IBM's Cloud Computing Reference Architecture

Contribution to The Open Group

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Agenda

- Introduction
  - SOA and Cloud
  - Using the SoA RA with the CCRA
- Cloud Computing Reference Architecture
  - Intro
  - Roles
  - Architectural Elements
  - Cloud Service Provider
Definition of cloud (NIST)

- Cloud solutions require support for
  - On-demand self-service
  - Broad network access
  - Resource pooling
  - Rapid elasticity
  - Measured Service

Didn’t we do all of this with SOA?
The SOA RA and Cloud

... We did – created solutions unique for each

... What is different about cloud?
Definition of cloud (NIST)

- Cloud solutions require support for
  - On-demand self-service
  - Broad network access
  - Resource pooling
  - Rapid elasticity
  - Measured Service

What’s different about Cloud?

Solutions for the entire cloud community

Standards
Definition of cloud (NIST)

Cloud solutions require support for

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

Which implies solution need

- Multi-tenancy
- Automated Management
- Business support – Subscription, Usage, Billing
- Dynamic provisioning
- Virtualization

Therefore, services need:

- Automated delivery of cloud service
- Automated Management of Cloud service offering
- Business support – Subscription, Usage, Billing of cloud service and offering
- Virtualization of resources to support the cloud service
- Cloud service instances as the unit of delivery
Cloud Architecture and Service Oriented Architecture Differentiation

- Cloud Architecture is Service oriented
- Cloud Architectures are instances of Service Oriented Architectures (SOA)
  - Some architectural decisions have been made
  - More concrete on our continuum
- A Cloud Solution (adhering to the Cloud Architecture) is a SOA Solution
- All Cloud services are SOA services
  - BUT NOT all SOA services are also Cloud services
- SOA is the meta model for Cloud Architecture
Using the SOA RA with the CCRA
The Cloud Computing Reference Architecture

Cloud Service
Consumer

Cloud Service
Provider

Cloud Services

Existing & 3rd party services, Partner Ecosystems

Business-Process-as-a-Service

Software-as-a-Service

Platform-as-a-Service

Infrastructure-as-a-Service

Common Cloud Management Platform (CCMP)

Operational Support Services (OSS)

Business Support Services (BSS)

Infrastructure

Security, Resiliency, Performance & Consumability

Governance

Cloud Service
Creator

Cloud Service
Integration
Tools

Consumer
In-house IT

Service
Creation
Tools

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Cloud Service Creator – Service Development Tools

Cloud Service Consumer
- Cloud Service Integration Tools
- Consumer In-house IT

Cloud Service Provider
- Cloud Services
  - Existing & 3rd party services, Partner Ecosystems
  - Business-Process-as-a-Service
  - Software-as-a-Service
  - Platform-as-a-Service
  - Infrastructure-as-a-Service
- Common Cloud Management Platform (CCMP)
  - Operational Support Services (OSS)
  - Business Support Services (BSS)

Cloud Service Creator
- Service Creation Tools
  - Service Management Development Tools
  - Service Runtime Development Tools
  - Software Development Tools
  - Image Creation Tools

Governance
- Security, Resiliency, Performance & Consumability
Cloud Services Consumer

Cloud Services Consumer

Cloud Service Consumer

Cloud Service Provider

Cloud Services

Common Cloud Management Platform (CCMP)

Operational Support Services (OSS)

Business Support Services (BSS)

Existing & 3rd party services, Partner Ecosystems

Business-Process-as-a-Service

Software-as-a-Service

Platform-as-a-Service

Infrastructure-as-a-Service

Consumer End user

Cloud Service Integration Tools

Service Integrator

Consumer Business Manager

Existing & 3rd party services, Partner Ecosystems

Business-Process-as-a-Service

Software-as-a-Service

Platform-as-a-Service

Infrastructure-as-a-Service

Infrastructure

Security, Resiliency, Performance & Governance

Governance

Service Creation Tools

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Cloud Service Provider - Services

Cloud Services

- Infrastructure-as-a-Service
- Platform-as-a-Service
- Software-as-a-Service
- Business-Process-as-a-Service

Existing & 3rd party services, Partner Ecosystems

Common Cloud Management Platform (CCMP)

- Operational Support Services (OSS)
- Business Support Services (BSS)

In-house IT

Cloud Service Integration Tools

Consumer

Service Creation Tools

Cloud Service Provider

Security, Resiliency, Performance & Consumability

Governance

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Cloud Service Provider - Infrastructure

Cloud Services
- Existing & 3rd party services, Partner Ecosystems
- Business-Process-as-a-Service
- Software-as-a-Service
- Platform-as-a-Service
- Infrastructure-as-a-Service

Common Cloud Management Platform
- Operational Support Services (OSS)
- Business Support Services (BSS)

Infrastructure
- Server
  - Processor
  - Memory
  - Nodes
- Storage
  - Drives
  - Ephemeral
  - Persistent
- Network
  - Internal
  - External
  - Inter-site
- Facilities
  - Location
  - Power

Security, Resiliency, Performance & Consumability

Governance
Cloud Service Provider – Security, Resiliency, Performance, & Consumability

Cloud Services
- Existing & 3rd party services, Partner Ecosystems
- Business-Process-as-a-Service
- Software-as-a-Service
- Platform-as-a-Service
- Infrastructure-as-a-Service

Common Cloud Management Platform
- Operational Support Services (OSS)
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Security
- Security Event Management
- Security Policy
- Threat & Vulnerability Management
- Software, System & Service Assurance
- Access & Identity Lifecycle Management
- Data and Information Protection
- Governance
- Security Entitlement
- Data policy enforcement

Resiliency
- Data Resiliency
- Resiliency Compliance Assessment
- Configuration for Resiliency
- Resiliency Policy Management
- Resiliency Monitoring/Analysis
- Availability & Continuity Management

Consumability
- Ease of Doing Business
- Positive First Use Experience
- Readily Adapts
- Simplified Operations
- Rapidly Integrates

Governance

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References


Barroso A., Hölzle U., The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines

Amazon, AWS and EC2 resources

Google App Engine articles


IBM GTW world-wide CoP lecture series (contact: Teisha Harry)

National Institute of Standards and Technologies; Draft NIST Working Definition of Cloud Computing, May 14, 2009
Cloud Computing Reference Architecture (CC RA) – Overall drill-down
From SOA to Cloud Architecture

SOA Reference Architecture

SOA Reference Architecture Service Categories

Cloud specifics
- Problem domain constrained to “service delivery & consumption”
- Ecosystem Aspects (Consumer, Provider, Creator)
- Mgmt & delivery
- I/P/S/BPaaS
- Virtualization
- Engineering of infrastructure

Add cloud specific characteristics according to NIST
- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured Service

Cloud Reference Architecture
CCRA V1 rearranged into the SOA RA Diagram