

CS528

Introduction to Cloud

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Outline

- What is Cloud Computing?
- (HPC, Data Center, Grid) Vs Cloud
- Virtualization
- Advantage of Cloud System : User Prospects
- Dis-advantage of Cloud System : User Prospects

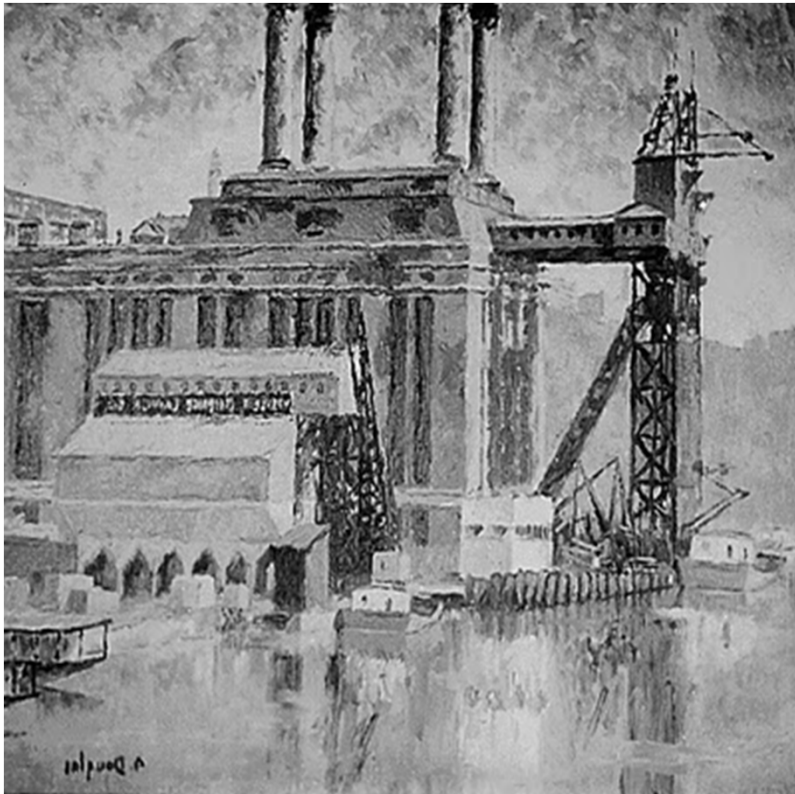
HPC/Grid Vs Cloud

- Grid/HPC : Self owned
 - Too costly : CAPEX (Capital Expenditure)
 - IITG HPC Example: 10.6 Crores, 3800 J cores
 - OPEX : Operational cost, AC, electricity, AMC
- Cloud : User and Owner are Separated
 - Lets of VC own the HPC but users uses as RENT
 - User get cheaply at need time
 - Owner get a lots of demand for USE
 - Win-Win for Both, Example Public BUS
- OLA, UBER, Any Taxi Service
 - Get a CAR and used for Taxi

Utility Model

- Do we require to own a car to ride?
- Rent a CAR for 1 month (schedule your self how you will use)
- Rent a CAR for 1 Day (schedule your self how you will use)
- Use Pickup or Drop service, personalized
 - Src-Dst defined
- Use shared services: Piggy back with others

Utility Computing



- Long been a vision
- Grid computing failed to really catch on
- Technology advances as well as a viable business model have helped Cloud Computing catch on
- Cloud Computing allows for fuller utilization of hardware
- Energy consumption is turning into a major issue

Cloud Computing Economic Benefits

- Most identifiable economic benefit of cloud computing is
 - direct cost savings, which occur from changes within the organization and the data centers that house the IT infrastructure.
 - Supply Side – Large scale data centers lower cost due to superior buying power

Cloud Computing Economic Benefits

- Other economic benefit of cloud
 - Demand Side – Allowing multiple users across varying industries regions & time zones allowing for server utilization
 - Multi-user efficiency – Increasing # of users lowers server cost per tenant
 - Data center efficiency – Advanced data center designs reduce power loss and improved cooling

What is Cloud Computing?

- Cloud Computing is a general term
- **Used to describe a new class of network based computing that takes place over the Internet,**
 - Basically a step on from Utility Computing
 - A collection/group of integrated and networked hardware, software and Internet infrastructure (called a platform).
 - Using the Internet for communication and transport provides hardware, software and networking services to clients

What is Cloud Computing?

- These platforms
 - hide the complexity and details of the underlying infrastructure from users and applications
 - by providing very simple graphical interface or API (Applications Programming Interface).

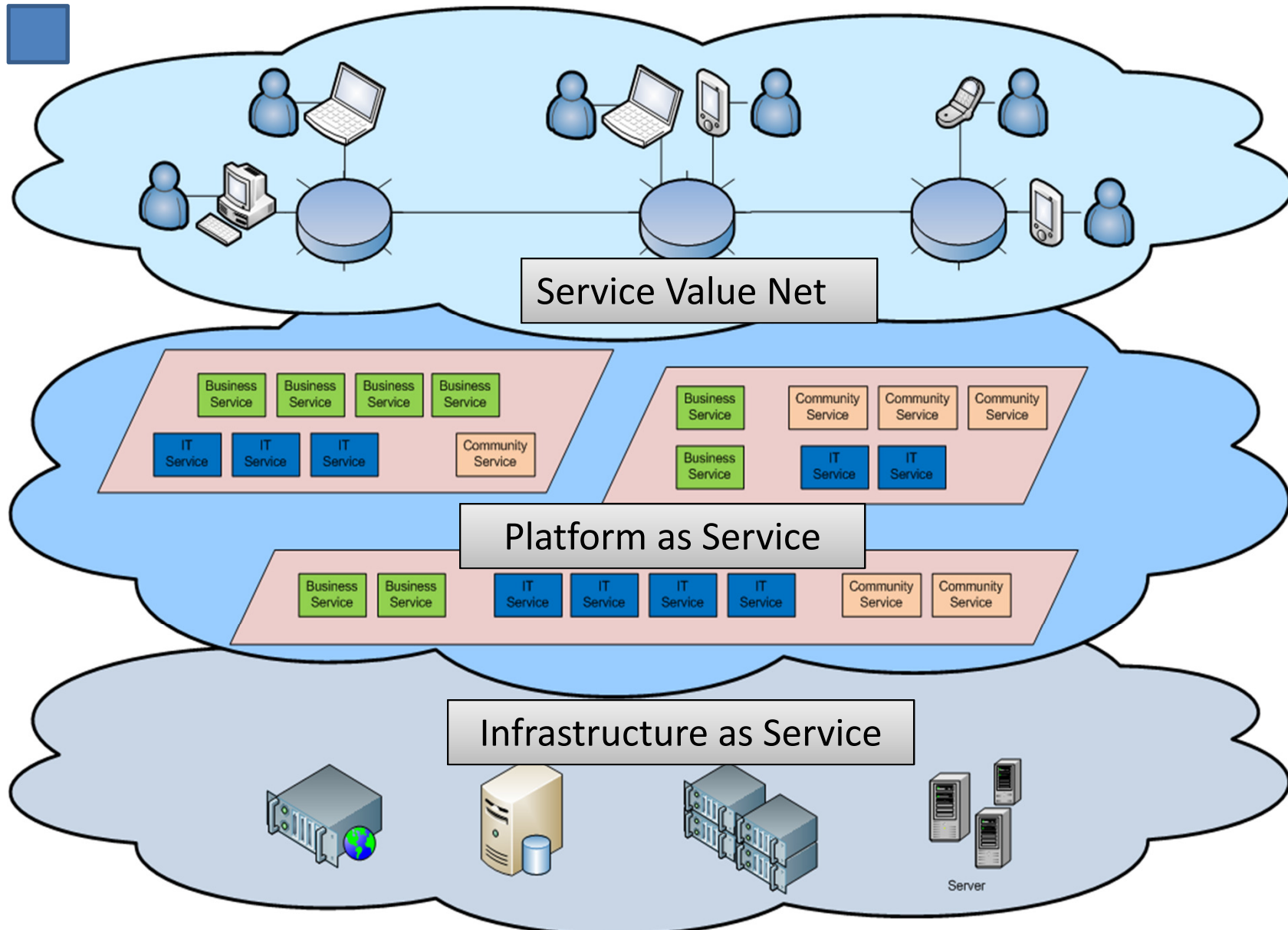
What is Cloud Computing?

- In addition, the platform provides on demand services, that are always on, anywhere, anytime and any place.
- Pay for use and as needed, elastic
 - Scale Up and Down in capacity and functionalities
- The H/W and S/W services are available to
 - general public, enterprises, corporations and businesses markets

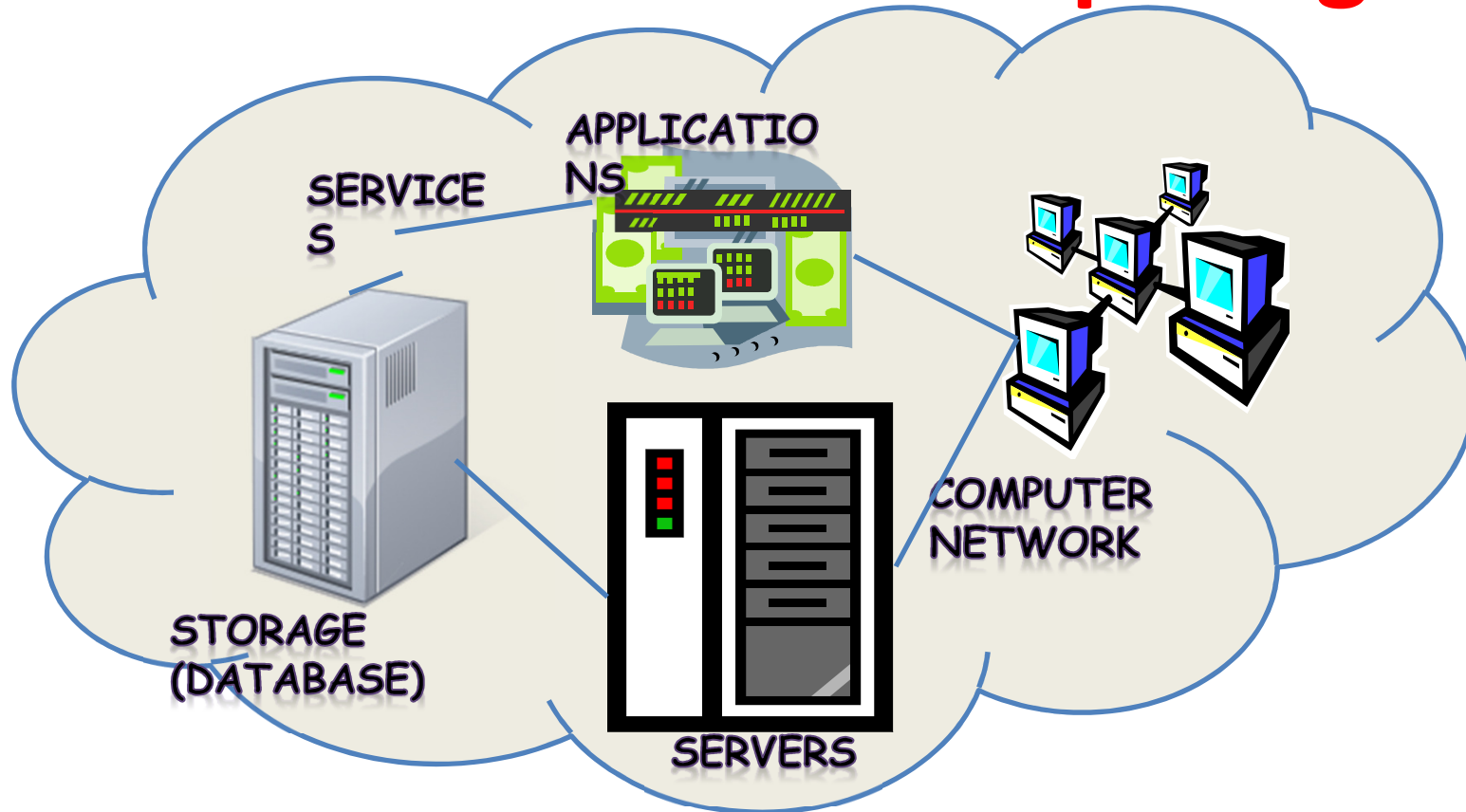
Cloud Summary

- Cloud computing : an umbrella term used to refer to Internet based development and services
- A number of characteristics define cloud data, applications services and infrastructure:
 - **Remotely hosted**: Services or data are hosted on remote infrastructure.
 - **Ubiquitous**: Services or data are available from anywhere.
 - **Commodified**: The result is a utility computing model similar to traditional that of traditional utilities, like gas and electricity - you pay for what you would want!

Cloud Architecture



What is Cloud Computing



- Shared pool of configurable computing resources
- On-demand network access
- Provisioned by the Service Provider

Cloud Computing Characteristics

Common Characteristics:

Massive Scale	Resilient Computing
Homogeneity	Geographic Distribution
Virtualization	Service Orientation
Low Cost Software	Advanced Security

Essential Characteristics:

On Demand Self-Service	
Broad Network Access	Rapid Elasticity
Resource Pooling	Measured Service

Cloud Computing Characteristics

- **Scalability** Infrastructure capacity allows for traffic spikes and minimizes delays.
- **Resiliency** Cloud providers have mirrored solutions
 - To minimize downtime in the event of a disaster.
 - This type of resiliency can give businesses the sustainability they need during unanticipated events.
- **Homogeneity:** No matter which cloud provider and architecture an organization uses
 - An open cloud will make it easy for them to work with other groups,
 - even if those other groups choose different providers and architectures.

Cloud Computing Characteristics

- *On-demand self-service*: A consumer can unilaterally provision computing capabilities
 - Such as server time and network storage,
 - as needed automatically without requiring human interaction with each service's provider.
- *Broad network access*. Capabilities are available over the network and
 - Accessed through standard mechanisms
 - promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, PDAs).

Cloud Computing Characteristics

- ***Resource pooling: Multi-tenant model***
 - There is a sense of location independence in that
 - The customer generally has no control or knowledge over the exact location of the provided resources
 - but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter).
 - Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.
- ***Rapid elasticity. Capabilities can be rapidly and elastically provisioned***
 - In some cases automatically
 - To quickly scale out and rapidly released to quickly scale in.
 - To the consumer, the capabilities available for provisioning often appear to be unlimited
 - can be purchased in any quantity at any time.

Cloud Computing Characteristics

- *Measured Service*
 - Cloud systems automatically control and optimize resource use
 - by leveraging a metering capability at some level of abstraction appropriate to the type of service
 - E.g., storage, processing, bandwidth, and active user accounts

Cloud Service Models

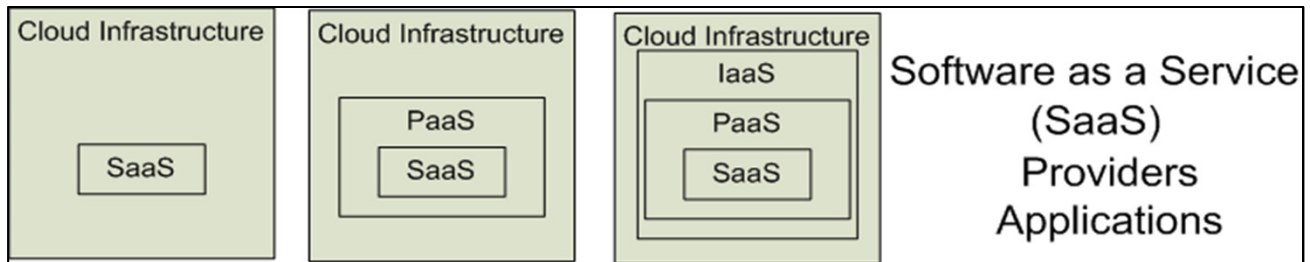
Software as a Service (SaaS)

Platform as a Service (PaaS)

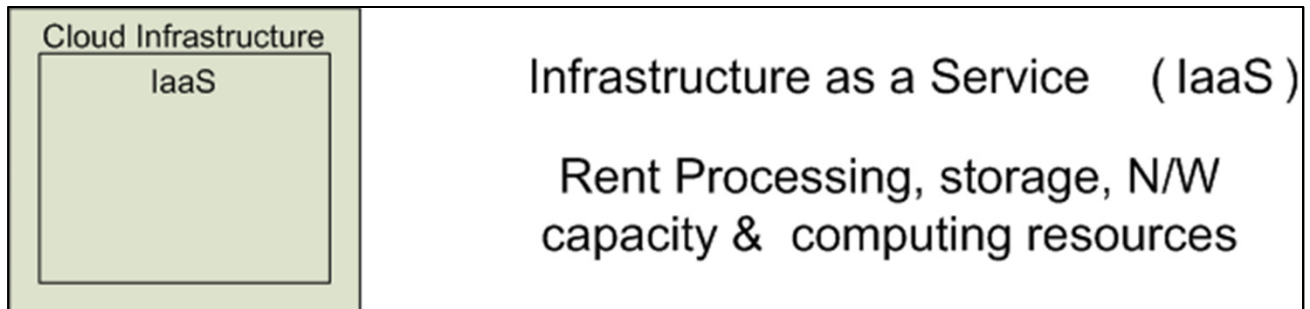
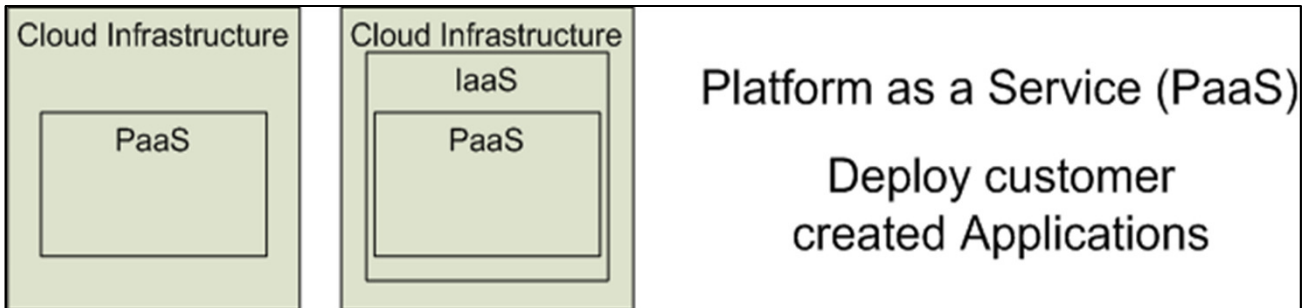
Infrastructure as a Service (IaaS)

SalesForce CRM

LotusLive



Google App



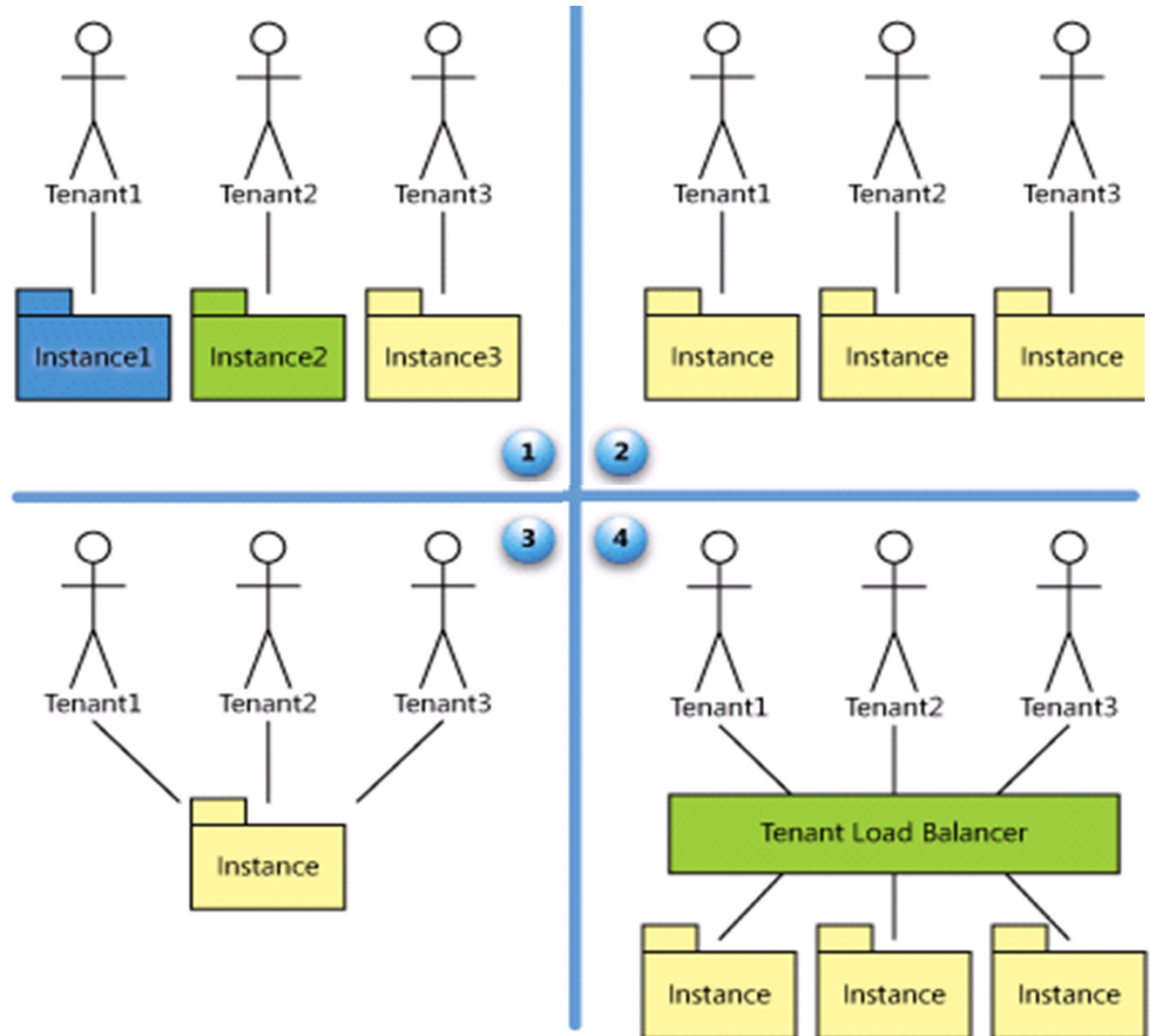
SaaS Maturity Model

**Level 1: Ad-Hoc/Custom –
One Instance per customer**

**Level 2: Configurable
per customer**

**Level 3: configurable &
Multi-Tenant-Efficient**

**Level 4: Scalable,
Configurable & Multi-
Tenant-Efficient**



Different Cloud Computing Layers

Application Service (SaaS)	MS Live/ExchangeLabs, IBM, Google Apps; Salesforce.com Quicken Online, Zoho, Cisco
Application Platform	Google App Engine, Mosso, Force.com, Engine Yard, Facebook, Heroku, AWS
Server Platform	3Tera, EC2, SliceHost, GoGrid, RightScale, Linode
Storage Platform	Amazon S3, Dell, Apple, ...

Cloud Computing Service Layers

		Services	Description
App. Focused	{	Services	Services – Complete business services such as PayPal, OpenID, OAuth, Google Maps, Alexa
		Application	Application–Cloud based S/W that eliminates local installation: Google Apps, MS Online
		Development	Development – S/W Dev. platforms used to build custom cloud based applications (PAAS & SAAS) such as Salesforce
Infra. Focused	{	Platform	Platform – Cloud based platforms, typically provided using virtualization, such as Amazon ECC, Sun Grid
		Storage	Storage – Data storage or cloud based NAS such as CTERA, iDisk, CloudNAS
		Hosting	Hosting – Physical data centers such as those run by IBM, HP, NaviSite, etc.

Basic Cloud Characteristics

- The “**no-need-to-know**” in terms of the underlying details of infrastructure, applications interface with the infrastructure via the APIs.
- The “**flexibility and elasticity**” allows these systems to scale up and down at will
 - utilising the resources of all kinds
 - CPU, storage, server capacity, load balancing, and databases
- The “**pay as much as used and needed**” type of utility computing and the “**always on!, anywhere and any place**” type of network-based computing.

Basic Cloud Characteristics

- Cloud are transparent to users and applications, they can be built in multiple ways
 - branded products, proprietary open source, hardware or software, or just off-the-shelf PCs.
- In general, they are built on clusters of PC servers and off-the-shelf components plus Open Source software combined with in-house applications and/or system software.

Software as a Service (SaaS)

- SaaS is a model of software deployment where an application is hosted as a service provided to customers across the Internet.
- SaaS alleviates the burden of software maintenance/support
 - but users relinquish control over software versions and requirements.
- Terms that are used in this sphere include
 - **Platform as a Service (PaaS)** and
 - **Infrastructure as a Service (IaaS)**