

Cloud Computing Overview

COMP3207/COMP6244

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What is Cloud Computing?

- A marketing term?
- A technical term?
- A different way to deliver computing resources
 - Not a new technology itself
 - Builds on some existing technologies
- Computing as a utility, like electricity or water
 - Available on demand
 - Pay for what you use

What is Cloud Computing?

Cloud is:

- A new consumption and delivery model inspired by consumer Internet services
- End-user focused

Cloud enables:

- Self-service
- Sourcing options
- Economies of scale

Cloud represents:

- The industrialization of delivery for IT-supported services

Multiple clouds coexist:

- Private, public and hybrid
- Workload or programming model-specific

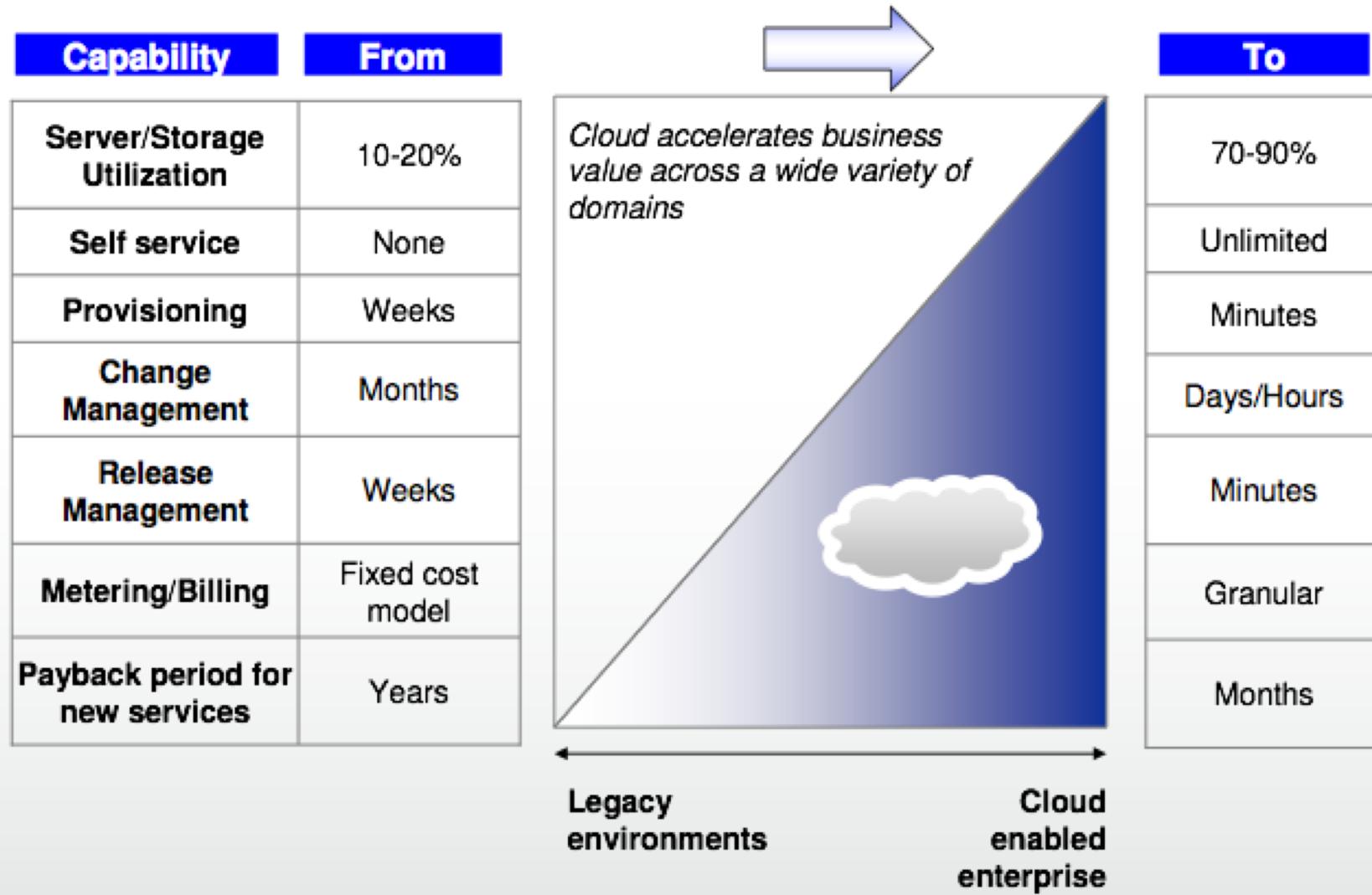


Cloud is essentially an IT consumption and delivery model that is optimized by workload

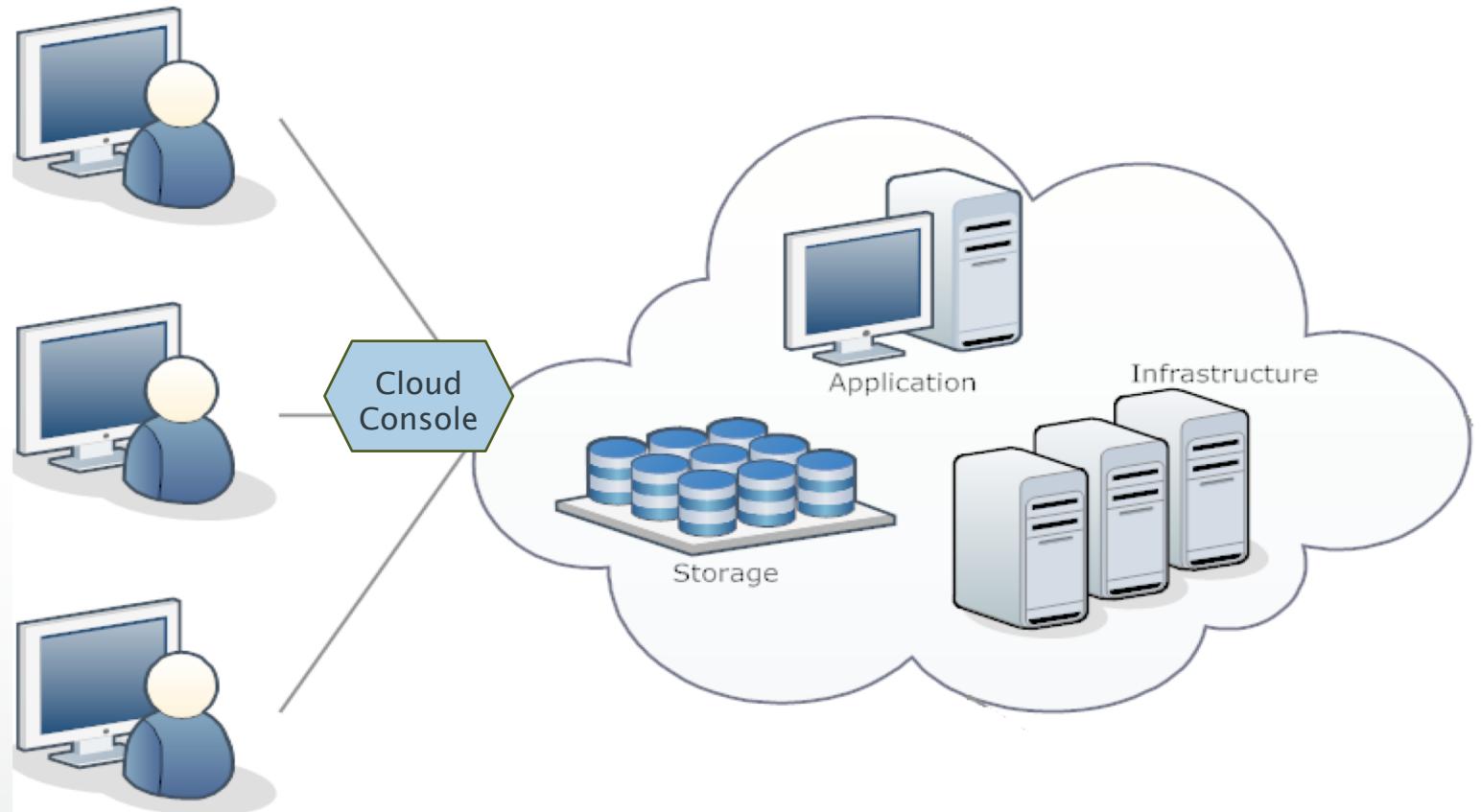
Built on Existing Technologies

- Consolidation and virtualization
- Service-oriented architectures
- Service management automation
- Usage tracking and billing
- Web 2.0
- What's new?
 - Focus on self-service and self-management using these services
 - Using these technologies together, to create a cloud environment

Traditional Hosting vs Cloud Environment



Cloud Users and Cloud Providers



Cloud Users

Cloud Provider

What does a cloud user need?

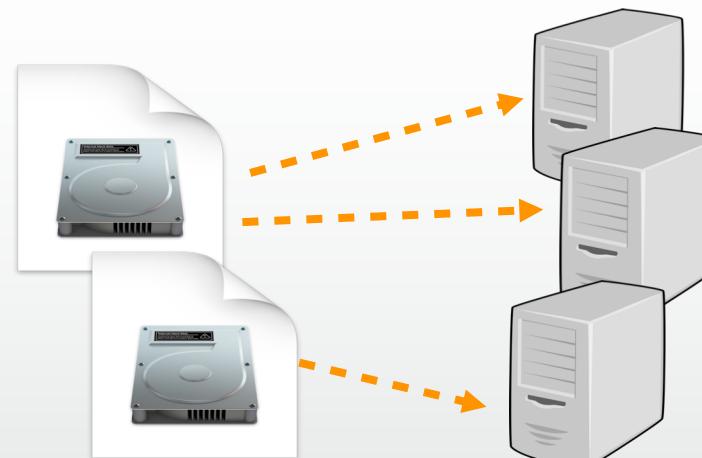
- Scenario - I want to deploy an online auction application
 - Consisting of web front-end, a business logic layer and a database
- What do I want from the cloud?
 - Image: The template from which I will create my server instances
 - Instances: The running machines

What Does a Cloud User Need?

- Scenario - I want to deploy an online auction application
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Images

- Disk image of the machine to be run
- A template for the instances



Instances

- Running machines based on the image
- Virtual Machines
- Processor, memory, network addresses, local storage allocated to them

How Big Are my Instances?

- I want an instance that is only as big as I need (so I don't pay too much)
- Choose from a set of machine sizes



Small

1 GB memory
1 CPU
100 GB instance storage
32-bit platform



Medium

4 GB memory
2 CPU
200 GB instance storage
64-bit platform



Large

8 GB memory
4 CPU
400 GB instance storage
64-bit platform

Instances and Persistent Storage

- What happens when an instance is terminated?
 - All its local storage is removed = ephemeral storage
- For databases, we want persistent storage
 - Data can be shared across instances
 - Data will persist across reboots and restarts of an instance

Instances and Persistent Storage

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Instance Storage

When instance is
terminated, data will be lost



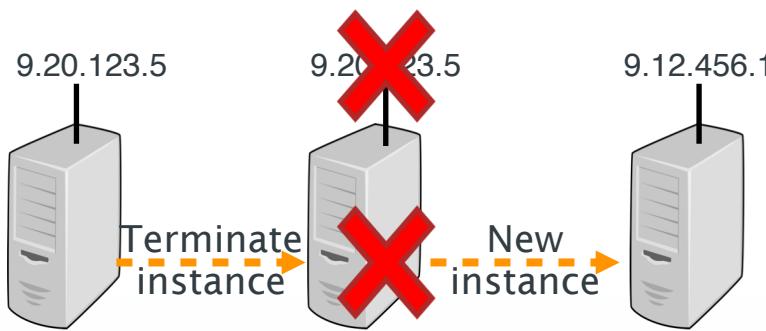
Volume Storage

Volume attached to running instance
When instance is terminated, data
remains on separate volume

Networking

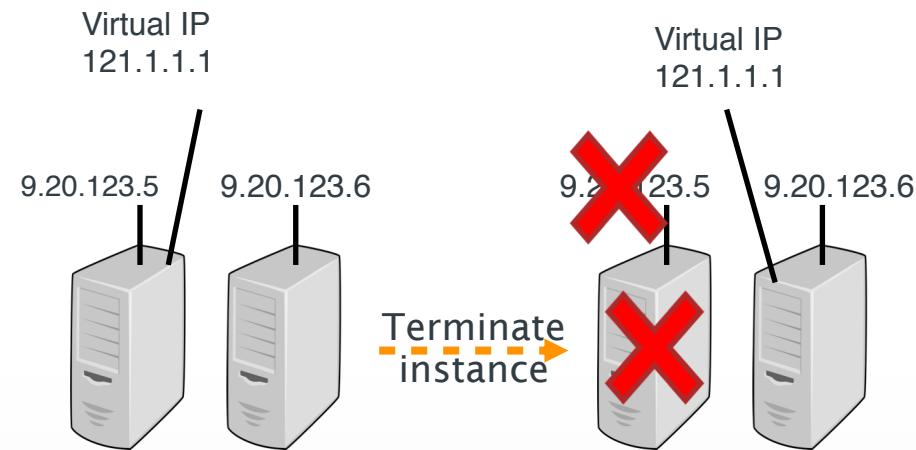
- I want a static IP address which will be my presence on the internet – Associate this IP address with my domain (DNS)
 - But an Instance IP address will only last as long as the instance
- Virtual IP address can be attached to an instance
 - e.g. Elastic IP Address in Amazon EC2, Global IP Address in SoftLayer, Heroku Router

Networking – How it Works



Instance IP Address

When instance is terminated, the IP address ceases to exist

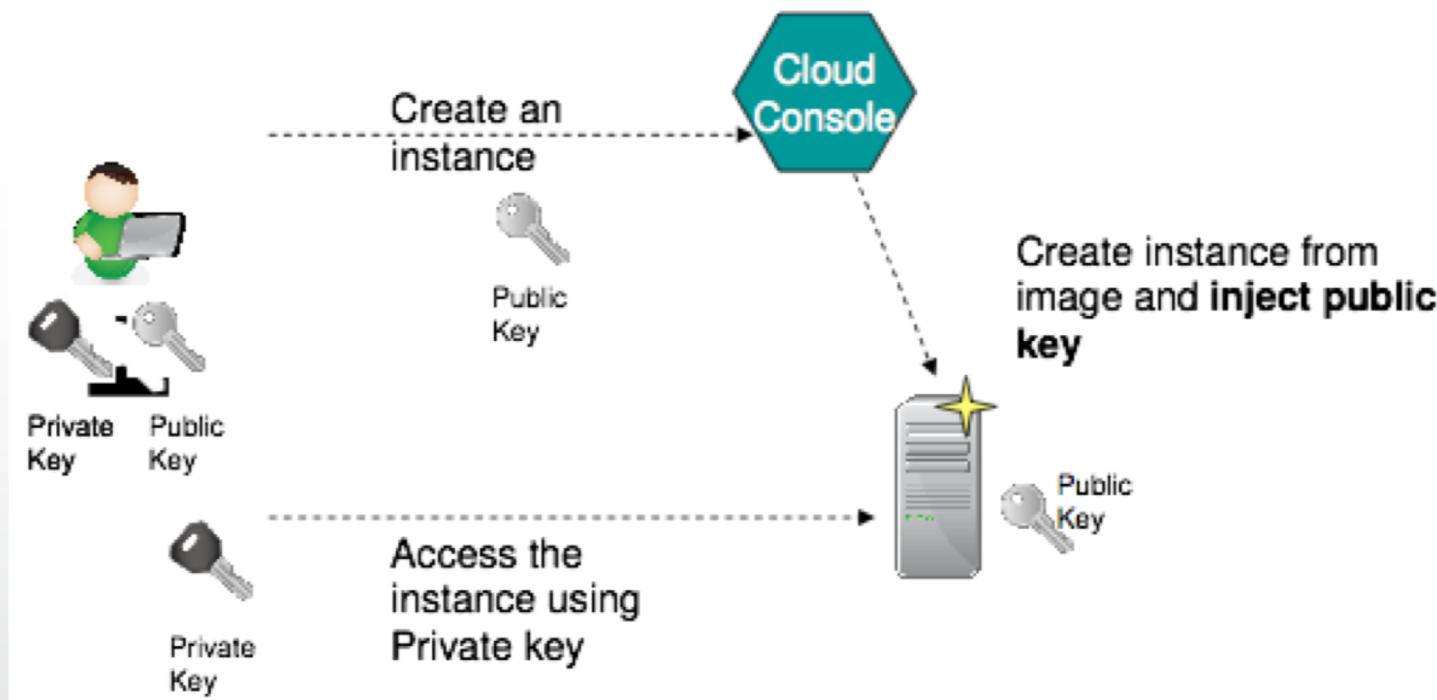


Virtual IP Address

Can be attached to an instance while it is running
Attach to another instance after failure

Security and Credentials

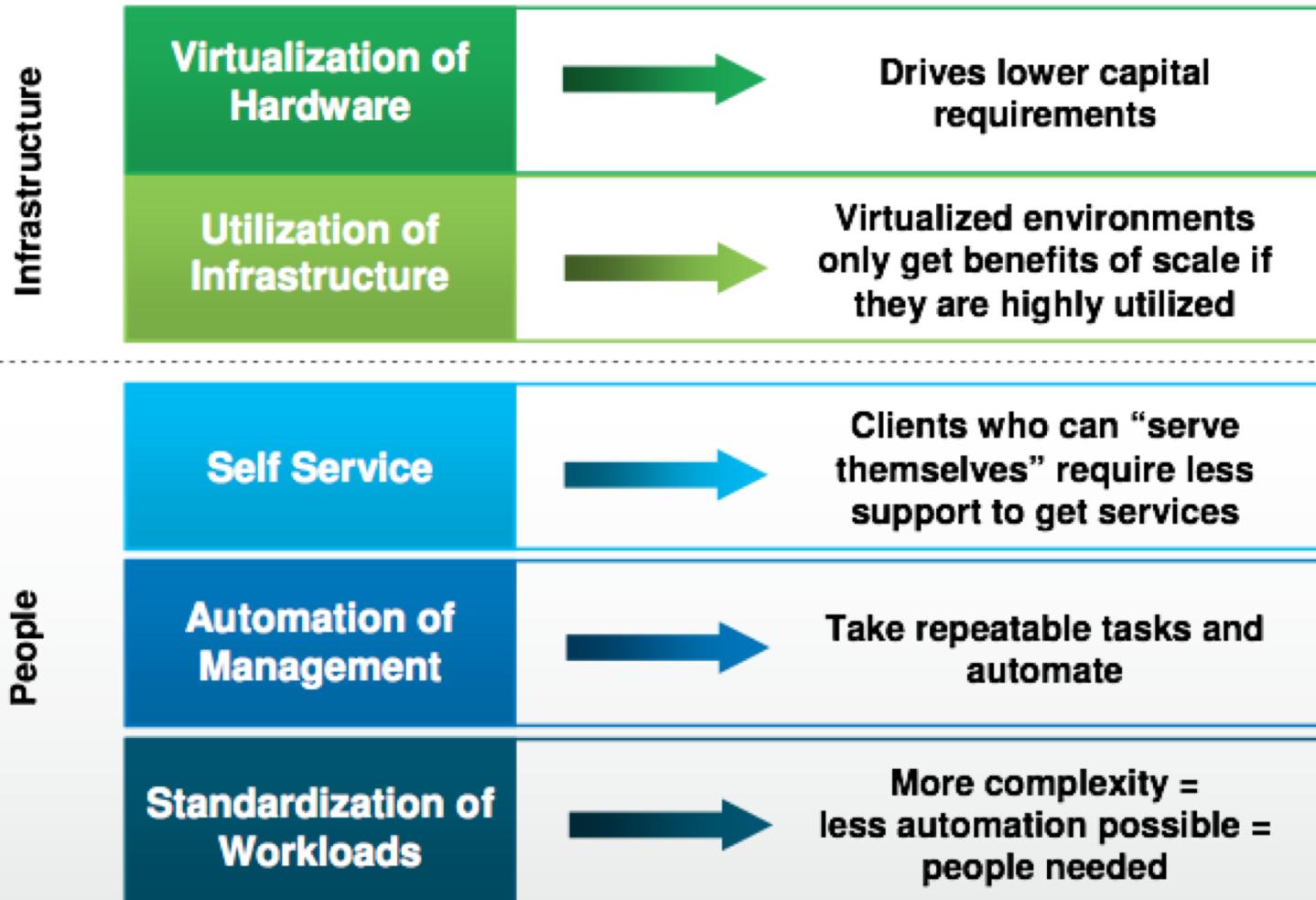
- Only I should be able to log into my instances
 - Create the instance with my own credentials
 - When the instance is created from the image the credentials are registered



The Cloud Provider Responsibilities

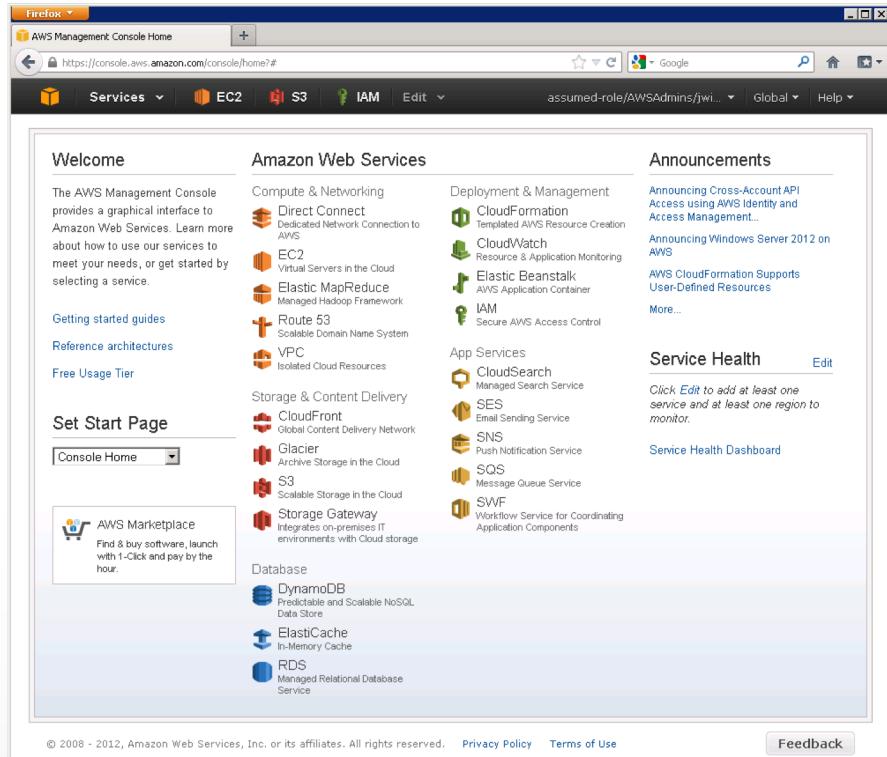
- A Cloud Provider needs to
 - Enable self service access
 - Manage the infrastructure on which the cloud will run
- The cloud must be architected to meet the key requirements such as:
 - Virtualization,
 - Automation,
 - Standardization
 - and service management

The Cloud Provider Responsibilities



Self-service Interfaces

- Cloud Console
 - Amazon: AWS console
 - Softlayer: Customer Portal
- Programmable APIs
 - E.g. web service APIs
- Capabilities
 - Cloud functions
 - Create images, create and terminate instances, create and destroy volumes, attach volumes to instances, etc...
 - User functions
 - Create users, manage accounts, manage credentials



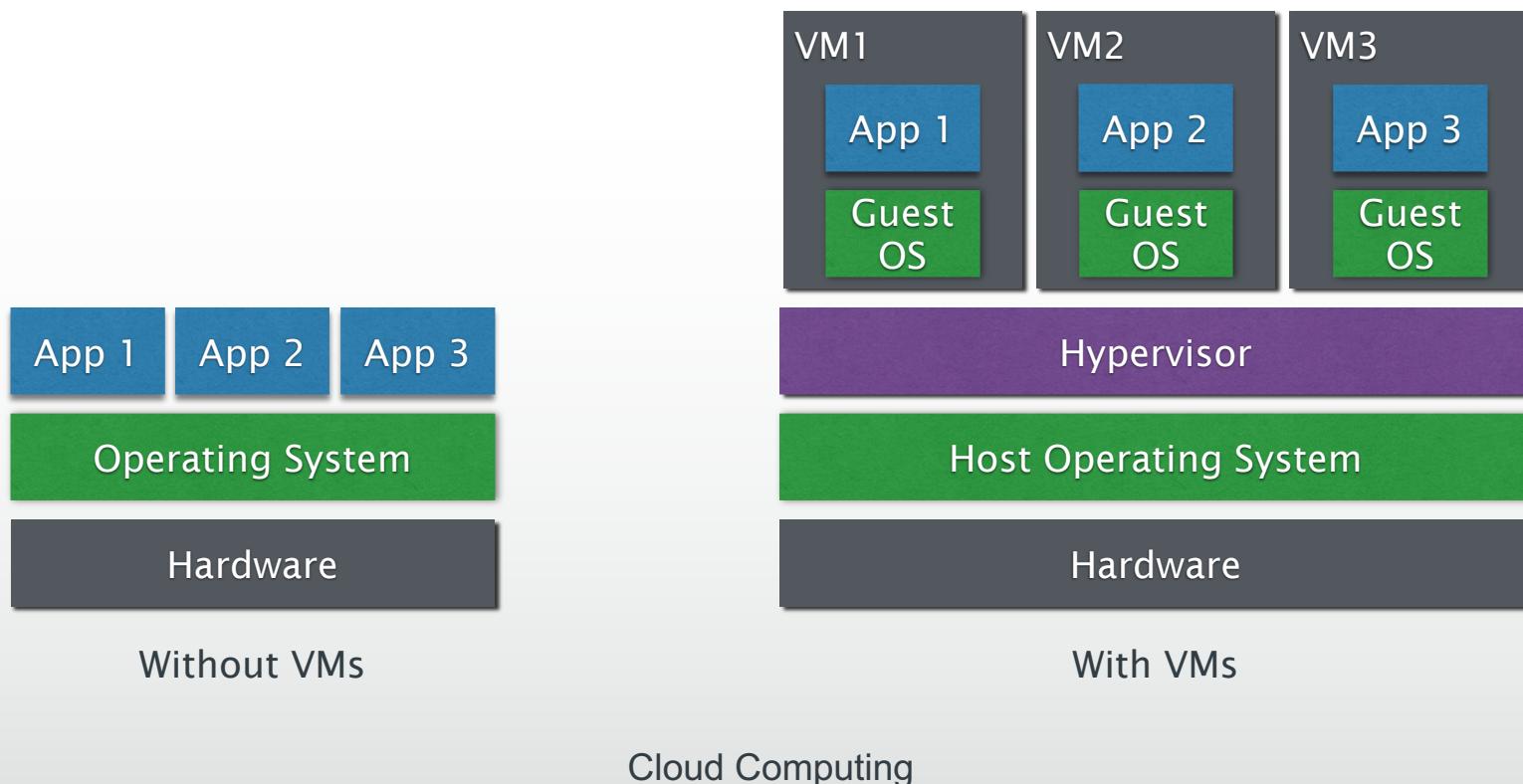
Managing Infrastructure

- Manage the data centres making up the cloud
- Hardware virtualisation is key to:
 - Efficiency savings
 - Flexibility



Hardware Virtualization

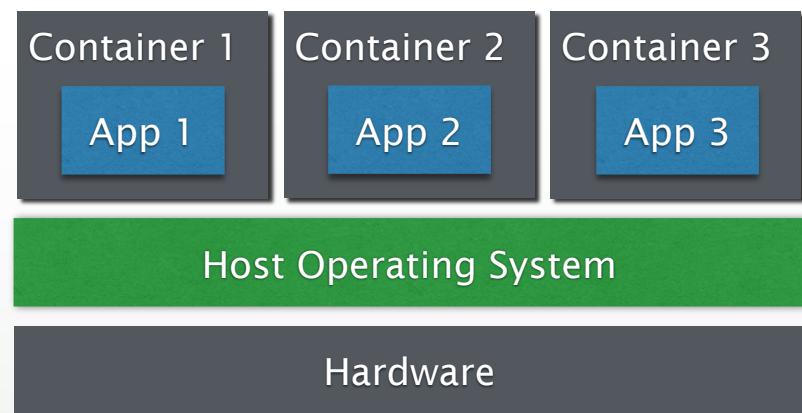
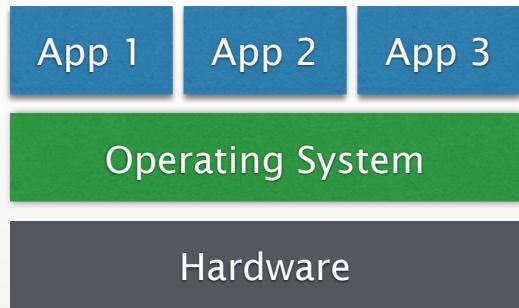
- Create a virtual resource from a physical resource
 - More efficiently use the physical resource
 - Isolate the applications



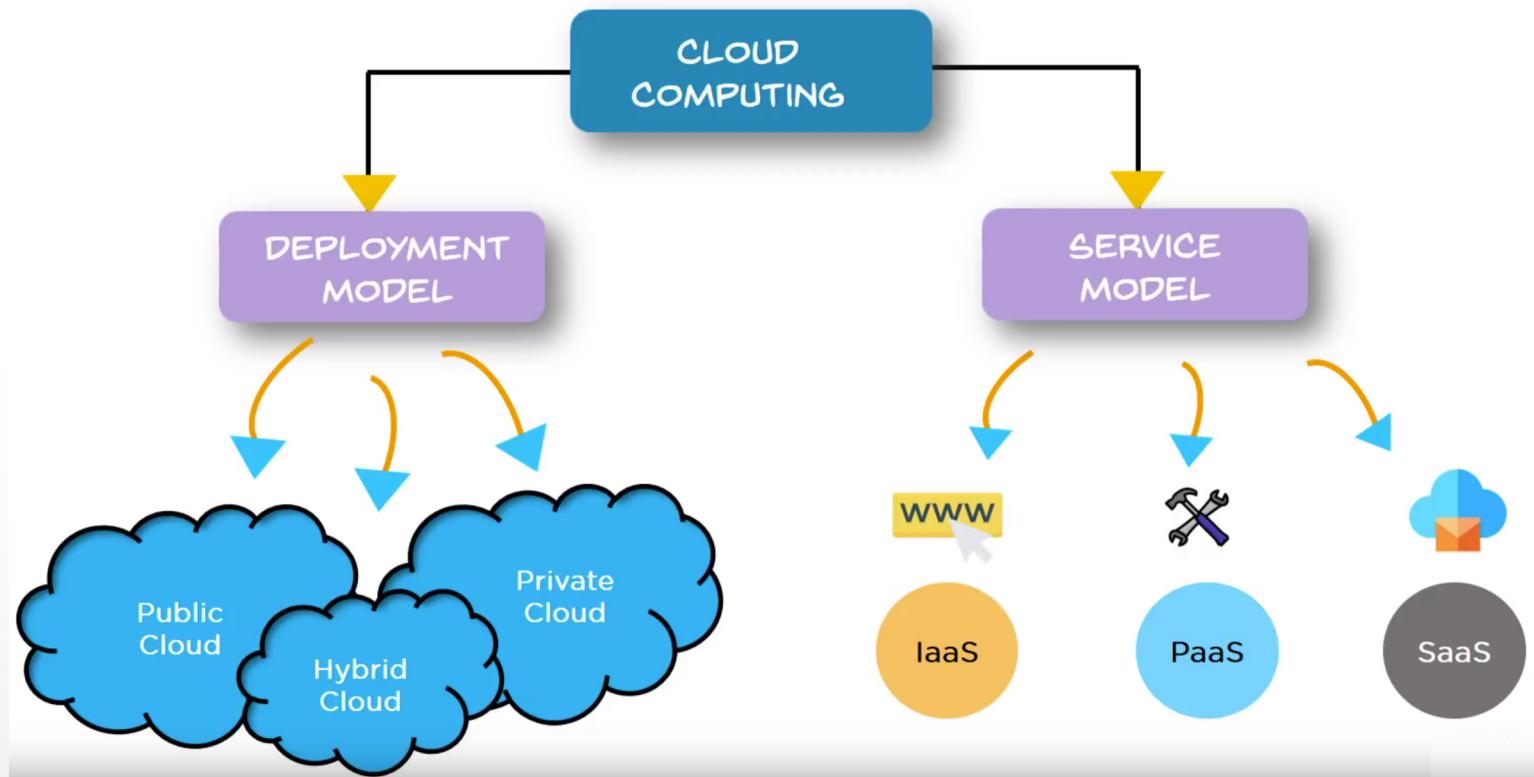
OS-Level Virtualization

- Create a virtual resource from a physical resource
 - More efficiently use the physical resource
 - Isolate the applications

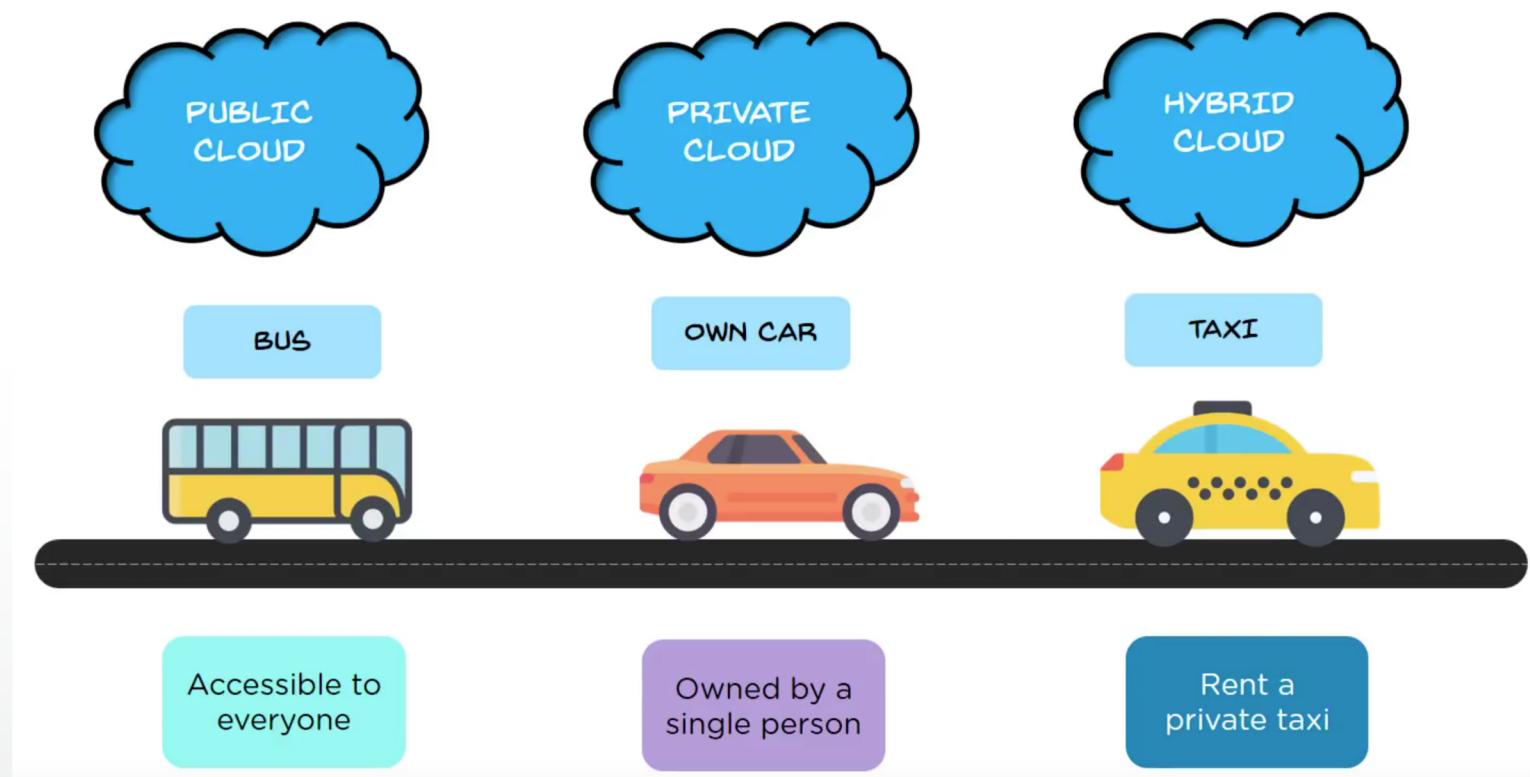
aka “containerisation” or “jails”



Types of Cloud Computing



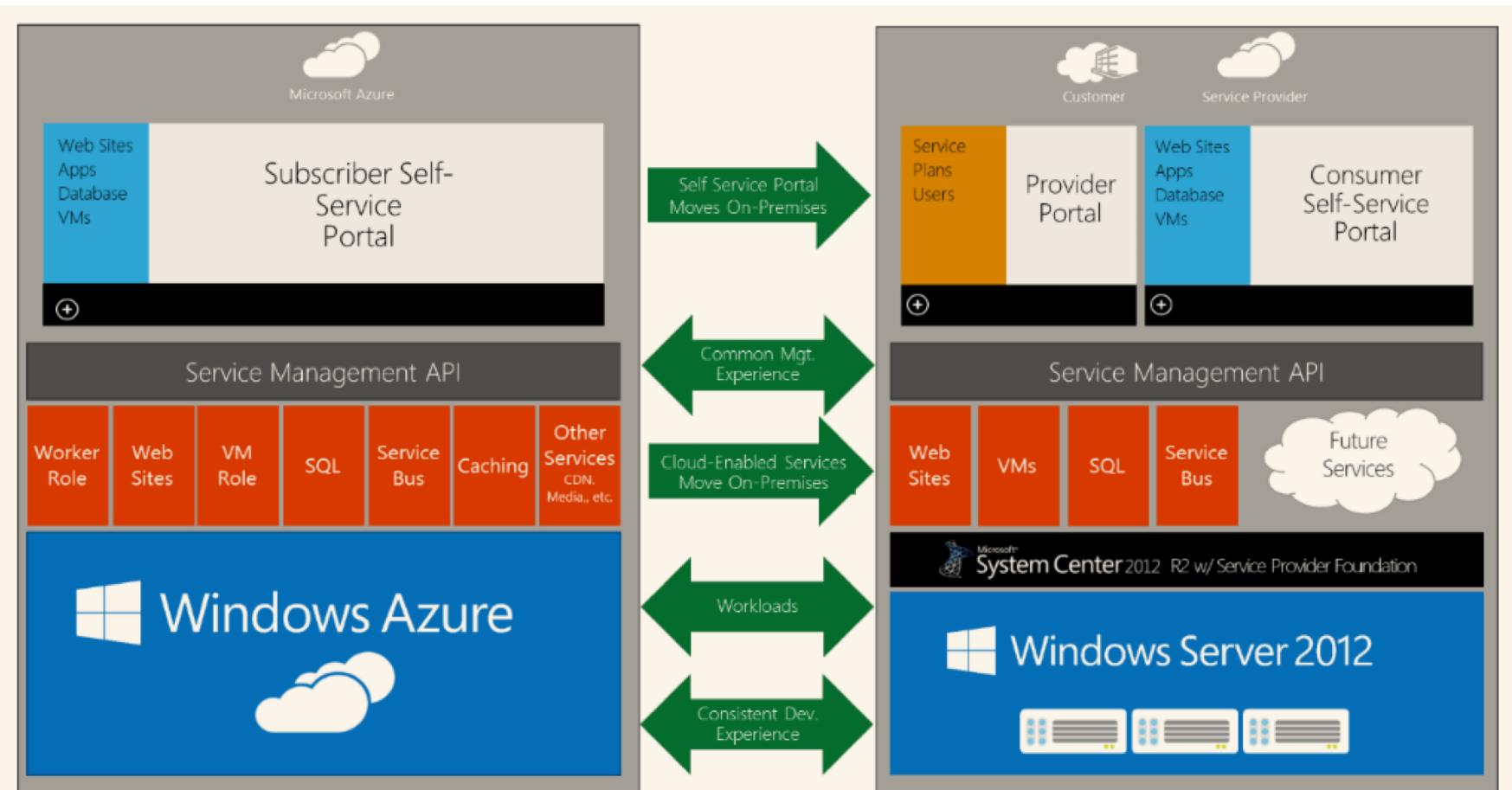
Types of Deployment Models



Deployment Models – Examples

- Examples of a **Public Cloud** are Microsoft Azure and Amazon AWS.
- Examples of a Community Cloud are Microsoft Azure Germany (location) or Microsoft Azure Government (organization and compliance) for US Government authorities.
- Examples of Private Cloud are Microsoft Windows Azure Pack (WAP) or Microsoft Azure Stack, as well as OpenStack, if they are used for internal deployment.
- Hybrid Cloud examples are Azure VMs connected to an on-premises infrastructure via ExpressRoute or site-to-site VPN.

Azure (Public Cloud) and Azure Pack (Private Cloud)



Comparison of Microsoft Azure (Stack) to Azure Pack

Types of Service Models

Which cloud service is suitable for you?



If your business needs a virtual machine, opt for Infrastructure as a Service



If your company requires a platform for building software products, pick Platform as a Service



If your business doesn't want to maintain any IT equipment, then choose Software as a Service



Infrastructure as a Service (IaaS)

IaaS



- ✓ IaaS is a cloud service that provides basic computing infrastructure
- ✓ Services are available on **PAY-FOR-WHAT-YOU-USE** model
- ✓ IaaS providers include Amazon Web Services, Microsoft Azure and Google Compute Engine
- ✓ Users: IT Administrators

IAAS PRODUCTS AND SERVICES



Infrastructure as a Service (IaaS)

- IaaS cloud provider takes care of all the IT infrastructure complexities.
- IaaS cloud provider provides all the infrastructure functionalities.
- IaaS cloud provider guarantees qualified infrastructure services.
- IaaS cloud provider charges clients according to their resource usage.
 - Then, what are the problems you are facing ?
 - Clients will request different operating systems.
 - Clients will request different storage sizes.
 - Clients will request different network bandwidths.
 - Clients will change their requests anytime.

Platform as a Service (PaaS)

PaaS



-  PaaS provides cloud platforms and runtime environments for developing, testing, and managing applications
-  It allows software developers to deploy applications without requiring all the related infrastructure
-  Users: Software Developers

PAAS PRODUCTS AND SERVICES



Platform as a Service (PaaS)

- Platform as a Service (PaaS) is a set of cloud-delivered services that provide an environment for application development, deployment, management and integration in the cloud
- How is that different from IaaS?
 - With IaaS, you can write any application you like, in any language you like
 - But **you** have deal with scalability, persistence, security, availability
- So you use a programming model such as **Java Enterprise Edition** to help you
 - And you find you are creating IaaS images with a JEE application server for all your applications
- Wouldn't it be easier if this application server was provided by the Cloud?
- This is **Platform as a Service**

Software as a Service (SaaS)

SaaS



-  In SaaS, cloud providers host and manage the software application on a pay-as-you-go pricing model
-  All software and hardware are provided and managed by a vendor so you don't have to maintain anything
-  Users: End Customers

SAAS PRODUCTS AND SERVICES



 Office 365  Google™ Apps

Service Model - Azure Example

- The most popular **IaaS** resources in Azure contain virtual machines, virtual networks (internal and external), container services and storage.
- Microsoft Azure contains many **PaaS** resources such as SQL databases, Azure app services, or cloud services.
- Examples of **SaaS** applications are Office 365, Visual Studio Online, Outlook website, OneDrive, and even the Amazon website itself is a SaaS app with Amazon as its own consumer.

Differences Between IaaS, Paas and SaaS

On-Premises	IaaS	PaaS	SaaS
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

 Managed by you  Managed by Vendor

Lifecycle of a Cloud Computing Solution



Define the Purpose

Understand the requirements of the business and determine what type of applications to run on the cloud



EC2



Lambda



Elastic container
Service



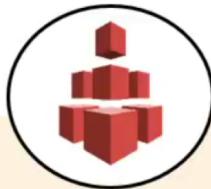
Define the Hardware

Choose a compute service that will provide the right support where you resize the compute capacity in the cloud to run application programs

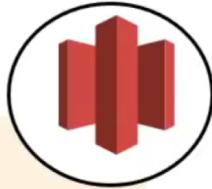
Lifecycle of a Cloud Computing Solution



S3



EFS



Glacier



VPC



Route 53

Direct
Connect

Define the Storage

Choose a storage service where you can backup and archive your data over the internet



Define the Network

Define a network that securely delivers data, videos, applications etc. with low latency and high transfer speed

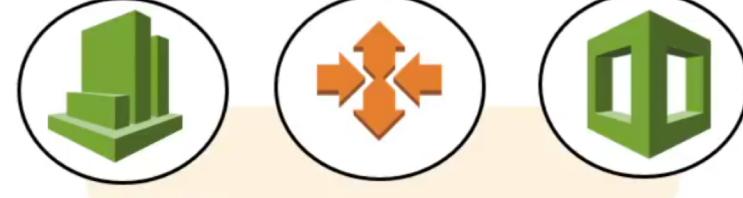
Lifecycle of a Cloud Computing Solution



IAM

KMS

Cognito



CloudWatch

Auto scaling

CloudFormation



Define Security

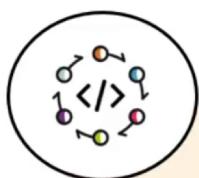
Set up your security service which enable services for user authentication or limiting access to a certain set of users on your AWS resources



Define Management Processes and Tools

You can have complete control on your cloud environment by defining management tools which monitor AWS resources and the customer applications running on AWS platform

Lifecycle of a Cloud Computing Solution



CodeStar



CodeBuild



CodePipeline



Athena



EMR



CloudSearch



Testing the process

Verify the process using AWS developer tools where you can build, test and deploy your code quickly



Analytics

Finally, analyze and visualize data by using analytics services where you can start querying data instantly and get results

Questions?