NIST Cloud Computing Program

Cloud Computing Standards – A NIST Perspective

Robert Bohn, PhD
Advanced Network Technologies Division

28 January 2016
Cloud Standards Coordination – ETSI
Brussels, Belgium

NIST National Institute of Standards and Technology U.S. Department of Commerce

NIST's Goal

To accelerate the federal government's adoption of cloud computing

- *Build a USG Cloud Computing Technology Roadmap*
- *Lead efforts to develop standards and guidelines*

NIST Cloud Computing Program

The NIST Cloud Computing Program

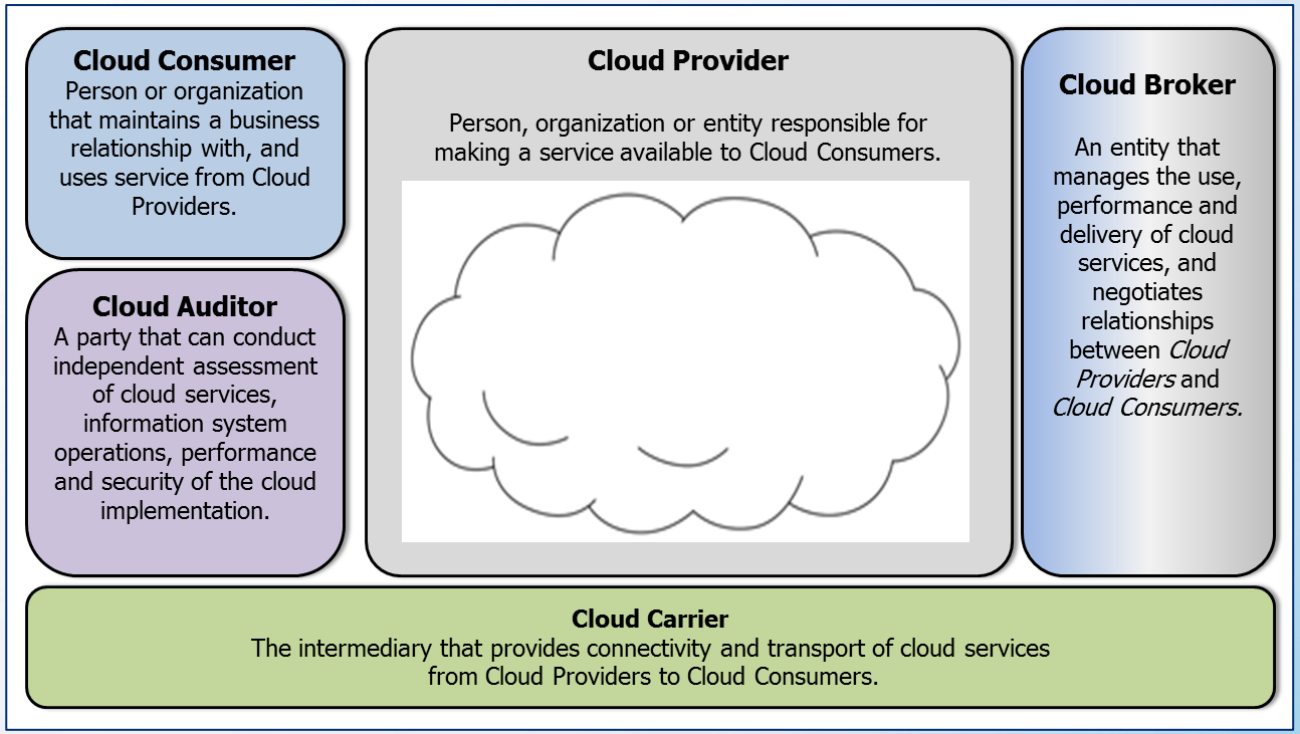
Public Working Groups	Standards	Outreach
• Develop fundamental concepts in cloud computing • Address Requirements from USG Cloud Computing Technology Roadmap	• Develop international standards with SDOs • Publish NIST Cloud Computing Standards Roadmap • Trust • Commerce • Innovation	• Annual NCC Forum & Workshop • Collaborate w other Govt Agencies • Speaking Events

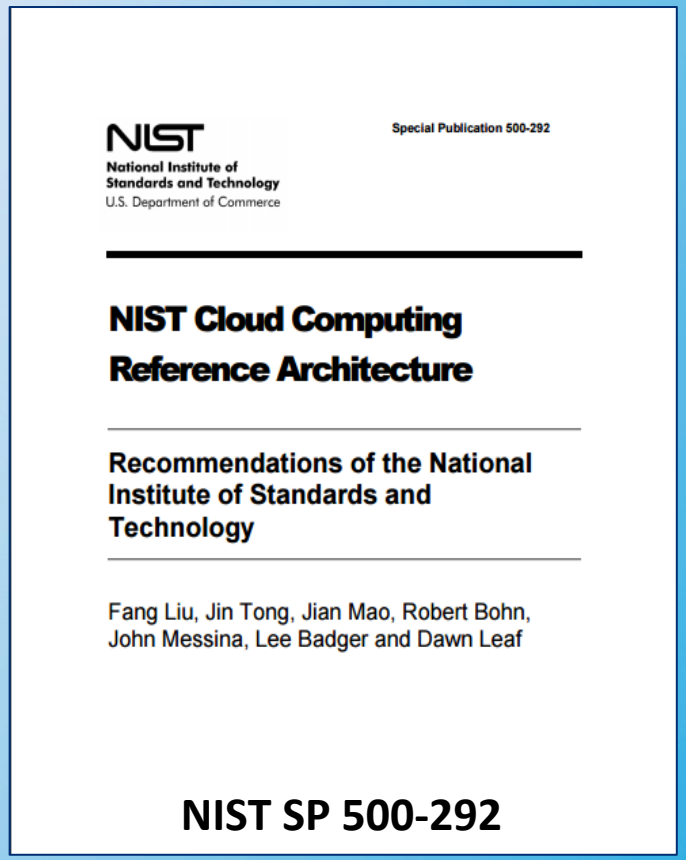
NIST Cloud Computing Program

Building a Roadmap

Public Working Groups

- Reference Architecture
- Standards
- Security
- Technical Use Cases
- Business Use Cases




NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Special Publication 500-292

NIST Cloud Computing Reference Architecture

Recommendations of the National Institute of Standards and Technology

Fang Liu, Jin Tong, Jian Mao, Robert Bohn, John Messina, Lee Badger and Dawn Leaf

NIST SP 500-292

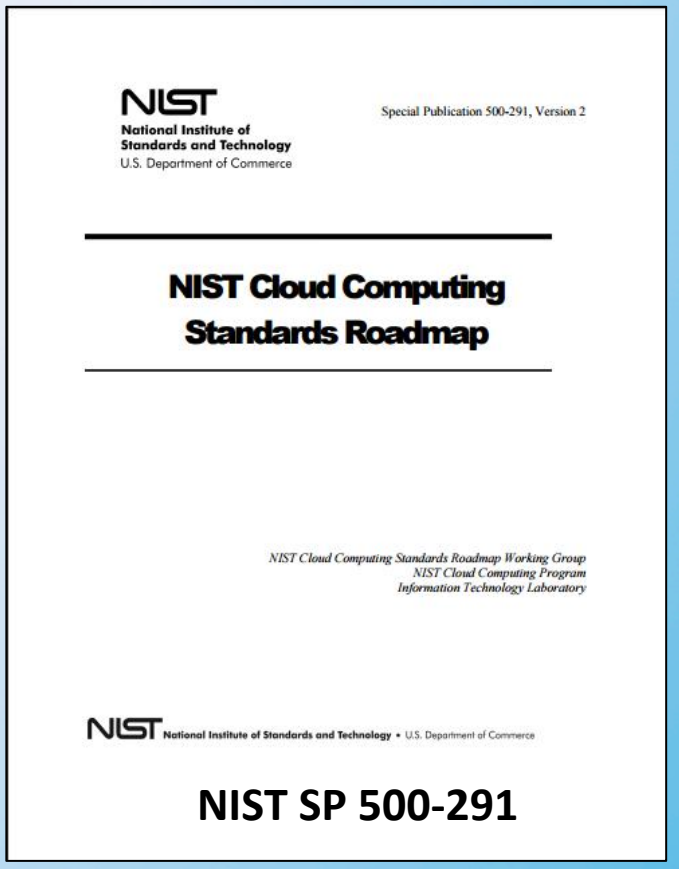
NIST Cloud Computing Program

Roadmapping for Standards

Public Working Groups

Reference Architecture | Standards | Security | Technical Use Cases | Business Use Cases

- Role of Conformity Assessment
- Standards Inventory
- Gap Analysis
- Priorities
- Recommendations


NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Special Publication 500-291, Version 2

NIST Cloud Computing Standards Roadmap

NIST Cloud Computing Standards Roadmap Working Group
NIST Cloud Computing Program
Information Technology Laboratory

NIST National Institute of Standards and Technology • U.S. Department of Commerce

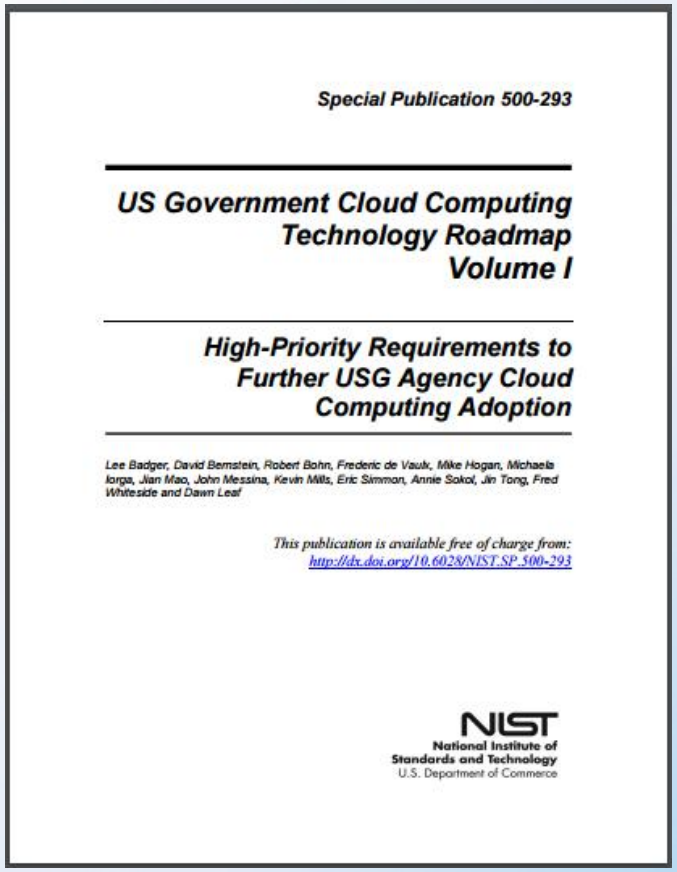
NIST SP 500-291

NIST Cloud Computing Program

A USG Technology Roadmap

Public Working Groups

- Reference Architecture
- Standards
- Security
- Technical Use Cases
- Business Use Cases



Special Publication 500-293

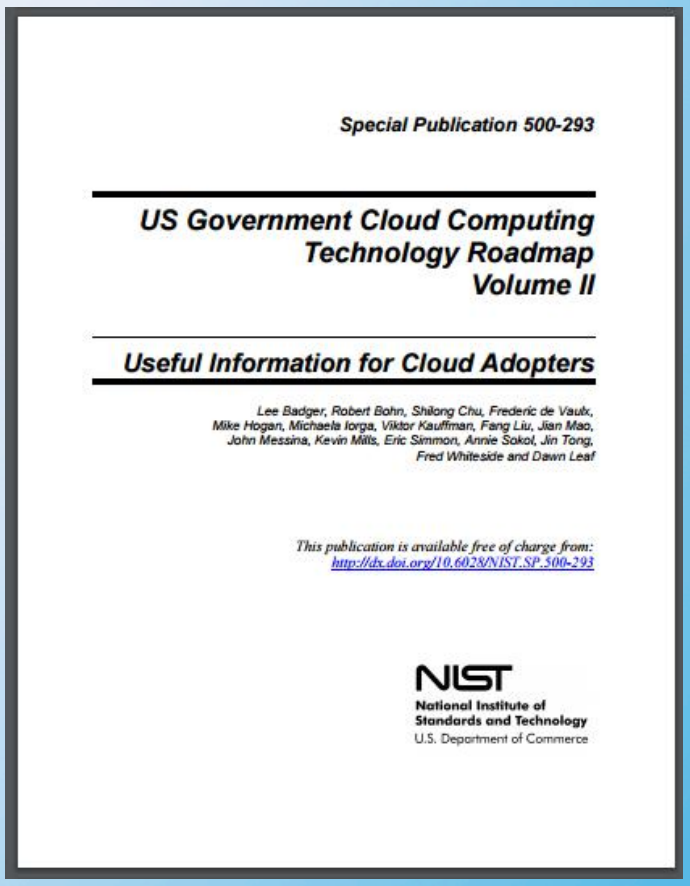
US Government Cloud Computing Technology Roadmap Volume I

High-Priority Requirements to Further USG Agency Cloud Computing Adoption

Lee Badger, David Bernstein, Robert Bohn, Frederic de Vaulx, Mike Hogan, Michaela Iorga, Jian Mao, John Messina, Kevin Mills, Eric Simmon, Annie Sokol, Jin Tong, Fred Whiteside and Dawn Leaf

This publication is available free of charge from: http://dx.doi.org/10.6028/NIST.SP.500-293

NIST
National Institute of Standards and Technology
U.S. Department of Commerce



Special Publication 500-293

US Government Cloud Computing Technology Roadmap Volume II

Useful Information for Cloud Adopters

Lee Badger, Robert Bohn, Shilong Chu, Frederic de Vaulx, Mike Hogan, Michaela Iorga, Viktor Kauffman, Fang Liu, Jian Mao, John Messina, Kevin Mills, Eric Simmon, Annie Sokol, Jin Tong, Fred Whiteside and Dawn Leaf

This publication is available free of charge from: http://dx.doi.org/10.6028/NIST.SP.500-293

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

NIST Cloud Computing Program

USG Cloud Computing Technology Roadmap Requirements (NIST SP 500-293)

1. International voluntary consensus-based standards
2. Solutions for High-priority Security Requirements, technically de-coupled 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

NIST Cloud Computing Program

The NIST Cloud Computing Program

Standards

With the International Organization for Standardization (**ISO**) and the International Electrotechnical Commission (**IEC**)

Foundational

Vocabulary & RA (17788, 17789)

Continuing

SLAs - 4 part (19086)
Interoperability/Portability (19941)
Data & Data Flow (19944)

NIST Cloud Computing Program

Reference Architectures (RA) and Vocabularies

- **NIST SP 800 – 145 (The NIST Definition of Cloud Computing)**
- **NIST SP 500 – 292 (NIST Cloud Computing Reference Architecture)**
- **ISO/IEC 17788:2014/ ITU-T Y.3500 (08/2014) (Cloud Computing Overview and Vocabulary)**
- **ISO/IEC 17789:2014/ ITU-T Y.3502 (08/2014) (Cloud Computing Reference Architecture)**

NIST Cloud Computing Program

Free copies of ISO/IEC standards are located at:
(http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html)

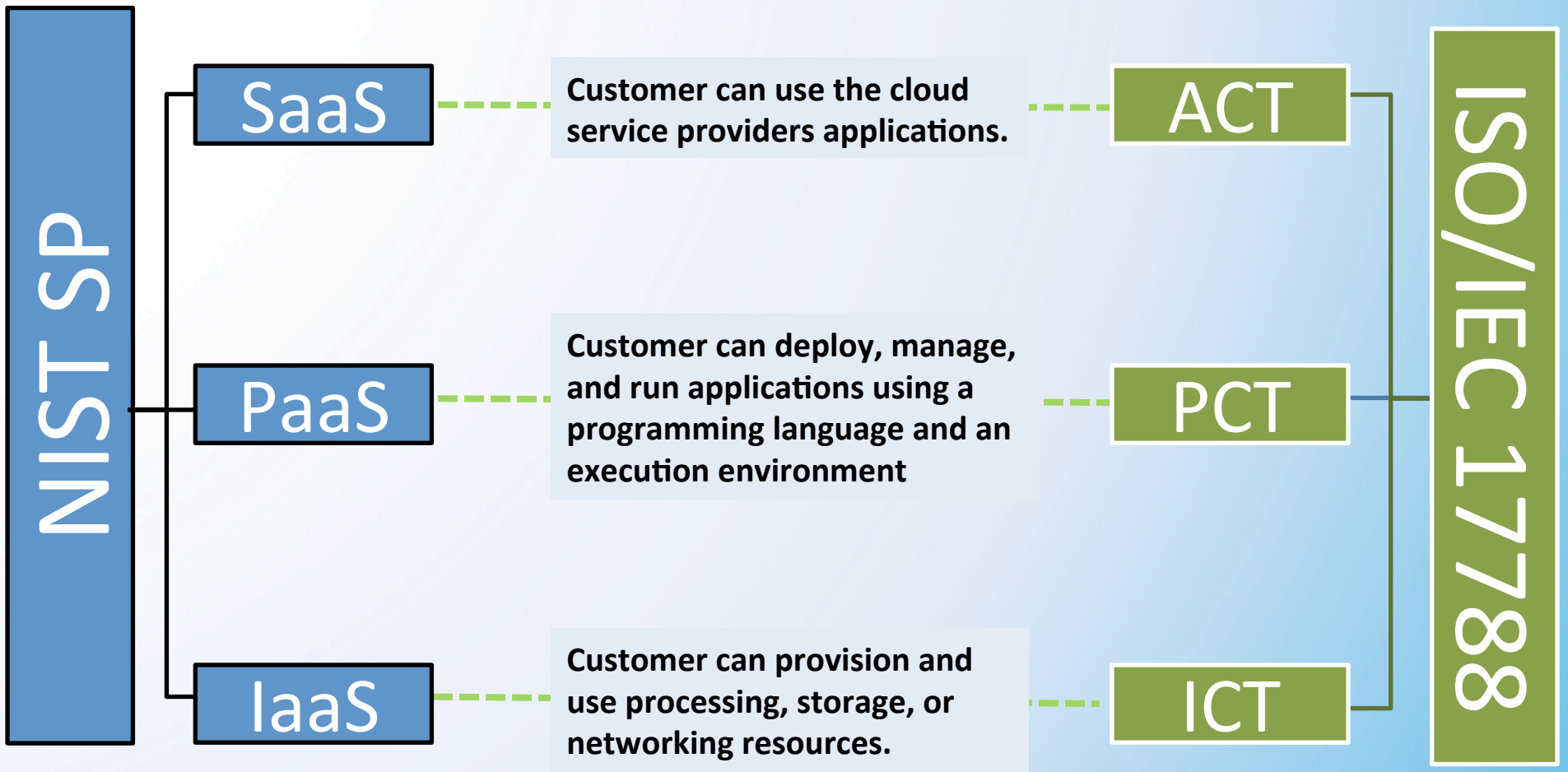
Vocabularies and Overview

The 17788/Y.3500 is largely interchangeable with the NIST documentation, but for a few caveats…

- Renaming of SaaS, PaaS, and IaaS.
- Introduction of Service Categories
- Reduction of Cloud Roles from 5 to 3.
- Expansion and addition of new terms and concepts
- New Scope of Hybrid Clouds

NIST Cloud Computing Program

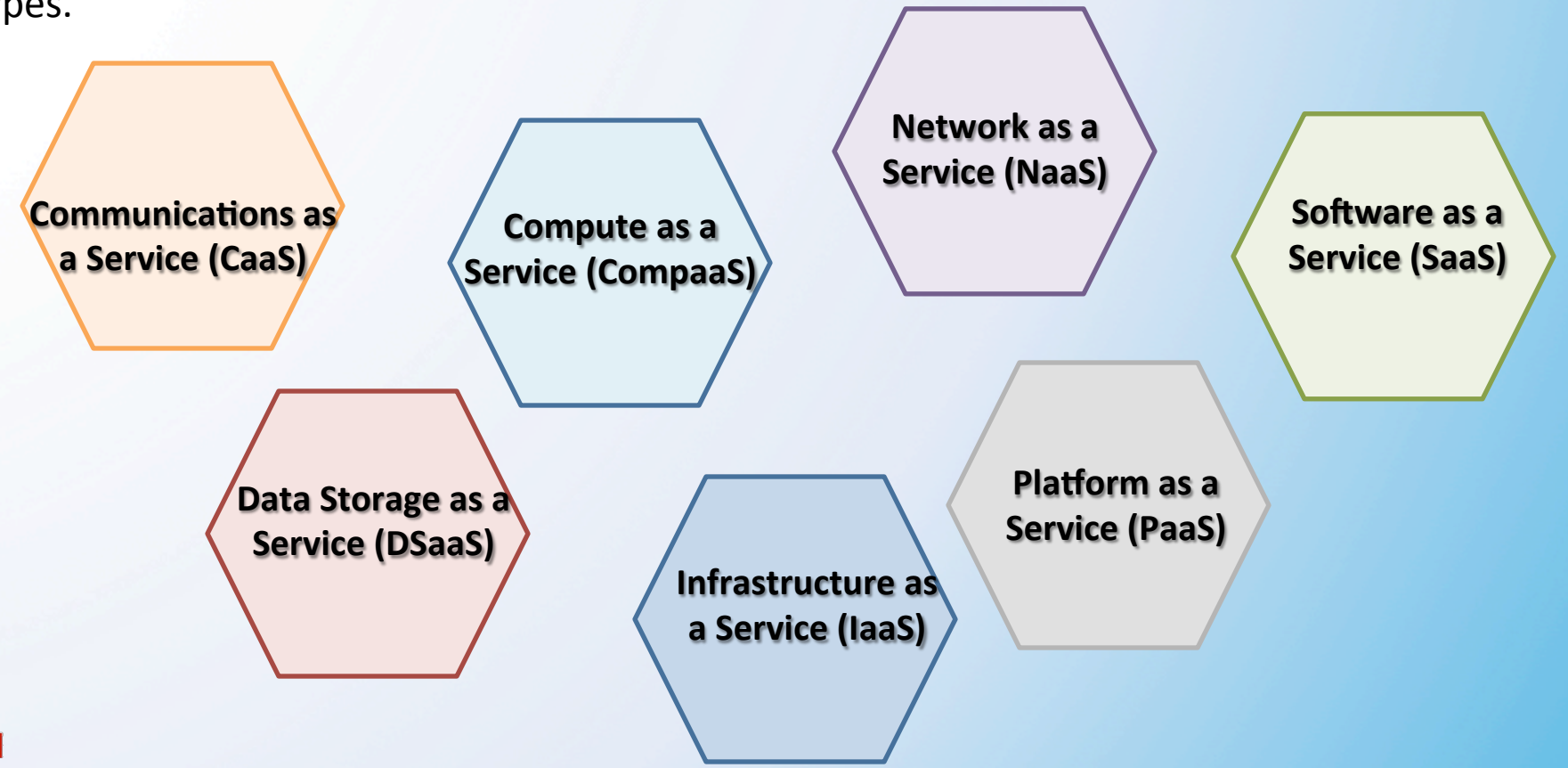
Service Models & Capability Types



NIST Cloud Computing Program

Service Models and Service Categories

A cloud service category is a group of cloud services that possess some common set of qualities. A cloud service category can include capabilities from one or more cloud capabilities types.



NIST Cloud Computing Program

Service Models and Service Categories

This table shows the relationship of the cloud service categories and cloud capabilities types

Cloud Service Categories	Cloud Capabilities Types		
	Infrastructure	Platform	Applications
Compute as a Service	X		
Communications as a Service		X	X
Data Storage as a Service	X	X	X
Infrastructure as a Service	X		
Network as a Service	X	X	X
Platform as a Service		X	
Software as a Service			X

NIST Cloud Computing Program

Cloud Key Characteristics

NIST

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

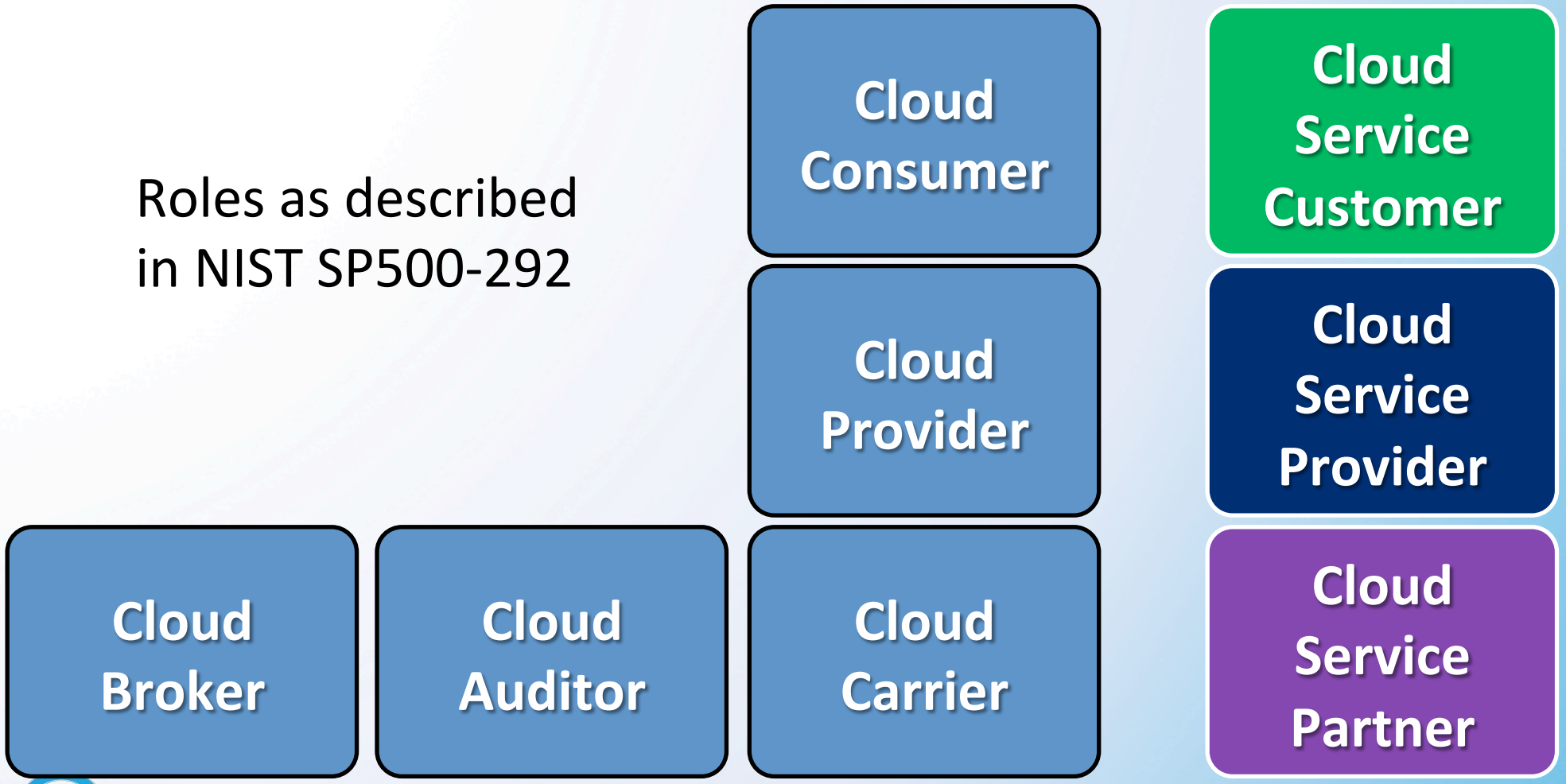
ISO 17788

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity and scalability
- Measured service
- Multi-tenancy

NIST Cloud Computing Program

Roles

Roles as described in NIST SP500-292



NIST Cloud Computing Program

Hybrid Cloud

NIST

A hybrid cloud is a composition of **two or more clouds** (on-site private, on-site community, off-site private, off-site community or public) that remain as distinct entities but are bound together by standardized or proprietary technology that enables data and application portability

ISO 17788

- Uses at least two different cloud deployment models
- Hybrid clouds represent situations where interactions between two different deployments may be needed but remained linked via appropriate technologies. As such the boundaries set by a hybrid cloud reflect its two base deployments.

NIST Cloud Computing Program

Service Level Agreement Frameworks
Current Standards Progress

- **ISO/IEC DIS 19086-1** (DIS Ballot)
  Part 1: Overview and concepts

- **ISO/IEC NP 19086-2** (Working Draft)
  Part 2: Metrics

- **ISO/IEC CD 19086-3** (Committee Draft Ballot)
  Part 3: Core conformance requirements

NIST Cloud Computing Program

DIS – Draft International Standard
NP – New Project
CD – Committee Draft

Stages of ISO Standard Development

ISO/IEC 19941: WD – Interoperability & Portability

- ***Establishes common terminology*** for use in understanding concepts of interoperability and portability to facilitate a common understanding
- ***Defines types of interoperability and portability*** in cloud computing & in cloud capabilities types: ACT, ICT, PCT
- ***Describes models for interoperability and portability***

NIST Cloud Computing Program

ISO/IEC 19944: CD Data and their flow across devices and cloud services

- ***Describes the various types of data flowing in the cloud computing ecosystem*** and the impact of connected devices on the data that flow within the cloud computing ecosystem.
- ***Extends the existing cloud computing vocabulary and reference architecture*** to describe an ecosystem involving devices consuming cloud services.
- ***Identifies the categories of data*** that flow across the cloud service customer devices and cloud services in order to help cloud service customers understand and protect the privacy and confidentiality of their data through increased transparency of policies and practices.
- ***Provides a formal scheme*** for cloud service providers to declare use statements for the various data types which are processed by their cloud services, which provide transparency concerning the handling of data.

NIST Cloud Computing Program

Future of Cloud Standards

- Dynamic Seamless integration between clouds
- InterCloud – Federated Clouds – Cloud of Clouds
- Not every CSP has every service
- Library of Cloud Services, Shared Services

NIST Cloud Computing Program

Contacts

Dr. Abdella Battou	abdella.battou@nist.gov	CC Lead/ANTD Chief
Dr. Robert Bohn	robert.bohn@nist.gov	Program Mgr
John Messina	john.messina@nist.gov	RA/Tax, Federated Cloud
Dr. Michaela Iorga	micheala.iorga@nist.gov	Security
Annie Sokol	annie.sokol@nist.gov	Interop/Port, Standards
Mike Hogan	michael.hogan@nist.gov	Standards
Eric Simmon	eric.simmon@nist.gov	Cloud Services/Standards
Frederic de Vaulx	frederic.devaulx@nist.gov	Metrics
Lisa Carnahan	lisa.carnahan@nist.gov	Conformity Assessment

NIST ITL Cloud Computing Home Page **http://www.nist.gov/itl/cloud**

NIST Cloud Metrics Collaboration Site (Twiki)
http://collaborate.nist.gov/twiki-cloud-computing /bin/view/CloudComputing/RATax_CloudMetrics

NIST Cloud Computing Program

SAVE THE DATE

Cloud Computing Forum & Workshop #9 September 13-15, 2016