

The logo features a blue cloud shape on the left, formed by a thick blue arrow that curves upwards and then downwards, ending in a blue arrowhead pointing to the right. To the right of the cloud, the text "NIST Cloud Computing Program" is displayed in a bold, sans-serif font. "NIST" is in grey, while "Cloud Computing Program" is in red.

# NIST Cloud Computing Program

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Software and Systems

NIST

# Cloud Computing Program

## Phase I

Launch & Objectives

Standards, Workshops, Architecture

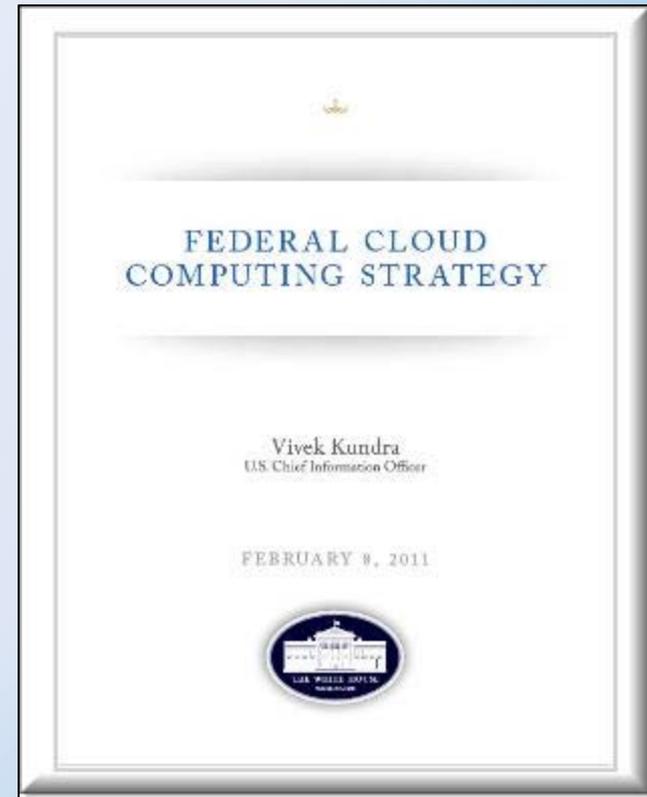
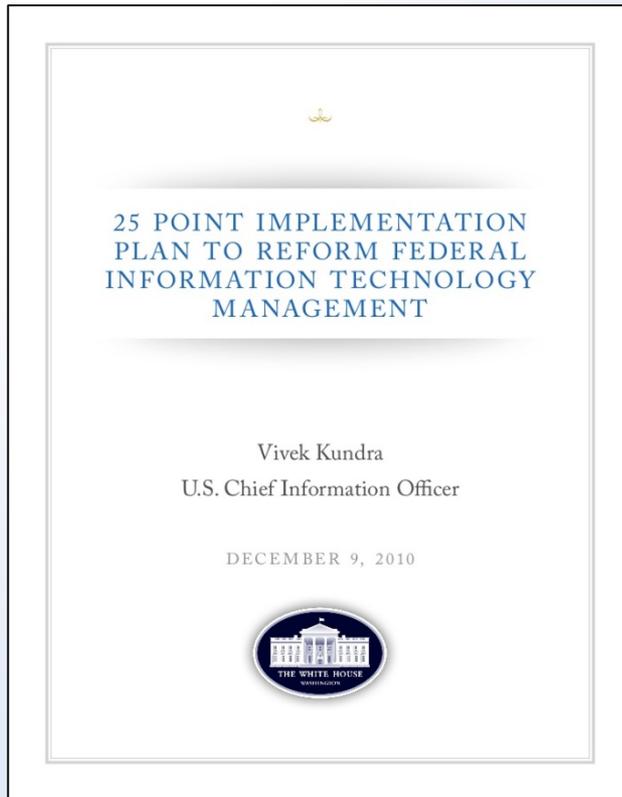
## Phase II

Future Architecture

Activities



# Federal IT Strategy Documents



# Federal Cloud Computing Strategy

US IT Budget ~ \$80B/year: Savings ~25%

Move existing apps to cloud when possible

- Select – Provision - Manage

Investigate cloud-applicability for new services

Three main agencies

GSA – Procurement (*FedRAMP*)

DHS – Operational Security

**NIST – Standards**



# NIST Cloud Computing Program Goal

**To accelerate the federal government's adoption  
of cloud computing**

***Build a USG Cloud Computing Technology Roadmap*** which focuses on the highest priority USG cloud computing security, interoperability and portability requirements

***Lead efforts to develop standards and guidelines*** in close consultation and collaboration with standards bodies, the private sector, and other stakeholders



# Why NIST?

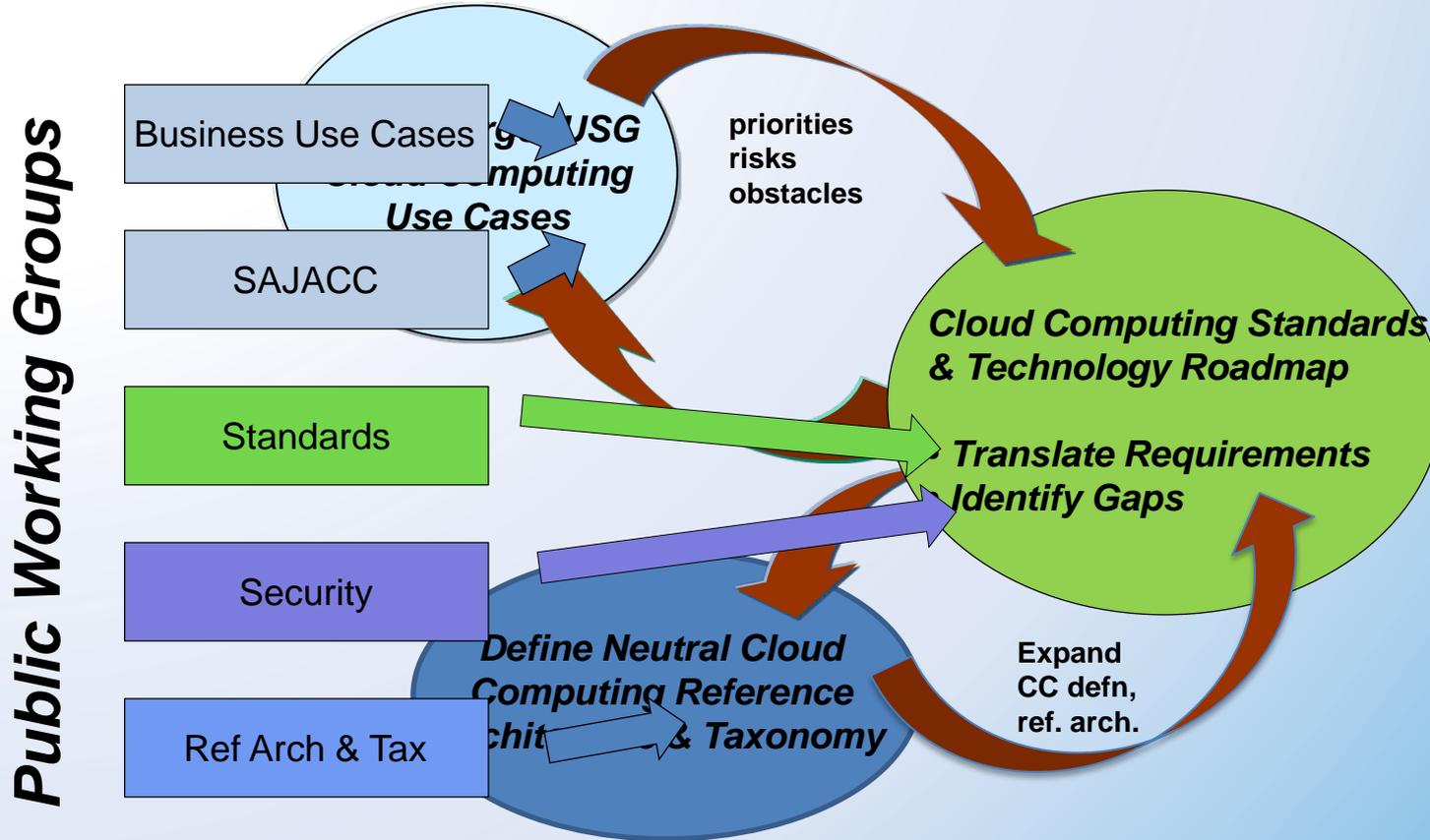
US government agencies need Cloud Computing **standards & guidance** to accelerate effective adoption

Private sector and U.S. government agencies must work together to identify highest priority USG Cloud Computing **requirements & gaps**

**Neutral, objective** entity is instrumental in encouraging innovation and “a level playing field” for U.S. industry



# Building the NIST Cloud Computing Technology Roadmap



# NIST Definition of Cloud Computing

*“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.”*

## **3 Service Models**

- Software as a Service
- Platform as a Service
- Infrastructure as a Service

## **4 Deployment models**

- Public, Private, Community, Hybrid

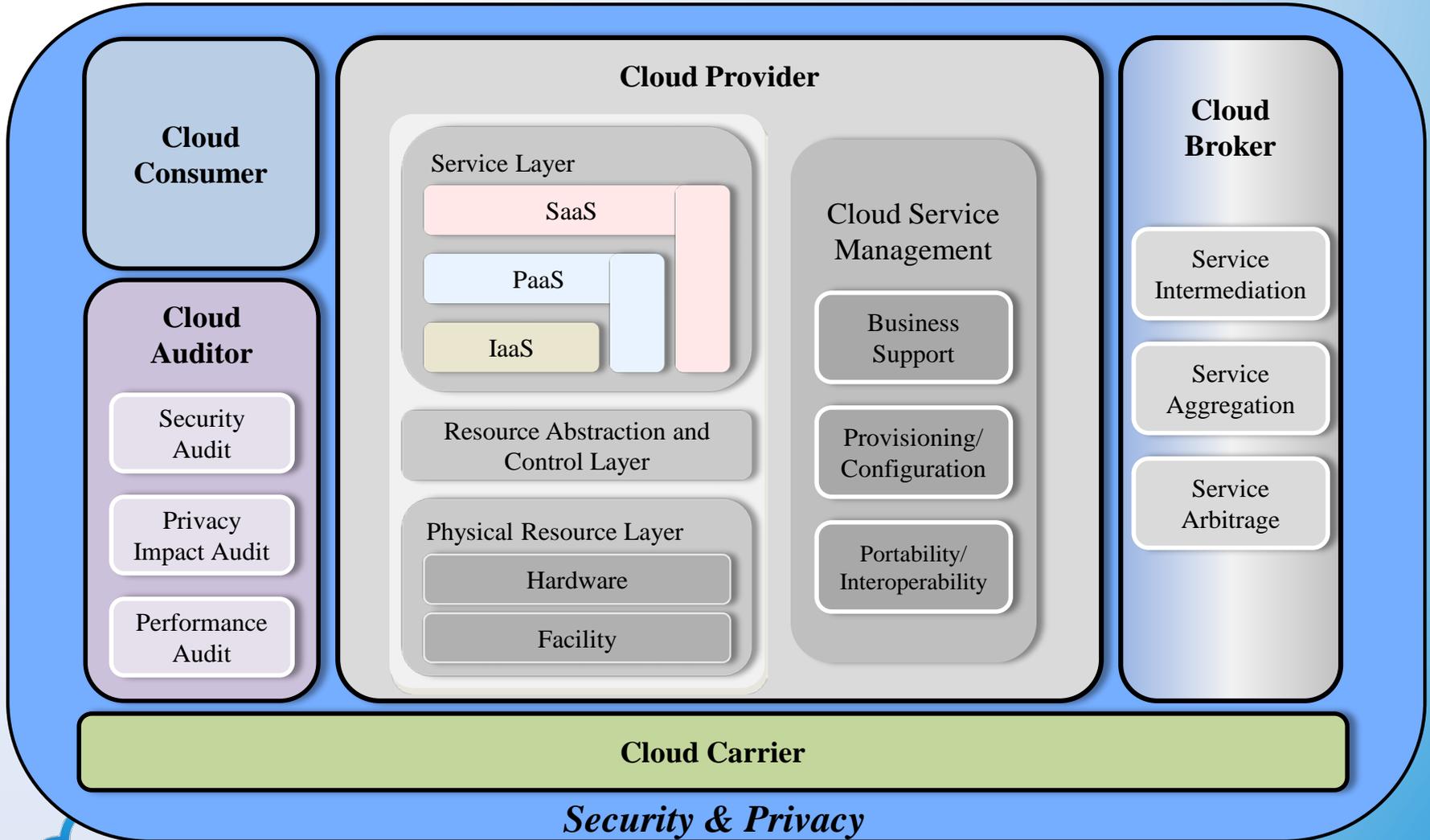
## **5 Essential Characteristics**

- On demand self-service
- Broad network access
- Resource Pooling
- Rapid Elasticity
- Measured Service

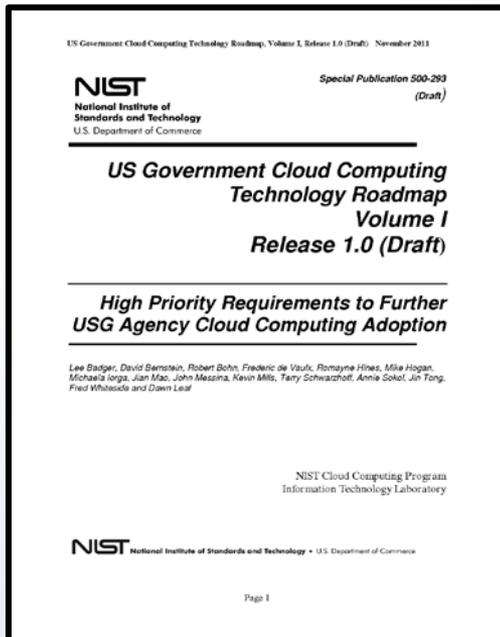


***The “What” of Cloud Computing, not the “How”***

# NIST Reference Architecture



# USG Cloud Computing Roadmap – Vol I



## Core Elements:

- **Prioritized strategic and tactical requirements that must be met for USG agencies to further cloud adoption;**
- **Interoperability, portability, and security standards, guidelines, and technology needed to satisfy these requirements;**
- **Recommended list of Priority Action Plans (PAPs) -- candidates for voluntary self-tasking by the stakeholder community.**

**Collaboration through public working groups & Federal Cloud Computing Standards & Technology Working Group**

**Intent is to leverage PAPs that are identified as complete or under way by cloud stakeholder community; some may fall within NIST scope**



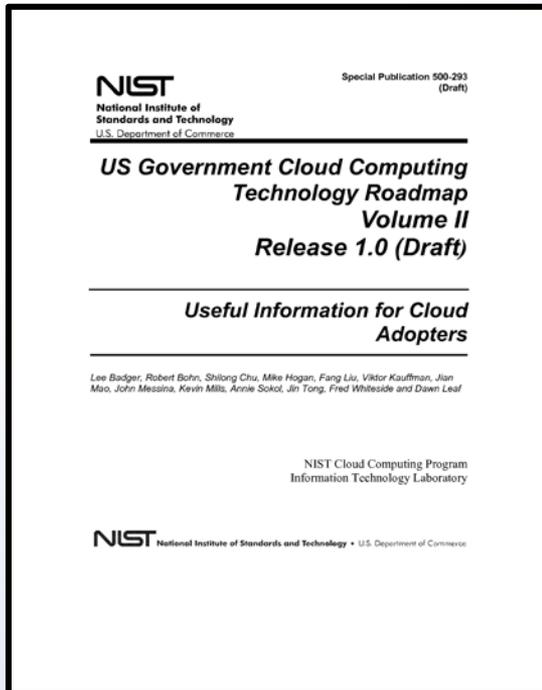
# Volume I - Roadmap

## Requirements

1. International voluntary consensus-based standards
2. Solutions for High-priority Security Requirements, technically decoupled from organizational policy decisions
3. Technical specifications to enable development of consistent, high-quality Service-Level Agreements
4. Clearly and consistently categorized cloud services
5. Frameworks to support seamless implementation of federated community cloud environments
6. Updated Organization Policy that reflects the Cloud Computing Business and Technology model
7. Defined unique government regulatory requirements and solutions
8. Collaborative parallel strategic “future cloud” development initiatives
9. Defined and implemented reliability design goals
10. Defined and implemented cloud service metrics



# USG Cloud Computing Roadmap – Volume II



## Reference Architecture & Taxonomy

- Recommend Industry Mapping so that USG agencies & others can more easily and consistently compare cloud services
- In parallel, support formal standards development process leveraging the reference architecture

## Standards

- Provide avenue for USG agency engagement
- Continue standards roadmap

## Target Business Use Cases & SAJACC

- Expand initial use case set & use SAJACC to identify gaps

## Security

- leverage working groups to finalize special publication focusing on challenging security requirements
- Continue technical advisor role – e.g. FedRAMP, continuous monitoring, conformity assessment system

Use collaboration through public working groups & Federal Cloud Computing Standards & Technology Working Group to continue to validate findings



# NIST Additional Cloud Docs

NIST Special Publication 500-292, **NIST Cloud Computing Reference Architecture**, September 2011

NIST Special Publication 500-291, **NIST Cloud Computing Standards Roadmap**, July 2011

NIST Special Publication 800-145, **NIST Definition of Cloud Computing**, September 2011

NIST Special Publication 500-299, **NIST Cloud Computing Security Reference Architecture (draft)**



# NIST Cloud Computing Forum & Workshop Series

First cloud workshop - May 2010

Seven cloud events total

## Purpose

- Communication
- Outreach
- Building relationships
- Forming communities

## Special Events

- Cloud & Big Data – January 2013
- Cloud & Mobility – March 2014



# Status

## Phase I (**COMPLETED**)

- Reference Architecture & Taxonomy
- Security Reference Architecture
- Descriptions of Cloud Broker
- Standards Inventory

## Phase II – (ACTIVE)



# Future Outlook

The convenience of reliable, trusted and measurable cloud services become a foundational element of the global economy.

These services, constructed with open standards and metric based building blocks, form the basis for a collection of interconnected clouds to:

- facilitate world-wide collaboration & shared knowledge
- drive innovation
- provide positive environmental and economic impacts



# Beyond the Reference Architecture

Consumers know what they are getting

Not limited to a single provider (**unless** a single provider meets their requirements)

Dynamically adapt to changing needs

- Rapidly provision-able, elastic, scalable

Secure, measureable services

# Current Cloud Focus Areas

## Refinement

- Actors
- Services
- Architecture

## Service level agreements

## Metrics

## Interoperability and Portability

## Federation

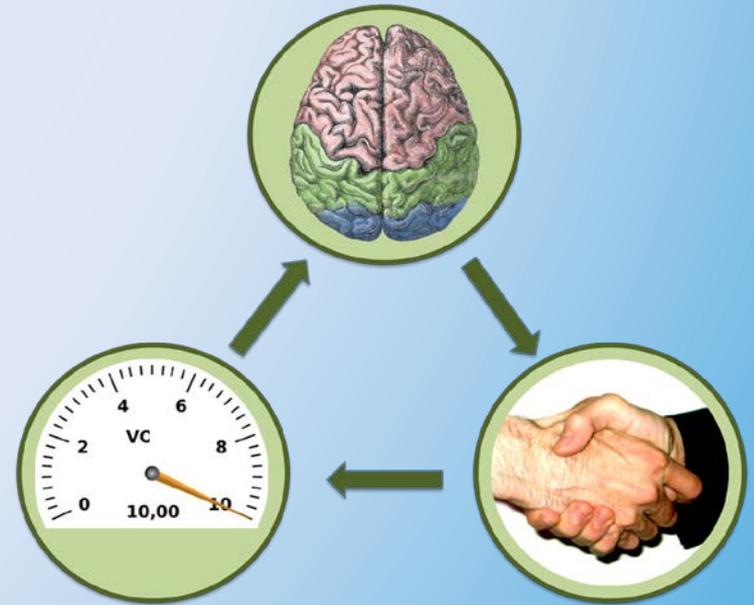


# Three parts to the process

**Decide** - lay out the requirements for the service

**Agree** - the **SA/SLA** is the agreement connecting customer and provider

**Measure** - are the SLA objectives met.



# Metrics – the glue

Provide a consistent way of describing a measurable property of a cloud computing system

Used to make comparable measurements

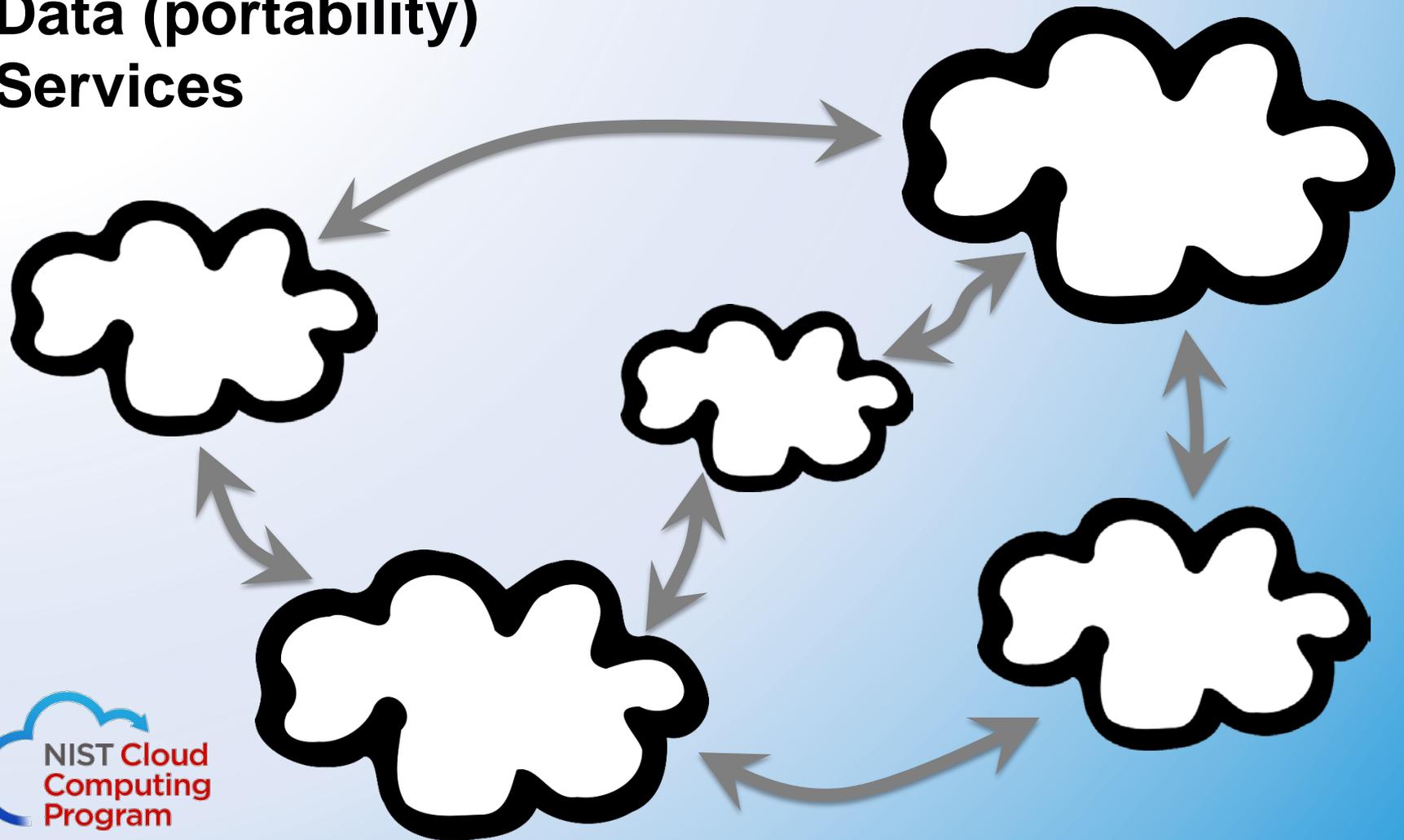
**ALSO** used to describe capabilities

**AND** can be used to describe requirements



# Interoperability

Data (portability)  
Services



# Federated



# Metrics/SLA

## NIST working group

- Metrics (draft document out now)

## ISO/IEC 19086 Cloud SLA standard (editor)

- Part 1 - concepts
- Part II - metrics
- Part III - requirements

# Interoperability & Portability WG

Types of cloud computing interoperability and portability

- Relationship, interactions

Contexts where interoperability and portability are relevant in cloud computing, with respect to the cloud computing reference architecture; and

Common terminology and concepts used to describe interoperability and portability.



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# Federated Cloud WG

Develop a common understanding and definition of what a Federated Cloud entails

Identifying the requirements needed to reach the achieve a Federated cloud,

Identify the technology and standards gaps that need to be addressed in order to enable the Federated Cloud

Provide a path to achieving the Federated Cloud



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# Cloud Service WG

Explore the foundational characteristics of cloud services and examine the intricacies that exist between cloud service types.

Customers will make better selections of cloud services

Customers will be able to objectively evaluate, compare, and select between products from cloud vendors

Cloud Providers will have clear guidance where interoperability and portability must exist within similar categories of cloud services



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# Additional Information

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NIST ITL Cloud Computing Home Page

<http://www.nist.gov/itl/cloud>

NIST Cloud Computing Collaboration Site

(twiki) <http://collaborate.nist.gov/twiki-cloud-computing/>

