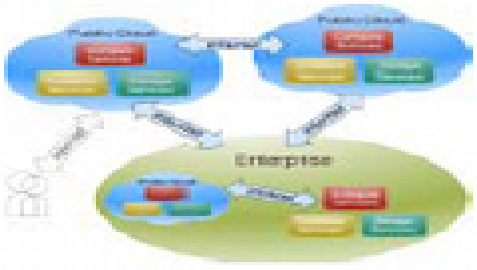
- Cloud Computing Use Cases White Paper
  http://groups.google.com/group/cloud-computing-use-cases
- SNIA Cloud Storage Use Cases (addressed by CDMI)
  http://www.snia.org/tech_activities/publicreview/CloudStorageUseCasesv0.5.pdf
- OCC Presentation on Use Cases and Standards
  http://www.slideshare.net/rgrossman/cloud-computing-standards-and-use-cases-robert-grossman-09v8p

- DMTF Cloud Incubator White Paper
  - http://www.google.com/url?q=http://www.dmtf.org/about/cloud-incubator/DSP_IS0101_1.0.0.pdf
- OGF GFD.162:  Open Cloud Computing Interface - Use cases and requirements for a Cloud API
  - http://www.ogf.org/documents/GFD.162.pdf

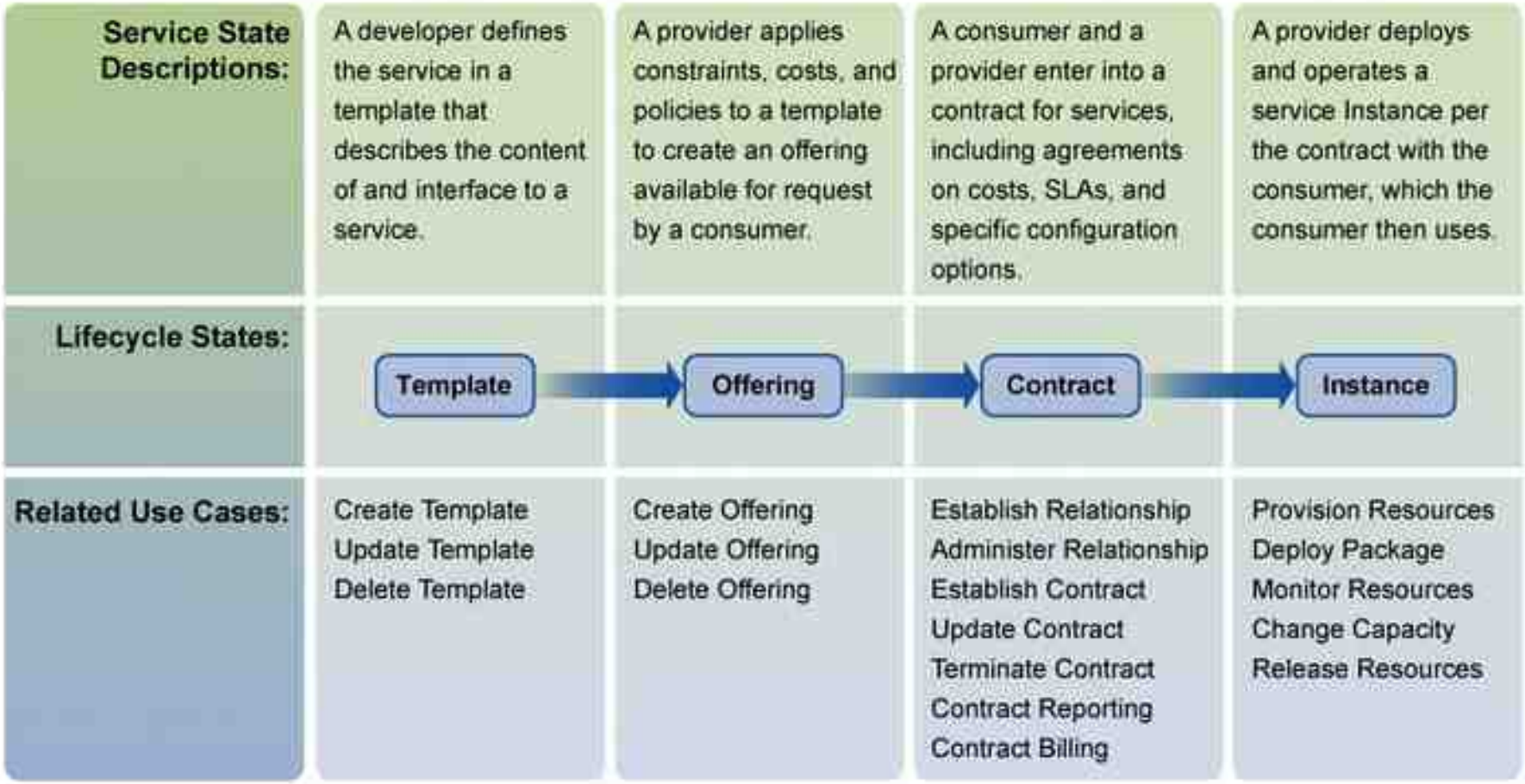
# Cloud Use Cases

| | | |
|---|---|---|
| **End User to Cloud** ***(Public Services)*** | Applications running on the cloud and accessed by end users |   |
| **Enterprise to Cloud to End User** ***(Enhanced Services)*** | Applications running in the public cloud and accessed by employees and customers |   |
| **Enterprise to Cloud** ***(Outsourced Services)*** | Cloud applications integrated with internal IT capabilities |   |

From http://cloud-computing-use-cases.googlegroups.com/

| | | |
|---|---|---|
| **Enterprise to Cloud to Enterprise**<br><br>***(Shared Services)*** | Cloud applications running in the public cloud and interoperating with partner applications (supply chain) |  |
| **Private Cloud**<br><br>***(Private Services)*** | A cloud hosted by an organization inside that organization's firewall. |  |
| **Changing Cloud Vendors**<br><br>***(Migration)*** | An organization using cloud services decides to switch cloud providers or work with additional providers.<br>(SaaS, Middleware. Storage, VMs) |  |
| **Hybrid Cloud**<br><br>***(MultiCloud Services)*** | Multiple clouds work together, coordinated by a cloud broker that federates data, applications, user identity, security and other details. |  |

# Cloud Service Life Cycle & use cases



# Specifications

# Existing Specifications

*Include these in RFPs now?*

- SNIA Cloud Data Management Interface (CDMI)
  http://www.snia.org/cloud

- DMTF Open Virtualization Format (OVF)
  http://www.dmtf.org/standards/published_documents/DSP0243_1.0.0.pdf

- OGF Open Cloud Computing Interface (OCCI)
  http://www.ogf.org/Public_Comment_Docs/Documents/2010-01/occi-core.pdf

# Standard Requirement Categories for IaaS

- **Cloud Management:** Cloud computing is not feasible without service management, governance, metering, monitoring, federated identity, SLAs and benchmarks, data and application federation, location awareness, deployment and lifecycle management.
- **Security:** Security in cloud computing is vital, although the requirements for security will vary widely depending on the application and data types.
- **Common VM Formats, Data Formats and APIs:** Virtual machines, data and applications created for one cloud provider should run on another cloud provider without changes. (Open Virtualization Format is emerging standard)

From
http://cloud-computing-use-cases.googlegroups.com

# IaaS Standards Requirements Mapped to Use Cases

| Requirement | End User to Cloud | Enterprise to Cloud to End User | Enterprise to Cloud | Enterprise to Cloud to Enterprise | Private Cloud | Changing Cloud Vendors | Hybrid Cloud |
|---|---|---|---|---|---|---|---|
| Identity | ✓ | ✓ | | ✓ | | | ✓ |
| Open Client | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Federated Identity | | ✓ | ✓ | ✓ | | | ✓ |
| Location Awareness | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Metering and Monitoring | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Management and Governance | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Security | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

From

| Requirement | End User to Cloud | Enterprise to Cloud to End User | Enterprise to Cloud | Enterprise to Cloud to Enterprise | Private Cloud | Changing Cloud Vendors | Hybrid Cloud |
|---|---|---|---|---|---|---|---|
| Deployment | | | ✓ | | ✓ | | ✓ |
| Transactions and Concurrency | | | | ✓ | | | |
| Interoperability | | | | ✓ | | | ✓ |
| Industry-Specific Standards | | | ✓ | ✓ | | | ✓ |
| VM Image Format | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Cloud Storage API | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Cloud Database API | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Cloud Middleware API | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Data and Application Federation | | ✓ | ✓ | ✓ | | | ✓ |
| SLAs | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Lifecycle Management | | ✓ | ✓ | ✓ | | | ✓ |

# Reference Implementations

# Reference Implementations

- (SNIA CDMI) Open Source Reference Implementation http://snia.org/cloud
- (OGF OCCI) Open Nebula http://www.opennebula.org/doku.php

# Testbeds

- Open Cloud Consortium Testbed
  http://opencloudconsortium.org/testbed/

- Open Cirrus Testbed
  https://opencirrus.org/

# Some Open Source Clouds

- Globus Nimbus http://www.nimbusproject.org/
- NASA Nebula http://nebula.nasa.gov/

# Demonstrations

- Joint SNIA and OGF OCCI CDMI Demo June 2010 (Chicago)
- http://groups.google.com/group/cloud-demo
- http://cloud.r2ad.net/
- AI: *need government presence at the demo*

- ETSI Interoperability Demonstration December 2009 http://docbox.etsi.org/Workshop/2009/200912_GRID/SCHULZ_GCSIPLUPresentation.pdf

- TM Forum Cloud Catalyst Projects http://www.tmforum.org/Catalysts/8342/home.html
  - Inter-Cloud Service Management
  - Cloud Service Broker
  - Service Model Catalyst
  - IPsphere: Bringing Quality to the Cloud

# Recommendations

# Recommendations

- ***Develop and document a process for Open Standards to become US Government recommendations***
- Working with Cloud standards groups and providers, develop a plan for creating demos, test-beds, and reference implementations
- Collect and prioritize government use cases
- Document standards requirements and specifications
- Review existing standards activities and identify the need for future standards and innovative capabilities
- Validate compatibility of uses cases, specifications, standards, and innovative capabilities
- Verify that standards and innovative capabilities satisfy specifications and can be deployed by government projects

# Possible Testbeds and Demos Areas

- Federated Security across Clouds
- Federated Cloud Storage
- Data Interoperability across Clouds
- Portability of applications and tools across IaaS Clouds
- Standards for Cloud Monitoring and Management
- Standards for Cloud Development and Deployment

**Follow-on meetings among government, industry, and standards groups after May 20 could be used to plan these activities**

# Backup:
# Individual Standards Groups

# Cloud Security Alliance

- *"The Cloud Security Alliance was created to promote the use of best practices for providing security assurance within Cloud Computing, and provide education on the uses of Cloud Computing to help secure all other forms of computing."*

- Security Guidance for Critical Areas of Focus in Cloud Computing – "*Covers key issues and provides advice for both Cloud Computing customers and providers within 15 strategic domains.*"
  http://www.cloudsecurityalliance.org/guidance/csaguide.pdf

# Distributed Management Task Force

- *“DMTF’s Open Cloud Standards Incubator will focus on standardizing interactions between cloud environments by developing cloud resource management protocols, packaging formats and security mechanisms to facilitate interoperability.”*

- Open Virtualization Format (OVF)
  http://cloud-standards.org/wiki/index.php?title=Open_Virtualization_Format_(OVF)

- Interoperable Clouds White Paper - *“This white paper describes a snapshot of the work being done in the DMTF Open Cloud Standards Incubator, including use cases and reference architecture as they relate to the interfaces between a cloud service provider and a cloud service consumer”.*
  *http://www.dmtf.org/about/cloud-incubator/DSP_IS0101_1.0.0.pdf*

# Storage Networking Industry Association

- SNIA Cloud TWG – *"SNIA has created the Cloud Storage Technical Work Group for the purpose of developing SNIA Architecture related to system implementations of Cloud Storage technology."*
- SNIA Cloud Storage Initiative – "***The mission of the SNIA CSI is to foster the growth and success of the market for what is generally referred as cloud storage and more generally the use of data storage resources and services in the cloud."***
- SNIA Cloud Data Management Interface (CDMI) – "SNIA has released a Cloud Data Management Interface (CDMI) standard specification." http://snia.org/cloud

# Open Grid Forum

- OGF Open Cloud Computing Interface(OCCI) – "*The purpose of this group is the creation of a practical solution to interface with Cloud infrastructures exposed as a service (IaaS). We will focus on a solution which covers the provisioning, monitoring and definition of Cloud Infrastructure services.*" *http://www.occi-wg.org/*

- Open Cloud Computing Interface Specification
  http://cloud-standards.org/wiki/index.php?title=Open_Cloud_Computing_Interface_Specification

- Open Cloud Computing Interface Terms and Diagrams
  http://cloud-standards.org/wiki/index.php?title=Open_Cloud_Computing_Interface_Terms_and_Diagrams

# SNIA –OGF Collaboration

- OGF and SNIA created a Cloud Storage for Cloud Computing whitepaper.
  http://www.snia.org/cloud/CloudStorageForCloudComputing.pdf

- The OGF and the SNIA are working on a joint demo along the lines of what is discussed the in the white paper
  http://cloud-standards.org/wiki/index.php?title=Main_Page

# Open Cloud Consortium

- The Open Cloud Consortium (OCC)
  http://www.opencloudconsortium.org/
  - Supports the development of standards for cloud computing and frameworks for interoperating between clouds
  - Develops benchmarks for cloud computing
  - Supports reference implementations for cloud computing, preferably open source reference implementations

# OASIS

- The Organization for the Advancement of Structured Information Standards *“drives the development, convergence and adoption of open standards for the global information society”* http://www.oasis-open.org/

- *Identity in the Cloud TC “The purpose of the OASIS Identity in the Cloud TC is to collect and harmonize definitions, terminologies, and vocabulary of Cloud Computing, and develop profiles of open standards for identity deployment, provisioning and management.”*

  *http://xml.coverpages.org/ID-Cloud-CFP.html*

# The Open Group

- The Open Group Cloud Work Group "*includes some of the industry's leading cloud providers and end-user organizations, collaborating on standard models and frameworks aimed at eliminating vendor lock-in for enterprises looking to benefit from cloud products and services.*" http://www.opengroup.org/cloudcomputing/

# TM Forum

- The TM Forum has created a  Cloud Services Initiative. “*The centerpiece of this initiative is an ecosystem of major buyers and sellers who will collaborate to define a range of common approaches, processes, metrics and other key service enablers*.”
  http://tmforum.org/ManagingCloudServices/8006/home.html

- *“An Enterprise Cloud Buyers Council will serve as the anchor for this ecosystem.”*
  *http://www.tmforum.org/EnterpriseCloudBuyers/8009/home.html*

# ITU-T

- The International Telecommunications Union-Telecommunications Standards Group (ITU-T) has formed a Focus Group on Cloud Computing whose purpose is
  - to identify potential impacts on standards development and priorities for standards needed to promote and facilitate for cloud computing
  - investigate future study items and related actions for fixed and mobile networks in the scope of ITU-T
  - analyze how interoperability can be assured in the cloud computing
  - familiarize ITU-T and standardization communities with emerging attributes and challenges of cloud computing

  http://www.itu.int/ITU-T/focusgroups/cloud/

  - The Focus Group has produced a White Paper on Cloud Computing Terms of Reference
    http://isotc.iso.org/livelink/livelink?func=ll&objId=8973178&objAction=Open

# Object Management Group

- *“OMG's focus is always on modeling, and the first specific cloud-related specification efforts have only just begun, focusing on modeling deployment of applications & services on clouds for portability, interoperability & reuse.”*
  *http://www.omg.org*

# ETSI TC Grid

- European Telecommunication Standards Institute (ETSI) Technical Committee (TC) GRID – *“The goal of ETSI TC GRID is to address issues associated with the convergence between IT (Information Technology) and Telecommunications. Since TC GRID has particular interest in interoperable solutions in situations which involve contributions from both the IT and Telecom industries, the emphasis is on the Infrastructure as a Service (IaaS) delivery model.”*
  http://docbox.etsi.org/Workshop/2009/200912_GRID/ETSITCGRID.pdf

# Other Standardization Activities

- Simple Cloud API http://www.simplecloud.org/
- OpenID http://openid.net/
- OAuth http://oauth.net/
- Eclipse g-Eclipse http://www.eclipse.org/geclipse/

| STANDARD AND/OR PROJECT (25) | STAGE | TC |
| --- | --- | --- |
| **ISO/IEC 17789:2014**<br>Information technology — Cloud computing — Reference architecture | 90.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 17826:2016**<br>Information technology — Cloud Data Management Interface (CDMI) | 60.60 | ISO/IEC JTC 1 |
| **ISO/IEC 18384-1:2016**<br>Information technology — Reference Architecture for Service Oriented Architecture (SOA RA) — Part 1: Terminology and concepts for SOA | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 18384-2:2016**<br>Information technology — Reference Architecture for Service Oriented Architecture (SOA RA) — Part 2: Reference Architecture for SOA Solutions | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 18384-3:2016**<br>Information technology — Reference Architecture for Service Oriented Architecture (SOA RA) — Part 3: Service Oriented Architecture ontology | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 19086-1:2016**<br>Information technology — Cloud computing — Service level agreement (SLA) framework — Part 1: Overview and concepts | 60.60 | ISO/IEC JTC 1/SC 38 |

| | | |
|---|---|---|
| **ISO/IEC 19086-2:2018**<br>Cloud computing — Service level agreement (SLA) framework — Part 2: Metric model | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 19086-3:2017**<br>Information technology — Cloud computing — Service level agreement (SLA) framework — Part 3: Core conformance requirements | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 19086-4:2019**<br>Cloud computing — Service level agreement (SLA) framework — Part 4: Components of security and of protection of PII | 60.60 | ISO/IEC JTC 1/SC 27 |
| **ISO/IEC 19941:2017**<br>Information technology — Cloud computing — Interoperability and portability | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC DIS 19944-1**<br>Cloud computing – Cloud services and devices: data flow, data categories and data use — Part 1: Fundamentals | 40.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 19944:2017**<br>Information technology — Cloud computing — Cloud services and devices: Data flow, data categories and data use | 90.92 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 20933:2019**<br>Information technology — Distributed application platforms and services (DAPS) — Framework | 60.60 | ISO/IEC JTC 1 |

| | | |
|---|---|---|
| **ISO/IEC DIS 22123-1**<br>Information technology — Cloud computing — Part 1: Terminology | 40.20 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC CD 22123-2**<br>Information technology — Cloud computing — Part 2: Concepts | 30.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC 22624:2020**<br>Information technology — Cloud computing — Taxonomy based data handling for cloud services | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC TR 22678:2019**<br>Information technology — Cloud computing — Guidance for policy development | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC TS 23167:2020**<br>Information technology — Cloud computing — Common technologies and techniques | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC TR 23186:2018**<br>Information technology — Cloud computing — Framework of trust for processing of multi-sourced data | 60.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC PRF TR 23187**<br>Information technology — Cloud computing — Interacting with cloud service partners (CSNs) | 50.20 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC TR 23188:2020**<br>Information technology — Cloud computing — Edge computing landscape | 60.60 | ISO/IEC JTC 1/SC 38 |

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| **ISO/IEC TR 23613**<br>Information technology — Cloud computing — Cloud service metering elements and billing modes | 60.00 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC CD 23751**<br>Information technology — Cloud computing and distributed platforms — Data sharing agreement (DSA) framework | 30.60 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC PRF TR 23951**<br>Information technology — Cloud computing — Guidance for using the cloud SLA metric model | 50.00 | ISO/IEC JTC 1/SC 38 |
| **ISO/IEC TR 30102:2012**<br>Information technology — Distributed Application Platforms and Services (DAPS) — General technical principles of Service Oriented Architecture | 60.60 | ISO/IEC JTC 1/SC 38 |