Introducing the Cloud

Chapter 1

01.01 Defining the Cloud

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Definition

- The NIST definition of cloud computing:

  Cloud computing is a model for enabling ***ubiquitous***, ***convenient***, ***on-demand*** network access to ***shared pools*** of configurable ***computing resources*** that can be ***rapidly provisioned*** and released with ***minimal management effort*** or service provider interaction.

Ubiquitous

- Available anywhere…
  - …there is an Internet connection

Convenient

- No server room required
- No power provisioning required
- No hardware installation required
- Sometimes, no software installation required

On-Demand

- Available when required
- Scheduled availability
- Created in minutes – not hours or days

Shared Pool

- Multi-tenant
  - More than one entity using a shared server
- Automatic prioritization

Computing Resources

- Processing
- Memory
- Storage
- Networking
- Special hardware

Rapidly Provisioned

- Cloud provisioning is simplified through:
  - Single-click launch
  - Template-based launch
  - Solution-based launch

Minimal Management

- Automatic updates/patch management
- Integrated monitoring and reporting
- Automatic scaling
- Scheduled availability

01.02 Deployment Models

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Cloud Deployment Models

- Deployed by:
  - Others (public/community)
  - Self (private)
  - Both (hybrid)

Selecting a Deployment Model

- Constraints and requirements drive selection
  - Examples:
    - Business policies
    - Functional (tasks)
    - Security (compliance)

01.03 Public Cloud (Demo)

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Public Cloud

- Used by public consumers
- Pay-as-you-go/pay-as-you-grow
- Examples
  - Microsoft Azure
  - Amazon AWS
  - Google Cloud Platform (GCP)

01.04 Private Cloud Demo

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Private Cloud

- Implemented in-house
  - Hardware and software
  - Everything managed in-house
  - Behind a firewall
  - Possibly in a DMZ
- Based on virtualization
  - Virtual machines to rapidly deploy servers as needed
- Need extra physical hardware
  - Rapid deployment
  - Storage space
  - Compute
  - Services

DEMO

- OpenStack
- Cloudify

01.05 Community Cloud Demo

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Community Cloud

- Built for specific groups
  - Healthcare
  - Science
  - Education
  - Systems management (partner cloud)
- Sometimes blurred with simple SaaS solutions

DEMO

- coconstruct.com – SaaS/Community Cloud
- Penta.com – SaaS/Community Cloud

01.06 Hybrid Cloud Demo

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Hybrid Cloud

- Mixture of public and private cloud solutions
  - Data in the private cloud, processing in the public cloud
  - Processing in the private cloud, data in the public cloud
- Applications/APIs used to integrate the two

Hybrid Cloud

- Driving factors
  - Cost
  - Data
  - Security
- Hybrid cloud solution
  - Using applications in the cloud to create data stored in a private cloud

01.07 Additional Models

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Single Server

- A private cloud run by a single powerful server
- A single physical server in the cloud
- A single virtual server in the cloud

Single Cloud

- One cloud provides all services
- Small and medium businesses
- Partial security constraints are not in place

Multi-Cloud

- Multiple clouds
  - Services
  - Departments
  - Divisions/companies
  - Security constraints
- Orchestration platforms help manage multi-cloud deployments

01.08 Cloud Architectures

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Cloud Architectures

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)
- Everything as a Service (XaaS)

SaaS

- Software as a Service
  - Provides the software in the cloud
    - Google apps
    - Adobe cloud
    - Microsoft Office 365
    - Salesforce automation
    - Inventory management
    - Project management
  - May be API as a Service (AaaS)

PaaS

- Platform as a Service
  - Simple implementation of platforms
  - Runtimes, modules, components
  - Easy application deployment
  - Often used by developers and programmers

IaaS

- Infrastructure as a Service
  - Complete solution from hardware up
  - VMs and operating systems
  - Network configuration
  - Network services
  - Ex: AWS, Azure, Google Cloud Platform

XaaS

- Everything as a Service
  - Networking
  - Analytics
  - Artificial intelligence
  - Device management
  - Data extract, transform, load (ETL) operations
  - Ex: DBaaS (Database as a Service), WSaaS (Web Server as a Service)

01.09 Capacity, Elasticity, and Support Agreements

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Capacity

- The workload capability of a system
  - Storage
    - Amount
    - Speed of read/write for I/O operation concurrency
      - IOPS – input/output operations per second
  - Networking
    - Speed of transfer/number of users
  - Processing
    - Speed of workload processing

Elasticity

- The ability to expand and contract as required
  - CPU resources
  - Storage
  - Servers
  - Threads/requests

Service Model Maintenance

- Metering mused to measure cloud resource consumption
- Chargeback can be made to departments other than IT
  - Each department is charged for their IT resources
- Pay-as-you-grow
  - Allows for low cost of entry

Service Model Maintenance

- Demand-driven service
  - Service to be provisioned based on current demand

Service Model Maintenance

- Responsibility
  - You manage what you put in the cloud
  - Cloud provider manages the cloud itself
  - Support agreements
    - SLAs
    - Response time
    - Service contact methods

01.10 Resource Balancing

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Resource Balancing

- Provides for the resources required at optimal cost
- Several techniques can be used
  - On-demand provisioning
  - Auto-scaling
  - Hybrid clouds
  - Serverless processing

Ideal Resources for the Cloud

- Public resources
  - Ex: your website
- Private scale resources
- Resources used for distributed work
  - Local access to resources across regions
- Anything requiring central processing

Poor Resources for the Cloud

- Anything requiring offline access
  - Possible solution: synchronize with the cloud
- Some security-related resources
  - Cloud provider might not be able to adhere to strict security requirements
- Low-latency demand resources
  - Edge processing may be better

01.11 Change Management

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Change Management Components

- Advisory board
  - Usually an expert approves/rejects changes
- Approval process
  - When should something go through official approval process?
- Documentation
  - Change Management Database (CMDB)
  - Spreadsheet

Change Approval Process

- Submit a change request
  - Description
  - Positive reason for the change
  - Possible negative consequences
- Change reviewed by advisory board
- Approval/rejection
  - Implement or alter