Project Title:
Distributed and Cloud-based Network Defense System for NRENs (DCNDS)

Series 1 Workshop

(10 -11 April, 2019)

Workshop on Cloud-based Web Security Best Practices and System Configuration Overview

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: An Overview

by

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Outline

- Introduction and definition cloud computing
- Characteristics of Cloud Computing
- Service delivery models of cloud computing
- Deployment models of cloud computing
- Cloud Role and Boundaries
- Technologies in Cloud Computing
- Key drivers to adopt the cloud

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Introduction

- In 1965, **Corbato** *et al*. provide a business model for on demand computing resources that is based on *pay-as you-go* manner - means customers get to choose whatever resources (like- CPUs, memory, bandwidth, platforms, etc) from the vendor.
- Cloud computing developed in 2005/2006 as a new distributed computing model with the aimed of attaining the computing as a utility like public user obtain services from traditional public utility services such as water, electricity, gas and telephone.

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Introduction…

- Cloud computing is taking services and moving them outside an organization's firewall. Applications, storage and other services are accessed via the Web.

- The provision of dynamically scalable and often virtualized resources as a service over the Internet on a utility basis.
- Users need not have knowledge of, expertise in, or control over the technology infrastructure in the 'cloud' that supports them."

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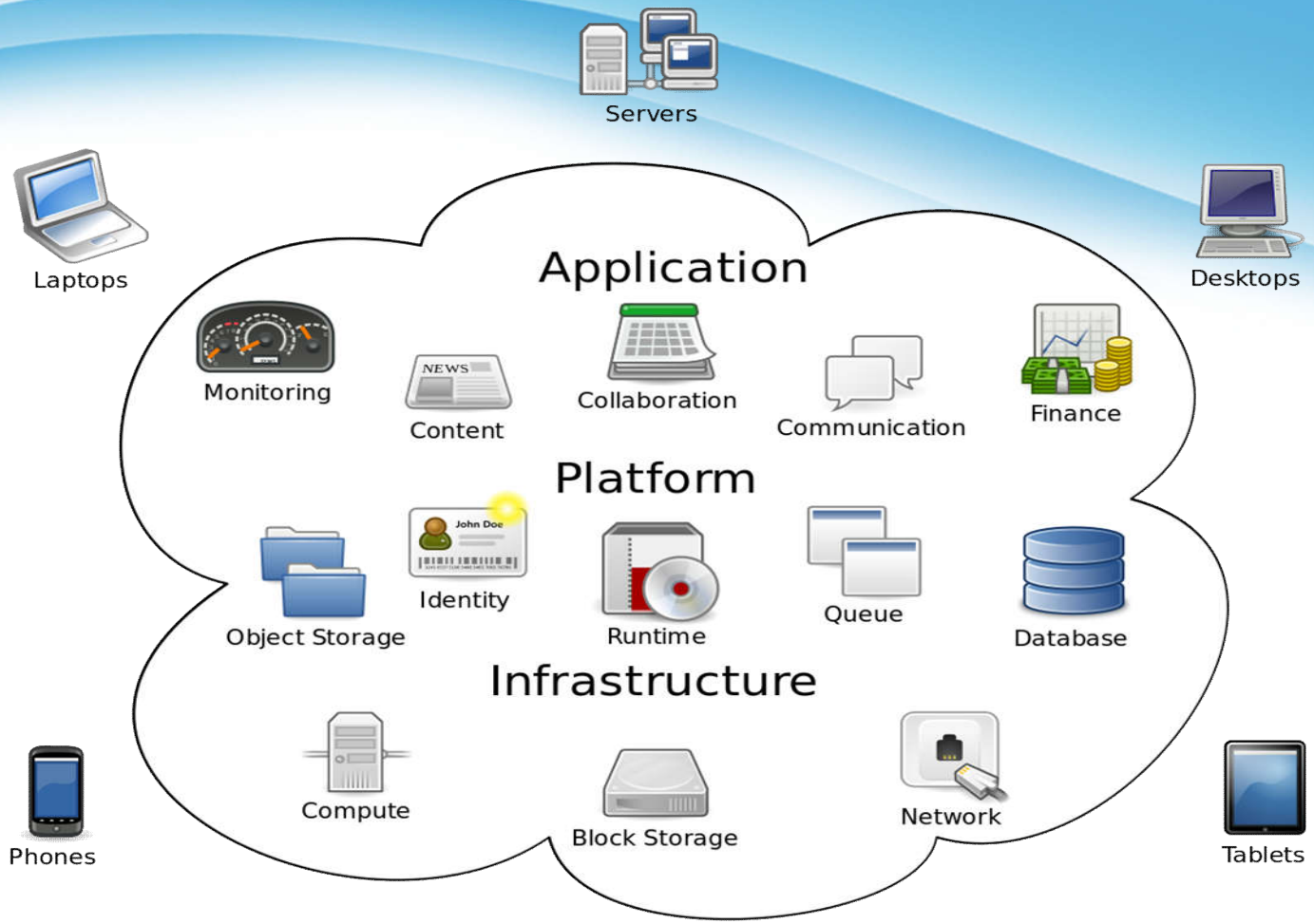
Cloud Definition

The **NIST** has a more comprehensive definition of cloud computing as-

"*A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g.,* ***networks, servers, storage, applications, and services****) that can be rapidly provisioned and released with minimal management effort or service provider interaction*."



Cloud computing

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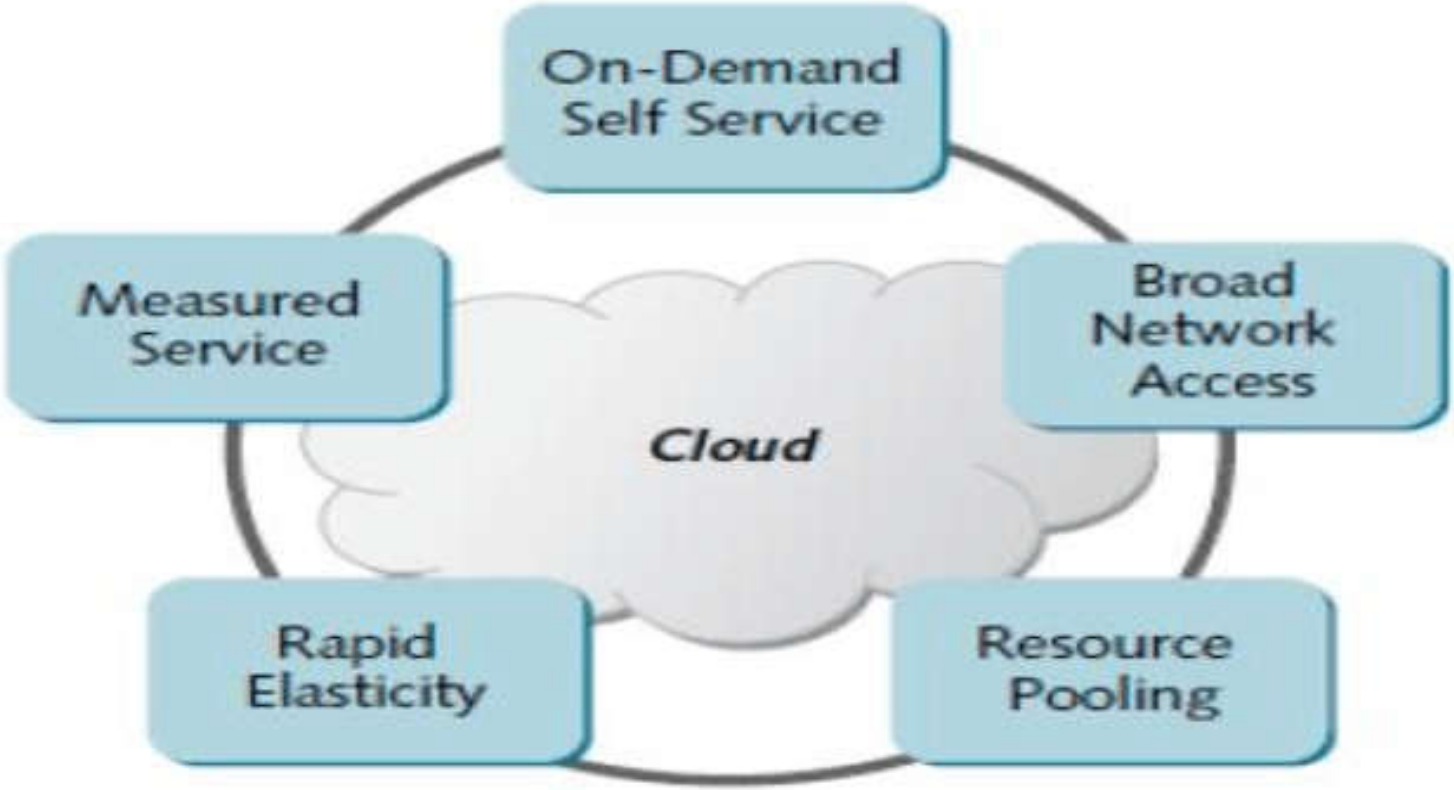
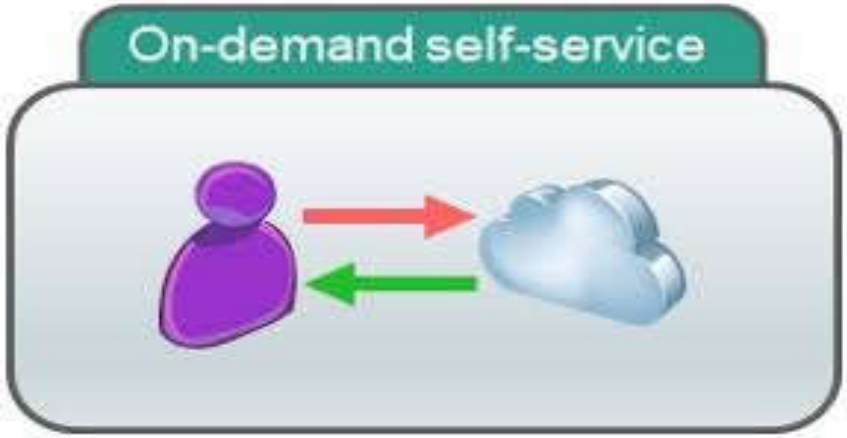
Characteristics of cloud computing



On-demand self-service

- It enables consumers to directly request, manage and access the services through the web services and management interfaces without any human interaction.
- Computing resources are instantly available to users as per their requests.



Broad network access

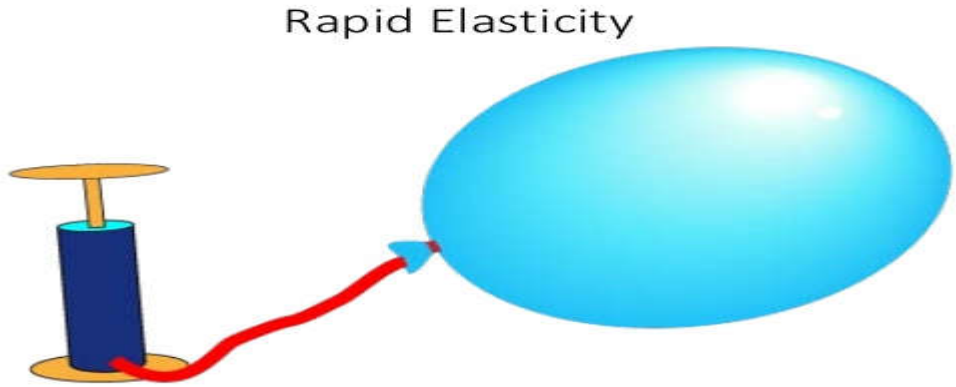
- The data and services are presented in the cloud are accessible through using any standard device like mobile phones, PC, desktop, laptop.
- Cloud-based services are accessed from any location any time provided that there is adequate IP networking.

Resource pooling

- The cloud provider provides a large physical or virtual computing resources that are shared among multiple users.
- These resources are allocated dynamically in a multi-tenant environment.

Rapid elasticity

- Resources are scaled according to the consumer requirements. Customers have unlimited resources that can be purchased as needed in pay-per use manner.
- Elastically increases service capacity during busy periods, and reduces capacity during customers' off-peak periods.

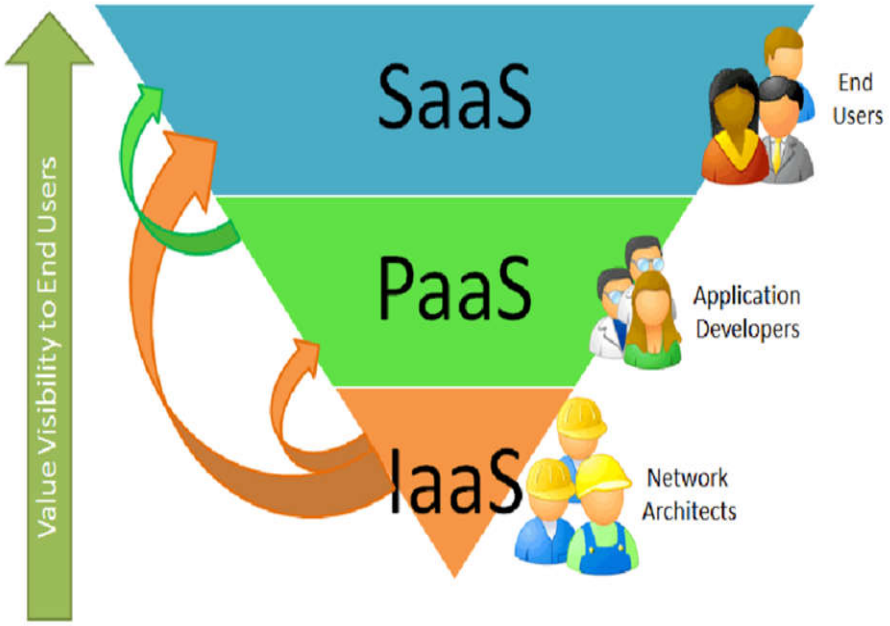


Measured Service

* You get what you pay for.
* The resources usage can be monitored, controlled, and reported.
* Allows for accountability for the provider and consumer.

Service models of cloud computing

1. **Software as a service (SaaS)**
2. **Platform as a Service (PaaS):**
3. **Infrastructure as a service (IaaS)**

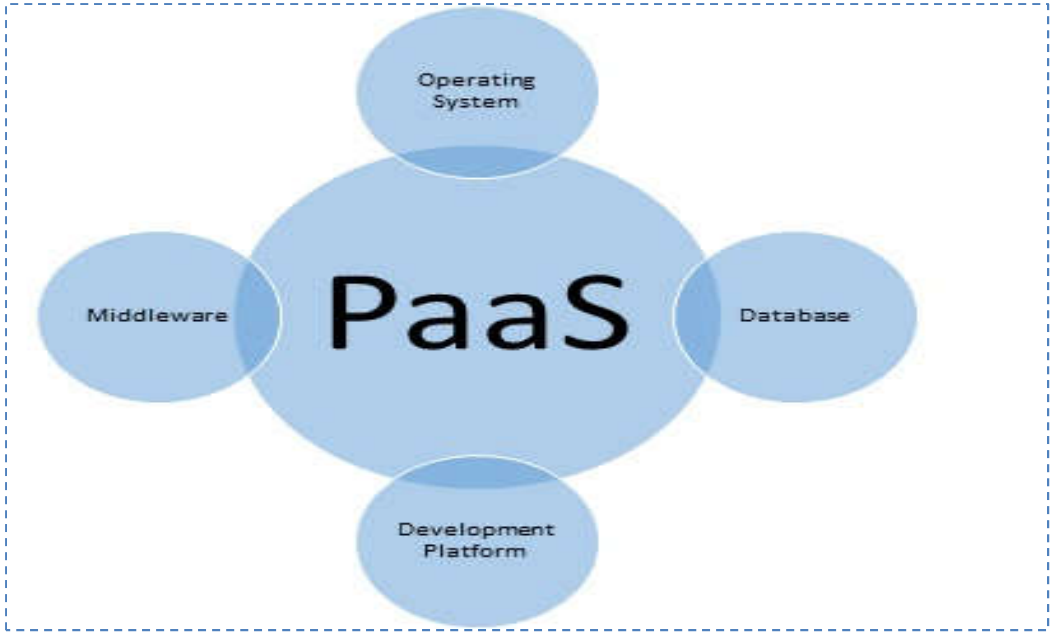


Software as a service

- Provides consumer the capability to use applications running on a cloud infrastructure mainly on the web browser to access software that offer as a service over the web.
- The consumers do not have control the underlying framework including system, servers, network, operating systems, storage.
- Example for SaaS are Dropbox, Google Apps and GoToMeeting etc.

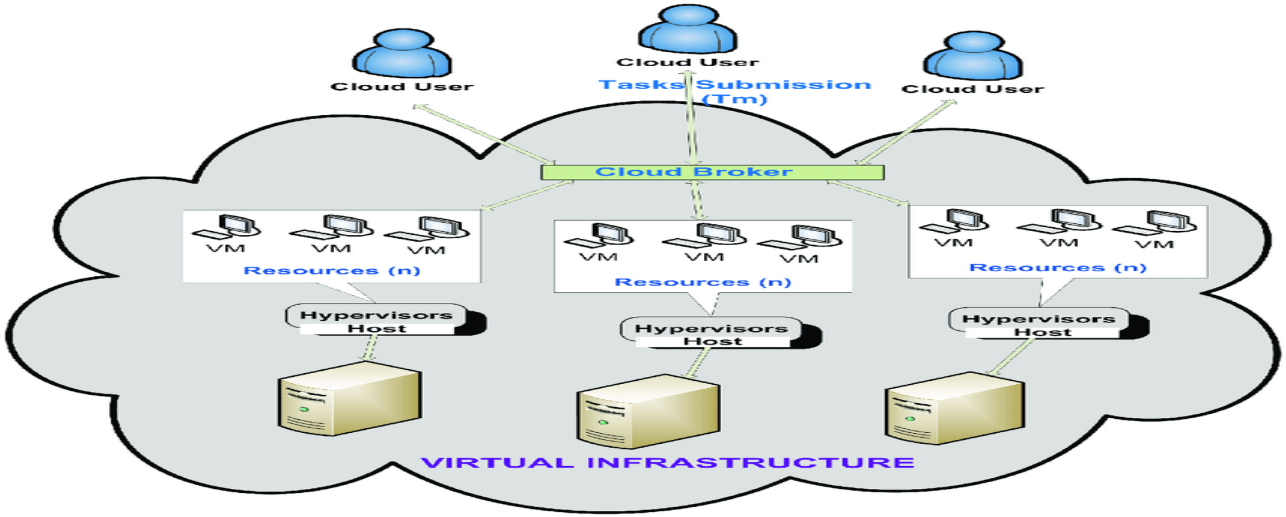
Service model: PaaS

- Provides the capability to deploy development environment onto the cloud infrastructure.
- Consumer creates/develops applications using set of programming languages and tools that are supported by the provider.
- Examples of PaaS are **Google App Engine** and **Microsoft Azure** Phantom



Service model: IaaS

- Provides the consumer with the capability to provision processing, storage, networks, and other fundamental computing resources and allow the consumer to deploy and run any software.
- The client has control over operating systems, storage, deployed applications and perhaps constrained control of select systems administration parts
- Examples of IaaS include *Amazon Web Services (AWS), Cisco Metapod, Microsoft Azure, Google Compute Engine (GCE*) etc.



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Service model: at a glance

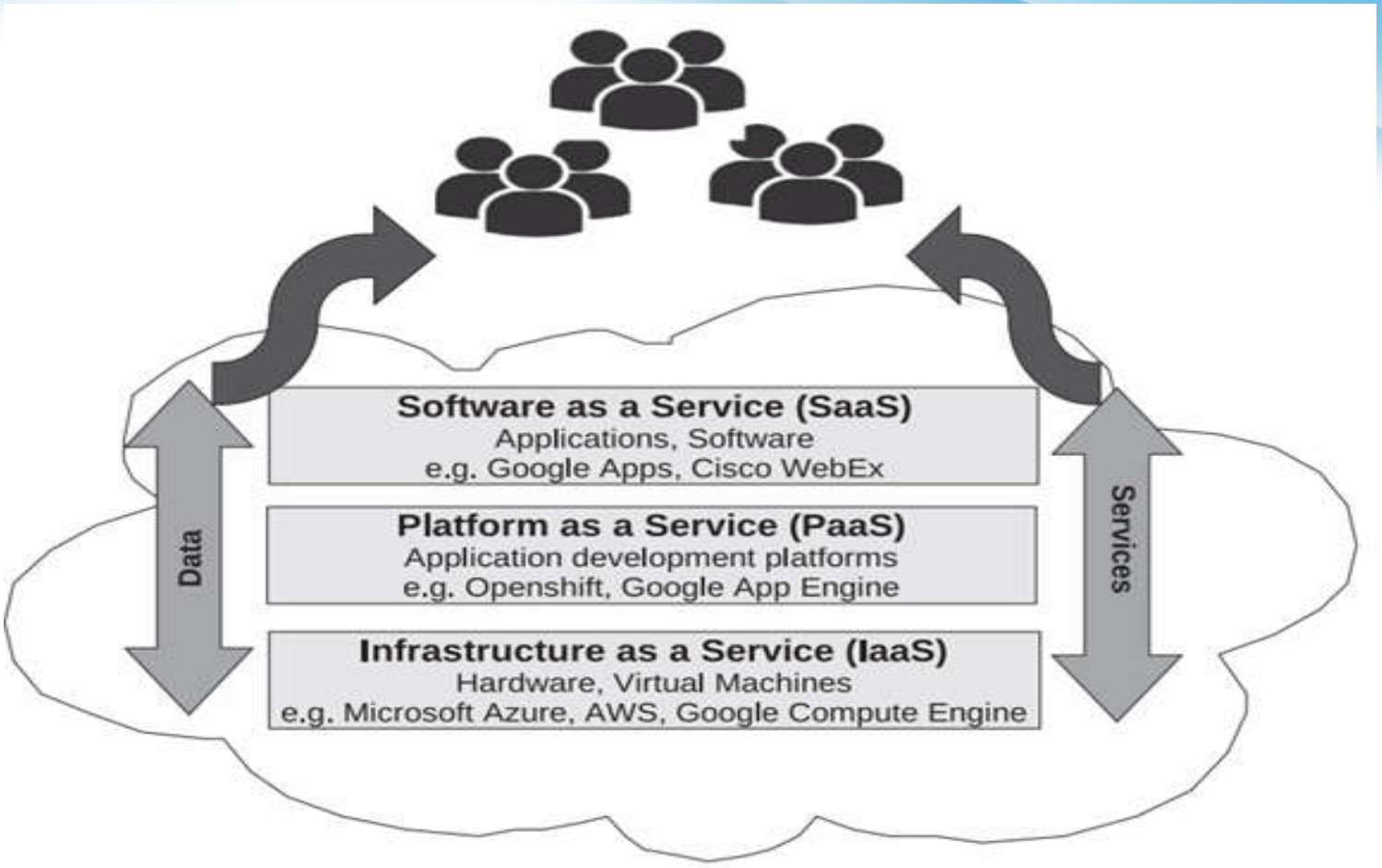
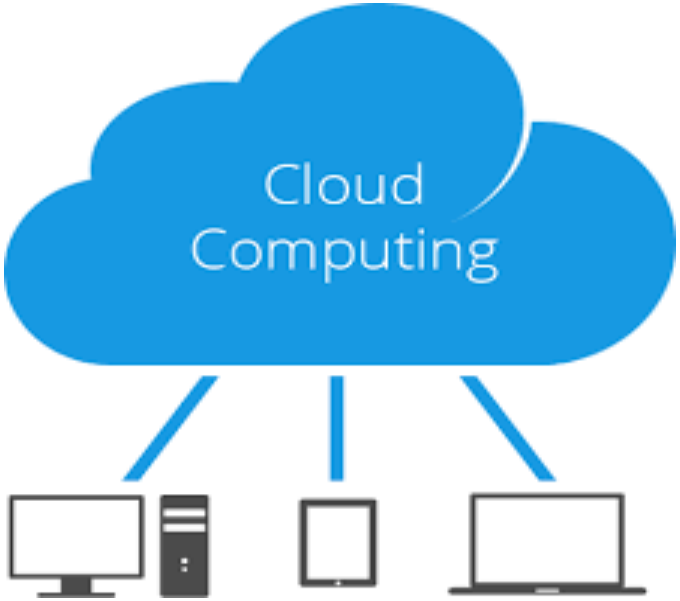


Fig. Cloud service delivery architecture.

Deployment models of cloud computing

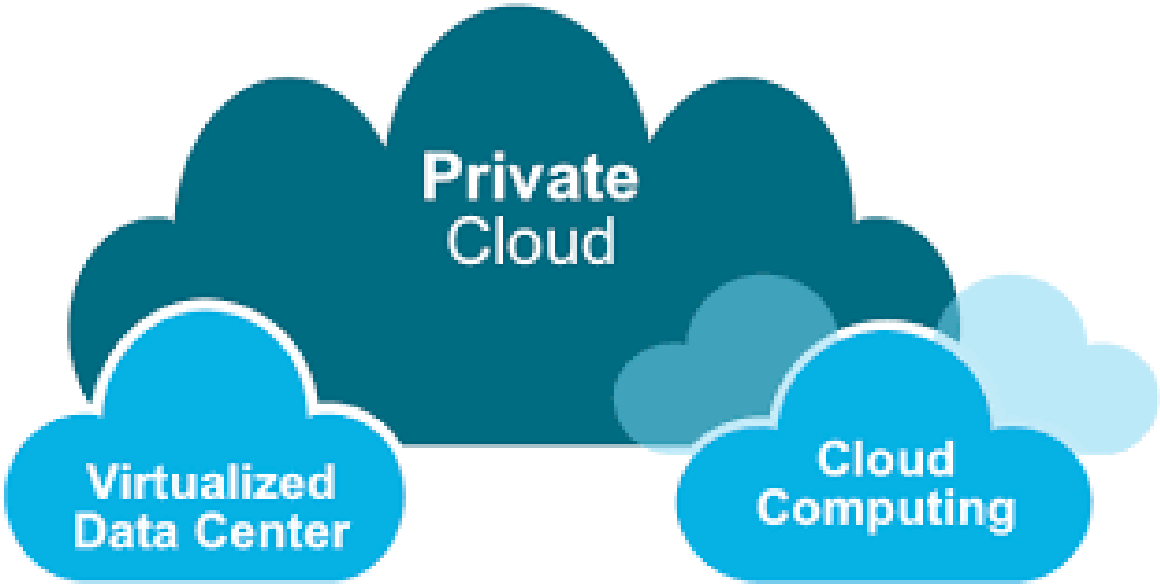
- A cloud organization model indicates how resources inside the cloud and shared.
- Deployment models are: **private cloud, public cloud, community cloud, and hybrid cloud**.

- Each model impacts the comparing scalability, reliability, security, and cost.



Private cloud

- A cloud that is used exclusively by one organization, company, or one of its customers.
- Cloud is operated and maintained internally by a single organization or through a Third Party Auditing .

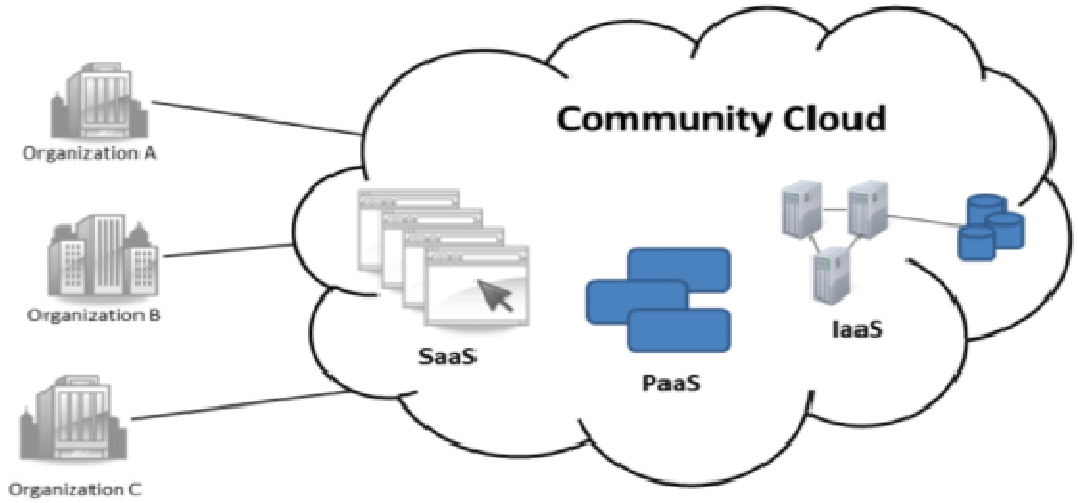


Public cloud

- A public cloud is run and managed by the CSP and the physical infrastructure may presented at off-site location of the user.
- The cloud resources are shared among the multiple people and people pay to the cloud provider according to the services they use.

Community Cloud

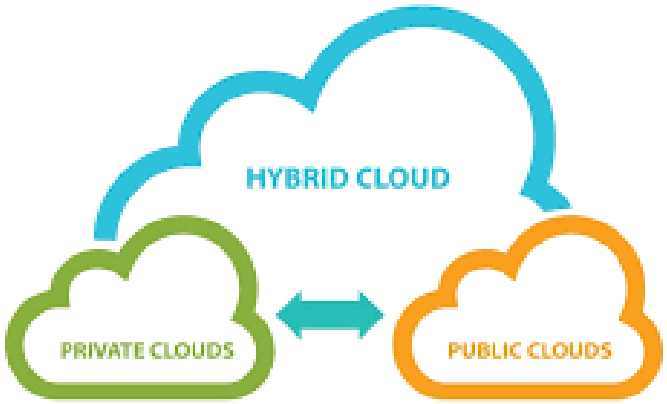
- Provides a cloud solution to a limited number of individuals or organizations that is governed, managed and secured commonly by all the participating organizations or a third party managed service provider.
- Often designed for businesses and organizations working on joint projects, applications, or research.



Hybrid Cloud

- Uses a mix of on-premises, private cloud and third-party, public cloud services with orchestration between the two platforms.

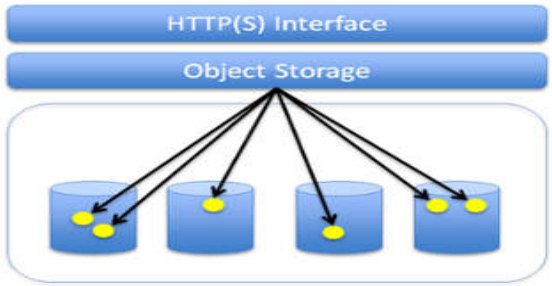
- Allows workloads to move between private and public clouds as computing needs and costs change. Hybrid cloud gives businesses greater flexibility and more data deployment options.



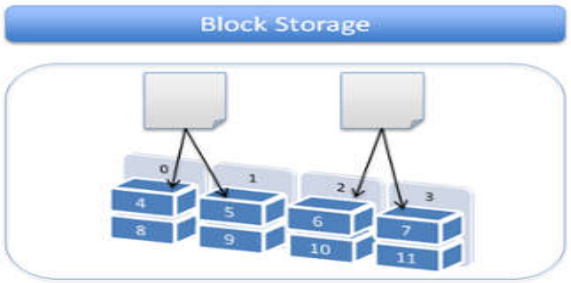
Storage models in the cloud

- The storage model tells about how data is stored in the cloud and availability of storage space.
- Cloud environment provides 3-types of storage solution.

1. **Shared file/block storage system**
2. **Object storage system**
3. **Database or table storage system**



- Store virtually unlimited files.
- Maintain file revisions.
- HTTP(S) based interface.
- Files are distributed in different physical nodes.

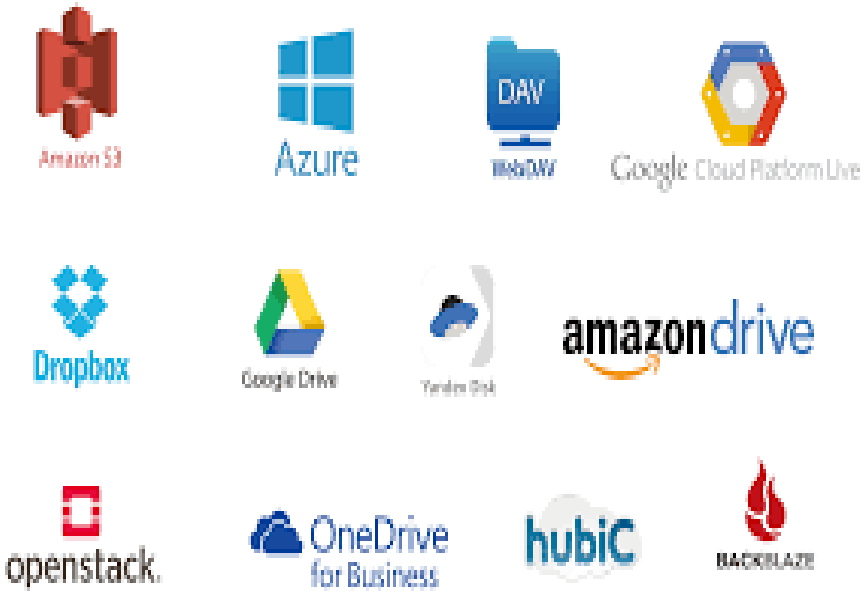


- File is split and stored in fixed sized blocks.
- Capacity can be increased by adding more nodes.
- Suitable for applications which require high IOPS, database, transactional data.

Cloud role and boundaries

The cloud provides different types of predefine role to the organization and human. These are:

- Cloud provider
- Cloud consumer
- Cloud service owner
- Cloud resource administrator
- Cloud broker
- Cloud carrier



Technologies in Cloud Computing

- Cloud computing isn't so much a technology as it is the combination of many pre-existing technologies.
- These technologies have matured at different rates and in different contexts, and were not designed as a coherent whole.
- These technologies have come together to create a technical ecosystem for cloud computing.

1. **Cloud access devices**
2. **Web technology**
3. **Broadband network and Internet technology**
4. **Data centers and server farms**
5. **Storage devices**
6. **Virtualization technologies**
7. **Service technology or API**
8. **Multi-tenant technology**

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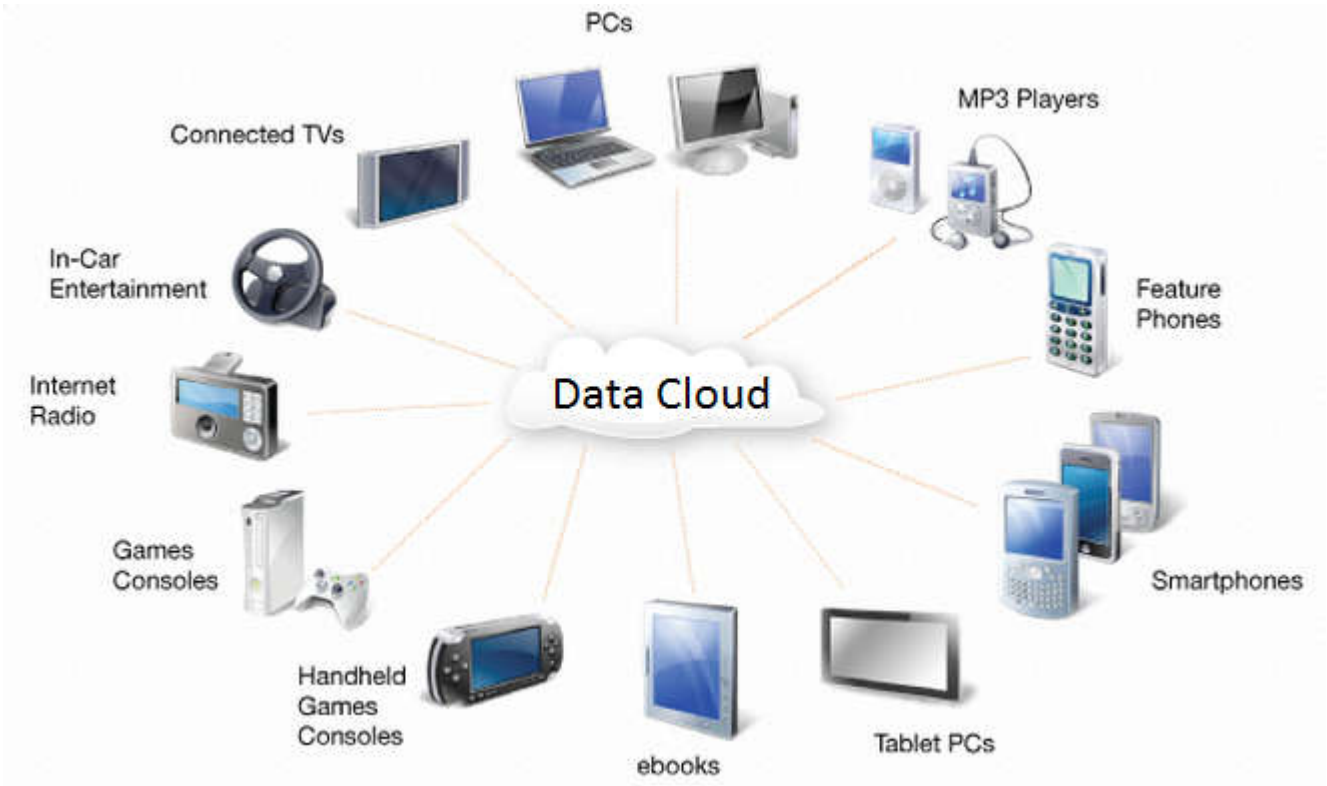
Cloud access devices

- The range of access devices for the cloud has expanded in recent years like home & enterprise PCs, network computers, mobile phone devices, and custom static devices are all online.



Web technology

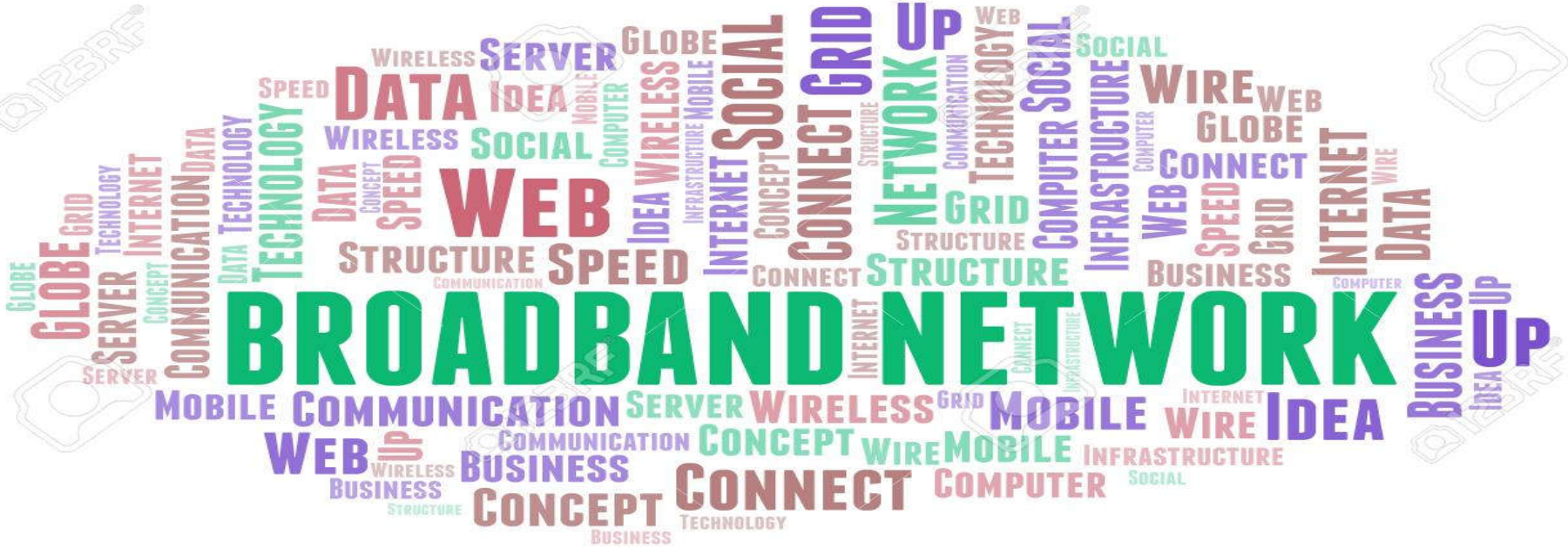
-Users of multiple device types can now access applications and information from wherever they can load a browser.

-The two fundamental constituent of the web technology is web client and web server. Proxies, routers, cache server, and gateways are known as the secondary components of the web

Broadband network and Internet technology

- A critical component of the cloud is the broadband network, which offers the means to connect components.

-Broadband access is now widely available, especially in global metropolitan areas.



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Data centers and server farms

- Data center technology contains multiple technologies and components that are typically composed with one another.
- The data center has both physical and virtualized IT resources.

Storage devices

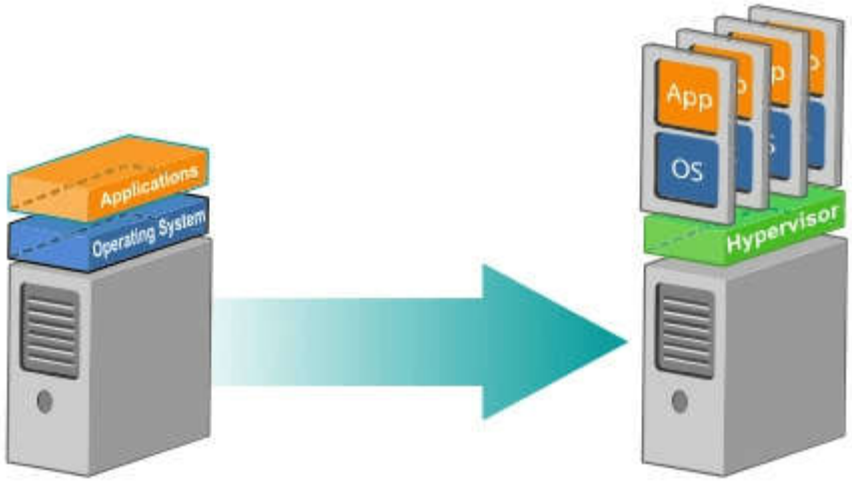
-The fixed direct access storage device (DASD) has been replaced with storage area networks (SANs), which have reduced costs and allowed a great deal more flexibility in enterprise storage.

-SAN software manages integration of storage devices and can independently allocate storage space on demand across a number of devices.

Virtualization technologies

-Virtualization refers to the abstraction of compute resources (CPU, storage, network, memory, application stack, and database) from applications and end users consuming the service.

-Virtualization technologies enable multi-tenancy cloud business models by providing a scalable, shared resource platform for all tenants.



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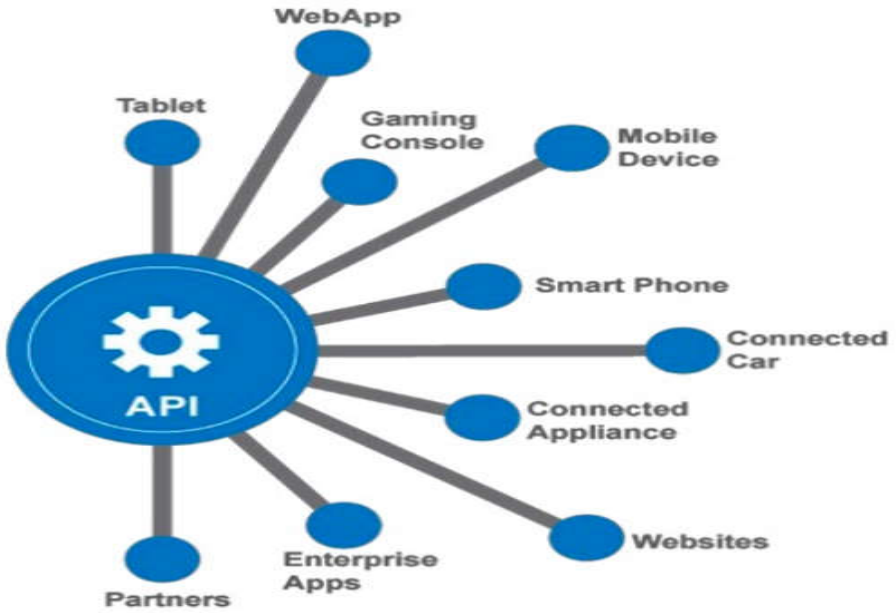
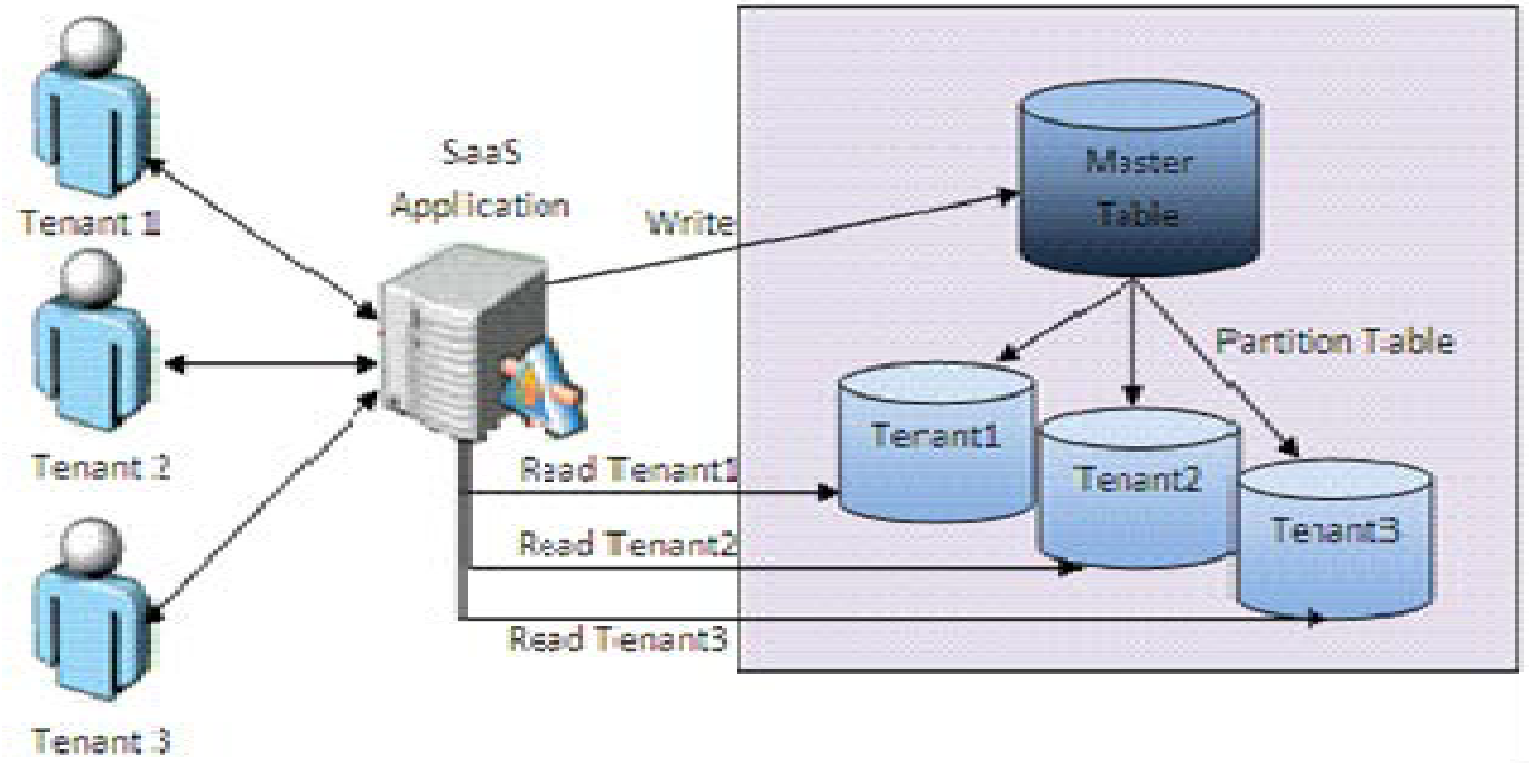
Service technology or API

- Depending on the type of cloud services delivery model, an API can manifest in different forms, ranging from simple URL manipulations to advanced SOA-like programming models.
- APIs help to exploit the full potential of cloud computing and mask the complexity involved in extending existing IT management processes of the cloud services.



Multi-tenant technology

- The same application logic is simultaneously accessed by multiple users using multi-tenant technology.
- The most common features of multi-tenants application is usage isolation, data recovery, data tier isolation, data security, application upgrades, system scalability, and metered usage



Traditional IT vs Cloud Computing

TABLE. Cloud computing: A customer's perspective

Dedicated/traditional IT	Cloud computing
High upfront IT investments for new builds	Low upfront IT investments; pay-for-use model
High cost of reliable infrastructure	Reliability built into the cloud architecture
High complexity of IT environment	Modular IT architecture environments
Complex infrastructure	No infrastructure

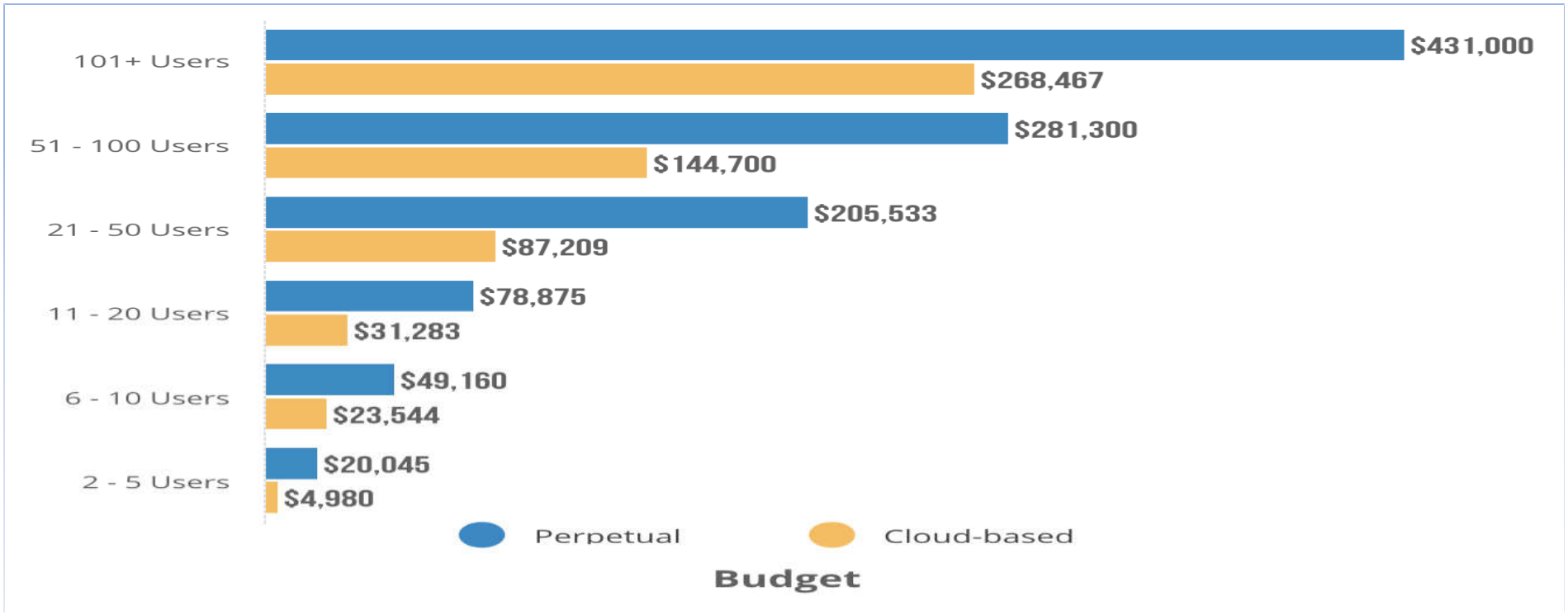
Key drivers of adopting cloud

There are a number of compelling reasons to move operations toward cloud computing.

- **Small Initial Investment and Low Ongoing Costs**
- **Economies of Scale**
- **Open Standards**
- **Sustainability**

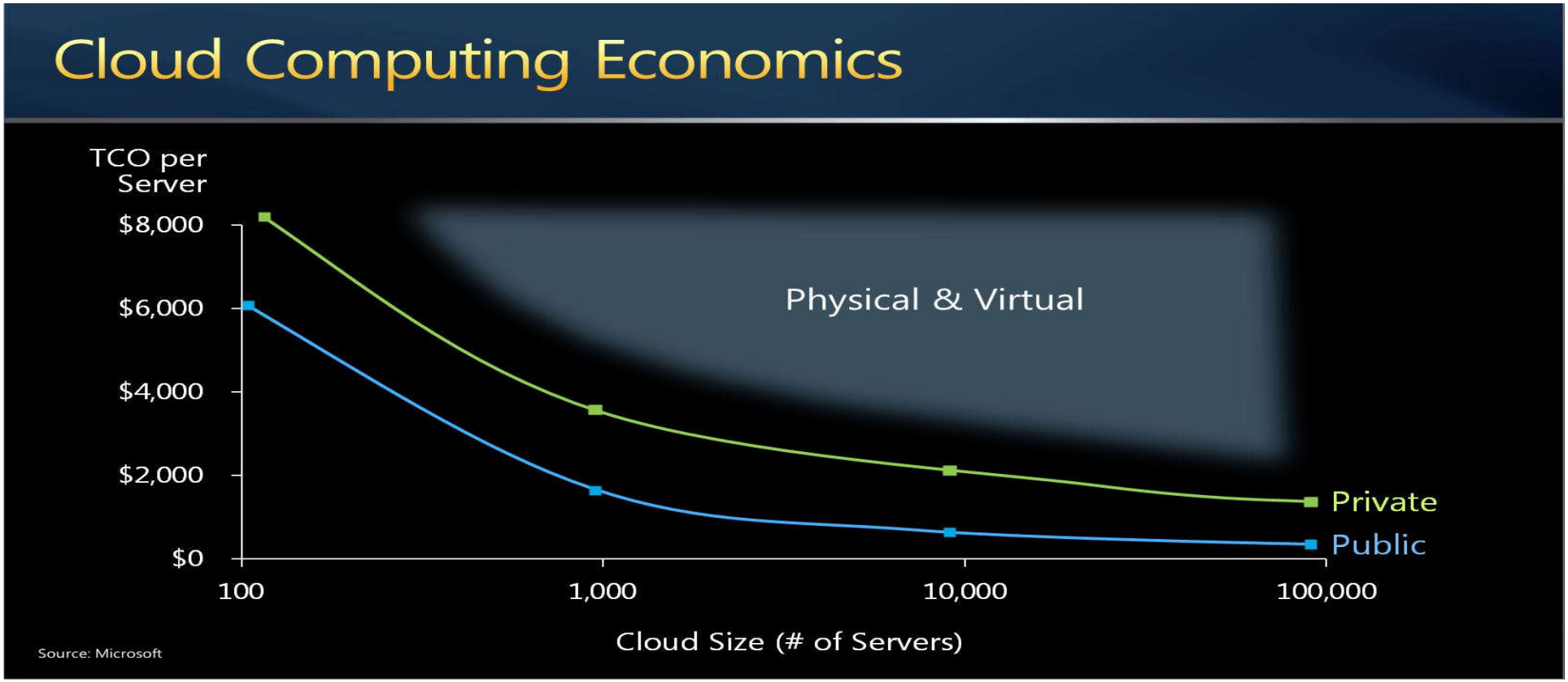
Key Drivers: Small Initial Investment and Low Ongoing Costs

- Public cloud computing can avoid capital expenditures because no hardware, software, or network devices need to be purchased.
- Cloud usage is billed on actual use only, and is therefore treated no more as an expense venture.



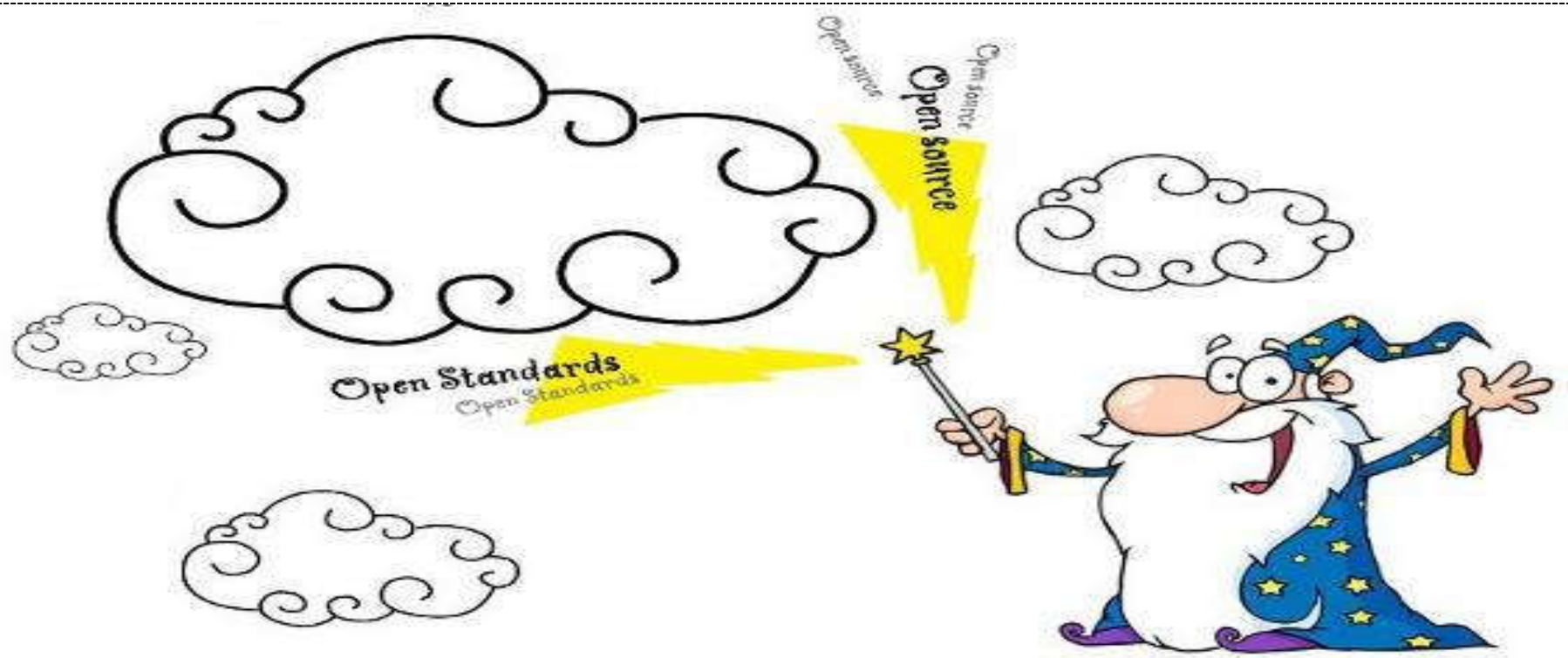
Key Drivers: Economies of Scale

- Most development projects have a sizing phase during which attempts to calculate the storage, processing power, and memory requirements during development, testing, and production.
- With the flexibility that cloud computing solutions offer, companies can acquire computing and development services as needed and on demand,



Key Drivers: Open Standards

- Some capabilities in cloud computing are based on open standards for building a modular architecture that can grow rapidly and can change when required.
- The flexibility to alter the source code is essential to allow for continued growth in the cloud solution.



Key Drivers: Sustainability

- CSPs have invested considerable expense and thought into creating a resilient architecture that can provide a highly stable environment
- Cloud computing allows companies to rely on the CSP to have limited points of failure, better resilience via clustering, and the ability to invest in state-of-the-art resilience solutions

Thank You

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