About the AZ-900 exam

AZ-900 exam

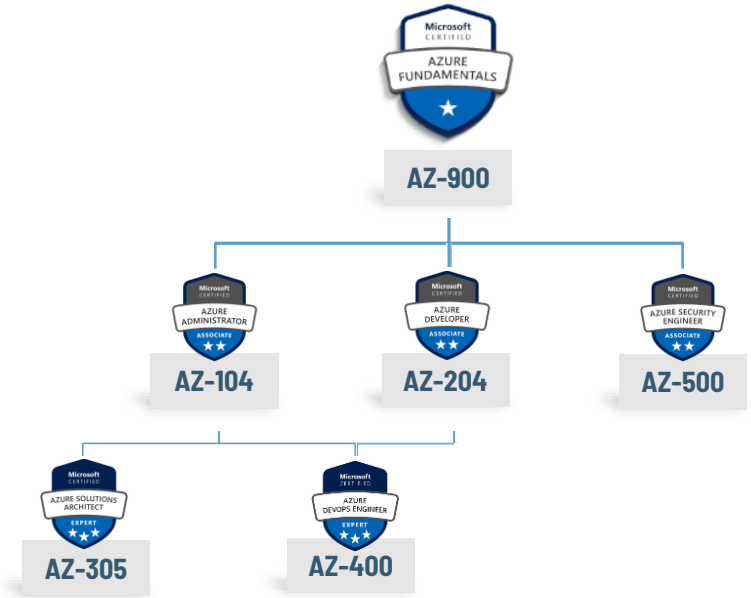
Why AZ-900?

Foundational certification in Azure.

Foundational

Associate

Expert



Starting point to all additional exams.

Future proof, great job opportunities.

AZ-900 exam

Why AZ-900?

Foundational certification in Azure.
Starting point to all additional exams.
Future proof, great job opportunities.

What is covered?

https://learn.microsoft.com/en-us/certifications/exams/az-900
Exam topics are always kept up-to-date.

Questions

Understanding the main services in Azure.
What is the service about? What is the service used for?
Knowlegde-based exam. *Not how to configure!*

Demos

Not needed for the exam.
Help with memorizing.
Give you practical foundation.

Goal

Clear exam with ease.
Practical foundation to start working with Azure.

Passing Score

700 / 1000
After this course you will be able to achieve a score of 900+

How to
Master the exam

Master the exam

Free trial account

Not needed for the exam.
Help with memorizing.
Give you practical foundation.

Exam overview

https://learn.microsoft.com/en-us/certifications/exams/az-900

Exam duration

Seat time: 65min
Questions time: 45min

Questions

~ 45 – 60 questions
Understanding the main services in Azure.
What is the service about? What is the service used for?

Which Azure feature allows you to prevent resources from being accidentally deleted?

- ❑ Azure Policies
- ☑ Azure Locks
- ❑ Azure Tags
- ❑ Azure Key Vault

If you want to quickly provision a group of identical and load-balanced virtual machines but you don't want to configure them individually which service would you use?

- ☑ Azure virtual machine scale set
- ❑ Azure virtual machine elastic groups
- ❑ Azure ExpressRoute
- ❑ Azure VM network

Master the exam

Free trial account

Not needed for the exam.
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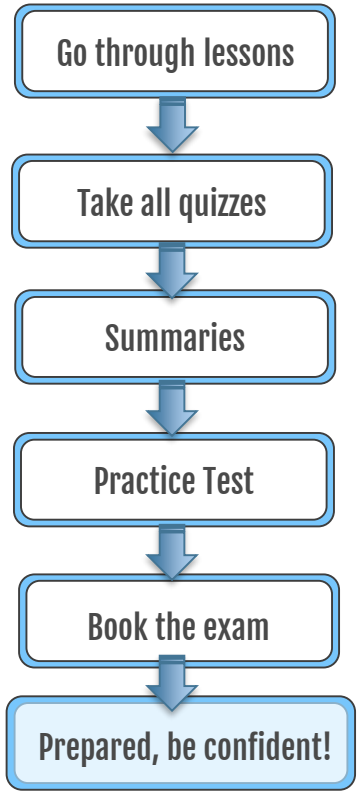
~ 45 – 60 questions
Understanding the main services in Azure.
What is the service about? What is the service used for?

Exam sandbox

https://aka.ms/examdemo

Recipe to clear the exam



Step-by-step incl. Demos

~ 30-60 min / day

Practice and test your knowledge

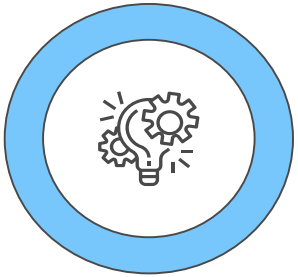
At the end of each module
Remember the important points

Evaluate your knowledge and your weaknesses

Go through the relevant lectures again to eliminate weaknesses

https://learn.microsoft.com/en-us/certifications/exams/az-900

What is Cloud Computing?



Azure Cloud Computing

- Azure is Cloud Computing Platform

- **Offer SERVICES**
- Compute services
- Storage services
- Database services
- Software services

...

Consumption-based pricing

"Pay-as-you-go"

Computing

Storage

01

Build own data center

Server, infrastructure, staff etc.

02

Rent service from cloud provider

Compute, storage, etc.

Azure Cloud

CapEx vs. OpEx

01

Capital Expenditure (CapEx)

High upfront cost,
Own infrastructure, hardware cost

Expenses will be deducted over time

Examples: Buying server

Own data center

02

Operational Expenditure (OpEx)

No upfront cost,
Product or services, that can be paid when used ("rented")

Expenses can be immediately deducted

Examples: Azure Cloud,
Monthly payments (employees, electricity, software licenses)

Azure "Pay-as-you-go"

Benefits of the cloud

High Availability

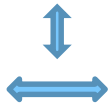
Continuous functioning of services

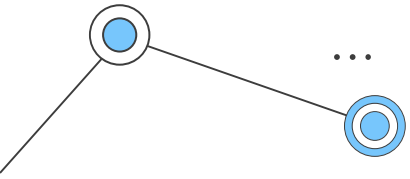
- Access to services for a high percentage of time
- E.g. 99.9% availability = 0.1% downtime

Scalability

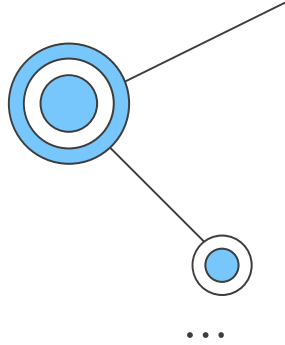
Ability to handle increased load

- Vertical scalability: Scale up *More CPU per VM*
- Horizontal scalability: Scale out *More virtual machines*





Benefits of the cloud



Reliability

Ability of a system to recover from failures and continue to function

- Global deployment and redundancy options
- Functioning even in catastrophic events
- Automatic shifting from one region to another

Predictability

Predictable cost and performance

- Performance aims at positive customer experience
- Autoscaling, balancing traffic
- Transparant pricing, pricing calculator, trackable cost

Benefits of the cloud

Security

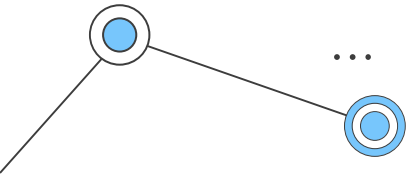
Architected to handle security

- Security can be fully managed
- Updates can be automatically applied
- Can handle Distributed denial of service (DDoS) attacks

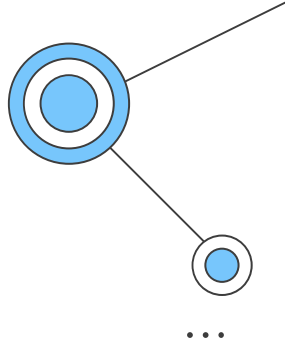
Governance

Support of Governance and Compliance

- Templates ensure corporate standards and governmental regulations
- Updates can be applied when standards change



Benefits of the cloud



Manageability

Ability to manage cloud resources

Management of the cloud

- Autoscaling options
- Pre-defined templates, no need for manual configuration
- Automatic alerts
- Monitoring of the health of resources and replacement if necessary

Management in the cloud

- Azure Portal
- Command line interface
- APIs
- PowerShell

Cloud models

Public Cloud

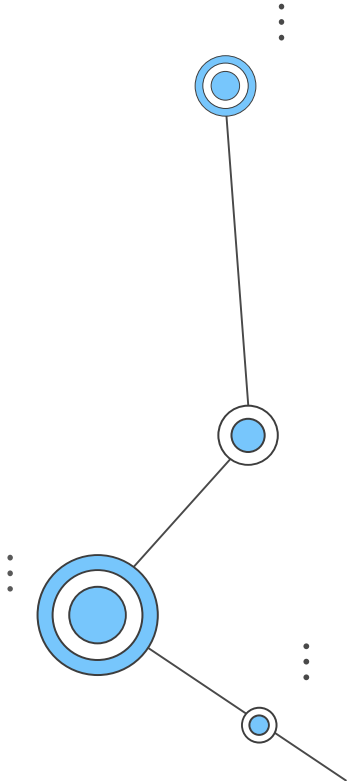
Azure Cloud – Most common model

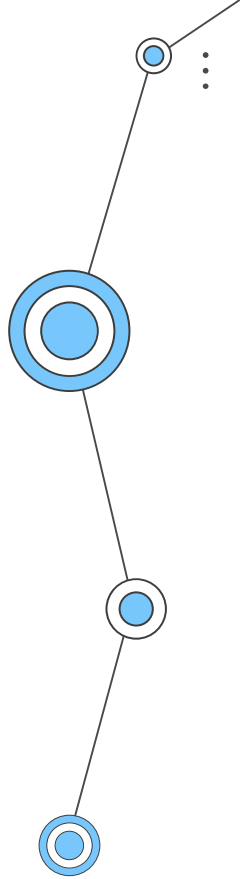
Private Cloud

Own "cloud" / own data center

Hybrid Cloud

Combination of both





Cloud models

Public Cloud

Azure Cloud – Most common model

Shared hardware that everyone can use

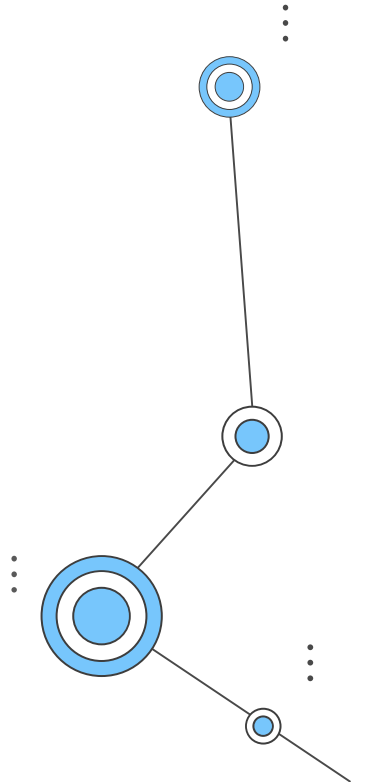
No CapEx – only OpEx – Consumption-based pricing

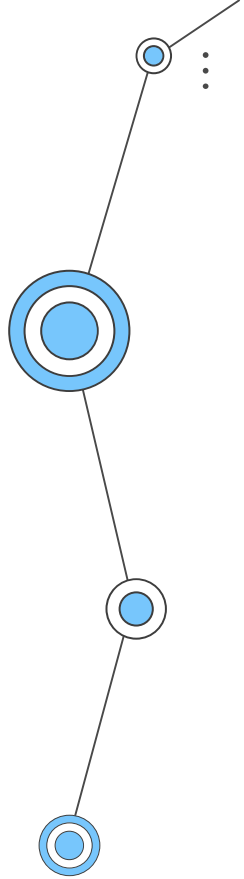
Infrastructure owned by cloud provider

Same configuration options available

No absolute control over infrastructre

Cloud benefits apply





Cloud models

Private Cloud

Private data center

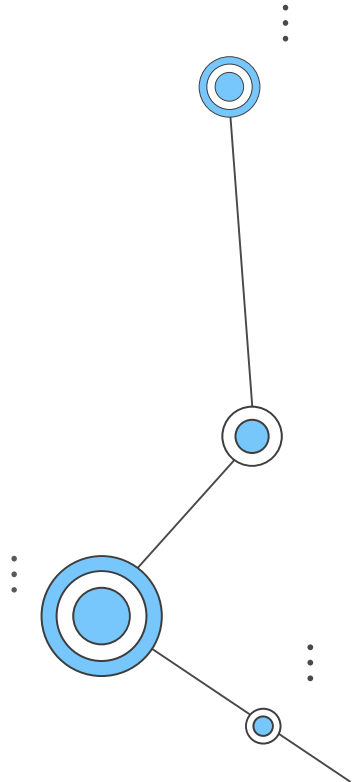
In special situations (e.g. legal / compliance reasons)

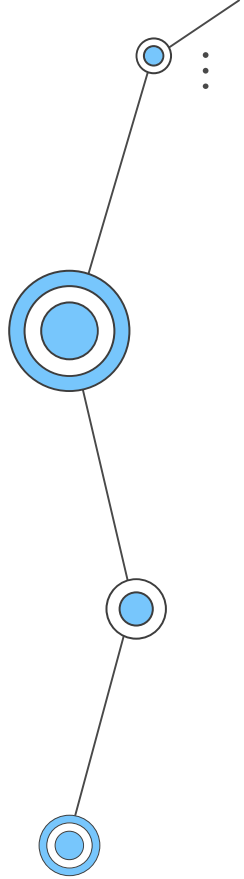
Hardware is owned by the company

Control all aspects of hardware

Capital Expenditure (CapEx) applies

Complete responsibility for hardware, security etc.





Cloud models

Hybrid Cloud

Combination of Public & Private

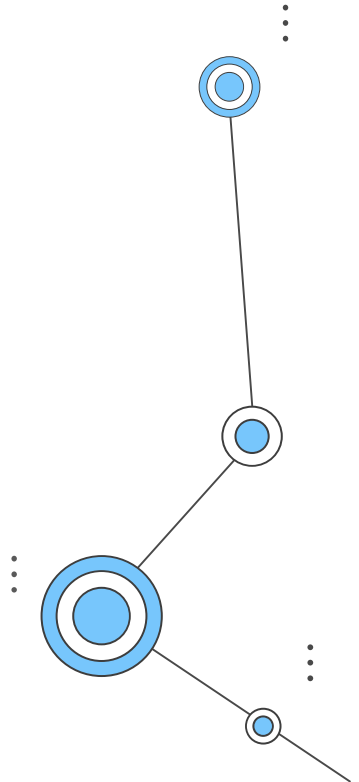
Some (critical) resources are owned
others are used from the Public cloud

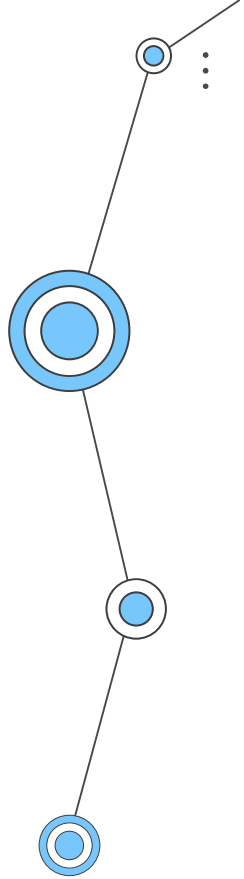
Combination of CapEx & OpEx

Example: *Hosting an app service with computing from cloud*
Data is stored on an on-premise database

Can be expanded flexibly:

From Public ⇒ Hybrid
From Private ⇒ Hybrid





Cloud service types

IaaS

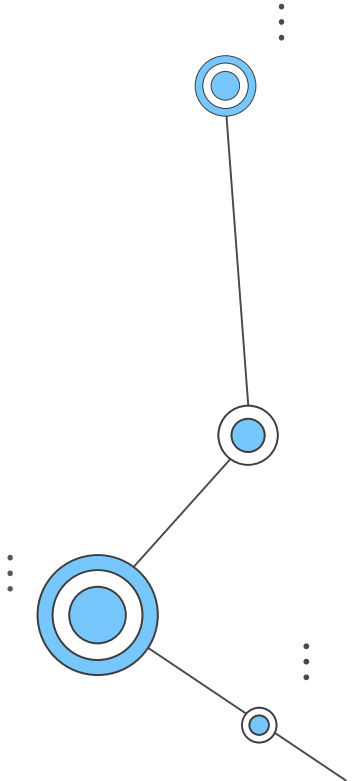
Infrastructure-as-a-Service

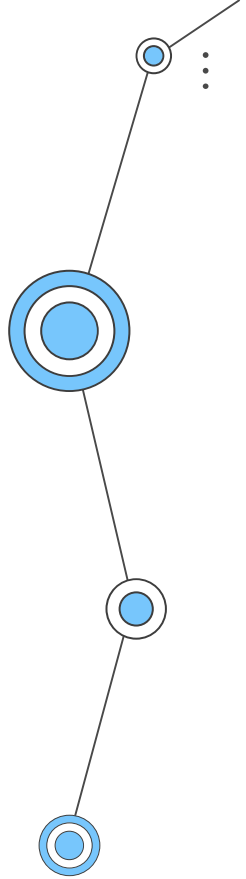
PaaS

Platform-as-a-Service

SaaS

Software-as-a-Service





Cloud Services

IaaS

Infrastructure-as-a-Service

Renting of hardware / infrastructure (servers, storage, etc.)

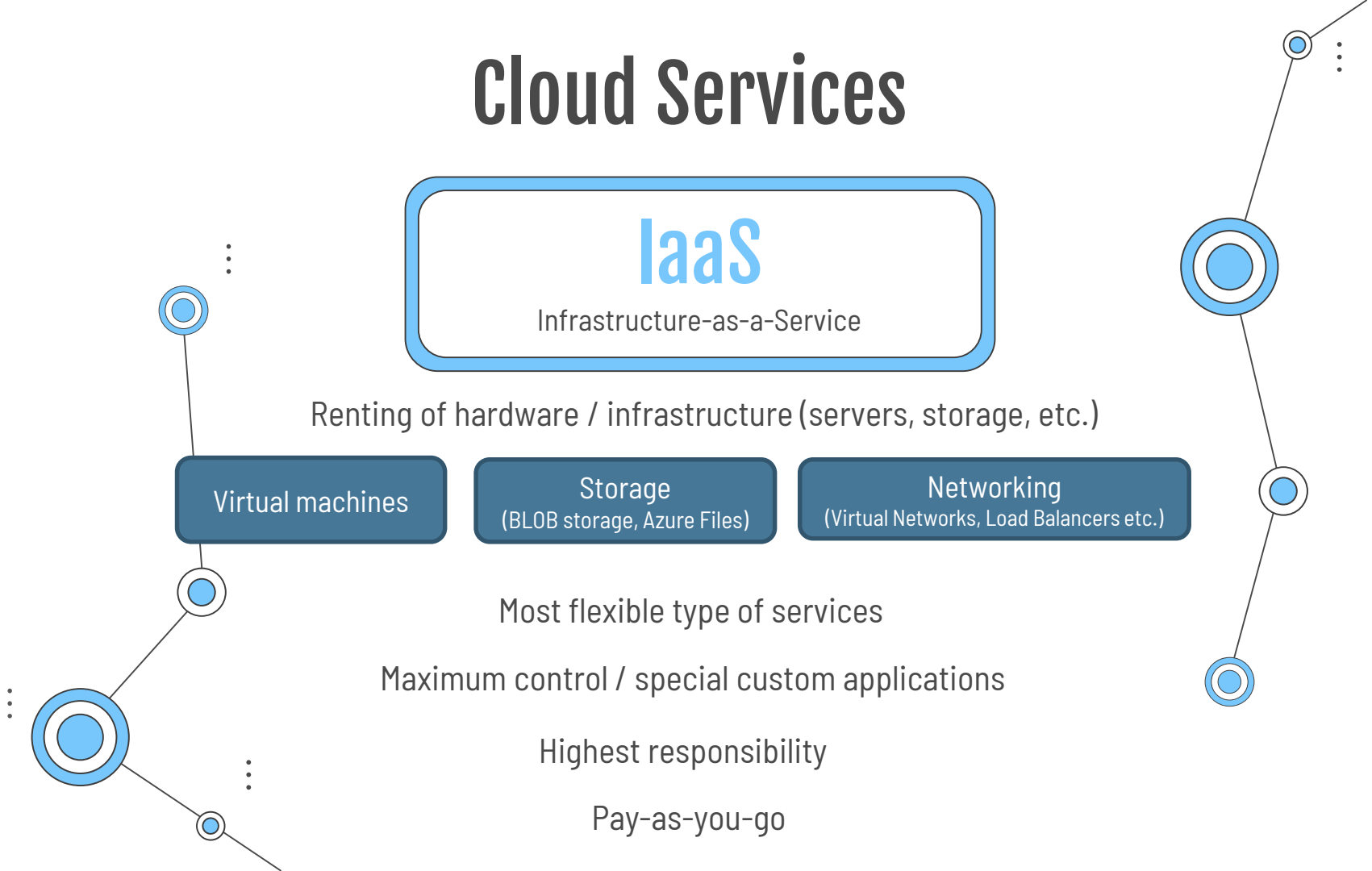
- Virtual machines
- Storage (BLOB storage, Azure Files)
- Networking (Virtual Networks, Load Balancers etc.)

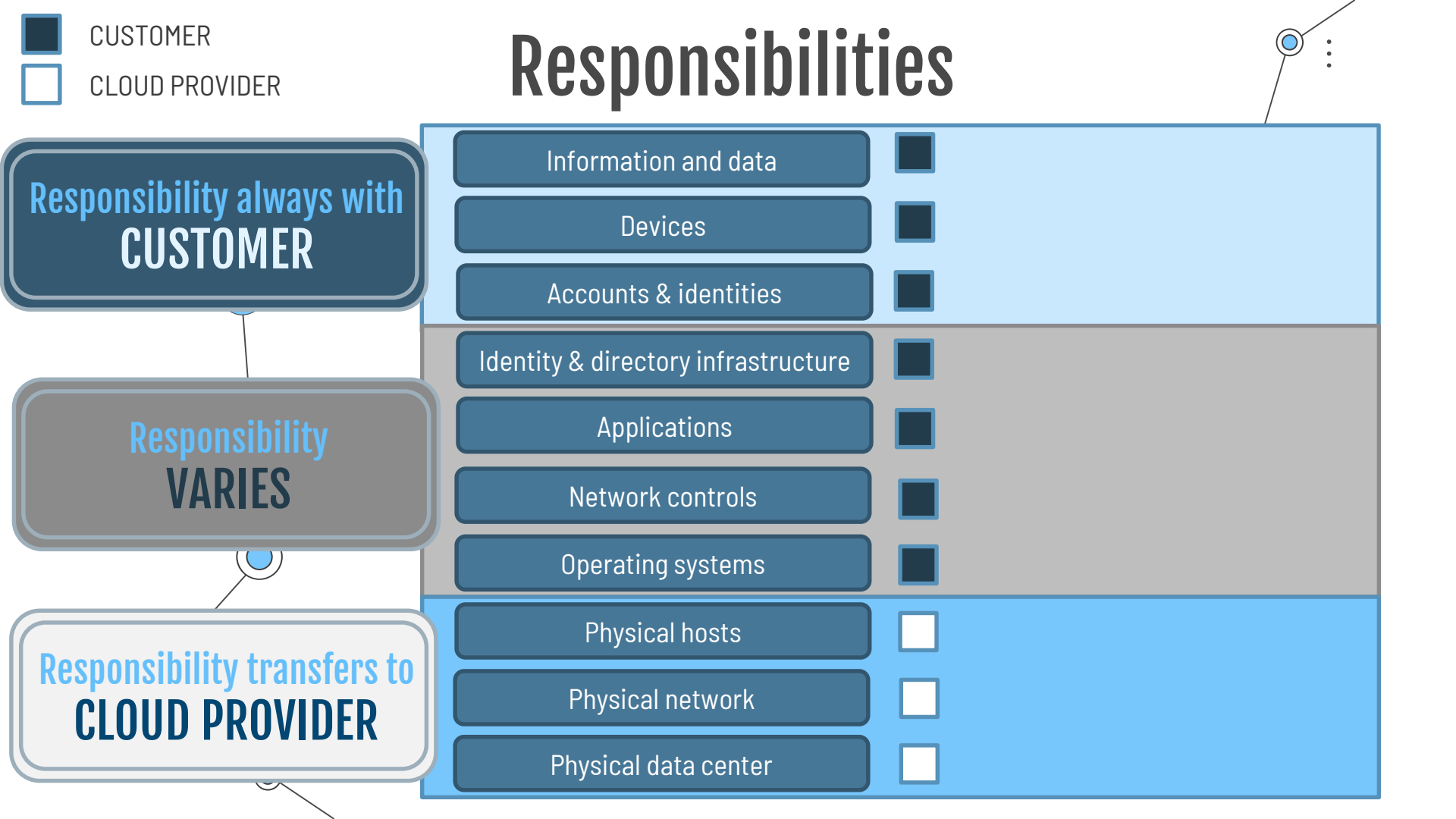
Most flexible type of services

Maximum control / special custom applications

Highest responsibility

Pay-as-you-go




CUSTOMER
CLOUD PROVIDER
Responsibilities
Responsibility always with CUSTOMER
Responsibility VARIES
Responsibility transfers to CLOUD PROVIDER
Information and data
Devices
Accounts & identities
Identity & directory infrastructure
Applications
Network controls
Operating systems
Physical hosts
Physical network
Physical data center

Cloud Services

PaaS

Platform-as-a-Service

Hardware fully managed by Azure

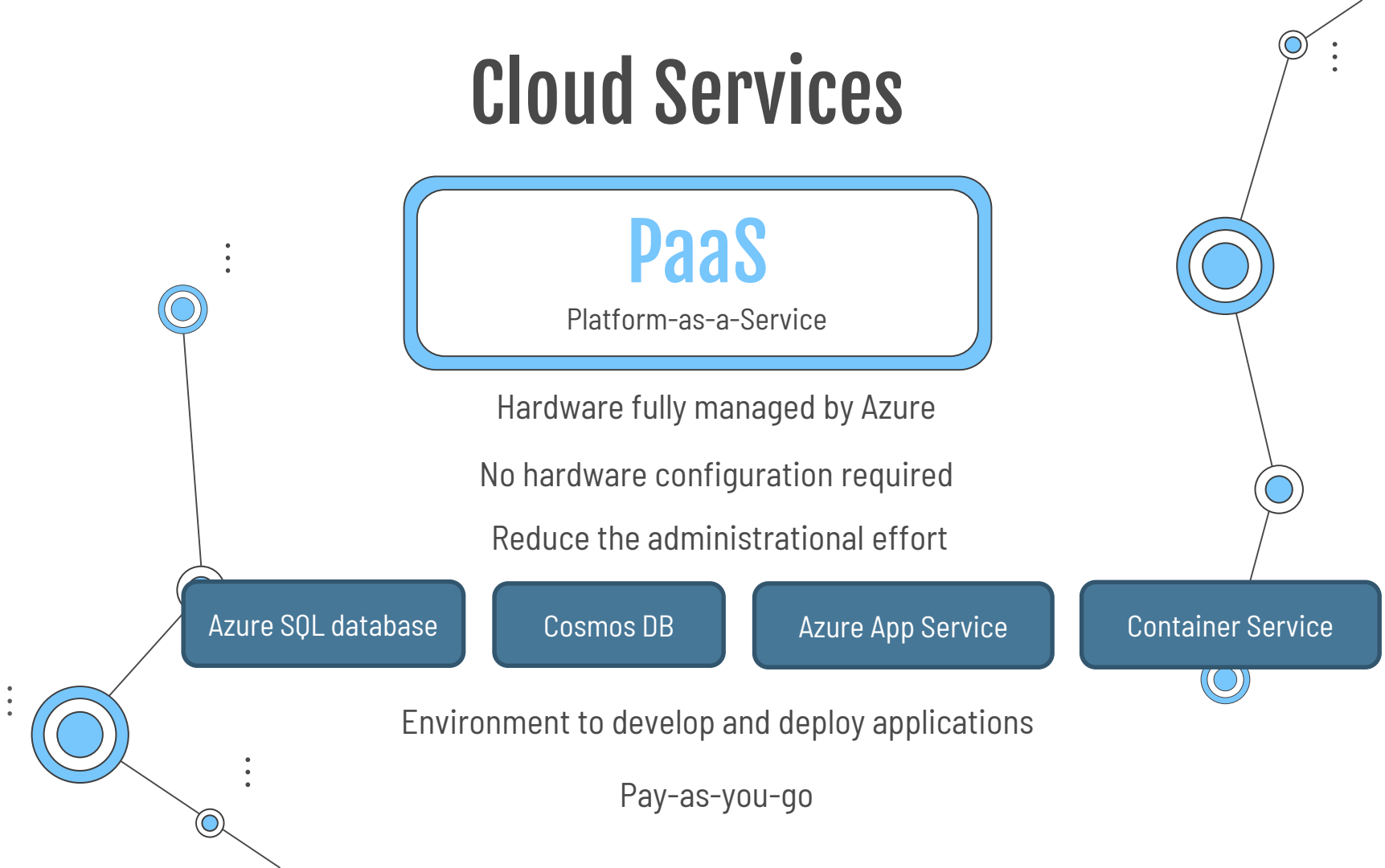
No hardware configuration required

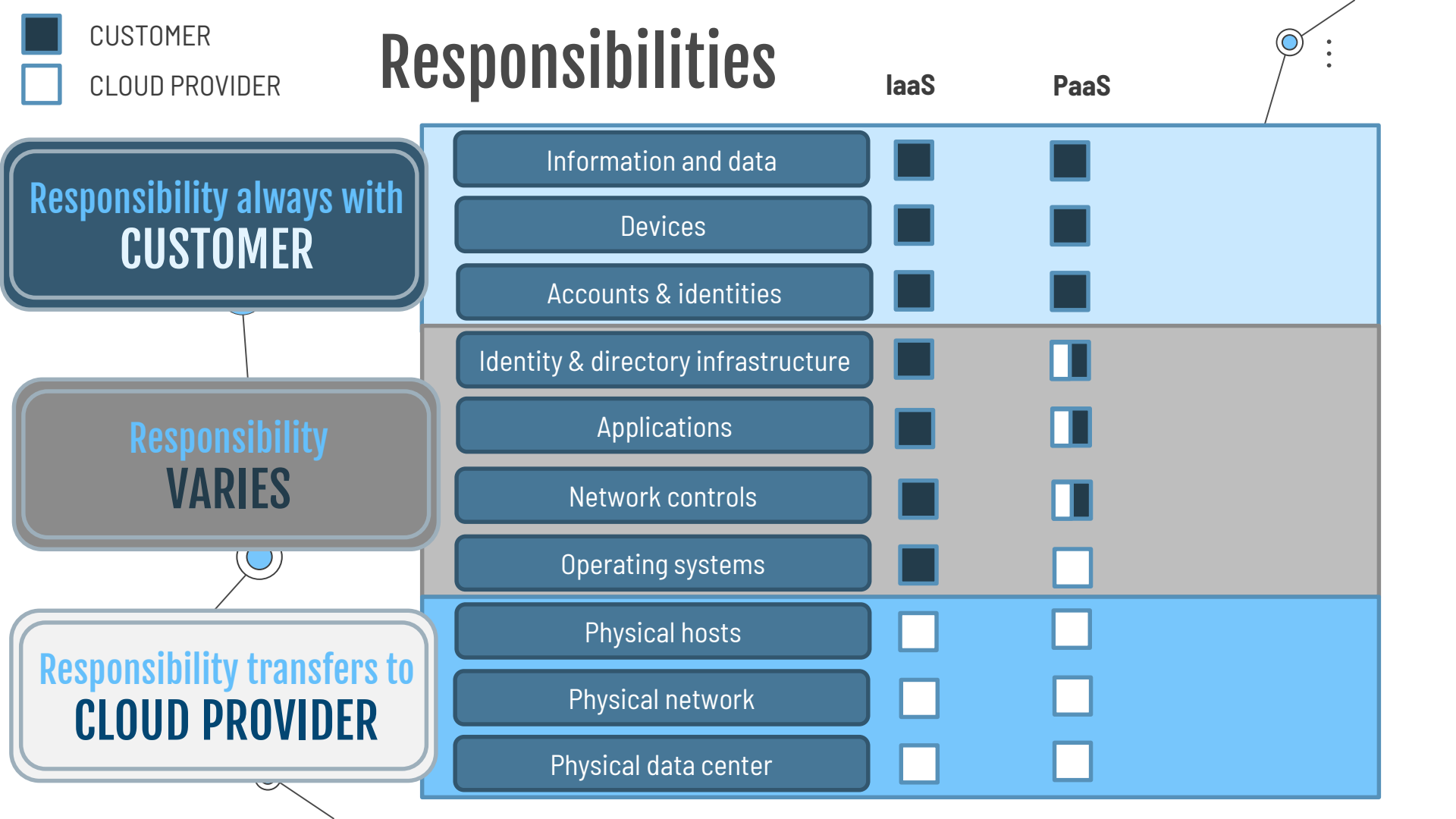
Reduce the administrational effort

- Azure SQL database
- Cosmos DB
- Azure App Service
- Container Service

Environment to develop and deploy applications

Pay-as-you-go

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Cloud Services

SaaS

Software-as-a-Service

Only the end application is used

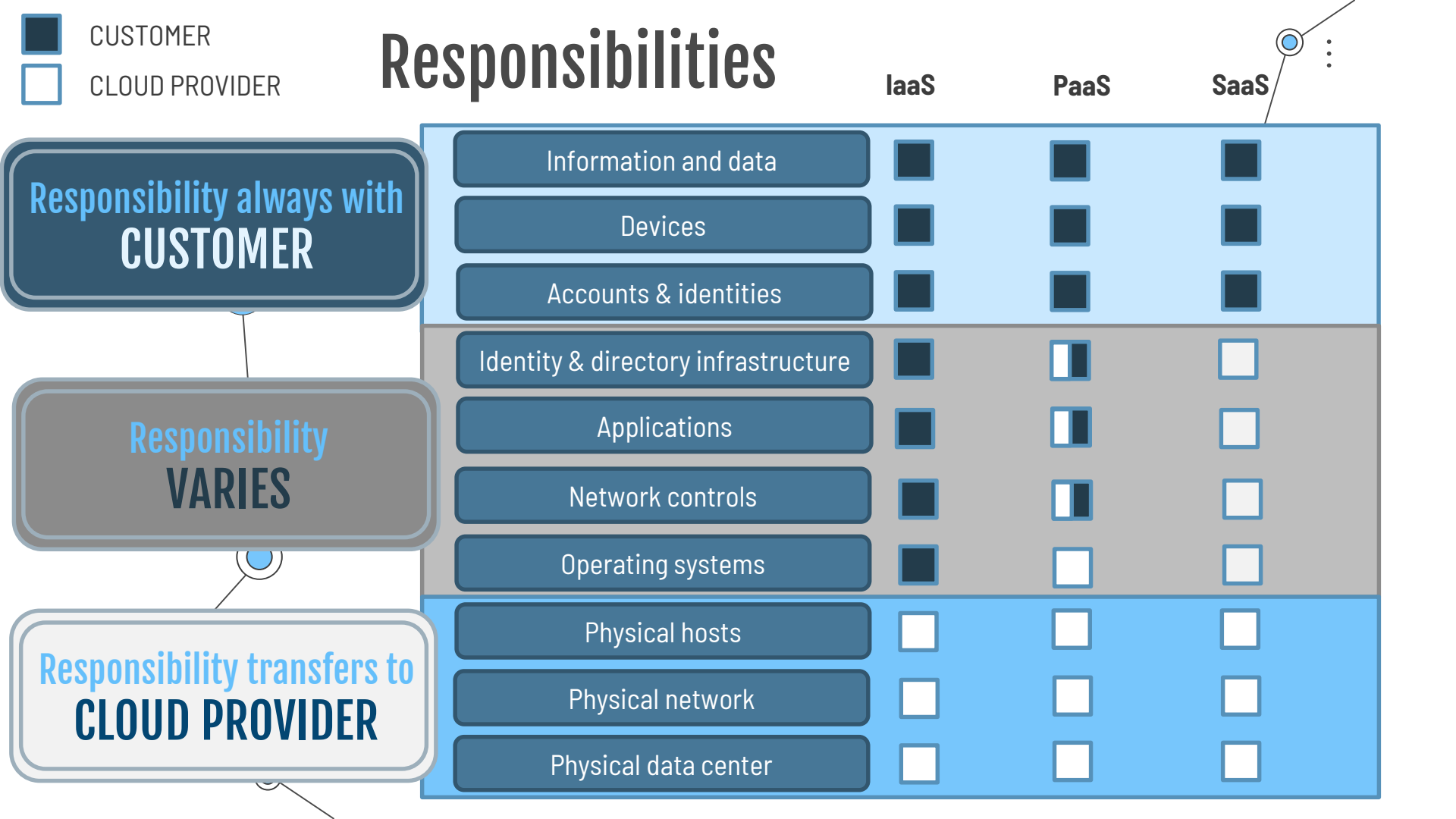
- Microsoft Office 365
- Outlook
- Microsoft Planner

No installation needed

Application is not developed – but only configured

Infrastructure remains invisible to customers

Pay-as-you-go model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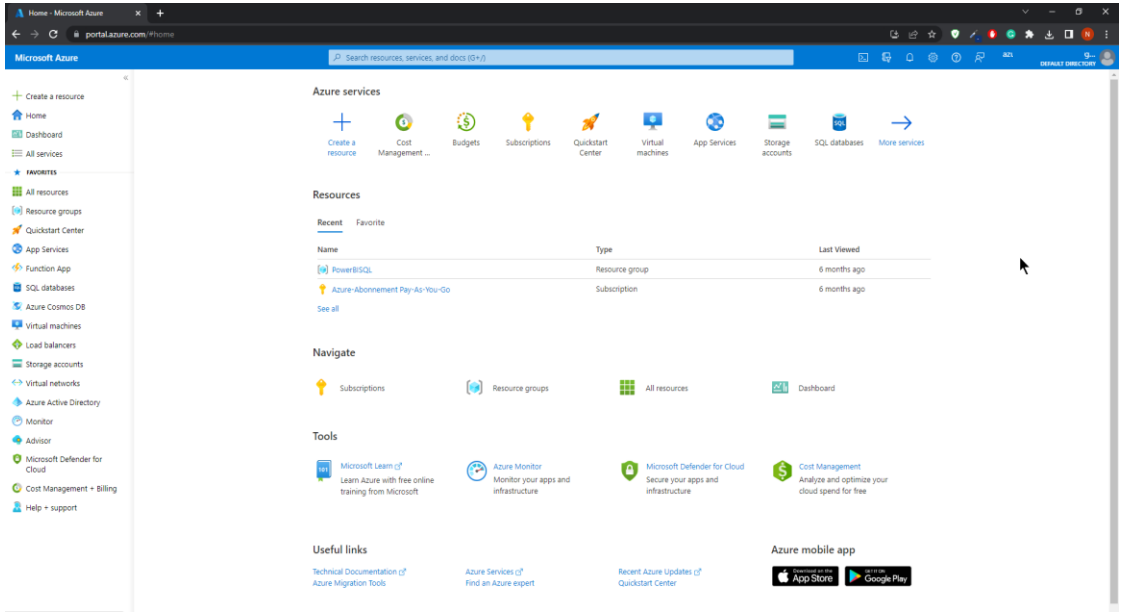
Azure Portal

Browser-based graphical user interface



Can be accessed with any device that has a browser

Consumption-based model

- ✓ Pay only for what is used.

Storage  $0.01 per GB / per month

Functions  Per execution

⇒ Pay per minute/day/execution/operation/volume

- ✓ No upfront investment / infrastructure necessary.
- ✓ Resources that are no longer needed, no longer need to be paid.

Summary

- ✓ **Cloud Computing**: Services through the internet
- ✓ **Benefits of the cloud:**

High Availability

Continuous functioning of services

Scalability

Ability to handle increased load

Security

Architected to handle security

Manageability

Ability to manage cloud resources

Reliability

Ability of a system to recover from failures and continue to function

Predictability

Predictable cost and performance

Governance

Support of Governance and Compliance

Summary

- ✓ **CapEx:** Upfront cost & own infrastructure

  OpEx: No upfront cost & "pay-as-you-go"

- ✓ **Public Cloud:** Shared hardware, services from the internet

  Private Cloud: Own private data center, absolute control (can be connected to internet)

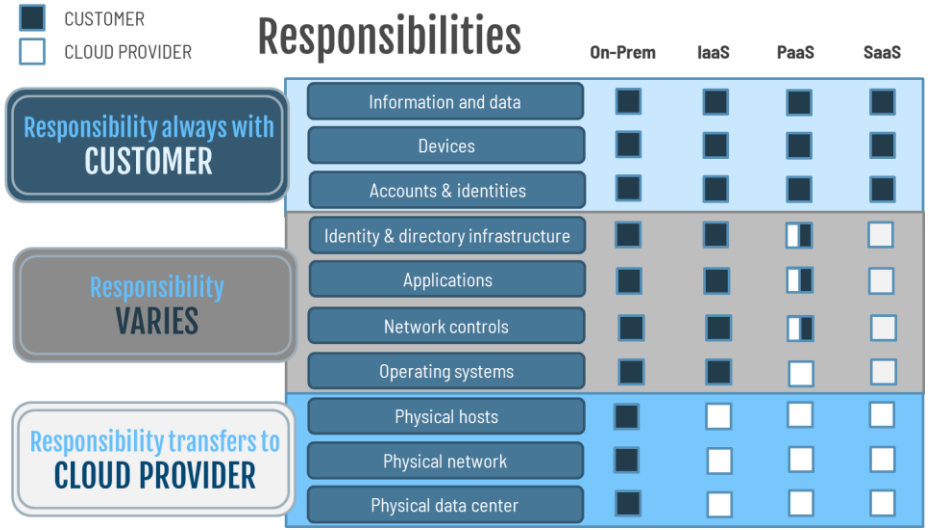
  Hybrid Cloud: Combination of both, can come from public & private

- ✓ **IaaS:** Most control, VMs, Storage, Networking like VNets

  PaaS: Mostly managed, less administrational effort, Databases, App Service

  SaaS: Use only the end product, no installation, only configuring, email provider, Office 365 etc.

Summary



- ✓ **Consumption-based model:** No upfront cost, pay only for what you use

Regions

Region consists of one or multiple data centers within a specific radius

Connected via low-latency network

Resources are deployed to regions

z.B. North Europe, West Europe, Germany West Central

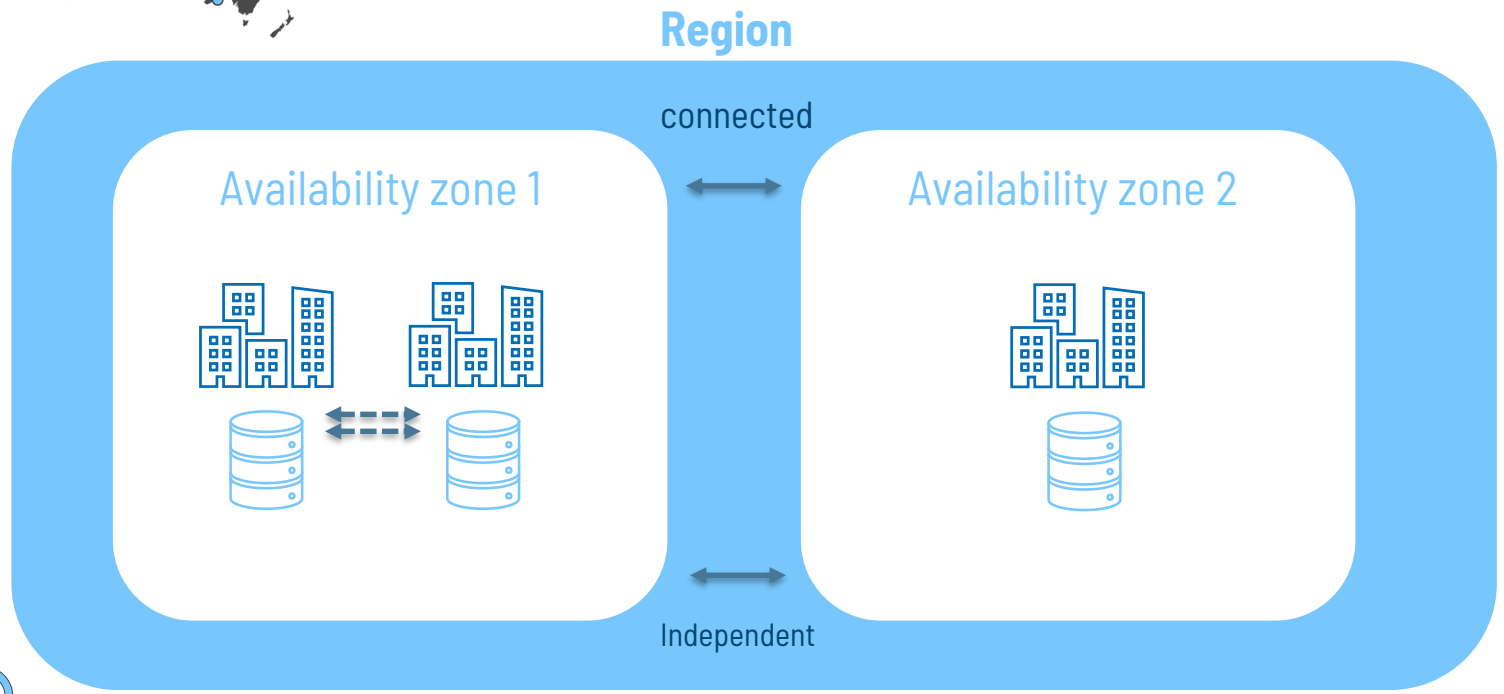
Availability Zones

Most of the regions support availability zones but not all of them

Designed to achieve redundancy and fault tolerance

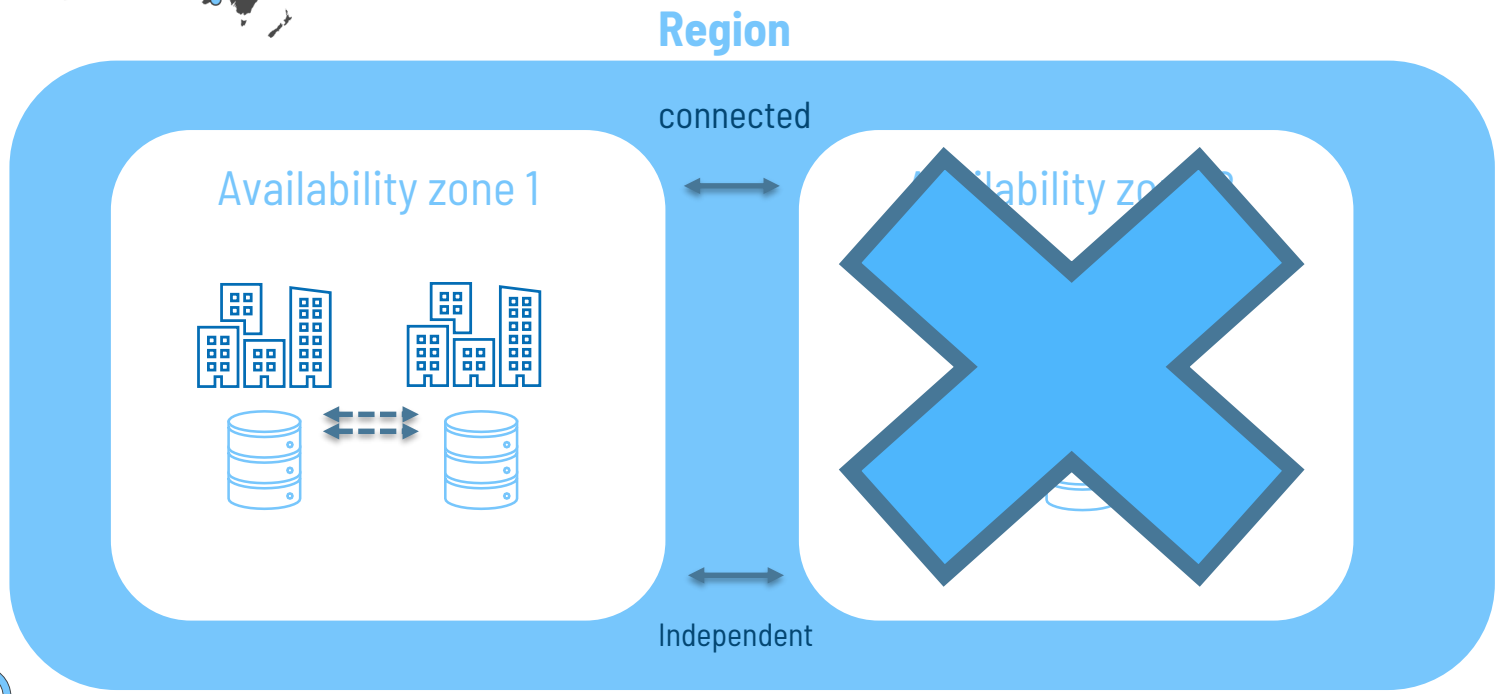
Availability zones

Physically separate locations within each Azure region



Availability zones

Physically separate locations within each Azure region

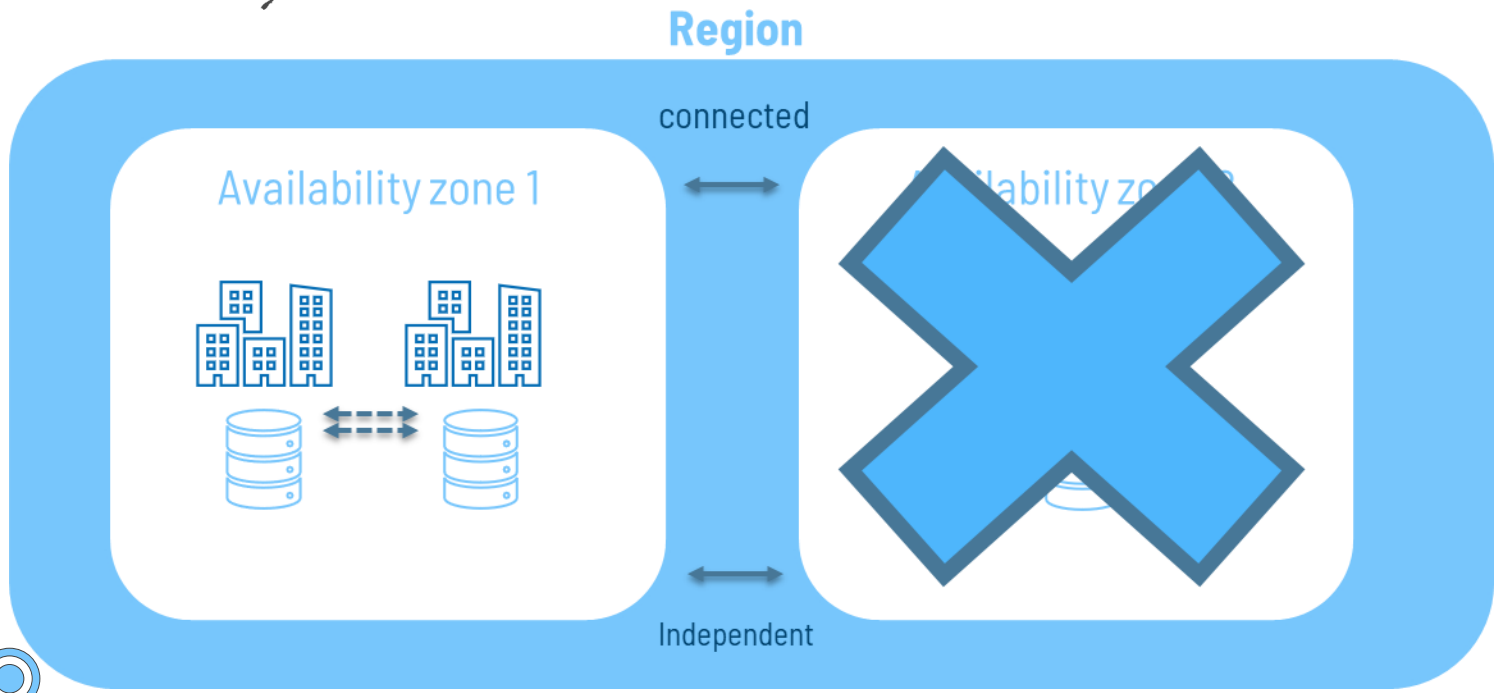


Availability zones

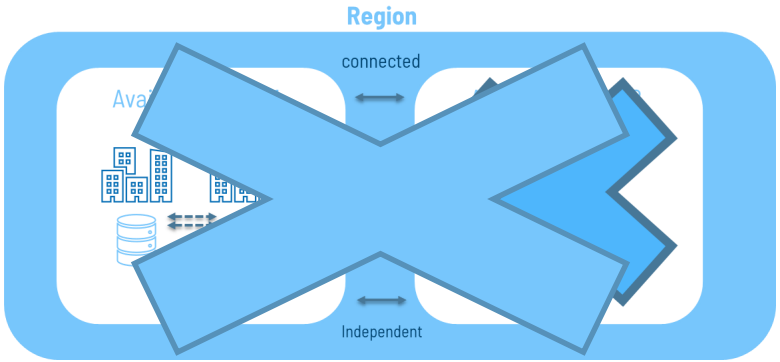
- ✓ **At least 3 availability zones** per availability zone supported region
- ✓ Connected via a **high-performance / low-latency network**
- ✓ **Independent power**, cooling, and networking infrastructure
- ✓ **Design to keep regions up** in the event of a disaster
- ✓ **Creating redundancies**

Availability zones

Physically separate locations within each Azure region



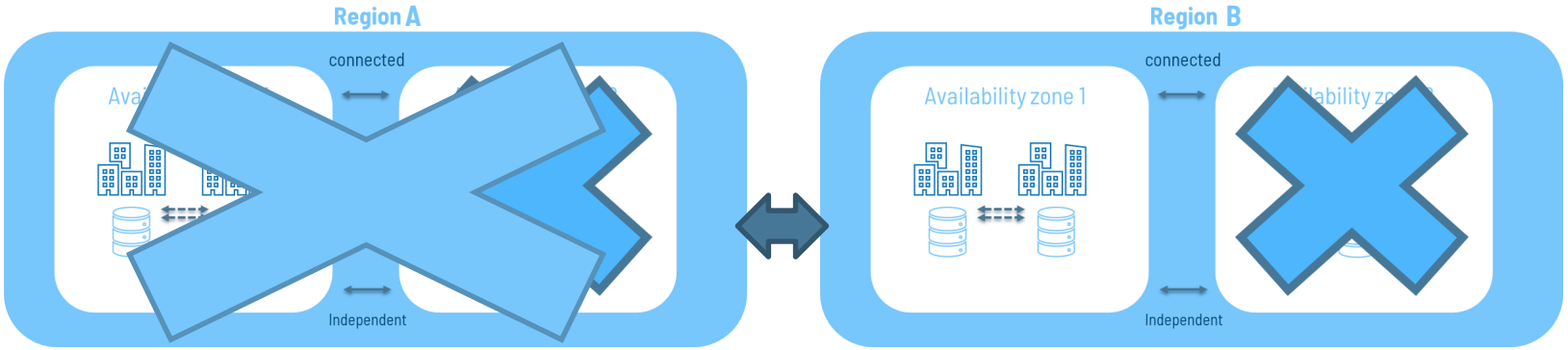
Availability zones



How to manage risks toward entire regions?

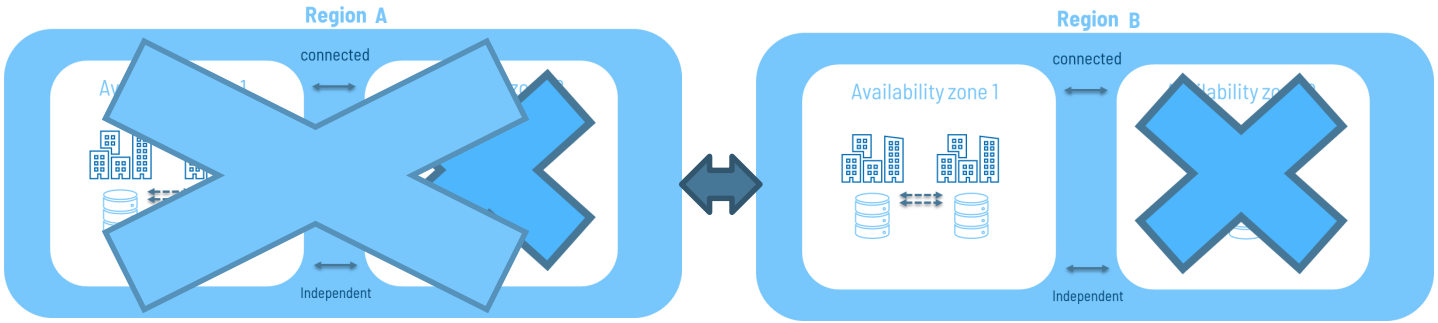
- Earthquakes,
- hurricanes,
- other natural or man-made disasters

Availability zones



Geo-Replication

Availability zones



Geo-Replication

Sequential updates (only in one region at a time)

High availability & Reliability

Region pairs

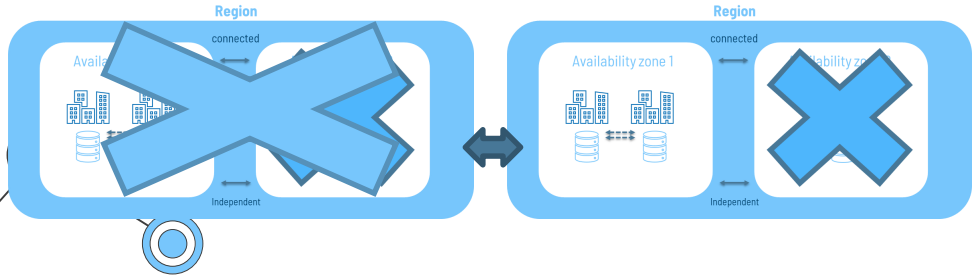
Factors involved in placement:

- Data residency
- Compliance
- Geo-political
- Internet latency

⇒ Region pairs: Recommend region for replication

Region pairs:

- Far enough to be isolated: > 300 miles
- Placed in the same geography



Geography

- Discrete market
- Maintaining data residency and compliance
- Withstand region failure

Region pairs

Geography	Region Pair A	Region Pair B
Asia Pacific	East Asia (Hong Kong)	Asia Southeast (Singapore)
Australia	Australia (East)	Australia Southeast
Australia	Australia, Central	Australia, Central 2*
Brazil	Brazil South	USA South Central
Brazil	Brazil, Southeast*	Brazil South
Canada	Canada, Central	Canada East
China	China North	China East
China	China North 2	China East 2
Europe	Europe North (Ireland)	West Europe (Netherlands)
France	France, Central	France South*
Germany	West-Central Germany	North Germany*
India	India, Central	India (South)
India	India, West	India (South)
Japan	Japan East	Japan, West
Korea	Korea, Central	Korea South
North America	US East	US West
North America	US East 2	US Central
North America	US North Central	US South Central
North America	US West 2	US West Central
Norway	Norway, East	Norway, West*
South Africa	South Africa, North	South Africa, West*
Switzerland	Switzerland, North	Switzerland, West*
UK	UK, West	UK, South
UAE	UAE, North	UAE, Central*
US Department of Defense	US DoD, East*	US DoD, Central*
US Government	US Gov Arizona*	US Gov Texas*
US Government	US Gov Iowa*	US Gov Virginia*
US Government	US Gov Virginia*	US Gov Texas*

(*) Certain regions are subject to access restrictions

Sovereign Regions

Geography	Region Pair A	Region Pair B
Asia Pacific	East Asia (Hong Kong)	Asia Southeast (Singapore)
Australia	Australia (East)	Australia Southeast
Australia	Australia, Central	Australia, Central 2*
Brazil	Brazil South	USA South Central
Brazil	Brazil, Southeast*	Brazil South
Canada	Canada, Central	Canada East
China	China North	China East
China	China North 2	China East 2
Europe	Europe North (Ireland)	West Europe (Netherlands)
France	France, Central	France South*
Germany	West-Central Germany	North Germany*
India	India, Central	India (South)
India	India, West	India (South)
Japan	Japan East	Japan, West
Korea	Korea, Central	Korea South
North America	US East	US West
North America	US East 2	US Central
North America	US North Central	US South Central
North America	US West 2	US West Central
Norway	Norway, East	Norway, West*
South Africa	South Africa, North	South Africa, West*
Switzerland	Switzerland, North	Switzerland, West*
UK	UK, West	UK, South
UAE	UAE, North	UAE, Central*
US Department of Defense	US DoD, East*	US DoD, Central*
US Government	US Gov Arizona*	US Gov Texas*
US Government	US Gov Iowa*	US Gov Virginia*
US Government	US Gov Virginia*	US Gov Texas*

(*) Certain regions are subject to access restrictions

Sovereign Regions

Separate from Public Cloud:

- Isolated from the main instance of Azure
- US Government, US DoD Central
- China
- Very strict compliance or legal requirements

Sovereign Regions

US Government

- Isolated from the main instance of Azure

  ⇒ https://portal.azure.us
- Meets the most complex compliance standards.
- Only US Government and its partners can use it
- From state to local government + partners
- Operated by screened U.S. personnel

Sovereign Regions

China

- More complex regulations to operate in China
- Data centers are not maintained directly by Microsoft
- Maintained by Microsoft partner: 21Vianet
- Separate instance: https://portal.azure.cn

Region pairs

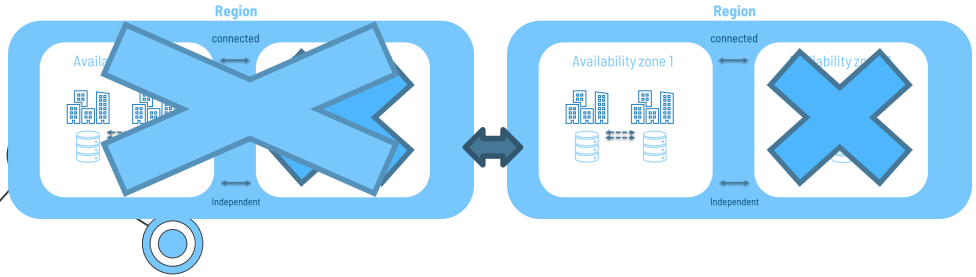
Factors involved in placement:

- Data residency
- Compliance
- Geo-political
- Internet latency

⇒ Region pairs: Recommend region for replication

Region pairs:

- Far enough to be isolated: > 300 miles
- Placed in the same geography



Geography

- Discrete market
- Maintaining data residency and compliance
- Withstand region failure

Resources & Resource groups

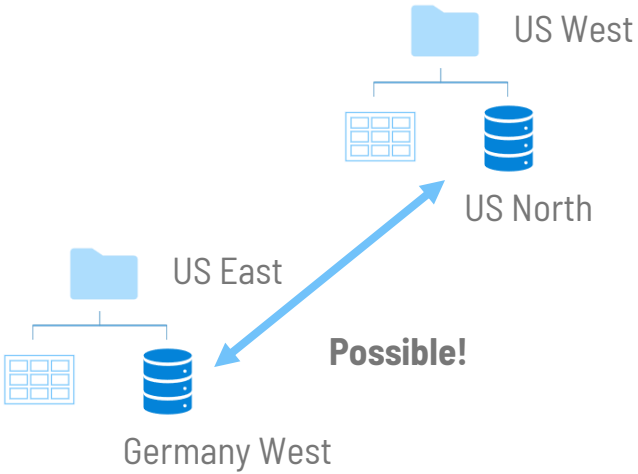
Resources & Resource groups

Resouces

- Instances of services that you create
- Example: Virtual machines or SQL databases
- Deployed to a region

Resource group

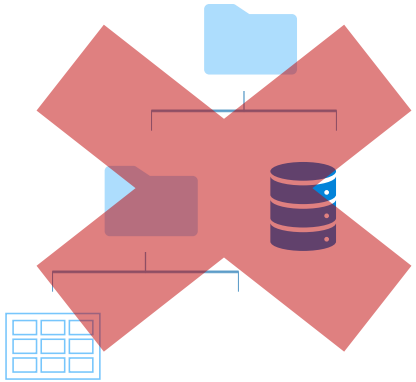
- Container of resources
- Management layer: Configure/delete resources
- Permissions are inherited (Tags are not inherited)
- Region of resource can be different from the region of resource groups
- Contains only metadata



Resources & Resource groups

Resource group

- Container of resources
- Management layer: Configure/delete resources
- Region of resource can be different from the region of resource groups
- Contains only metadata
- Cannot be nested

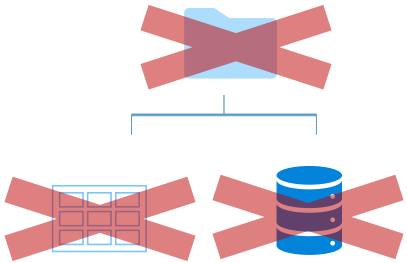


Not possible!

Resources & Resource groups

Resource group

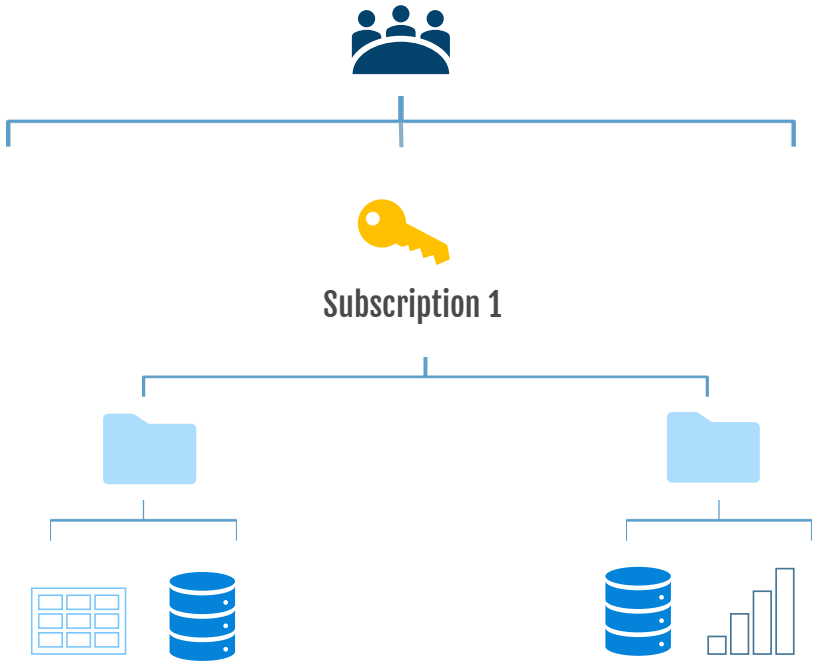
- Container of resources
- Management layer: Configure/delete resources
- Region of resource can be different from the region of resource groups
- Contains only metadata
- Cannot be nested
- Deleting group deletes all contained resources



Deletes ALL resources in the resource group

Subscription and management groups

Subscription and management groups



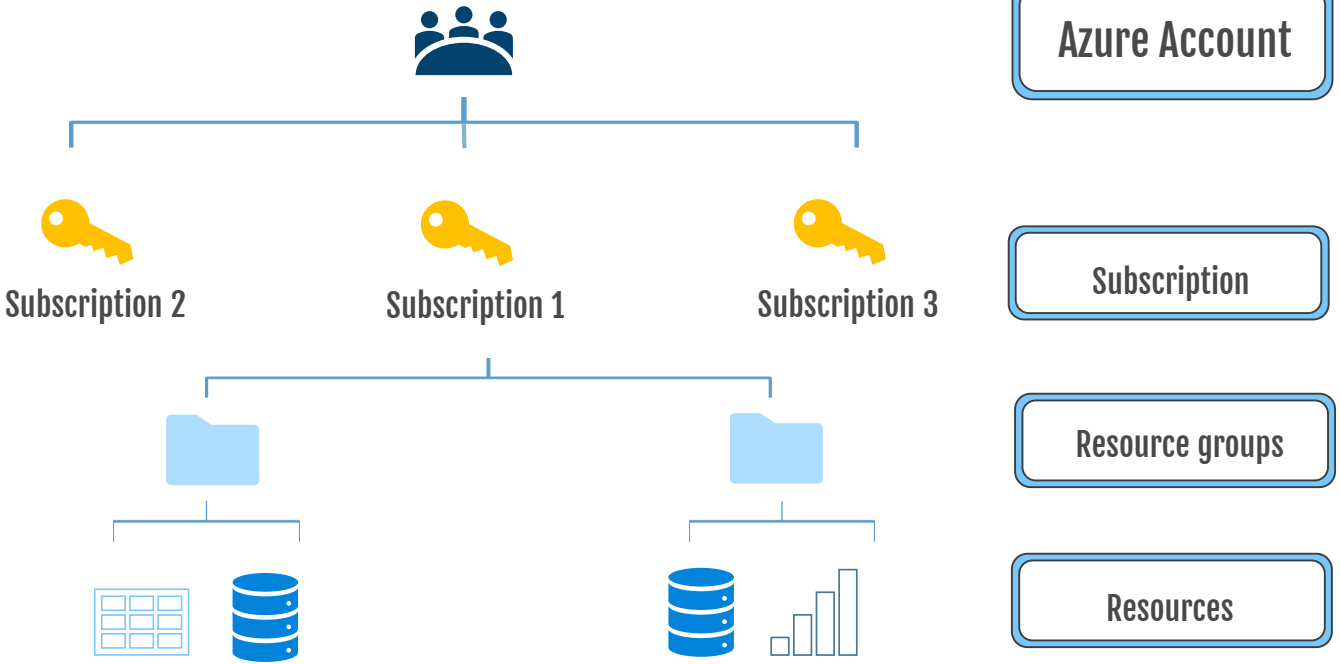
Azure Account

Subscription

Resource groups

Resources

Subscription and management groups



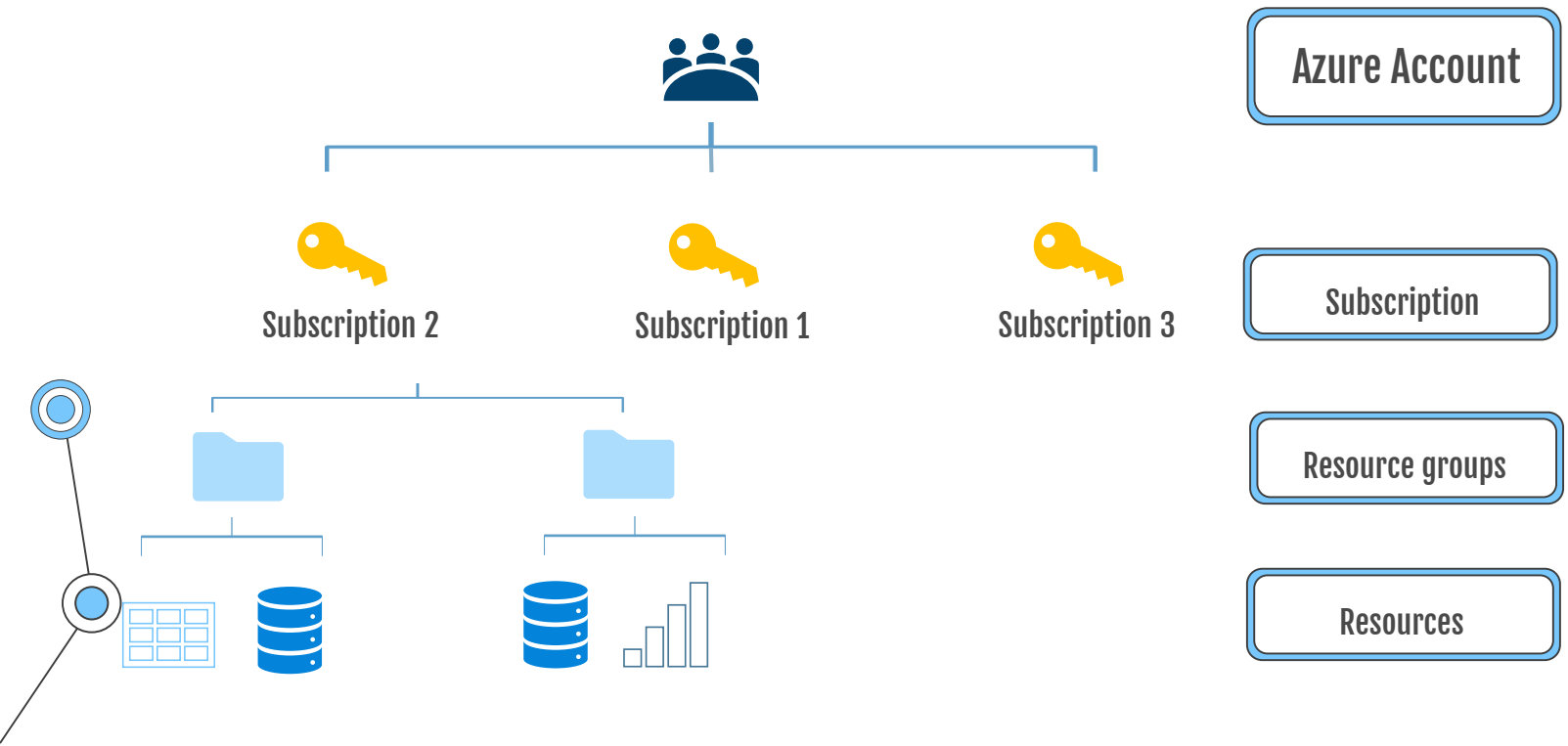
Azure Account

Subscription

Resource groups

Resources

Subscription and management groups



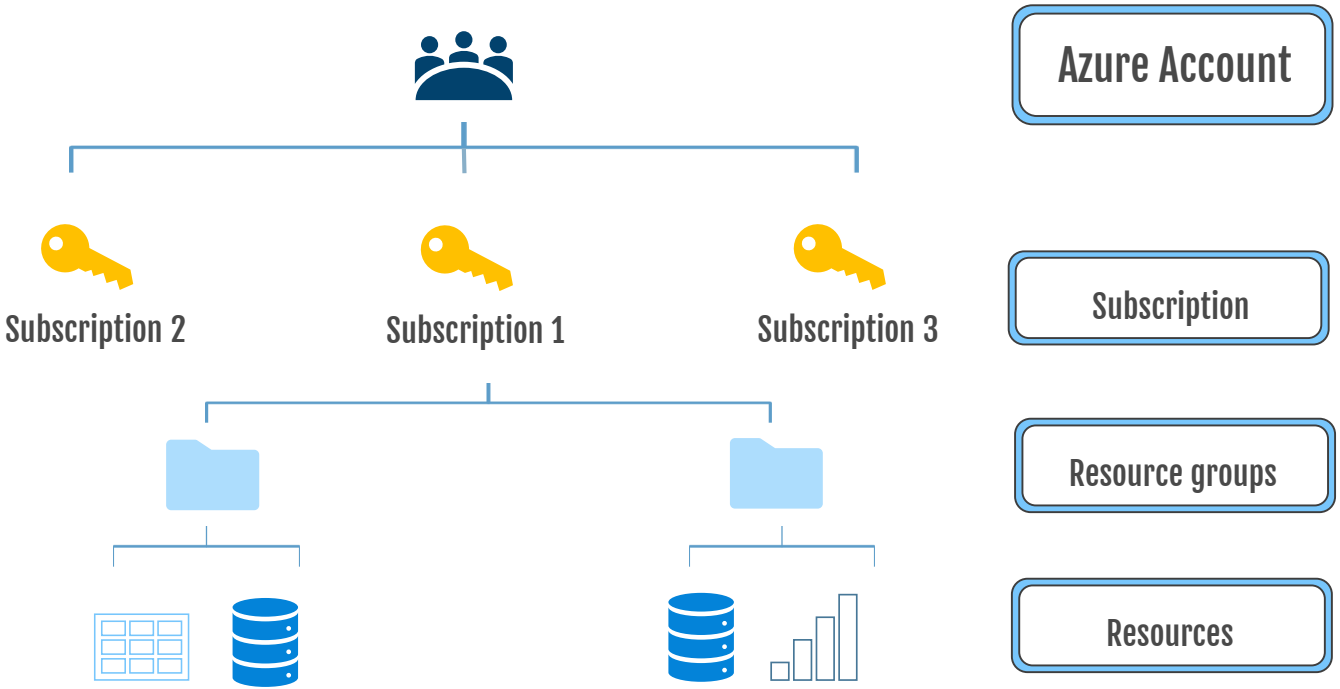
Azure Account

Subscription

Resource groups

Resources

Subscription and management groups



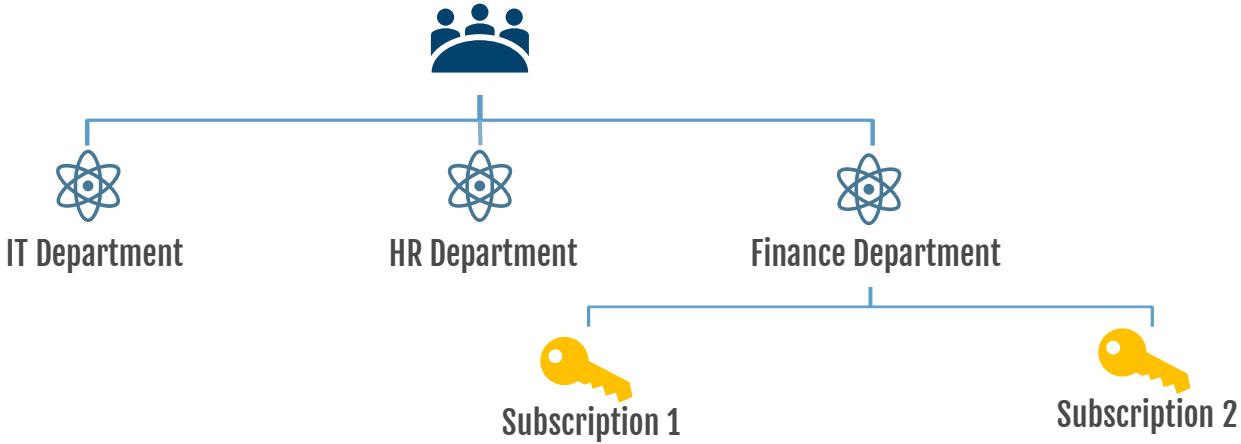
Azure Account

Subscription

Resource groups

Resources

Subscription and management groups



Azure Account

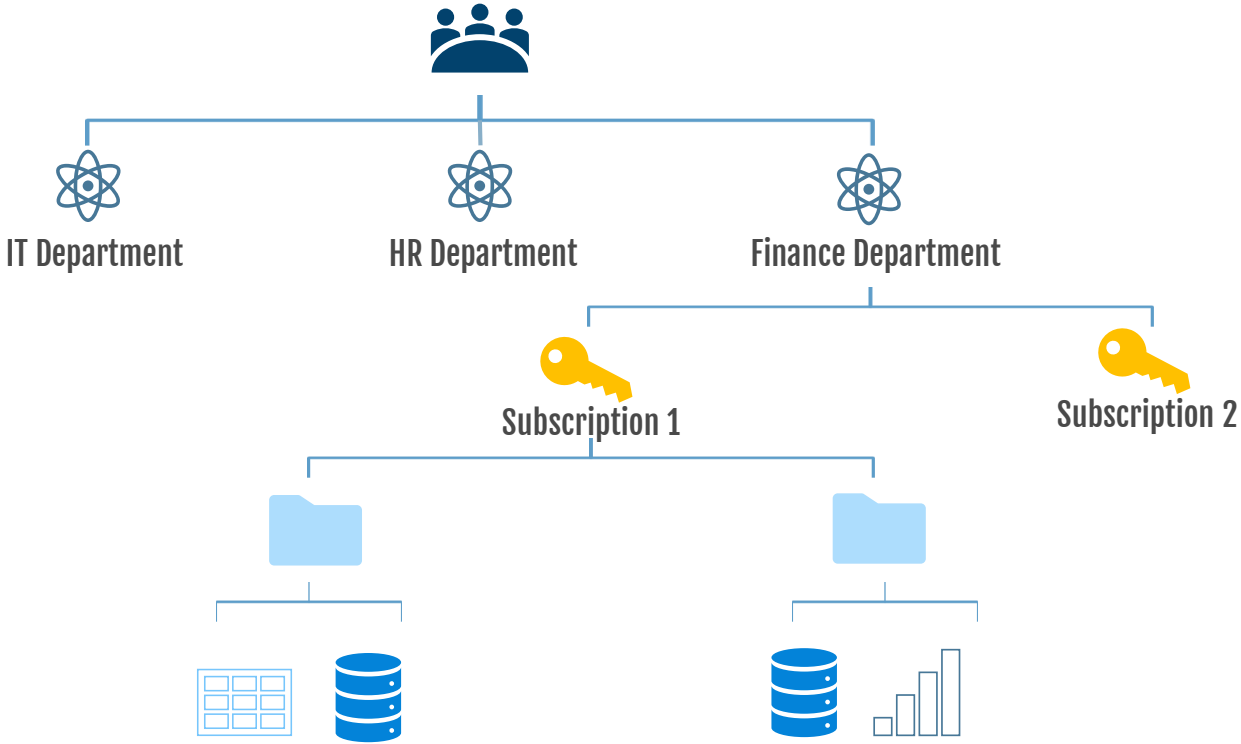
Management groups

Subscriptions

Resource groups

Resources

Subscription and management groups



Azure Account

Management groups

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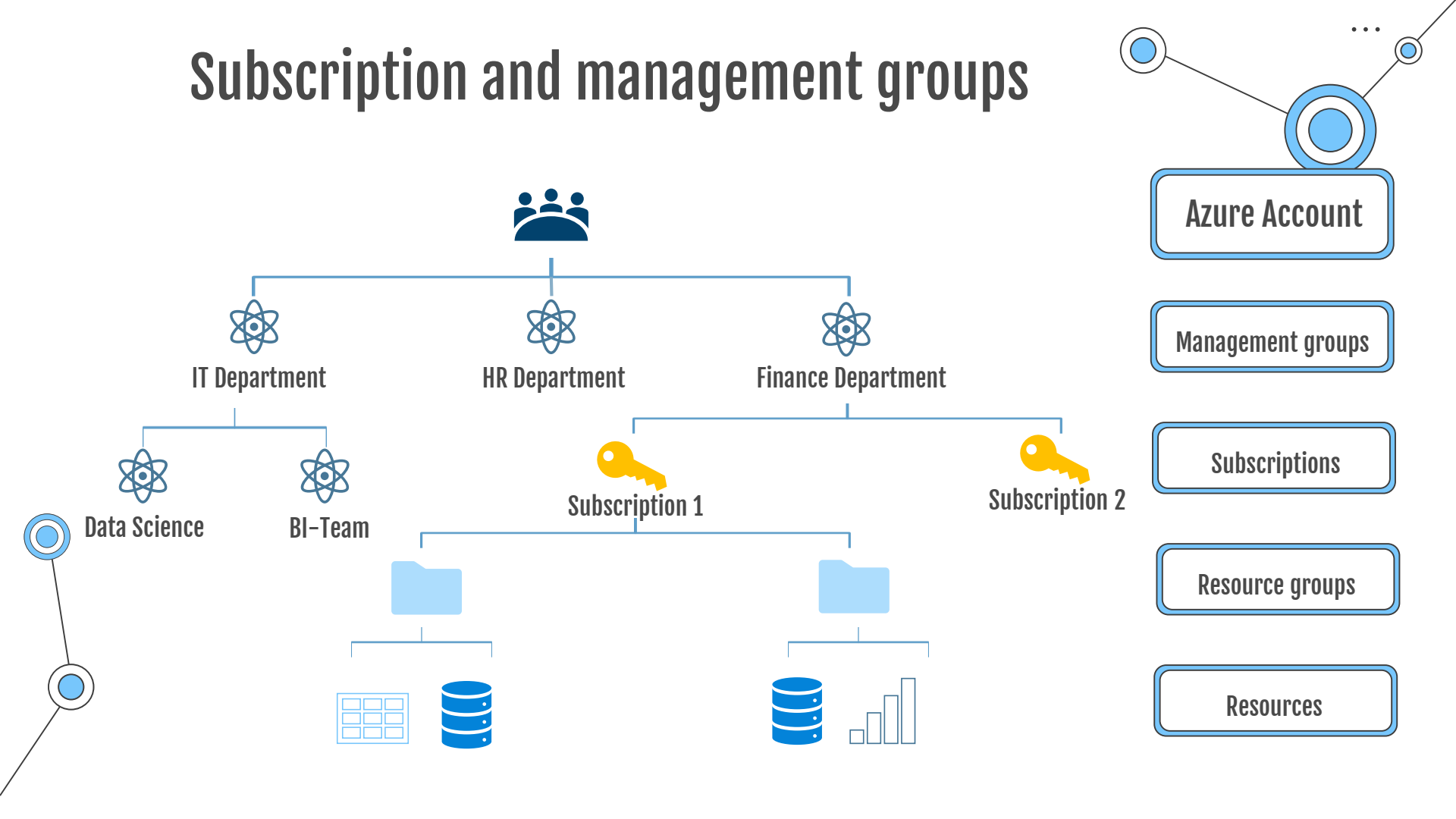
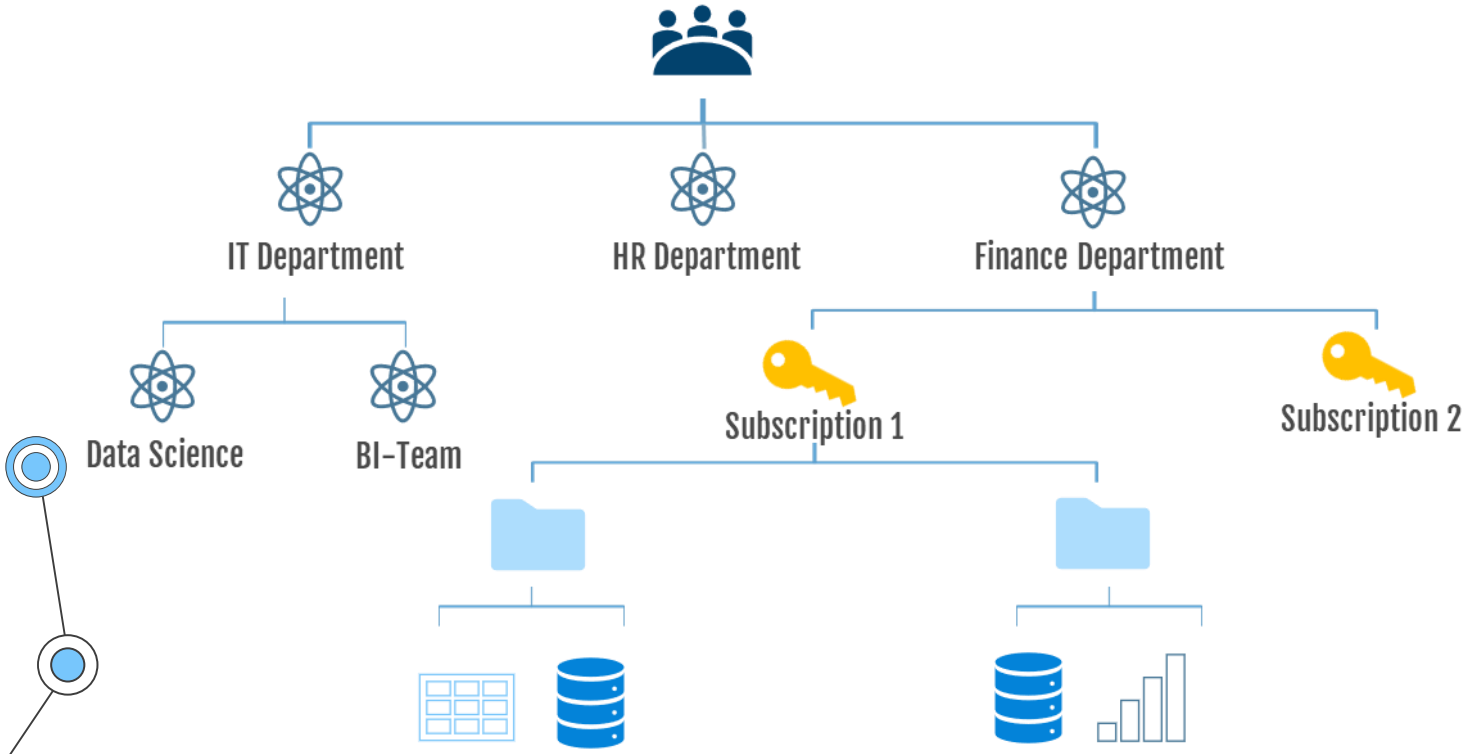
Resources

Subscription and management groups



Subscription and management groups



Azure Account

Management groups

Subscriptions

Resource groups

Resources

Subscription and management groups

Resources

e.g. databases, virtual machines, blob storage etc.

Can be moved to other subscriptions

Resource groups

Management of resources

Subscriptions

Account can have multiple subscriptions

This is where billing takes place

Cannot be merged

Management groups

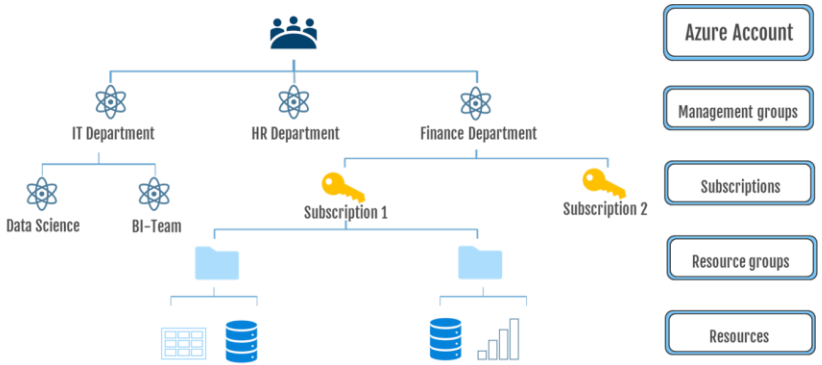
Management of subscriptions & policies

Can be nested

Environment: Test, Dev, Prod

Organizational structure

Billing purposes



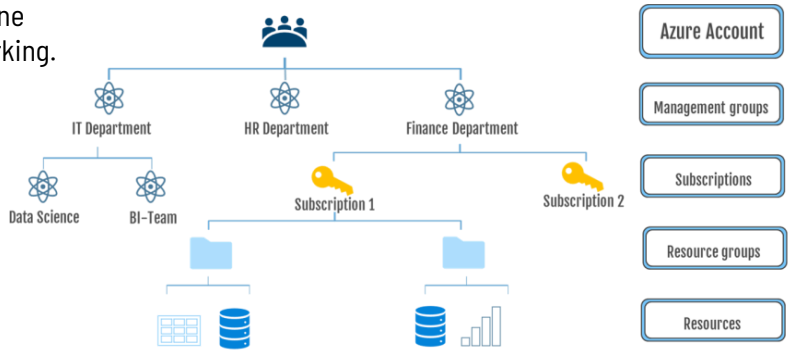
Summary

Geography — Area in the world, at least one region, define own market, data residency and compliance boundaries preserved

Region pairs — Two regions from the same geography

Region — Multiple data centers are connected within a radius via a dedicated regional network with low latency/latency.

Availability Zone — Physical locations within a region consisting of at least one data center with independent power, cooling, and networking.



Summary

Resources

e.g. databases, virtual machines, blob storage etc.

Resource groups

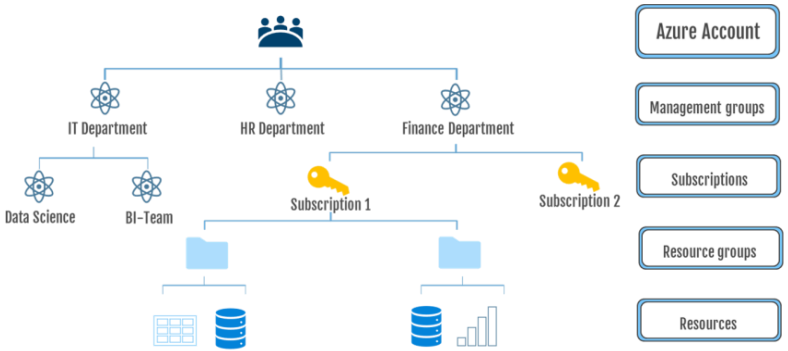
Management of resources

Subscriptions

This is where billing takes place

Management groups

Governance (e.g. via policies) across subscriptions



Compute Service

Compute Services

Provision of computing power on demand

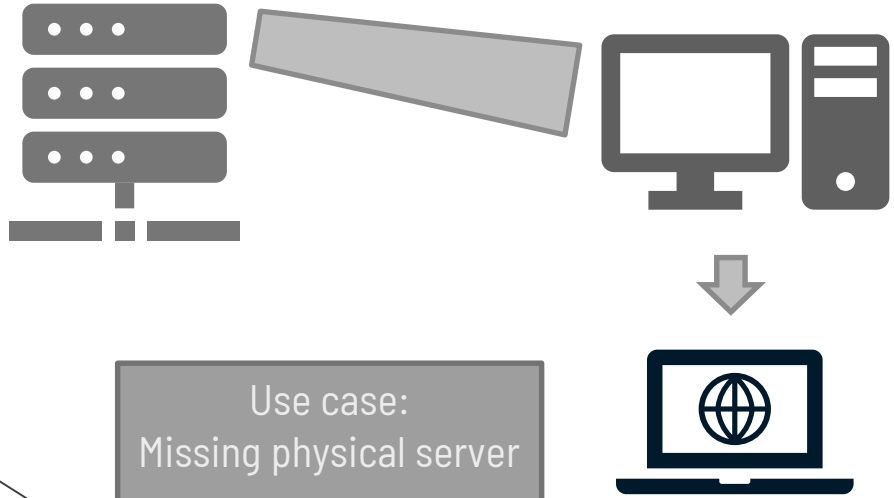
Computing power to run applications/code in the cloud

- Azure VMs + Scale Sets + Availability Sets
- DevTest Labs
- Azure Virtual Desktop
- Azure Container Instances
- Azure App Service
- Azure Functions + Azure Logic Apps (or serverless computing)

Virtual Machines (VMs)

IaaS
Infrastructure-as-a-Service

Software emulations of physical computers/servers



Virtual Processor

Virtual storage

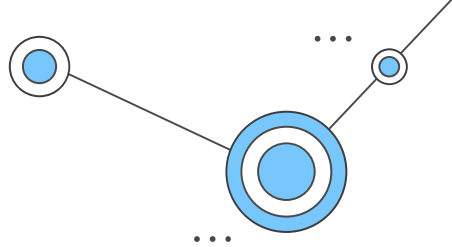
Virtual memory

Use case:
Missing physical server

All software is fully customizable

Operating system (Windows / Linux etc.)

Virtual Machines (VMs)

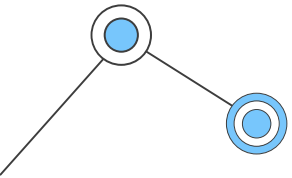


Benefits

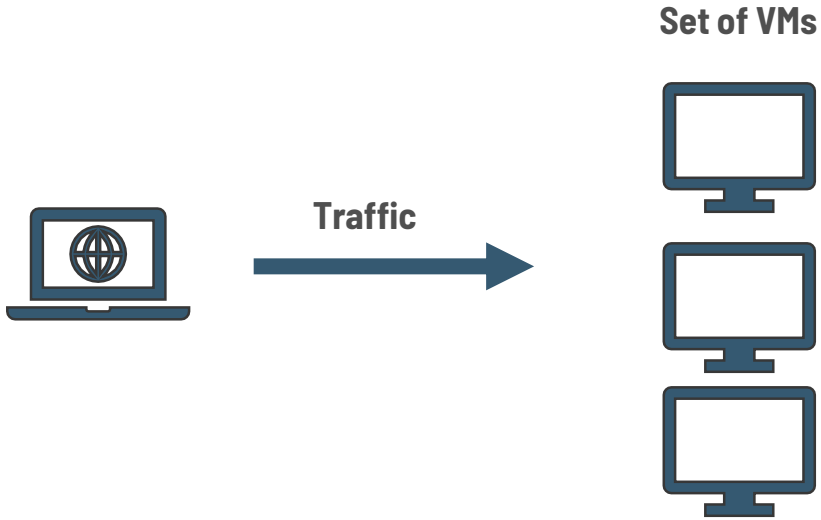
- Control of operating system
- No need of buying hardware
- Possibility to run custom applications

⇒ *It is necessary to configure, update, and maintain all software that runs on the VM*

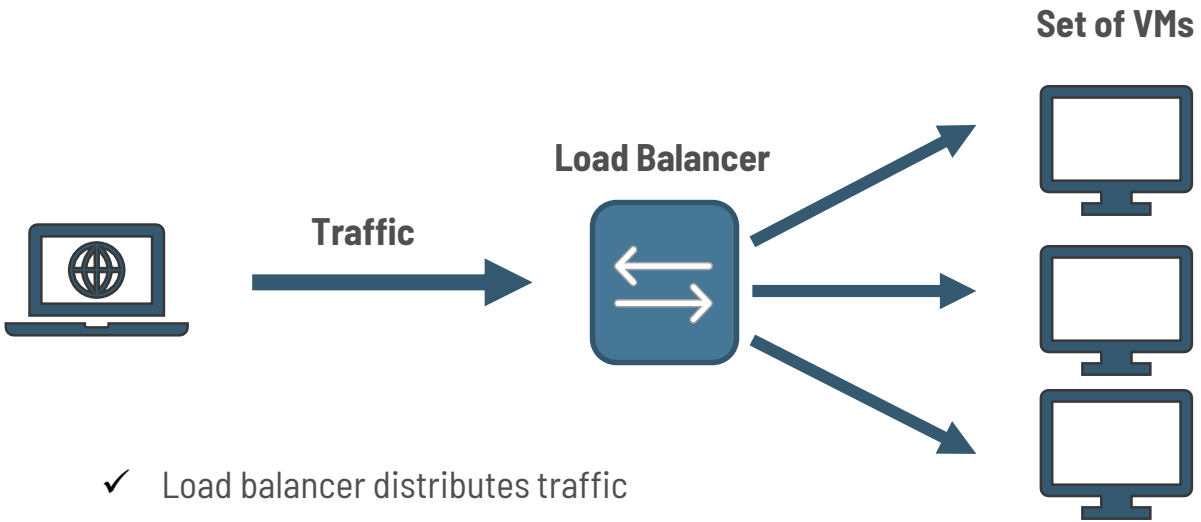
✓ Create and use images: Template with preconfigure OS and software



Load Balancers

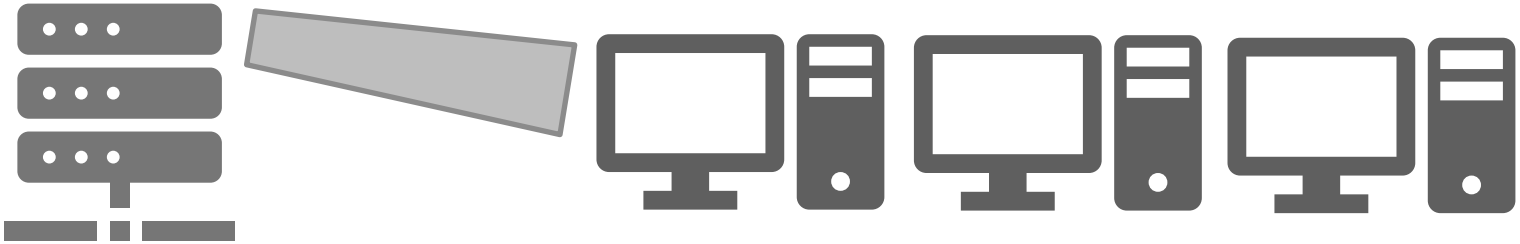


Load Balancers



- ✓ Load balancer distributes traffic
- ✓ Increase the availability and network performance

Virtual Machine Scale Sets



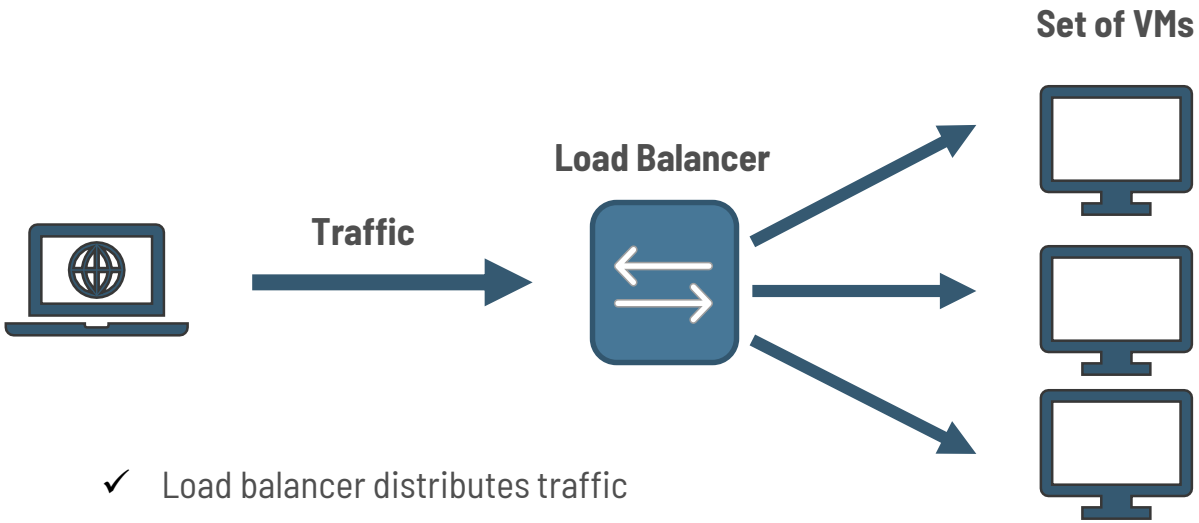
Deploy a group of identical VMs

All VMs in a VM scale set are configured the same

Facilitates the creation of large resources that rely on high computing power

Manual or automatic adjustment to demand (scaling)

Virtual Machine Scale Sets



- ✓ Load balancer distributes traffic
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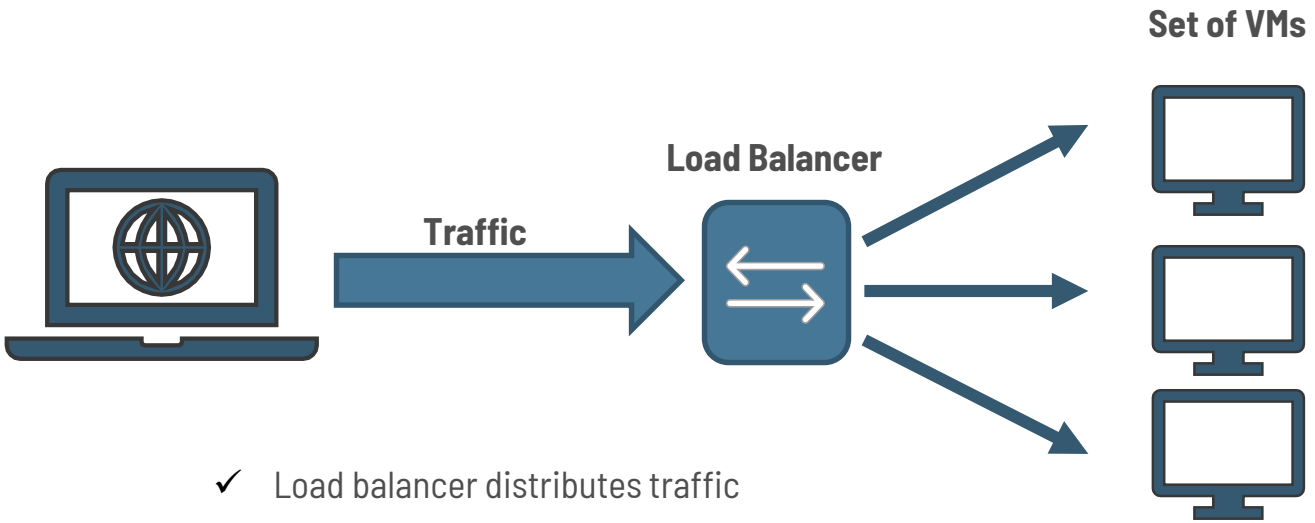
Virtual Machine Scale Sets



- ✓ Load balancer distributes traffic
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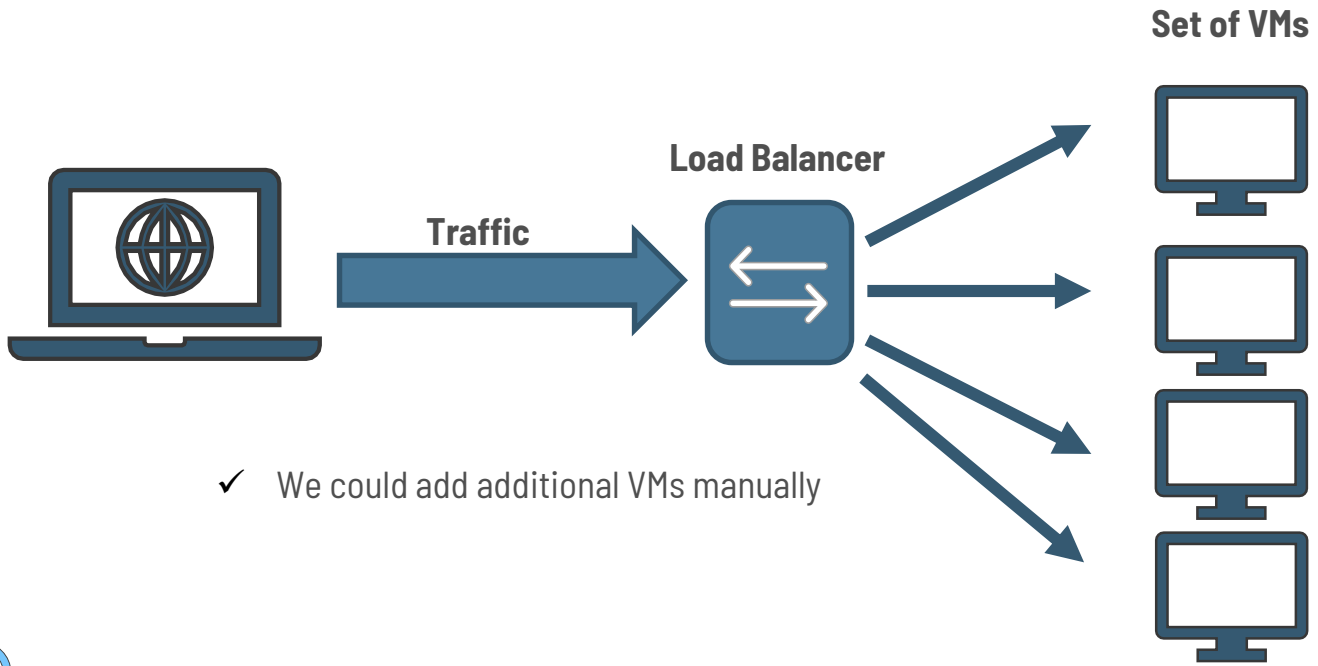
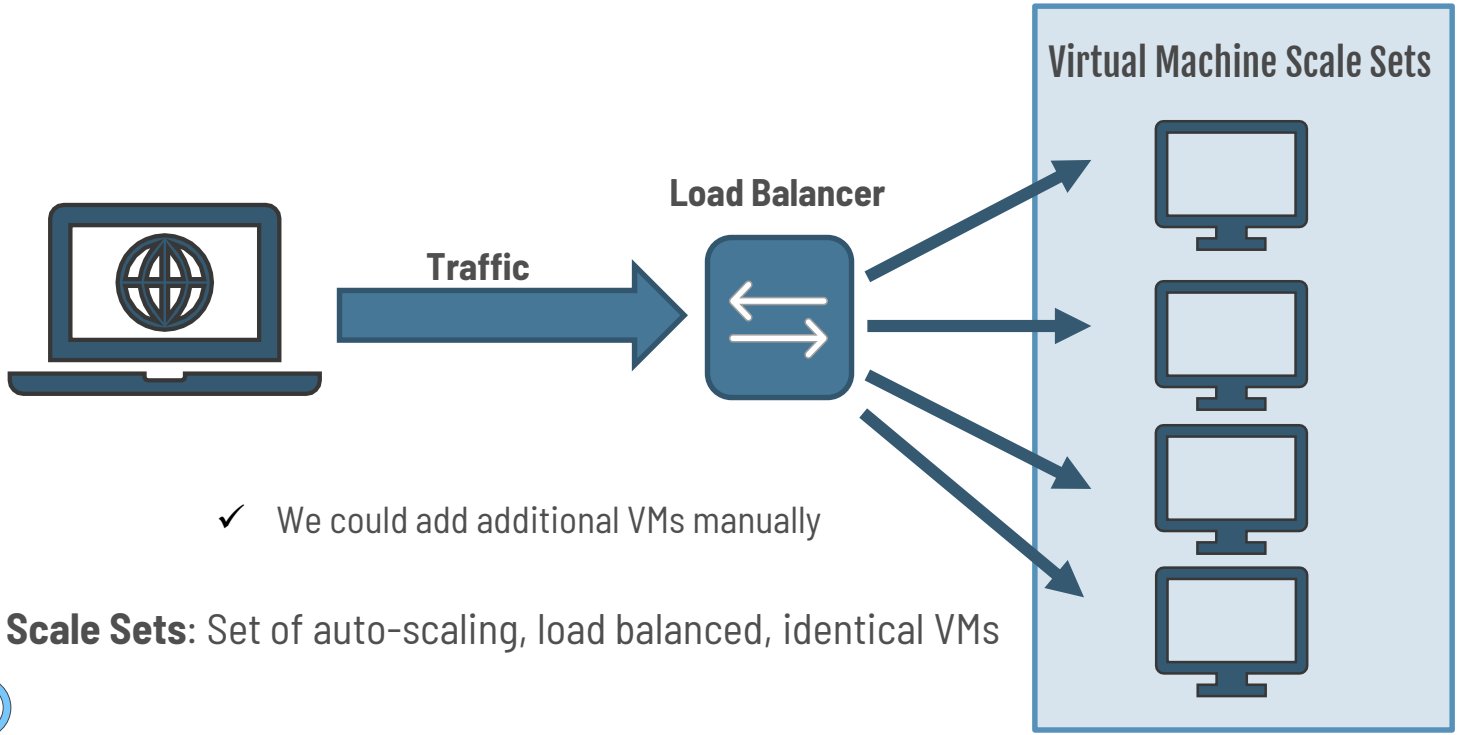
Virtual Machine Scale Sets



- ✓ We could add additional VMs manually

Virtual Machine Scale Sets



✓ We could add additional VMs manually

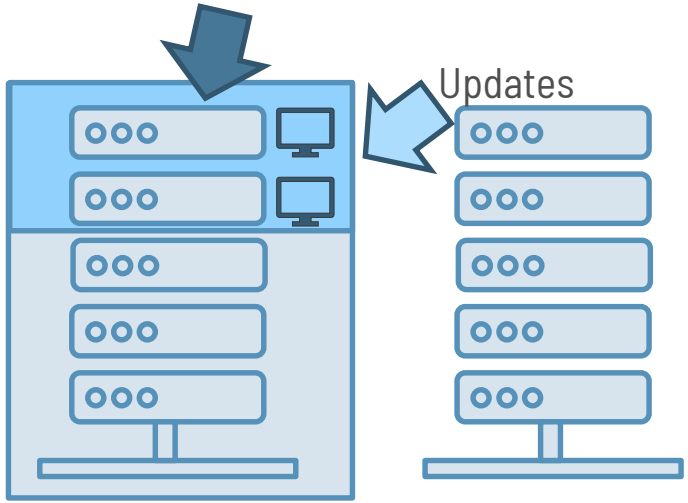
VM Scale Sets: Set of auto-scaling, load balanced, identical VMs

Update Domain

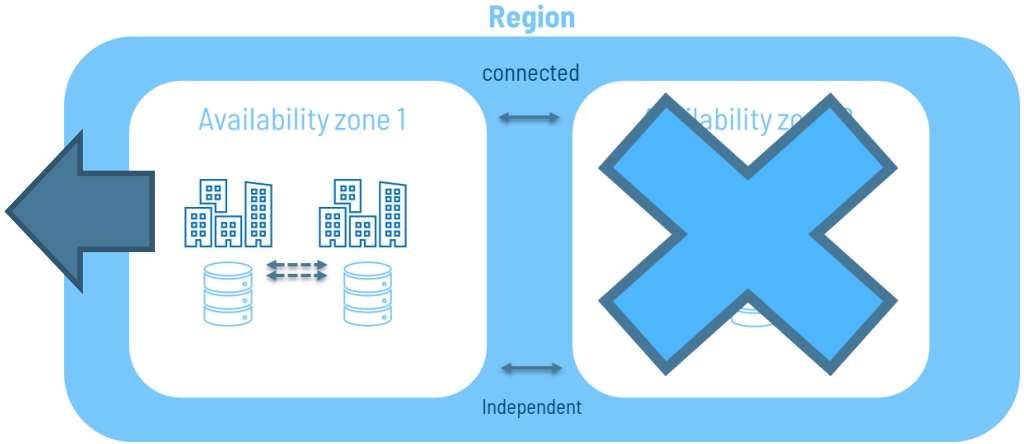
Fault Domain

Availability Sets

Connected cooling, powering, networking



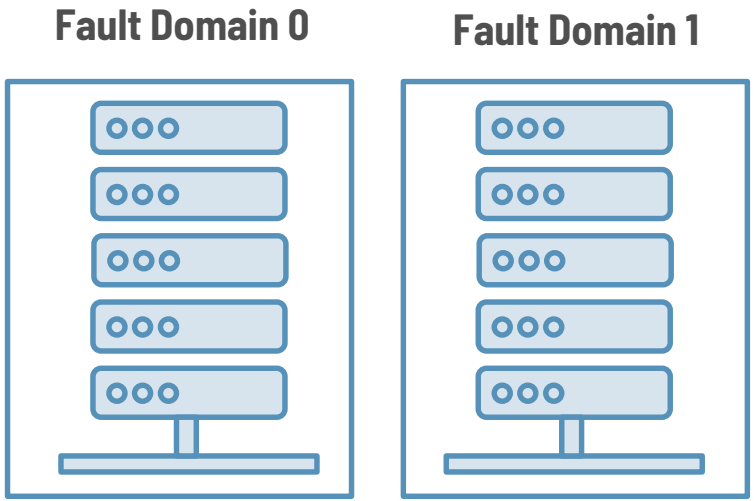
Availability Zone: Protection from entire data center failure



Availability sets protection against failure *within* data center (rack wide failure)

Availability sets group VMs inside a single data center

Availability Sets



Update Domain

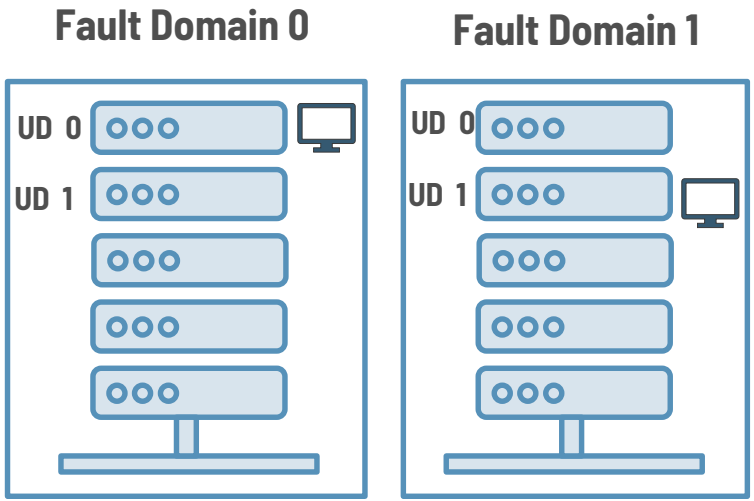
Can be rebooted together

Fault Domain

Independent cooling, powering, networking

Availability sets group VMs inside a single data center

Availability Sets



Update Domain

Can be rebooted together

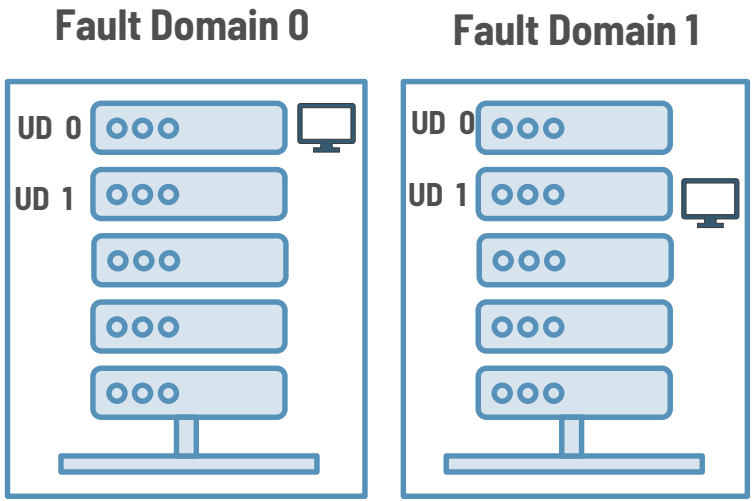
Fault Domain

Independent cooling, powering, networking

Availability sets group VMs inside a single data center

VMs will be automatically distributed across FD and UD

Availability Sets



Update Domain

Can be rebooted together

Fault Domain

Independent cooling, powering, networking

Guaranteed availability:

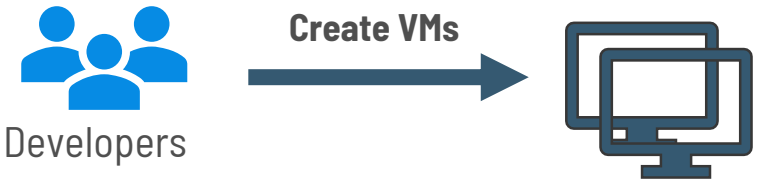
2 or more VMs within Availability Sets: 99.95%

2 or more VMs across 2 Availability Zones: 99.99%

DevTest Labs

DevTest Labs

Idea: Provide easy access to creating VMs for development and testing



DevTest Lab users can easily & quickly create VMs

Pre-configured VMs with pre-installed development tools

To control cost: Need to follow defined policies

Use-cases: Development, testing, training

Azure Virtual Desktop

Benefits

Independent from hardware

Access to application or to entire desktop

Centrilized security:
Operating system, apps and data are separated from your local hardware

Risk of confidential data left on hardware is avoided

Cloud security features like MFA

Azure Virtual Desktop

Azure Virtual Desktop

Desktop and app virtualization – accessible through a browser

We can access a cloud-hosted version of Windows from

- any location
- any device and
- any operating systems

Multiple operating systems are possible:

- Windows 10,
- Windows 7,
- Windows 11,
- Windows Server

Allows multiple concurrent user-sessions

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App Service

App Service

Platform-as-a-service to deploy and host web applications

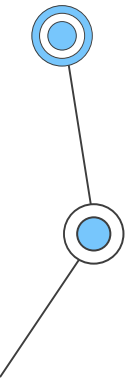
Focus on development of application without worrying about the infrastructure

Managed security & autoscaling

Pay only for compute resources used, according to the selected app services plan (Free, different paid ones)

Programming in many languages e.g. .NET, .NET Core, Java, Ruby, Node.js, PHP or Python

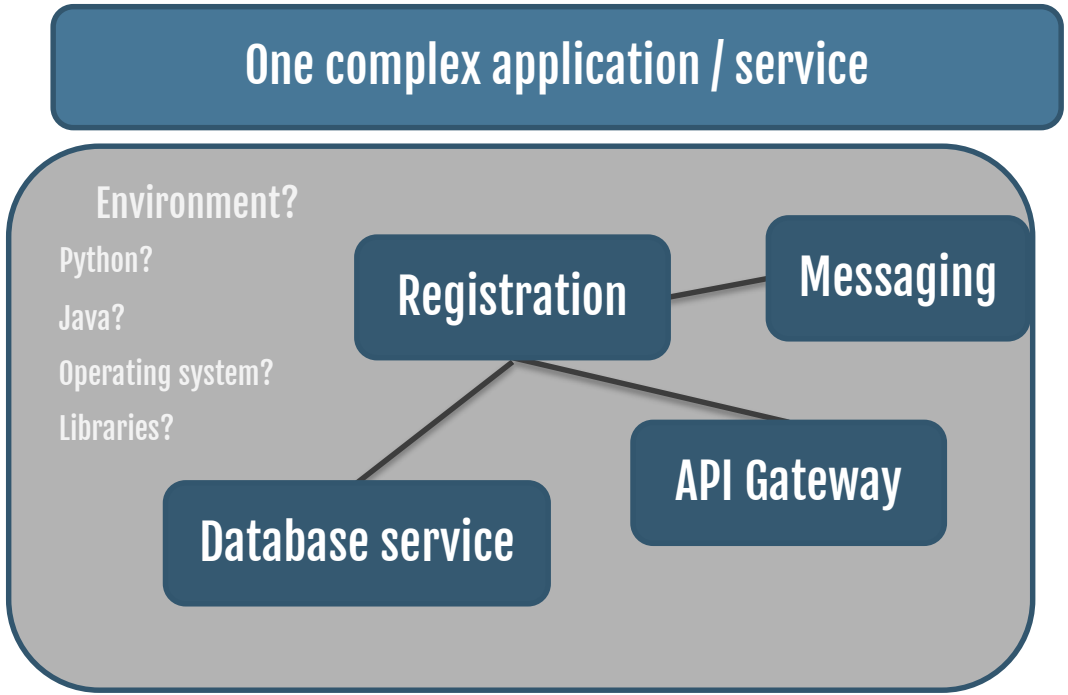
Continuous deployment, e.g. via Azure DevOps



Container Services

Container Services

Application development moving towards **microservices**



Environment can be complex to manage

Loosely connected microservices

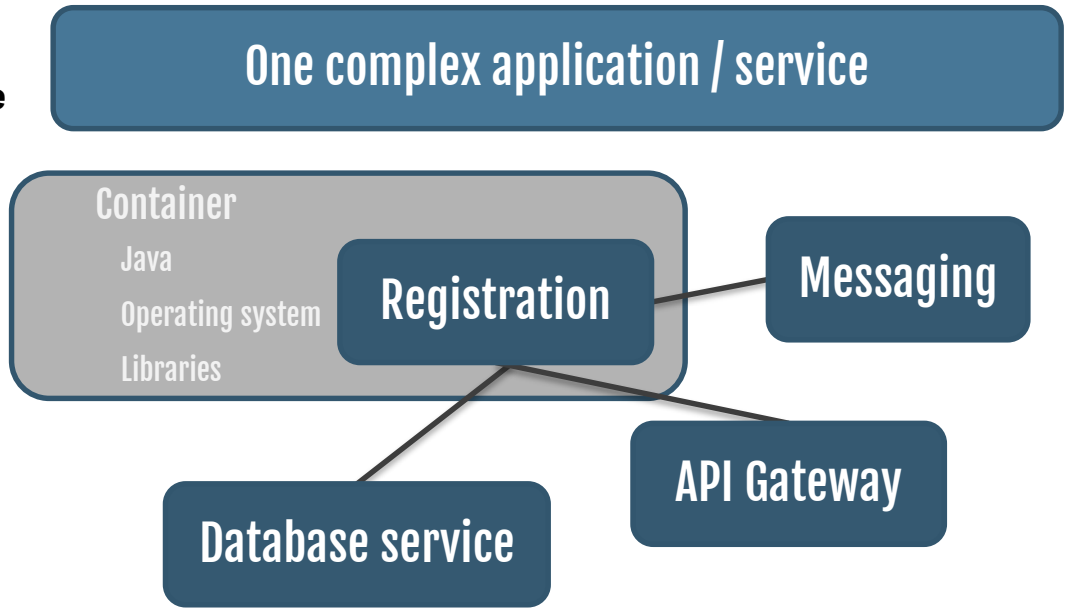
Enables rapid delivery of complex applications

Container Services

Containers package software for deployment

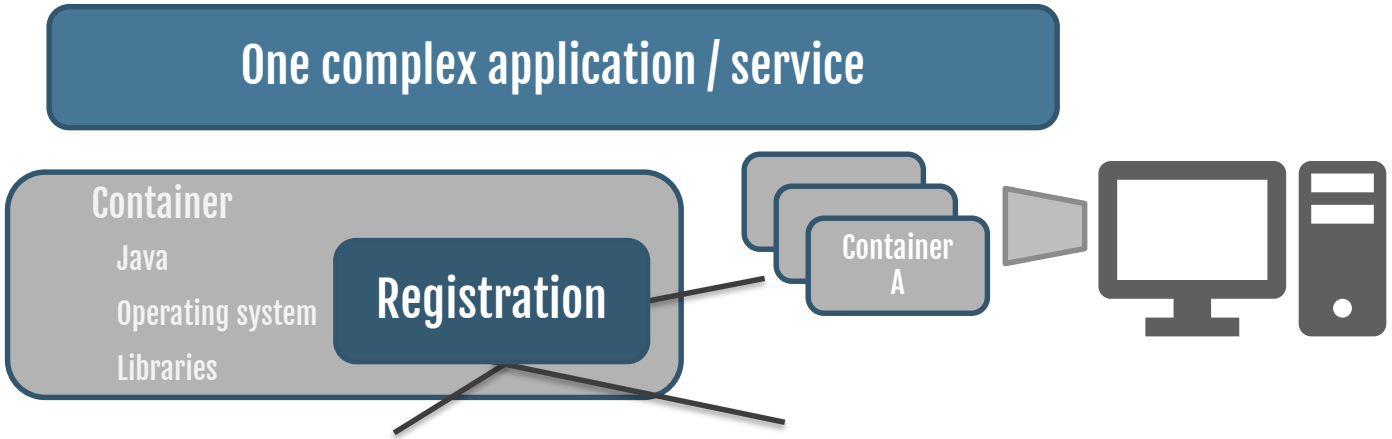
Containers package software for deployment

Microservice is run within container



Container Services

Containers package software for deployment



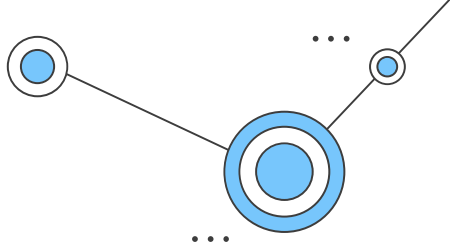
Microservice is run within container

VMs are virtualization of **physical hardware**

Containers are virtualization of **OS and software**

- ✓ **Light weight**
- ✓ **Can be started, scaled, ended very quickly**
- ✓ **We don't manage the OS (PaaS)**

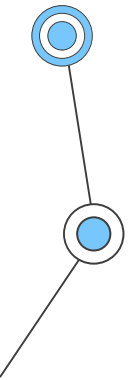
Container Services



Docker: One of the most popular container engines

Azure Container Instances (ACI):

- PaaS
- Fast and simple way to upload & run containers
- No need to manage a virtual machine



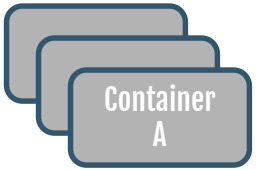
Azure Kubernetes Service

Azure Kubernetes Service

Azure Container Instances

Enables quick and easy deployment and management of containers without VMs

Containers at scale



Azure Kubernetes Service

Open-source **orchestration services** to deploy, manage, and scale containers

Manage and deploy containers at scale

Quickly create and scale containers

Azure Virtual Desktop

Desktop and app virtualization – accessible through a browser

We can access a cloud-hosted version of Windows from

- any location
- any device and
- any operating systems

Multiple operating systems are possible:

- Windows 10,
- Windows 7,
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- Windows Server

Allows multiple concurrent user-sessions

Azure Virtual Desktop

Benefits

Independent from hardware

Access to application or to entire desktop

Centrilized security:
Operating system, apps and data are separated from your local hardware

Risk of confidential data left on hardware is avoided

Cloud security features like MFA

Summary

Summary

Virtual Machines

Virtualization of physical server/computer

Infrastructure-as-a-service

All software + OS is fully customizable

Fully responsible to maintain all software

DevTest Labs

Enables users to easily create pre-defined VMs for development and testing

VM Scale Sets

Set of auto-scaling, load balanced, identical VMs

Azure Virtual Desktop

Desktop and app virtualization – accessible through a browser

Virtualization of different operating systems are possible

Operating system, apps and data are separated from your local hardware

Allows multiple concurrent user-sessions

Availability Sets

Group VMs inside a single data center
into Fault & Update Domains

Protection against failure within data center (rack wide failure)

Summary

App Service

Platform-as-a-service

Deploy and host web applications

Managed security & autoscaling

Azure Kubernetes Services

Orchestration service to deploy, manage, and scale containers at scale

Azure Container Instances

Platform-as-a-service

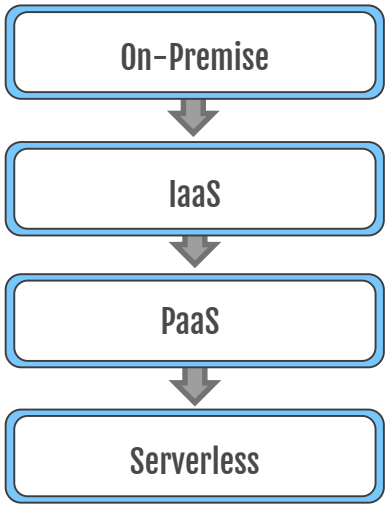
Containers package software for deployment

Fast and simple way to upload & run containers

No need to manage a virtual machine

Serverless

Serverless



What hardware is needed?
How can physical security be ensured?
Investment and scalability?

Is everything up-to-date?
Managing operating system
Monitoring applications

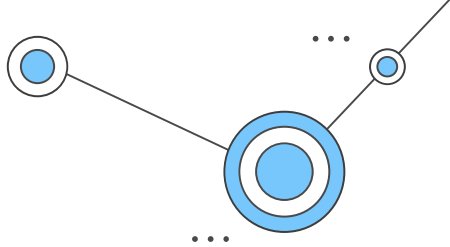
What size is needed?
How can auto-scaling be defined?

Server is invisible to the users
They completely focus on the code

Serverless

- ✓ Server is invisible to the users
- ✓ They completely focus on the code
- ✓ No worry about scaling
- ✓ Focus on event-driven code
- ✓ Events or triggers
- ✓ Microbilling

Azure Functions



Serverless compute: Azure manages server infrastructure and allocates resources

Scaling is automated

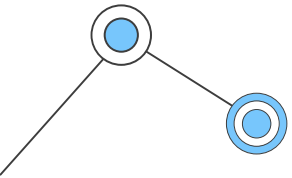
Azure Functions:
Executes code when triggered (platform, infrastructure irrelevant)

Simple functions in response to an event or a trigger

e.g. *HTTP request*

Pay only for time spent running the code

Can be stateful or stateless

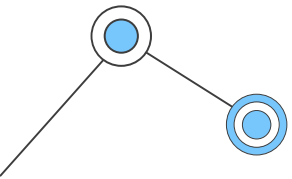


Use cases

- ✓ Run code when a file is uploaded or changed
- ✓ Run scheduled small tasks

Build event-driven systems

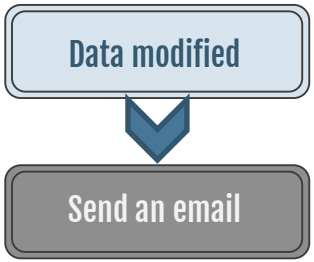
Many programming languages available

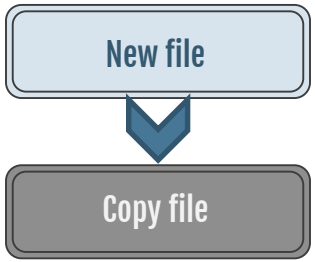


Logic App

Azure Logic App

Used to schedule, automate and orchestrate tasks, business process and workflows.





Trigger

Condition

Design a business **workflow** in a graphical way.

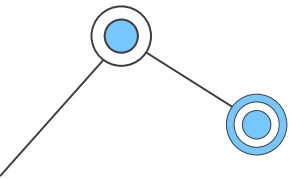
Send an email as a response to a trigger.

Use cases

- ✓ Run code when a file is uploaded or changed
- ✓ Run scheduled small tasks

Build event-driven systems

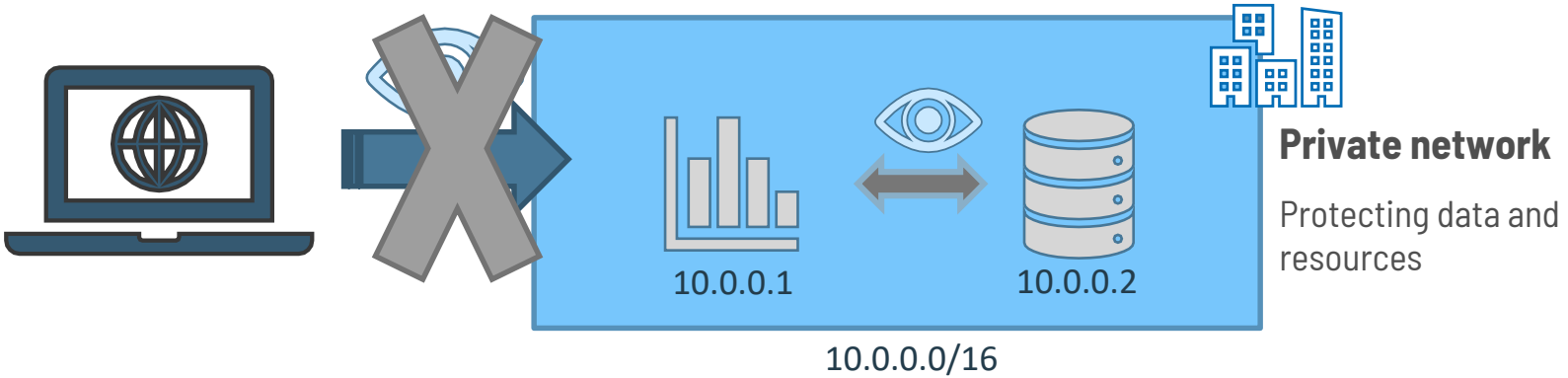
Many programming languages available



Virtual Networks

Virtual Networks

Enables resources to securely communicate with each other or with users over the Internet



Azure virtual network: *Emulates a physical network in the cloud*

Infrastructure-as-a-Service

Virtual Networks

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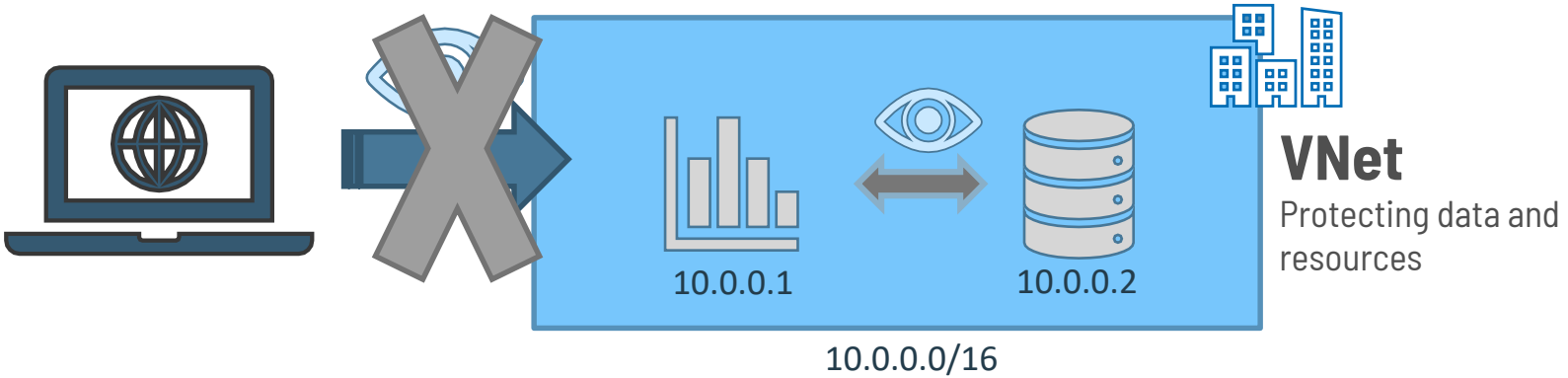

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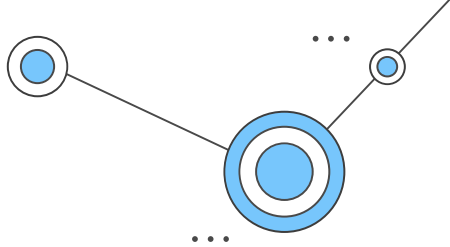
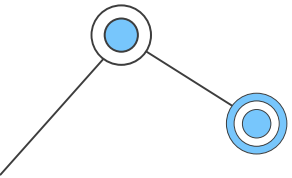


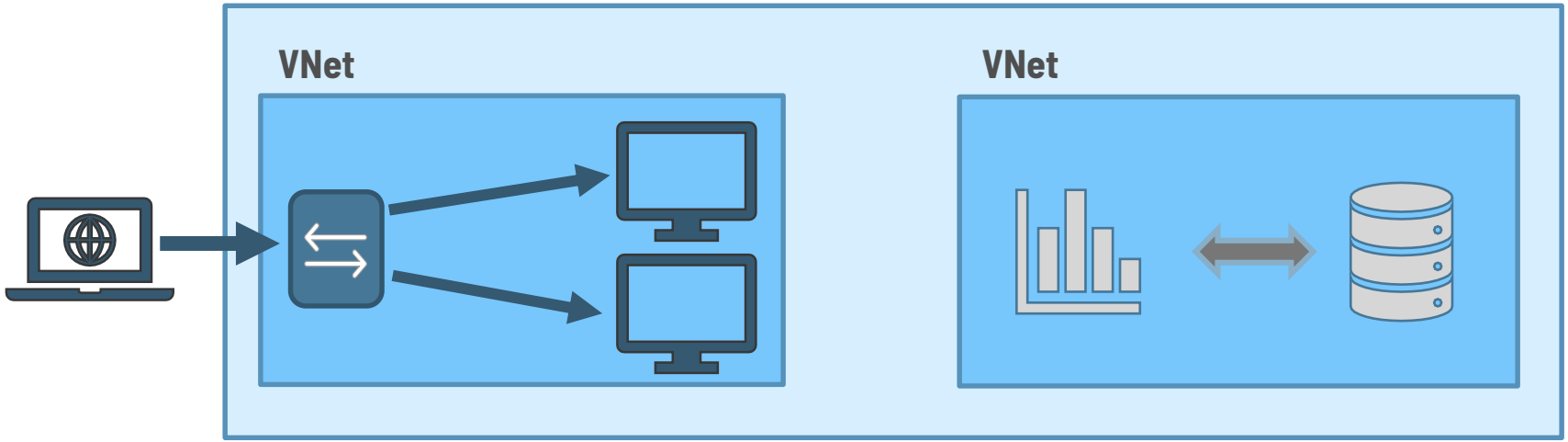
Virtual Networks

- Network traffic is isolated and segmented
- Defining a Private IP address space
- Every resource gets an IP address
- Communication with the Internet
- Communication between Azure resources
- Communication with local resources (cloud & on-premise coverage)



Virtual Subnets

Virtual Subnets

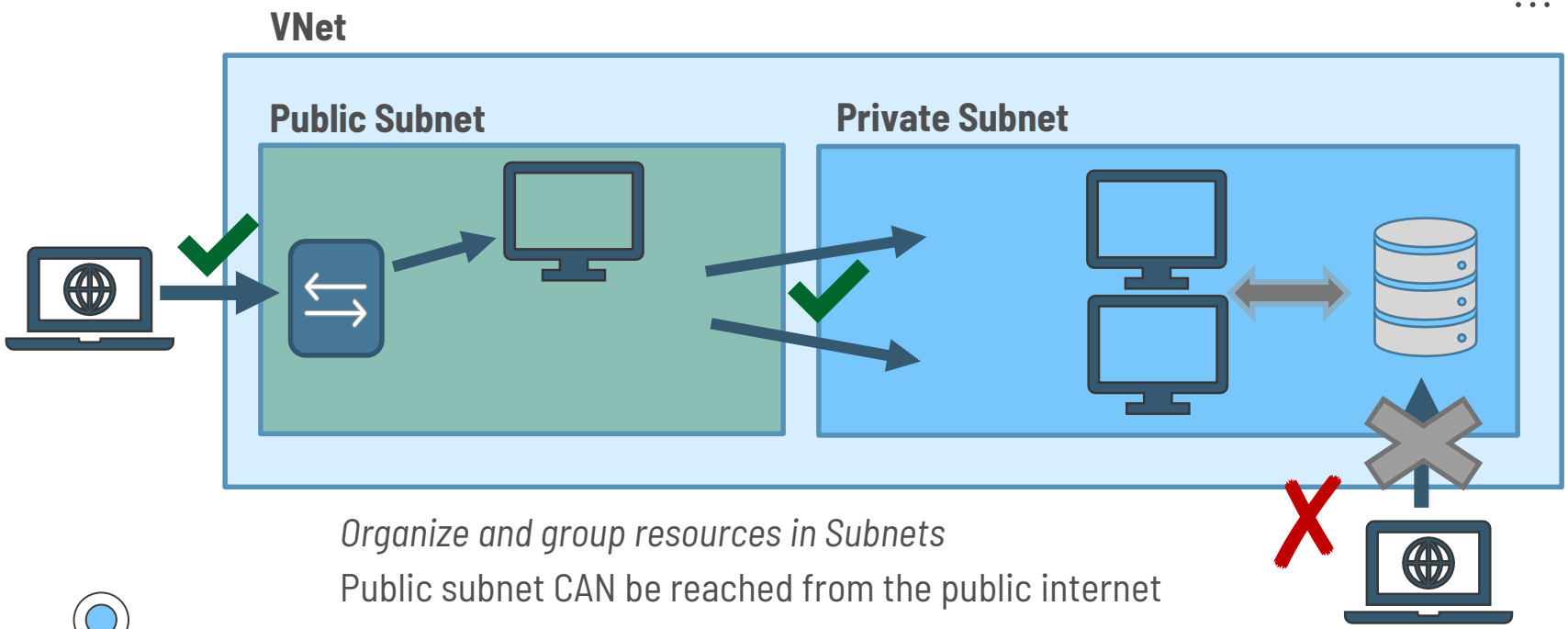


Resources have very different requirements

⇒ *Need for further partitioning*

⇒ *Organize and group resources in Subnets*

Virtual Subnets

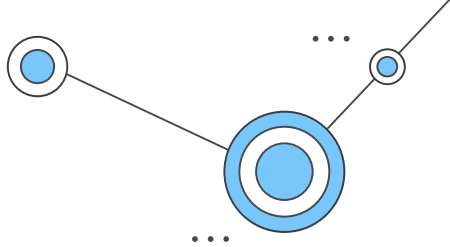


Organize and group resources in Subnets

Public subnet CAN be reached from the public internet

Private subnet CANNOT be reached from the public internet

Public subnet CAN access Privat Subnet



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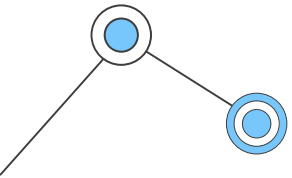
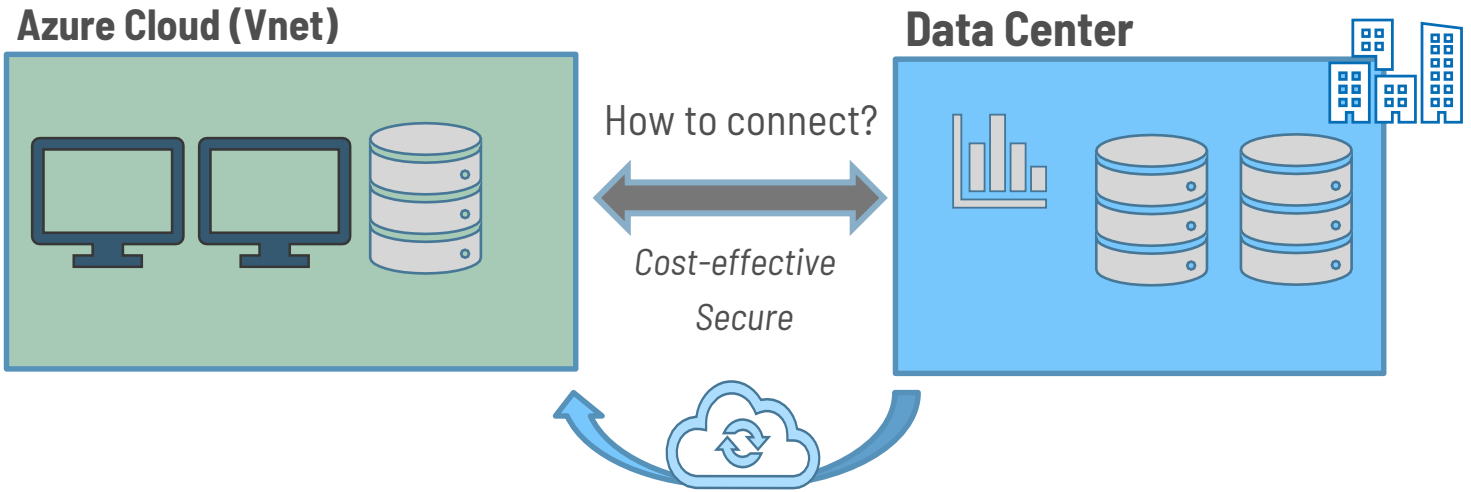


VPN Gateway

VPN Gateway

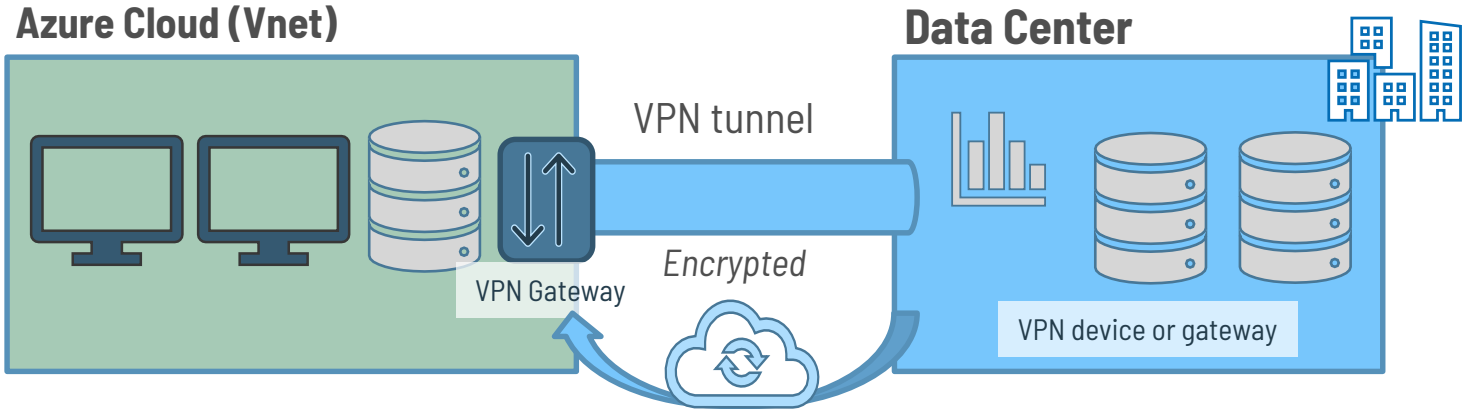
After migration: Hybrid cloud model



VPN (Virtual private network): *Use an encrypted tunnel to connect two or more networks over an untrusted network (public internet)*

VPN Gateway

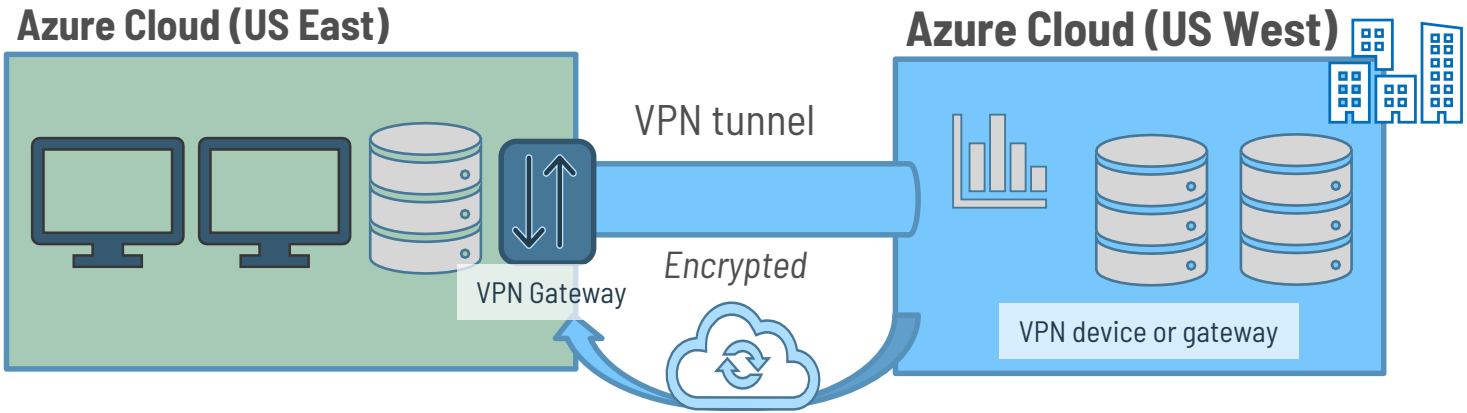
After migration: Hybrid cloud model



Site-to-site connection: On-premise datacenter to Azure virtual network

VPN Gateway

What if we need more bandwidth?



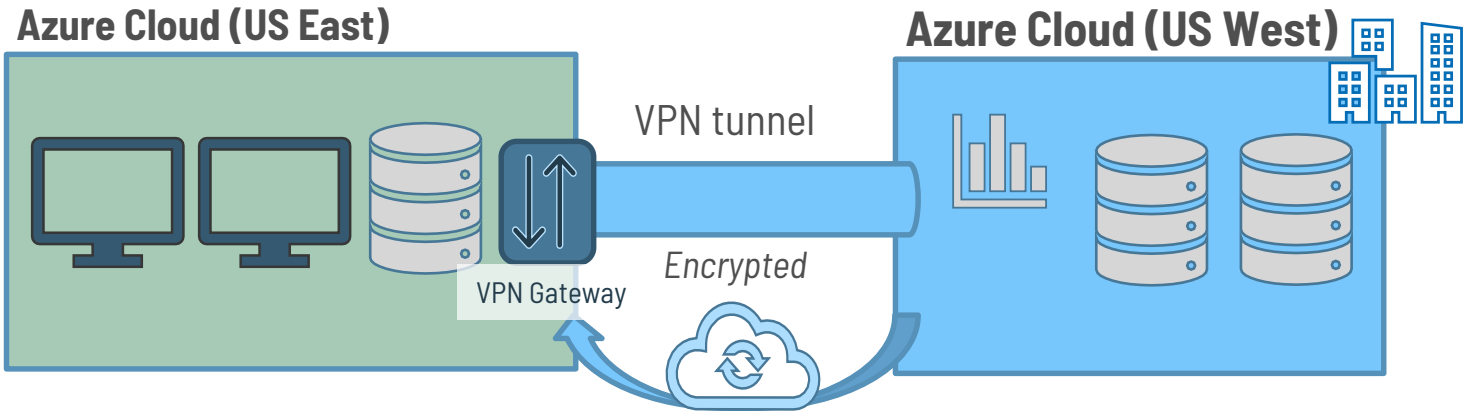
Site-to-site connection: On-premise datacenter to Azure virtual network

Network-to-network connection: Virtual network to another virtual network

Express Route

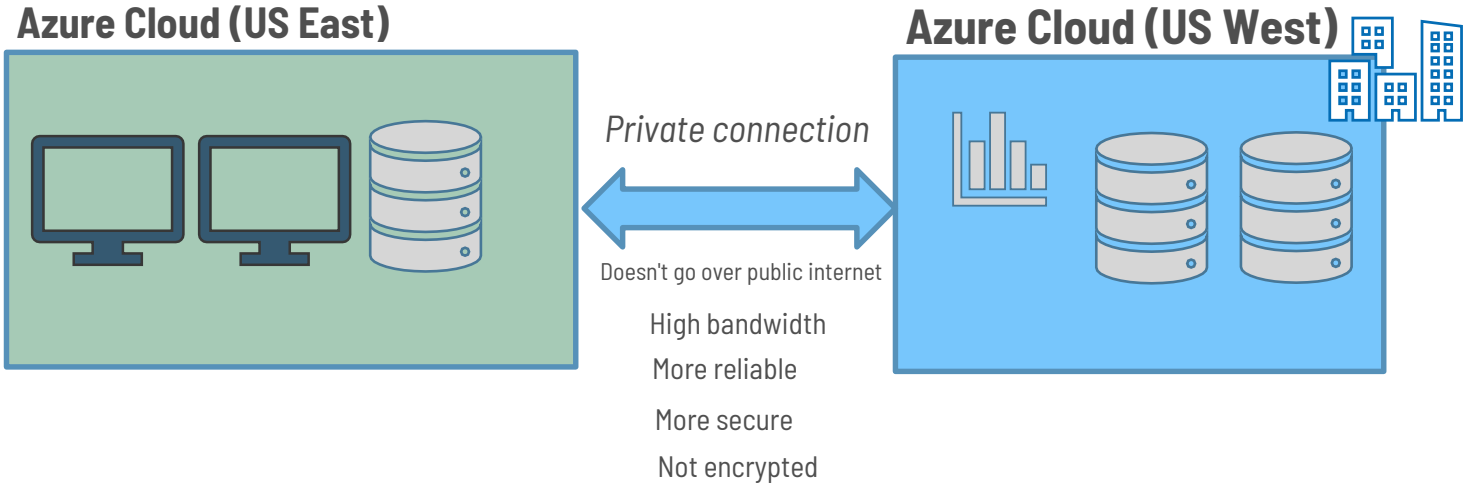
Express Route

What if we need more bandwidth?



Express Route

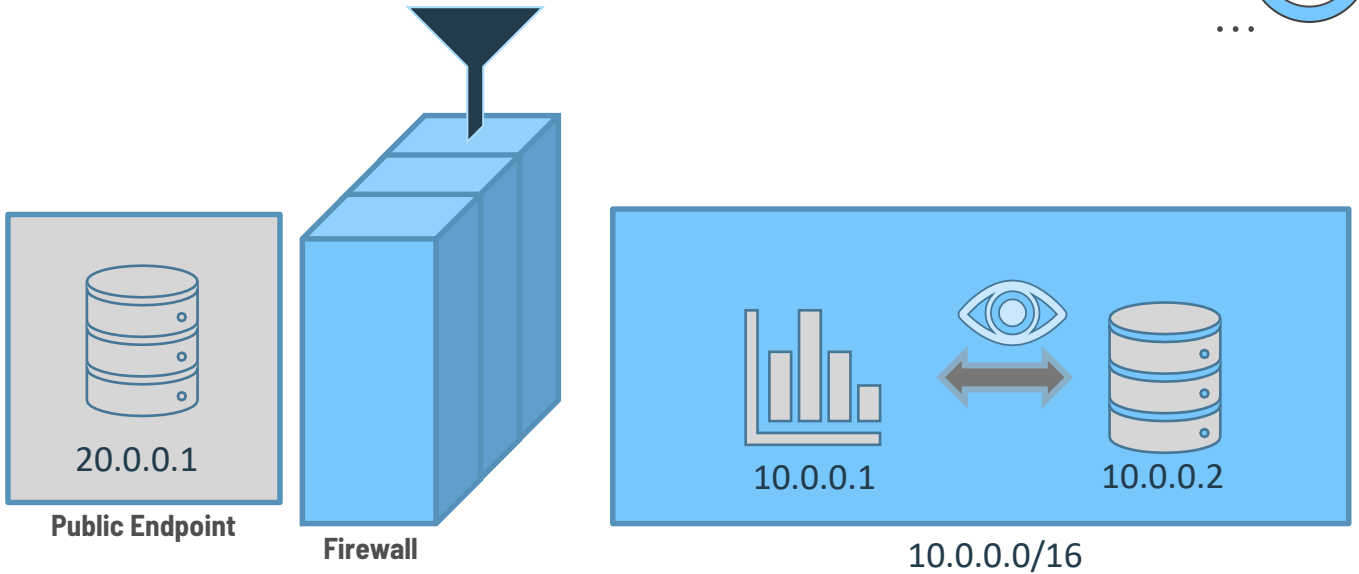
What if we need more bandwidth?



ExpressRoute: Extend on-premises networks into the Microsoft cloud over a private connection with the help of a connectivity provider.

Private & public endpoints

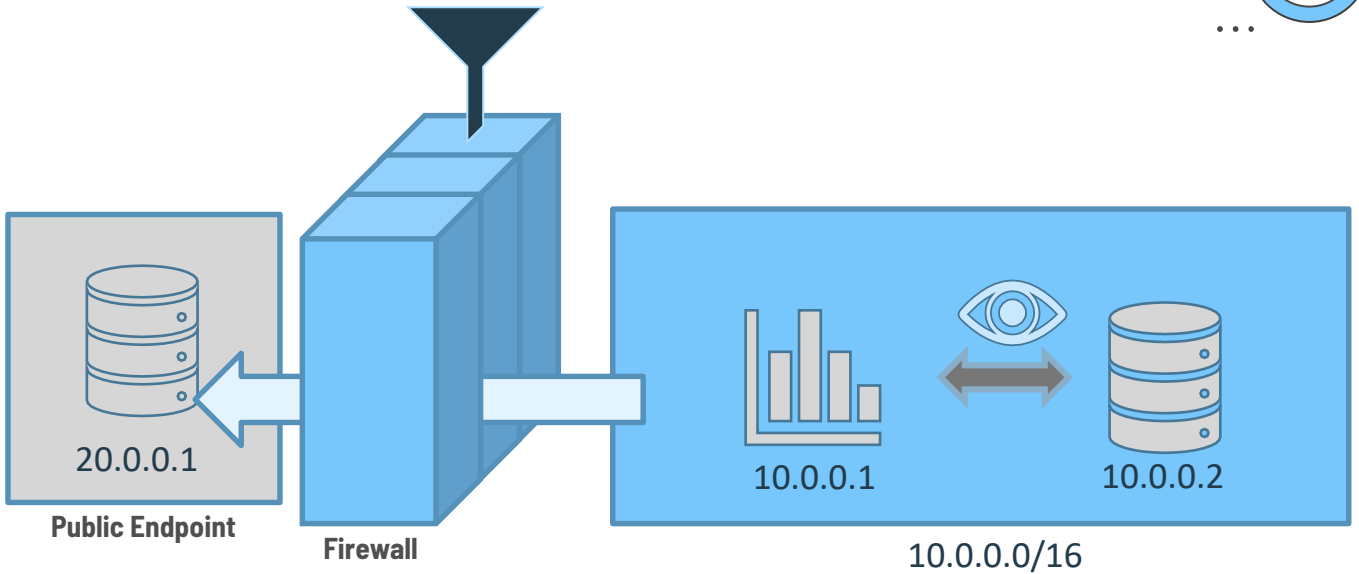
Private & public endpoints



Allow range of IP addresses

VNet

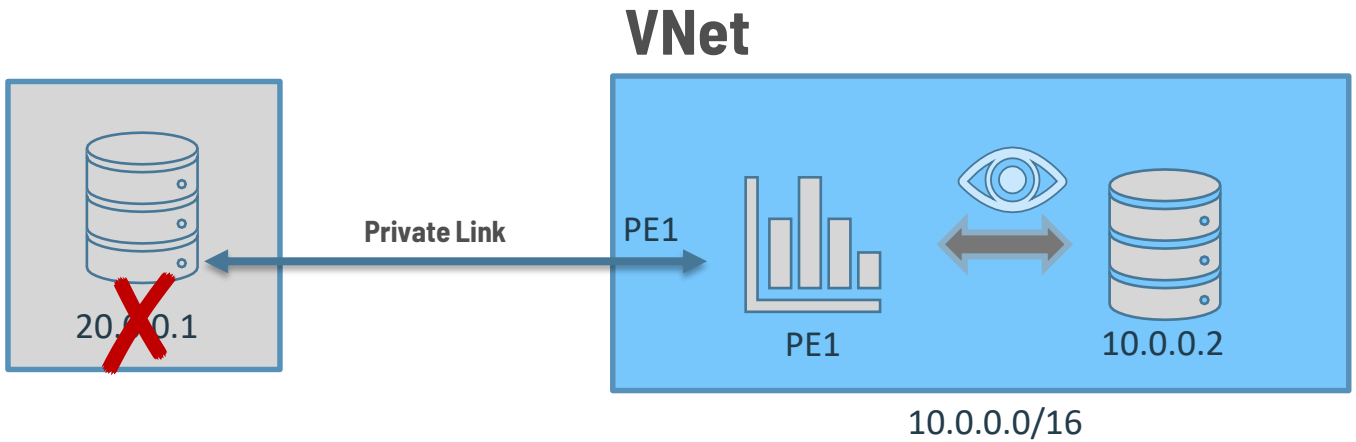
Private & public endpoints



Allow range of IP addresses

VNet

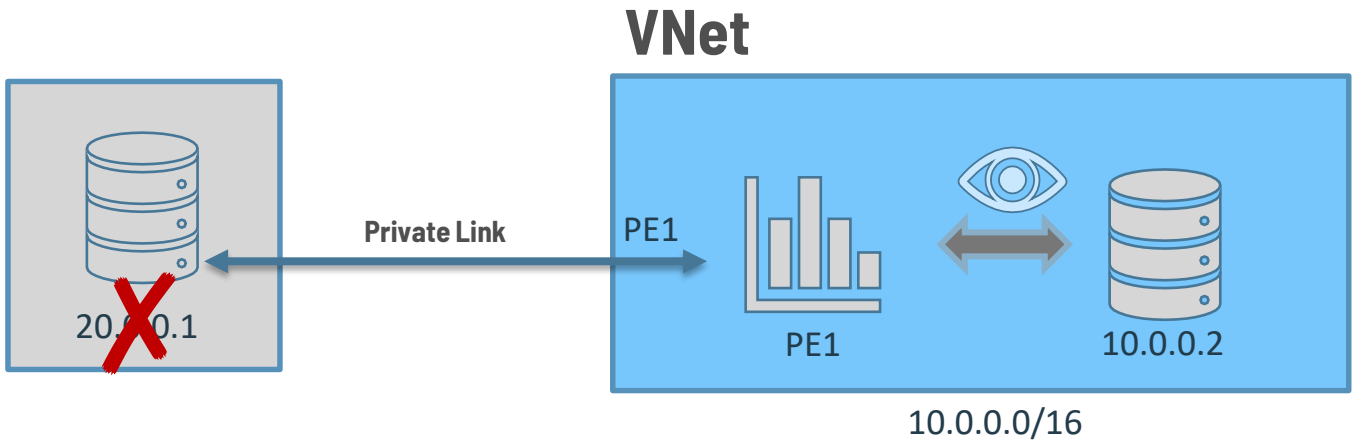
Private & public endpoints



Private Endpoint: *Uses private IP address from virtual network*

Azure Private Link: *Enables private connection to Azure PaaS services (storage account, Cosmos DB etc.)*

Private & public endpoints



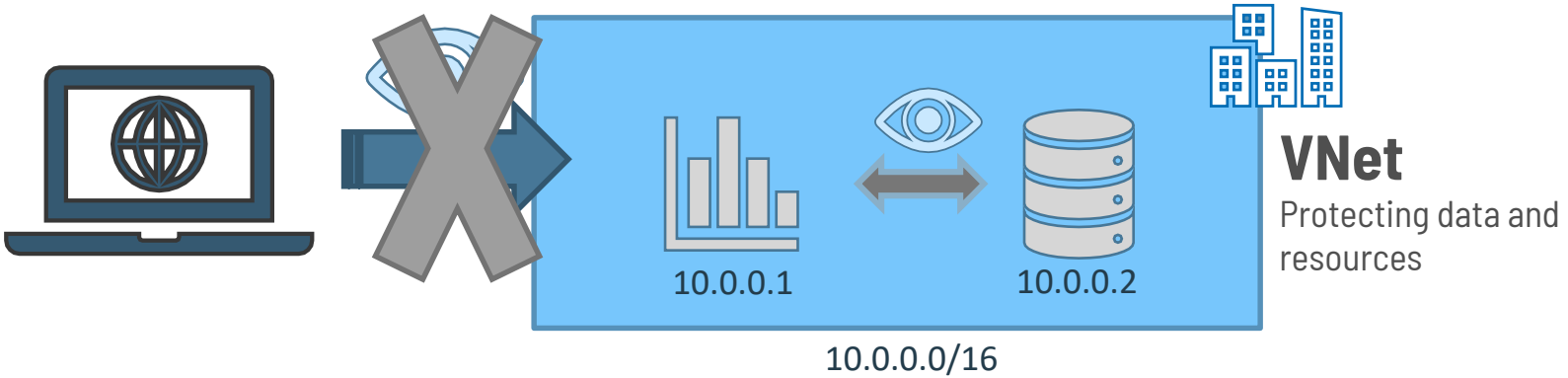
Private Endpoint: *Uses private IP address from virtual network*

Azure Private Link: *Enables private connection to Azure PaaS services (storage account, Cosmos DB etc.)*

Private endpoint brings the service into your virtual network.

Virtual Networks

Enables resources to securely communicate with each other or with users over the Internet



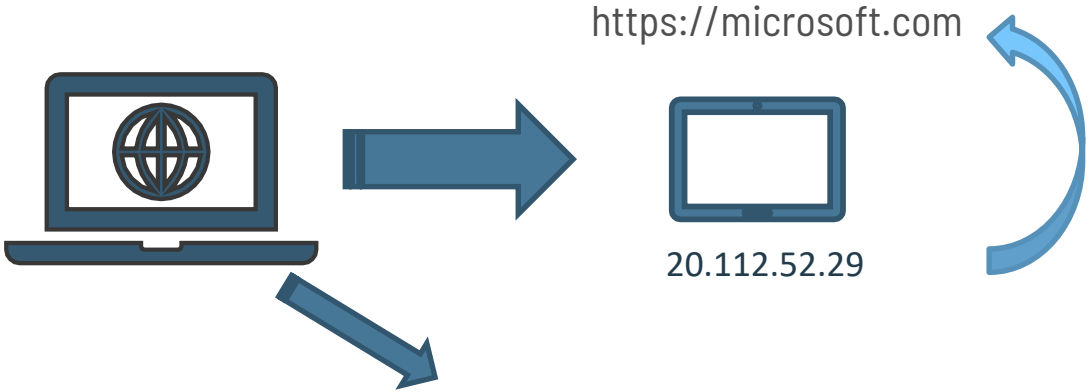
Azure virtual network: *Emulates a physical network in the cloud*

Infrastructure-as-a-Service

Azure DNS

Azure DNS

What is DNS?



https://microsoft.com →	20.112.52.29

DNS: Domain Name System

Azure DNS

https://data-science-academy.com

22.152.18.93

Azure DNS:

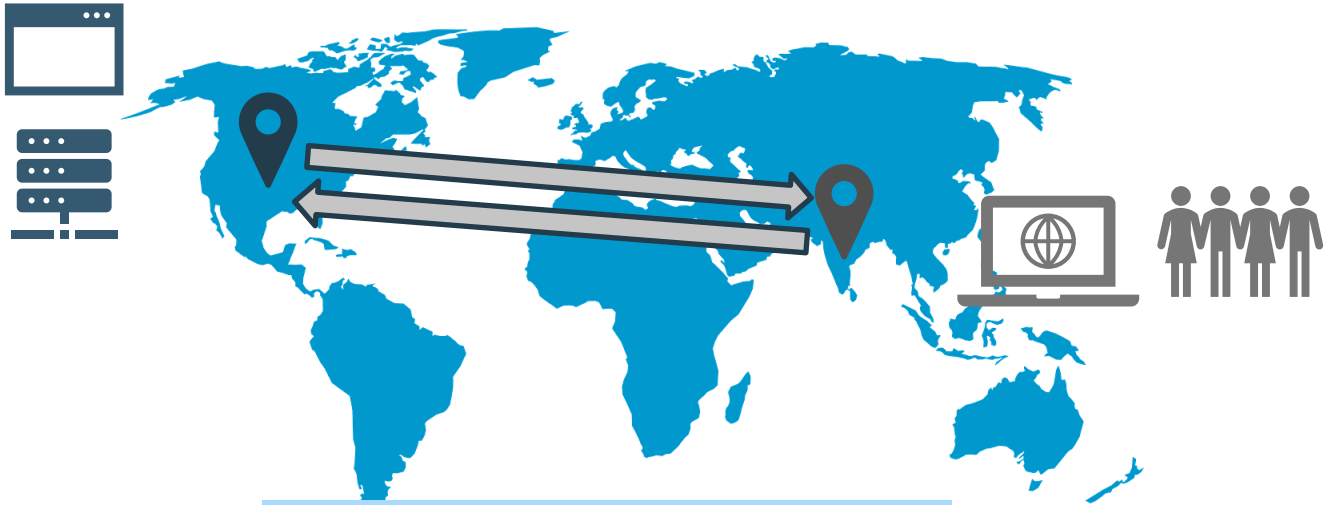
Provides name resolution by using Microsoft infrastrucutre

https://microsoft.com	20.112.52.29

Content delivery network (CND)

Content delivery network (CND)

Global network of servers that efficiently delivers web content to users

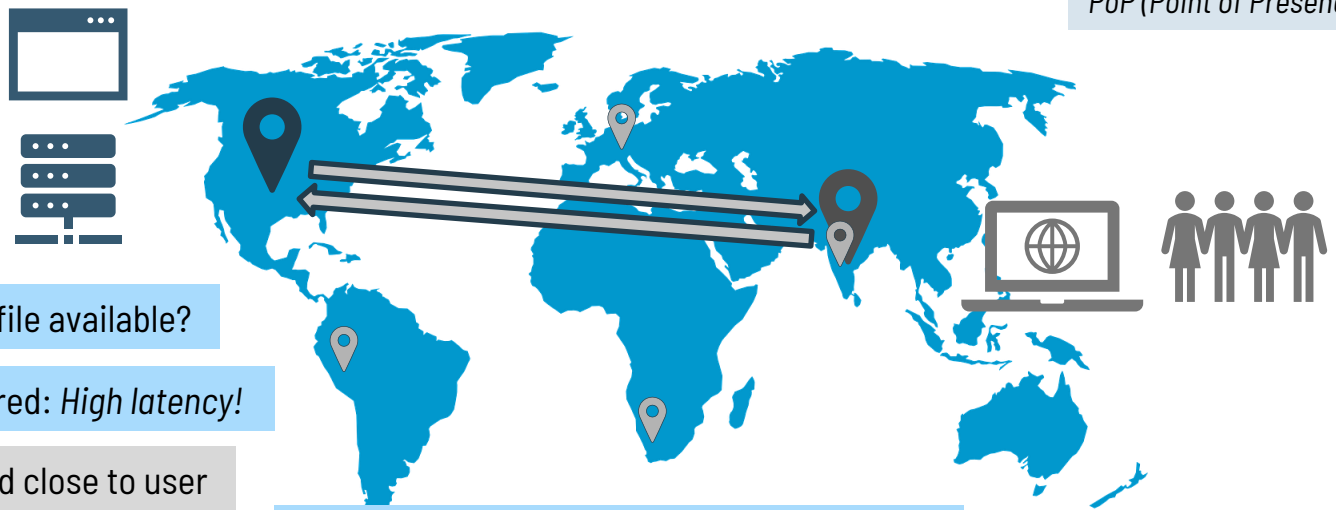


Long distances will result in higher latencies

Content delivery network (CND)

Global network of servers that efficiently delivers web content to users

Edge server
PoP (Point of Presence)



1. Request is sent – file available?
2. File will be delivered: *High latency!*
3. File will be cached close to user
4. Next request: *Low latency!*

Long distances will result in higher latencies

Physical nodes strategically placed around the globe

Better performance and user-experience

Summary

Summary

Virtual Networks

Emulates a physical network

Traffic is isolated and segmented

Secure communication of resources

Cloud resources + local resources

Virtual Subnet

Further segmentation

Public subnet CAN be reached from the public internet

Private subnet CANNOT be reached from the public internet

Public subnet CAN access Privat Subnet

VPN Gateway

Connects an Azure virtual network with an on-premise device or network (Site-to-Site)

Use an encrypted tunnel to connect two or more networks over an untrusted network (public internet)

Cost-effective solution

ExpressRoute

Extends on-premises networks into the Microsoft cloud.

Over a private connection with the help of a connectivity provider.

More bandwidth, more secure, and more reliable

Summary

Private Endpoint

Uses private IP address from your virtual network to bring PaaS services into your virtual network

Delivered via Azure Private Link

Private connection to Azure PaaS services

Azure DNS

Provides domain name resolution by using Microsoft infrastructure

Content delivery network (CND)

Global network of servers that efficiently delivers web content to users

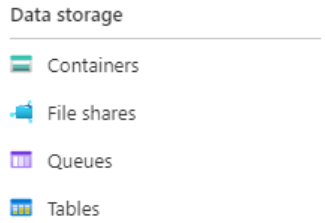
Storage account

Storage accounts

Cloud solution for storing data

Account in which have access to different types of storage services:

- Blobs (Containers)
- File Shares (File shares)
- Queues (Queues)
- Tables (Tables)



⇒ There are other storage-related services (e.g. SQL databases)

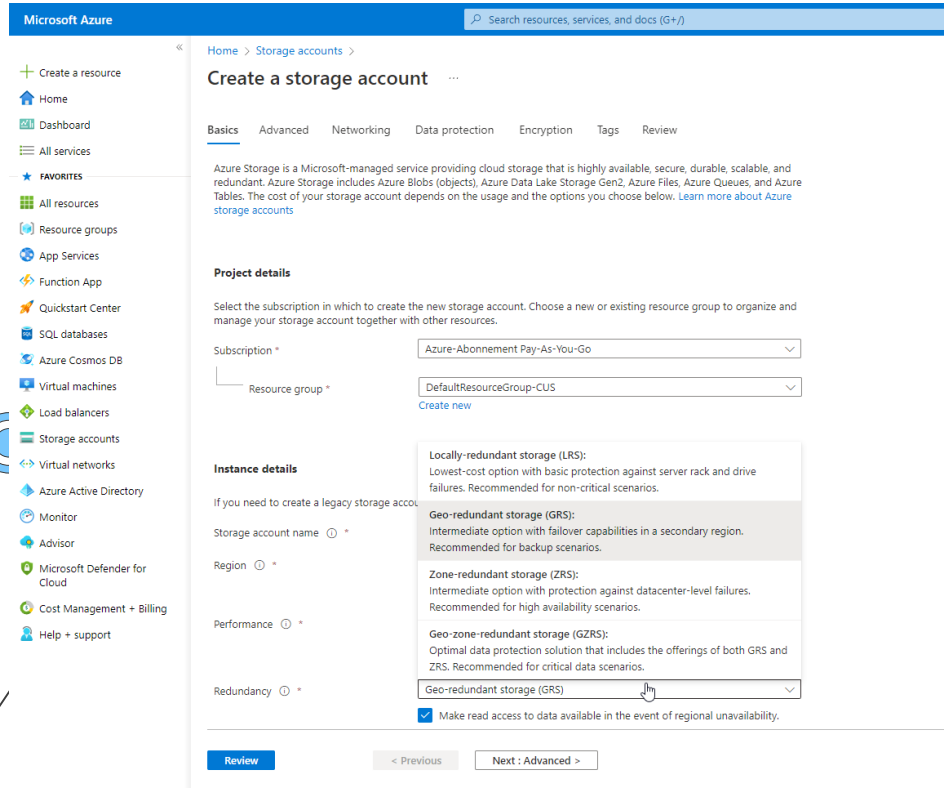
⇒ Most important data storage service

- Access Tier (Hot, cool, archive)
- Redundancy options
- Disc Storage, File Sync, Data Transfer, Data Migration
- Database services

Redundancy Options

Redundancy Options

Protect from planned and unplanned events



- Azure Storage always keeps multiple copies
- Trade-off:
  Higher availability + durability vs. cost

Redundancy Options

Locally redundant storage (LRS)

Three copies **within a single data center**

Lowest cost & least durability

Protects data against server rack and drive failures

Disaster in the data center: Data may be lost

Zone-redundant storage (ZRS)

Three replications **across three Availability Zones**

Separate physical location

Protects data against disaster in a data center

Geo-redundant storage (GRS)

Three copies using LRS in one region

Three copies using LRS in **secondary region**

Paired region based on region pairs

Read-access per default only after failure (RA-)GRS

Protects from regional disaster

Geo-zone-redundant storage (GZRS)

Three replications **across three Availability Zones (ZRS)**

Three copies using LRS in **secondary region**

Maximum durability, availability and consistency

Read-access per default only after failure (RA-)GZRS

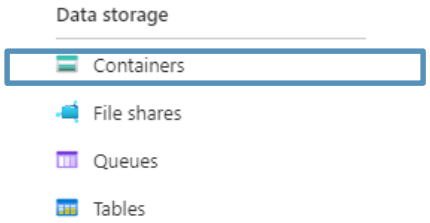
Blob Storage

Blob storage

(**B**inary **L**arge **OB**ject)

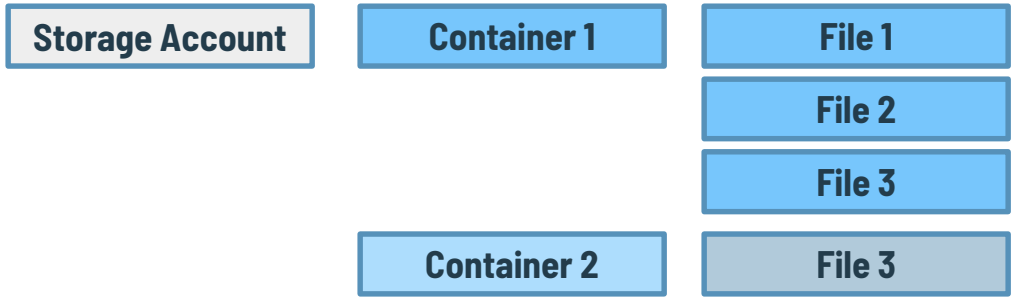
Solution to store massive amounts of unstructured data

⇒ Can be any type of data: Images, documents, backups, videos



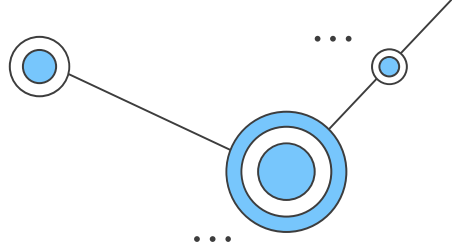
Containers are used to organize the files (like a folder)

Not hierarchical



Access Tiers

Access Tiers



Hot

More expensive storage cost

Cheaper read/write operations

Low latency

Good for ***frequently accessed*** data

Example: Images on a website

Cool

Cheaper storage cost than "Hot"

More expensive read/write operations

Higher latency

Good for ***infrequently accessed*** data

Example: Short-term backup

Older datasets

Archive

Cheapest storage

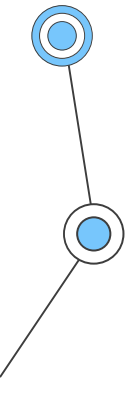
Most expensive access cost

Cannot be read directly (offline tier)

Must be rehydrated to cool or hot before it can be accessed

Example: ***Long-term backup***

Data Archiving



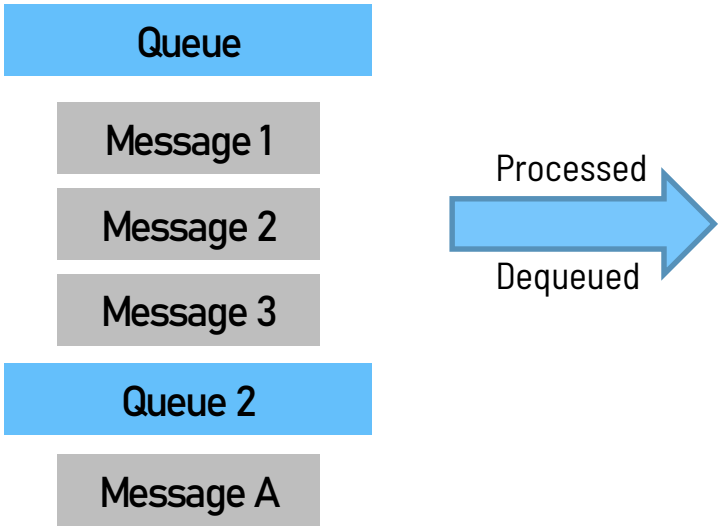
Default at account level: Hot or Cool

Queue storage

Queue storage

storing large numbers of messages

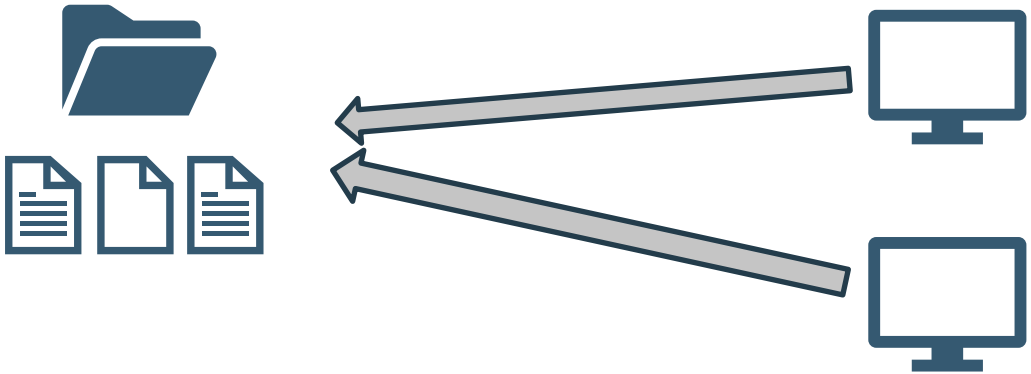
Create a backlog of work (messages)



Azure Files

Azure Files

Managed file shares in the cloud



Can be mounted by cloud or on-premise

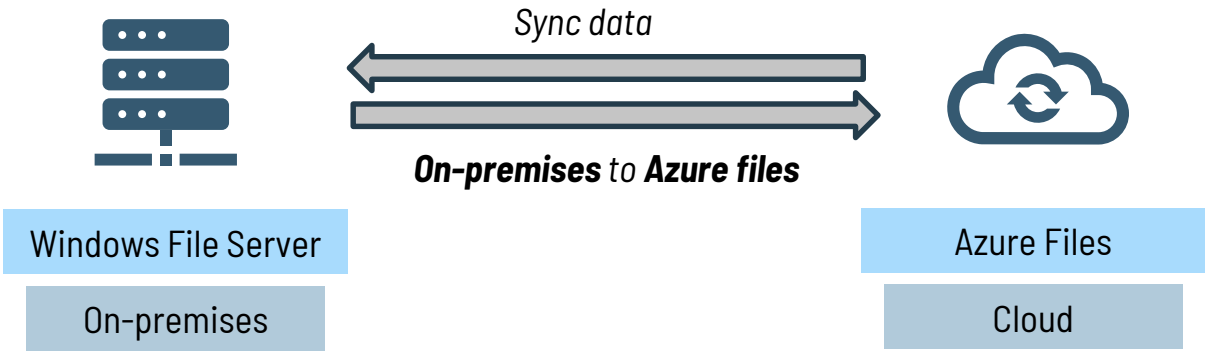
Replace or supplement on-premises file servers:

Can be accessed via *Server Message Block* (**SMB**) protocol or *Network File System* (**NFS**) protocol

File Sync

File Sync

Sync data from on-premises to Azure Files



Use-cases:

- Sync data across multiple sites/offices
- Disaster recovery

How:

- Install File Sync agent on Windows file server
- Add it to Azure File Sync Deployment

Azure Tables

Azure Tables

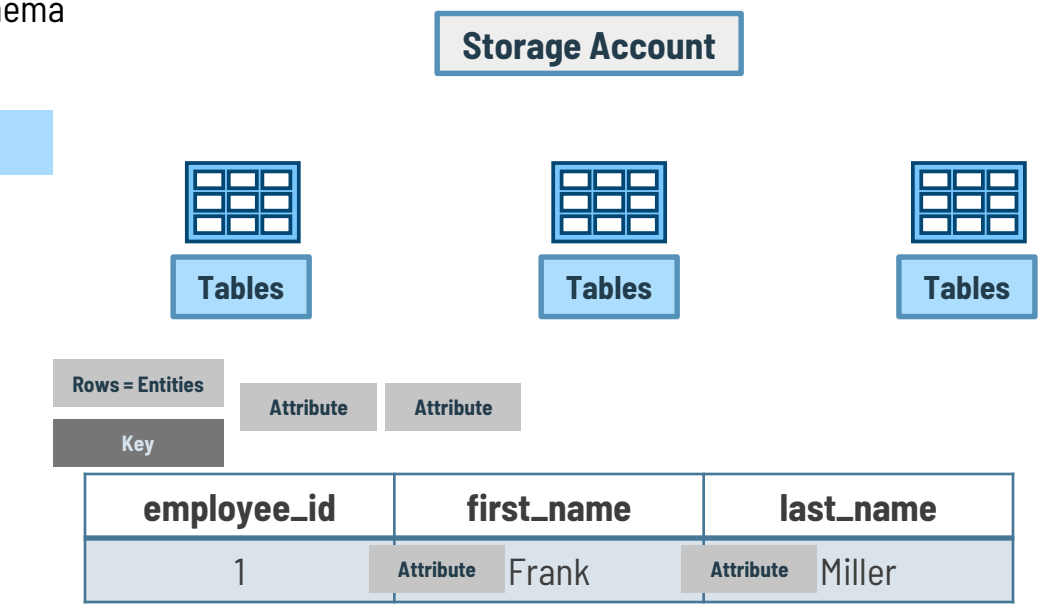
NoSQL (non-relational SQL) database solution

- Very inexpensive (NoSQL) database service
- Key/attribute data storage without schema
- Designed for high volumes of data

Redundancy options | High availability

Use cases:

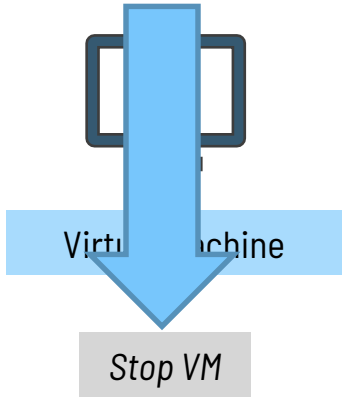
- Store large amount of structured data
- No need for complex joins
- Alternative to Cosmos DB



Disk storage

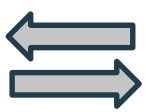
Disk storage

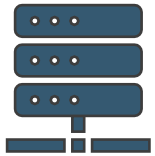
Storage for virtual machines



Virtu chine

Stop VM



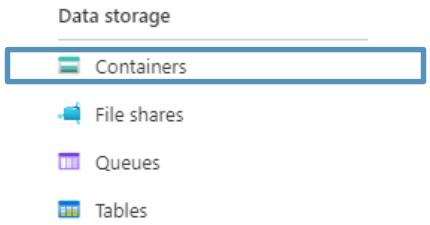


Storage

Still pay for storage

OS disk

data disk



Types

Standard HDD

Standard SSD

Premium SSD

Premium SSD

Managed Disks

Unmanaged Disks

Containers (Blob Storage) used for disks

AzCopy

AzCopy

Command-line tool to copy data to and from storage accounts

- Can be downloaded to Windows or Linux
- Used within Azure Cloud Shell
- Upload, download, sync or transfer files and blobs

```
azcopy [command] [arguments] --[flag-name]=[flag-value]
```

```
azcopy copy 'file-link-with-sas-key''container-link-with-sas-key'
```

Command	Description
azcopy copy	Copies source data to a destination location
azcopy list	Lists the entities in a given resource.
azcopy remove	Delete blobs or files from an Azure storage account.
azcopy make	Creates a container or file share.

Azure Migrate

Azure Migrate

Centralized platform that provides guidance and planning for migrations

Pre-migration steps

Discover → Dependency analysis → Assess

Cost analysis

Tools to help with migrations

Servers | Databases | Virtual Machines

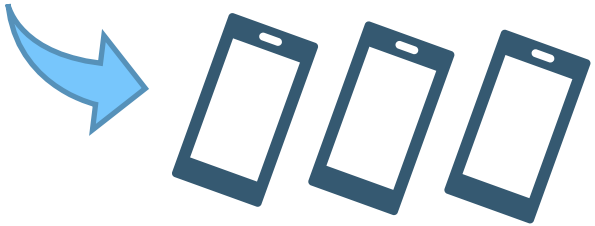
Web Apps | Data

Data Box

Data Box

Device to transfer TBs of data in and out of Azure

Data upload can very time consuming



Data Box device

Ordered via portal

Regional carrier

Azure datacenter

Quick | Inexpensive | Reliable | Secure

Data Box

Use-cases

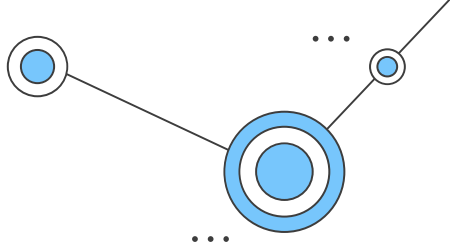
- Import & export
- > 40 TB
- No to limited network connectivity

- ❑ One-time migration
- ❑ Initial bulk transfer
- ❑ Periodic incremental transfers

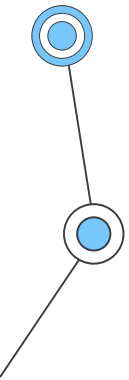
Workflow

Azure Marketplace

Azure Marketplace



- **Third-party companies** offer additional applications and services
- Accessed from within Azure portal
- Everything has been certified



Summary

Summary

Storage Account

Cloud solution for storing data

Account that offeres different storage services

Redundancy options

Locally redundant storage (LRS)	Zone-redundant storage (ZRS)
Geo-redundant storage (GRS)	Geo-zone-redundant storage (GZRS)

Access Tier

Blob Storage

Solution to store massive amounts of unstructured data

Any type of data: Images, documents, backups, videos

Queue Storage

Storing large numbers of messages

Azure Files

Managed file shares in the cloud

Can be mounted by cloud or on-premise

Replace or supplement on-premises file servers

Azure Sync

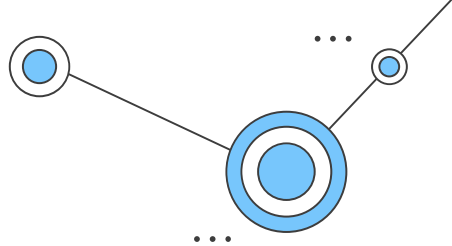
Sync data from on-premises to Azure Files

Azure Tables

Inexpensive NoSQL database service

Basic structured data

Summary



Disk storage

Storage for virtual machines
Still pay for storage
Containers (Blob Storage) used

AzCopy

Command-line tool to copy data to and from storage accounts

Storage Explorer

Convenient tool to manage storage resources from Desktop

Azure Migrate

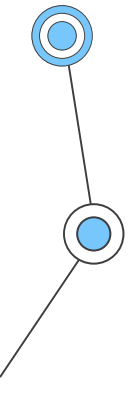
Centralized platform that with tools for planning migrations

Data Box

Device to transfer TBs of data in and out of Azure

Azure Marketplace

Trusted third-party companies offer additional applications



Authentification vs. Authorization

Authentification vs. Authorization

Authentification

Are you who you say you are?

Proving that you are who you say

Password

Verification of identity

Multi-factor authentification

Authorization

What is the authenticated person allow to do?

Granting permission to an authenticated party to do something

Role-based access control (RBAC)

Azure Active Directory (Azure AD)

Azure Active Directory (Azure AD)

Azure's identity and access management service

Helps employees to access resources and applications

Managed service - "identity-as-a-service"

Microsoft 365

Azure portal

Resources

Identities

Manged by **Azure AD**

Authentification

Authorization

Users

Credentials

Groups

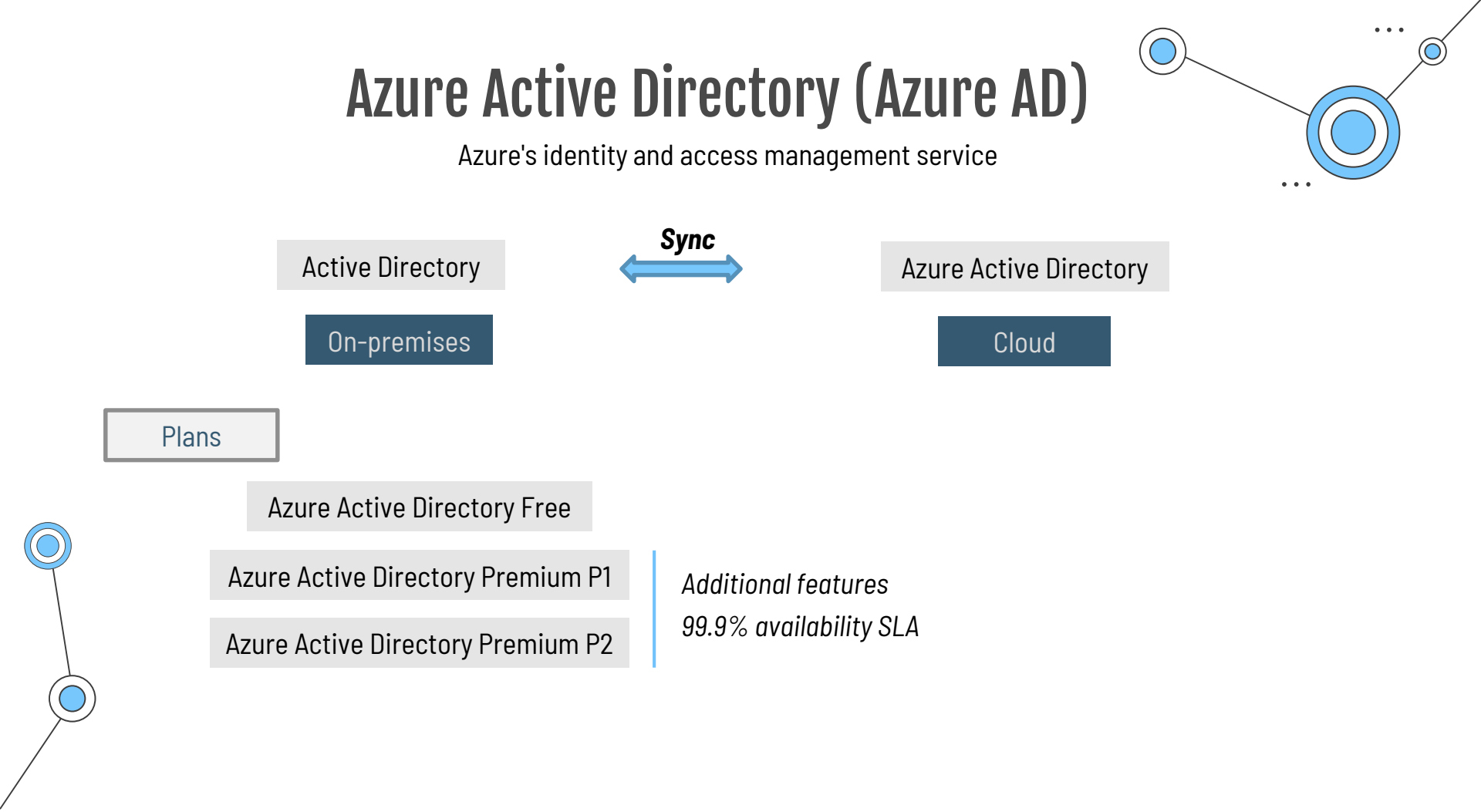
Multi-factor authentification

Single-sign-on (SSO)

Guest access

Azure Active Directory (Azure AD)

Azure's identity and access management service



Azure Active Directory (Azure AD)

Azure's identity and access management service

Azure account

Tenant

= Organization

Azure Active Directory Instance

Distinct identities & settings

Tenant 2

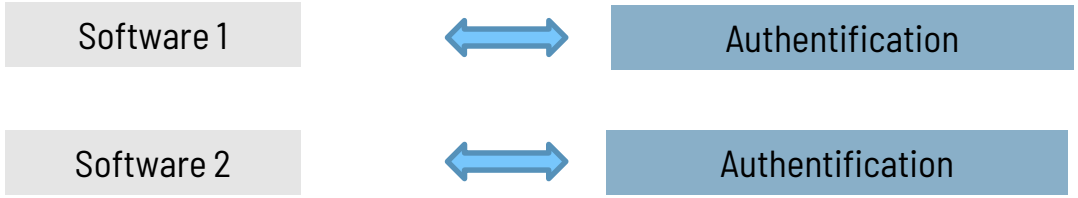
Azure Active Directory Instance 2

Distinct identities & settings

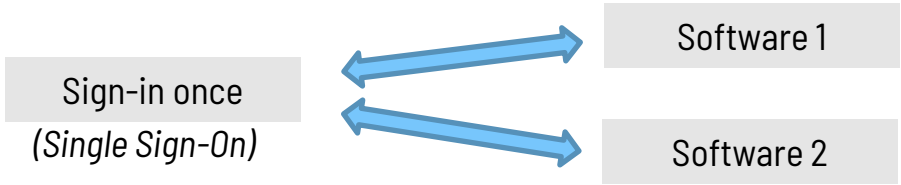
Single sign-on (SSO)

Single sign-on (SSO)

Sign in with one set of credentials to multiple independent software systems



Insecure + Inconvenient



Azure AD

Easy to manage + more secure

Multi-Factor Authentication

Multi-Factor Authentication

Additional method of authentication

Username: nikolai.schuler@[...].com

Password: **********

Authentication

Password can get found out!

One way:
Conditional Access

2nd authentication factor

Something you …

… Know

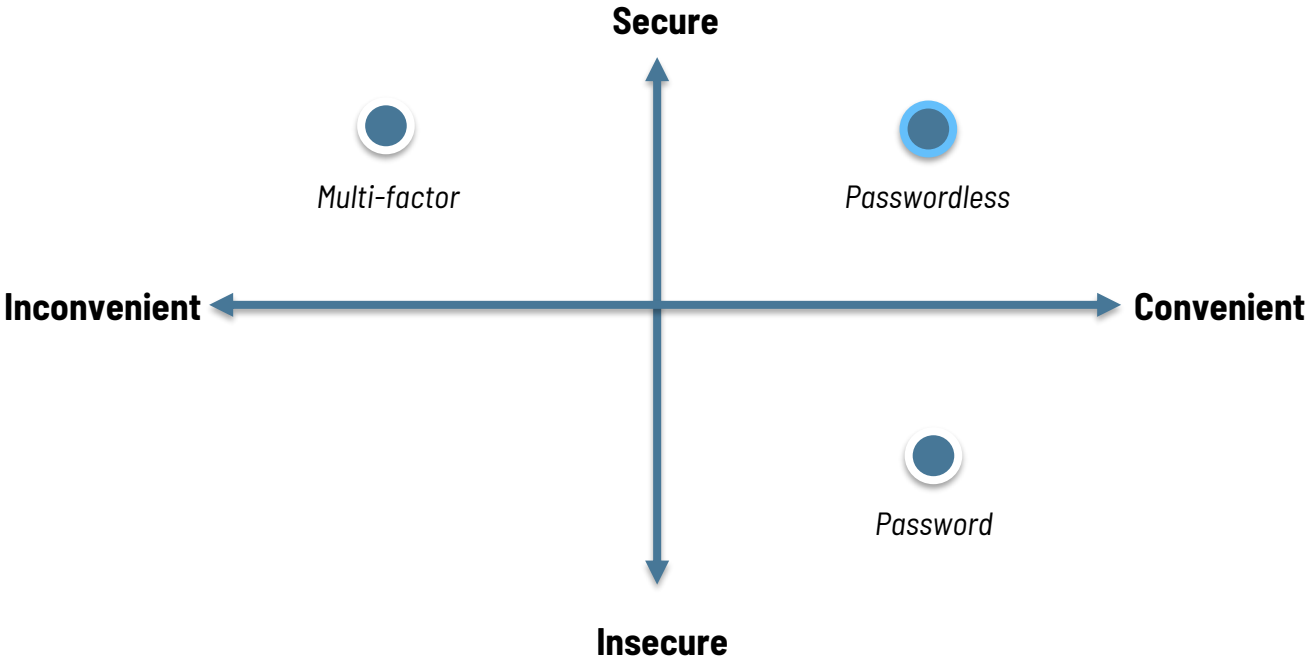
… Have

… Are

Password: **********

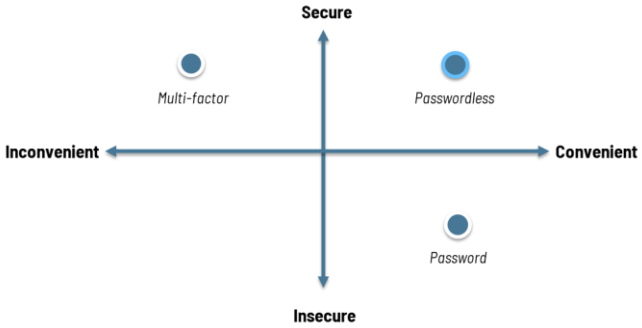
Passwordless authentication

Passwordless authentication



Passwordless authentication

More secure + more convenient



3 passwordless options

Windows Hello for Business	Credentials connected to Windows device *Face recognition, 4-digit PIN*
Microsoft authenticator app	App on user's phone *Push notification + PIN or biometrics*
FIDO2 Security Key	Open standard for passwordless *Hardware devices like finger print etc.*

All supported by Azure AD!

Guest access

Guest access

Inviting external users

Internal users

Members of the organisation

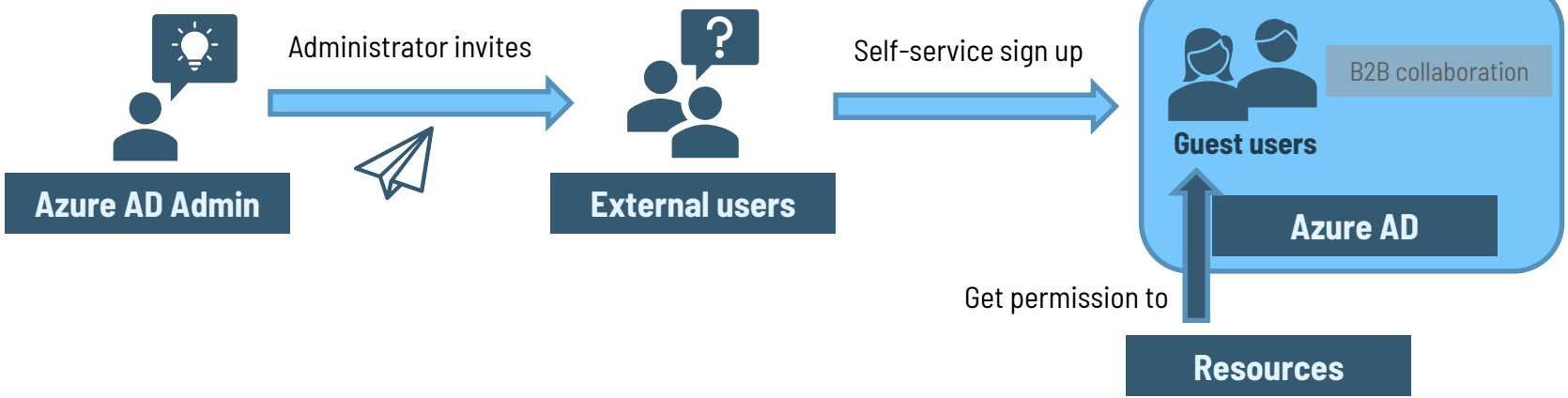
External users

Not members of the organisation

From different tenant or not Azure users at all

Guest access

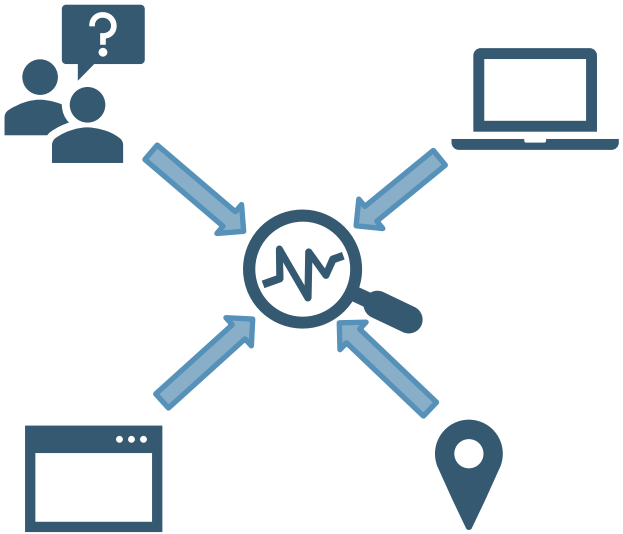
Inviting external users



Conditional access

Conditional access

Including intelligent signals in access control decisions



USER

LOCATION

DEVICE

BEHAVIOR

SIGNALS

Acess allowed

Block access

Limited access

MFA required

Password change required

DECISION

Conditional access

Including intelligent signals in access control decisions

Examples:

- Administrators always require MFA
- Access from specific countries is not allowed at all
- Unusual location requires MFA
- User outside of the company's network generally require MFA

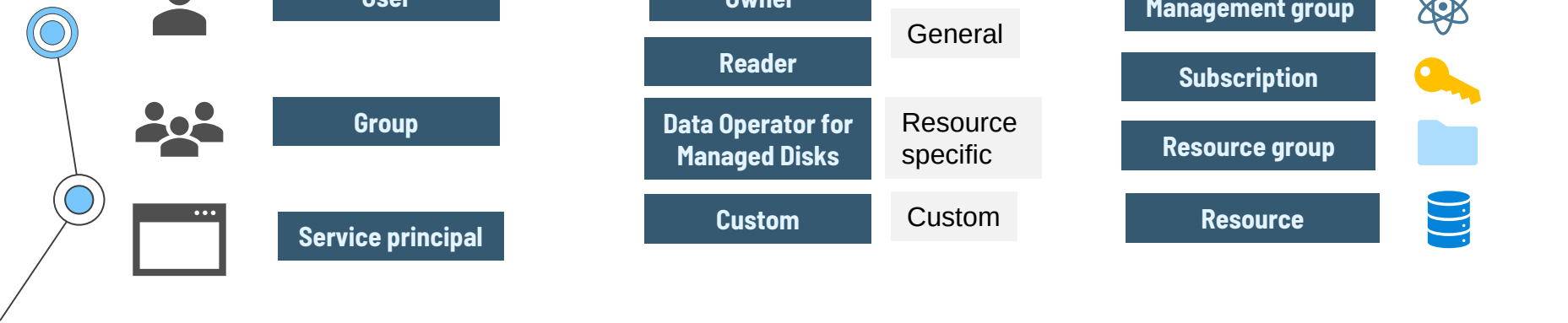
Role-based access control (RBAC)

Role-based access control (RBAC)

Access management to resources

Authorization: Configure access for users and groups to resources

Example: Allow one user to manage all SQL databases in a resource group.



Role-based access control (RBAC)

Access management to resources

Examples:

- ***One user*** gets assigned the role ***Reader*** to an ***entire resource group.***
- ***One user group*** gets assigned the role ***Storage account contributor*** to ***three storage accounts.***

Security principal	Role	Scope

Zero Trust

Zero Trust

Modern security principals

Strategy: Follow the following security principals:

- **Assume breach**

  End-to-end encryption, network segmentation, analytics, threat detection, continuous monitoring, updates

- **Use least privilege access**

  Limit access to what is just enough

  Just-In-Time (JIT) and Just-Enough-Access (JEA)

- **Verify explicitly**

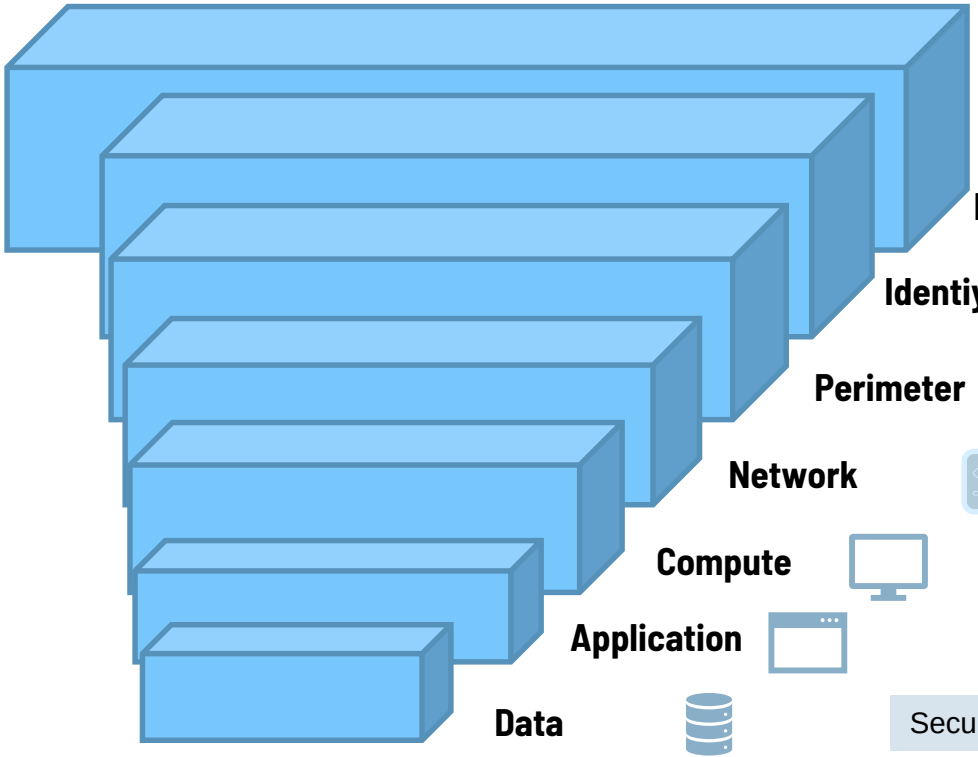
  Use all data points and every opportunity to authenticate and authorize

Zero Trust mindset: “assume breach, never trust, always verify”

Defense in depth

Defense in depth

Multiple layers of security



Physical Security — Physical building

Identiy & Access — Azure AD, SSO, MFA

Perimeter — DDos Protection, Perimeter firewalls

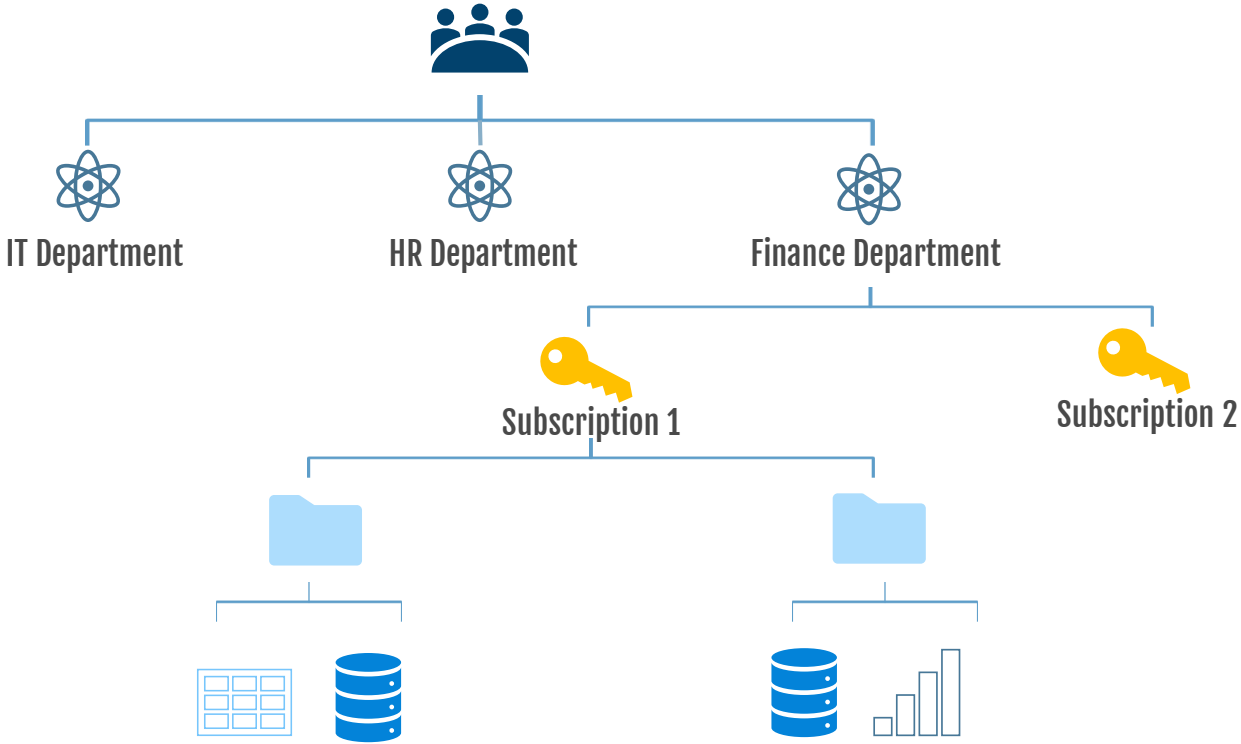
Network — Limit communication between resources

Compute — Secure access to VMs

Application — Secure application design

Data — Secure data storage, encryption

Subscription and management groups



Azure Account

Management groups

Subscriptions

Resource groups

Resources

Microsoft Defender for Cloud

Microsoft Defender for Cloud

Security tools for cloud and on-premises

Azure cloud | **Multicloud** | **On-premises**

Security posture

Security score that continuously assesses your security situation

Security recommendations

Recommendations as step-by-step actions on how to improve your security posture

Alerts

Defends in real-time and sends alerts

Continous Assessment

Secure

Defend

Two pillars of security

CSPM
Cloud Security Posture Management

Free service

CWPP
Cloud Workload Protection Platform

Paid service

Microsoft Defender for Cloud

Security tools for cloud and on-premises

Security posture | **Continous Assessment**

- Security score = assessment of vulnerabilities
- Regulatory compliance
- Asset inventory

Free services

Security recommendations | **Secure**

- Security recommendations
- Just-in-time VM access
- Adaptive application controls

Alerts | **Defend**

- Security alerts
- Defends and detects
- Intelligent threat detection

Paid service

Summary

Summary

Authentication

Proving that you are who you say

Authorization

Granting permission to an authenticated party to do something

Multi-factor Authentication

Additional method of authentication

Biometrics or trusted device

Azure AD

Manged service for identity and access management (Azure & O365)

Azure AD Connect: Sync on-premise Active directory & Azure AD

Free plan and premium plans (99.9% availability)

Authentication & Authorization

Distinct from other resources & services

Invite exernal users (guest users)

Single sign-on

One set of credentionals to sign in to multiple systems

Passwordless

Secure + convenient

- Windows Hello for Business
- Microsoft authenticator app
- FIDO2 Security Key

Summary

Conditional access

Including intelligent signals in access control decisions

E.g. Administrator needs to use MFA

Role-based access control (RBAC)

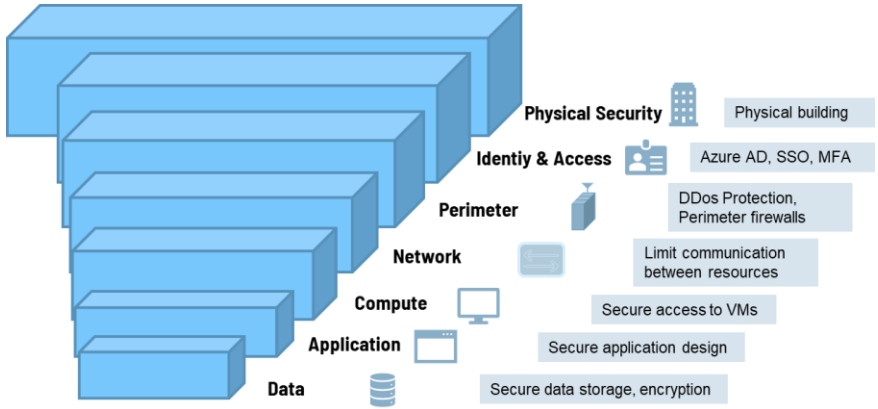
Authorization: Configure access for users and groups to resources

Allow one user to manage all SQL databases in a resource group

Zero Trust

Security principals: Assume breach, never trust, always verify!

Defense in depth



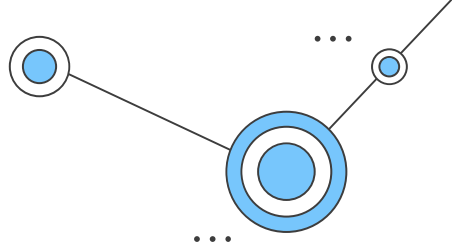
Microsoft Defender for cloud

Security tools for cloud (Azure + multicloud) and on-premises

Security score, security recommendations and alerts

Cost affecting factors

Cost affecting factors



Subscription type

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

Resource type

- Free resources
- Consumption model

Usage

Usage metrics: How many operations, how much time, how much storage?

Configuration

How much CPU? OS type? Redundancy options?

Region

Different prices depending on region

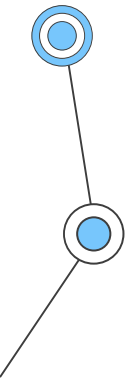
Reserved capacity

Discounts for 1-year, 3-year reservations for VMs

Bandwidth

Free: Inbound
Within same region

Not free: Outbound
Across different regions



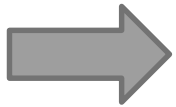
Pricing calculator

Pricing calculator

Calculate cost estimation for a planned project in Azure

Estimates

- Subscription type
- Resource type
- Usage
- Configuration
- Region
- Reserved capacity
- Bandwidth



Monthly or hourly cost estimates

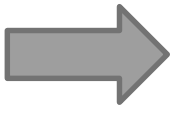
Cost estimation tool

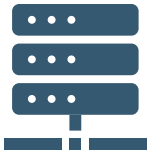
Total cost of ownership calculator

Total cost of ownership calculator (TCO)

Calculates the **total cost of ownership & cost savings**

On-premises





All costs combined

Saving potential

when migrating to the Azure cloud

Cost Management and Billing tool

Cost Management and Billing tool

Manage cost and usage of resources

- Breakdown of costs over time and by resources
- Analyze costs
- Set budgets and alerts
- See invoices
- Manage billing options

Reducing costs

Reducing costs

Reserved instances

- Discounts on reservation options
- Paying upfront for 1-year or 3-years

Spot pricing

- Bid for available capacity
- Deep discounts
- Instances can be interrupted without prior notice

Hybrid Benefit

- If you already have on-premises license you can use it in the cloud
- Choose cost-effective OS

Delete unused resources

Deallocate VMs when not used

Migrate from IaaS to PaaS

Tags

Tags

How can we categorize resources?

- By using resource groups 
- Using ***tags***

Department	Finance	Reporting	Marketing
Cost Center	1002	1003	
Environment	Dev/Test	Prod	
Site	USA	India	Germany

Tags

How can we categorize resources?

- Using ***tags***

Most typically used for billing purposes!

Resources can be filtered by tags

Name	***Values***		
Department	Finance	Reporting	Marketing
Cost Center	1002	1003	
Environment	Dev/Test	Prod	
Site	USA	India	Germany

Tags

Tags are labels

- *Name – value* pairs that can be applied to resources

Group and categorize

- Important for *cost and billing*

Not inherited!

- Tags are not inherited through hierarchy

Can be enfornced

- Certain tags can be set to mandatory by Azure Policies

Summary

Summary

Cost factors

Subscription type, resource type, configuration, usage metrics, region, reserved capacity, license discounts, bandwidth

bandwidth: inbound & within region free
outbound & inter-region not free

Cost saving options

Reserved instances

Hybrid benefit (license from on-premises)

Spot pricing

Delete unused resources, deallocate (stop) VMs

Migrate from IaaS to PaaS

Pricing calculator

Cost estimation tool to estimate cost for resources

TOC calculator

Calculates the total cost of ownership & cost savings when migrating to the Azure cloud

Tags

Labels to categorize resources

Important for cost and billing

Will not be inherited

Can be enforced by Policies

Azure Policies

Azure Policies

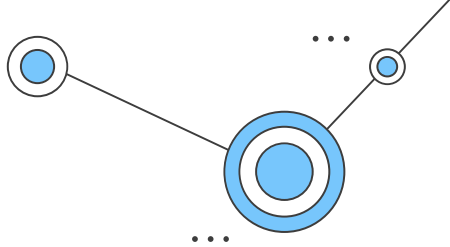
Enforce standards and compliance

- Resource consistency
- Regulatory compliance
- Security
- Cost
- Management

Examples

- Some resources types can only be created in one region
- Enforcing specific tags
- Allowing only specific VM sizes

Azure Policies



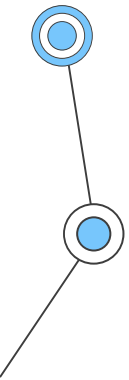
- Can be applied to different **hierarchy level**:

  Management groups, subscriptions or resource groups

Policy initiatives

Grouping of a set of policies

Built-in policies, e.g. ISO standards



Azure Policies

How they work

Policy definition

- Business rules (JSON format)

Policy assignment

- Assignment them to a given scope (e.g. subscription, management group)

Policy effect

- E.g. *Append* (add tags automatically)
- *Audit* (create a warning in the activity log when evaluated to non-compliant)
- *Deny* (resource cannot be updated or created when non-compliant)

Azure Blueprints

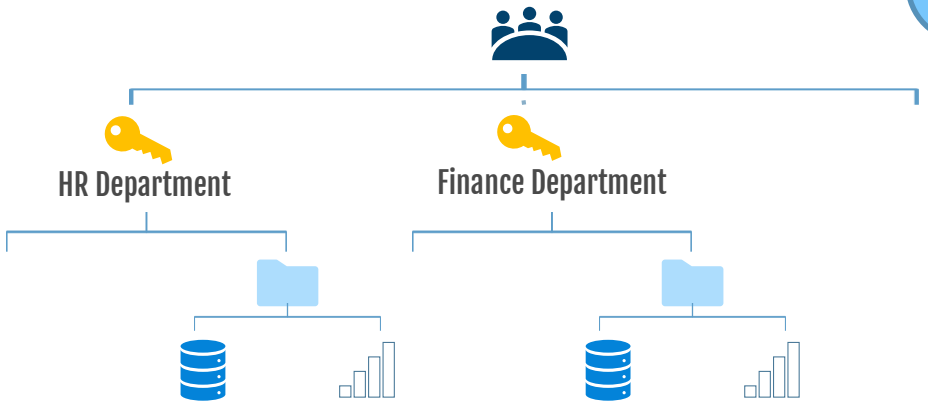
Azure Blueprints

Defined package of reusable resources

Rapidly build new environments

Governance framework that can be deployed easily

Ensures **compliances**



ARM template

Resource groups

Policies

Role assignments

Template

1. *Define*

2. *Assign*

Subscription

Azure Locks

Azure Locks

Protect from accidental deletion and modification

First the lock needs to be removed before deleting resource

Delete — Can read and modify but not delete

Read-only — Can read but not modify and delete

Works across all users and roles

Can be applied on ...

Subscription

Resource group

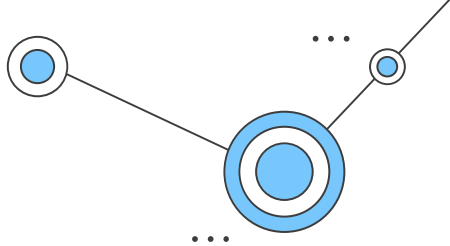
Resource

It will be inherited!

Multiple locks can be applied

Service Trust Portal

Service trust portal



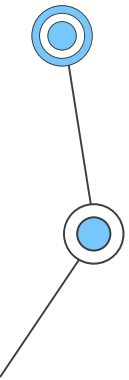
Privacy Statement

How Microsoft collects, processes, uses, and protects personal data.

Service Trust portal

A website that provides all documents around how Microsoft complies with regulations, compliance and security

- Compliance certifications (like ISO 27001)
- Security: How data is encrypted and backed up
- And more



Summary

Summary

Policies

Enforce standards that can be applied to
Management groups, subscriptions or resource groups

Important to comply with regulations and standards

Initiative: Group of policies

Locks

Prevent accidental deletion or modification

Delete or Read-only

Multiple locks can be applied

Will be inherited

Blueprints

Define a package of artifacts that can be reused at large scale

Quickly build new environments with consistency
and set standards

Applied to subscription level

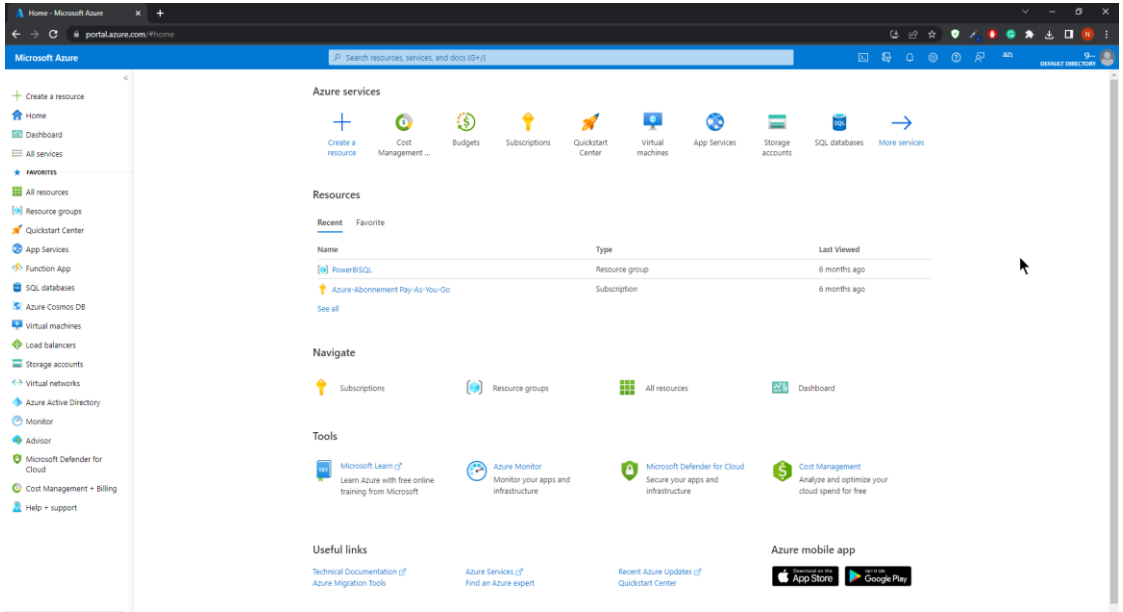
Service Trust Portal

Website that contains documentation and certifications about how Microsoft complies with the relevant regulations

Privacy statement: How Microsoft collects and uses personal data

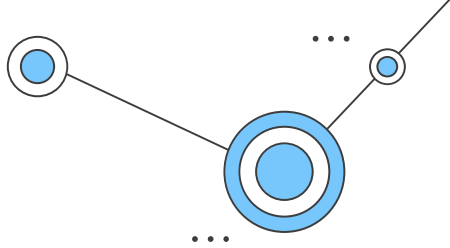
Azure Portal

Browser-based graphical user interface



Can be accessed with any device that has a browser

Azure Portal + Mobile App



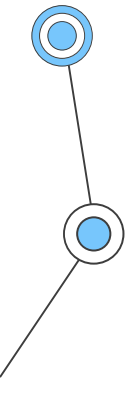
Benefits

Graphical interface, easy to learn, easy to manage

Downsides

For bulk tasks it can be tedious

Not ideal for repeatable tasks and automation



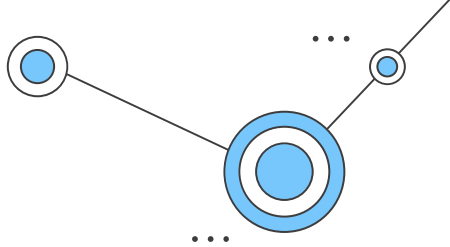
Alternative: Azure CLI and Azure Power Shell

Azure Mobile App

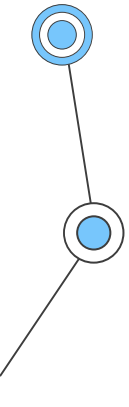
Android + iOS

Limited options but it is mobile

Azure CLI + Azure Power Shell



- *Command-line tools that allow to create and manage resources*
- *Repeatable tasks, bulk creation/management*
- *Cross-plattform, installable on Windows, MacOS and Linux*
- *Overlapping functionality*
- *Main difference: Syntax*
- *Which one to choose: Depending on your previous experience and current work environment*



Azure CLI

Azure CLI is similar to Bash scripting

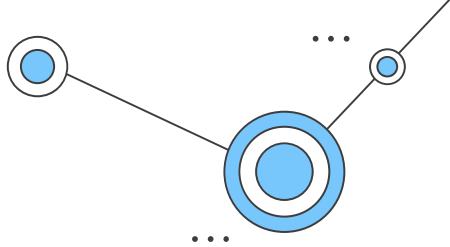
If you mainly work with Linux systems, it feels more familiar

Azure Power Shell

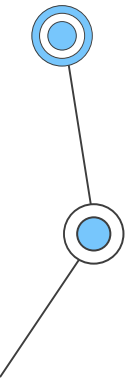
You can use Windows Power Shell for Azure Power Shell

If you mainly work with Windows systems, it's more natural

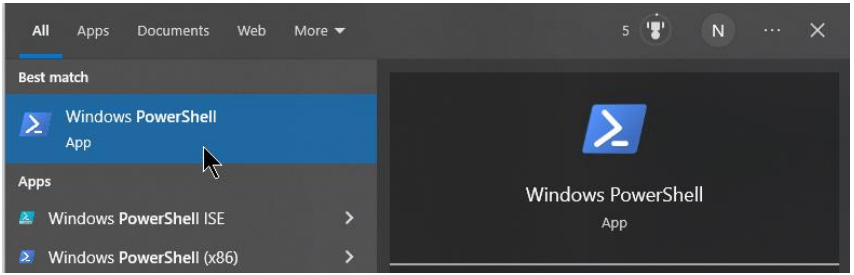
Azure CLI + Azure Power Shell

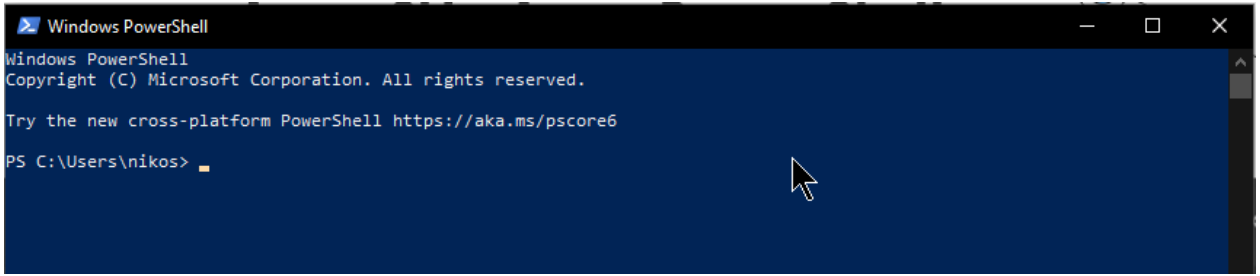


Command	Azure CLI	Azure PowerShell
Sign in with Web Browser	`az login`	`Connect-AzAccount`
List VMs	`az vm list`	`Get-AzVM`
Get Help	`az --help`	`Get-Help`
List Azure Locations	`az account list-locations`	`Get-AzLocation`



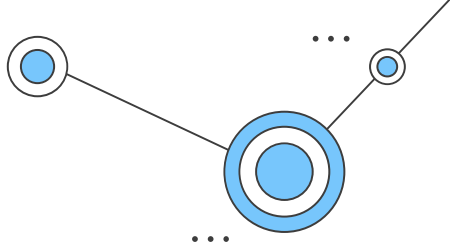
Azure Power Shell Installation





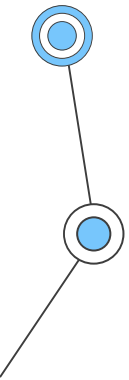

```
Install-Module -Name Az -Scope CurrentUser -Repository PSGallery -Force
```

Azure CLI Installation



Can be installed and run from Windows Command Promt or PowerShell

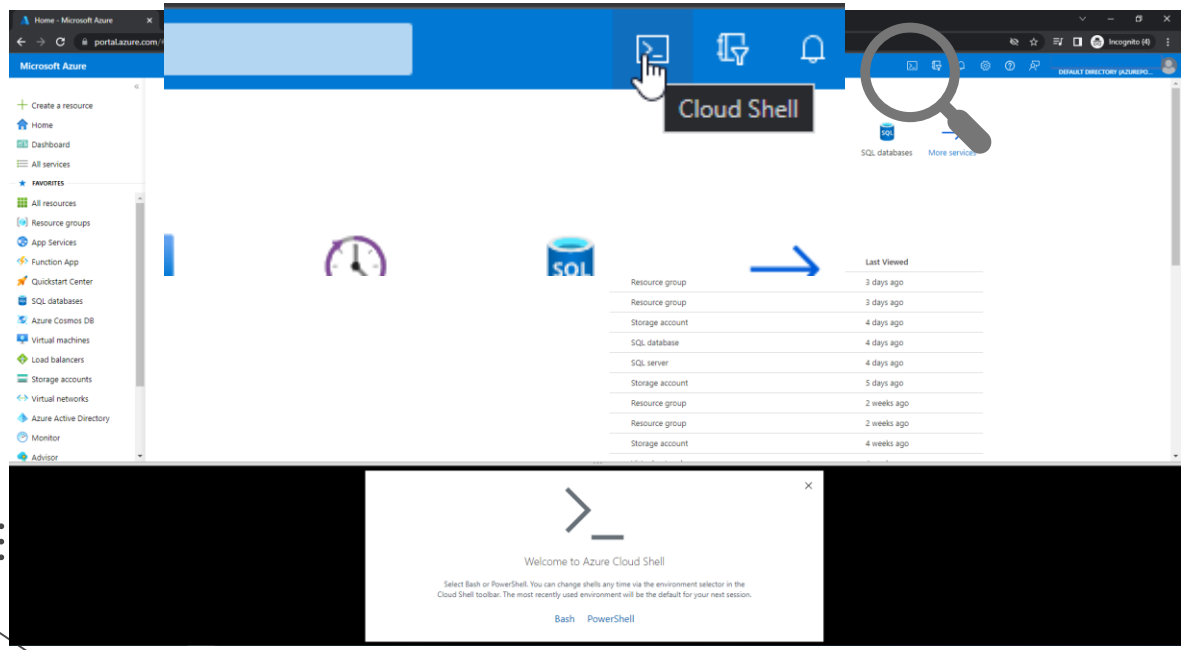
Uses `az` commands



Azure Cloud Shell

The **easiest way** to use Azure CLI and Azure Power Shell is through the Azure Portal via **Azure Cloud Shell**

You need to mount a dedicated storage account to run

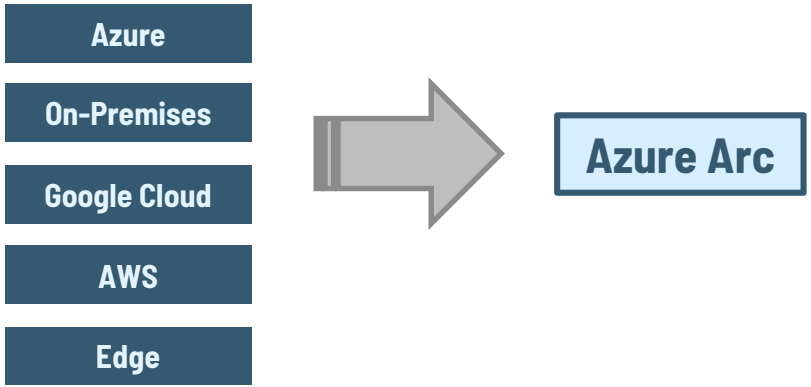


Azure Arc

Azure Arc

Hybrid and multi-cloud management solution

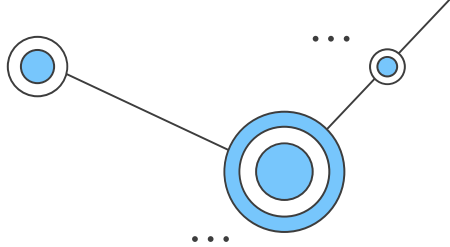
Managing multiple complex environments can be challenging



Centralized management platform for multi-cloud, on-premises and edge

Azure Arc

Hybrid and multi-cloud management solution

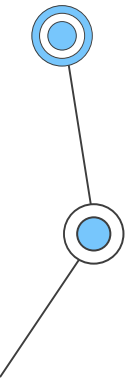


Unified experience:

- Project non-Azure and on-premises resources into Azure (ARM)
- Consistent management, governance and security

<u>Management of the following resources:</u>

- Servers
- Kubernetes clusters
- Azure data services
- SQL Servers
- Virtual machines

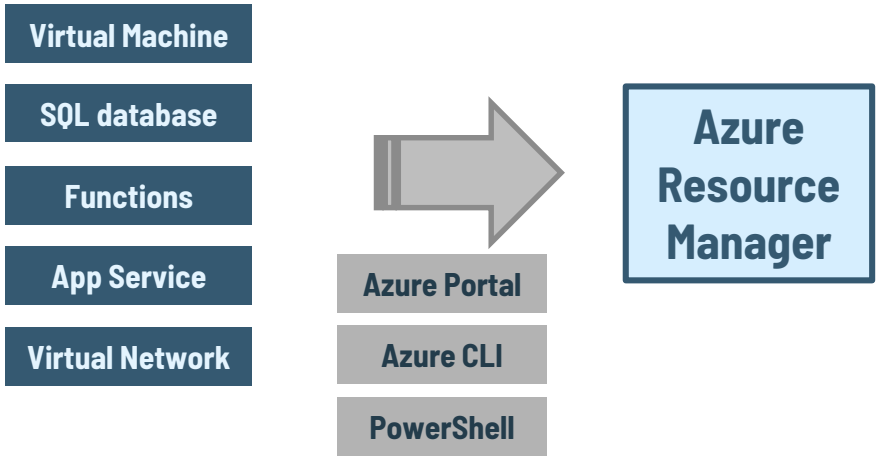


Azure Resource Manager

Azure Resource Manager

Management layer to create, update, and deploy resources

Whenever you create a resource...



... it will be created through Azure Resource Manager!

Azure Resource Manager

Management layer to create, update, and deploy resources

ARM templates:

```
{
    "$schema": "http://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
    "contentVersion": "1.0.0.0",
    "parameters": {
        "location": {
            "type": "string"
        },
        "networkInterfaceName1": {
            "type": "string"
        },
        "networkSecurityGroupName": {
            "type": "string"
        },
        "networkSecurityGroupRules": {
            "type": "array"
        },
        "subnetName": {
            "type": "string"
        },
        "virtualNetworkName": {
```

- Re-deploy existing solutions
- Bulk deployment
- Define dependencies

Summary

Summary

Azure Portal

Web-based graphical interface

Very easy to learn and navigate

Every device with a browsers

Mobile App: Convenient but limited functionality

Azure CLI + PowerShell

Cross-platform command-line tools

Azure CLI scripting similar to Bash (az command)

Bulk deployment and repeatable tasks

Azure Cloud Shell

Accessible through Azure Portal

Access PowerShell and Azure CLI conveniently

Azure Arc

Managing hybrid and multi-cloud

Centralized platform for consistent management, governance and security

Azure Resource Manager

Management layer to create, update, and deploy resources

ARM templates: Re-deployment, bulk-deployment, and define dependencies

Azure Advisor

Azure Advisor

Offers actionable, personalized recommendations

Free and **personalized** guide to best practices

- Analyzes your resources and gives actionable step-by-step recommendations
  - ✓ Security
  - ✓ Cost
  - ✓ Reliability
  - ✓ Performance
  - ✓ Operational Excellence

- *Cloud score* about how well-architected your workloads are

Azure Resource Manager

Management layer to create, update, and deploy resources

ARM templates:

```
{
    "$schema": "http://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
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        "virtualNetworkName": {
```

- Re-deploy existing solutions
- Bulk deployment
- Define dependencies

Azure Service Health

Azure Service Health

Informs you about the health of your resources

- Azure Status: Global view of the health of all services
  incl. planned maintenance and service-impacting events `status.azure.com`

- Service Health: Personalized view of the health of services you are using
  Best place to look for events that affect our services

  ✓ Planned maintenance
  ✓ Outages
  ✓ Other issues impacting your services

  Understands which services you are using.

  Alerts can be configured to be notified

- Resource Health: Specific information about your resources (e.g. specific instance of VM)

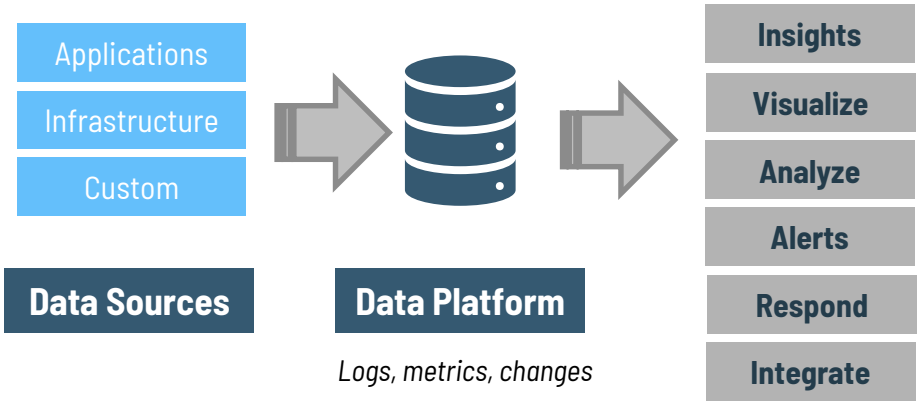
Azure Monitor

Azure Monitor

Monitor availability and performance of applications and services

Collect and **analyze** performance data and logs

Cloud **On-premises**



Metrics: *Numerical values over time*
E.g. CPU utilization
Graphs

Logs: *Events that happened at a time*
Can be analyzed with queries in ***Log Analytics***

Changes: *Series of events*
Change Analysis sent ***alerts*** *based on changes*

Application Insights: Monitors the performance and usage of your web applications

Summary

Summary

Azure Advisor

Personalized and actionable recommendations

Free guide to best practises

Azure Monitor

Monitor performance, availability and usage of services and applications

Activity log, alerts, and application insights

Azure Service Health

Azure Status: Global view

Service Health: Personalized view on health of used services

Resource Health: Health of your resources

Final tips & booking the exam

Final tips

Take the practice test

Evaluate your weaknesses

Work on the sample questions provided by Microsoft

Exam details

Exam duration: 65 min (45min for exam itself)

40-60 questions of different types

Passing score: 700 / 1000

Results are immediately displayed and sent by email

Canceling or rescheduling at least 24 hours before exam

Recommendations

Have your space prepared

Read questions carefully

Eliminate wrong answers and guess if necessary

Remember questions for later