

# Cloud Computing

## An Elephant In The Dark

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co

no, its a  
throne!

co

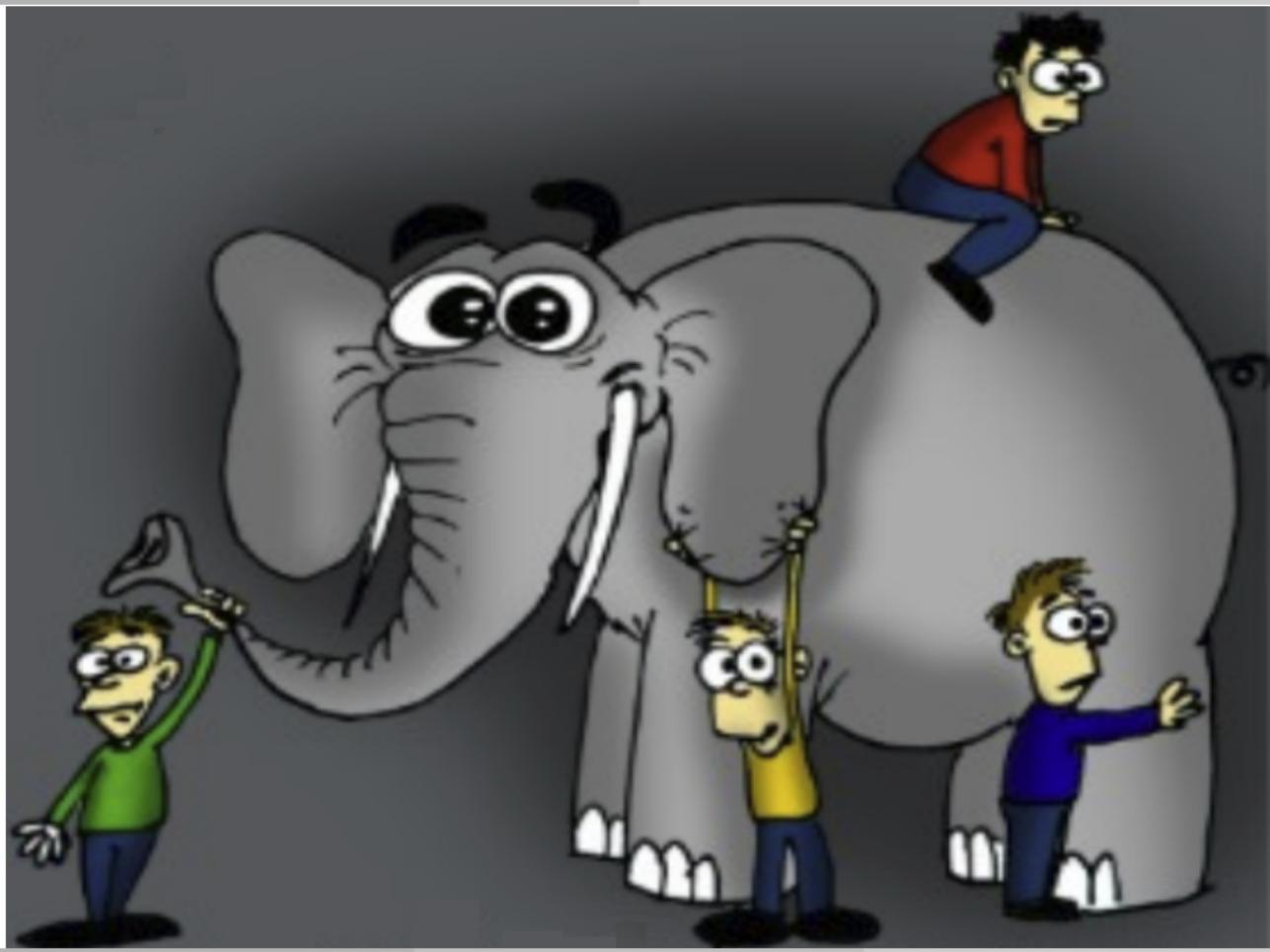
its a hose!

its a trunk,  
dudes!

co

nah, mate  
its a fan!

co



# What is Cloud Computing?

Is it virtualisation?



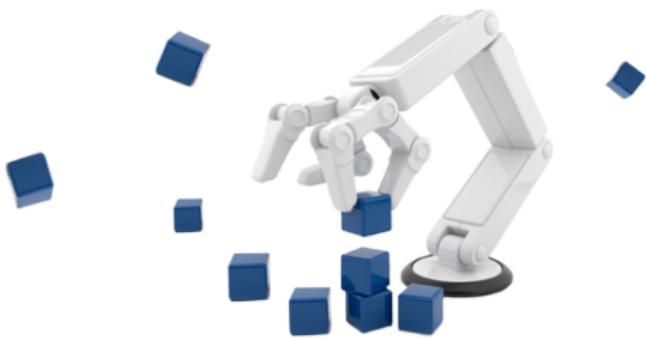
Is it a **self-service** portal?



Is it **on-demand** computing?



Is it **automation**?

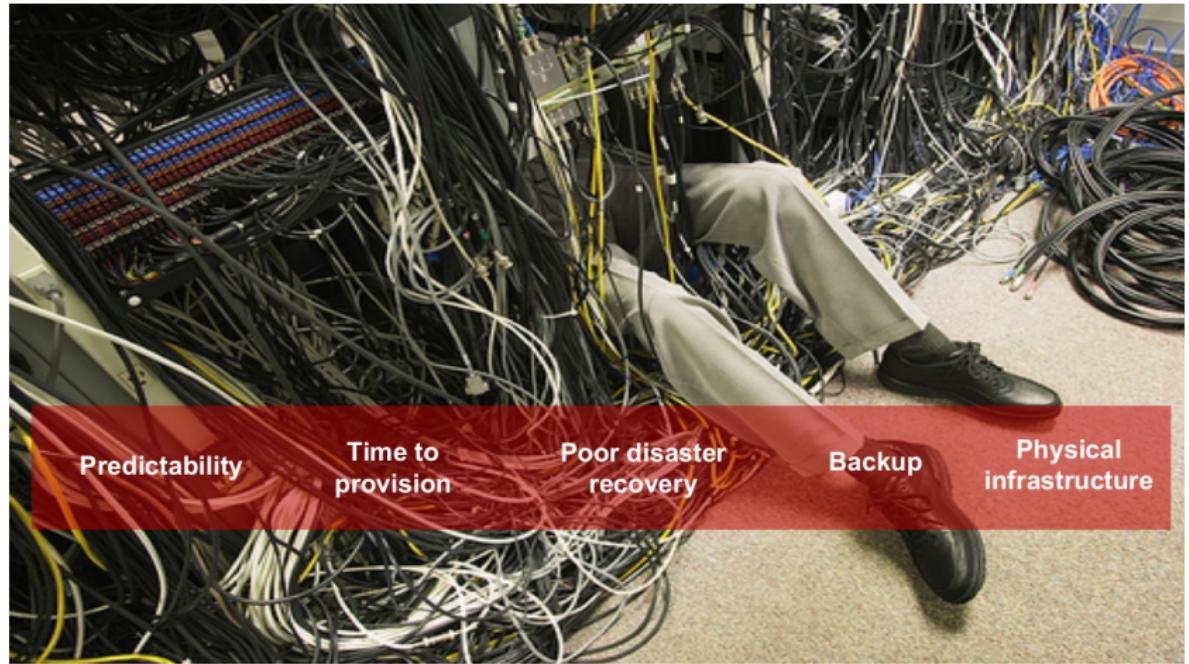


## Is it Anything as a Service (XaaS)?





# Infrastructure Challenges



# Options?



## Aftermarket extension's

- ▶ Marginal gain
- ▶ Increase cost



## Refresh infrastructure

- ▶ Same service
- ▶ Same challenges



## Move to a Cloud model

- ▶ Validated infrastructure
- ▶ SLA driven
- ▶ Reduce cost
- ▶ Service improvement

# Cloud Disclaimers

We've redefined Cloud Computing to include everything that we already do. I don't understand what we would do differently other than change the wording of some of our ads.

- Larry Ellison (Oracle CEO)



# Cloud Disclaimers

It's stupidity. It's worse than stupidity: it's a marketing hype campaign. Somebody is saying this is inevitable - and whenever you hear somebody saying that, it's very likely to be a set of businesses campaigning to make it true.

- Richard Stallman



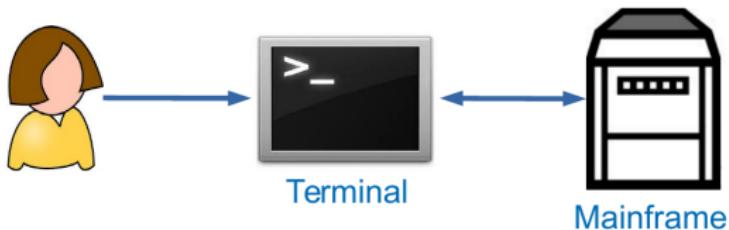




History

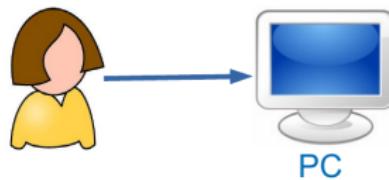
# Computing Paradigms - Phase 1

- ▶ Many users shared **powerful mainframes** using **dummy terminals**.



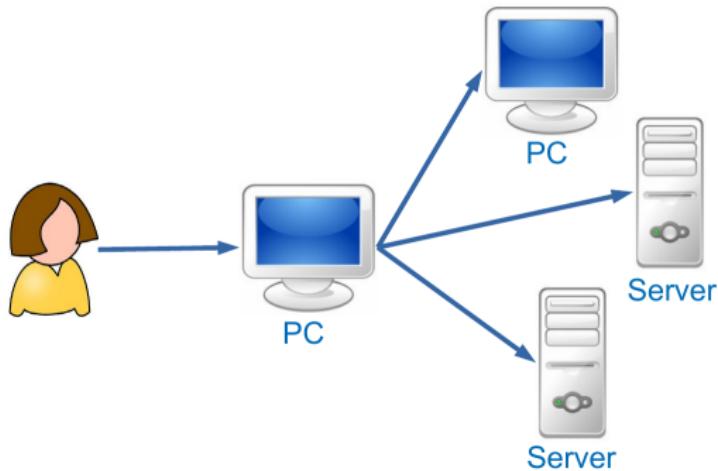
# Computing Paradigms - Phase 2

- ▶ Stand-alone PCs.



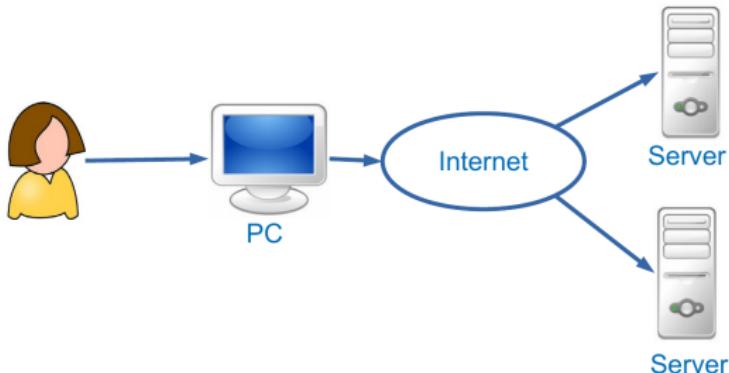
# Computing Paradigms - Phase 3

- ▶ PCs, laptops, and servers were connected together through local networks.



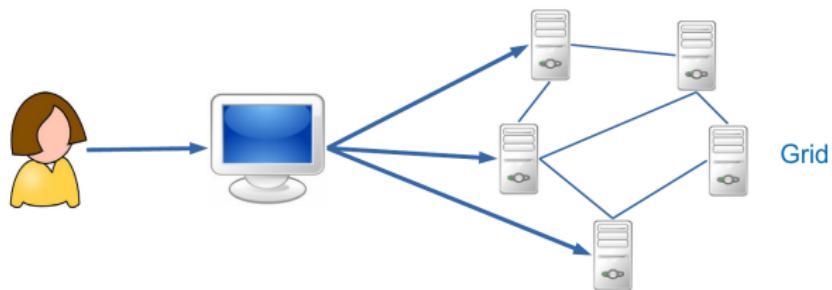
# Computing Paradigms - Phase 4

- **The Internet:** a global network of local networks.



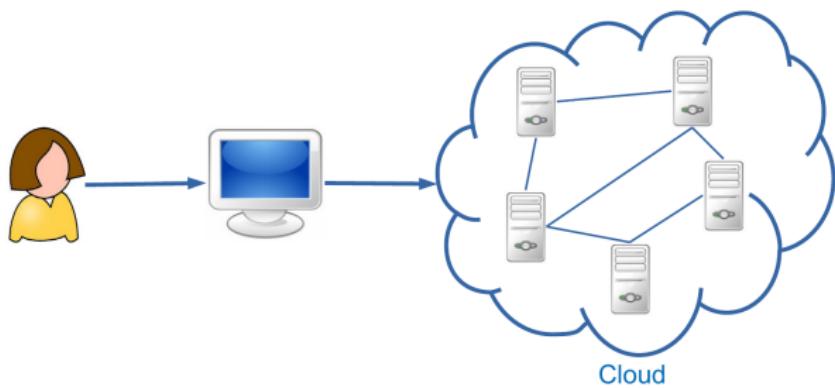
# Computing Paradigms - Phase 5

- **Grid computing:** shared computing power and storage through a distributed computing system.



# Computing Paradigms - Phase 6

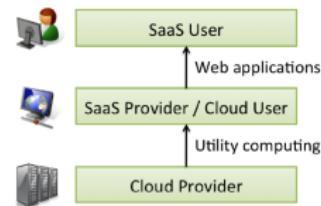
- ▶ **Cloud computing:** shared resources on the Internet in a scalable and simple way.





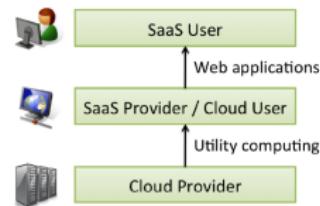
# Cloud Definition (1/2)

- ▶ Cloud Computing refers to both:



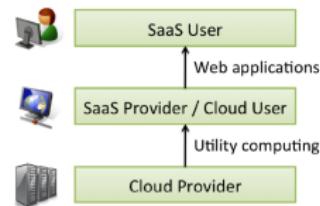
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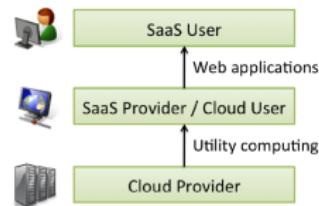
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  - ② the **hardware and systems software** in the datacenters that provide those **services**.



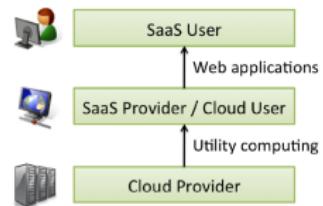
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- ▶ The datacenter hardware and software: called Cloud



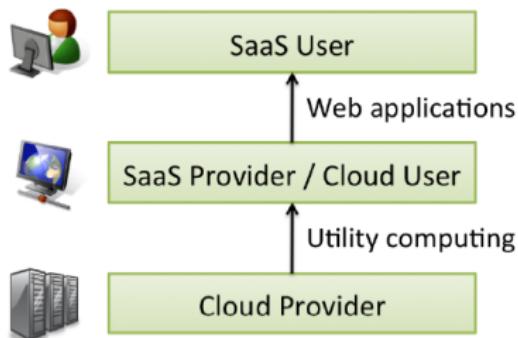
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- ▶ The datacenter hardware and software: called Cloud
- ▶ The services: called Software as a Service (SaaS).



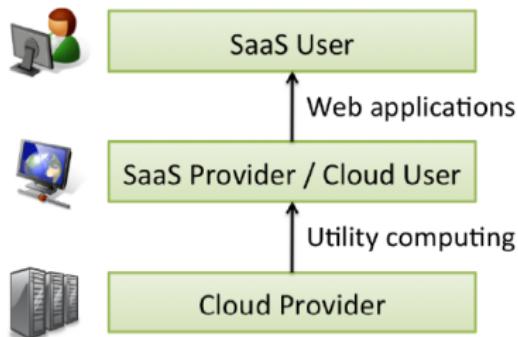
## Cloud Definition (2/2)

- ▶ The service being sold is **Utility Computing**.
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- ▶ The service being sold is **Utility Computing**.
  - E.g., AmazonWeb Services, Google AppEngine, and Microsoft Azure
- ▶ **Cloud Computing** is the sum of **SaaS** and **Utility Computing**.



► The NIST definition:

- Five characteristics
- Three service models
- Four deployment models



# Cloud Characteristics

# Cloud Characteristics



On-demand  
self-service

Ubiquitous  
network  
access

Location  
transparent  
resource  
pooling

Rapid  
elasticity

Measured  
service with  
pay per use

[<http://aka.ms/532>]

## Cloud Characteristics - On-demand Self-Service

- ▶ A consumer can **unilaterally** provision **computing capabilities** without **human interaction** with the service provider.



On-demand  
self-service

## Cloud Characteristics - Ubiquitous Network Access

- ▶ Available over the **network**.
- ▶ Accessed through mobile phones, laptops, ...



Ubiquitous  
network  
access

## Cloud Characteristics - Resource Pooling

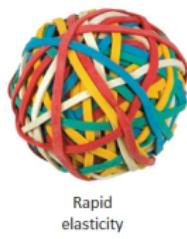
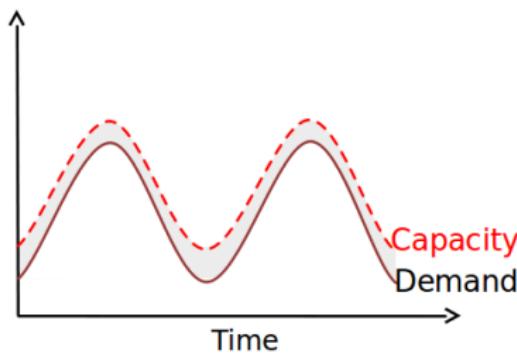
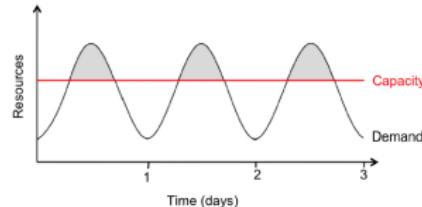
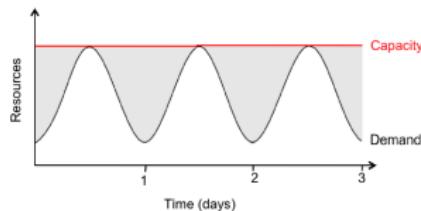
- ▶ Provider's computing resources are pooled to serve consumers.
- ▶ Location transparent



Location  
transparent  
resource  
pooling

# Cloud Characteristics - Rapid Elasticity

- ▶ Capabilities can be rapidly and elastically provisioned, in some cases automatically.



Rapid elasticity

## Cloud Characteristics - Measured Service

- ▶ Resource usage can be monitored, controlled, and reported providing transparency for both the provider and consumer.



Measured service with pay per use

# Cloud Service Models

# Cloud Service Models



SaaS



PaaS



IaaS

[<http://aka.ms/532>]

- ▶ Assume, you just moved to a city and you are looking for a place to live.



- ▶ What is your choice?



- ▶ What is your choice?
  - Built a new house?



- ▶ What is your choice?
  - Built a new house?
  - Buy an empty house?



► What is your choice?

- Built a **new house**?
- Buy an **empty house**?
- Live in a **hotel**?



- ▶ Let's built a **new house!**



- ▶ Let's built a **new house!**
- ▶ You can **fully control** everything you like your new house to have.
- ▶ But that is a **hard work.**



- ▶ What if you buy an **empty house**?



- ▶ What if you buy an **empty house**?
- ▶ You can **customize** some part of your house.
- ▶ But never change the original architecture.



- ▶ How about live in a **hotel**?



- ▶ How about live in a **hotel**?
- ▶ Live in a hotel will be a good idea if the only thing you care is enjoy your life.
- ▶ There is **nothing you can** do with the house except living in it.



Let's translate it to  
Cloud Computing

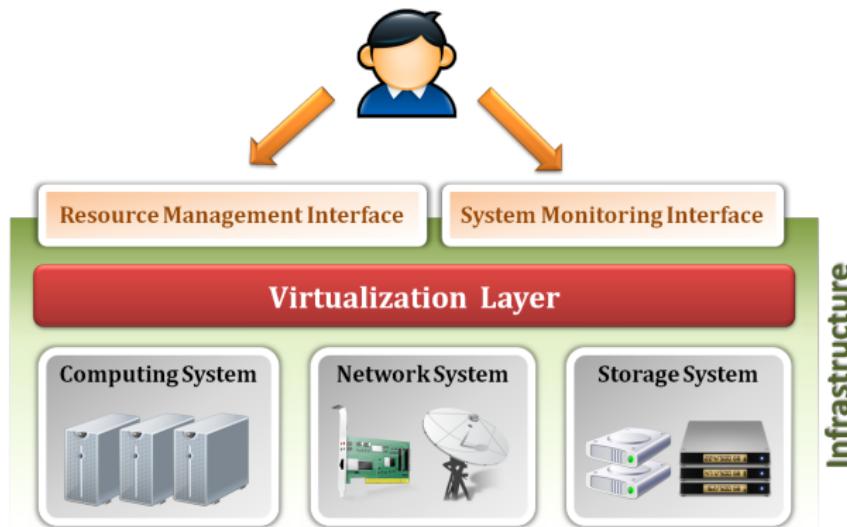
- ▶ Infrastructure as a Service (**IaaS**): similar to **build a new house**.
- ▶ Platform as a Service (**PaaS**): similar to **buy an empty house**.
- ▶ Software as a Service (**SaaS**): similar to **live in a hotel**.

- ▶ Vendor provides **resources**, e.g., processing, storage, network, ...
- ▶ Consumer is provided customized **virtual machines**.
- ▶ Consumer has **control** over the resources.

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- ▶ Consumer has **control** over the resources.
- ▶ Example: Amazon Web Services (AWS), Rackspace, ...

# IaaS - (2/2)

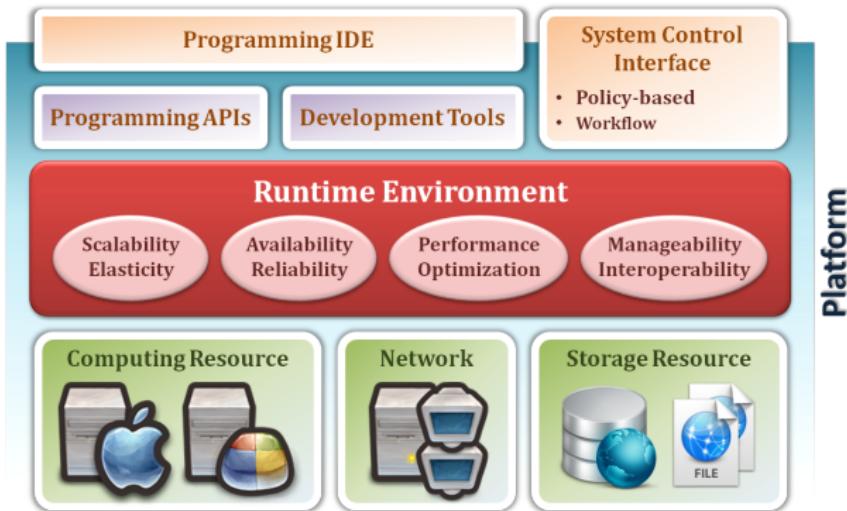
- ▶ System architecture



- ▶ Vendor provides **development environment**.
  - Tools and technology selected by vendor.
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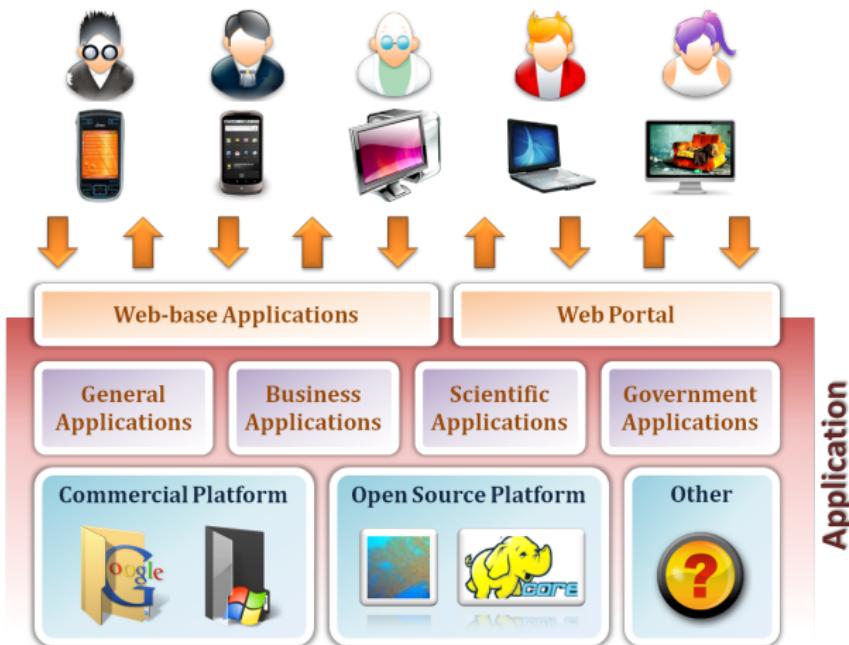


- ▶ Vendor provides **applications** accessed over the network.

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- ▶ Example: Google Docs, Salesforce.com

# SaaS - (2/3)

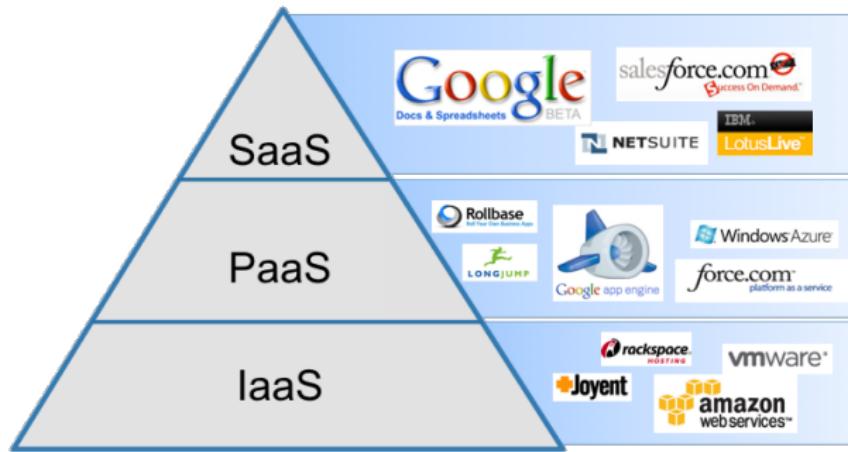
## ► System architecture



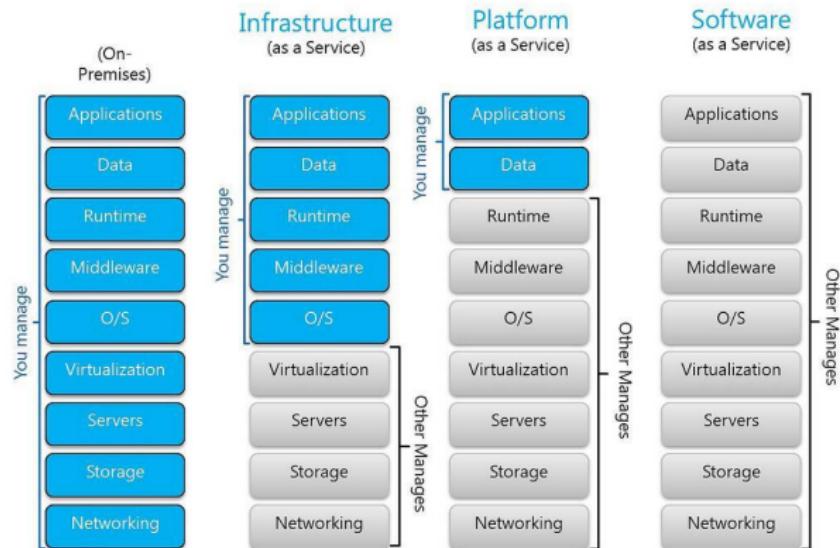
- ▶ **Web Service** and **Web 2.0**
- ▶ Viewing the **Internet** as a **computing platform**.
- ▶ Running interactive applications through a **web browser**.



# IaaS - PaaS - SaaS

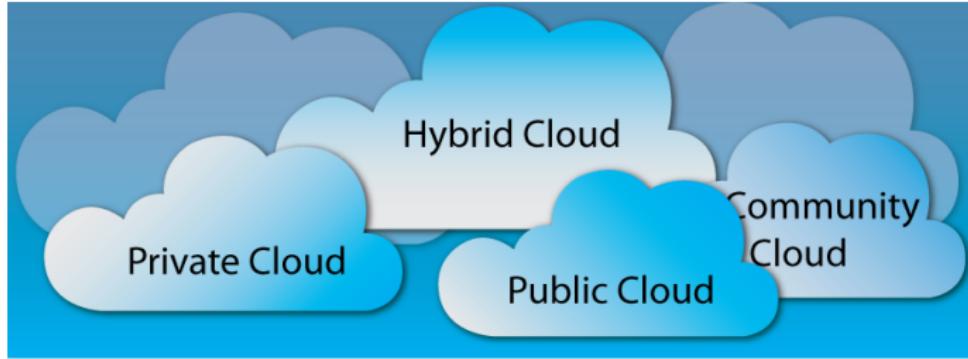


# IaaS - PaaS - SaaS



# Cloud Deployment Models

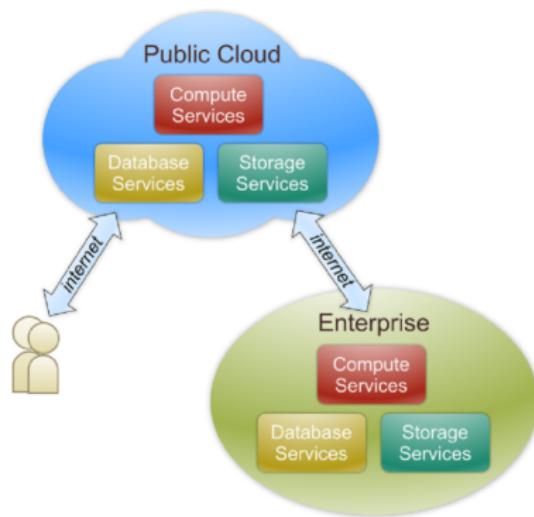
# Cloud Deployment Models



[<http://www.atomrain.com/it/technology/cloud-deployment-models>]

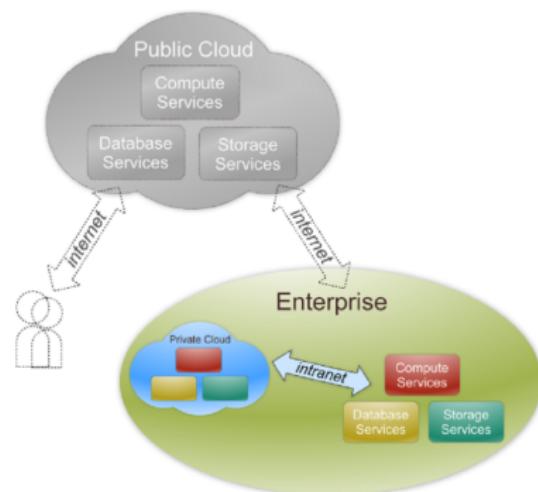
# Public Cloud

- ▶ Infrastructure is made available to the **general public**.
- ▶ Owned by an organization selling cloud services.



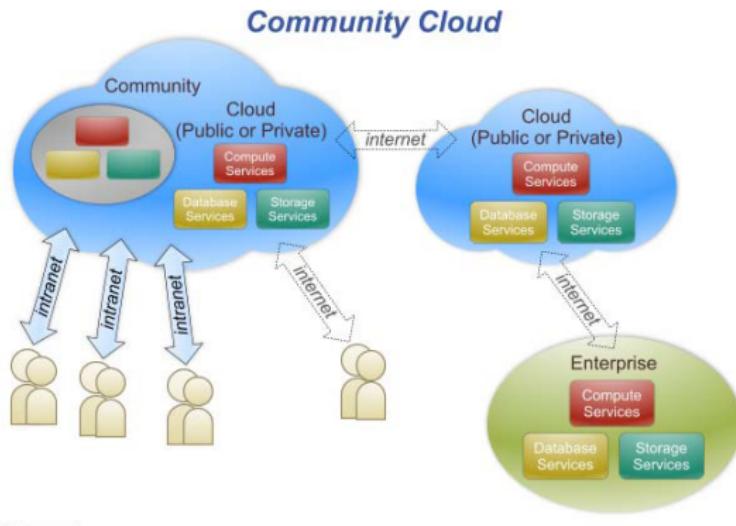
# Private Cloud

- ▶ Infrastructure is operated **solely for an organization**.
- ▶ Managed by the organization or by a third party.



# Community Cloud

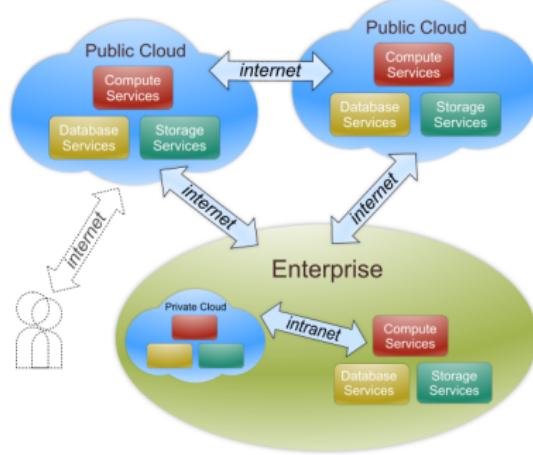
- ▶ Supports a specific **community**.
- ▶ Infrastructure is **shared** by several organizations.



# Hybrid Cloud

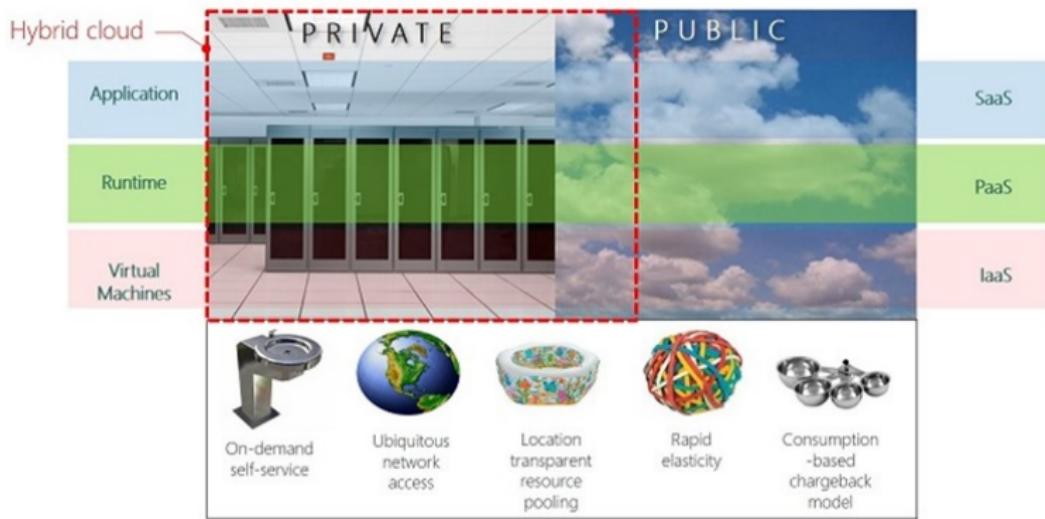
- ▶ Infrastructure is a **composition** of two or more clouds deployment models.
- ▶ Enables data and application portability.

## *Hybrid Cloud*



# Summary

# A Page To Remember



[<http://aka.ms/532>]

# Questions?