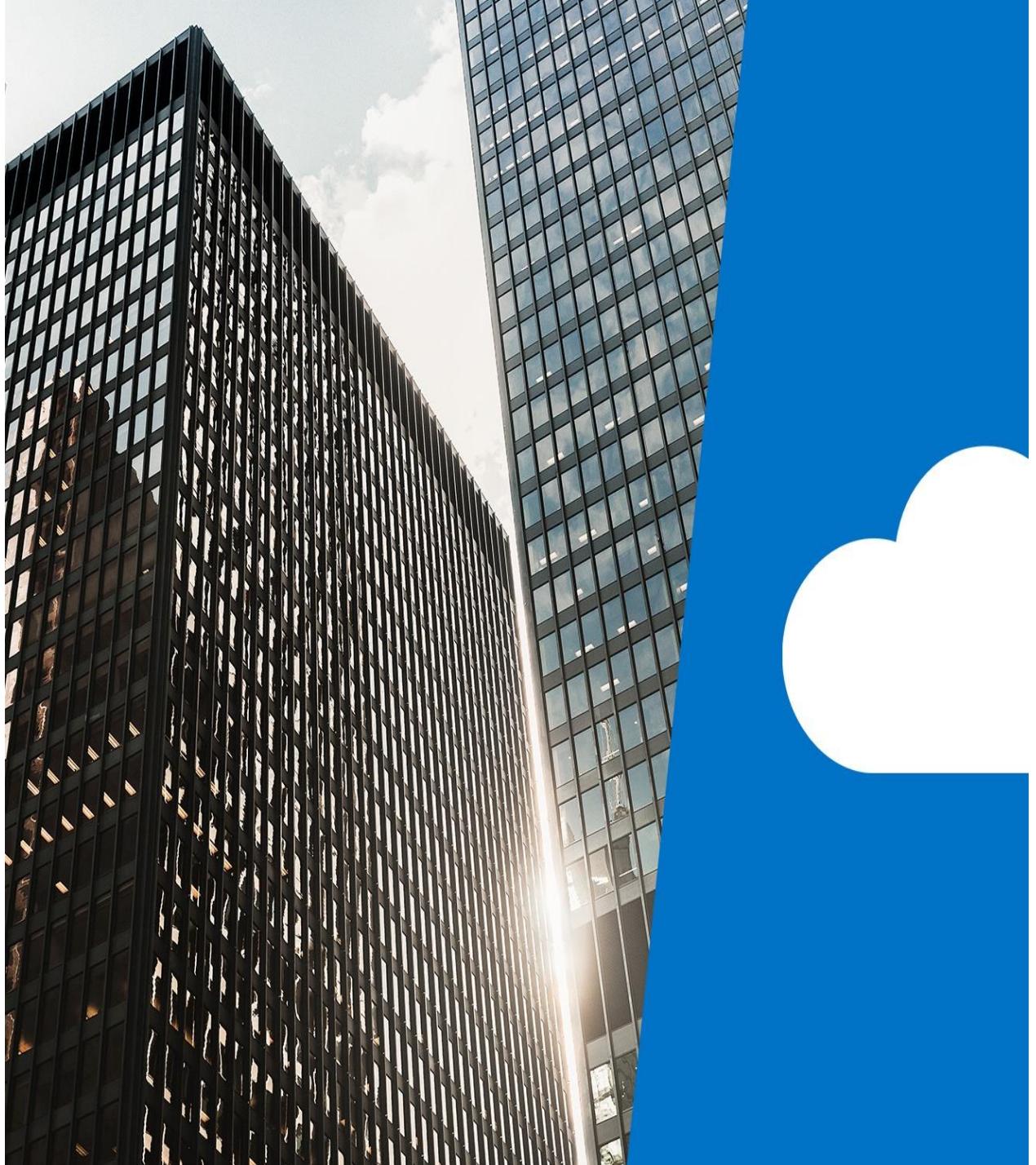




Azure Fundamentals





Module 01

Why cloud services?



Module 1 – Learning objectives

- Describe and understand cloud services and their benefits
- Understand key terms you will encounter when working with cloud services
- Understand public, private, and hybrid cloud models
- Understand infrastructure as a service (IaaS)
- Understand platform as a service (PaaS)
- Understand software as a service (SaaS)

Cloud computing characteristics

Ref: The NIST Definition of Cloud Computing

<https://csrc.nist.gov/publications/detail/sp/800-145/final>



On-demand
self-service



Broad network
access



Resource
pooling



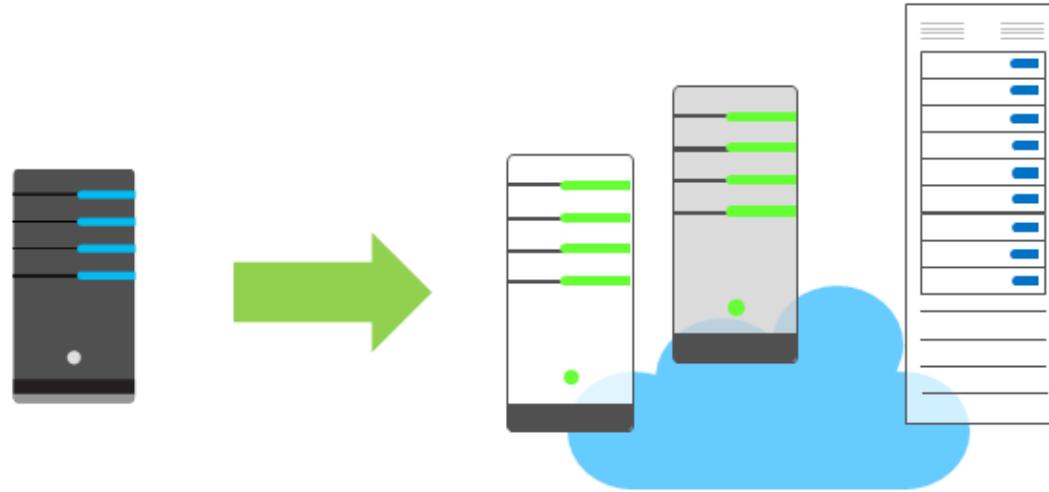
Rapid
elasticity



Measured
service

Economies of scale

- Less expensive
- More efficient
- Pass benefits on



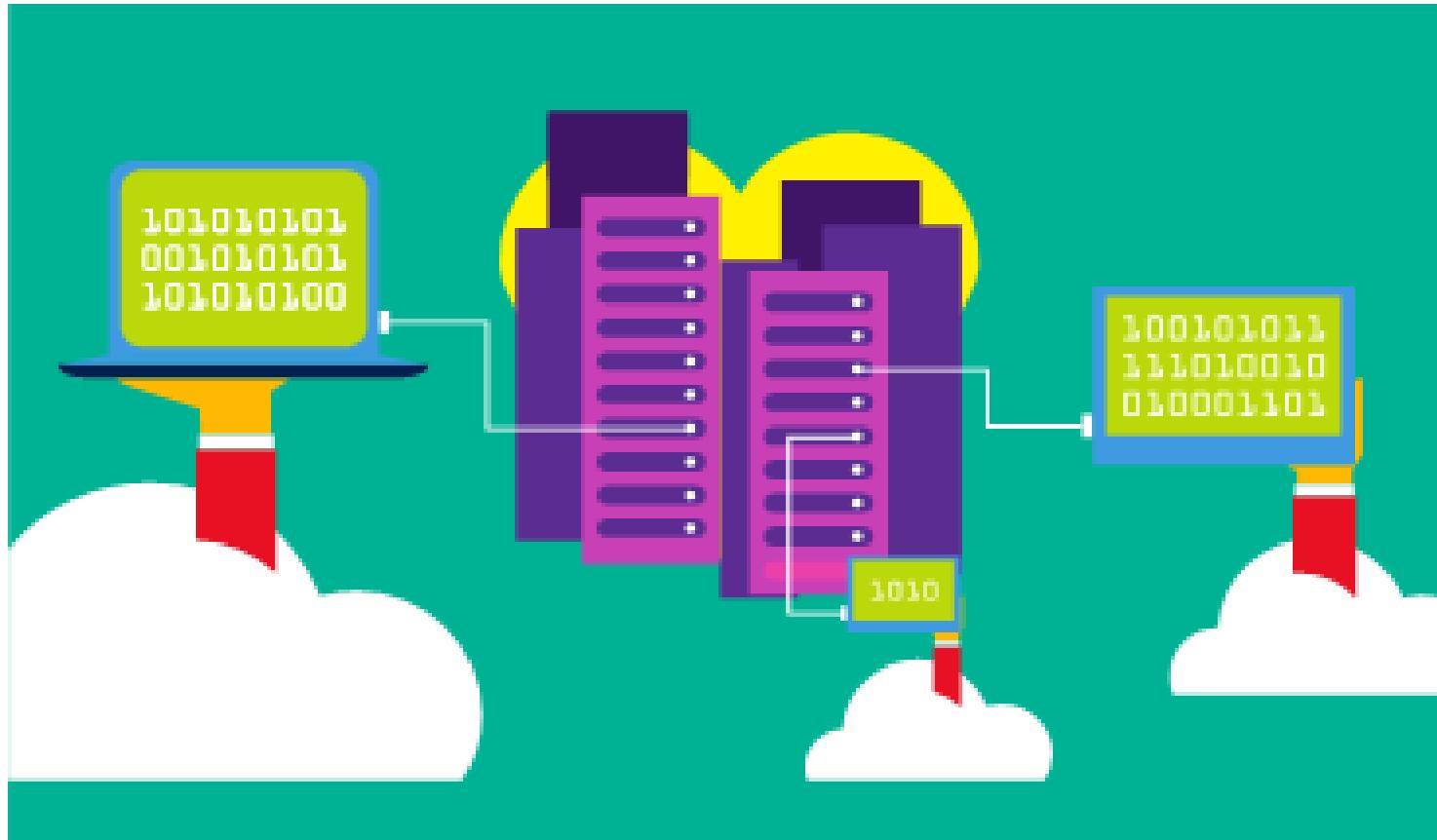
CapEx vs. OpEx



Cloud model comparison



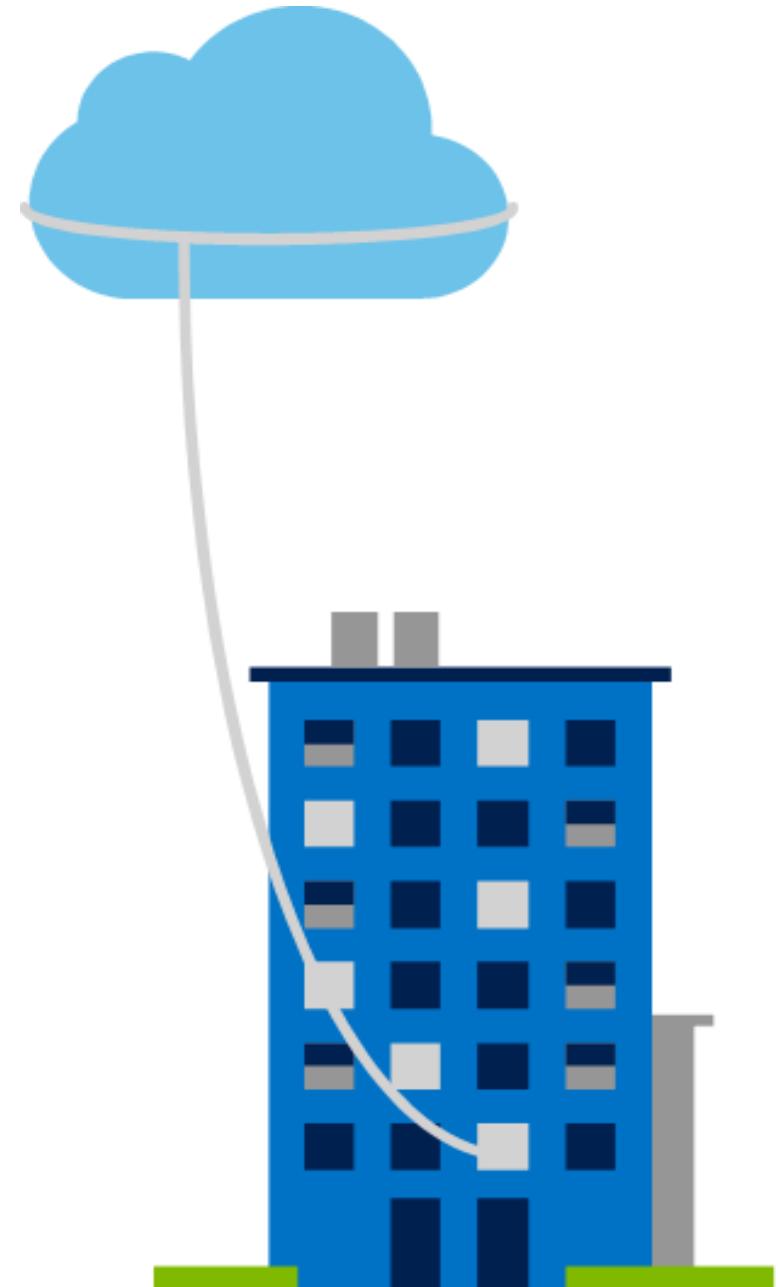
Public cloud



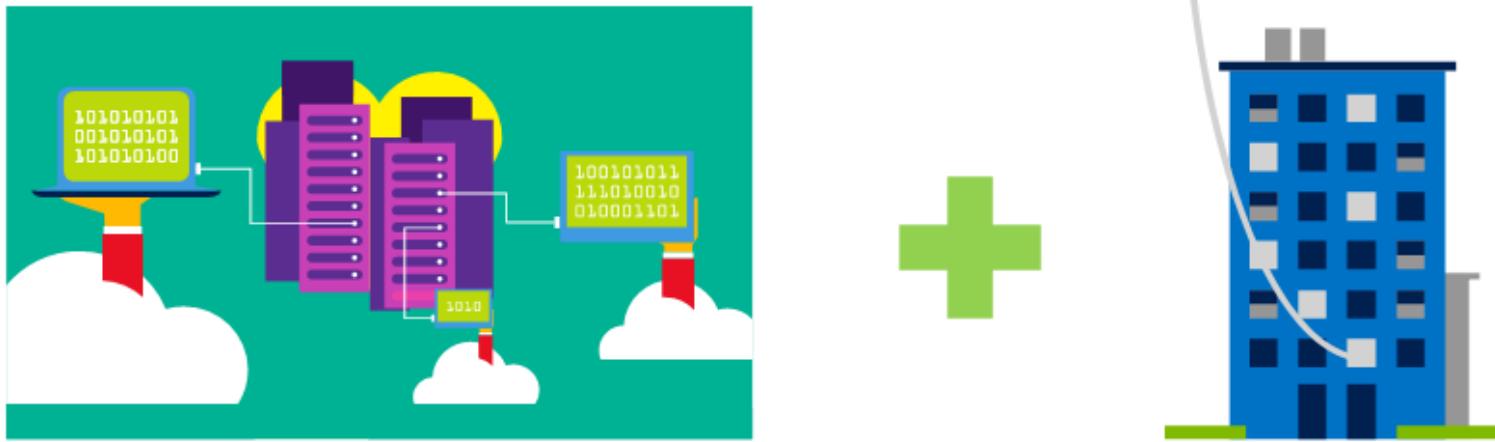
A *public cloud* is owned by a cloud services provider (also known as a *hosting provider*).

Private cloud

A *private cloud* is owned and operated by the organization that uses the resources from that cloud.



Hybrid cloud



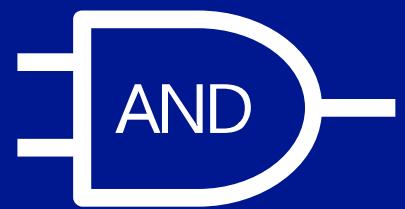
A *hybrid cloud* combines both public and private clouds, allowing you to run your applications in the most appropriate location.

Think AND not OR

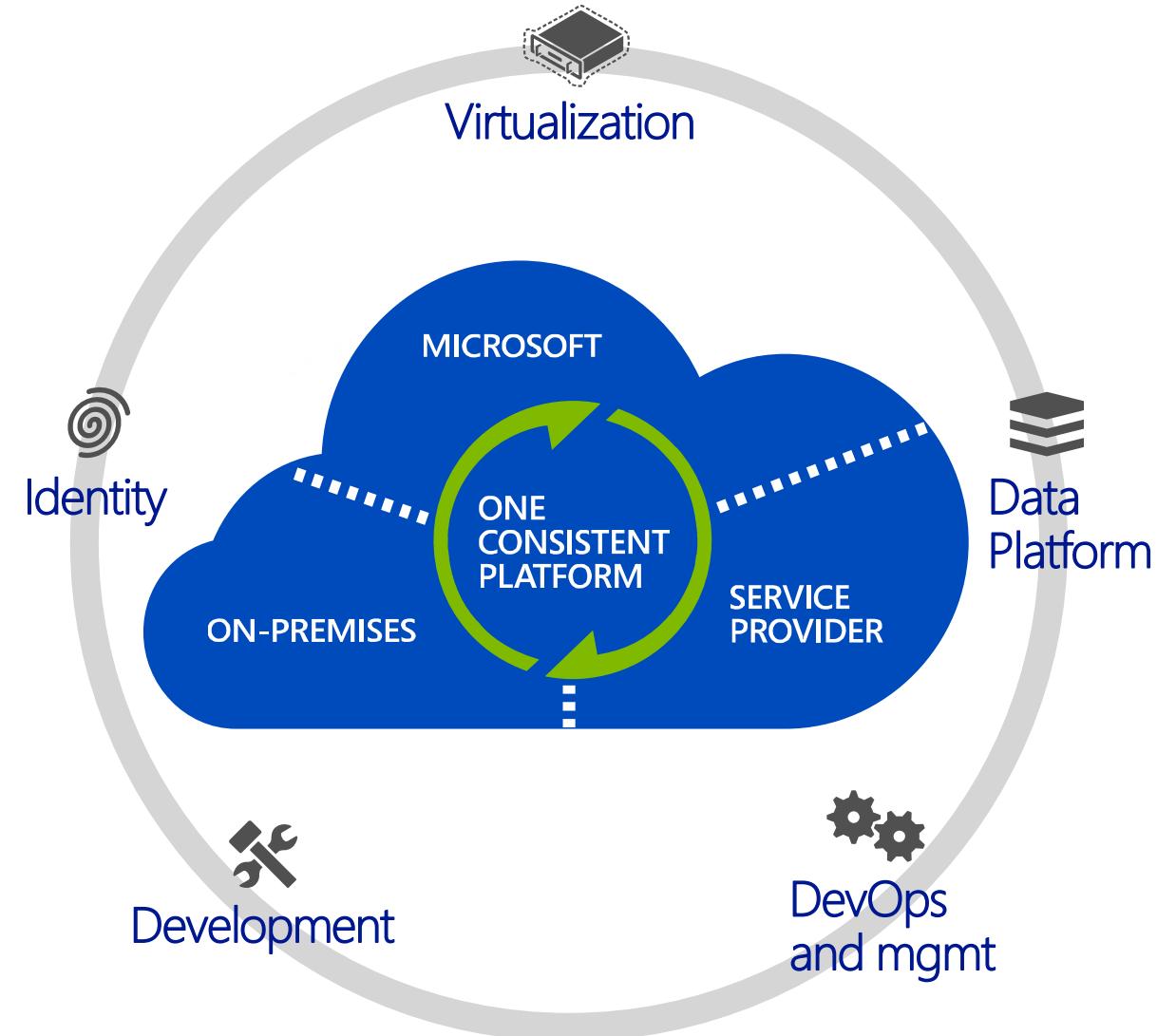
Business
needs



Integration



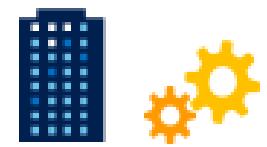
On-premises
AND Cloud



IaaS

IaaS is the most basic category of cloud computing services. With IaaS, you rent IT infrastructure servers, and virtual machines (VMs), storage, networks, and operating systems from a cloud provider on a pay-as-you-go basis. It's an instant computing infrastructure, provisioned and managed over the internet.

IaaS

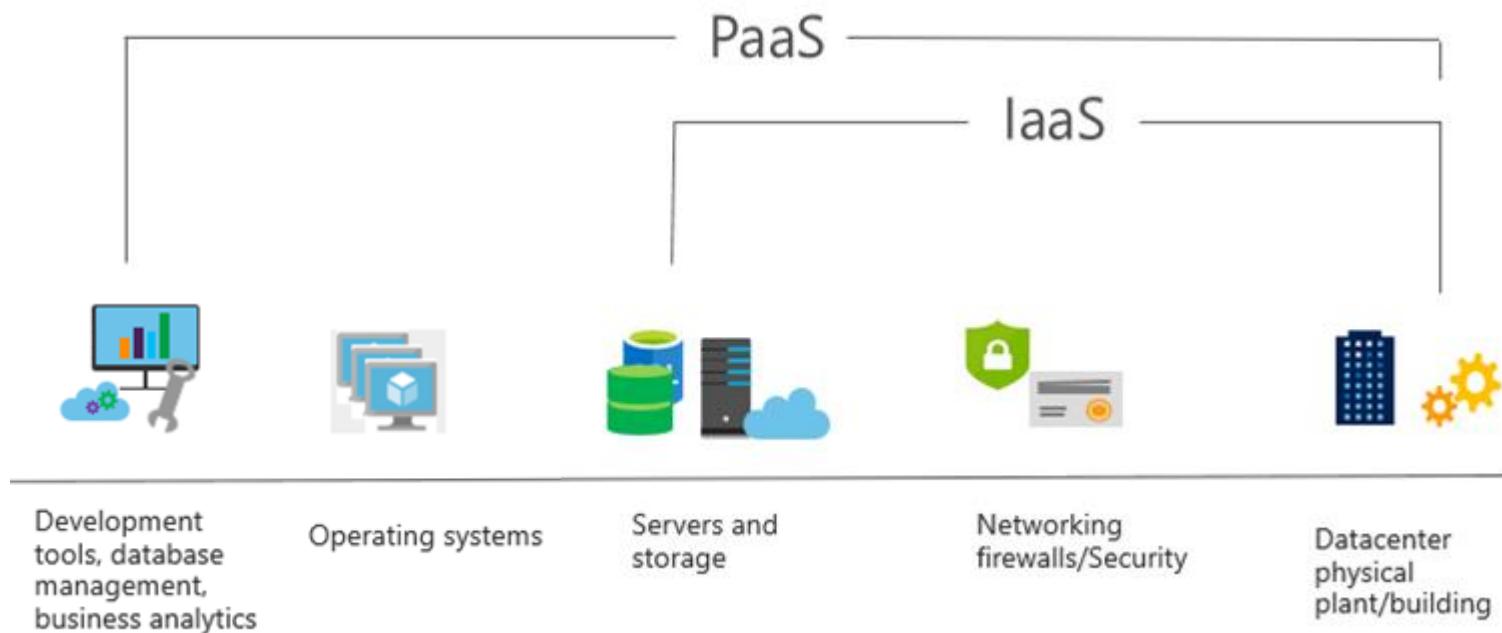


Servers and storage

Networking firewalls/Security

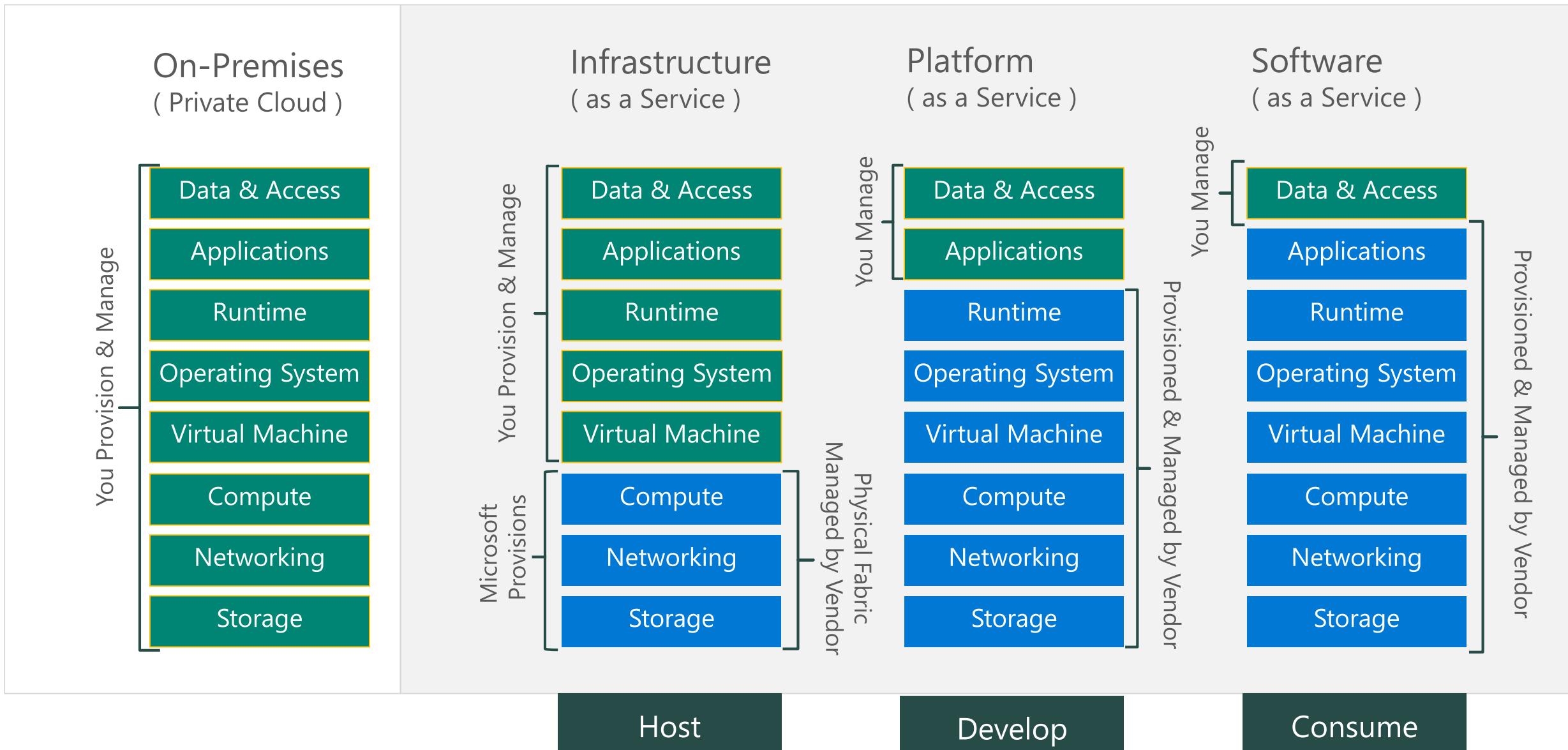
Datacenter physical plant/building

PaaS

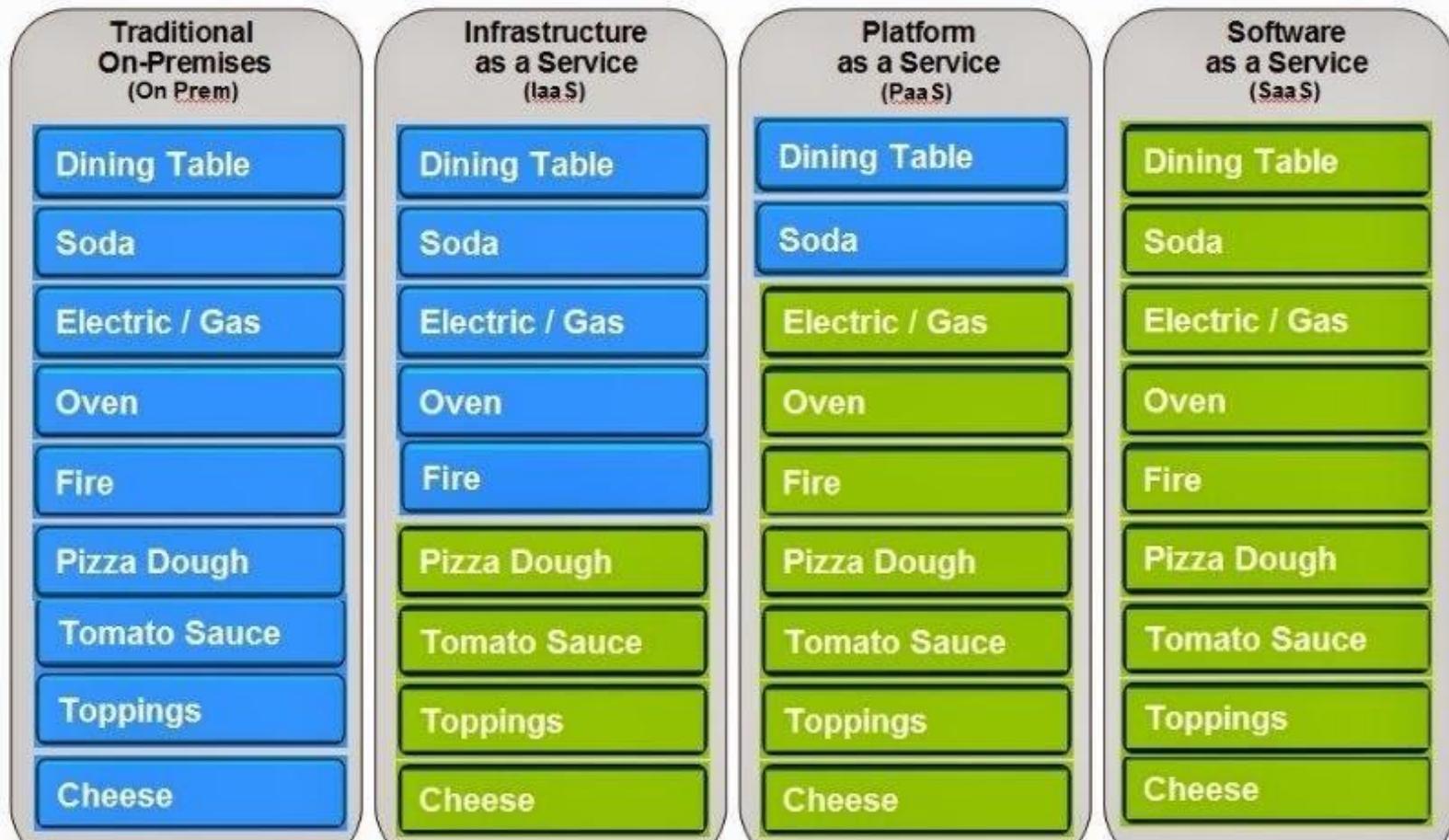


PaaS provides an environment for building, testing, and deploying software applications. The goal of PaaS is to help create an application as quickly as possible without having to focus on managing the underlying infrastructure.

Cloud computing models and responsibilities



Pizza as a Service



Made at home

Take & Bake

Pizza Delivered

Dined Out

■ You Manage ■ Vendor Manages



Module 02

Core Azure Services



Module 2 – Learning objectives

- Understand and describe core Azure architectural components
- Understand and describe core Azure services and products
- Understand and describe Azure solutions
- Understand and describe Azure management tools

54

Azure regions



Geographies

- Defined by geo-political boundaries or country borders
- Defines the data residency boundary for customer data
- Geographies:
 - Americas
 - Europe
 - Asia Pacific
 - Middle East
 - Africa



Microsoft Azure Regions

Microsoft Azure Geographies



Microsoft Azure Regions

Microsoft Azure Geographies

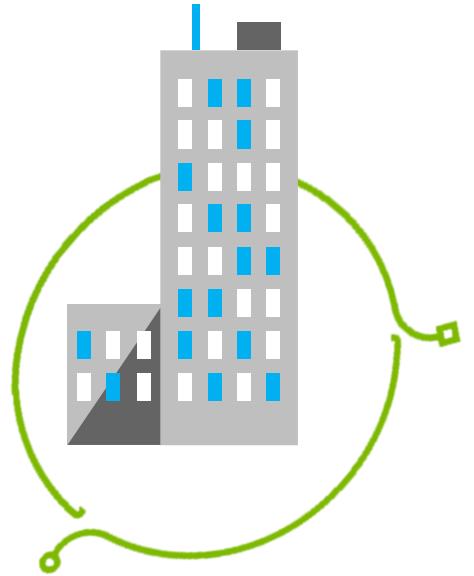


Regions - continued

Azure special regions

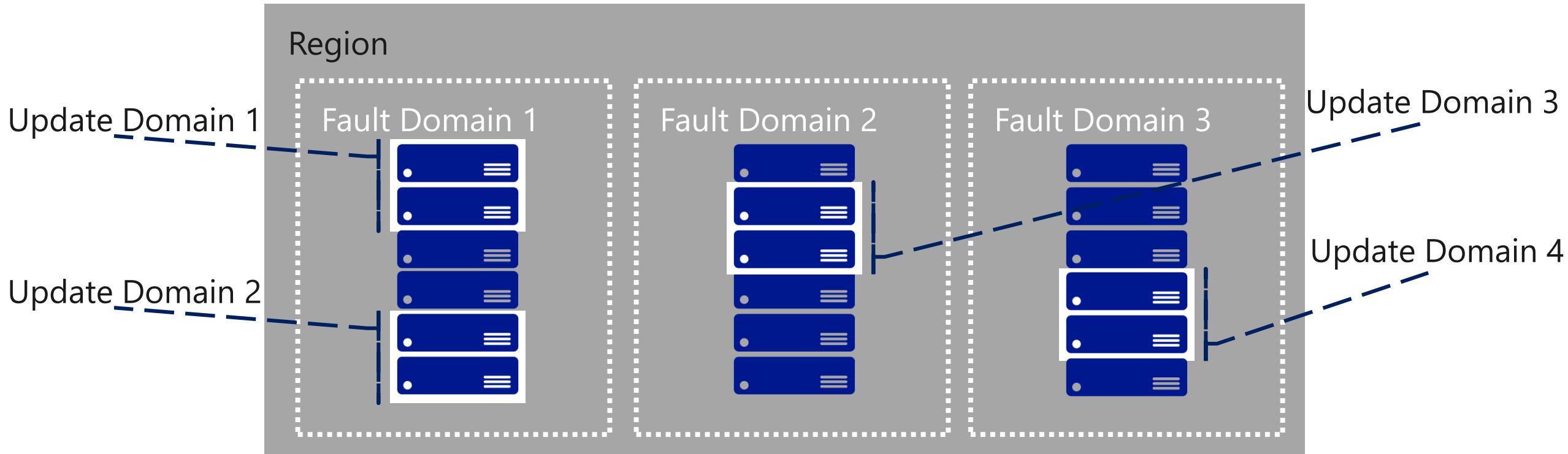
For applications with specific compliance or legal requirements.

- Azure Government (North America)
- Azure China 21Vianet
- Azure Germany



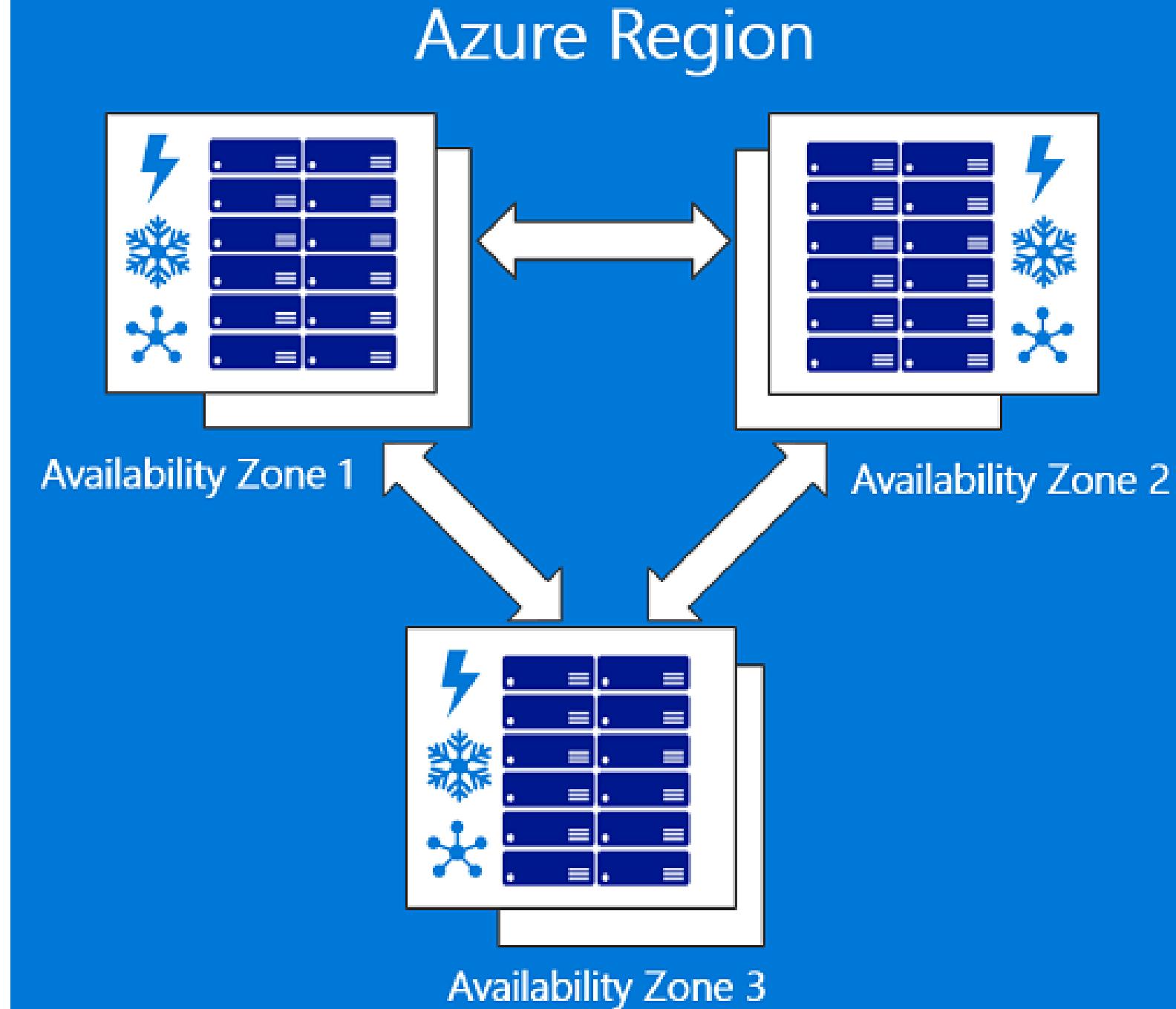
Availability sets

- Fault Domains
 - Segments clusters within a region (Up to 3)
- Update Domains
 - Segments updates and patches to clusters (Up to 20)



Availability zones

- Separate locations
- Independent
 - Power
 - Cooling
 - Networking
- Isolation Boundary



Availability zones and SLA's

Region



Resource Group

Single Instance VM



99.9% Availability

* With premium storage

VMs in Availability Set



99.95% Availability

*in a single availability zone

VMs in Availability Zones

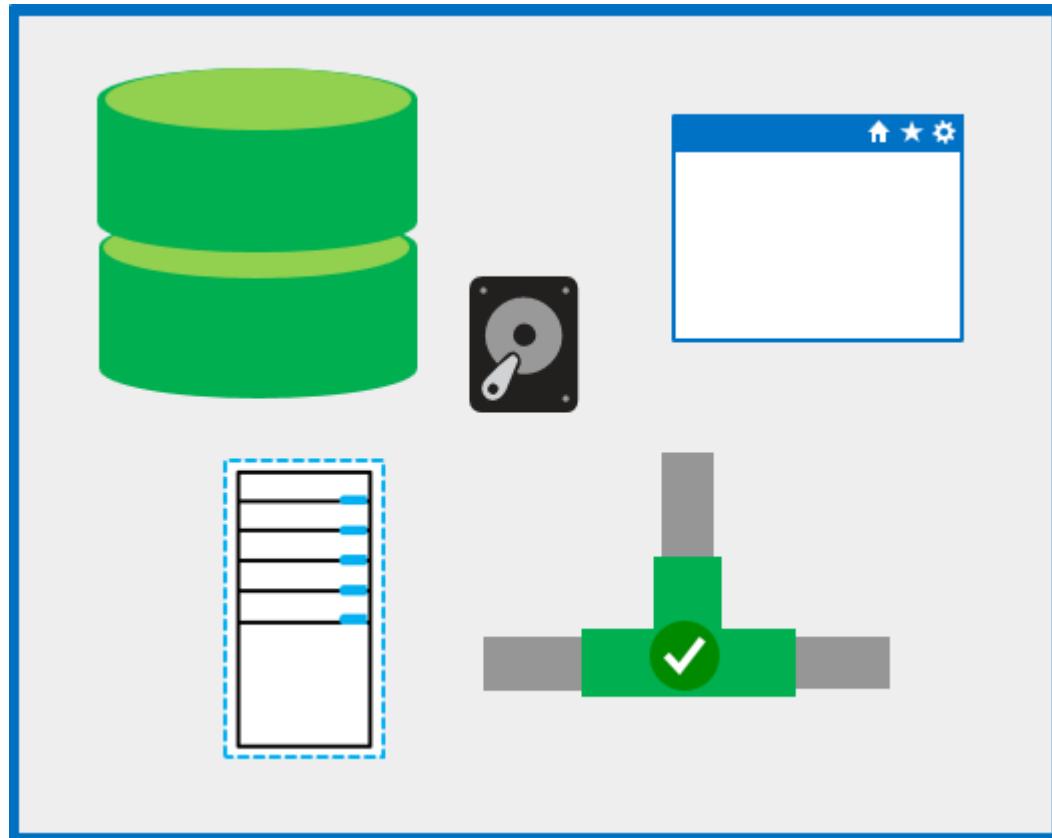


99.99% Availability

* across availability zones

Resource groups

A collection of resources in Azure.



Resource group features:

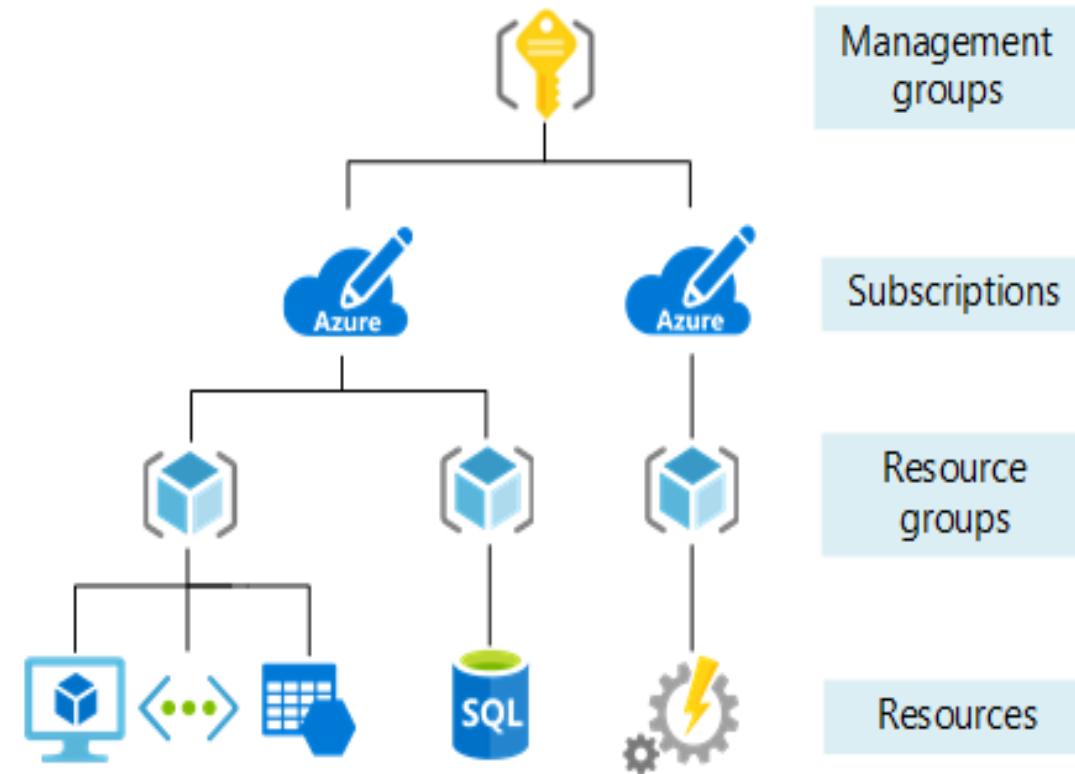
- Act as containers to aggregate the resources required by an application into a single, manageable unit.
- Every Azure resource must exist in one (and only one) Resource Group.

Azure Resource Manager

Provides a management layer in which resource groups and all the resources within it are created, configured, managed, and deleted

With Azure Resource Manager, you can:

- Create, configure, manage and delete resources and resource groups
- Organize resources
- Control access and resources
- Automate using different tools and SDKs



Core Azure Services demo



Azure Services

Compute

- VMs, Availability Sets & Zones, Scale sets, App services, Azure Functions, Containers

Networking

- vNets, Load Balancers, Application Gateways, VPN Gateways, CDN, ExpressRoute

Databases

- CosmosDB, Azure SQL, Azure Database Migration service

Big Data & Analytics

- Azure SQL Data Warehouse, HDInsight, Data Lake Analytics

AI & IoT

- IoT Central & Hub, Azure Machine Learning



Azure compute services - virtual machine services

VMs are software emulations of physical computers. Examples of Azure services for virtual machines include:



- Azure VMs: Infrastructure as a service (IaaS) to create and use VMs in the cloud
- VM scale sets: Designed for automatic scaling of identical VMs
- App services: Platform as a service (PaaS) offering to build, deploy, and scale enterprise-grade web, mobile, and API apps
- Functions: Creates infrastructure based on an event



Azure compute services – container services

Containers are a virtualization environment. However, unlike virtual machines, they do not include an operating system. Containers are meant to be lightweight, and are designed to be created, scaled out, and stopped dynamically. Examples of Azure services for containers include:



- Azure Container Instances: A PaaS offering that allows you to upload your containers, which it then will run for you
- Azure Kubernetes Service: A container orchestrator service for managing large numbers of containers



Compute demo



Azure network services

Networking on Azure allows you to connect cloud and on-premises infrastructure and services.



- Azure Virtual Network: An IaaS service to create and use VMs in the cloud



- Azure Load Balancer: Designed for automatic scaling of identical VMs



- VPN Gateway: A PaaS offering to build, deploy, and scale enterprise-grade web, mobile, and API apps



- Azure Application Gateway: Creates infrastructure based on an event



- Content Delivery Network: Creates infrastructure based on an event

Storage types

Structured data

- Adheres to a schema

Semi-structured data

- Non-relational (NoSQL) data

Unstructured data

- No restrictions, flat files
- Holds PDFs, JPGs, JSON files, etc.



Azure storage services – Azure services

Azure Storage is a service that you can use to store files, messages, tables, and other types of information.



Blob storage. No restrictions on the kinds of data it can hold. Blobs are highly scalable



Disk storage. Provides disks for virtual machines, applications, and other services



File storage. Azure Files offers fully-managed file shares in the cloud



Archive storage. Storage facility for data that is rarely accessed

Storage demo



Azure database services



- Azure Cosmos DB: A globally-distributed database service that enables you to elastically and independently scale throughput and storage
- Azure SQL Database: A relational database as a service (DaaS) based on the latest stable version of the Microsoft SQL Server database engine
- Azure Database Migration: A fully-managed service designed to enable seamless migrations from multiple database sources to Azure data platforms with minimal downtime

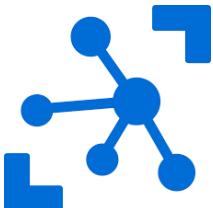


Internet of Things

The internet allows any item that's online-capable to access valuable information. This ability for devices to garner and then relay information for data analysis is referred to as the *Internet of Things* (IoT)



- Microsoft IoT Central: A fully-managed global IoT software as a service (SaaS) solution that makes it easy to connect, monitor, and manage your IoT assets at scale
- Azure IoT Hub: A managed service hosted in the cloud that acts as a central message hub for **bidirectional communication** between your IoT application and the devices it manages



Azure Marketplace

Service on Azure connects end users with solutions:

- Microsoft partners
- Independent software vendors (ISVs)
- Start-ups

Over 8,000 listings



Serverless computing

Azure Functions

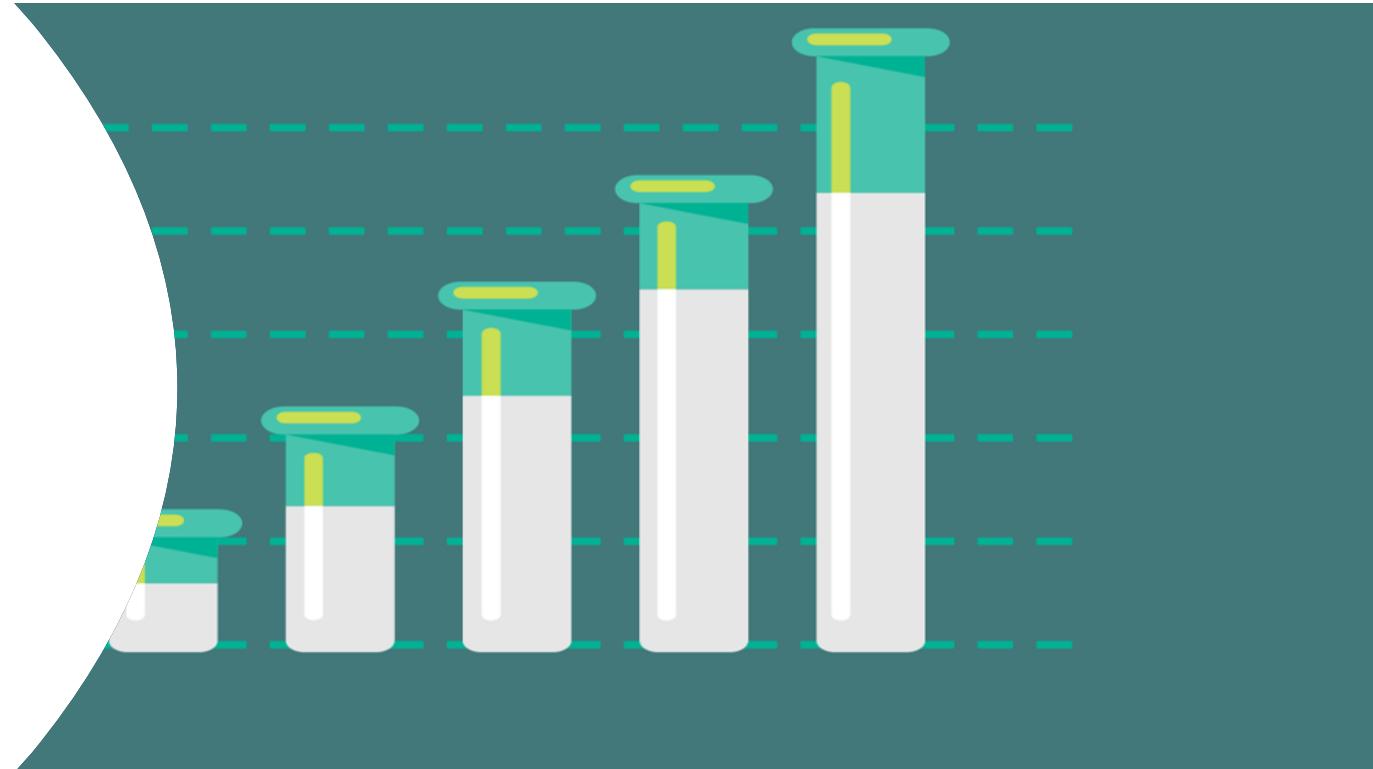
Azure Logic Apps

Azure Event Grid

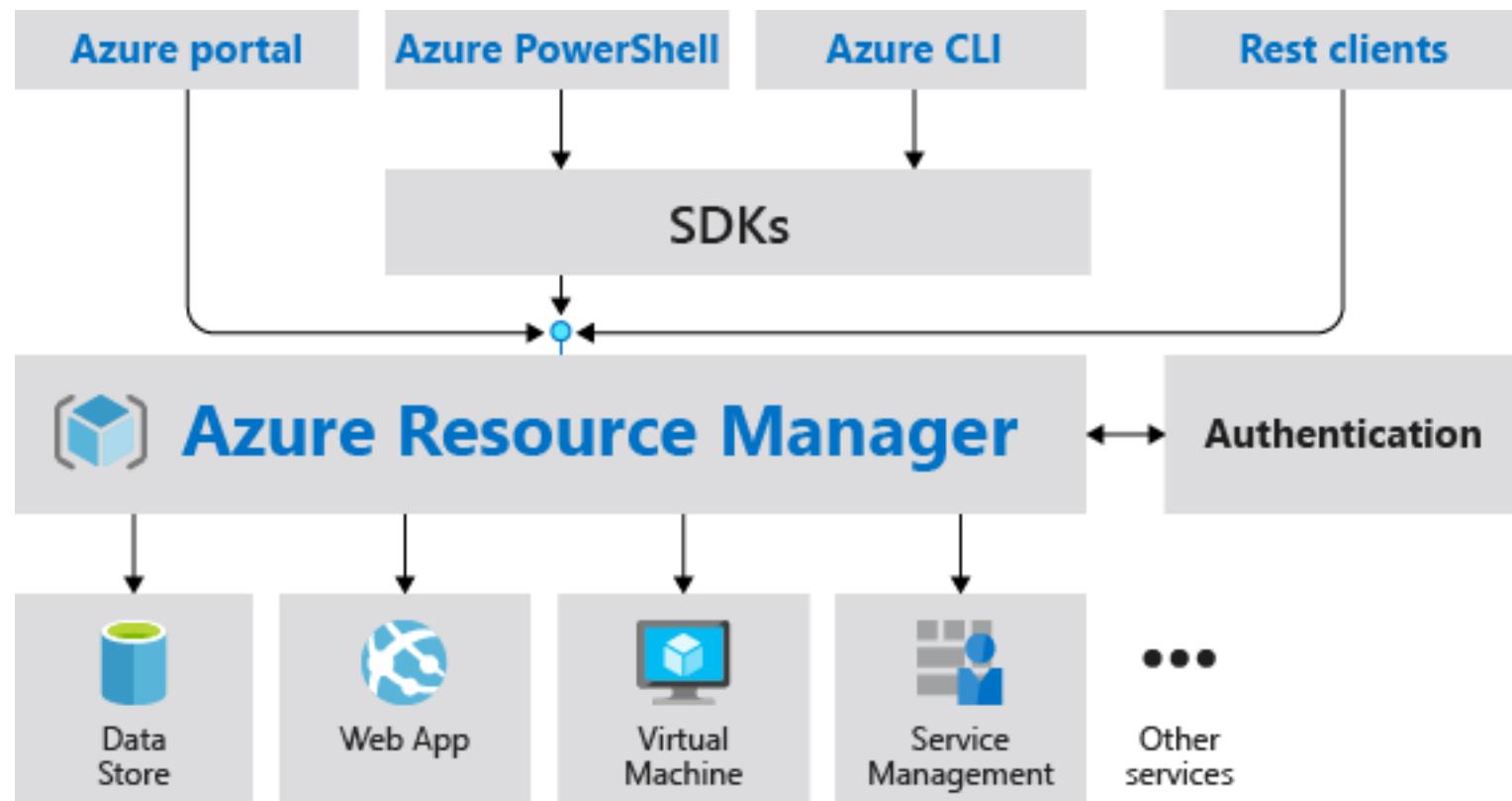


DevOps

- Azure DevOps Services
 - Pipelines
 - Git
 - Kanban boards
- Azure DevTest Labs



Azure management tools



Azure Portal

- Web portal

Azure PowerShell

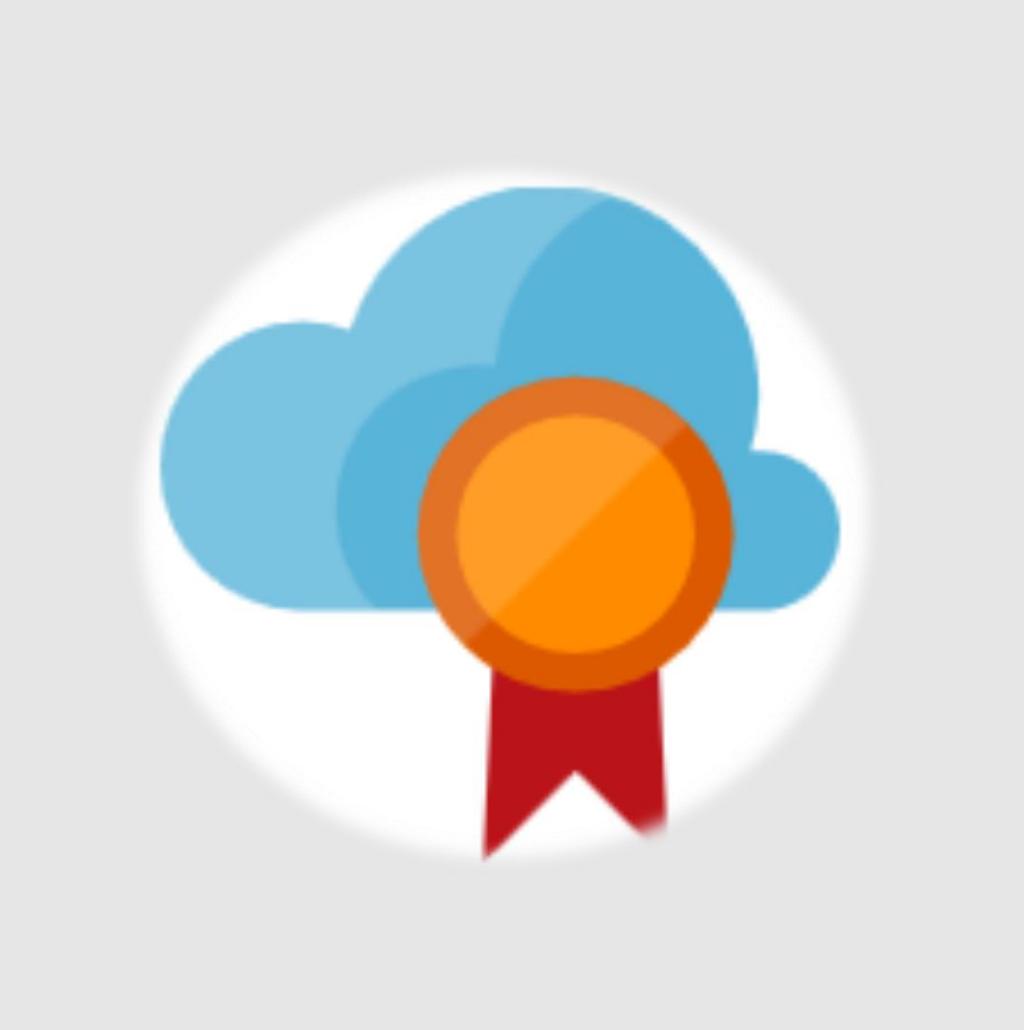
- Client-based shell based on Windows (.NET), Linux, or MacOS (.NET Core)

Azure CLI

- CLI for Windows, Linux, and MacOS
- Bash on Windows Subsystem for Linux

Azure Cloud Shell

- Browser-based environment for PowerShell & Bash CLI



Azure Advisor

Free Service

Get best practices recommendations

Help Improve:

- **Performance**
- **Security**
- **High Availability**
- **Azure costs**

Get recommendations with proposed actions inline

Management tools demo





Module 03: Security, privacy, compliance, and trust



Module 3 (Part 1)

Security, privacy, compliance, and trust



Module 3 – Learning objectives

- Understand and describe how to secure network connectivity in Microsoft Azure.
- Understand and describe core Azure identity services.
- Understand and describe security tools and features.
- Understand and describe Azure governance methodologies.
- Understand and describe monitoring and reporting in Azure.
- Understand and describe privacy, compliance, and data protection standards in Azure.

Azure Security Services



- Azure Firewall
 - Managed cloud service
 - Grants or denies access to network resources
 - Built-in high availability, scalability, filtering rules, and Azure Monitor logging
- Azure DDoS Protection
 - Protects against DDoS attacks
 - Monitors network traffic at Azure edge, protecting services
- Network Security Groups
 - Fine-grained network traffic filtering
 - Packet filter, not a firewall



Azure DDoS Service Tiers

Feature	DDoS Protection Basic	DDoS Protection Standard
Active traffic monitoring & always on detection	Yes	Yes
Automatic attack mitigations	Yes	Yes
Availability guarantee	Azure region	Application
Mitigation policies	Tuned for Azure region traffic volume	Tuned for application traffic volume
Metrics & alerts	No	Real time attack metrics & diagnostic logs via Azure monitor
Mitigation reports	No	Post attack mitigation reports
Mitigation flow logs	No	NRT log stream for SIEM integration
Mitigation policy customizations	No	Engage DDoS experts
Support	Best effort	Access to DDoS Experts during an active attack
SLA	Azure region	Application SLA guarantee & cost protection
Pricing	Free	Monthly & usage based

Choosing Azure network security solutions

Defense in Depth

A layered approach that provides multiple levels of protection so that if an attacker gets through one layer there are further protections in place. A common security concept that is applied to computing systems is *defense in depth*, which is essentially a layered approach to providing security.

Physical Security

Identity & Access

Perimeter

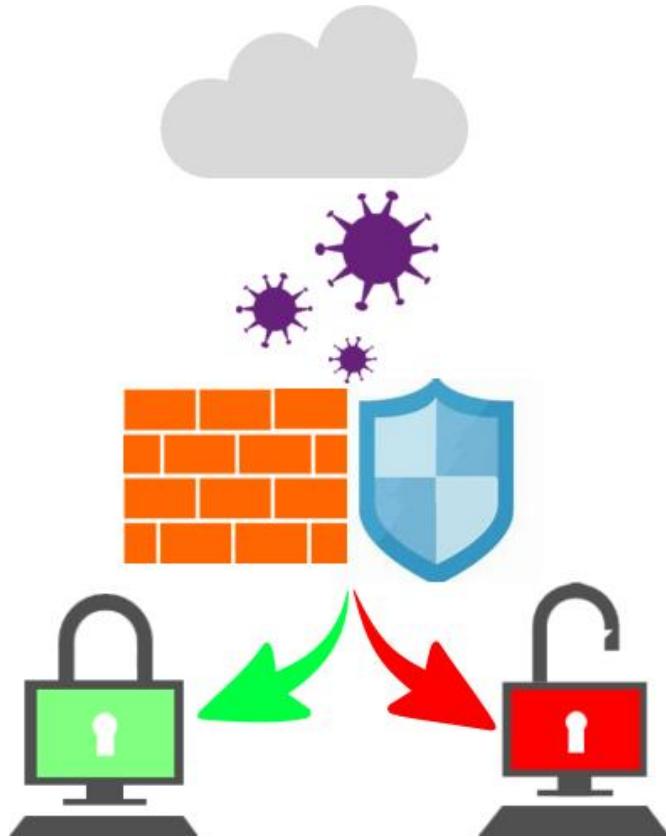
Network

Compute

Application

Data

Choosing Azure network security solutions



- **Perimeter layer:** protect your networks' boundaries with Azure DDoS Protection and Azure Firewall.
- **Networking layer:** only permitted traffic should pass between networked resources with Network Security Group (NSG) inbound and outbound rules.

Azure supports combined network security solutions. For example, NSGs with Azure Firewall; Web Application Firewall (WAF) with Azure Firewall.

Shared responsibility

Migrating from customer-controlled to cloud-based data centers shifts the responsibility for security.

Security becomes a shared concern between cloud providers and customers.

Responsibility	On-premises	IaaS	PaaS	SaaS
Data governance and Rights Management	Customer	Customer	Customer	Customer
Client endpoints	Customer	Customer	Customer	Customer
Account and access management	Customer	Customer	Customer	Customer
Identity and directory Infrastructure	Customer	Customer	Microsoft/ Customer	Microsoft/ Customer
Application	Customer	Customer	Microsoft/ Customer	Microsoft
Network controls	Customer	Customer	Microsoft/ Customer	Microsoft
Operating system	Customer	Customer	Microsoft	Microsoft
Physical hosts	Customer	Microsoft	Microsoft	Microsoft
Physical network	Customer	Microsoft	Microsoft	Microsoft
Physical datacenter	Customer	Microsoft	Microsoft	Microsoft

Azure Active Directory

Azure AD

- Cloud-based identity
- SSO
- B2B (Federation)
- B2C (Consumer)

Multi-factor authentication

- Something you know
- Something you have
- Something you are



Authentication vs Authorization



- Authentication
 - Establishes an identity
 - Challenges access for credentials
- Azure AD
 - Cloud-based identity
 - B2B (Federation)
 - B2C (Consumer)
- Multi-factor authentication
 - Something you know, have, or are
- Authorization
 - Assumes successful **authentication**
 - Establishes appropriate level of access based on the authenticated identity

Azure Security Center

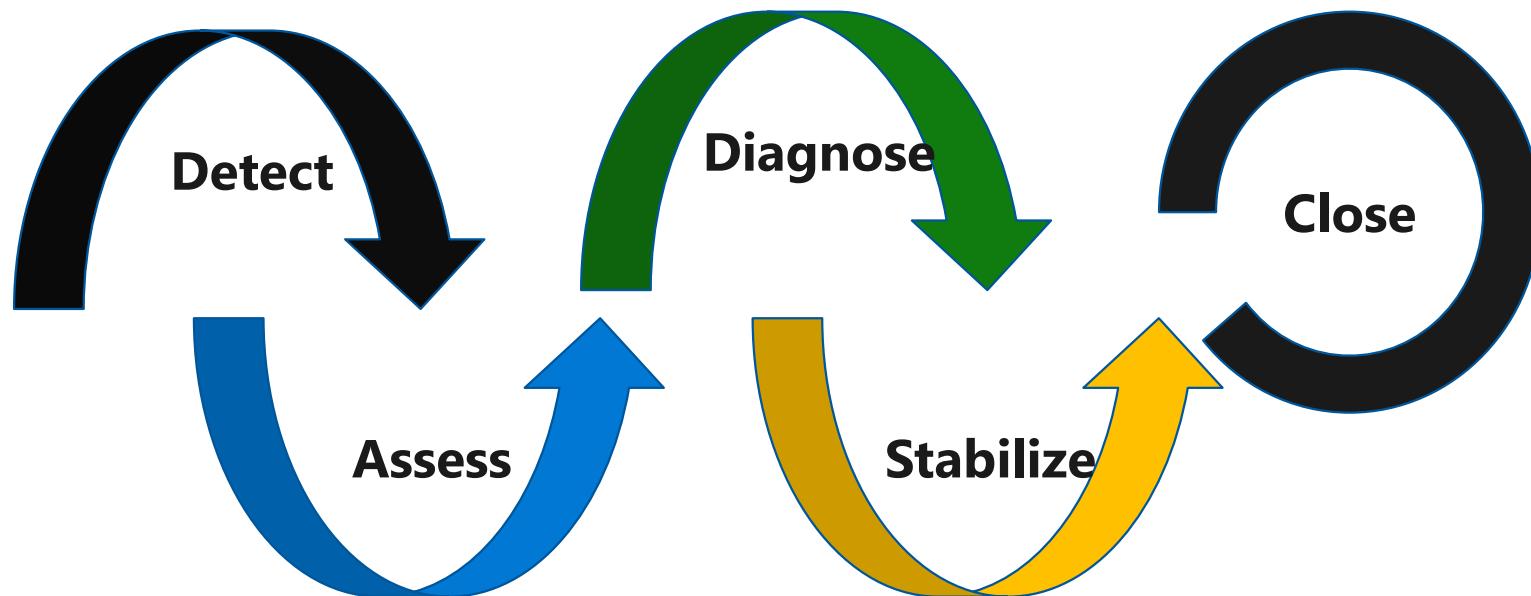
A monitoring service that provides threat protection across all your Azure, and on-premises, services.

Azure Security Center features :

- provides security recommendations based on your configurations, resources, and networks.
- monitors security settings across your on-premises and cloud workloads.
- automatically applies your security policies to any new services you provision.



Azure Security Center



Security Center demo

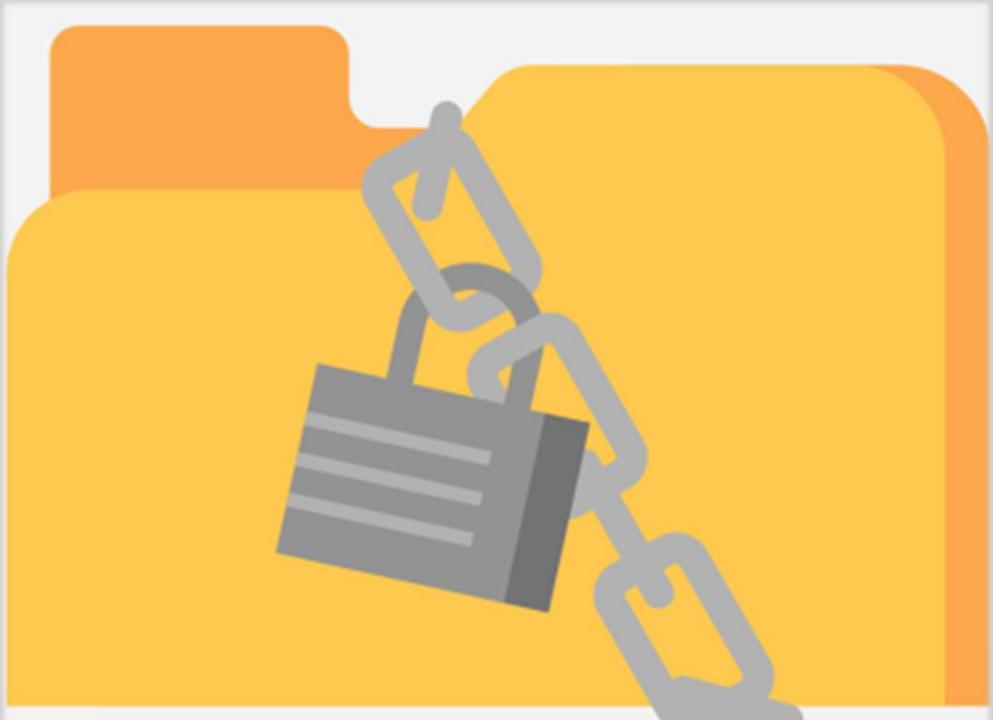


Azure Key Vault



- Stores keys
 - Application secrets
 - Certificates
 - Key management
- Secure access
- Permission controls
- Access logging
- Encrypted with HSM*

Azure Information Protection



Classify and protect documents and emails

Uses labels to apply classification

Automatically based on rules and conditions

Manually by users



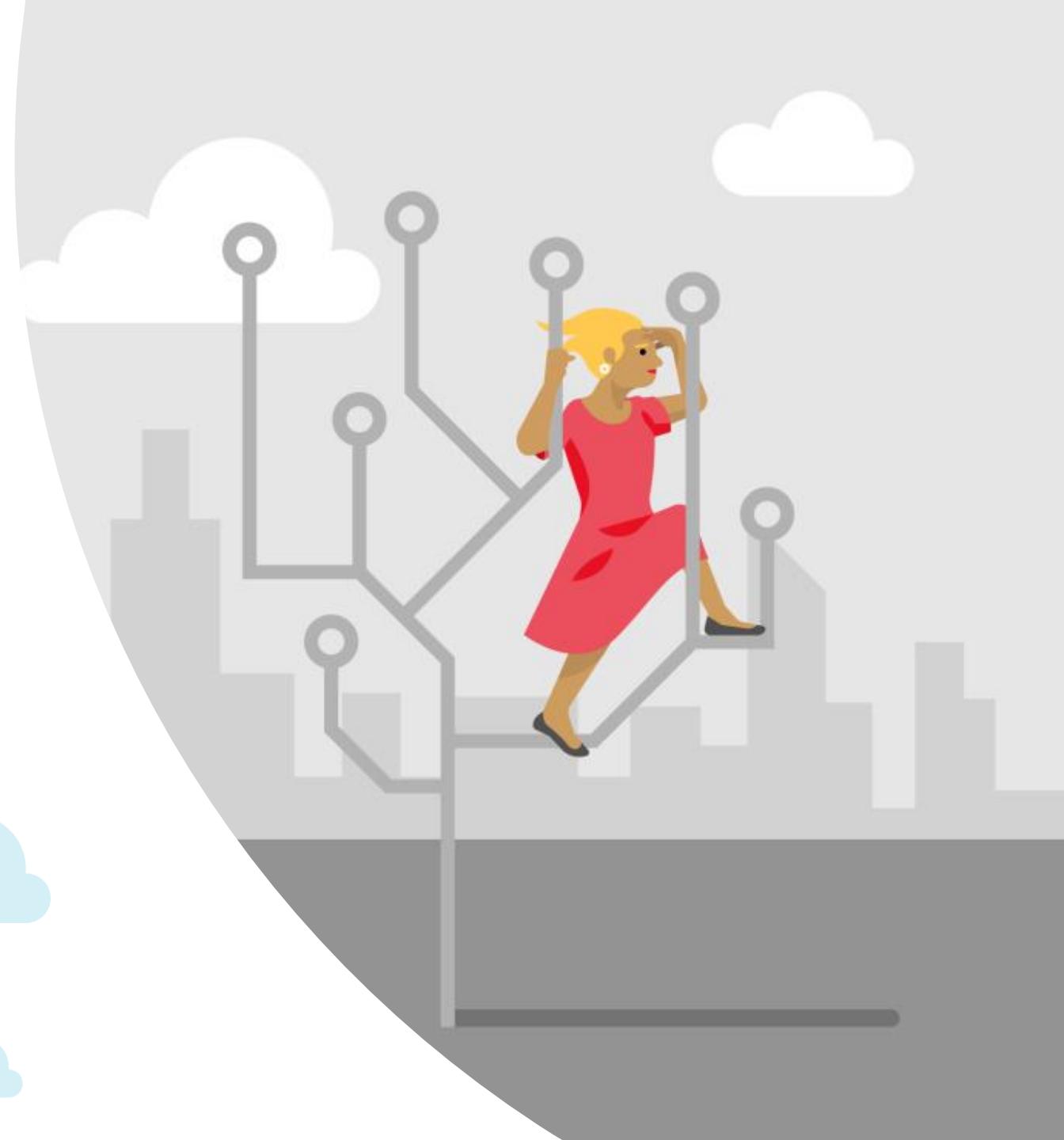
Azure Advanced Threat Protection (Azure ATP)

Identify, detect, and investigate threats

Azure ATP portal

Azure ATP sensor (Domain Controllers)

Azure ATP cloud service



Module 3 (Part 2)

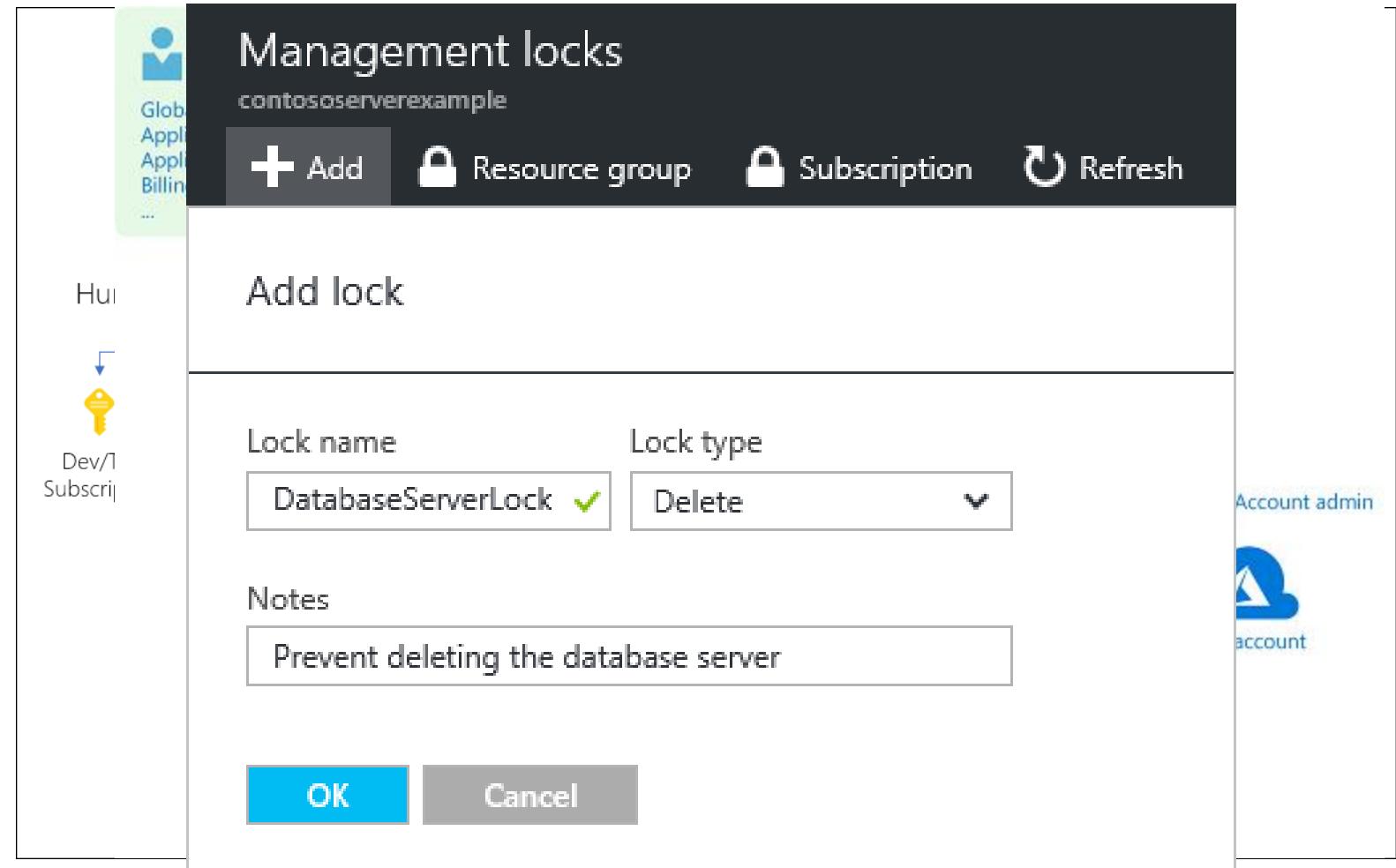
Security, privacy, compliance, and trust



Governance

Management Groups

- Resource Graph
- Azure Policy
- Azure Blueprints
- RBAC
- Resource locks



Azure Policy

Stay compliant with your corporate standards and service level agreements (SLAs) by using policy definitions to enforce rules and effects for your Azure resources.

Azure Policy features :

- evaluates and identifies Azure resources that do not comply with your policies.
- provides built-in policy and initiative definitions, under categories such as Storage, Networking, Compute, Security Center, and Monitoring.



Policies : Example policy definitions

Allowed Storage Account size

- conditions and rules define acceptable sizes for new storage accounts.
- requests to create storage accounts outside the defined sizes are denied.

Allowed Locations

- defines the Azure locations where your organization can deploy resources, to enforce geographic compliance requirements.
- requests to deploy resources outside the defined locations are denied.

More Azure Policy examples :

docs.microsoft.com/azure/governance/policy/samples/

Initiatives

Initiatives work alongside policies in Azure Policy.

- **Initiative definitions** : Group multiple policy definitions into a single unit, to track compliance at greater/ macro-level scope.

For example, one initiative can monitor all of your Azure Security Center recommendations.

- **Initiative assignments** : Initiative definitions that are assigned to a specific scope. Initiative assignments reduce the need to make an initiative definition for each scope.

Role-based access control (RBAC)

Fine-grained access management control over your Azure resources.

Available to *all* Azure subscribers, at no additional cost.



Example uses of Azure RBAC :

- Grant specific access rights to particular users for certain jobs. One user can manage VMs, while another manages virtual networks.
- Allocate particular database types to certain database administration groups.

Locks

Protect your Azure resources from accidental deletion or modification .

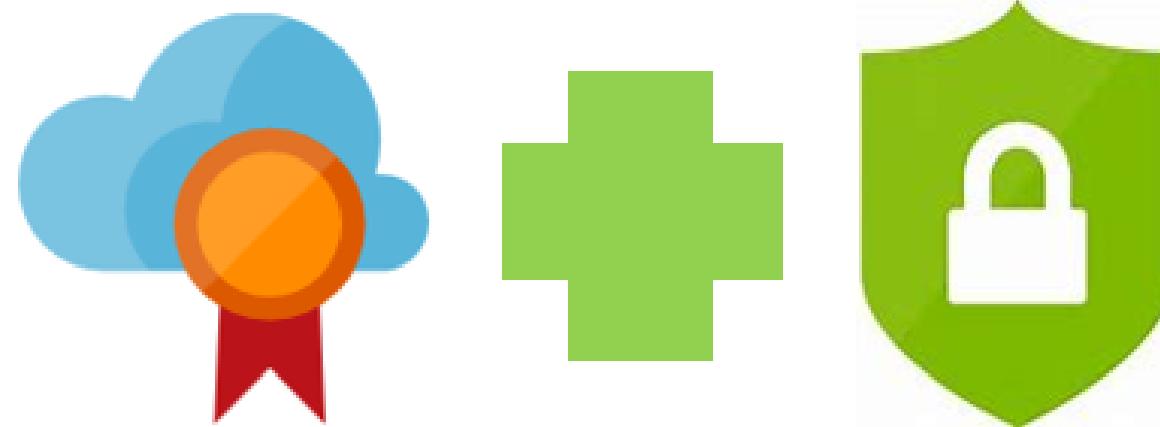
Manage locks at subscription, resource group, or individual resource levels within Azure Portal.

User Actions			
Lock Types	Read	Update	Delete
CanNotDelete	Yes	Yes	No
ReadOnly	Yes	No	No

Azure Advisor security assistance

Get personalized advice and recommendations to improve and enhance security.

- Integrates with Azure Security Center to provide in-depth security recommendations.
- View recommendations in the Azure Advisor dashboard.

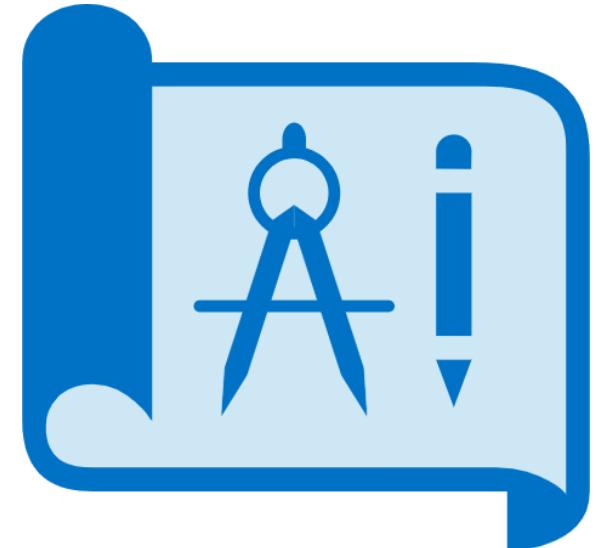


Azure Blueprints

Create reusable environment definitions that can recreate your Azure resources and apply your policies instantly.

Use Azure Blueprints to:

- help audit and trace your deployments, and maintain compliance using built-in tools and artifacts.
- associate blueprints with specific Azure DevOps build artifacts, and release pipelines, for rigorous tracking.



Tags

You can apply tags to your Azure resources providing metadata to logically organize them into a taxonomy such as an organization structure, workload, geography or any other logical grouping.

Each tag consists of a name and a value pair



Name	Value
Environment	Production
Department	IT

- Tags are useful when you need to organize resources for billing or management.

Azure Monitoring



- Azure Monitor
 - Collects and analyzes telemetry from cloud and on-prem resources
 - Enable 'Diagnostics' on resources to enhance collection
- Azure Service Health
 - Azure Status
 - Service Health
 - Azure Resource Health
- Azure Advisor
 - Provides security recommendations and security governance
- Azure Sentinel



Privacy & Compliance

- Privacy statement
 - Personal data, interactions with data, data transparency
- Trust Center
 - One-stop shop for security, privacy, and compliance documents
- Compliance terms
 - GDPR, HIPAA, ISO
- Compliance manager
 - Assess your compliance
- Service Trust Portal
 - Audit reports, compliance guides, and trust reports

Compliance & Trust demo



Azure Government and Other Regions

- Azure Government
 - Separate instance of global Azure services
 - Physical isolation by region
 - Subject to regulations such as FedRAMP, **NIST** 800.171 (DIB), ITAR, IRS 1075, DoD L2, L4 & L5, and CJIS.
- Azure Germany
 - Data residency and data at rest within Germany
 - Uses a data trustee model to handle all aspects of data
- Azure China
 - Separate instance of global services
 - Operated by Chinese partner, 21Vianet
 - Compliant with Chinese regulations

Module 4

Azure pricing and support



Module 4 – Learning objectives

- Understand and describe Microsoft Azure subscriptions and management groups
- Recognize ways to plan and manage Azure costs
- Identify Azure support options
- Understand and describe features of Azure Service Level Agreements (SLAs)
- Understand and describe the service lifecycle in Azure

Azure Subscriptions

Multiple subscriptions per account

Provides access and boundaries between products and services

- Billing boundaries
- Access control boundaries with Azure Policy

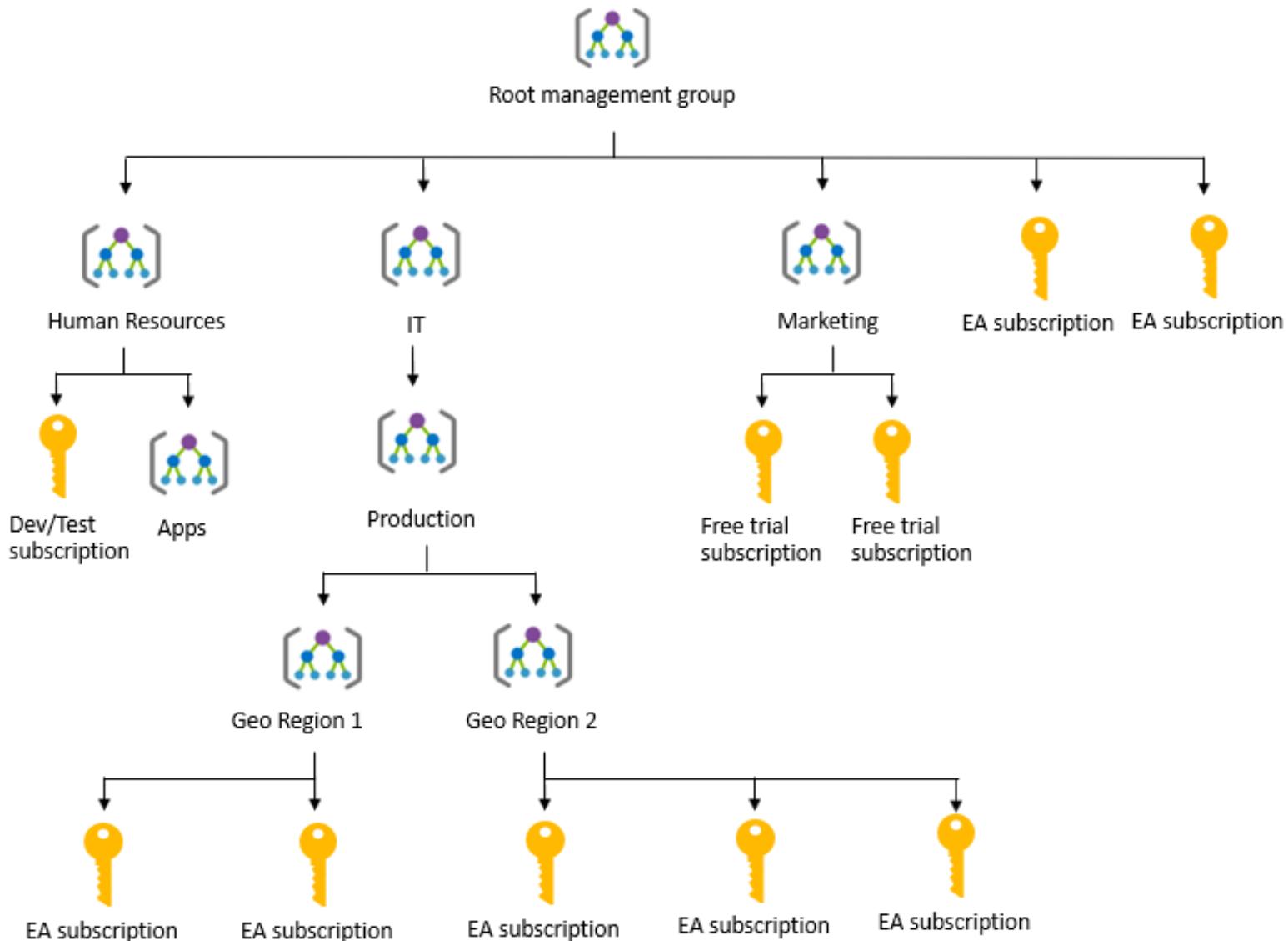
Various subscription types

- Free
- Pay-as-you-go
- Enterprise Agreement

Create management hierarchy with Management Groups

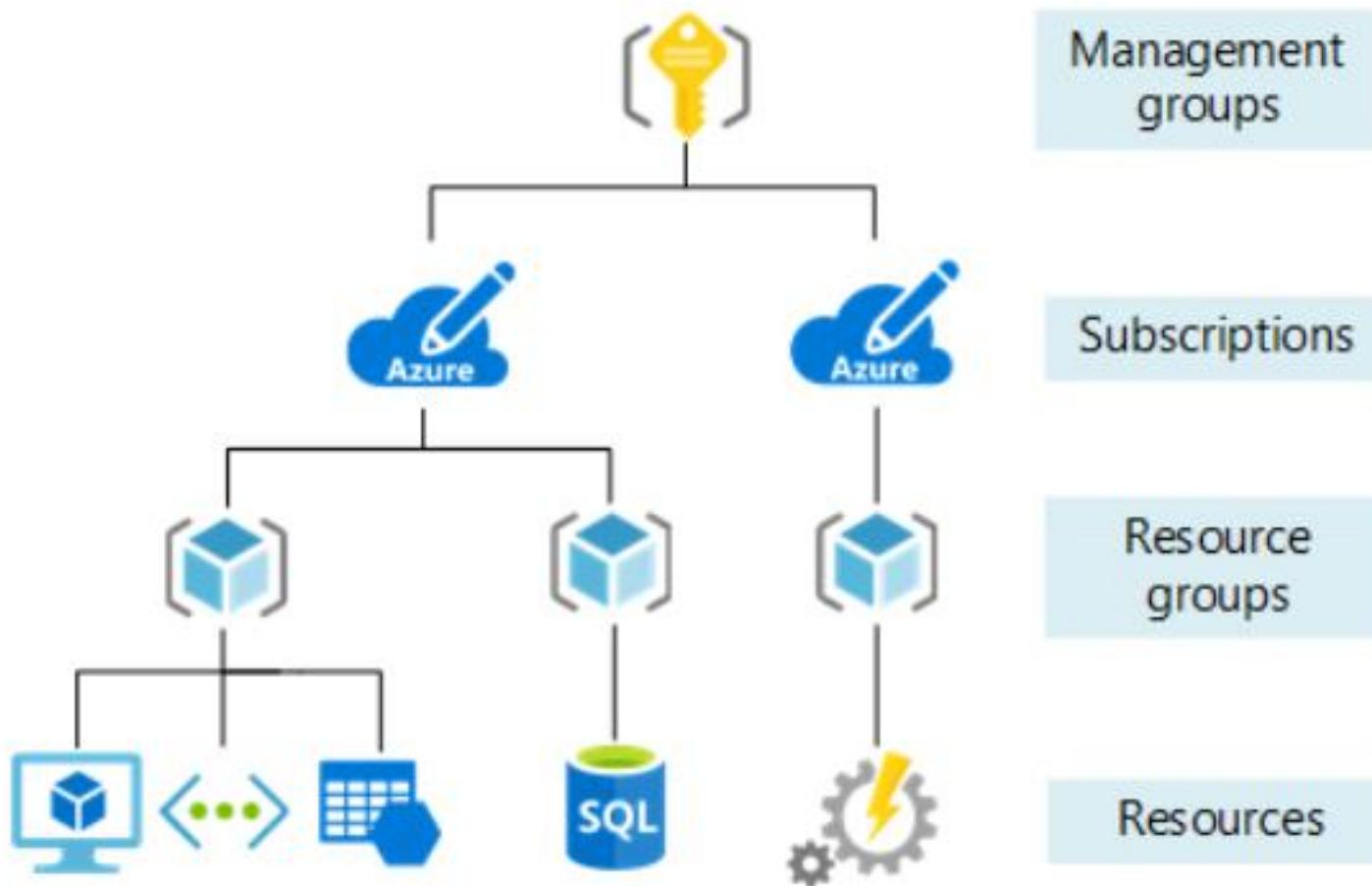
Management groups

- *Azure Management groups* are containers for managing access, policies, and compliance across multiple Azure subscriptions
- *Management groups* allow you to order your Azure resources hierarchically into collections, which provide a further level of classification beyond subscriptions.



Object Hierarchy

The organizing structure for resources in Azure has four levels:



Pricing and purchasing

It depends.

- Enterprise
- CSP
- Web direct

Pricing factors

- Resource type
- Service
- Region



Billing zones



Pricing tools

Pricing calculator

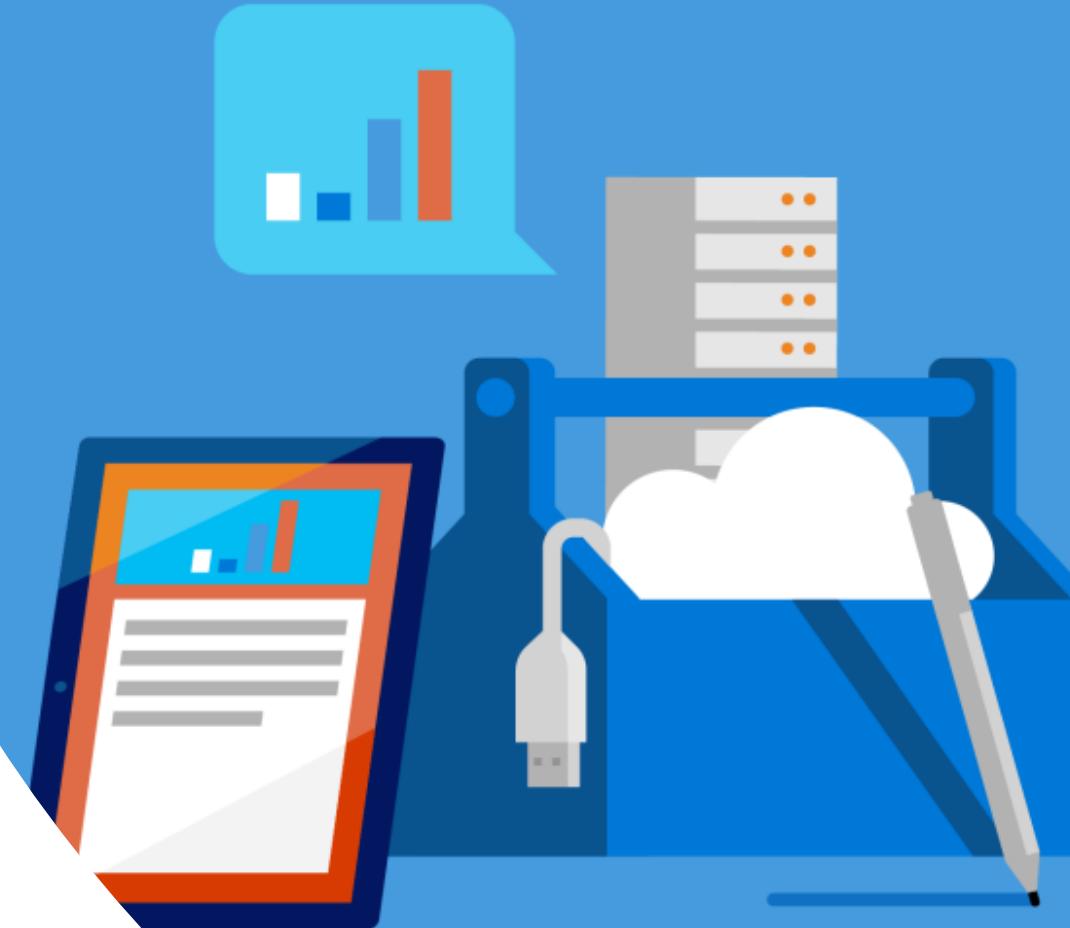
- Detailed cost estimate of services
- Only includes PayGo pricing
- EA discounts and credits not included

Total cost of ownership calculator

- Estimate savings migrating on-premises to Azure

Minimize costs

- Perform cost analysis
- Azure Reservations + AHB
- Spending limits
- Monitor usage with Azure Advisor
- If possible, use low-cost locations
- Azure Cost Management tool



Demo Pricing Tools



Azure Support Plans

Free (Billing and Subscription)

Developer

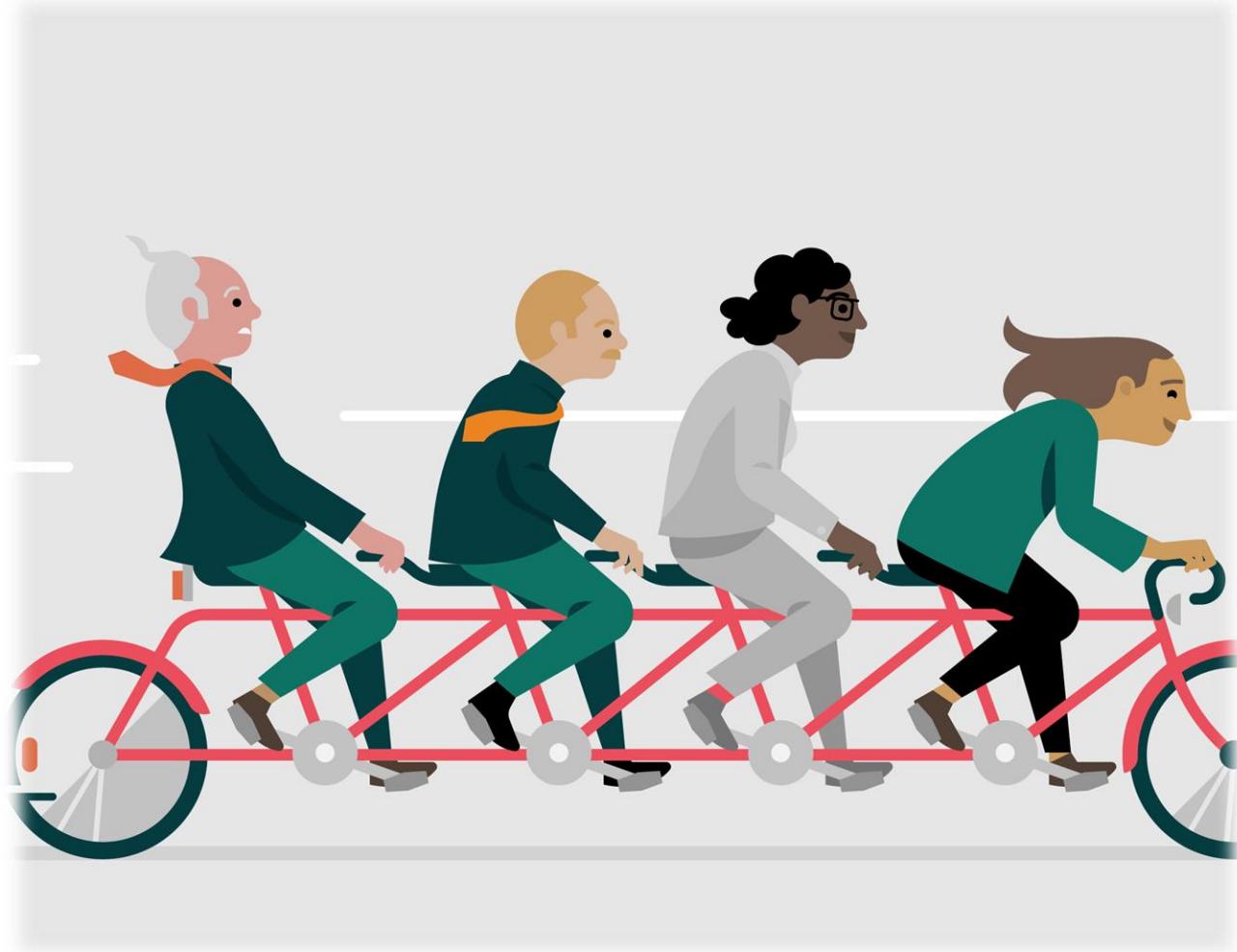
Standard

Professional Direct

Premier

Open a support ticket from Help + Support

- For best results, perform directly from impacted resource



Support plans – more than just troubleshooting

Higher dependency on Azure

1	2	3	4	5
Basic  Getting started Self help and subscription management support that's included with the Azure service subscription	Developer  Trial and Testing Access to technical support for customers testing and developing with Azure 1 business day response for all cases submitted	Standard  Production workloads Fast and affordable access to problem resolution for customers running production workloads 1 hour response for critical cases	ProDirect  Business-critical functions Escalation and technical advisory services for customers who want to build, optimize and grow their business Prioritized 1 hour response for critical cases	Unified  Cross-product High-impact Proactive, dedicated support with access to network of experts to endure accelerated response and help with planning, rollouts, health checks and remediation Prioritized 1 hour response or less for critical cases <i>(based on plan)</i>

Severities & initial response times

Severity	Business Impact	Initial Response Target (hours)					24x7 support
		Developer	Standard	ProDirect	Unified	Azure Rapid Response	
A	Critical Production systems are down	N/A	1 	1 	1 	15 mins 	Always
B	Moderate Production systems significantly affected	N/A	4 	2 	2 	2 	Optional
C	Minimum No impact on production systems	8 	8 	4 	4 	4 	N/A (business days & hours only)

<https://azure.microsoft.com/en-us/support/plans/response/>



Azure SLAs

Defines the Microsoft commitment

- Separate SLAs for each product and service

Three characteristics:

- Uptime or connectivity guarantees
- Performance target ranges (99.9% to 99.99%)
- Service credits

Composite SLAs

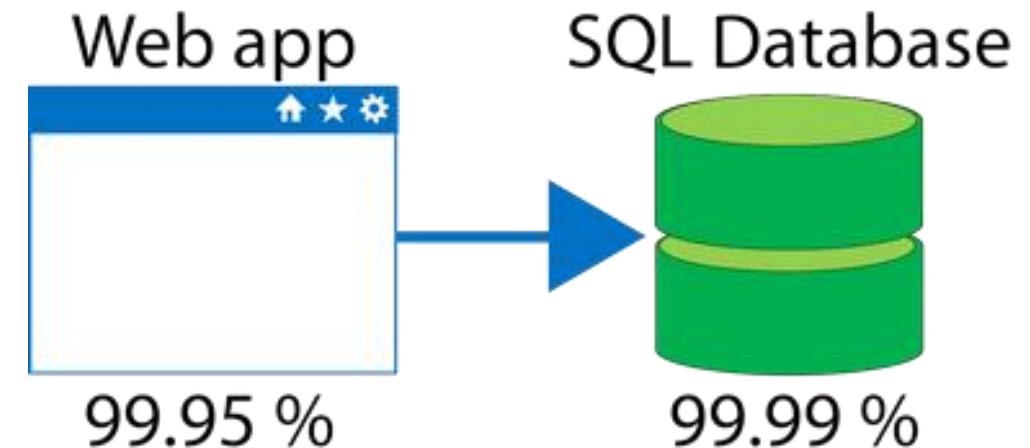
- At the time of this writing, an App Service web app that writes to Azure SQL Database has the following SLAs:

- App Service Web Apps is 99.95 percent
- SQL Database is 99.99 percent

- Question: What is the maximum downtime you would expect for this application?

- Answer: The composite SLA for this application is $99.95\% \times 99.99\% = 99.94\%$.

- This is lower than the individual SLAs. However, you can construct SLAs to improve overall application SLA.



Composite SLAs - Exercise



Azure SQL



Web App



Application
Gateway



Azure AD
B2C

99.99% X 99.95%

X 99.95% X 99.9%

=

99.79%

Improving application SLAs - *continued*

The following table lists the potential cumulative downtime for various SLA levels over different durations

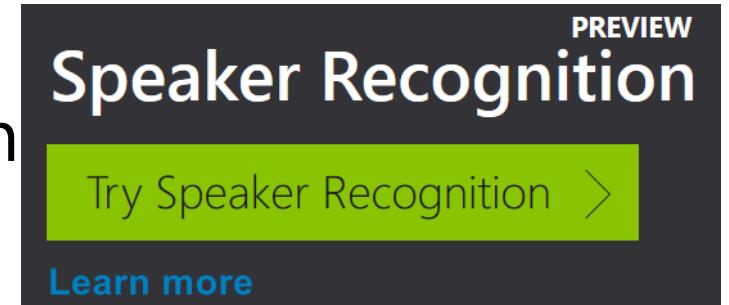
SLA	Downtime per week	Downtime per month	Downtime per year
99%	1.68 hours	7.2 hours	3.65 days
99.9%	10.1 minutes	43.2 minutes	8.76 hours
99.95%	5 minutes	21.6 minutes	4.38 hours
99.99%	1.01 minutes	4.32 minutes	52.56 minutes
99.999%	6 seconds	25.9 seconds	5.26 minutes

Public and private preview features

- Microsoft offer previews of Azure features for evaluation purposes.
- With Azure previews, you can test beta and other pre-release features, products, services, software, and regions.
- There are two types of Azure preview modes:
 - **Private Preview:** An Azure feature is available to certain Azure customers for evaluation purposes
 - **Public Preview:** An Azure feature is available to all Azure customers for evaluation purposes

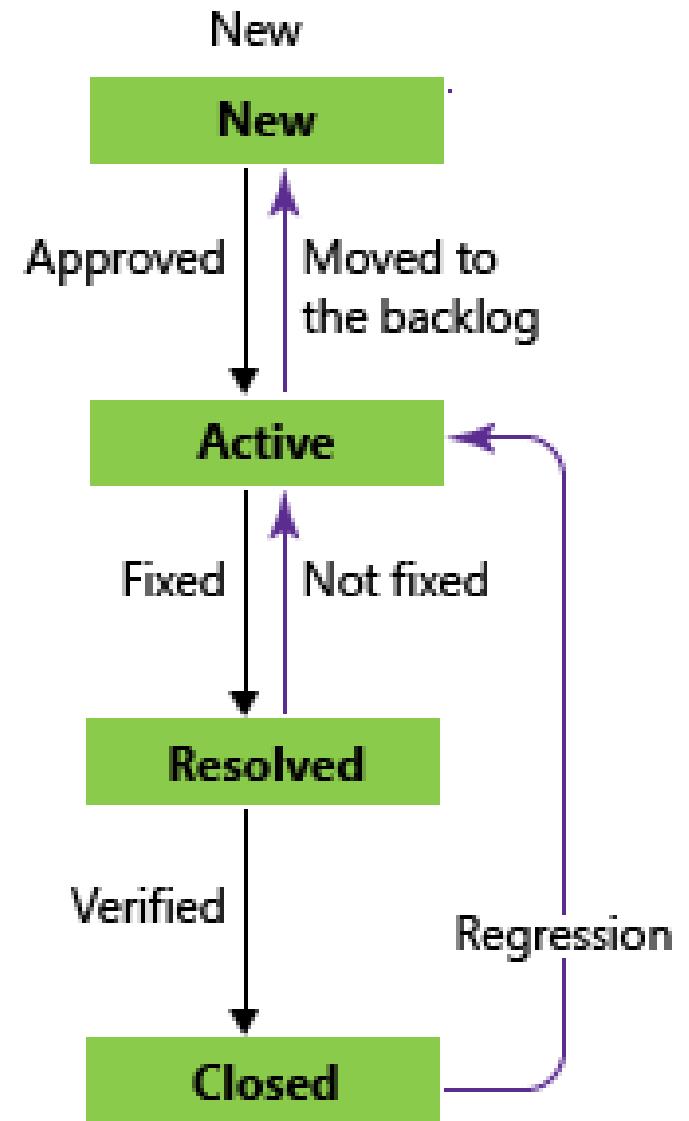
How to access preview features

- Review a list of preview features that are available for evaluation at [Azure Preview Features](#)
- To preview a feature, select the **Try it** button for the applicable feature
- Portal Preview features:
 - Access preview features that are specific to the Azure Portal from the [Portal Preview Features](#) page.
 - Typical portal preview features provide performance, navigation, and accessibility improvements to the Azure portal interface



General Availability

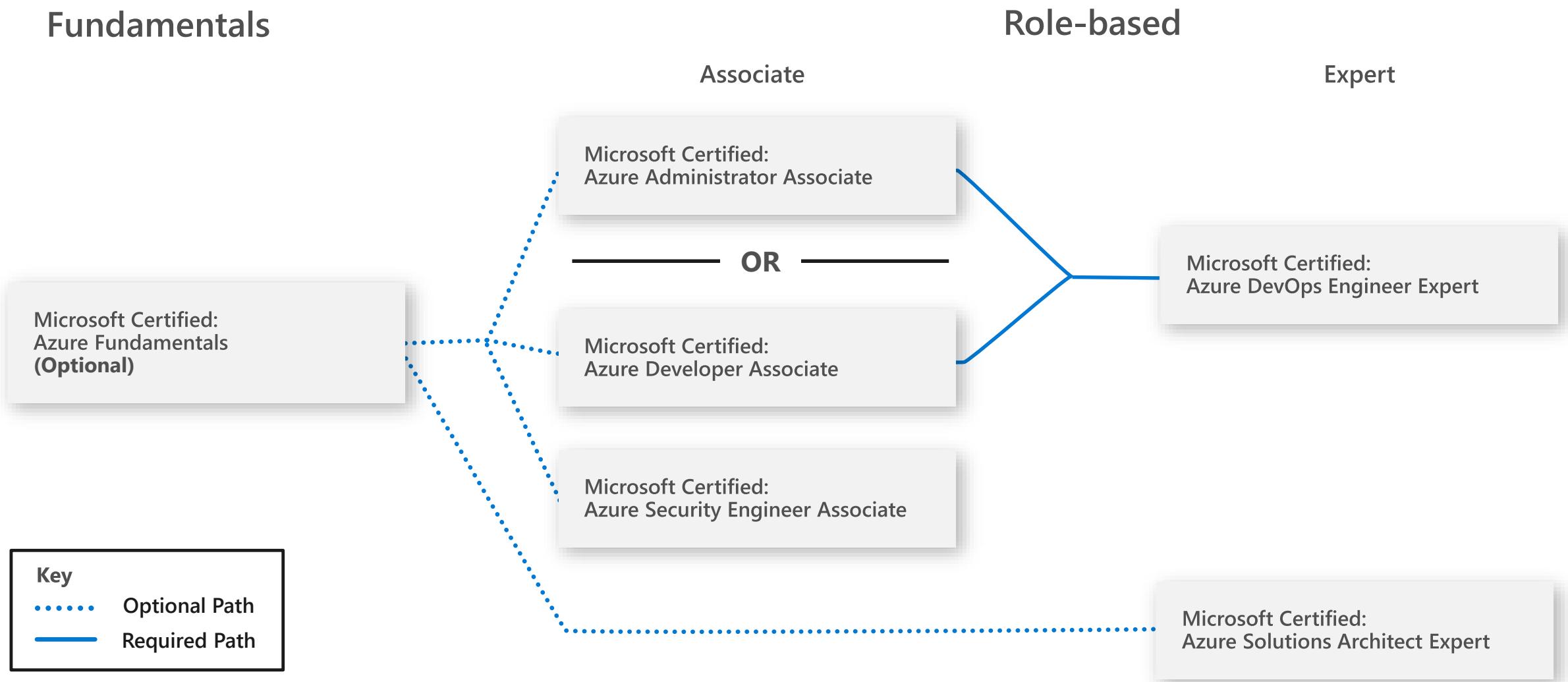
- Once a feature is evaluated and tested successfully, it might be released to customers as part of Azure's default product, service, or feature set
- Bugs for features and products go through their lifecycle as in the graphic across.
- Once the feature meets a specific criteria the feature is released to all Azure customers, and this release is referred to *general availability*.



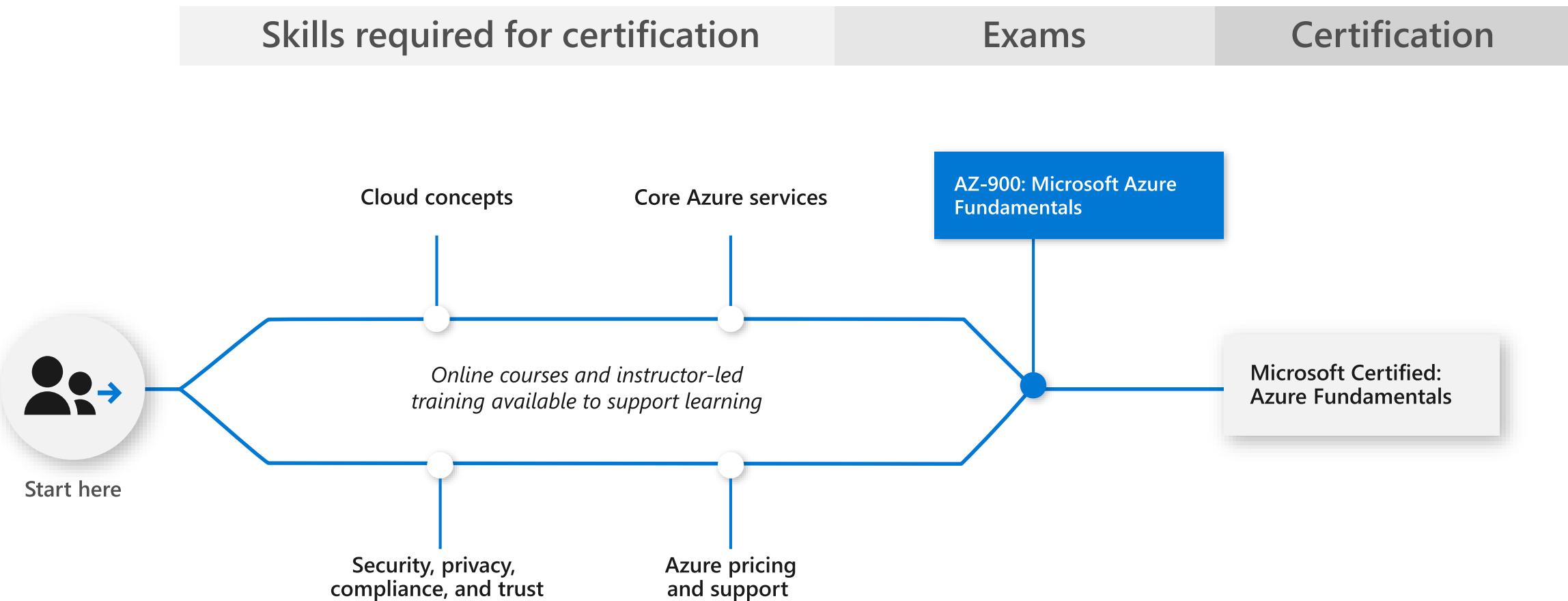
Monitoring feature updates

- Information about the latest updates to Azure products, services, and features, and product roadmaps, and announcements are available at [Azure updates](#)
- Azure updates page:
 - View details about all Azure updates
 - See which updates are in general availability, preview, or development
 - Subscribe to Azure update notifications by RSS

Azure Applications and Infrastructure certifications



Learning path for Azure Fundamentals



Azure Applications and Infrastructure Certification exams: aka.ms/ExamsAzure

Azure Data & AI Certification exams: aka.ms/DataAIExams



Kiitos

Dzięki

Gracias

Teşekkürler

ধন্যবাদ

شکر

감사합니다

Danke

مرسي

Thank
you!

Grazie

Спасибо

唔該

感謝你

Merci

Takk

Obrigado

ありがとう