Microsoft Certified: Azure Fundamentals

# Learning Path: Azure Fundamentals: Describe Cloud Concepts

This module is an introduction to general cloud concepts. It will start with an introduction to the cloud in general and will cover concepts such as shared responsibility, different cloud models and unique cloud pricing. The learning objectives of the module are as follows;

* Define cloud computing
* Describe the shared responsibility model
* Define cloud models, including public, private, and hybrid
* Identify appropriate use cases for each cloud model
* Describe the consumption-based model
* Compare cloud pricing models

## Describe Cloud Computing

### **1.1.1** What is Cloud Computing?

Cloud computing is the delivery of computing services (virtual machines, storage, databases, networking, etc.) over the internet. It also enhances traditional computing technologies by incorporating concepts such as Internet of Things (IoT), Machine Learning (ML), Artificial Intelligence (AI).

Because cloud computing uses the internet to deliver these services, there are no physical infrastructure constraints. This allows IT infrastructure to be upgraded quickly instead of building a new data center.

### 1.1.2 Describe the Shared Responsibility Model

In the traditional data center model, the company is responsible for the maintenance, security, modification, etc. of the physical space. The IT department is responsible for maintaining all infrastructure and software to keep the data center running.

In the shared responsibility model (SRM), these responsibilities are shared between the cloud provider and the consumer. The cloud provider is responsible for physical security, power, cooling, network connectivity, etc. The consumer, on the other hand, is responsible for the data and information stored in the cloud and the security of access.

The shared responsibility model is highly dependent on the type of cloud service:

* Infrastructure as a service (IaaS)
* Platform as a service (PaaS)
* Software as a service (SaaS)

IaaS places the most responsibility on the consumer, with the cloud provider responsible for the basics such as physical security, power and connectivity. SaaS, on the other hand, places most of the responsibility on the cloud provider. PaaS, on the other hand, sits in the middle and distributes responsibility mostly equally.

The image below highlights who is responsible for what depending on the cloud service type of the shared responsibility model.

A diagram of a customer service

Description automatically generated with medium confidence

<https://learn.microsoft.com/en-us/training/wwl-azure/describe-cloud-compute/media/shared-responsibility-b3829bfe.svg>

For which the consumer is always responsible:

* Information and data stored in the cloud
* Devices allowed to connect to the cloud
* Accounts and identities of people, services and devices in the organization

What the cloud provider is always responsible for:

* Physical data center
* Physical network
* Physical hosts

Varying responsibilities according to service model:

* Operating systems
* Network controls
* Applications
* Identity and infrastructure

### 1.1.3 Define Cloud Models

Cloud models define the type of deployment of cloud resources. There are three main cloud models: Private, Public, Hybrid.

#### 1.1.3.1 Private Cloud

In some ways it is the natural evolution of an enterprise data center. It is the cloud used by a single organization and delivers IT services over the internet. It provides much more control for the company and the IT department. It comes with higher costs and again, fewer of the cloud deployment benefits. A private cloud can be hosted in your on-site data center, off-site in a private data center or by a third party.

#### 1.1.3.2 Public Cloud

The public cloud is created, controlled and maintained by a third-party cloud provider. Anyone who wants to buy cloud services can access and use the resources. Public availability is the biggest difference with the private cloud.

#### 1.1.3.3 Hybrid Cloud

A hybrid cloud is an environment that utilizes both public and private clouds in an interconnected environment. It can be used to distribute public cloud resources, allowing a private cloud to surge for increased, temporary demand. It can be used to provide an extra layer of security.

A black and white chart with text

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<https://learn.microsoft.com/en-us/training/modules/describe-cloud-compute/5-define-cloud-models>

#### 1.1.3.4 Multi-Cloud

Multi-cloud is an increasingly likely scenario. In multi-cloud, more than one public cloud provider is used. A multi-cloud scenario may involve the use of different features from different providers, or a migration process to a different provider.

#### 1.1.3.5 Azure Arc

Azure Arc is a set of technologies that help manage the cloud environment. Whether it's a public cloud on Azure only, a private cloud in a data center, or a hybrid structure, Azure Arc helps manage the cloud environment.

#### 1.1.3.6 Azure VMware Solution

Azure VMware solution enables running VMware workloads on Azure with seamless integration and scalability.

### 1.1.4 Desctibe the Consumption-Based Model

There are two types of expenditure to consider when comparing IT infrastructure models:

* Capital Expenditure (CapEx)
* Operational Expenditure (OpEx)

CapEx is usually a one-time expenditure to purchase or secure tangible resources. A new building, repaving a parking lot, building a data center, etc. are examples of CapEx.

OpEx is spending money on services and products over time. Renting a convention center, renting a company car, signing up for cloud services, etc. are examples of OpEx.

Cloud computing falls under OpEx because cloud computing works on a consumption-based model. In the cloud, physical infrastructure, electricity, security, etc. are not spent. Instead, you pay for the IT resource used. This consumption-based model has many benefits:

* No upfront costs
* No need to purchase costly infrastructure that users cannot use to its full potential
* Pay for excess resources when needed
* Payments for resources that are no longer needed can be stopped

In a cloud-based model, there is no need to worry about meeting resource needs exactly. They can be added when more is needed, or removed if they are surplus. In both cases, the provider is paid for the capacity used.

#### 1.1.4.1 Compare Cloud Pricing Models

Cloud computing is the delivery of IT services over the internet using a "pay-as-you-go" pricing model. Typically, you only pay for the services used, making it easier to plan and manage operating costs;

* Facilitates planning and management of operating costs
* Infrastructure is run more efficiently
* Scalable as business needs change

In other words, it is the process of renting processing power and storage space from someone else's data center.

## Descibe the Benefits of Using Cloud Services

This module introduces the benefits that cloud computing can offer. The learning objectives of the module are;

* Describe the benefits of high availability and scalability in the cloud
* Describe the benefits of reliability and predictability in the cloud
* Describe the benefits of security and governance in the cloud
* Describe the benefits of manageability in the cloud

### Describe the Benefit of High Availability and Scalability in the Cloud

The two biggest considerations when building or deploying a cloud application are uptime (or availability) and the ability to meet demand (or scale).

#### 1.2.1.1 High Availability

When deploying an application or service, it is important that resources are available when they are needed. High availability focuses on ensuring maximum availability regardless of disruptions. Service availability guarantees should be taken into account when designing the solution. These guarantees are part of service-level agreements (SLAs).

#### 1.2.1.2 Scalability

Another key benefit of cloud computing is scalability. Scalability is the ability to adjust resources to meet demand. In the event of sudden heavy traffic, scaling can help you get through it without problems.

Another benefit of scalability is not overpaying for services. If demand drops, the resource is reduced and so can the cost.

Scaling is usually of two types: vertical and horizontal scaling. Vertical scaling focuses on increasing or decreasing the capacity of resources, while horizontal scaling is the process of adding or subtracting the number of resources.

##### 1.2.1.2.1 Vertical Scaling

With vertical scaling, more CPU or RAM can be added to a virtual machine when an application is being developed and more processing power is needed. Conversely, if there is a surplus of resources, features can be reduced.

##### 1.2.1.2.2 Horizontal Scaling

With horizontal scaling, distributed resources can be scaled (automatically or manually) in case of a sudden large increase in demand.

### Describe the Benefits of Reliability and Predictability in the Cloud

Reliability and predictability are two key cloud benefits that help build solutions with confidence.

#### Reliability

Reliability is the ability of a system to recover from failures and continue to operate. The cloud supports a reliable and resilient infrastructure thanks to its decentralized design and enables distributed resources in regions around the world. This global scale means that even if there is a problem in one part of the world, other regions will continue to function.

#### Predictability

Predictability in the cloud enables moving forward with confidence. It can be focused as performance predictability or cost predictability.

##### 1.2.2.2.1 Performance

Performance predictability focuses on predicting the resources required to deliver a positive experience to customers. Autoscaling, load balancing and high availability are cloud concepts that support performance predictability.

##### 1.2.2.2.2 Maliyet

Cost predictability focuses on estimating and forecasting the cost of cloud spending. With the cloud, resource utilization can be tracked in real time, monitored to ensure resources are being used in the most efficient way, and resource allocations can be better planned. Using tools such as Total Cost of Ownership (TCO) or a pricing calculator, an estimate of potential cloud spend can be obtained.

### 1.2.3 Describe the Benefits of Security and Governance in the Cloud

Whether you are deploying IaaS or SaaS, cloud capabilities support governance and compliance. Feature like templates ensure that all deployed resources meet organizational standards and regulatory requirements. Cloud-based auditing helps flag any resources that are not compliant with your corporate standards and provides mitigation strategies.

A cloud solution can be found to suit security needs. If maximum control over security is desired, IaaS provides physical resources but requires management of operating systems and installed software, including patches and maintenance. If automated maintenance is desired, PaaS or SaaS may be the best cloud strategies.

As the cloud is designed to deliver IT resources over the internet, cloud providers are often well suited to deal with situations such as Distributed Denial of Service (DDoS) attacks, making the network more robust and secure.

### 1.2.4 Describe the Benefits of Manageability in the Cloud

One of the most important advantages of cloud computing is its manageability options.

#### 1.2.4.1 Management of the Cloud

Cloud management refers to managing cloud resources.

* Automatically scaling resource deployment according to need
* Deploy resources according to a pre-configured template, eliminating the need for manual configuration
* Monitor the status of resources and automatically replace failed resources
* Receive automated alerts based on structured metrics, real-time awareness of performance

#### 1.2.4.2 Management in the Cloud

Management in the cloud refers to how the cloud environment and resources can be managed.

* Through a web portal
* Using a command line interface (CLI)
* Using APIs
* Using PowerShell

## Describe Cloud Service Types

Share some compatible use cases and benefits of different types of cloud services. The learning objectives are;

* Infrastructure as a service (IaaS)
* Platform as a service (PaaS)
* Software as a service (SaaS)
* Appropriate use cases for each cloud service

### 1.4.1 Describe Infrastructure as a Service (IaaS)

IaaS is the most flexible category of cloud services as it provides the maximum amount of control for cloud resources. In an IaaS model, the cloud provider is responsible for maintaining the hardware, network connectivity and physical security. The consumer is responsible for everything else. With IaaS, you essentially rent a cloud data center, but what you do with that hardware is up to the consumer. Here are some scenarios where IaaS might make sense;

* Lift-and-Shift Migration: Setting up cloud resources similar to an on-premises data center and then moving what runs on-premises onto IaaS infrastructure
* Testing and Development: Configurations have been created for development and test environments that need to be rapidly replicated. With an IaaS fabric, different environments can be quickly stood up or shut down, or full control can be maintained.

### 1.4.2 Describe Platorm as a Service (PaaS)

PaaS is a middle ground between renting space in a data center and paying for a complete (IaaS) and deployed solution (SaaS). In a PaaS environment, the cloud provider provides the infrastructure, security and internet connectivity. In a PaaS scenario there is no need to worry about licensing or patching for operating systems and Databases. PaaS is well suited to provide a complete development environment without the hassle of maintaining the entire development infrastructure. Here are some scenarios where PaaS can make sense;

* Development Framework: PaaS provides a framework that developers can build upon to develop or customize cloud-based applications. Similar to creating an Excel macro, PaaS allows developers to build applications using built-in software components. Cloud features such as scalability, high availability and multi-tenancy are included, reducing the amount of coding developers need to do.
* Analytics or Business Intelligence: Tools provided as a service with PaaS allow organizations to analyze and mine their data, find insights and patterns, and predict outcomes to improve forecasts, product design decisions, ROI and other business decisions.

### 1.4.3 Describe Software as a Service (SaaS)

SaaS is the most complete cloud service model from a product perspective. With SaaS, you are essentially renting and using a fully developed application. Email, financial software, messaging applications and connectivity software are common examples of SaaS applications. While the SaaS model is the least flexible, it is also the easiest to get up and running. It requires the least amount of technical knowledge or expertise to fully utilize.