



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.



<u>Ubiquitous</u>

- 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

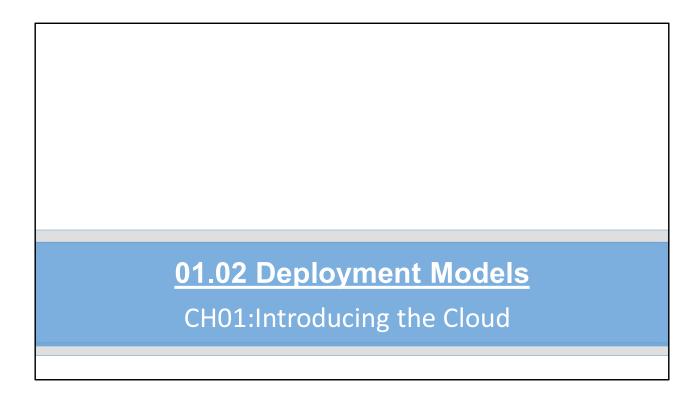
- Cloud provisioning is simplified through:
 - Single-click launch
 - Template-based launch
 - Solution-based launch



Minimal Management

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







Cloud Deployment Models

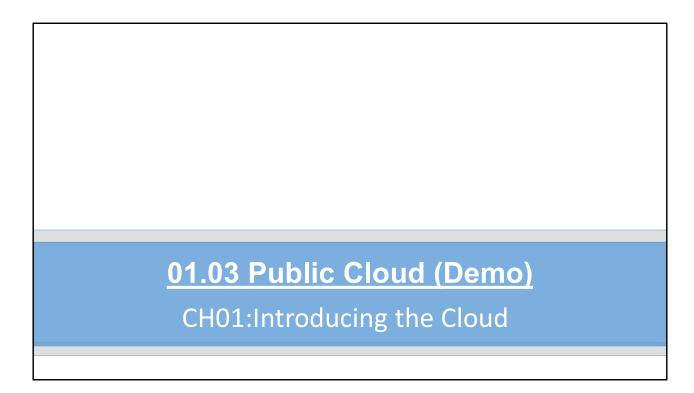
- •Deployed by:
 - Others (public/community)
 - Self (private)
 - Both (hybrid)



Selecting a Deployment Model

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



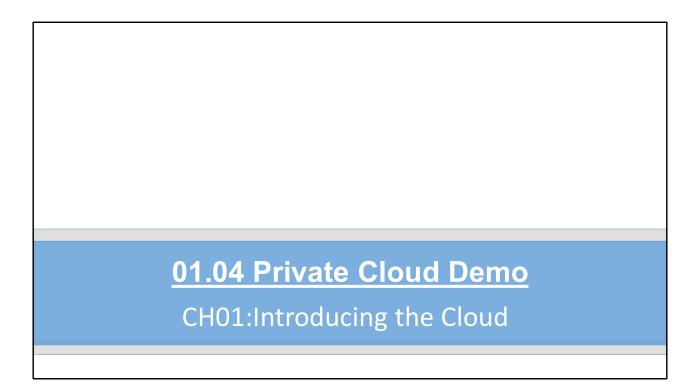




Public Cloud

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







Private Cloud

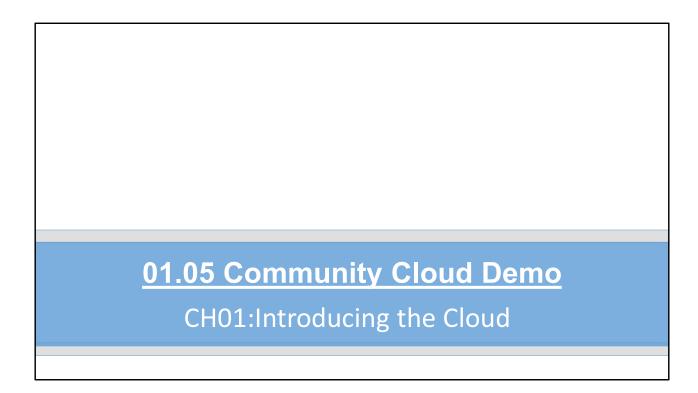
- Implemented in-house
 - Hardware and software
 - Everything managed in-house
 - Behind a firewall
 - Possibly in a DMZ
- Based on virtualization
 - Virtual machines to rapidly deploy servers as needed
- Need extra physical hardware
 - Rapid deployment
 - Storage space
 - Compute
 - Services



<u>DEMO</u>

- OpenStack
- Cloudify







Community Cloud

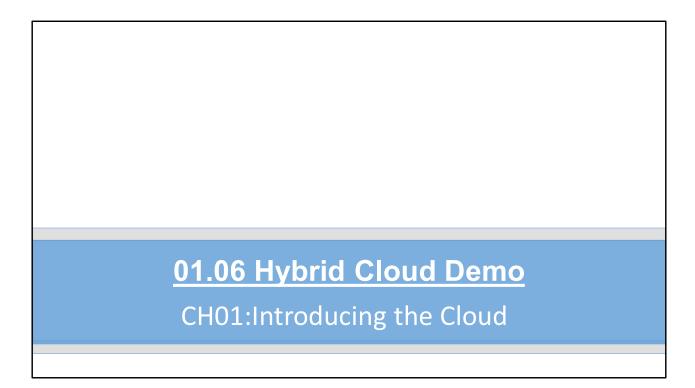
- Built for specific groups
 - Healthcare
 - Science
 - Education
 - Systems management (partner cloud)
- Sometimes blurred with simple SaaS solutions



<u>DEMO</u>

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







Hybrid Cloud

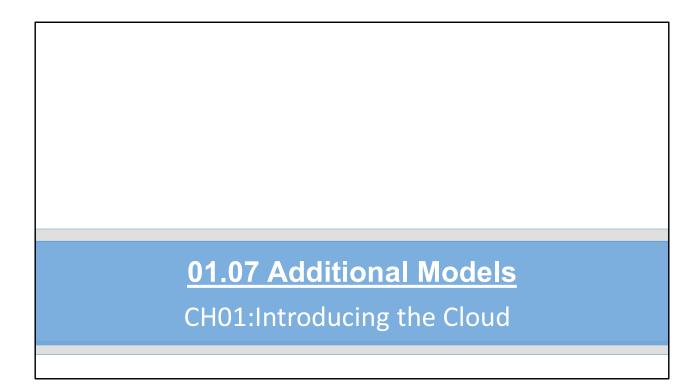
- Mixture of public and private cloud solutions
 - Data in the private cloud, processing in the public cloud
 - Processing in the private cloud, data in the public cloud
- Applications/APIs used to integrate the two



Hybrid Cloud

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







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

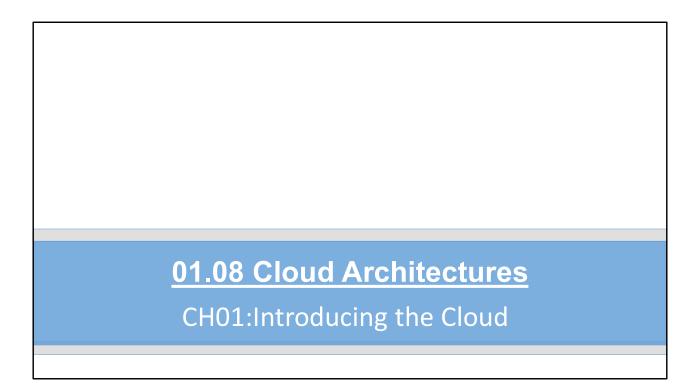
- One cloud provides all services
- •Small and medium businesses
- Partial security constraints are not in place



Multi-Cloud

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







Cloud Architectures

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (laaS)
- 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)



<u>PaaS</u>

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



<u>laaS</u>

- •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
CH01:Introducing the Cloud



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

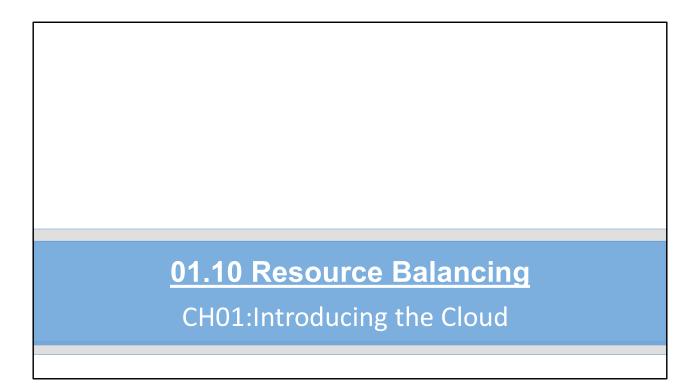
- Demand-driven service
 - Service to be provisioned based on current demand



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







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

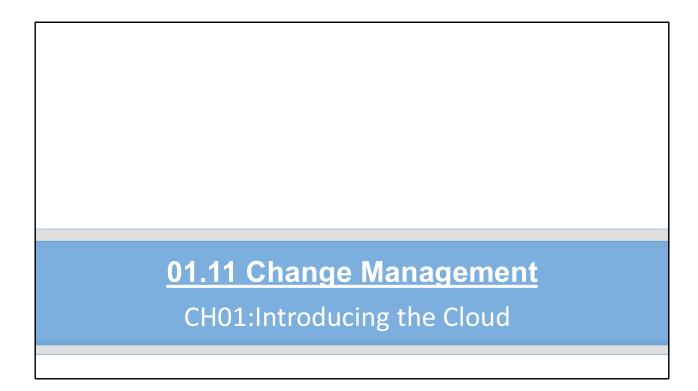
- Public resources
 - Ex: your website
- Private scale resources
- Resources used for distributed work
 - Local access to resources across regions
- Anything requiring central processing



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







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

