

# Unit-III

**Cloud delivery model:** IaaS, PaaS and SaaS, Cloud delivery model with the perspective of cloud provider and the cloud consumer.



The contents has been taken from the book: Cloud Computing: Concepts, Technology & Architecture  
Book by Ricardo Puttini, Thomas Erl, and Zaigham Mahmood.

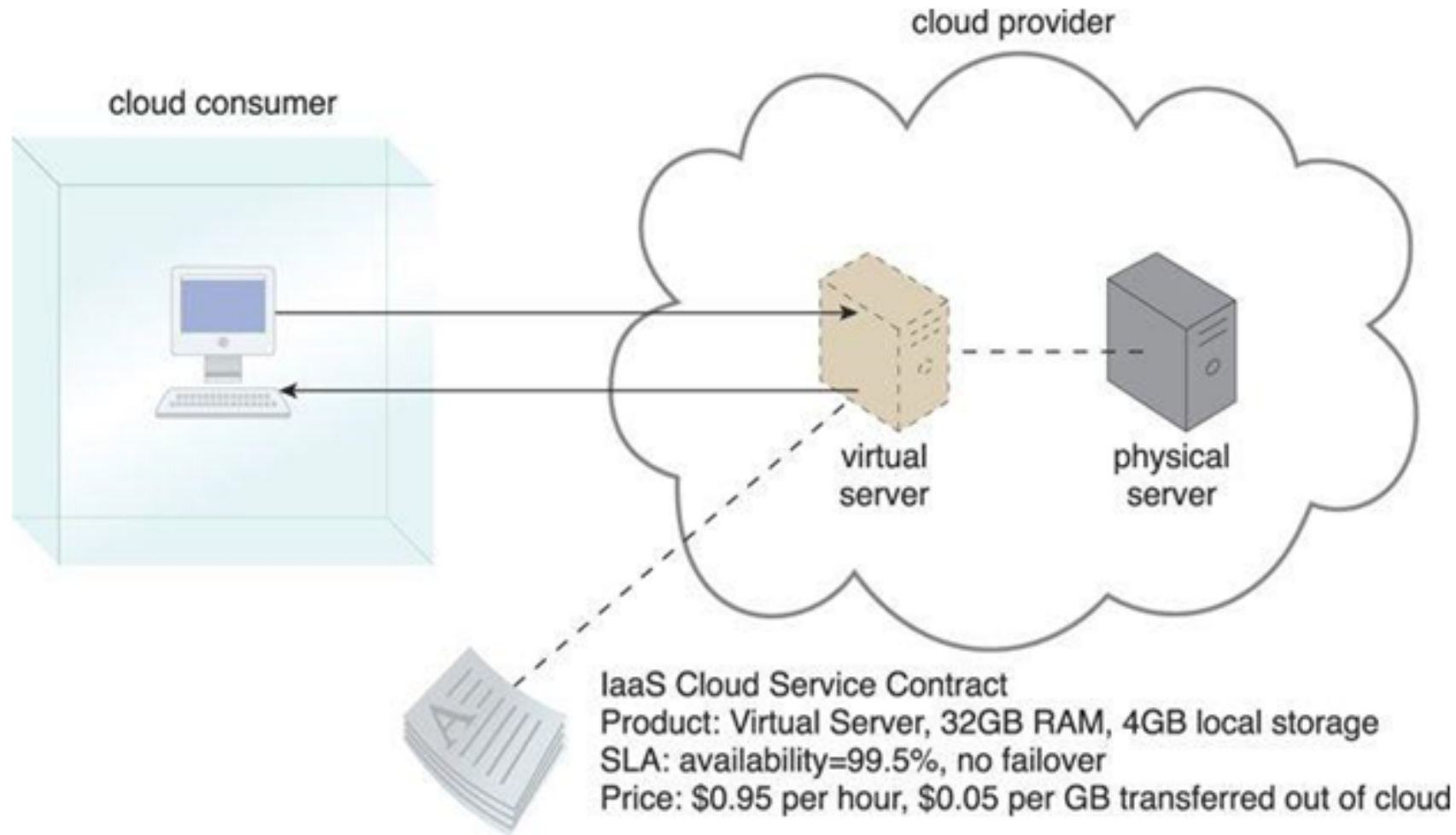
- A *cloud delivery model* represents a specific, pre-packaged combination of IT resources offered by a cloud provider. Three common cloud delivery models have become widely established and formalized:
  - Infrastructure-as-a-Service (IaaS)
  - Platform-as-a-Service (PaaS)
  - Software-as-a-Service (SaaS)

- **Many specialized variations** of the three base cloud delivery models have emerged, each comprised of a distinct combination of IT resources. Some examples include:
  - Storage-as-a-Service
  - Database-as-a-Service
  - Security-as-a-Service
  - Communication-as-a-Service
  - Integration-as-a-Service
  - Testing-as-a-Service
  - Process-as-a-Service

# Infrastructure-as-a-Service (IaaS)

- This environment can include hardware, network, connectivity, operating systems, and other “raw” IT resources.
- The general purpose of an IaaS environment is to provide cloud consumers with a high level of control and responsibility over its configuration and utilization.
- The types and brands of the IT resources provided by IaaS products offered by different cloud providers can vary.
- IT resources available through IaaS environments are generally offered as freshly initialized virtual instances.
- A central and primary IT resource within a typical IaaS environment is the virtual server. Virtual servers are leased by specifying server hardware requirements, such as processor capacity, memory, and local storage space.

# An Example



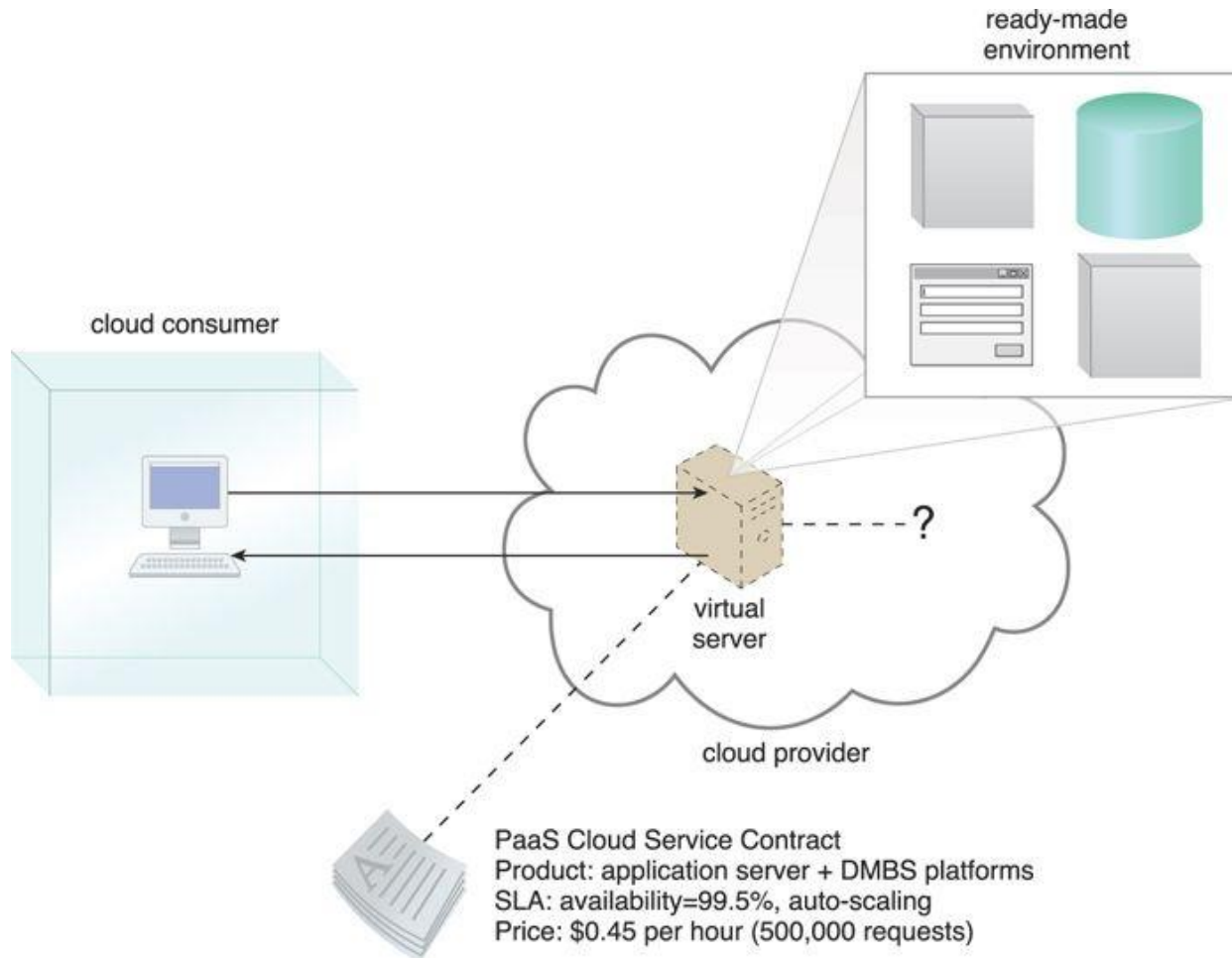
A cloud consumer is using a virtual server within an IaaS environment. Cloud consumers are provided with a range of contractual guarantees by the cloud provider, pertaining to characteristics such as capacity, performance, and availability

# PaaS

The PaaS delivery model represents a pre-defined “ready-to-use” environment typically comprised of already deployed and configured IT resources.

Scenarios:-

- The cloud consumer wants to extend on-premise environments into the cloud for scalability and economic purposes.
- The cloud consumer uses the ready-made environment to entirely substitute an on-premise environment.
- The cloud consumer wants to become a cloud provider and deploys its own cloud services to be made available to other external cloud consumers.

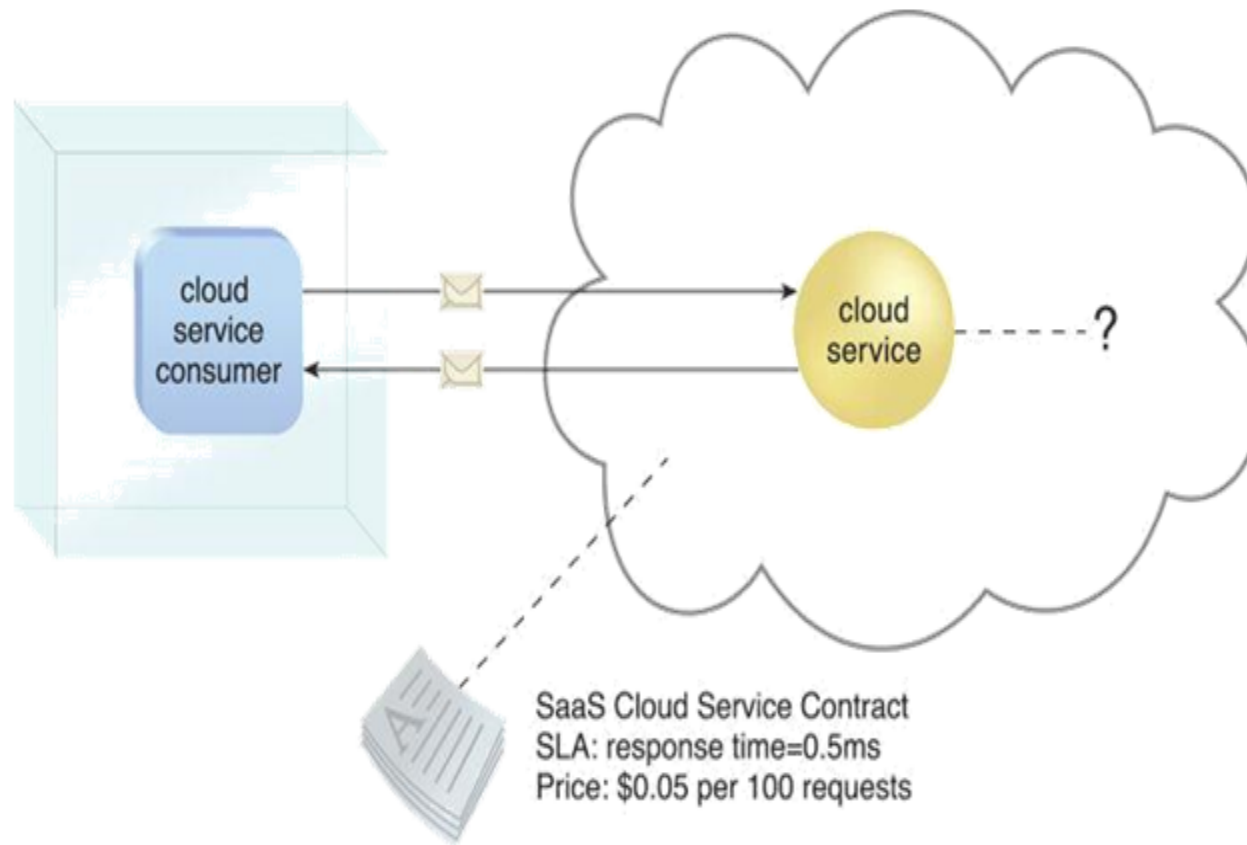


A cloud consumer is accessing a ready-made PaaS environment. The question mark indicates that the cloud consumer is intentionally shielded from the implementation details of the platform

# Software-as-a-Service (SaaS)

- A software program positioned as a shared cloud service and made available as a “product” or generic utility represents the typical profile of a SaaS offering.
- The SaaS delivery model is typically used to make a reusable cloud service widely available (often commercially) to a range of cloud consumers. An entire marketplace exists around SaaS products that can be leased and used for different purposes and via different terms





The cloud service consumer is given access the cloud service contract, but not to any underlying IT resources or implementation details.

# A comparison of typical cloud delivery model control levels.

Cloud Delivery Model	Typical Level of Control Granted to Cloud Consumer	Typical Functionality Made Available to Cloud Consumer
SaaS	usage and usage-related configuration	access to front-end user-interface
PaaS	limited administrative	moderate level of administrative control over IT resources relevant to cloud consumer's usage of platform
IaaS	full administrative	full access to virtualized infrastructure-related IT resources and, possibly, to underlying physical IT resources

Typical activities carried out by cloud consumers and cloud providers in relation to the cloud delivery models.

# Comparison w.r.t typical responsibilities and usage

Cloud Delivery Model	Common Cloud Consumer Activities	Common Cloud Provider Activities
SaaS	uses and configures cloud service	implements, manages, and maintains cloud service monitors usage by cloud consumers
PaaS	develops, tests, deploys, and manages cloud services and cloud-based solutions	pre-configures platform and provisions underlying infrastructure, middleware, and other needed IT resources, as necessary monitors usage by cloud consumers
IaaS	sets up and configures bare infrastructure, and installs, manages, and monitors any needed software	provisions and manages the physical processing, storage, networking, and hosting required monitors usage by cloud consumers

# Combining Cloud Delivery Models

The three base cloud delivery models comprise a natural provisioning hierarchy, allowing for opportunities for the combined application of the models to be explored. The upcoming sections briefly highlight considerations pertaining to two common combinations.

i. **IaaS + PaaS**

ii. **IaaS + PaaS + SaaS**

# IaaS + PaaS

(CASE-I )A PaaS environment will be built upon an underlying infrastructure comparable to the physical and virtual servers and other IT resources provided in an IaaS environment. [Figure \(in next slide\)](#) shows how these two models can conceptually be combined into a simple layered architecture.

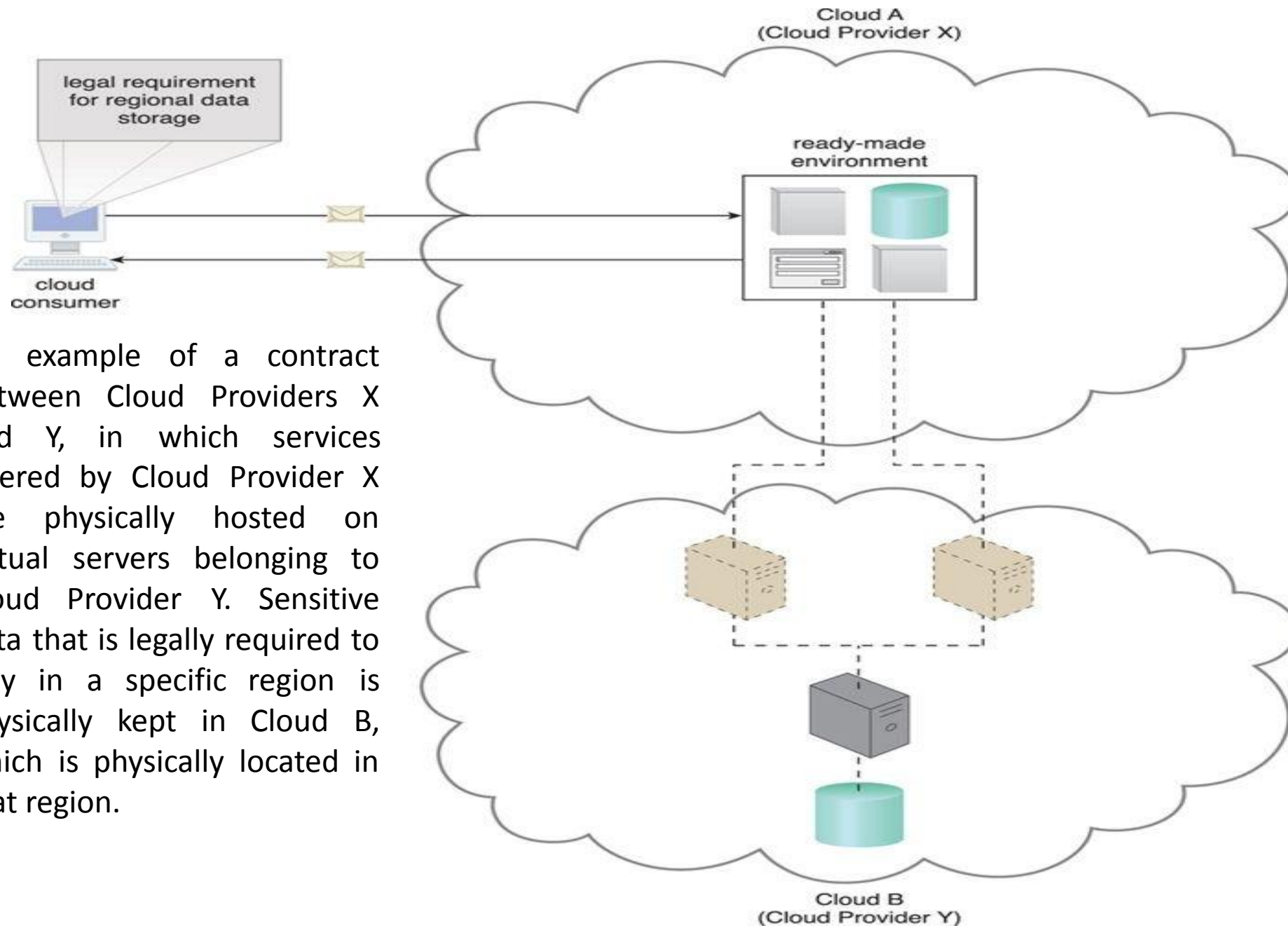
PaaS

Ready-Made  
Environment AReady-Made  
Environment BReady-Made  
Environment CVirtual  
Server  
AVirtual  
Server  
BPhysical  
Server  
A

Figure: A PaaS environment  
based on the IT resources  
provided by an underlying  
IaaS environment

IaaS

(CASE-II) A cloud provider would not normally need to provision an IaaS environment from its own cloud in order to make a PaaS environment available to cloud consumers (see next slide)

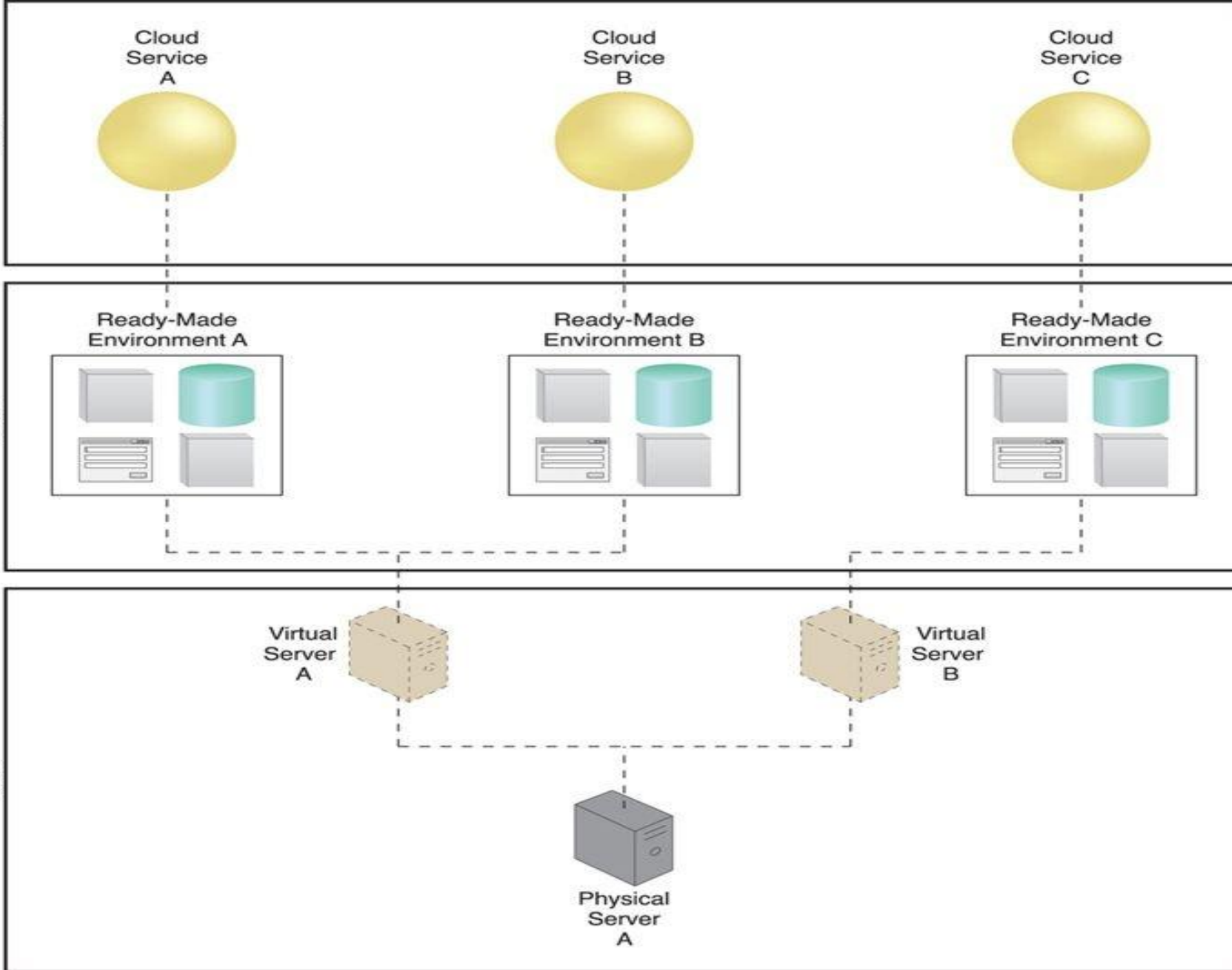


An example of a contract between Cloud Providers X and Y, in which services offered by Cloud Provider X are physically hosted on virtual servers belonging to Cloud Provider Y. Sensitive data that is legally required to stay in a specific region is physically kept in Cloud B, which is physically located in that region.



# IaaS + PaaS + SaaS

All three cloud delivery models can be combined to establish layers of IT resources that build upon each other



A simple layered view of an architecture comprised of IaaS and PaaS environments hosting three SaaS cloud service implementations.

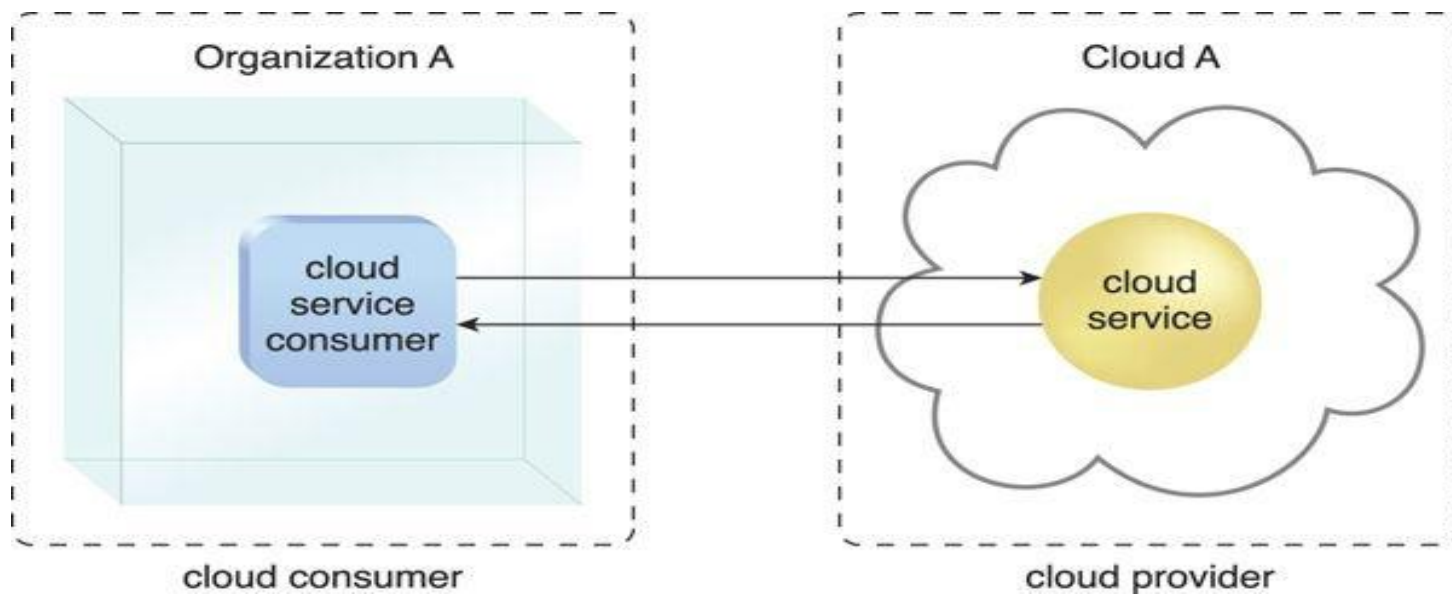
# Key Points

- The IaaS cloud delivery model offers cloud consumers a high level of administrative control over “raw” infrastructure-based IT resources
- The PaaS cloud delivery model enables a cloud provider to offer a preconfigured environment that cloud consumers can use to build and deploy cloud services and solutions, albeit with decreased administrative control.
- SaaS is a cloud delivery model for shared cloud services that can be positioned as commercialized products hosted by clouds.
- Different combinations of IaaS, PaaS, and SaaS are possible, depending on how cloud consumers and cloud providers choose to leverage the natural hierarchy established by these base cloud delivery models.

# Roles and responsibility

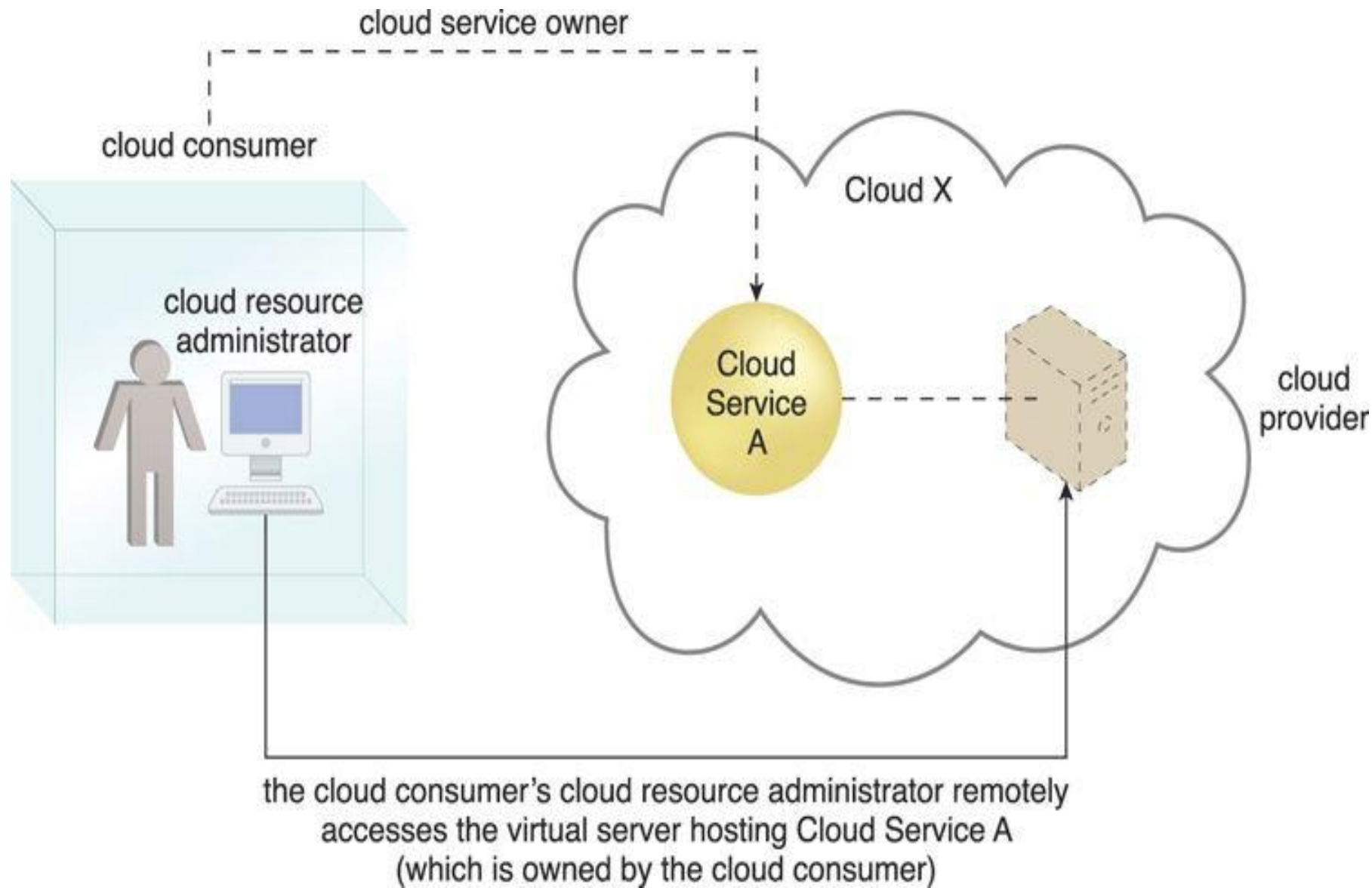
**Cloud Provider:**Cloud providers normally own the IT resources that are made available for lease by cloud consumers; however, some cloud providers also “resell” IT resources leased from other cloud providers.

A ***cloud consumer*** is an organization (or a human) that has a formal contract or arrangement with a cloud provider to use IT resources made available by the cloud provider. Specifically, the cloud consumer uses a cloud service consumer to access a cloud service

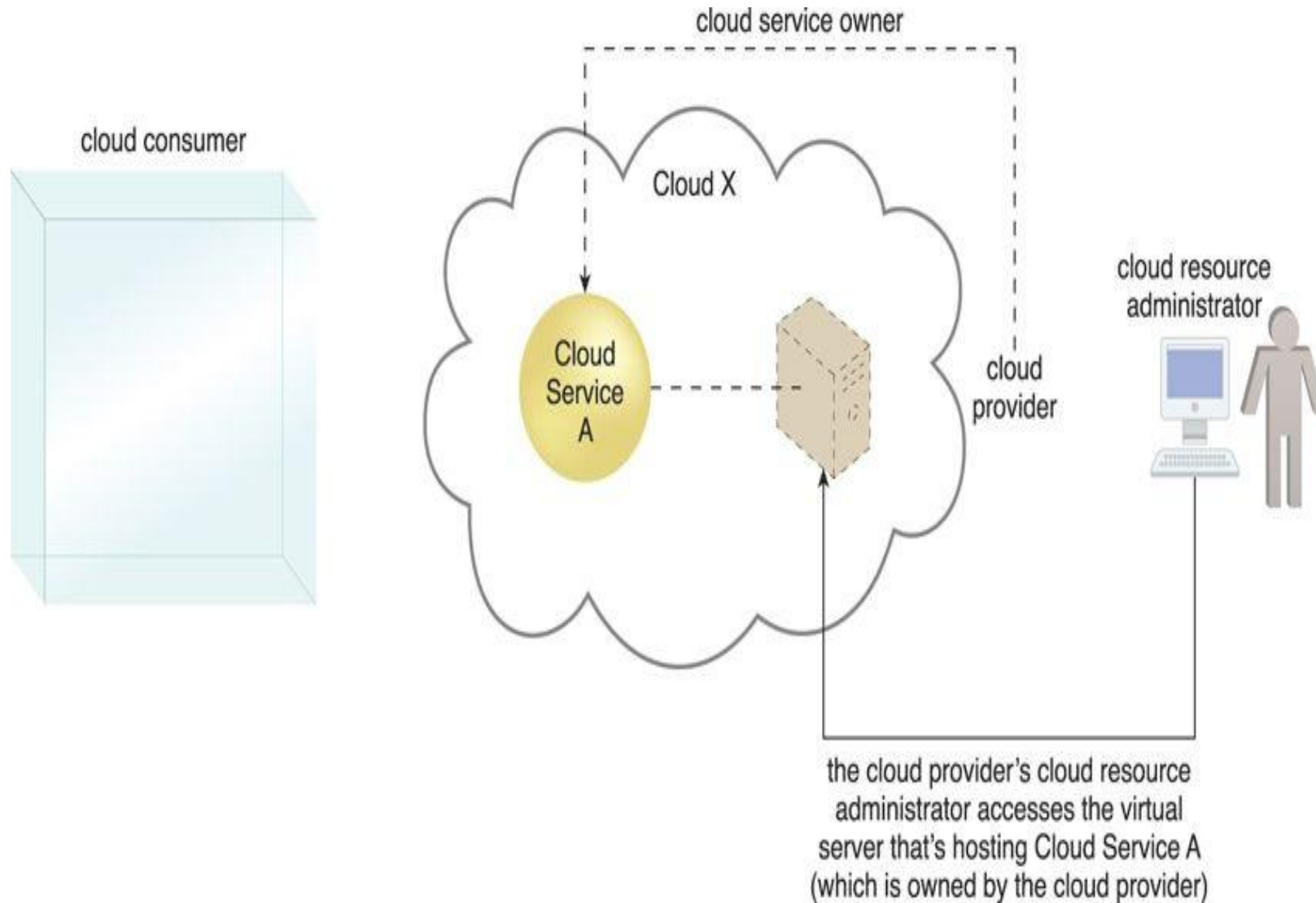


# Cloud Resource Administrator

- A *cloud resource administrator* is the person or organization responsible for administering a cloud-based IT resource (including cloud services).
- The cloud resource administrator can be (or belong to) the cloud consumer or cloud provider of the cloud within which the cloud service resides. Alternatively, it can be (or belong to) a third-party organization contracted to administer the cloud-based IT resource.



A cloud resource administrator can be with a cloud consumer organization and administer remotely accessible IT resources that belong to the cloud consumer.



A cloud resource administrator can be with a cloud provider organization for which it can administer the cloud provider's internally and externally available IT resources.

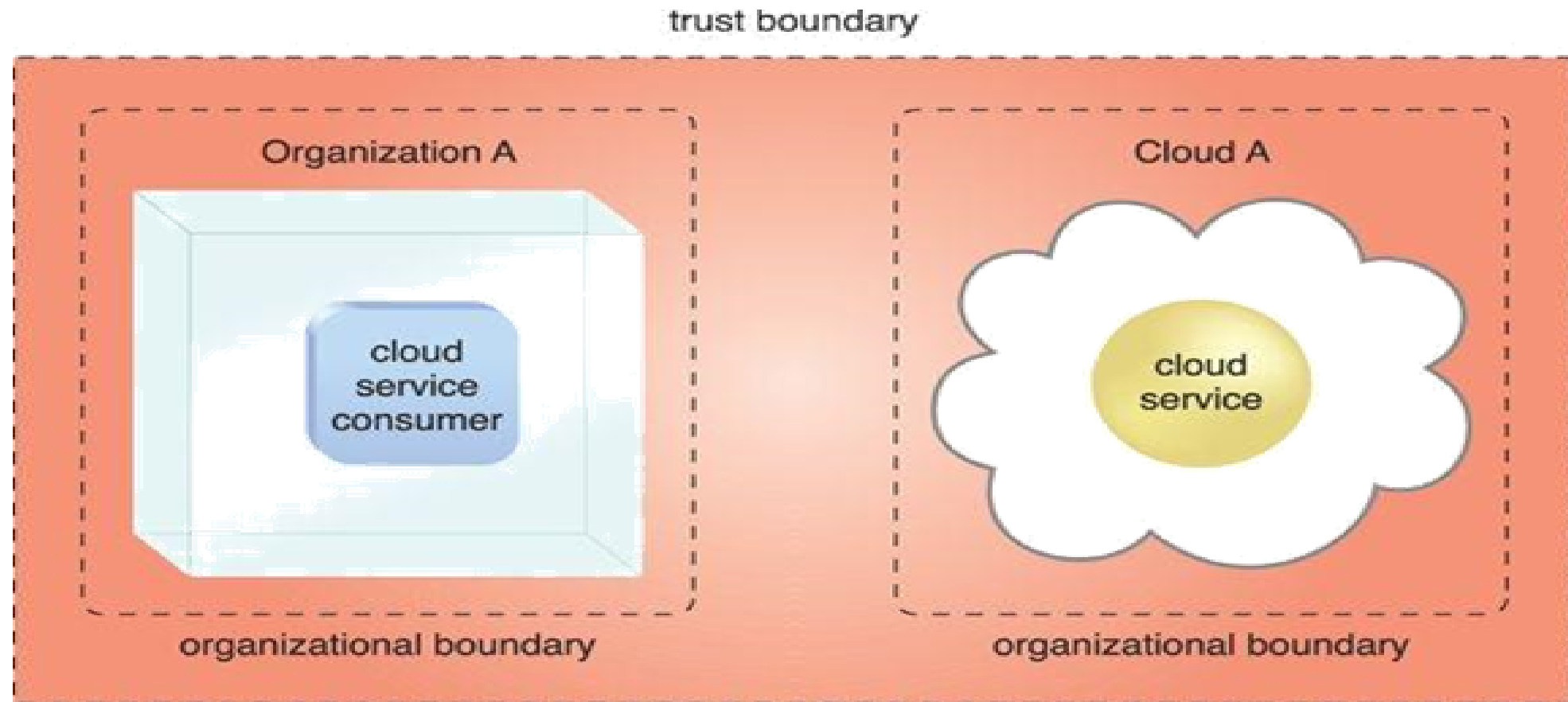


# Additional Roles

- *Cloud Auditor* – A third-party (often accredited) that conducts independent assessments of cloud environments assumes the role of the *cloud auditor*. The typical responsibilities associated with this role include the evaluation of security controls, privacy impacts, and performance. The main purpose of the cloud auditor role is to provide an unbiased assessment (and possible endorsement) of a cloud environment to help strengthen the trust relationship between cloud consumers and cloud providers.
- *Cloud Broker* – This role is assumed by a party that assumes the responsibility of managing and negotiating the usage of cloud services between cloud consumers and cloud providers. Mediation services provided by *cloud brokers* include service intermediation, aggregation, and arbitrage.
- *Cloud Carrier* – The party responsible for providing the wire-level connectivity between cloud consumers and cloud providers assumes the role of the *cloud carrier*. This role is often assumed by network and telecommunication providers.

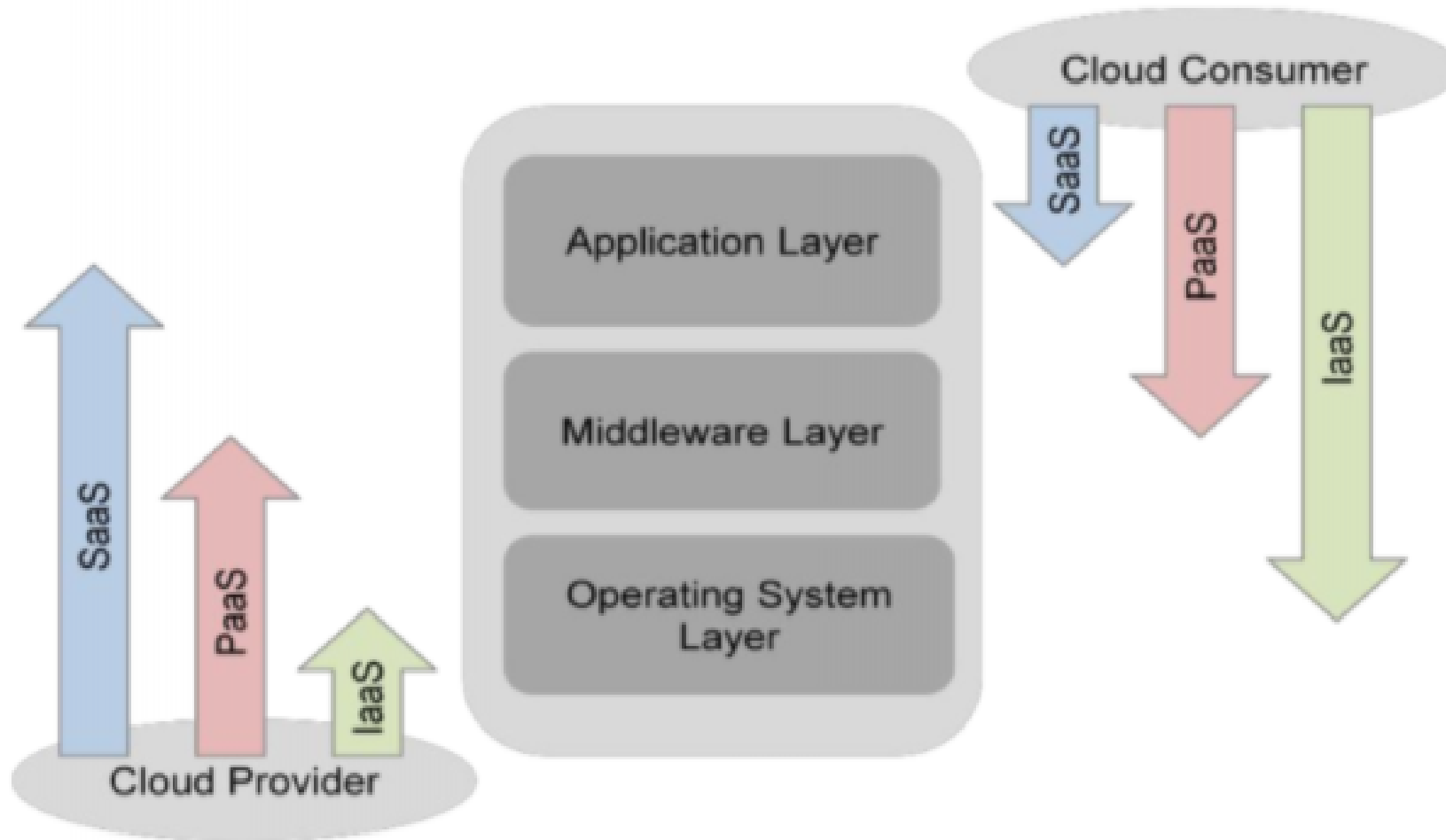
# Trust Boundary

When an organization assumes the role of cloud consumer to access cloud-based IT resources, it needs to extend its trust beyond the physical boundary of the organization to include parts of the cloud environment.



**Figure 4.7.** An extended trust boundary encompasses the organizational boundaries of the cloud provider and the cloud consumer.

# Who manages the layers?



Scope of Controls  
between Provider  
and Consumer

The application layer includes software applications targeted at end users or programs. The applications are used by SaaS consumers, or installed/managed/ maintained by PaaS consumers, IaaS consumers, and SaaS providers.

The middleware layer provides software building blocks (e.g., libraries, database, and Java virtual machine) for developing application software in the cloud. The middleware is used by PaaS consumers, installed/managed/ maintained by IaaS consumers or PaaS providers, and hidden from SaaS consumers.

The OS layer includes operating system and drivers, and is hidden from SaaS consumers and PaaS consumers. An IaaS cloud allows one or multiple guest OS"s to run virtualized on a single physical host. Generally, consumers have broad freedom to choose which OS to be hosted among all the OS"s that could be supported by the cloud provider. The IaaS consumers should assume full responsibility for the guest OS"s, while the IaaS provider controls the host OS.

## No Cloud Technology (Legacy)

Infrastructure

Hardware

Network

Servers

Storage

Operating Systems

Software Applications

Data

## Infrastructure as a Service (IaaS)

Infrastructure

Hardware

Network

Servers

Storage

Operating Systems

Software Applications

Data

## Platform as a Service (PaaS)

Infrastructure

Hardware

Network

Servers

Storage

Operating Systems

Software Applications

Data

## Software as a Service (SaaS)

Infrastructure

Hardware

Network

Servers

Storage

Operating Systems

Software Applications

Data

Managed by You

NOT Managed by You

Based on Cloud  
Service models

References:

<https://timesofcloud.com/cloud-tutorial/based-on-cloud-service-models/>

cloud computing concepts technology & architecture [Book]

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