

Cloud Computing with Microsoft Azure

Day 01 | Cloud Models (IaaS, PaaS, SaaS) | Consumption vs. CapEx

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Day 01

Azure Fundamentals

- **Day 01 Agenda – Cloud Models & Consumption vs. CapEx**

- Session Overview

- What is Cloud Computing?
 - Cloud Deployment Models: Public, Private, Hybrid
 - Cloud Service Models: IaaS, PaaS, SaaS
 - The Shared Responsibility Model
 - CapEx vs. OpEx: Cloud Economics
 - The Consumption-Based Model
 - Use Cases and Real-World Scenarios
 - AZ-900 Exam Objectives Covered
 - Hands-On Lab & Knowledge Check

Azure Fundamentals

- **What is Cloud Computing?**

- Computing services include: servers, storage, databases, networking, software, analytics, and intelligence
- Cloud services are provided on-demand via the internet

Key Characteristics

- On-demand self-service – provision resources without human interaction
- Broad network access – accessible from any device via the internet
- Resource pooling – provider serves multiple customers (multi-tenancy)
- Rapid elasticity – scale up or down quickly to match demand
- Measured service – usage is monitored, controlled, and billed

Azure Fundamentals

- **Why Do Organisations Move to the Cloud?**

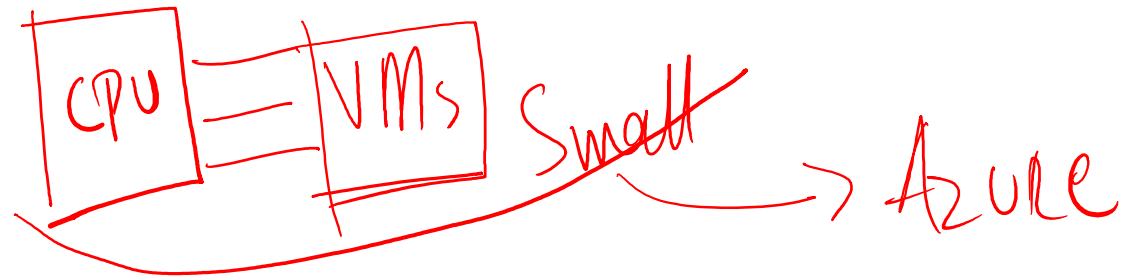
- **Key Business Drivers**

- Agility – deploy new services in minutes, not months
 - Cost Efficiency – replace unpredictable CapEx with predictable OpEx
 - Global Scale – deploy to any Azure region worldwide instantly
 - Reliability – built-in redundancy, backups, and disaster recovery
 - Security – Microsoft invests \$1B+ annually in cloud security

- **Traditional IT Challenges Solved**

- No need to purchase, install, configure, or manage on-premises hardware
 - Eliminate idle capacity and over-provisioning costs
 - Focus internal teams on innovation rather than infrastructure maintenance

Azure Fundamentals



- **Cloud Deployment Models – Overview**

- There are three main deployment models for cloud computing:

Public Cloud

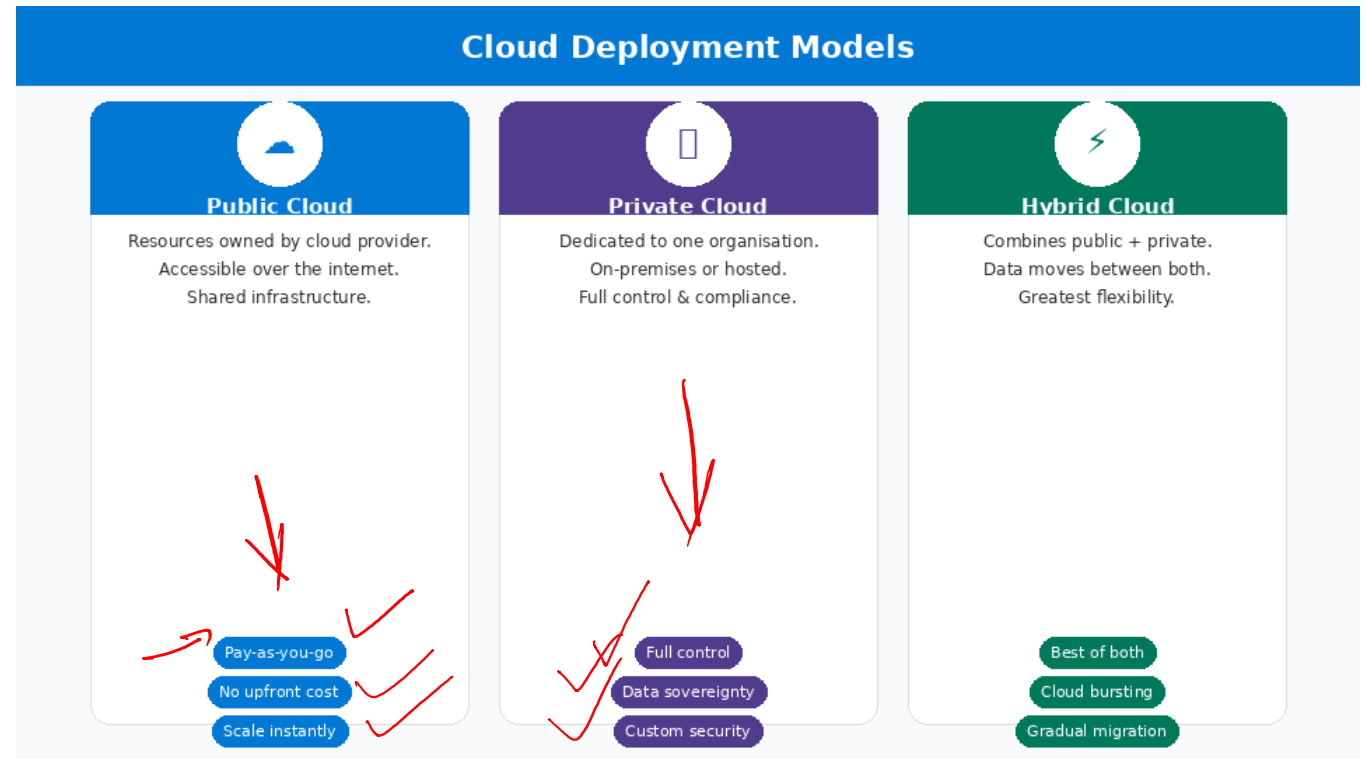
- Cloud resources owned and operated by a third-party provider (e.g., Microsoft Azure)
- Delivered over the internet; shared infrastructure across multiple tenants

Private Cloud

- Cloud infrastructure operated solely for one organisation
- Can be on-premises or hosted by a provider; full control and customisation

Hybrid Cloud

- Combines public and private clouds, allowing data and applications to move between them
- Provides greater flexibility and optimises existing infrastructure



Azure Fundamentals

• Public Cloud – Deep Dive

- No capital expenditure to scale up
- Applications can be provisioned and deprovisioned quickly
- Only pay for what you use (consumption-based)

B2C

Pay as you go!

MS/Google

Characteristics

- **Ownership:** Cloud provider owns all hardware and infrastructure
- **Tenancy:** Multiple organisations share the same physical resources
- **Access:** Services accessed via the public internet
- **Responsibility:** Provider manages physical security, networking, and hardware

Azure as a Public Cloud

- Azure operates 60+ regions globally, serving customers in 140+ countries
- Azure data centres are owned and managed entirely by Microsoft

B2B → B2B

Azure Fundamentals

- **Private Cloud – Deep Dive**

- Cloud environment hosted in your own data centre
- Organisation provides self-service access to compute resources to users in the organisation
- You are responsible for operating the services you provide

Characteristics

- **Hardware: Organisation purchases, installs, and manages hardware**
- **Control: Complete control over security, compliance, and data residency**
- **Cost: Full CapEx model – upfront investment required**
- **Use Case: Government agencies, financial institutions, healthcare providers**

When to Choose Private Cloud

- Strict regulatory or data sovereignty requirements
- Legacy applications not suited for public cloud migration
- Existing data centre investment to maximise (hardware lifecycle)

Azure Fundamentals

- **Hybrid Cloud – Deep Dive**

- Combines public and private clouds, connected by technology that allows them to share data and applications
- Provides greatest flexibility and most deployment options

Key Scenarios

- Cloud Bursting: Run normal workloads on-premises; burst to public cloud during peak demand
- Data Sovereignty: Keep sensitive data on-premises; run processing in public cloud
- Migration Path: Gradually move workloads from on-premises to cloud over time
- Disaster Recovery: Use Azure as failover site for on-premises systems

Azure Hybrid Services

- Azure Arc – manage on-premises and multi-cloud from Azure portal
- Azure VPN Gateway / ExpressRoute – secure private connectivity to Azure
- Azure Stack – run Azure services on your own hardware

Azure Fundamentals

• Cloud Service Models – Introduction

- Three Types of Cloud Service Models
- Each model differs in the level of control, flexibility, and management

IaaS – Infrastructure as a Service

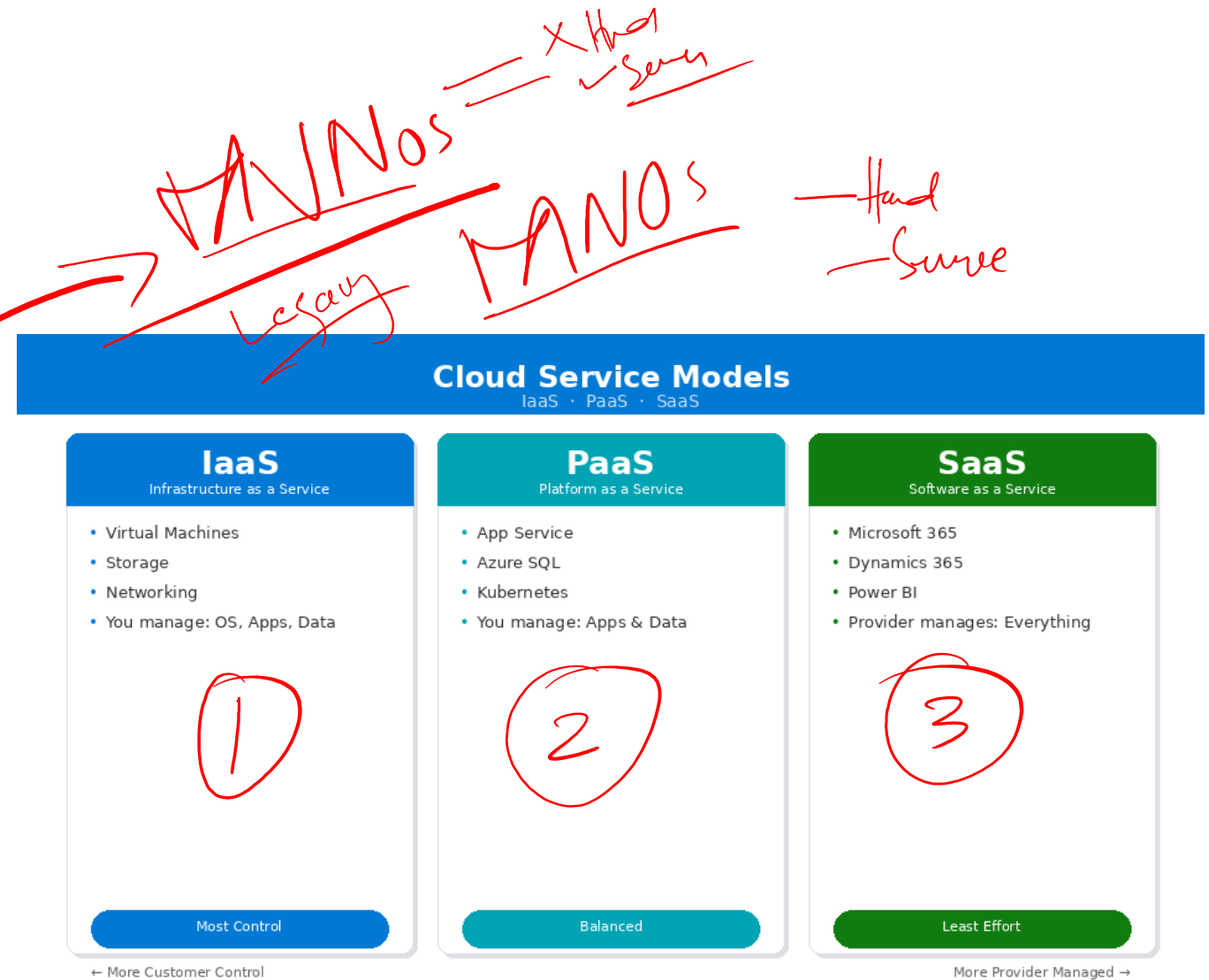
- You manage: OS, middleware, runtime, data, applications
- Provider manages: Virtualisation, servers, storage, networking

PaaS – Platform as a Service

- You manage: Applications and data only
- Provider manages: OS, middleware, runtime, infrastructure

SaaS – Software as a Service

- You manage: Configuration and your data
- Provider manages: Everything else (full stack)



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Infrastructure as a Service (IaaS)

- IaaS is the most flexible category of cloud service
- You rent IT infrastructure (servers, VMs, storage, networks) from a cloud provider on a pay-as-you-go basis

What You Control

- You configure and manage the hardware for your application
- You install and manage operating systems, middleware, and runtime
- You deploy, manage, and patch applications

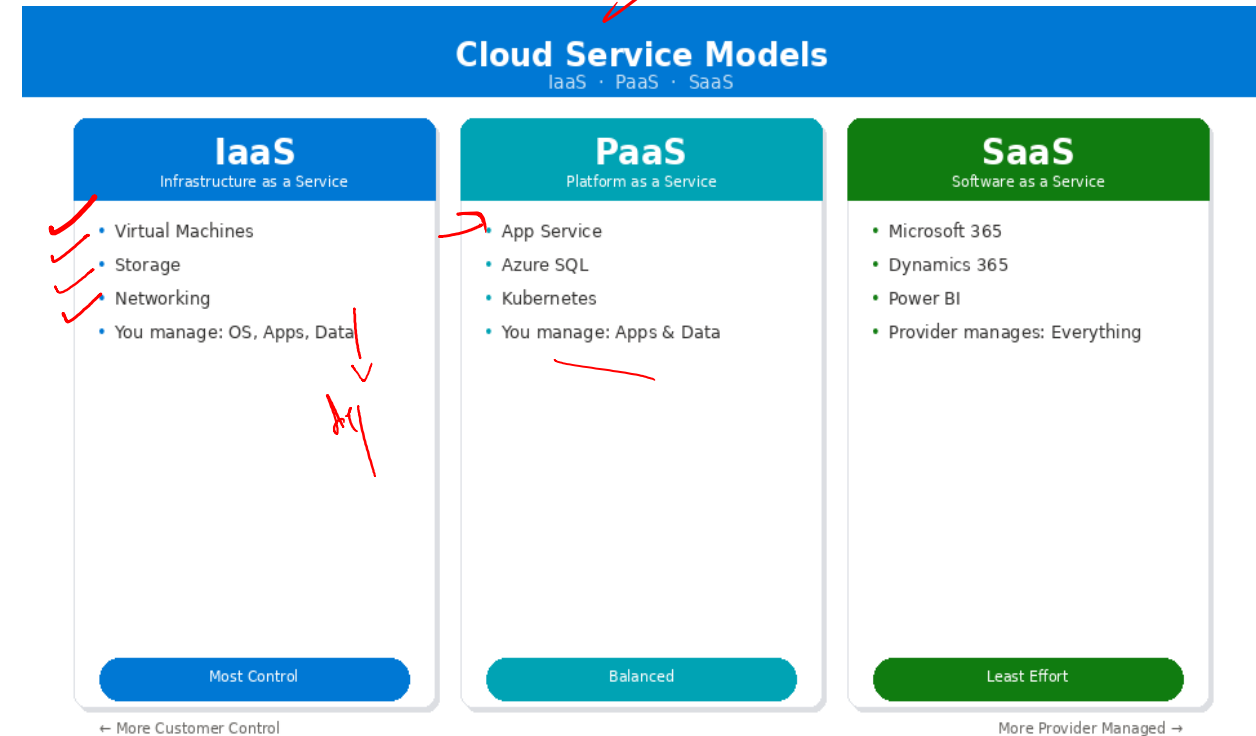
Azure IaaS Examples

- Azure Virtual Machines – fully configurable Windows or Linux VMs
- Azure Virtual Network – software-defined networking
- Azure Disk Storage – managed OS and data disks for VMs
- Azure Load Balancer – distribute traffic across VM instances

Typical Use Case

- Lift-and-shift migration of on-premises workloads to cloud
- Test and development environments
- Storage, backup, and disaster recovery

Handwritten red text: Azure → App



Azure Fundamentals

• Platform as a Service (PaaS)

- PaaS provides an environment for building, testing, and deploying software applications
- You focus on application development without managing the underlying infrastructure

What the Provider Manages

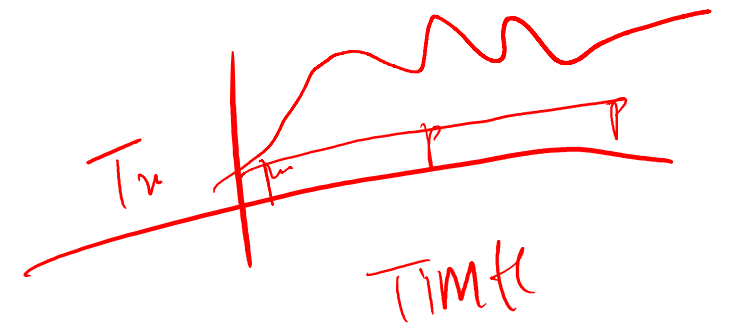
- OS, middleware, runtime, virtualisation, servers, storage, networking
- Automatic patching, updates, and scaling
- High availability and disaster recovery built-in

Azure PaaS Examples

- Azure App Service – host web apps, REST APIs, and mobile backends
- Azure SQL Database – fully managed relational database engine
- Azure Cosmos DB – globally distributed NoSQL database
- Azure Functions – serverless compute triggered by events
- Azure Kubernetes Service (AKS) – managed container orchestration

Typical Use Case

- Developing new cloud-native applications
- Analytics and business intelligence on managed platforms



Azure Fundamentals

- **Software as a Service (SaaS)**

- SaaS provides fully managed cloud-based applications over the internet
- Users connect to and use cloud-based apps on a subscription model

What the Provider Manages

- The complete application stack: ✓
- ✓ infrastructure, platform, and software
- Automatic software updates, patches, and new features
- Data backup and availability

Azure / Microsoft SaaS Examples

- • Microsoft 365 (Word, Excel, Outlook, Teams) – productivity suite
- • Microsoft Dynamics 365 – CRM and ERP business applications
- • Microsoft Intune – mobile device and application management
- • Power BI – business analytics and data visualisation service

Typical Use Case

- Email and collaboration tools (Office 365, Teams)
- ✓ • HR, finance, and business management software
- ✓ • Any commodity software not core to business differentiation

Azure Fundamentals

Assignment
Provider ↔ Client (B2B/B2C)

Comparing IaaS, PaaS, and SaaS

- Responsibility Spectrum
- As you move from IaaS to SaaS, the cloud provider takes on more responsibility

IaaS

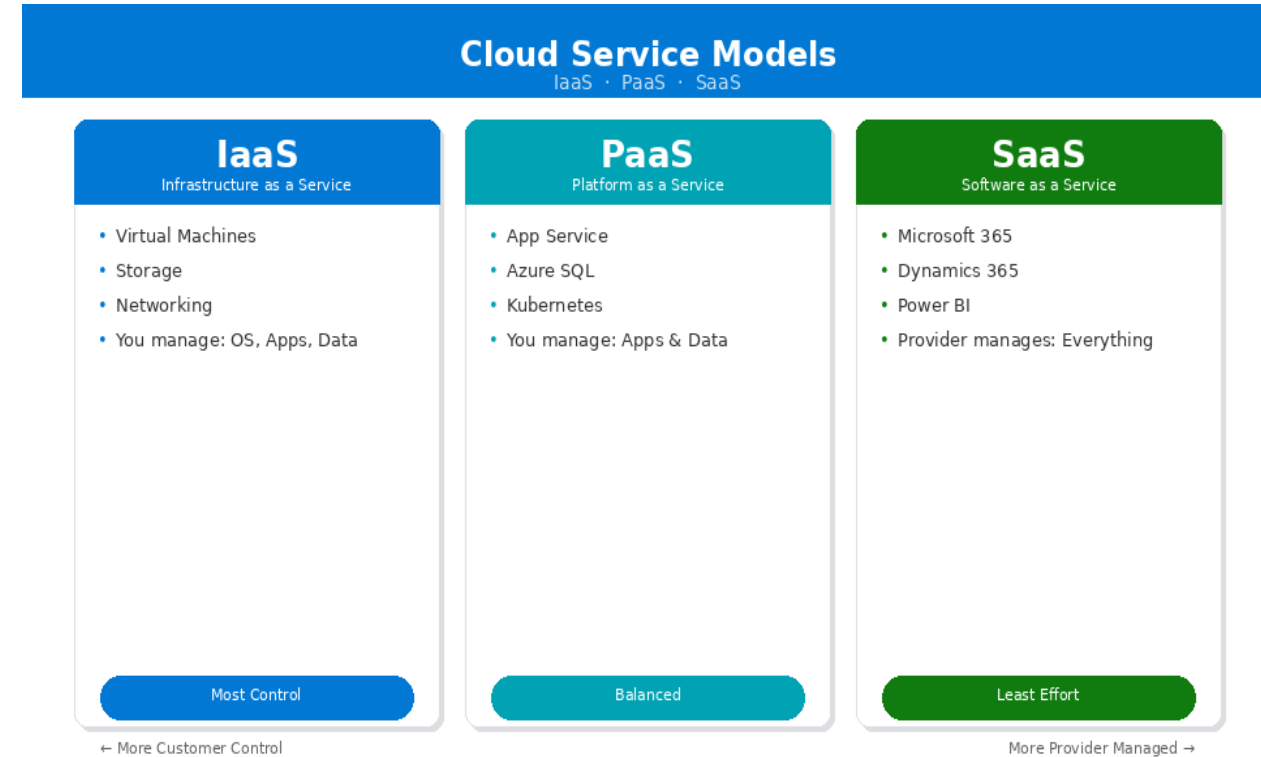
- Flexibility: Most flexible – configure and manage hardware for your application
- Responsibility: You manage OS, middleware, apps, and data
- Scenario: Legacy app migration, custom OS requirements, dev/test

PaaS

- Flexibility: Focus on application development; platform management is handled by provider
- Responsibility: You manage applications and data only
- Scenario: Web apps, APIs, databases, data analytics

SaaS

- Flexibility: Least flexible – use the application as-is
- Responsibility: Pay for the software you use; provider manages everything
- Scenario: Email, collaboration, CRM, HR software



Azure Fundamentals

The Shared Responsibility Model

- Security and compliance responsibilities are shared between the cloud provider and the customer
- The split depends on the service type: IaaS, PaaS, or SaaS

Always Customer Responsibility

- Data governance and rights management
- Client endpoints (devices used to access cloud services)
- Account and access management (user accounts, permissions)
- Information and data (what you store in the cloud)

Always Provider Responsibility

- Physical datacentre security and access controls
- Physical network infrastructure
- Physical host hardware
- Shared (varies by model)
- Identity and directory infrastructure – Customer (IaaS) / Shared (PaaS/SaaS)
- Application security – Customer (IaaS/PaaS) / Provider (SaaS)
- Network controls – Customer (IaaS) / Provider (PaaS/SaaS)

Shared Responsibility Model

Attributes	On-Premises	IaaS	PaaS	SaaS
1 Data & Information	Customer	Customer	Customer	Customer
2 Identities & Accounts	Customer	Customer	Customer	Customer
3 Applications ✓	Customer	Customer	Shared	Shared
4 Network Controls ✓	Customer	Customer	Shared	Provider
5 Operating System ✓	Customer	Customer	Provider	Provider
6 Virtual Infrastructure ✓	Customer	Customer	Provider	Provider
7 Physical Hosts	Customer	Provider	Provider	Provider
8 Physical Network	Customer	Provider	Provider	Provider
9 Physical Datacenter	Customer	Provider	Provider	Provider
10	Customer	Provider	Provider	Provider

■ Customer
 ■ Shared
 ■ Provider

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Azure Fundamentals

- **Shared Responsibility – Visual Model**

On-Premises (Traditional IT)

- Customer responsible for: Everything – hardware, OS, network, apps, data, physical security

IaaS

- Customer responsible for: OS, applications, middleware, data, network security config
- Provider responsible for: Physical infrastructure, virtualisation, physical network

PaaS

- Customer responsible for: Applications and data
- Provider responsible for: OS, middleware, runtime, infrastructure

SaaS

- Customer responsible for: Data, accounts, and access management
- Provider responsible for: Everything else including the application

Who Manages What? - Shared Responsibility				
	On-Premises	IaaS	PaaS	SaaS
Applications	Customer	Customer	Customer	Customer
Runtime / Middleware	Customer	Customer	Microsoft	Microsoft
Operating System	Customer	Customer	Microsoft	Microsoft
Virtualisation	Customer	Microsoft	Microsoft	Microsoft
Physical Servers	Customer	Microsoft	Microsoft	Microsoft
Physical Network	Customer	Microsoft	Microsoft	Microsoft
Datacentre	Customer	Microsoft	Microsoft	Microsoft

■ Customer Managed ■ Microsoft Managed

Azure Fundamentals

• Capital Expenditure (CapEx) – Traditional IT

- Capital Expenditure (CapEx) refers to upfront spending on physical infrastructure
- The costs are deducted over time through depreciation

Characteristics of CapEx

- Large upfront investment – servers, storage, networking equipment, data centre
- Value depreciates over time (asset on the balance sheet)
- Long planning cycles – hardware procurement takes weeks or months
- Risk of over-provisioning – buying capacity for peak demand that may never occur
- Fixed capacity – difficult to scale up or down quickly

CapEx Examples in Traditional IT

- Purchasing physical servers and installing them in a data centre
- Buying networking equipment (routers, switches, firewalls)
- Building or leasing a dedicated data centre facility
- Procuring software licences with perpetual terms



Azure Fundamentals

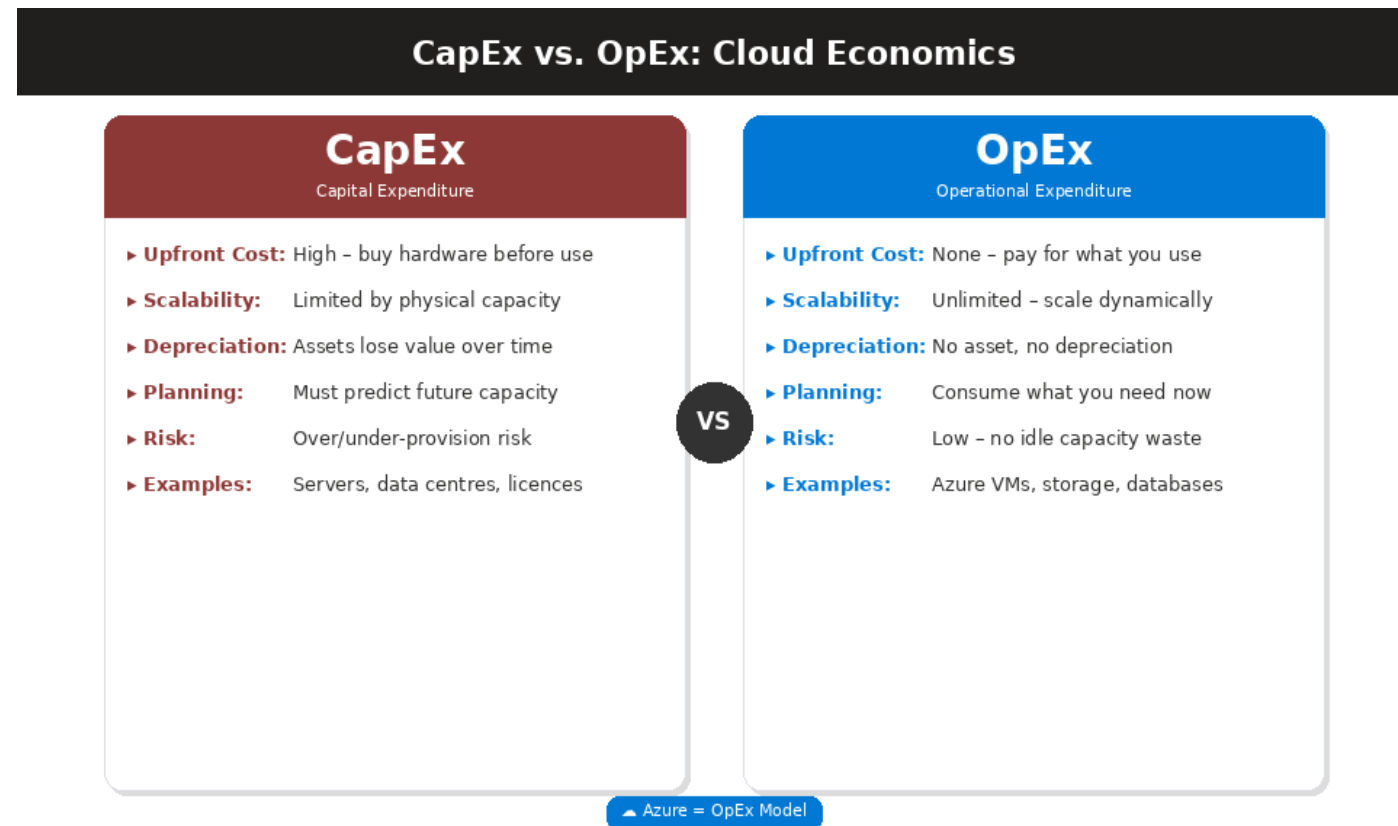
- **Operational Expenditure (OpEx) – Cloud Model**
 - Operational Expenditure (OpEx) refers to spending on services or products on a pay-as-you-go basis
 - Expenses are deducted in the same year they are incurred

Characteristics of OpEx

- No upfront cost – pay only when you consume the resource
- Predictable monthly/annual subscription costs
- Immediately deductible as a business expense
- Flexible – scale spending up or down based on actual need
- Low risk – no idle capacity or wasted investment

OpEx Examples in Cloud

- Azure subscription fees for virtual machines, storage, databases
- Microsoft 365 per-user monthly licence
- Pay-per-use for Azure AI and Cognitive Services
- Azure Reserved Instances – pre-pay for predictable workloads (still OpEx, just pre-committed)



AZ-900: Azure Fundamentals

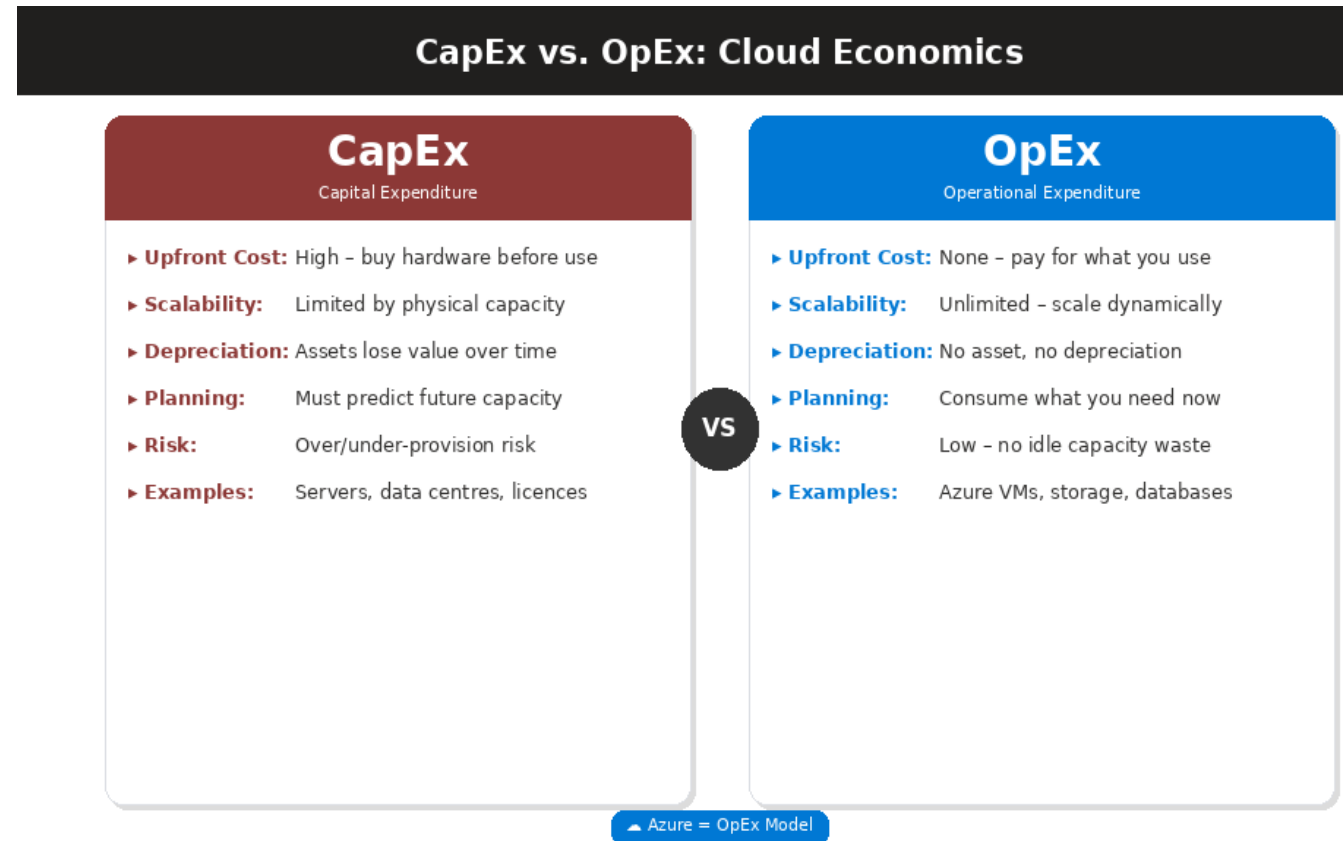
- **CapEx vs. OpEx – Side-by-Side Comparison**

Capital Expenditure (CapEx)

- Upfront cost: High (purchase hardware before use)
- Depreciation: Assets depreciate over time
- Scalability: Limited – physical constraints
- Forecasting: Must predict future capacity needs
- Risk: High – may over or under-provision
- Tax treatment: Depreciated over asset lifetime

Operational Expenditure (OpEx)

- Upfront cost: None – pay for what you use
- Depreciation: No asset; no depreciation
- Scalability: Unlimited – scale dynamically
- Forecasting: Consume what you need, when you need it
- Risk: Low – eliminate idle capacity
- Tax treatment: Fully deductible in year of expense



Azure Fundamentals

• The Consumption-Based Model

- Cloud providers operate on a consumption-based model
- End users only pay for the resources they use
- Whatever they use is what they pay for

Key Benefits

- Better cost prediction – no surprise hardware costs
- Granular billing – prices for individual resources and services are provided
- Usage-based billing – billed only for actual consumption
- No waste – pay for peak only when you need it, not year-round
- No over-provisioning – stop paying when you stop using

Practical Example

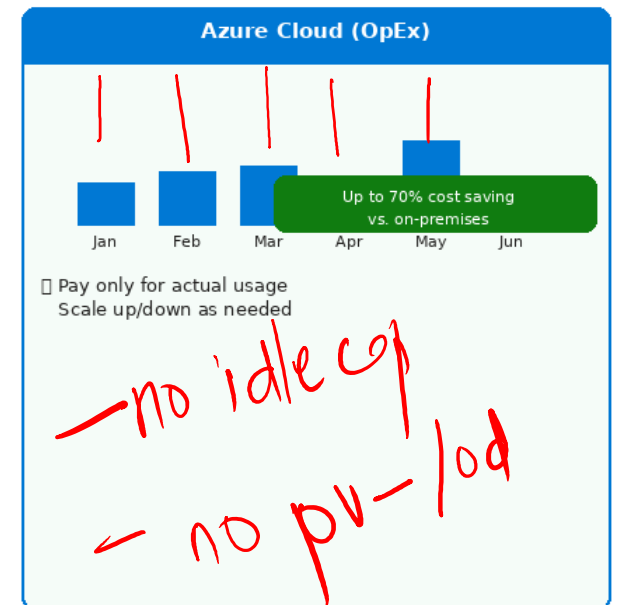
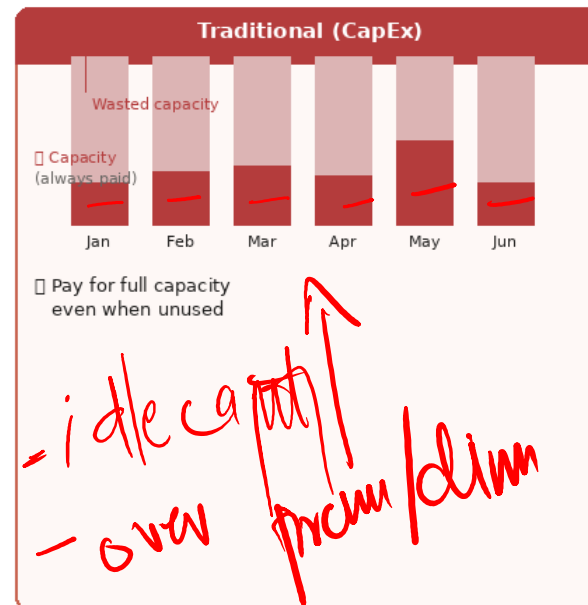
- On-premises: Buy a server that runs at 20% utilisation – you pay 100% of the cost
- Azure: Pay only for the 20% of compute you actually consumed
- Azure Pricing Calculator: Estimate costs before deploying resources

OpEx

↑ on-premises

↑ cloud

The Consumption-Based Model



Azure Fundamentals

- **Economies of Scale**

- The ability to do things more efficiently or at a lower cost per unit when operating at a larger scale
- Cloud providers like Microsoft operate at massive scale, passing savings to customers

How Azure Achieves Economies of Scale

- Purchases hardware at volume discounts unavailable to individual companies
- Maximises server utilisation across millions of workloads globally
- Invests in custom silicon (e.g., Azure Maia AI accelerator) for efficiency
- Operates on renewable energy targets (100% renewable by 2025)

What This Means for Customers

- Lower per-unit cost for compute, storage, and bandwidth ✓
- Enterprise-grade infrastructure at small-business prices ✓
- Example: Azure Blob Storage costs as little as \$0.018 per GB/month ✓
- Continuous price reductions as Microsoft passes on savings

Azure Fundamentals

- **Identify Use Cases – IaaS, PaaS, SaaS**

- **IaaS Use Cases**

- Test and development: quickly set up and dismantle test environments
 - Storage, backup, and recovery: cost-effective storage with flexible scaling
 - High-performance computing: run simulations and model complex problems
 - Big data analysis: mine large datasets with massive on-demand compute

- **PaaS Use Cases**

- Application development: build scalable apps without managing servers
 - Analytics and business intelligence: mine data and find insights
 - Database management: use managed database services (Azure SQL, Cosmos DB)

- **SaaS Use Cases**

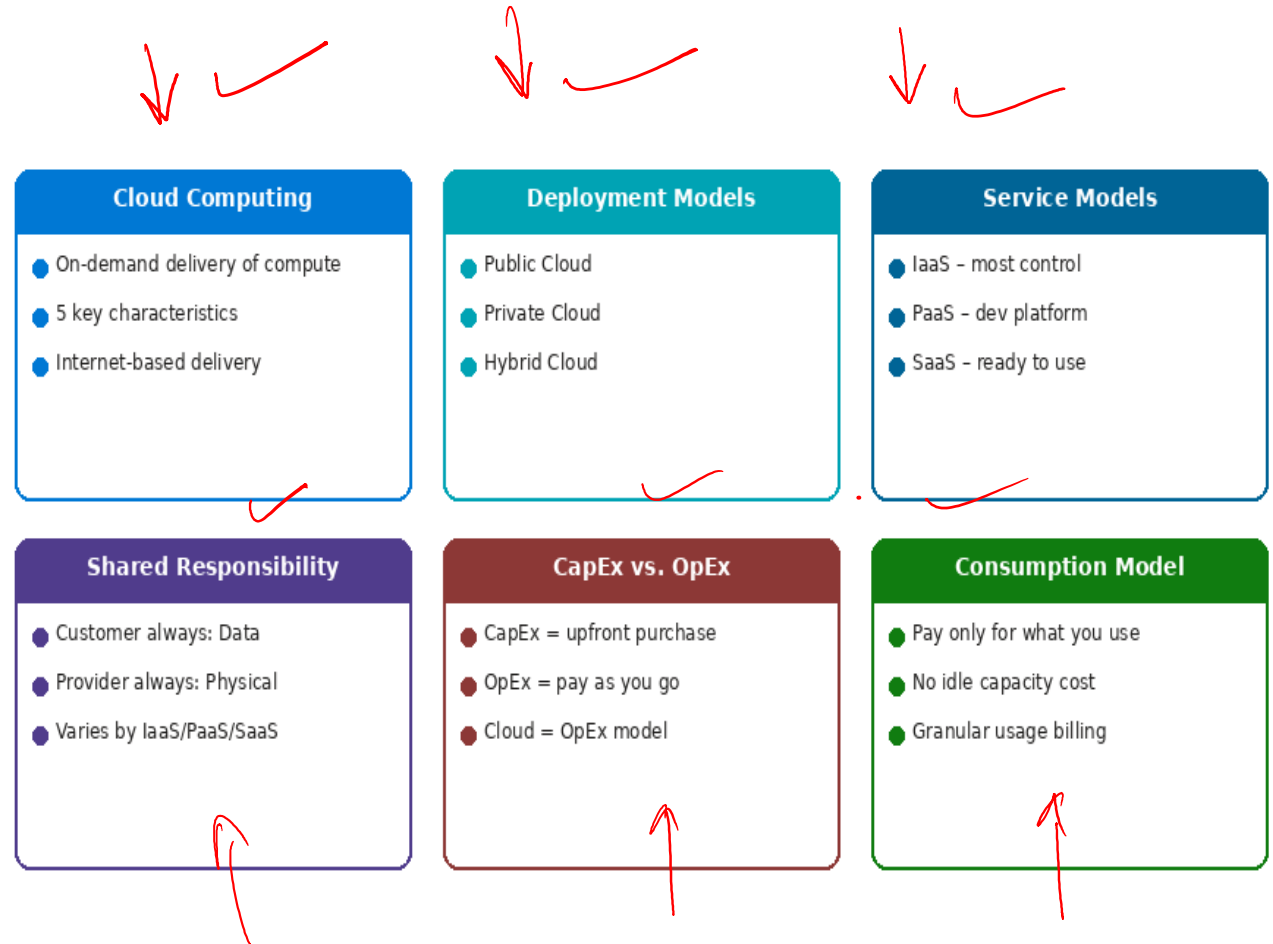
- Productivity and collaboration: Microsoft 365 (email, Teams, SharePoint)
 - Customer relationship management: Microsoft Dynamics 365
 - Enterprise resource planning: SAP, Oracle, Workday on cloud
 - Software development tools: GitHub, Azure DevOps

Azure Fundamentals

• Objective Summary – Cloud Concepts

Objectives Covered Today

- ✓ Describe cloud computing – definition and key characteristics
- ✓ Describe the shared responsibility model – custom vs. provider responsibilities
- ✓ Define cloud models (public, private, hybrid) – including appropriate use cases
- ✓ Describe IaaS – most flexible, you manage OS and above
- ✓ Describe PaaS – you manage apps and data only
- ✓ Describe SaaS – provider manages everything; subscription model
- ✓ Identify appropriate use cases for each service type
- ✓ Describe the consumption-based model – pay only for what you use
 - Compare CapEx and OpEx – upfront vs. ongoing spend



Source: learn.microsoft.com | AZ-900 Study Guide

Azure Fundamentals

- **Day 01 Assignment**

- Assignment Day 01

- Task 1: Create a Free Azure Account

- **Sign up at portal.azure.com using your email address**

- **Explore the Azure portal interface and locate the following services:**

- Virtual Machines (IaaS), Azure App Service (PaaS), Microsoft 365 portal (SaaS)

- Task 2: CapEx vs. OpEx Analysis

- **Your company currently runs 10 physical servers in an on-premises data centre**

- **Each server costs \$5,000 upfront and has a 5-year lifecycle**

- **Research and calculate: what would the equivalent Azure VM cost per month?**

- **Use the Azure Pricing Calculator at: azure.microsoft.com/en-us/pricing/calculator**

- Task 3: Reflection (Short Answer)

- **Describe one scenario from your own industry where PaaS would be more appropriate than IaaS**

- **Explain why using the shared responsibility model concepts from today**

THANK YOU!