

Cloud Computing

Topic 8A, Session 3



Part 3: Architecture and Technologies in Cloud Computing

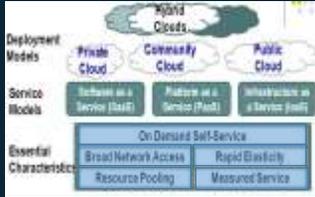
Content

- NIST Cloud Framework
- Cloud Service Models
- Cloud Components
- Virtualisation
- An overview of Microsoft Azure

NIST Cloud Framework

The National Institute of Standards and Technology (NIST) has identified 5 essential characteristics in a generalized cloud system:

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



Service Models

➢ Infrastructure as a Service (IaaS)

- Delivery of the complete computer infrastructure as a service where the client buys resources in form of servers, software data centre spaces and network equipment all of which are outsourced. Basically provides the nuts and bolts of the IT infrastructure. The client does not manage the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls)



Service Models

Platform as a Service (PaaS)

It is the **delivery of an integrated computing platform** to build/test/deploy custom applications as a service. The client is responsible for and has control over the deployed applications alone and does not manage the underlying hardware or software layers



Free enterprises from installing in-house hardware & software that are required to run applications

Service Models

Software as a Service (SaaS)

- It facilitates the *client* to use the *applications running on a cloud infrastructure*.
- The applications are accessible from various client devices typically through a thin client interface such as a web browser (e.g., web-based email).
- The client merely uses the applications and has very limited application configuration settings to do. (Examples?)

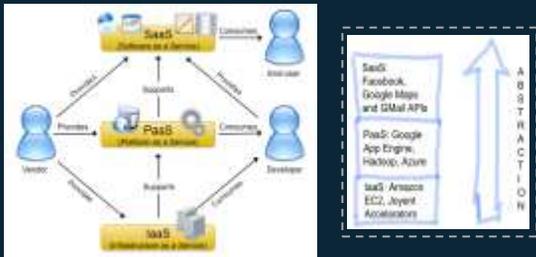


Key Differences of Service Models

- *Service models differ in terms of how much the cloud vendor manages and how much the consumer manages.*
- *The choice can be made based on the consumer requirements*



Service Model Relationship



Role of Service Models

| | | | |
|------------------------------|---|---|---|
| Cloud Infrastructure PaaS | Cloud Infrastructure PaaS | Cloud Infrastructure PaaS | Software as a Service (SaaS) Providers Applications |
| Cloud Infrastructure PaaS | Cloud Infrastructure PaaS | Platform as a Service (PaaS) Deploy customer created Applications | |
| Cloud Infrastructure IaaS | Infrastructure as a Service (IaaS) Rent Processing, storage, N/W capacity & computing resources | | |

- A vendor provides users with access to a cloud-based software. The applications reside on a remote cloud network accessed through the web or an API.
- A vendor provides users with a cloud environment in which they can develop, manage and deliver applications.
- A vendor provides users access to computing resources such as servers, storage and networking. Organizations use their own platforms and applications within a service provider's infrastructure.

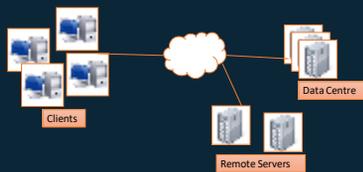
Cloud Platforms, As Perceived Today

End users and developers do not need to worry about the underlying magic that makes their applications work.



Cloud Components

There are three key components that exist, in a topological sense, in a cloud:



Clients

- **Mobile** – e.g. Smart phones, PDAs, etc.
- **Thick** – standard PC using web browser
- **Thin** – Just display data, less hardware (e.g. No internal HDD)



Data Centres

- **A large collection of servers hosting apps and/or data**
- **Usually zoned for efficiency**
- **Often make use of virtualisation (more of this in a minute)**

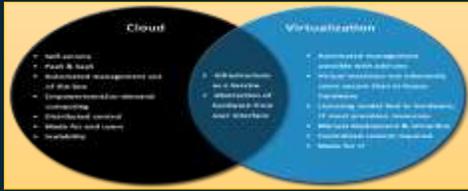


Remote Servers

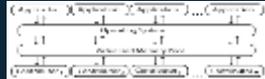
Service-Oriented Architecture (SOA)

- Service-Oriented Architecture (SOA) is a style of software design where services are provided to the other components by application components, through a communication protocol over a network.
- Its principles are independent of vendors and other technologies. In service oriented architecture, a number of services communicate with each other, in one of two ways: through passing data or through two or more services coordinating an activity.

Virtualisation



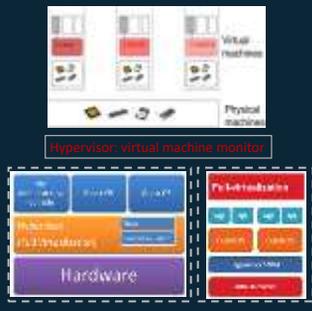
- > A core infrastructure technology deployed within Cloud solutions
- > A mechanism for running multiple "machine" instances on a single physical piece of hardware



Full virtualisation

It is a mechanism for running multiple "machine" instances on a single physical piece of hardware. It is a major enabler of IaaS.

- ❖ Dates back to 1967 with IBM
- ❖ e.g. One machine is completely contained within another so the server that the client connects to is completely virtual (i.e. No physical components) – hardware is emulated
- ❖ Became possible with AMD-V and Intel Virtualisation Technology (VT)



Paravirtualisation

Multiple OS instances run on a single hardware device sharing hardware resources efficiently

- ❖ Typically more efficient than full virtualisation (not everything emulated)
- ❖ Better support for scaling as lower overhead (due to no emulation)
- ❖ Trade off in security and flexibility (OS must be able to run on hardware and OS has more direct access to hardware)

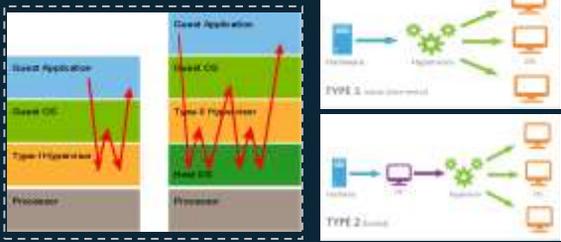


Hypervisor Applications

- ❖ Examples include VMware and Hyper-V
- ❖ Monitor and manage the hardware and guest OS
 - ✓ A layer underneath the guest OS
- ❖ Available to support either Full- (type 1) or para- (type 2) virtualisation
- ❖ Not only offer multiple instances but also multiple operating systems on a single hardware server

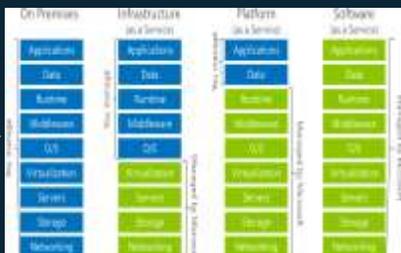


Hypervisor - Type I Vs Type II



Microsoft Azure

- Azure service models differ in terms of how much Azure manages and how much the consumer manages.
- The choice can be made based on the consumer requirements



Microsoft Cloud: Categories of Services

Azure Services are categorised according to the identified service models.



Azure Platform

The Azure™ Services Platform (Azure) is an internet-scale cloud services platform hosted in Microsoft data centers, which provides an operating system and a set of developer services that can be used individually or together.



Azure Architecture

