Presentation Topic

Cloud Computing

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(NBA and NAAC accredited, ISO 9001:2015 certified)

UNIT 1:

Introduction To Cloud Computing

Reference:

1) Thomas Erl, Zaigham Mahmood and Ricardo Puttini, *"Cloud Computing: Concepts, Technology and Architecture"*,
2) Wikipedia
3) Edureka

Contents

- Overview, Applications, Intranets and the Cloud.
- Your Organization and Cloud Computing- Benefits, Limitations, Security Concerns.
- Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions,
- Understanding SOA.
- Platform as a Service (PaaS).
- Infrastructure as a Service (IaaS)
- Case Study: Google Cloud Platform

CO Achieved in First Lecture

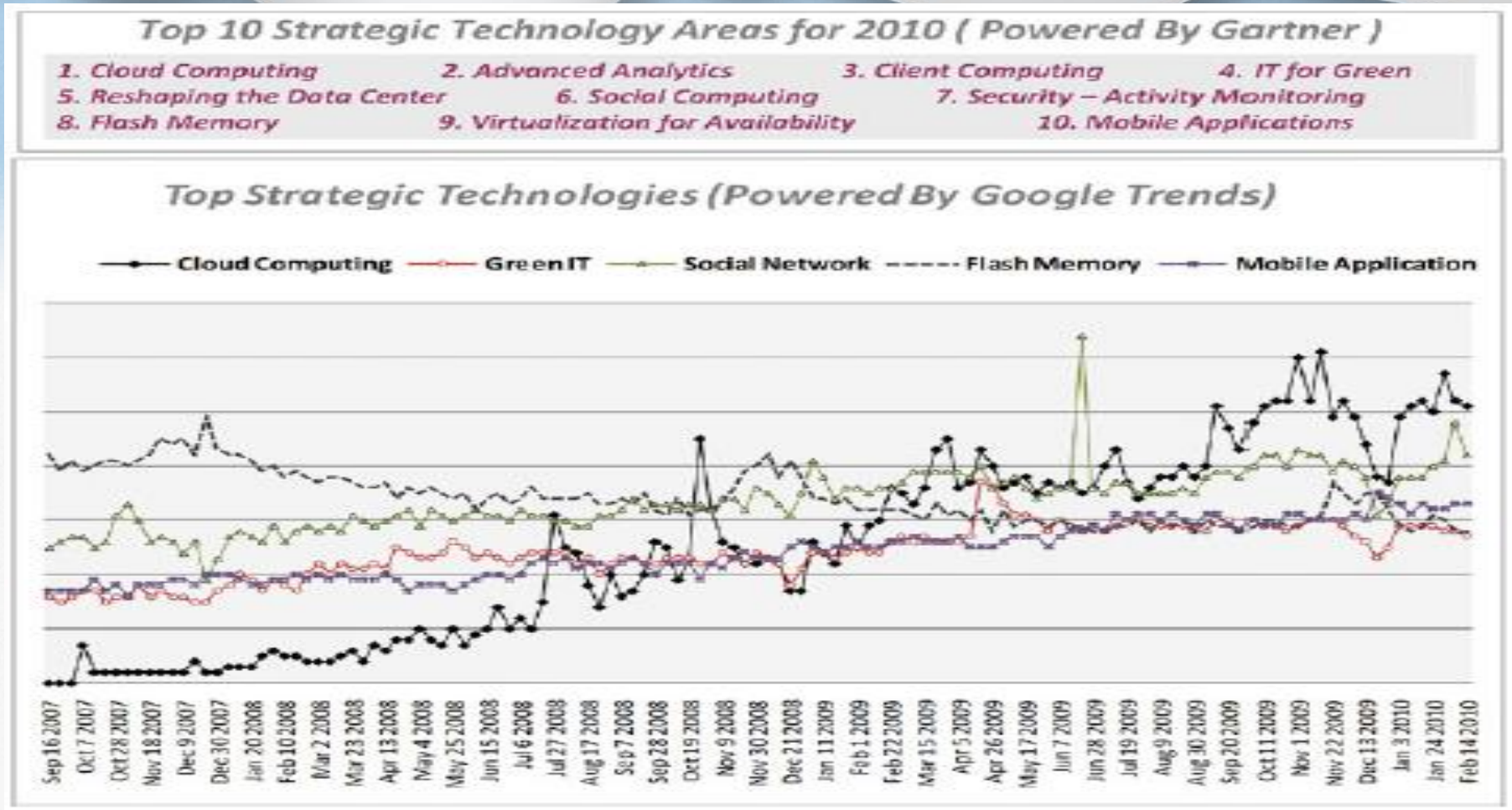
1) To understand cloud computing concepts
2) To study supporting technologies of cloud

Course Outcomes:-

At the end of the unit you will be able to:

1) Summarize the basic concepts of cloud computing (Understand)
2) Make use of supporting technologies for cloud computing (Understand, Apply)

Popularity of cloud computing

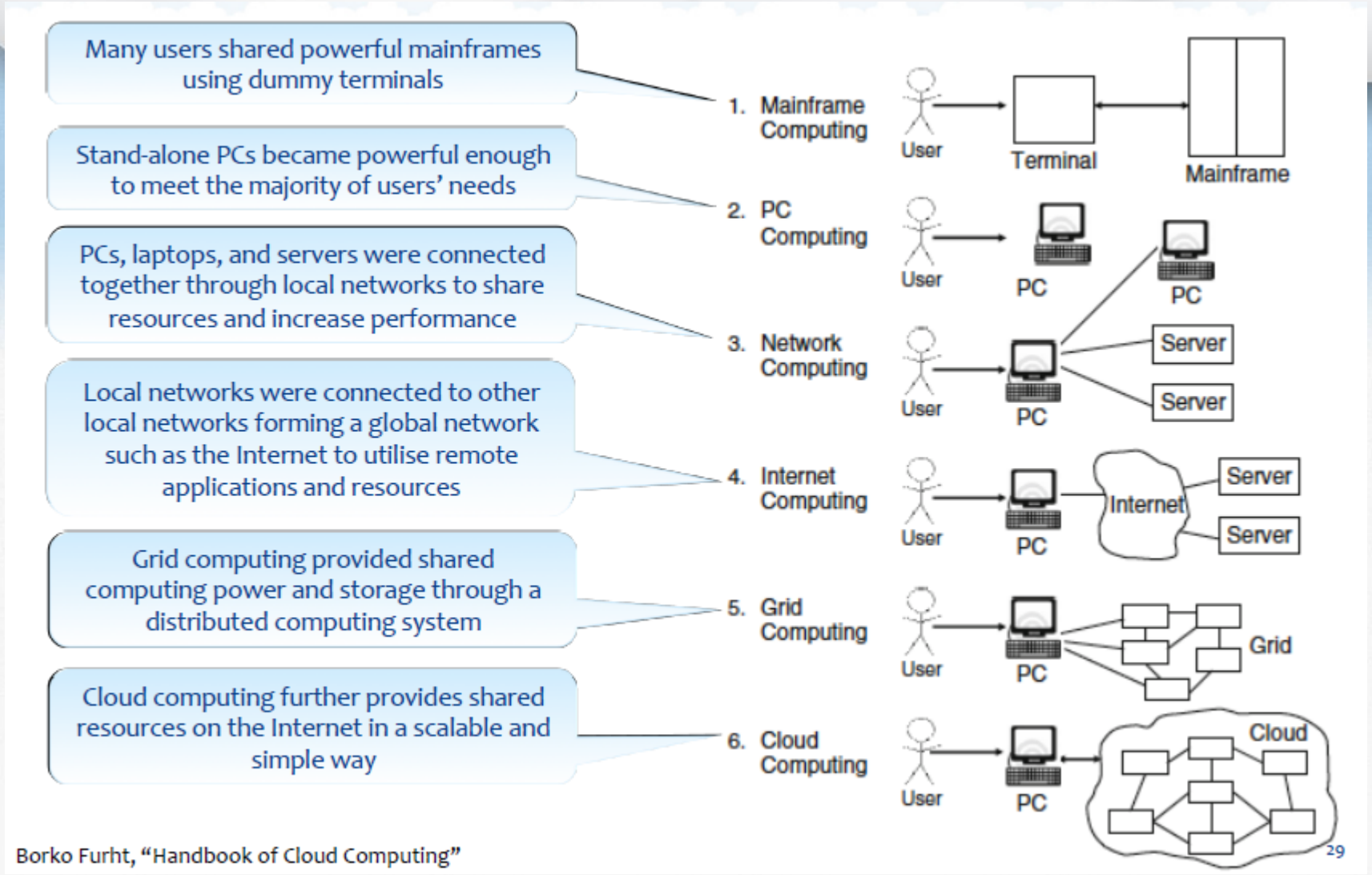


A brief history

- The idea of computing in a “cloud” traces back to the origins of utility computing, a concept that computer scientists **John McCarthy** publically proposed in **1961**:

“ If computers of the kind I have advocated become the computers of the future, then computing may someday be organized as a public utility just as the telephone system is a public utility…… the computer utility could become the basis of a new and important industry”

History



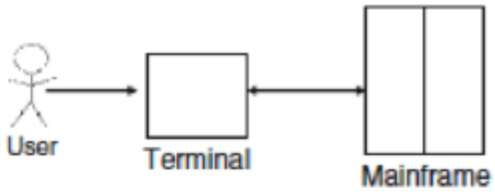
Borko Furht, "Handbook of Cloud Computing"

History

Offers finite computing power

Dummy terminals acted as user interface devices

1. Mainframe Computing

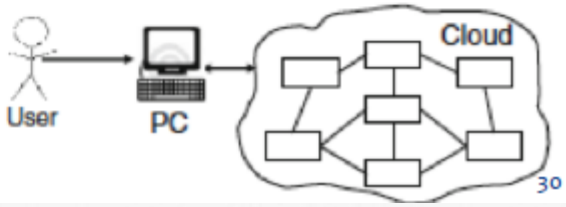


Quite similar?

Provides almost infinite power and capacity

Powerful PCs can provide local computing power and cashing support

6. Cloud Computing



Borko Furht, "Handbook of Cloud Computing"

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Introduction to Cloud Computing

- **Cloud Computing can be defined as**

  "a new style of computing in which dynamically scalable and often virtualized resources are provided as a services over the Internet".

Forrester Research provided its own definition of cloud computing:

"…. A standardized IT capability (services, software, or infrastructure) delivered via internet technologies in a pay-per-use, self-service way."

Introduction to Cloud Computing

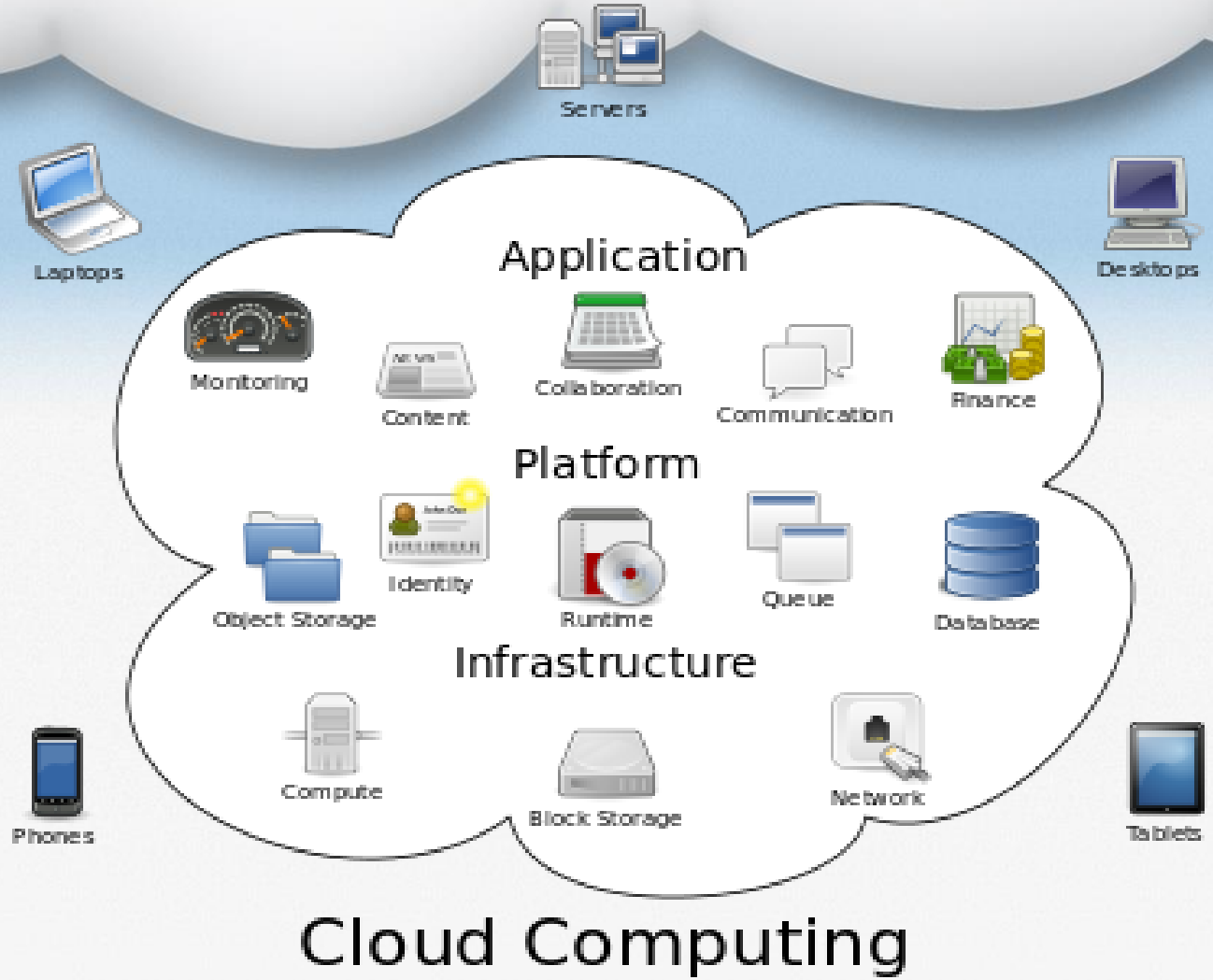
- **NIST *(National Institute of Standards & Technology)* Definition:**

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. network, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models."

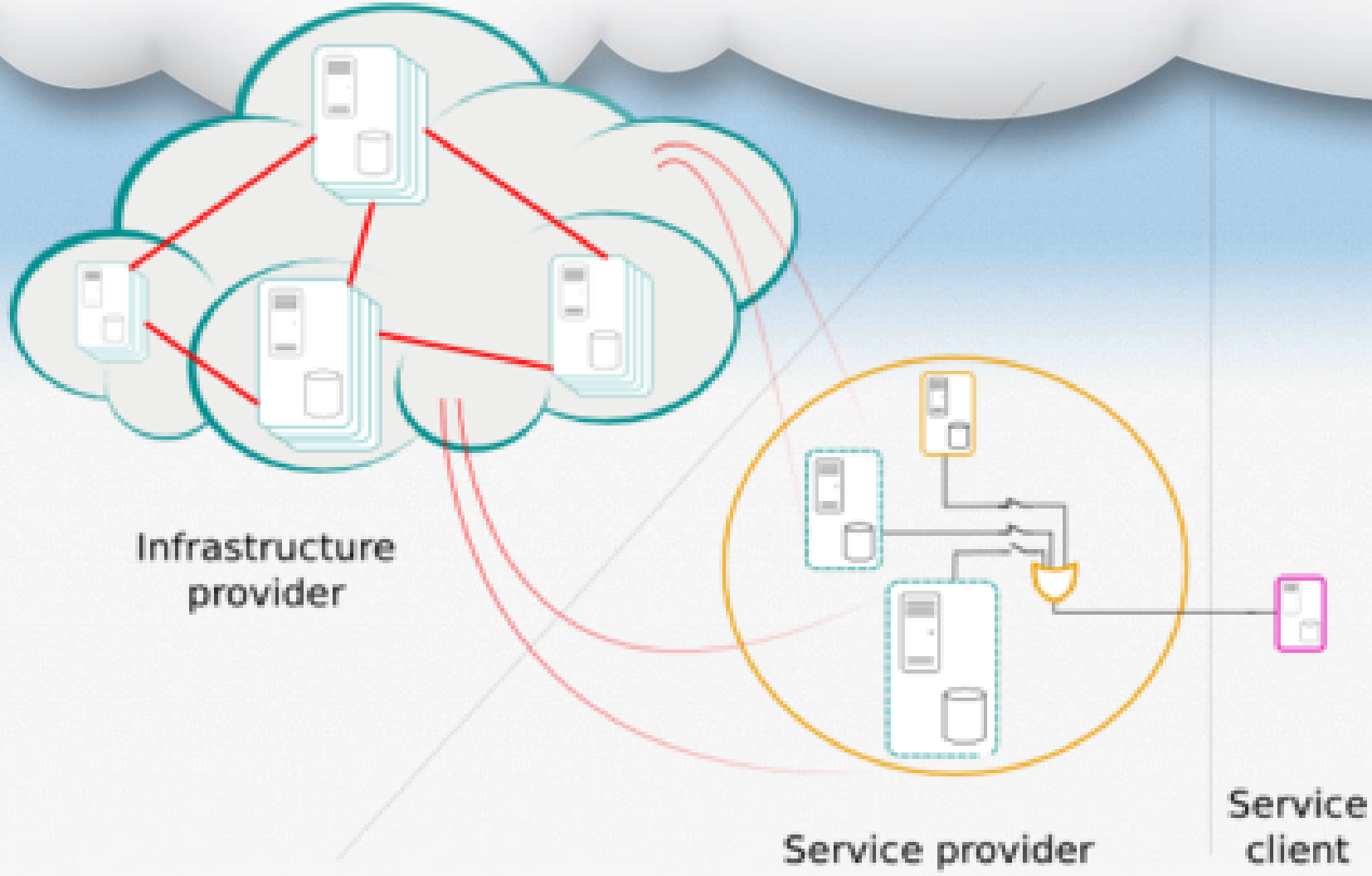
- A more concise definition:

“Cloud computing is a specialized form of distributed computing that introduces utilization models for remotely provisioning scalable and measured resources”

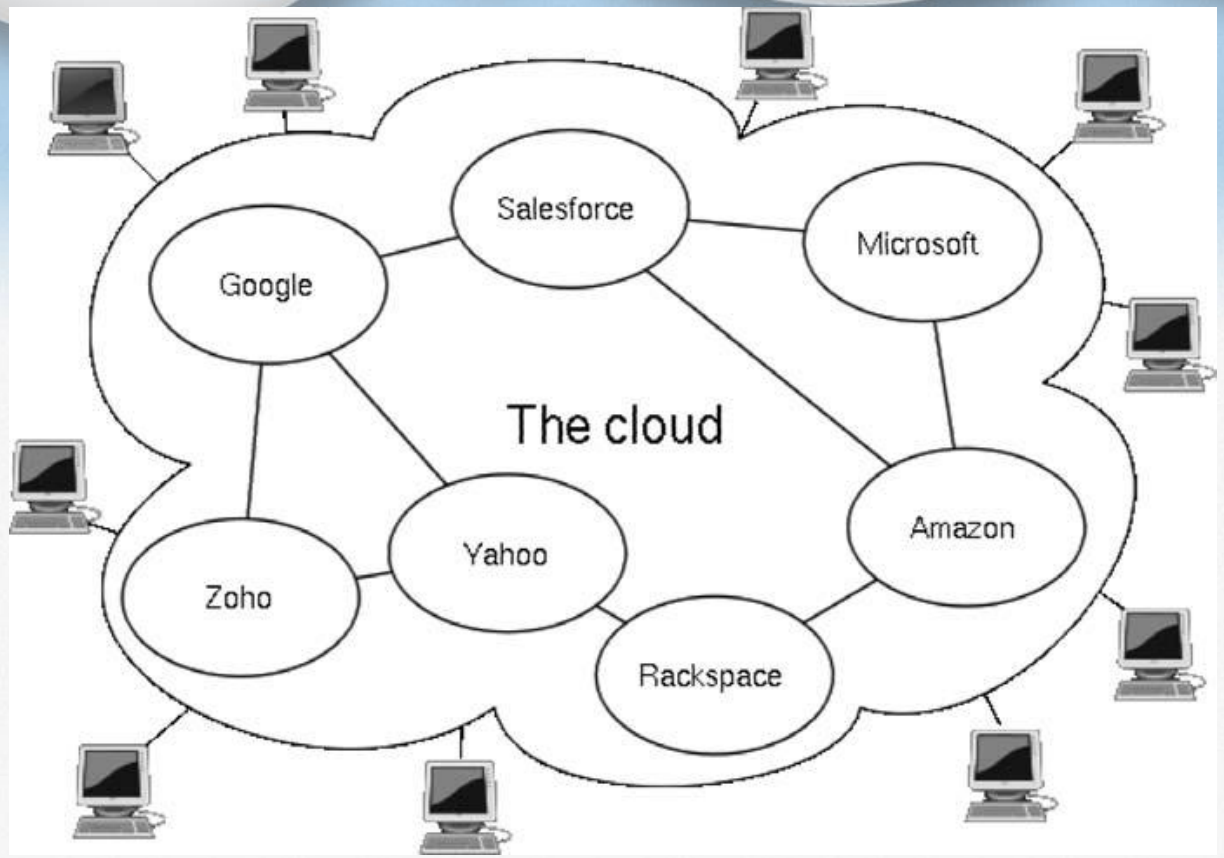
What is cloud computing?



What is cloud computing?



What is cloud computing?



Business Drivers

- Capacity Planning
- Cost Reduction
- Organizational Agility

Technology Innovations

•Clustering:

A cluster is a group of independent IT resources that are interconnected and work as a single system. System failure rates are reduced while availability and reliability are increased, since redundancy and failover are inherent to the cluster.

A general prerequisite of hardware clustering is that its component systems have reasonably identical hardware and operating systems to provide similar performance levels when one failed component is to be replaced by another. Component devices that form a cluster are kept in synchronization through dedication, high-speed communication links.

the basic concept of built-in redundancy and failover is core to cloud platforms.

Technology Innovations

- Grid Computing:

  A computing grid (or “Computational grid”) provides a platform in which computing resources are organized into one or more logical pools. These pools are collectively coordinated to provide a high performance distributed grid, sometimes referred to as a “super virtual computer”.

  Grid computing differs from clustering in that grid systems are much loosely coupled and distributed. As a result, grid computing systems can involve computing resources that are heterogeneous and geographically dispersed, which is generally not possible with cluster-based systems.

  The technological advancements achieved by grid computing projects have influenced various aspects of cloud computing platforms and mechanism, specifically in relation to common feature- sets such as networked access, resource pooling, and scalability and resiliency.
  These types of features can be established by both grid computing and cloud computing, in their own distinctive approaches.

Technology Innovations

•Virtualization:

Virtualization represents a technology platform used for the creation of virtual instances of IT resources.

A layer of virtualization software allows physical IT resources to provide multiple virtual images of themselves so that their underlying processing capabilities can be shared by multiple users.

Prior to the virtualization technology, software was limited to residing on and being coupled with static hardware environments. The virtualization process servers this software-hardware dependency, as hardware requirements can be simulated by emulation software running in virtualized environments.

Established virtualization technologies can be traced to several cloud characteristics and cloud computing mechanisms, having inspired many of their core features.

Modern virtualization technologies emerged to overcome the performance, reliability and scalability limitations of traditional virtualization platforms.

Technology Innovations Vs. Enabling Technologies

- It is essential to highlight several other areas of technology that continue to contribute to modern-day cloud-based platforms. There are distinguished as cloud-enabling technologies :
  - Broadband Networks and internet architecture
  - data center technology
  - (Modern) virtualization technology
  - Web technology
  - Multitenant technology
  - Service technology

Each of these cloud-enabling technologies existed in some form prior to the formal advent of cloud computing some were refined further, and on occasion even redefined, as a result of the subsequent evolution of cloud computing.

Summary of key points

- The primary business drivers that exposed the need of cloud computing and led to its formation include capacity planning, cost reduction, and organizational agility.

- The primary technology innovations that influenced and inspired key distinguishing features and aspects of cloud computing include clustering, grid computing, and traditional forms of virtualization.

Home Assignment Question

- Difference between Cluster, Grid and cloud computing??

- Tomorrow's Points:
  - Five essential characteristics,
  - Three service models, and
  - Four deployment models.

Basic Concepts & Terminology

- **Cloud:**
  - A ***cloud*** refers to a distinct IT environment that is designed for the purpose of remotely provisioning scalable and measured IT resources.
  - the symbol of cloud was commonly used to represent the Internet in a verity of specifications.
  - This same symbol is now used to specifically represent the boundary of cloud environment, as shown in fig.

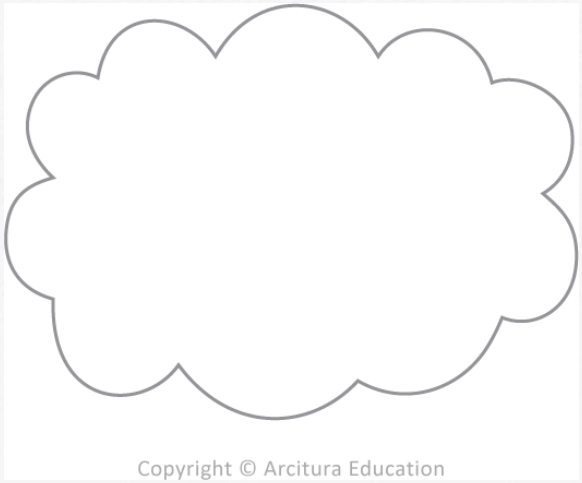


Fig: The symbol used to denote the boundary of a cloud environment.

Basic Concepts & Terminology

- Difference between “Cloud” and Internet :

1. As a specific environment used to remotely provision IT resources, a cloud has a finite boundary.

   whereas the Internet provides open access to many Web-based IT resources, a cloud is typically privately owned and offers access to IT resources that is metered.

2. Much of the internet is dedicated to the access of content-based IT resources published via the World Wide Web,

   on the other hand, are dedicated to supplying back-end processing capabilities and user-based access to these capabilities.

Basic Concepts & Terminology

- IT Resources:
  - An IT resource is a physical or virtual IT-related artifact that can be either software-based, such as virtual server or a custom software program, or hardware-based, such as a physical server or a network device.

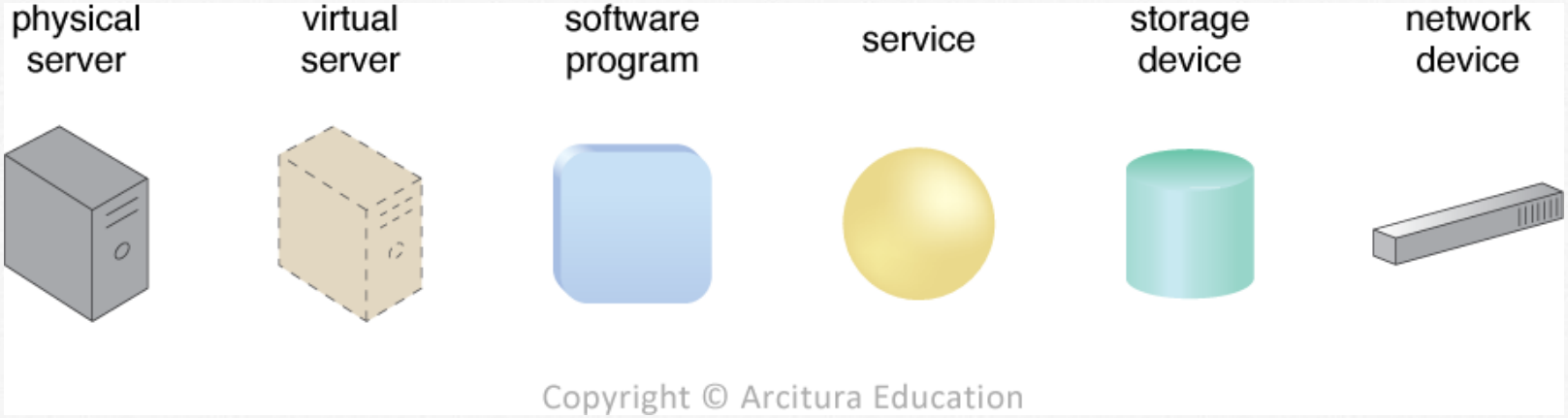


Figure: Examples of common IT resources and their corresponding symbols

Basic Concepts & Terminology

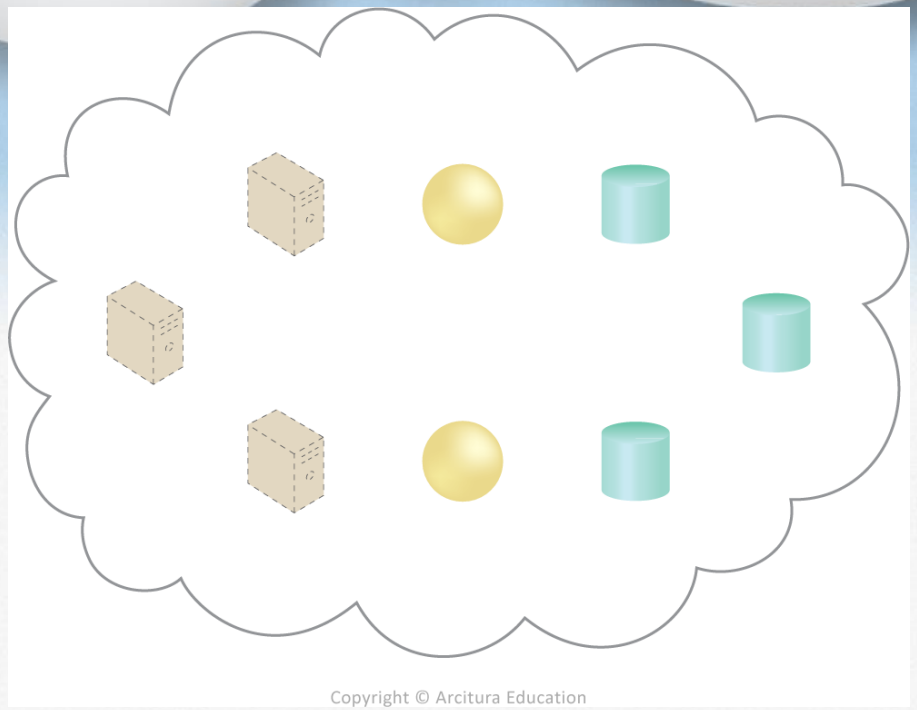


Figure: A cloud is hosting eight IT resources: three virtual servers, two cloud services, and three storage devices.

Basic Concepts & Terminology

- On-Premise:
  - As a distinct and remotely accessible environment, a cloud represents an option for the deployment of IT resources.
  - An IT resources that hosted in a conventional IT enterprise within an organizational boundary (that does not specifically represent a cloud) is considered to be located on the premises of the IT enterprise, or on-premise for short.
  - ***"on the premises of a controlled IT environment that is not cloud-based"***
  - ***An IT resources that is on-premise cannot be a cloud-based, and vice-versa.***

Basic Concepts & Terminology

- **Scaling:**

  Scaling, from an IT recourse perspective, represents the ability of the IT resource to handle increased or decreased usage demands.

  The following are types of scaling:

  - ***Horizontal Scaling :*** scaling out and scaling in
  - ***Vertical Scaling :*** scaling up and scaling down

Basic Concepts & Terminology

- ***Horizontal Scaling :***

  - ✓ The allocating or releasing of IT resources that are of the same type is referred to as ***horizontal scaling***, as shown in fig.
  - ✓ The horizontal allocation of resources is referred to as ***scaling out*** and the horizontal releasing of resources is referred to as ***scaling in***.
  - ✓ Horizontal scaling is a common form of scaling within cloud environment.

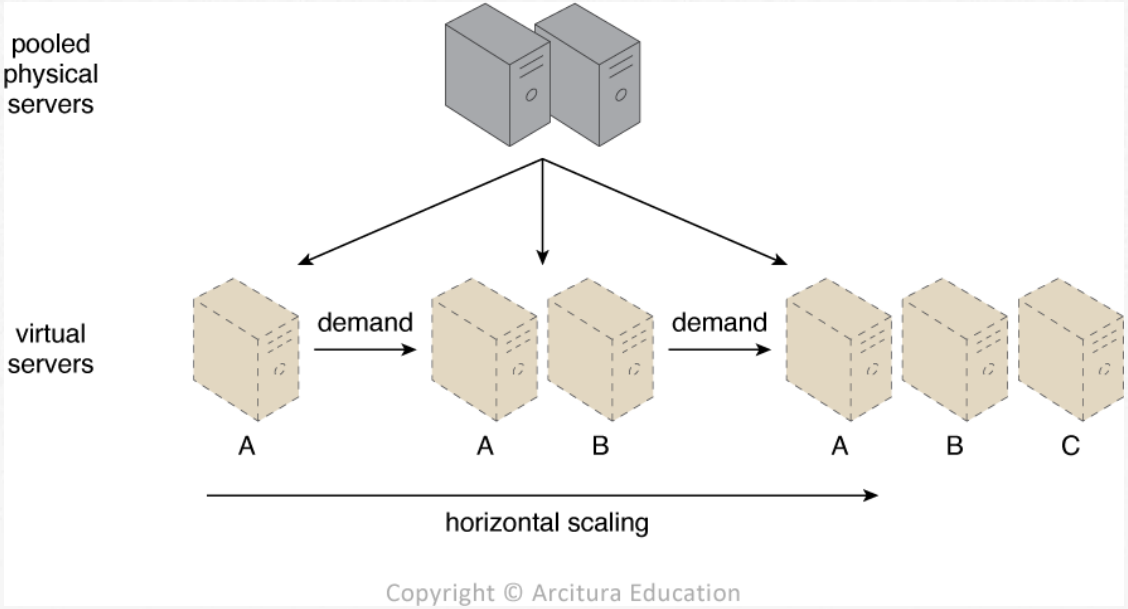


Fig: An IT resources (Virtual server A) is scaled out by adding more of the same IT resources (Virtual Server B and C)

Basic Concepts & Terminology

- ***Vertical Scaling*** :
  - ✓ When an existing IT resources is replaced by another with higher or lower capacity, ***vertical scaling*** is considered to have occurred, as shown in the fig.
  - ✓ The replacing of an IT resource with higher capacity is referred to as ***scaling up*** and the replacing an IT resource with lower capacity is referred to as ***scaling down***.

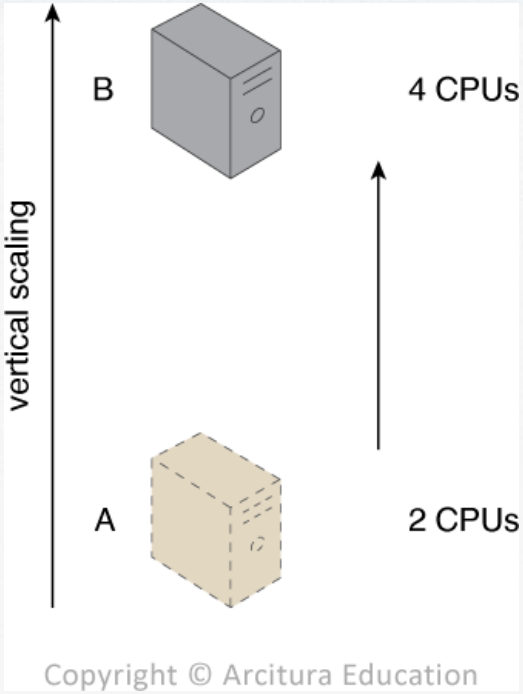


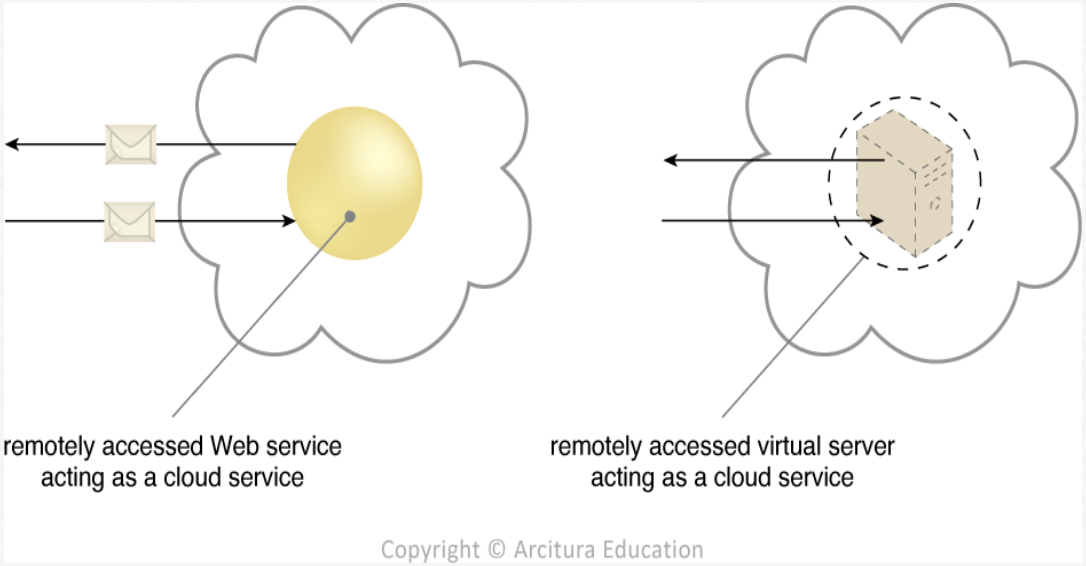
Figure: An IT resource (a virtual server with two CPUs) is scaled up by replacing it with a more powerful IT resource with increased capacity for data storage (a physical server with four CPUs)

Basic Concepts & Terminology

❑ Cloud Service:

- A ***cloud service*** is any IT resource that is made remotely accessible via a cloud.
- The term *"service"* within the context of cloud computing is especially broad.
- A cloud service can exist as a simple web-based software program with a technical interface invoked via the use of a messaging protocol, or as a remote access point for administrative tools or large environment and other IT resources.

Figure: A cloud service with a published technical interface is being accessed by a consumer outside of the cloud (left). a cloud service that exists as a virtual server is also being accessed from Outside of the cloud's boundary (right)



Basic Concepts & Terminology

❑ Cloud Service consumers:

- A ***cloud service consumer*** is a temporary runtime role assumed by a software program when it accesses a cloud service.
- As shown in the fig. common type of cloud service consumers can include software programs and services capable of remotely accessing cloud services with published service contracts.

Figure: Examples of cloud service consumers. Depending on the nature of a given diagram, an artifact labeled as a cloud service consumer may be a software program or a hardware device (in which case it is running a software program capable of acting as a cloud service consumer).

Goals & Benefits

- Reduced Investments and proportional costs
- Increased scalability
- Increased availability and reliability

Cloud Reference Model

- The design of the NIST cloud computing reference architecture serves the following objectives:
  - to illustrate and understand the various cloud services in the context of an overall cloud computing conceptual model;
  - to provide a technical reference to USG agencies and other consumers to understand, discuss, categorize and compare cloud services;
  - and to facilitate the analysis of candidate standards for security, interoperability, and portability and reference implementations.

Cloud Reference Model

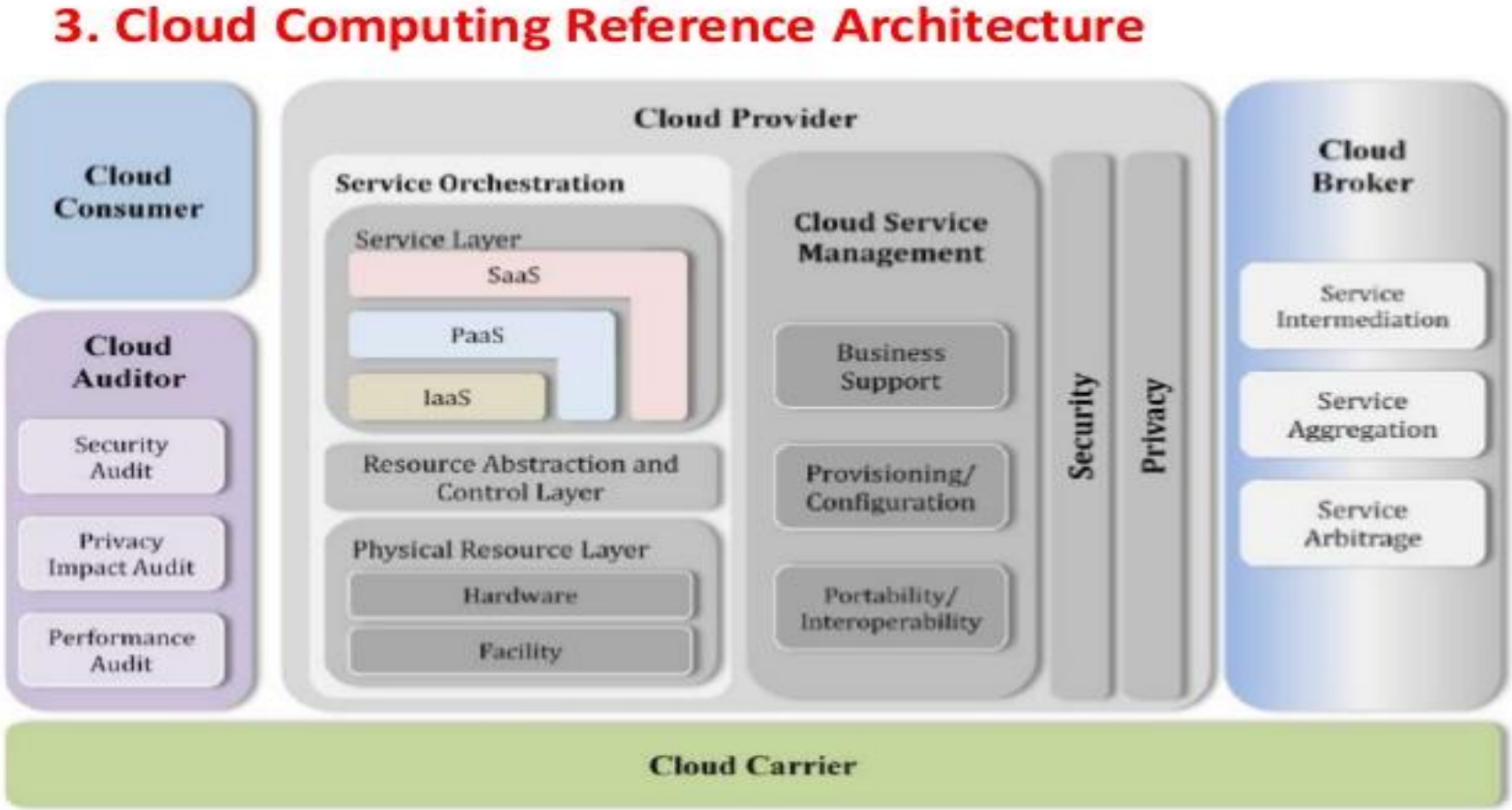


Figure 1: The Conceptual Reference Model

Roles in Cloud Computing

Actor	Definition
Cloud Consumer	A person or organization that maintains a business relationship with, and uses service from, *Cloud Providers*.
Cloud Provider	A person, organization, or entity responsible for making a service available to interested parties.
Cloud Auditor	A party that can conduct independent assessment of cloud services, information system operations, performance and security of the cloud implementation.
Cloud Broker	An entity that manages the use, performance and delivery of cloud services, and negotiates relationships between *Cloud Providers* and *Cloud Consumers*.
Cloud Carrier	An intermediary that provides connectivity and transport of cloud services from *Cloud Providers* to *Cloud Consumers*.

Table 1: Actors in Cloud Computing

Communication between actors

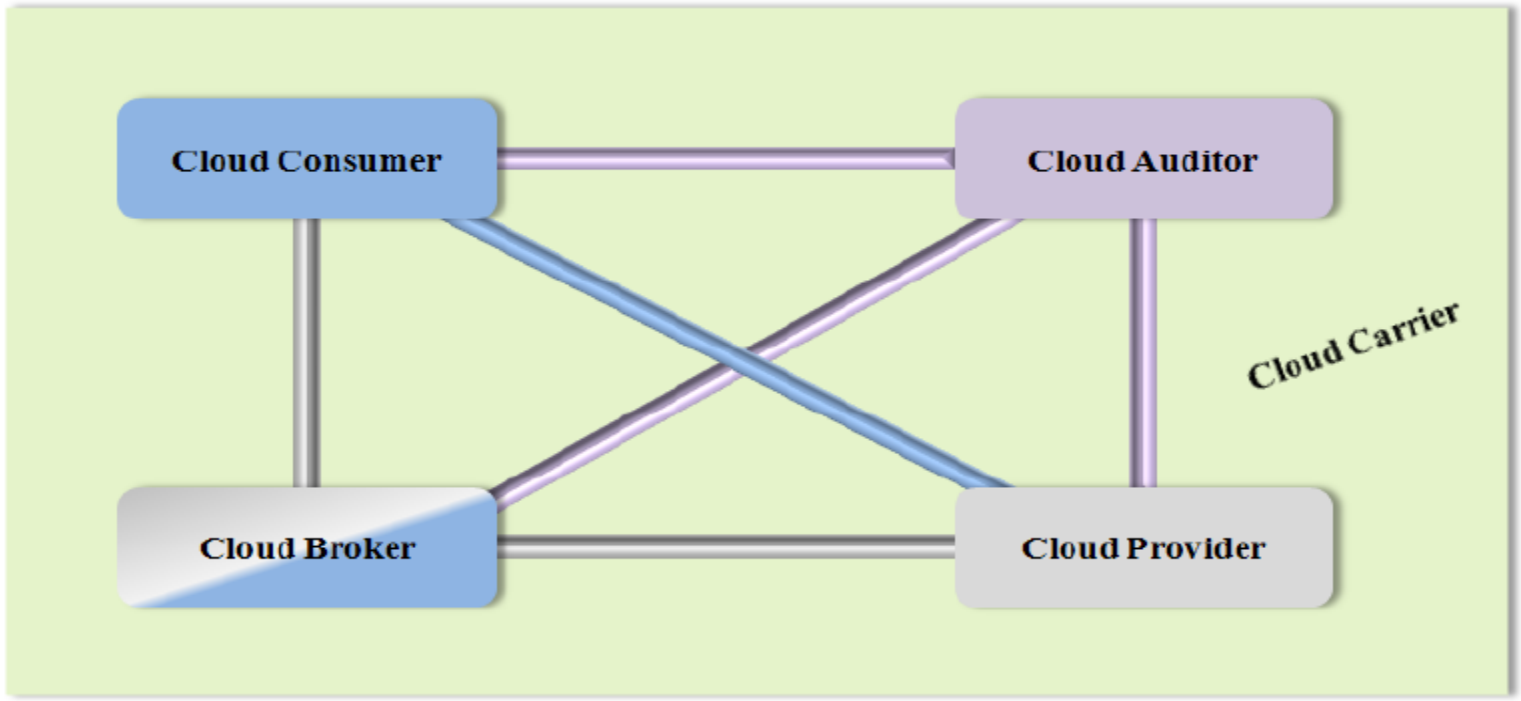


Figure 2: Interactions between the Actors in Cloud Computing

Cloud Usage Scenario Examples

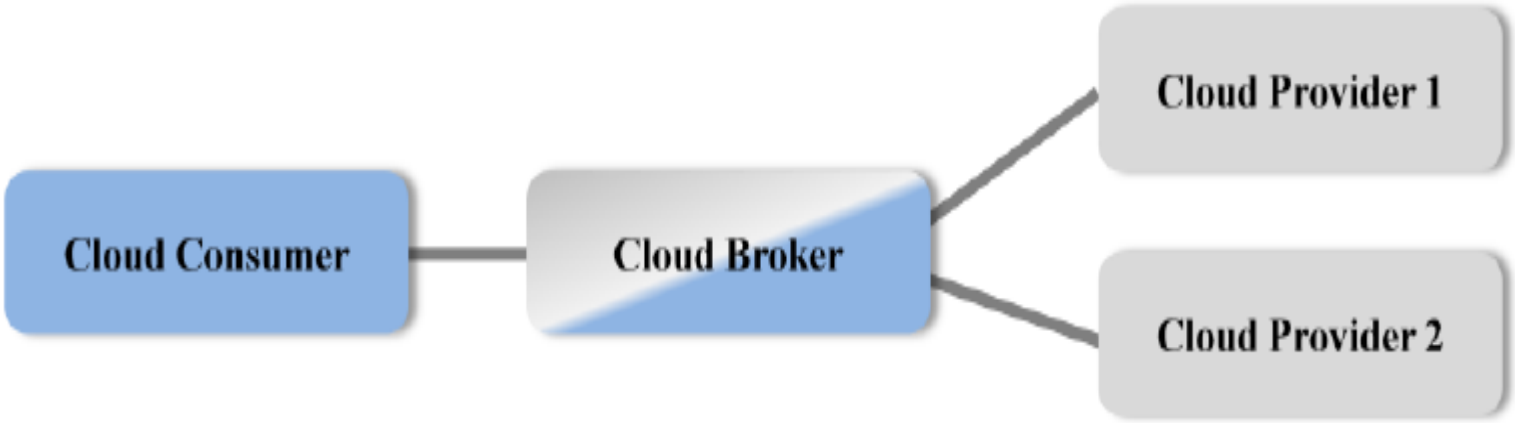


Figure 3: Usage Scenario for Cloud Brokers

Cloud Usage Scenario Examples

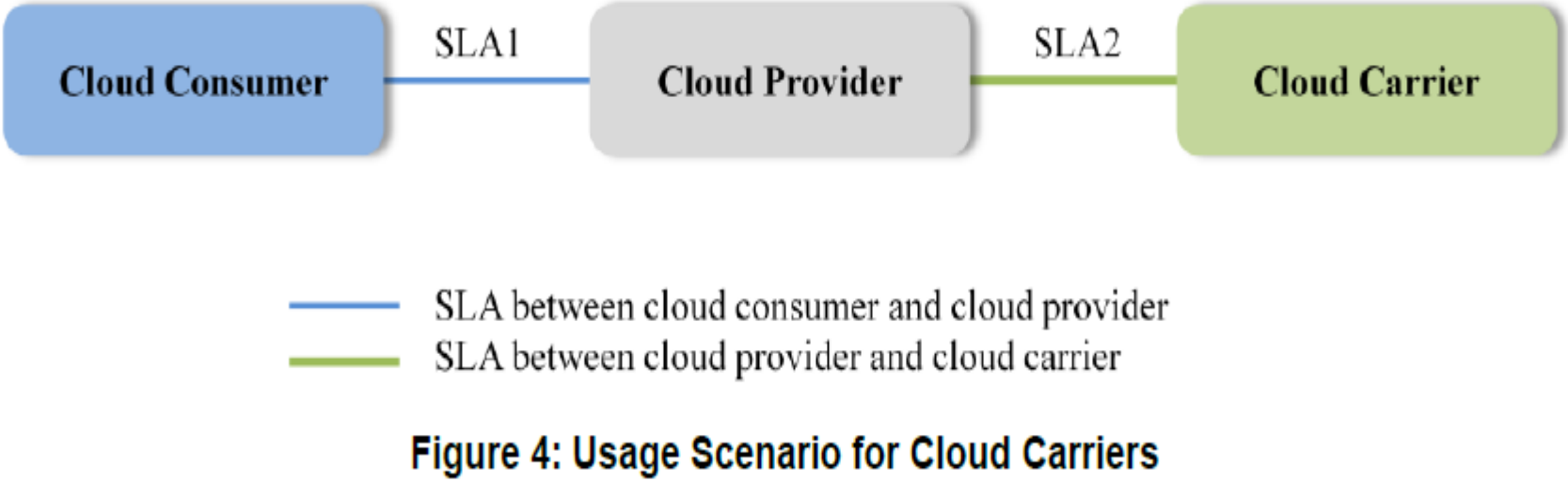


Figure 4: Usage Scenario for Cloud Carriers

Cloud Usage Scenario Examples

Figure 5: Usage Scenario for Cloud Auditors

Cloud Consumer

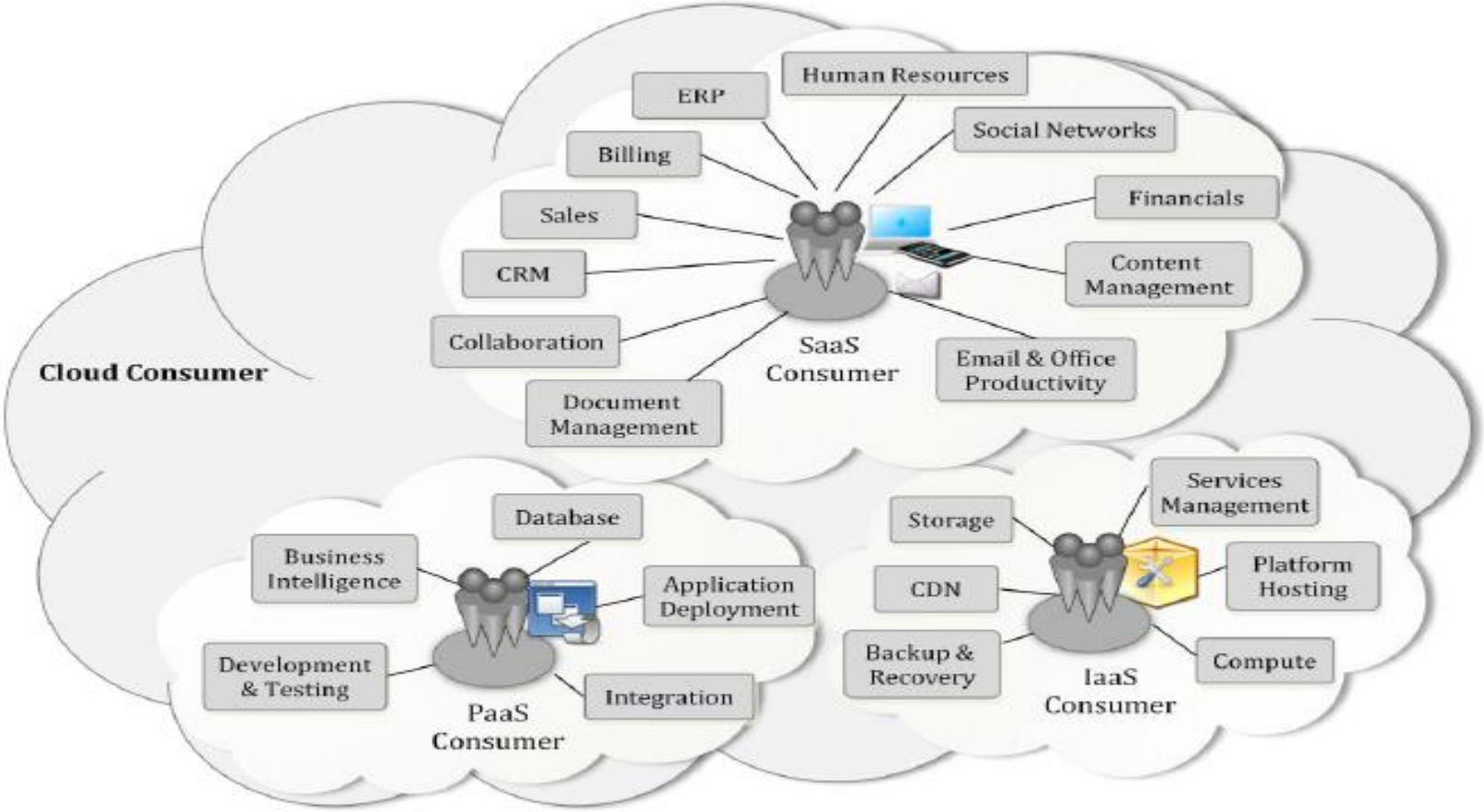


Figure 6: Example Services Available to a Cloud Consumer

Cloud Service Provider

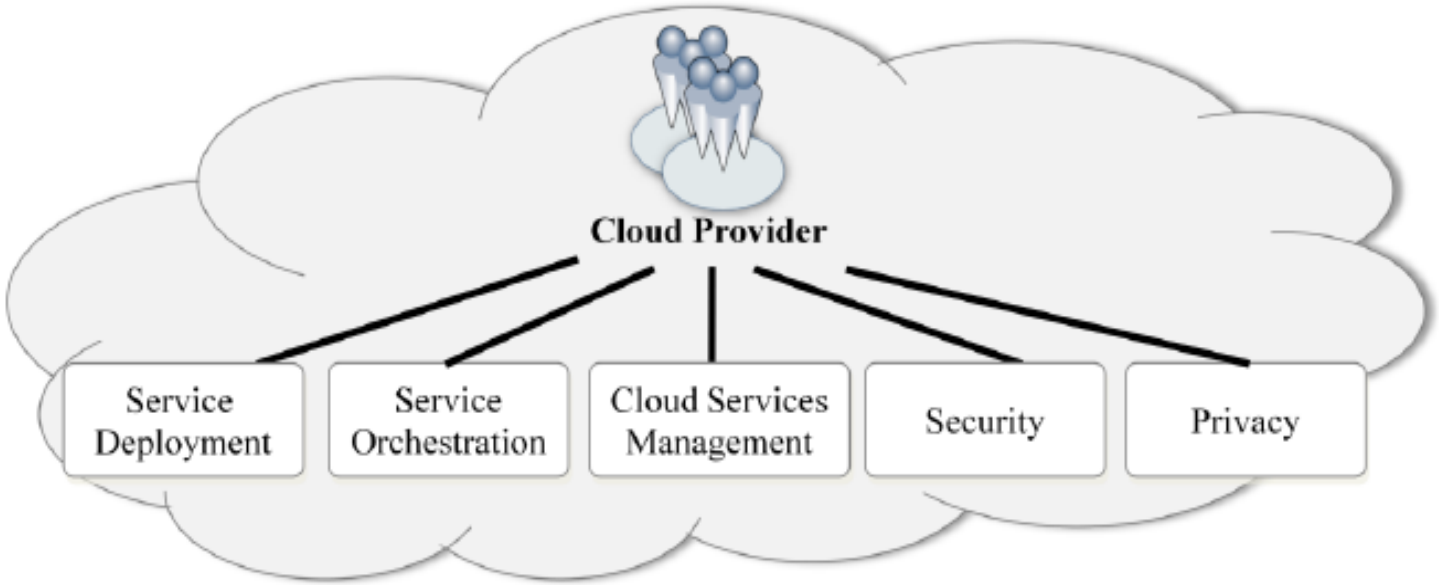


Figure 7: Cloud Provider - Major Activities

Cloud Auditor

- A cloud auditor is a party that can perform an independent examination of cloud service controls with the intent to express an opinion thereon.
- Audits are performed to verify conformance to standards through review of objective evidence.
- A cloud auditor can evaluate the services provided by a cloud provider in terms of security controls, privacy impact, performance, etc.

- **COMPANY EXAMPLES:**
  - ISACA (Infor. System audit & Control Association)
  - Product of ISACA is COBIT 5. (Control Objectives for Information and Related Technologies)
  - CloudChecker.com
  - Etc….

Cloud Broker

- As cloud computing evolves, the integration of cloud services can be too complex for cloud consumers to manage.
- A cloud consumer may request cloud services from a cloud broker, instead of contacting a cloud provider directly.
- A cloud broker is an entity that manages the use, performance and delivery of cloud services and negotiates relationships between cloud providers and cloud consumers.

- Cloud Broker Companies: *(Total market is of $2.03 billions in 2018)*
  - Appirio
  - AWS Marketplace
  - Bluewolf
  - CloudCompare
  - RED HAT Cloudforms is multicloud management platform.

Cloud Broker

In general, a cloud broker can provide services in three categories:

- ***Service Intermediation:*** A cloud broker enhances a given service by improving some specific capability and providing value-added services to cloud consumers. The improvement can be managing access to cloud services, identity management, performance reporting, enhanced security, etc.
- ***Service Aggregation*****:** A cloud broker combines and integrates multiple services into one or more new services. The broker provides data integration and ensures the secure data movement between the cloud consumer and multiple cloud providers.
- ***Service Arbitrage*****:** Service arbitrage is similar to service aggregation except that the services being aggregated are not fixed. Service arbitrage means a broker has the flexibility to choose services from multiple agencies. The cloud broker, for example, can use a credit-scoring service to measure and select an agency with the best score.

Cloud Carrier

- A cloud carrier acts as an intermediary that provides connectivity and transport of cloud services between cloud consumers and cloud providers.

- Cloud carriers provide access to consumers through network, telecommunication and other access devices. For example, cloud consumers can obtain cloud services through network access devices, such as computers, laptops, mobile phones, mobile Internet devices (MIDs), etc.

- The distribution of cloud services is normally provided by network and telecommunication carriers or a *transport agent*, where a transport agent refers to a business organization that provides physical transport of storage media such as high-capacity hard drives.

Scope of Control between Provider & Consumer

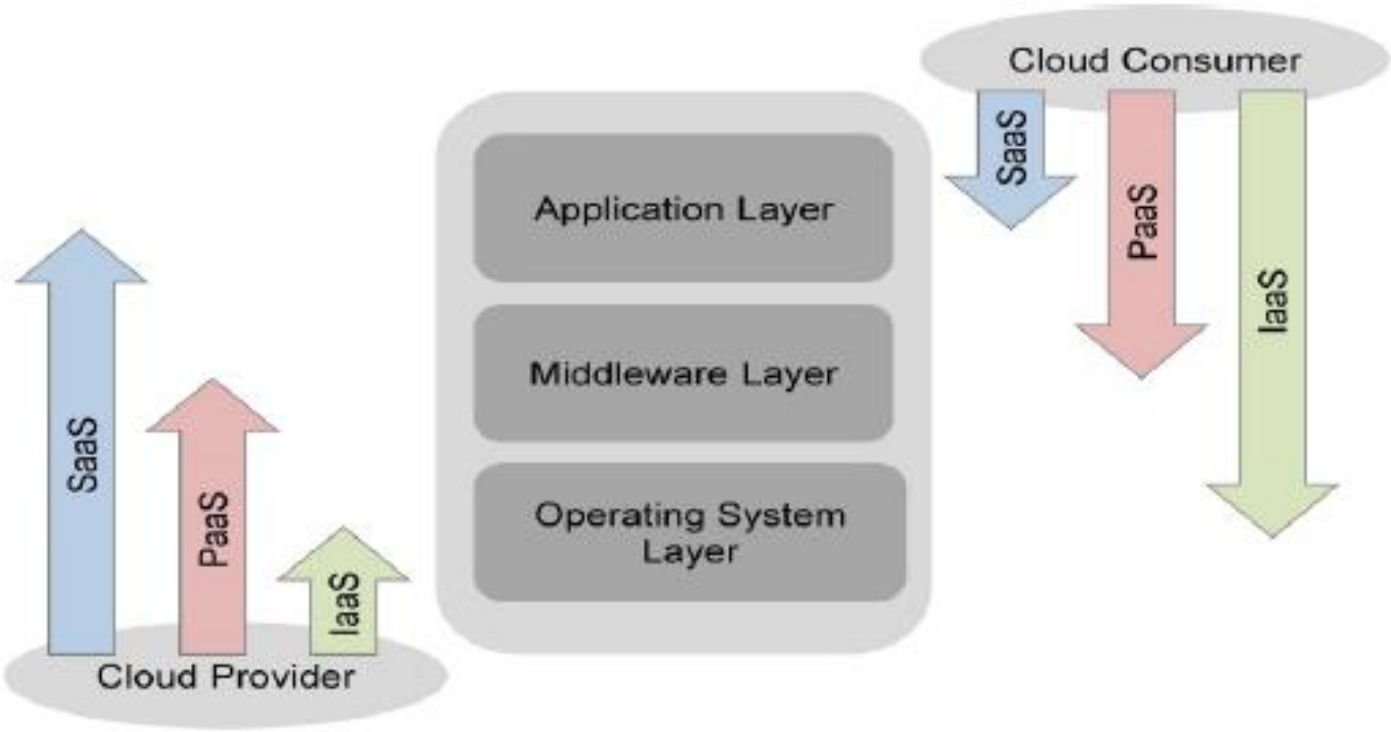
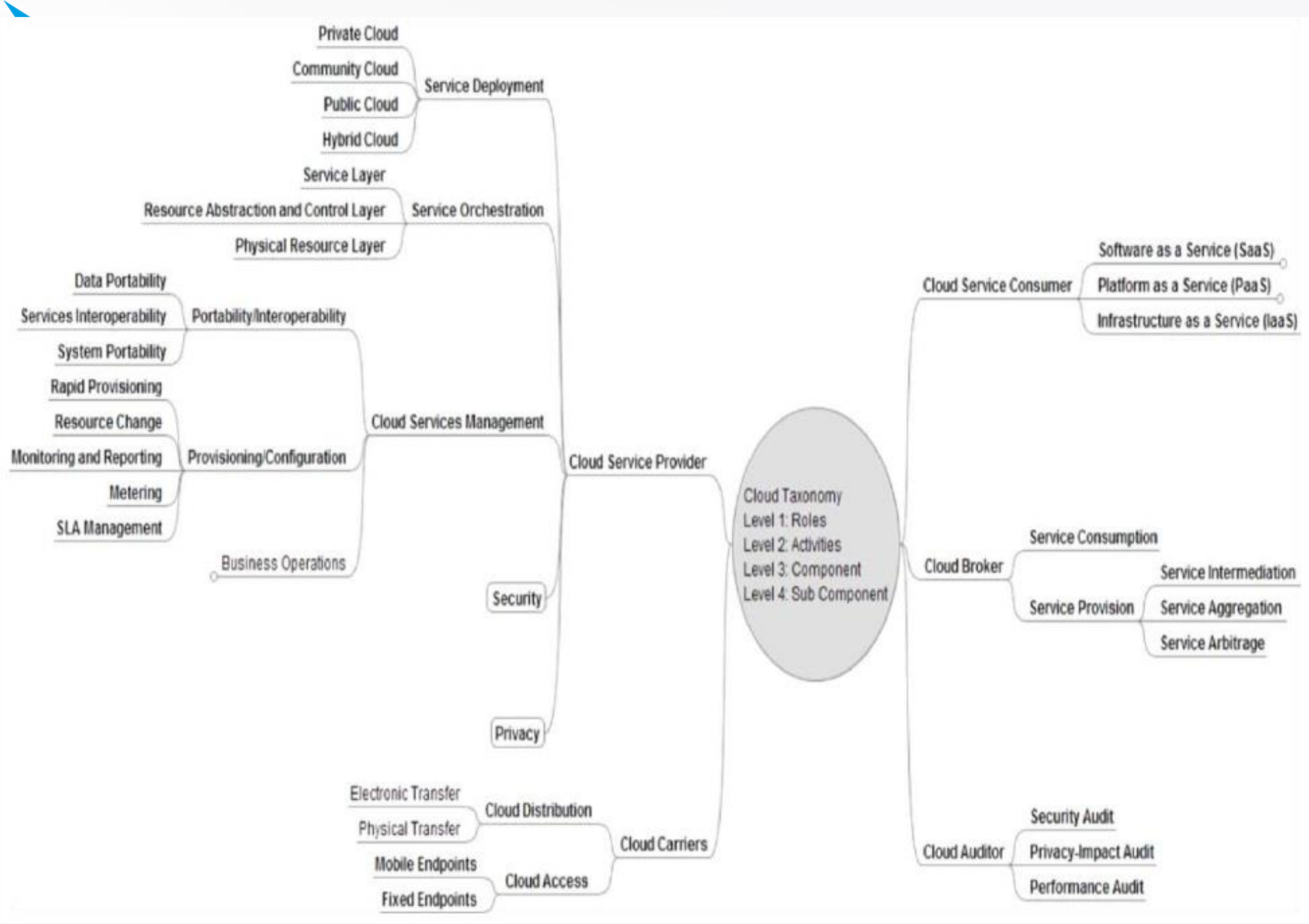


Figure 8: Scope of Controls between Provider and Consumer

Cloud Taxonomy

- Taxonomy is the science of categorization, or classification, of things based on a predefined system.

- Typically, taxonomy contains a controlled vocabulary with a hierarchical tree-like structure.


Cloud Taxonomy
Level 1: Roles
Level 2: Activities
Level 3: Component
Level 4: Sub Component
Cloud Service Provider
Service Deployment
Private Cloud
Community Cloud
Public Cloud
Hybrid Cloud
Service Orchestration
Service Layer
Resource Abstraction and Control Layer
Physical Resource Layer
Cloud Services Management
Portability/Interoperability
Data Portability
Services Interoperability
System Portability
Provisioning/Configuration
Rapid Provisioning
Resource Change
Monitoring and Reporting
Metering
SLA Management
Business Operations
Security
Privacy
Cloud Carriers
Cloud Distribution
Electronic Transfer
Physical Transfer
Cloud Access
Mobile Endpoints
Fixed Endpoints
Cloud Service Consumer
Software as a Service (SaaS)
Platform as a Service (PaaS)
Infrastructure as a Service (IaaS)
Cloud Broker
Service Consumption
Service Provision
Service Intermediation
Service Aggregation
Service Arbitrage
Cloud Auditor
Security Audit
Privacy-Impact Audit
Performance Audit

Cloud Taxonomy

- Figure presents the taxonomy associated with the cloud computing reference architecture discussed in this document. In the figure, a four-level taxonomy is presented to describe the key concepts about cloud computing.
- ***Level 1:*** *Role*, which indicates a set of obligations and behaviors as conceptualized by the associated actors in the context of cloud computing.
- ***Level 2:*** *Activity*, which entails the general behaviors or tasks associated to a specific role.
- ***Level 3:*** *Component*, which refer to the specific processes, actions, or tasks that must be performed to meet the objective of a specific activity.
- ***Level 4:*** *Sub-component*, which present a modular part of a component.

Roles

- **Cloud Consumer** - Person or organization that maintains a business relationship with, and uses service from, Cloud Service Providers.
- **Cloud Provider** – Person, organization or entity responsible for making a service available to service consumers.
- **Cloud Carrier** – The intermediary that provides connectivity and transport of cloud services between Cloud Providers and Cloud Consumers.
- **Cloud Broker** – An entity that manages the use, performance and delivery of cloud services, and negotiates relationships between Cloud Providers and Cloud Consumers.
- **Cloud Auditor** – A party that can conduct independent assessment of cloud services, information system operations, performance and security of the cloud implementation.

Cloud Service provider activities

1. **Service Deployment** – All of the activities and organization needed to make a cloud service available

2. **Service Orchestration** - Refers to the arrangement, coordination and management of cloud infrastructure to provide different cloud services to meet IT and business requirements.

3. **Cloud Service Management** – Cloud Service Management includes all the service-related functions that are necessary for the management and operations of those services required by or proposed to customers.

Cloud Service provider activities

4. **Security** – Refers to information security. “information security” means protecting information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide:
   (A) **integrity**, which means guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity;
   (B) **confidentiality**, which means preserving authorized restrictions on access and disclosure, including means for protecting personal privacy and proprietary information;
   (C) **availability**, which means ensuring timely and reliable access to and use of information.
5. **Privacy** - Information privacy is the assured, proper, and consistent collection, processing, communication, use and disposition of disposition of personal information (PI) and personally-identifiable information (PII) throughout its life cycle.

Cloud Carrier activities:

1. **Cloud Distribution** – The process of transporting cloud data between Cloud Providers and Cloud Consumers.

2. **Cloud Access** – To make contact with or gain access to Cloud Services.

Risks & Challenges

- Increased security vulnerabilities.

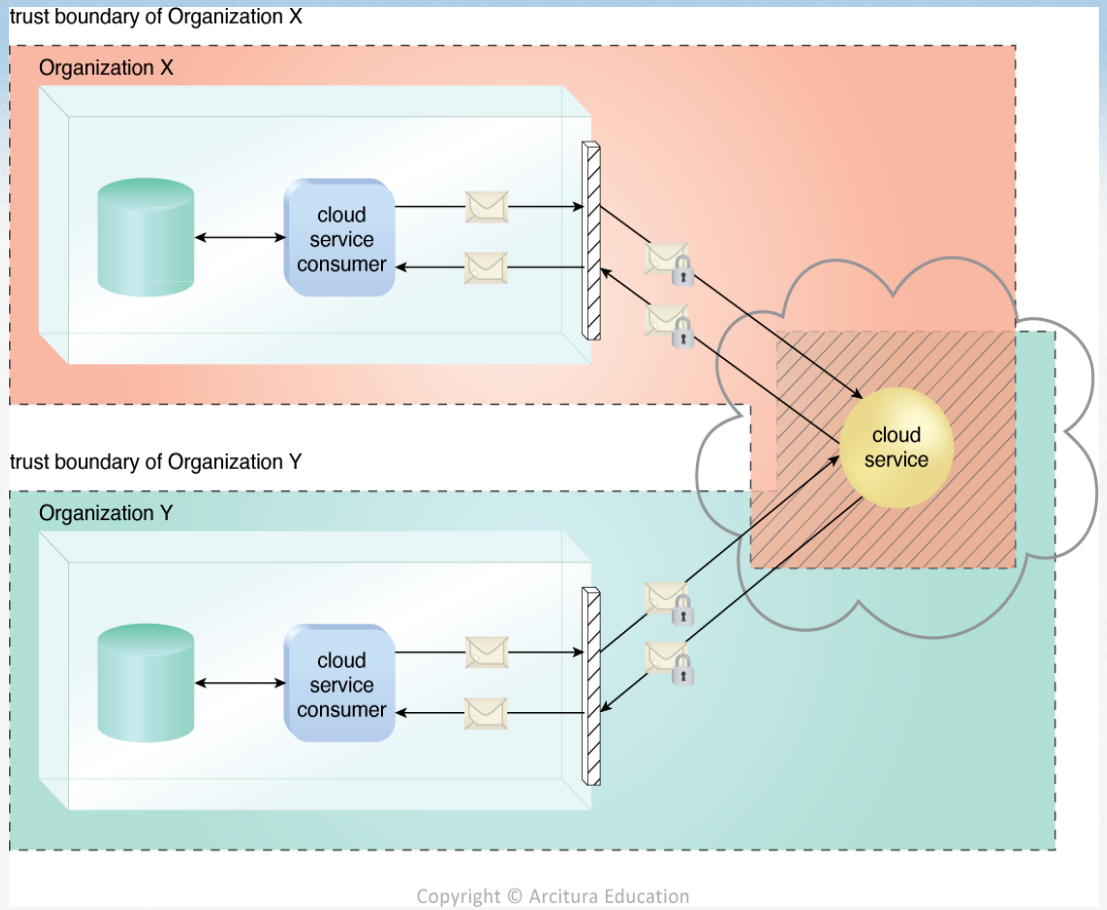


Figure: The shaded area with diagonal liens indicates the overlap of two organization's trust boundaries.

Risks & Challenges

- Reduced Operational Governance Control

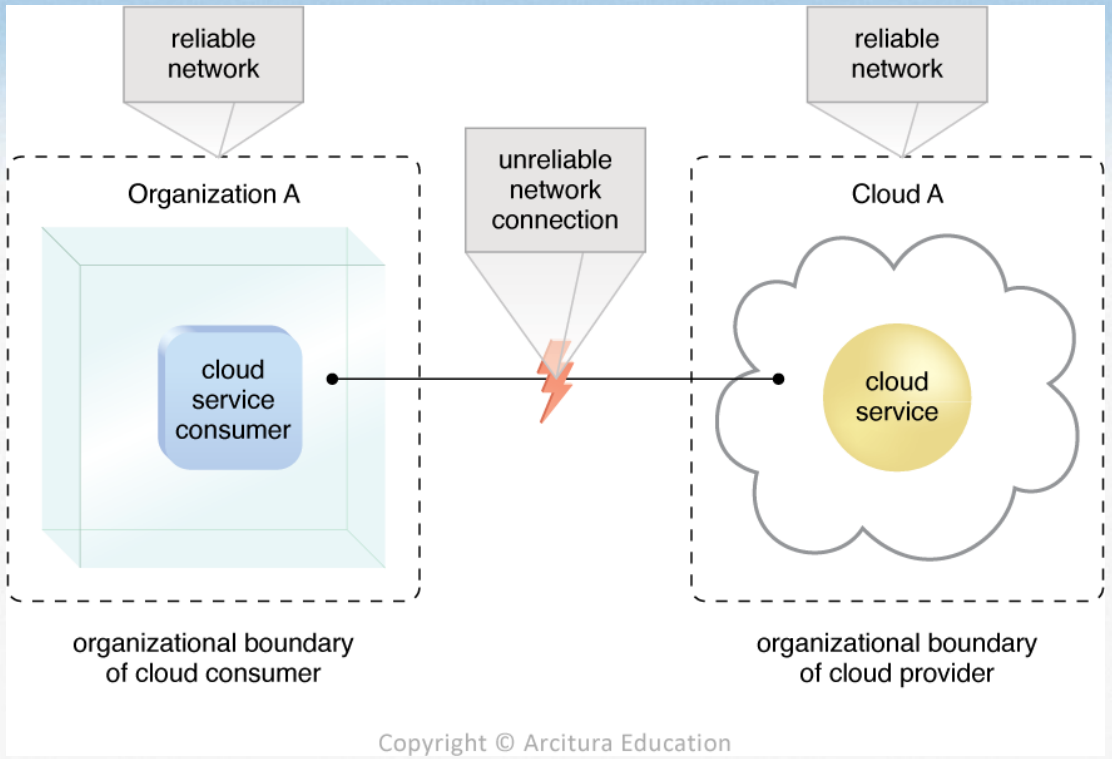


Figure: An unreliable network connection compromises the quality of communication between cloud consumer and cloud provider environments.

Risks & Challenges

- Limited Portability Between Cloud Providers

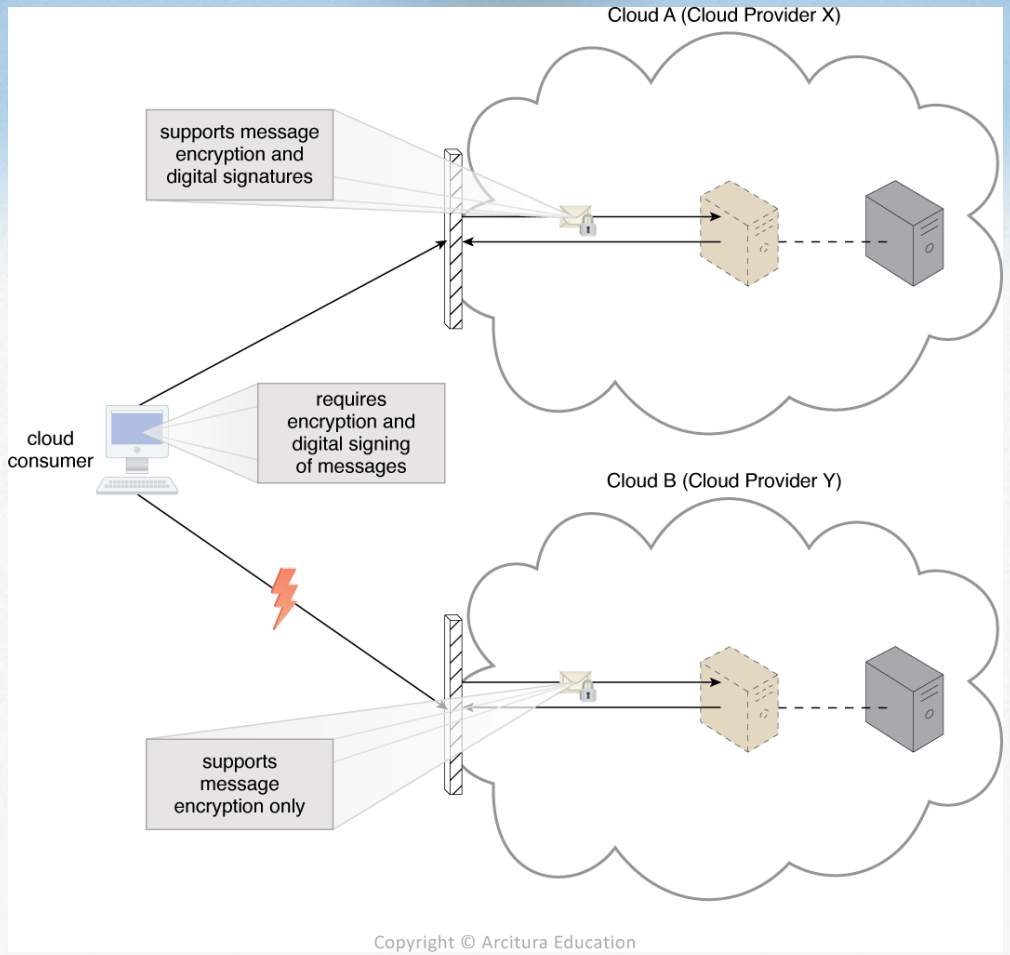


Figure: A cloud consumers application has a decreased level of portability when accessing a potential migration from Cloud A to Cloud B, because the cloud provider of Cloud B does not support the same security technologies as Cloud A.

Risks & Challenges

- Multiregional Compliance and Legal Issues

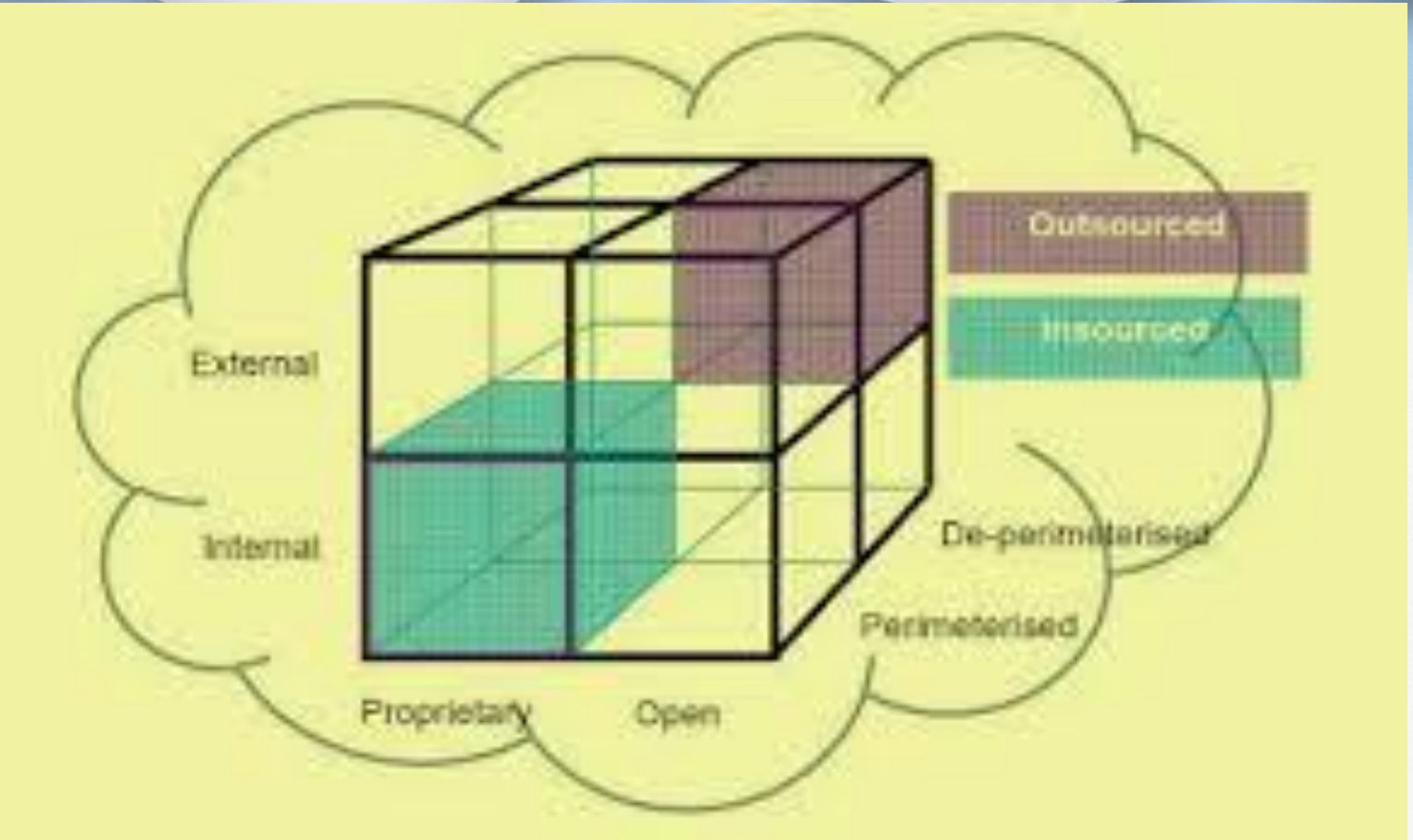
Summary of Key Points

- Cloud environments can introduce distinct security challenges, some of which pertain to overlapping trust boundaries imposed by a cloud provider sharing IT resources with multiple cloud consumers.
- A cloud consumer's operational governance can be limited within cloud environments due to the control exercised by a cloud provider over its platforms.
- The portability of cloud-based IT resources can be inhibited by dependencies upon proprietary characteristics imposed by a cloud.
- The geographical location of data and IT resources can be out of cloud consumer's control when hosted by a third-party cloud provider. This can introduce various legal and regulatory compliance concern.

Cloud Characteristics

- The following six specific characteristic are common to the majority of cloud environments:
  1) On-demand usage
  2) Ubiquitous access
  3) Multitenacy (and resource pooling)
  4) Elasticity
  5) Measured usage
  6) Resiliency

Cloud Cube Model



Cloud Cube Model

- The Jericho Forum has designed the Cloud Cube Model to help select cloud formations for security cooperation.
- Their fascinating new cloud model helps IT managers and business tycoons assess the benefits of cloud computing.
- The Cloud Cube Model looks at the several different "cloud formations".
- They amount to the cloud service and deployment models.
- The sourcing dimension addresses the delivery of service.
- The Cloud Cube Model may be designed to let users show that the traditional notion of network ranges & its boundaries with network firewall no longer applies in Cloud computing.

Cloud Cube Model

- **Cloud Cube Model**, designed and developed by **Jericho forum**.

- Which helps to categorize the cloud network based on the four-dimensional factor: Internal/External, Proprietary/Open, De-Perimeterized/Perimeterized, and Insourced/Outsourced.

- **Dimension 1: Internal/External**

- This dimension defines the physical location of the data; where does the cloud form exist – inside or outside organization boundaries? If the cloud form is within the organization's physical boundaries, then it is internal.

- If it is outside the organization's physical boundaries, then it is external. It's important to note that the assumption that internal is necessarily more secure than external is false. The most secure usage model is the effective use of both internal and external cloud forms.

ii. Proprietary/Open

- The second type of cloud formation is **proprietary and open**. The proprietary or open dimension states about the state of ownership of the **cloud technology** and interfaces. It also tells the degree of interoperability, while enabling data transportability between the system and other cloud forms..
- The **proprietary dimension** means, that the organization providing the **service is securing** and protecting the data under their ownership.
- The **open dimension** is using a technology in which there are more suppliers. Moreover, the user is not constrained in being able to share the data and collaborate with selected partners using the open technology.ther cloud forms.

iii. De-Perimeterized / Perimeterized

- The third type of cloud formation is **De-perimeterized and Perimeterized**.
- To reach this form, the user needs collaboration oriented architecture and Jericho forum commandments.
  The Perimeterised and De-perimeterized dimension tells us whether you are operating inside your traditional it mindset or outside it.

- **Perimeterized dimension** means, continuing to operate within the traditional it boundary, orphan signaled by network firewalls. With the help of VPN and operation of the virtual server in your own IP domain, the user can extend the organizations perimeter into external Cloud Computing domain. This means that the user is making use of the own services to control access.

iii. De-Perimeterized / Perimeterized

- **De-perimeterized dimension** means the system perimeter is architected on the principles outlined in the Jericho forums commandments. In De-perimeterized dimension, the data will be encapsulated with metadata and mechanisms, which will further help to protect the data and limit the inappropriate usage.

iv. Insourced/Outsourced

- The **Insourced and outsourced dimensions** have two states in each of the eight cloud forms. In the *outsourced dimension* the services provided by the third party, whereas in the *insourced dimension* the services provided by the own staff under the control.

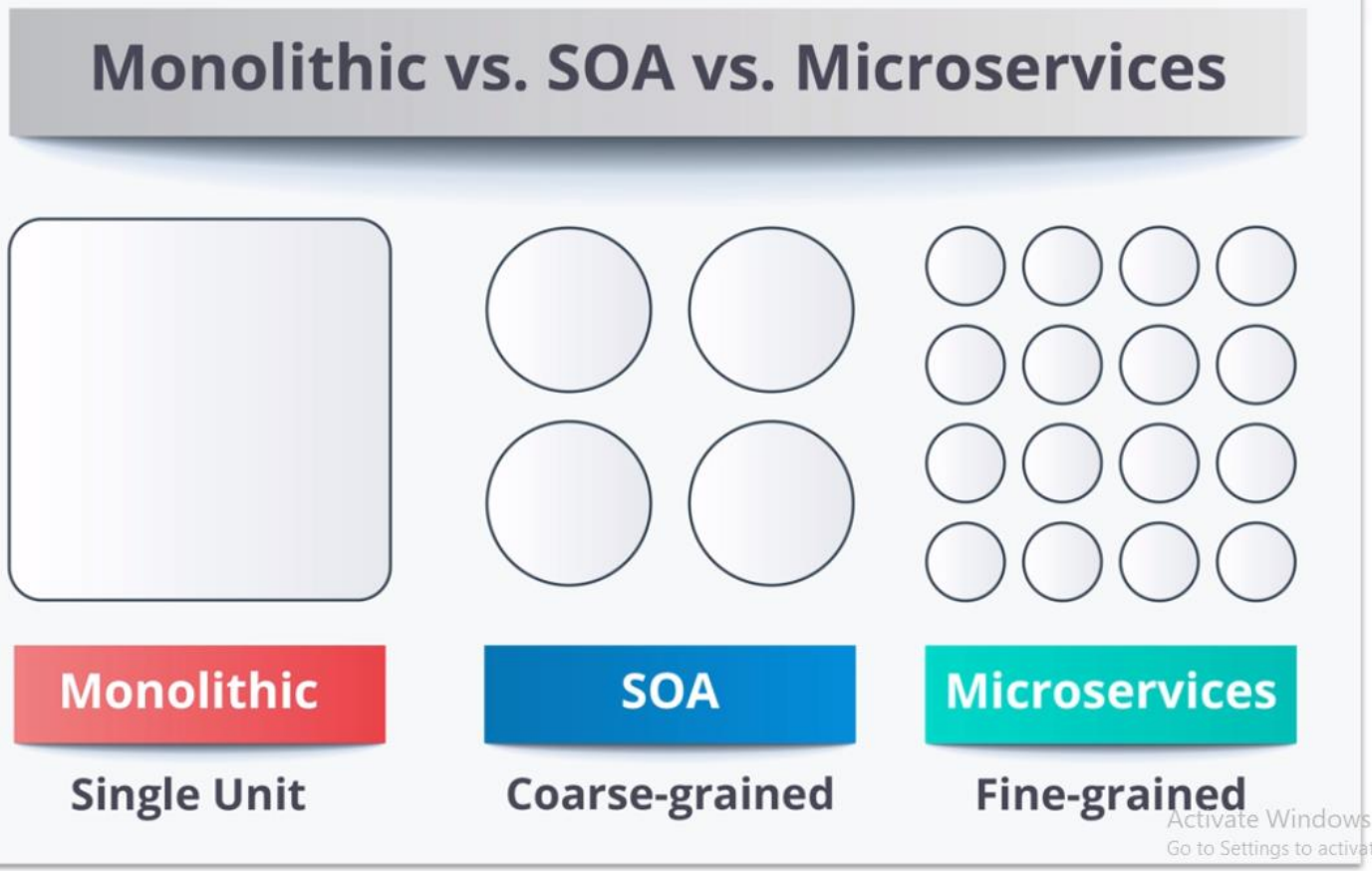
- In this few organizations that are traditional bandwidth software or hardware, providers will run fluently on becoming cloud service providers.
- The organizations which are seeking to procedure cloud services must have the ability to set legally binding collaboration agreement. In this, an organization should ensure that data is deleted from the service provider's Infrastructure.

Questions For Cloud Cube Model

- The Jericho forum states that there are three key questions, which a customer should ask their **Cloud Computing** supplier. So, that they must be aware that the data is secure and protected. The three questions are-

- Q 1. Wherein the cloud cube model is the cloud supplier operating while providing the services?
- Q 2. How will the clouds suppliers get a surety when the customer is using services in a cloud from that has maintained the features as per the expectations?
- Q 3. How can a customer ensure that the data which is stored in the cloud services will be available at the time of mishappenings such as bankruptcy or change in business direction?

MONOLITHIC, SOA & MICROSERVICES


Monolithic vs. SOA vs. Microservices
Monolithic
SOA
Microservices
Single Unit
Coarse-grained
Fine-grained
Activate Windows
Go to Settings to activate Windows.
edureka!
SUBSCRIBE

SOA Vs Microservice

SOA is like an orchestra where each artist is performing with his/her instrument while the music director guides them all.

With Microservices each dancer is independent and know what they need to do. If they miss some steps they know how to get back on the sequence.

Service Oriented Architecture

- **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.

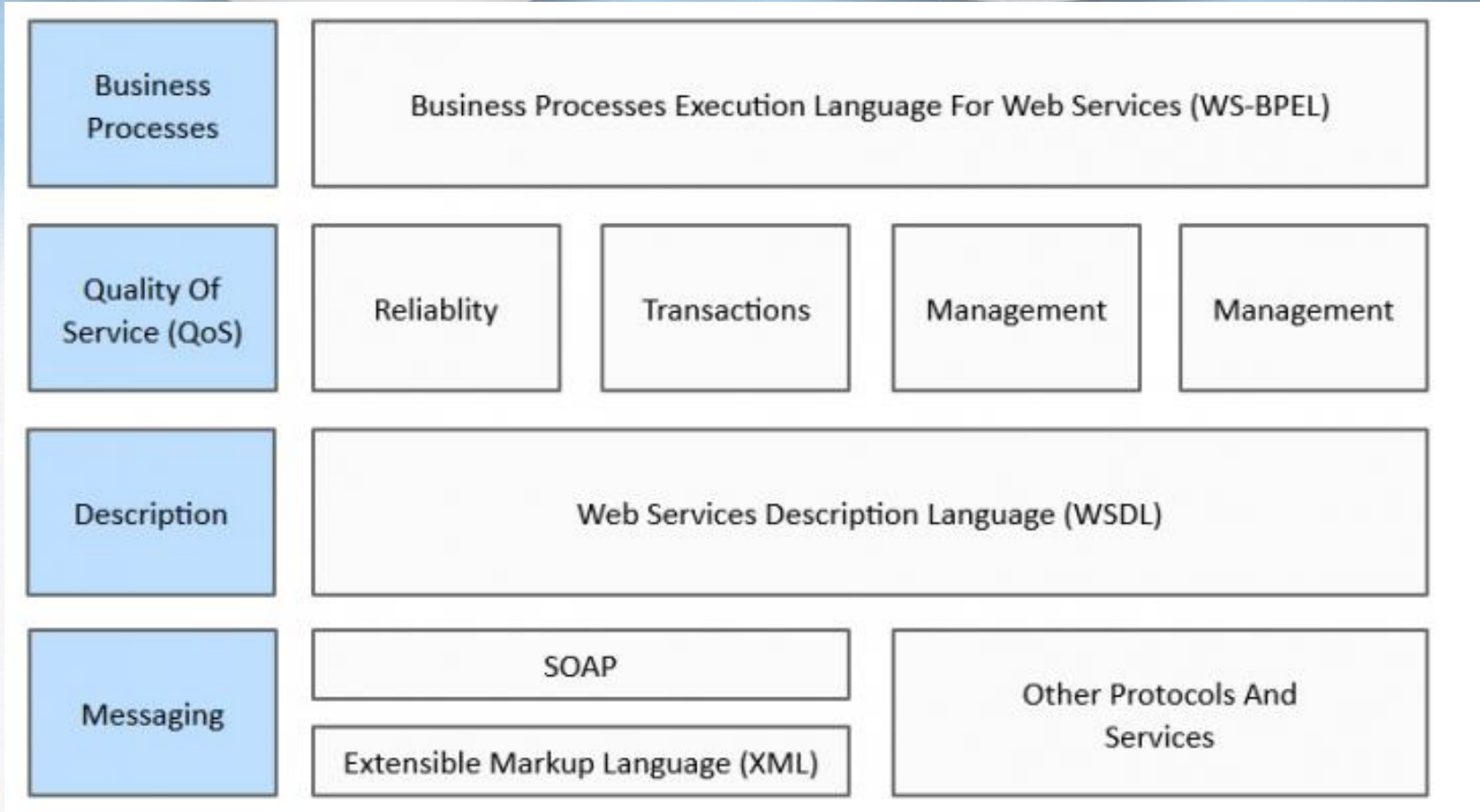
- A SOA service is a discrete unit of functionality that can be accessed remotely and acted upon and updated independently, such as retrieving a credit card statement online. SOA is also intended to be independent of vendors, products and technologies.

Service Oriented Architecture

- A service has four properties according to one of many definitions of SOA:
  - It logically represents a business activity with a specified outcome.
  - It is self-contained.
  - It is a black box for its consumers, meaning the consumer does not have to be aware of the service's inner workings.
  - It may consist of other underlying services.

- Different services can be used in conjunction to provide the functionality of a large software application, a principle SOA shares with modular programming.

SOA Architecture and Protocols



Service Oriented Architecture

- SOA architecture is viewed as five horizontal layers. These are described below:
  1) **Consumer Interface Layer:** These are GUI based apps for end users accessing the applications.
  2) **Business Process Layer:** These are business-use cases in terms of application.
  3) **Services Layer:** These are whole-enterprise, in service inventory.
  4) **Service Component Layer:** are used to build the services, such as functional and technical libraries.
  5) **Operational Systems Layer:** It contains the data model.

Service Oriented Architecture

- A manifesto was published for service-oriented architecture in October, 2009. This came up with six core values which are listed as follows:
  1) **Business value** is given more importance than technical strategy.
  2) **Strategic goals** are given more importance than project-specific benefits.
  3) **Intrinsic interoperability** is given more importance than custom integration.
  4) **Shared services** are given more importance than specific-purpose implementations.
  5) **Flexibility** is given more importance than optimization.
  6) **Evolutionary refinement** is given more importance than pursuit of initial perfection.

Guiding Principles of SOA:

- **Standardized service contract:** Specified through one or more service description documents.
- **Loose coupling:** Services are designed as self-contained components, maintain relationships that minimize dependencies on other services.
- **Abstraction:** A service is completely defined by service contracts and description documents. They hide their logic, which is encapsulated within their implementation.
- **Reusability:** Designed as components, services can be reused more effectively, thus reducing development time and the associated costs.

Guiding Principles of SOA:

- **Autonomy:** Services have control over the logic they encapsulate and, from a service consumer point of view, there is no need to know about their implementation.

- **Discoverability:** Services are defined by description documents that constitute supplemental metadata through which they can be effectively discovered. Service discovery provides an effective means for utilizing third-party resources.

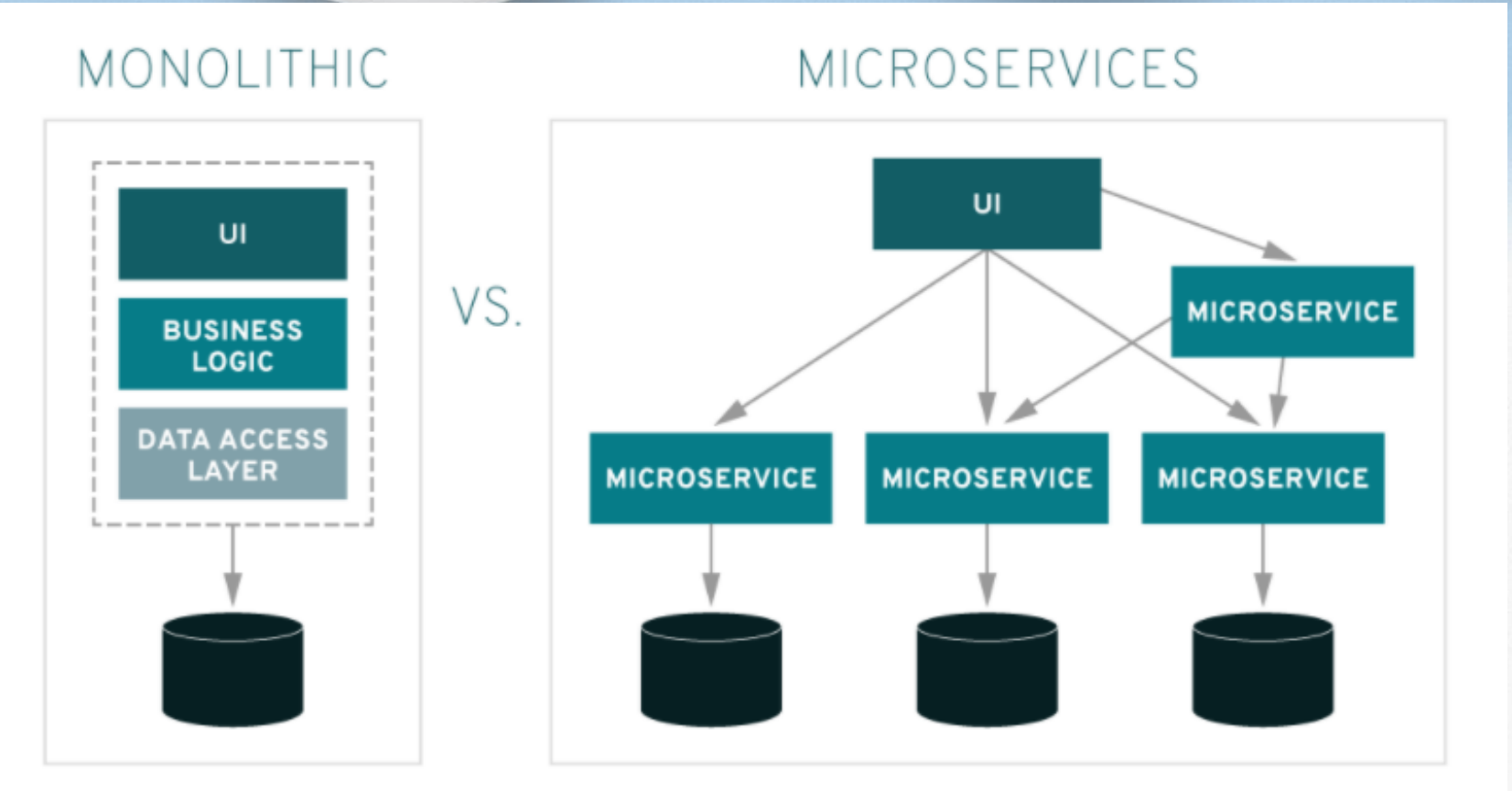
- **Composability:** Using services as building blocks, sophisticated and complex operations can be implemented. Service orchestration and choreography provide a solid support for composing services and achieving business goals.

Microservices

- **Microservice** architecture – a variant of the service-oriented architecture (SOA) structural style – arranges an application as a collection of loosely coupled services.

- In a microservices architecture, services are fine-grained and the protocols are lightweight.

Microservices



Microservices Features

WEB 1.0 To 5.0

- **Web 0.0** – Developing the internet
- **Web 1.0** – The shopping carts & static web
- **Web 2.0** – The writing and participating web
- **Web 3.0** – The semantic executing web
- **Web 4.0** – “Mobile Web”
- **Web 5.0-** Open, Linked and Intelligent

  Web = Emotional Web. “The next web”

VISHWAKARMA INSTITUTES VI

THANK YOU!!!!