

Exam AZ-900: Microsoft Azure Fundamentals Course

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

Describe cloud concepts (25–30%)

Describe Azure architecture and services (35–40%)

Describe Azure management and governance (30–35%)

Cloud Concepts - Principles of Cloud Computing

Learning objectives

In this module, you will:

- ✓ Explore common cloud computing services
- ✓ Explore the benefits of cloud computing
- ✓ Decide which cloud deployment model is best for you

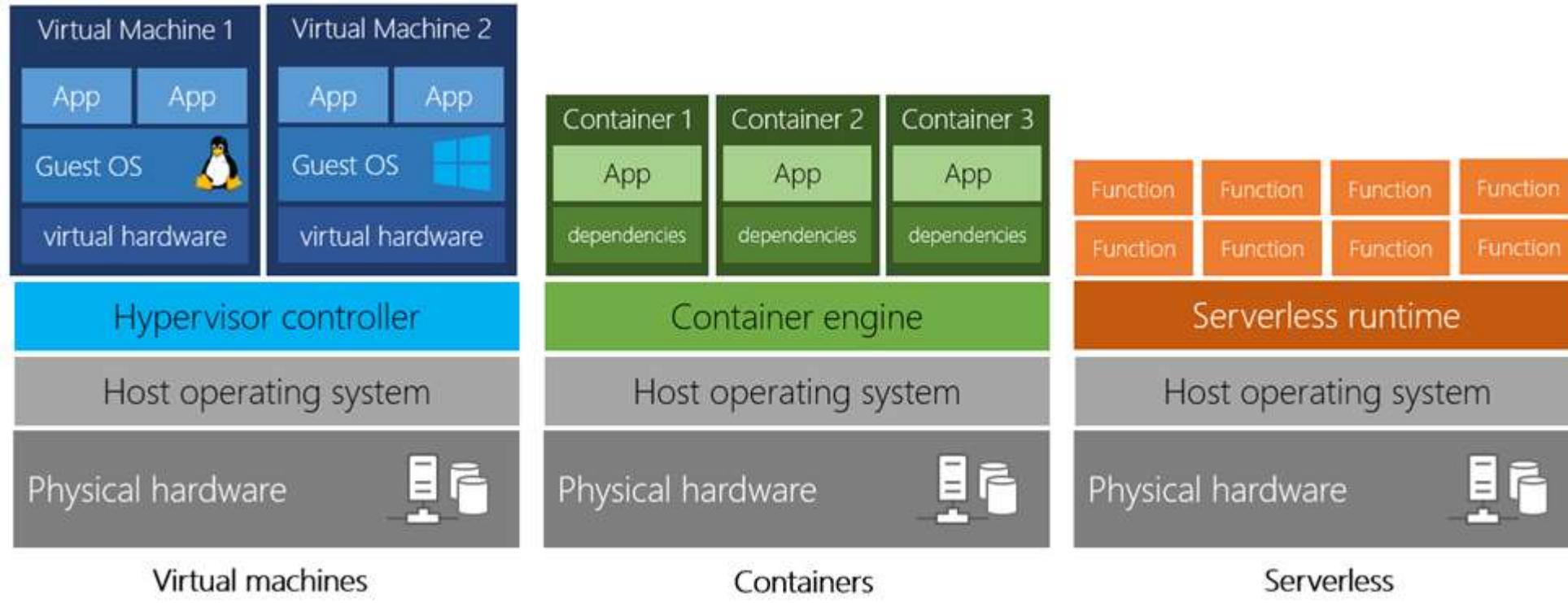
What is cloud computing?

Cloud computing is renting resources, like storage space or CPU cycles, on another company's computers. You only pay for what you use. The company providing these services is referred to as a cloud provider. Some example providers are Microsoft, Amazon, and Google.

The cloud provider is responsible for the physical hardware required to execute your work, and for keeping it up-to-date. The computing services offered tend to vary by cloud provider. However, typically they include:

- **Compute power** - such as Linux servers or web applications
- **Storage** - such as files and databases
- **Networking** - such as secure connections between the cloud provider and your company
- **Analytics** - such as visualizing telemetry and performance data

Cloud Computing Services



Every business has different needs and requirements. Cloud computing is flexible and cost-efficient, which can be beneficial to every business, whether it's a small start-up or a large enterprise.

Cloud Computing Services

Compute Power

The difference is that you don't have to buy any of the hardware or install the OS. The cloud provider runs your virtual machine on a physical server in one of their datacenters - often sharing that server with other VMs (isolated and secure). With the cloud, you can have a VM ready to go in minutes at less cost than a physical computer.

What are containers?

Containers provide a consistent, isolated execution environment for applications. They're similar to VMs except they don't require a guest operating system. Instead, the application and all its dependencies is packaged into a "container" and then a standard runtime environment is used to execute the app. This allows the container to start up in just a few seconds, because there's no OS to boot and initialize. You only need the app to launch. The open-source project, Docker, is one of the leading platforms for managing containers. Docker containers provide an efficient, lightweight approach to application deployment because they allow different components of the application to be deployed independently into different containers. Multiple containers can be run on a single machine, and containers can be moved between machines. The portability of the container makes it easy for applications to be deployed in multiple environments, either on-premises or in the cloud, often with no changes to the application.

Cloud Computing Services

What is serverless computing?

Serverless computing lets you run application code without creating, configuring, or maintaining a server. The core idea is that your application is broken into separate *functions* that run when triggered by some action. This is ideal for automated tasks - for example, you can build a serverless process that automatically sends an email confirmation after a customer makes an online purchase.

The serverless model differs from VMs and containers in that you only pay for the processing time used by each function as it executes. VMs and containers are charged while they're running - even if the applications on them are idle. This architecture doesn't work for every app - but when the app logic can be separated to independent units, you can test them separately, update them separately, and launch them in microseconds, making this approach the fastest option for deployment.

Storage

Most devices and applications read and/or write data. Here are some examples:

- Buying a movie ticket online
- Looking up the price of an online item
- Taking a picture
- Sending an email
- Leaving a voicemail

In all of these cases, data is either *read* (looking up a price) or *written* (taking a picture). The type of data and how it's stored can be different in each of these cases.

Cloud providers typically offer services that can handle all of these types of data. For example, if you wanted to store text or a movie clip, you could use a file on disk. If you had a set of relationships such as an address book, you could take a more structured approach like using a database.

The advantage to using cloud-based data storage is you can scale to meet your needs. If you find that you need more space to store your movie clips, you can pay a little more and add to your available space. In some cases, the storage can even expand and contract automatically - so you pay for exactly what you need at any given point in time.

High Availability, Fault Tolerance, and Disaster Recovery

Scalability and Elasticity

Business Agility

Economies of Scale

Capital Expenditure (CapEx) and Operational Expenditure (OpEx)

The Consumption-Based Model

High Availability

High Availability Maintaining **acceptable continuous performance** despite temporary load fluctuations or failures in services, hardware, or datacentres.

Data Center Redundancies

- Power
- Cooling
- Networking - Etc.

Availability Zone Redundancies

- One or more data centers

Region Redundancies

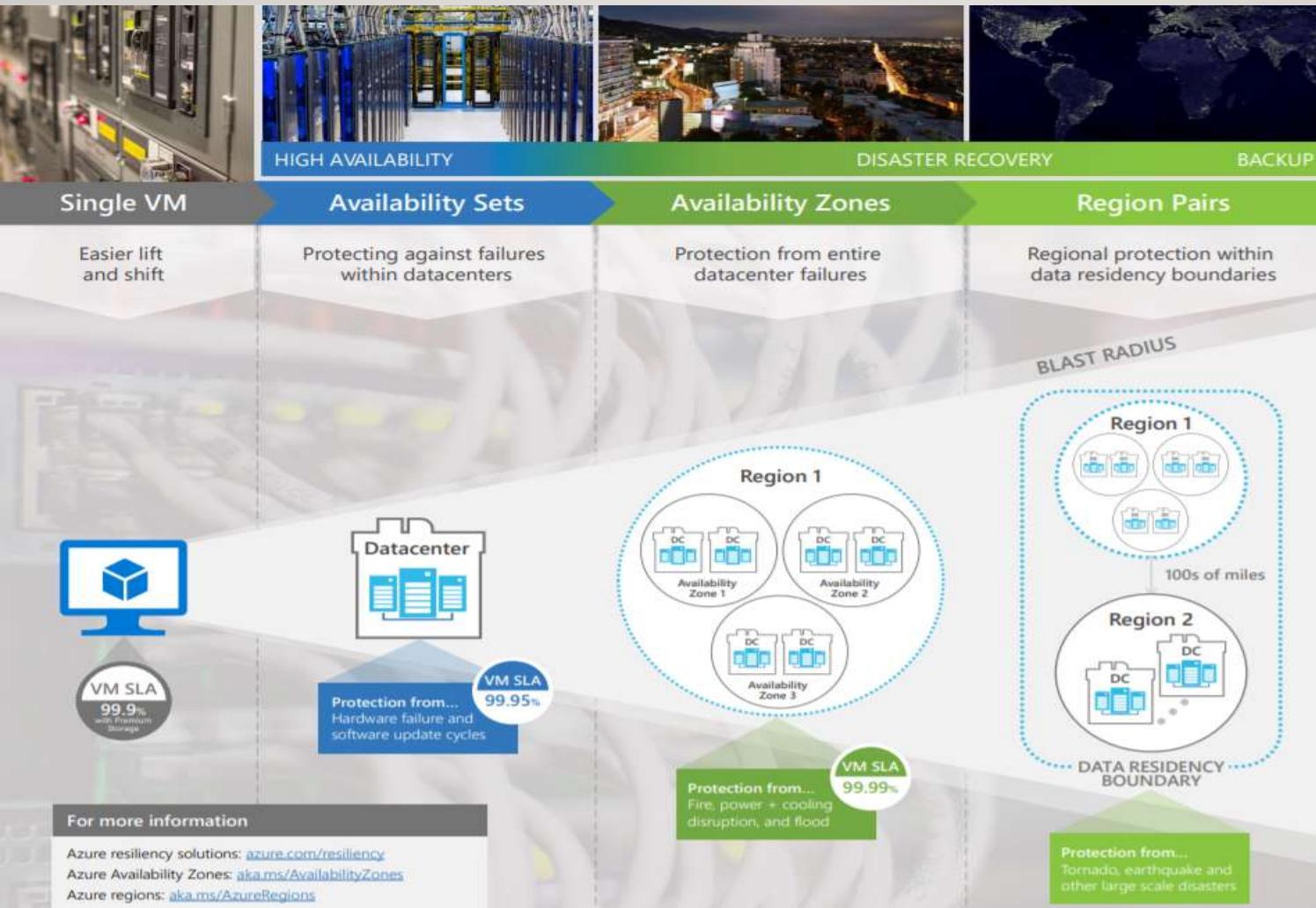
- Multiple availability zones

Achieve High Availability faster in the cloud

As soon as you sign up, access the tools, the infrastructure, and the guidance you need to deploy your applications in the cloud. Support your most demanding mission-critical applications to build always-available sites cost-effectively. And take advantage of an SLA of up to 99.99 percent for your virtual machines.

High-availability solutions

- **Availability Zones**
- **Availability sets**
- **Virtual Machine Scale Sets (VMSS)**
- An Availability Set is a logical grouping capability for isolating VM resources from each other when they're deployed. Azure makes sure that the VMs you place within an Availability Set run across multiple physical servers, compute racks, storage units, and network switches. If a hardware or software failure happens, only a subset of your VMs are impacted and your overall solution stays operational. Availability Sets are essential for building reliable cloud solutions.



Understand Azure global infrastructure

Regions

A region is a set of datacenters deployed within a latency-defined perimeter and connected through a dedicated regional low-latency network.

With more global regions than any other cloud provider, Azure gives customers the flexibility to deploy applications where they need to. Azure is generally available in 52 regions around the world, with plans announced for 3 additional regions.

Geographies

A geography is a discrete market, typically containing two or more regions, that preserves data residency and compliance boundaries.

Geographies allow customers with specific data-residency and compliance needs to keep their data and applications close. Geographies are fault-tolerant to withstand complete region failure through their connection to our dedicated high-capacity networking infrastructure.

Availability Zones

Availability Zones are physically separate locations within an Azure region. Each Availability Zone is made up of one or more datacenters equipped with independent power, cooling, and networking.

Availability Zones allow customers to run mission-critical applications with high availability and low-latency replication.

Fault Tolerance

Redundancy is often built into cloud services architecture so if one component fails, a backup component takes its place. This is referred to as fault tolerance and it ensures that your customers aren't impacted when an unexpected accident occurs.

Proactive

- Regularly backup Data / app/Resources
- Deploy to multiple Availability zones or Regions
- Load balance across multiple availability zones or regions
- Monitor health of data /apps / resources

Reactive

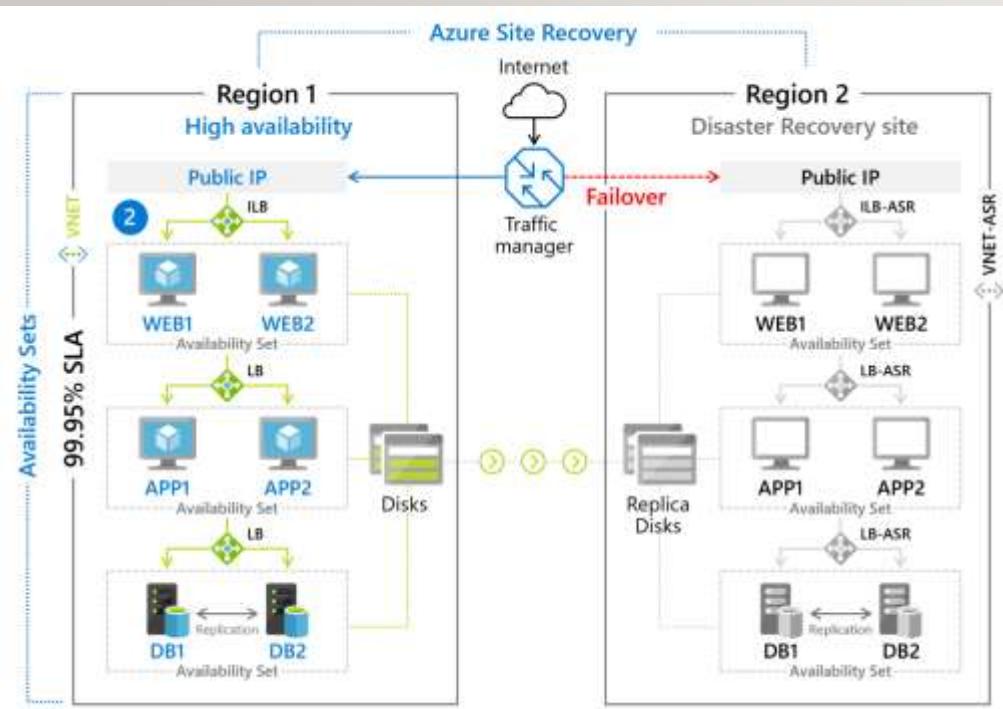
Restore data/apps/Resources to different availability zones or regions

Deploy to different Availability zones or regions

Disaster Recovery

Disaster Recovery

The ability to recover from rare but major incidents: non-transient, wide-scale failures, such as service disruption that affects an entire region. Disaster recovery includes data backup and archiving, and may include manual intervention, such as restoring a database from backup.



- On-Premises to On-Premises
- On-Premises to Azure
- other Cloud to Azure
- Azure to Azure

Scalability & Elasticity

The ability to increase the instance count or size of existing resources.

Scaling Out

- Increase instance count of existing resources
- Non-disruptive

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/autoscale-overview>

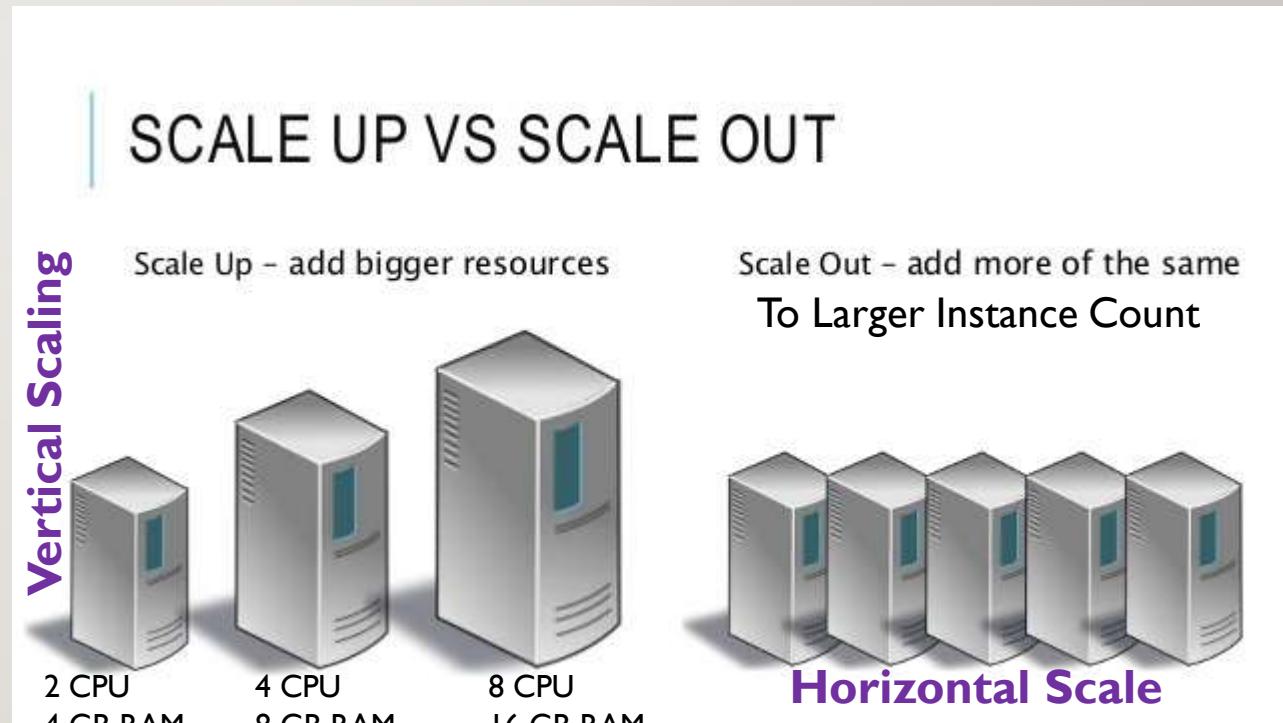
Scaling Up

- Increase instance size of existing resources
- Disruptive

Elasticity

The Ability to Increase or decrease the instance count or Size of existing resources based on fluctuations in traffic or load or in resource workload.

- Ability to scale in both Directions Up and Down
- Can be manual or automatic
- Based on Changes in load or workload
- Pay only for what you use



Business Agility

An organization's ability to **rapidly adapt** to market and environmental changes in productive and cost-effective ways and take advantage of available resources to meet customer demands.



Economies of Scale

Supply-side savings

- ▶ Lower costs of land, servers, power, labor, etc.
- ▶ Higher buying power, security, reliability, etc.

Demand-side savings

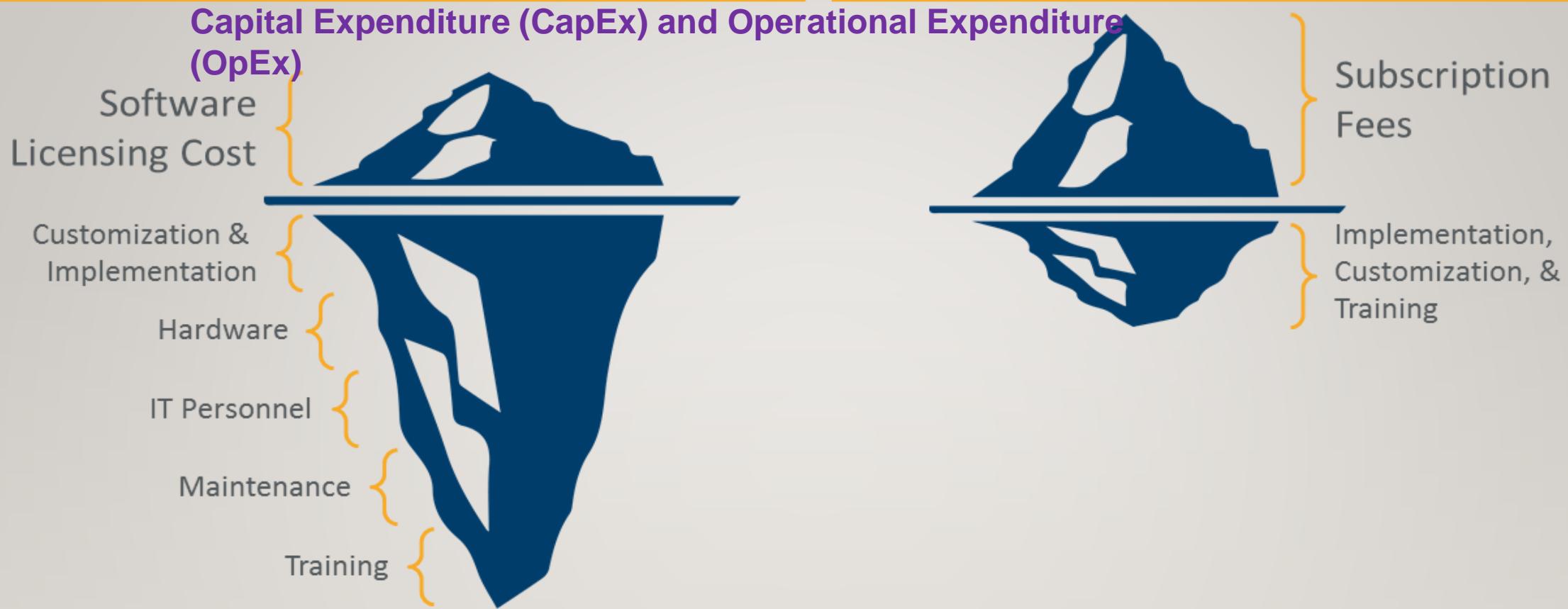
- ▶ Serving more customers allows for higher server utilization rates
- ▶ Higher server utilization rates allow for lower costs

Multi-tenancy savings

- ▶ More tenants (customers or users) lowers the cost of servers and management per tenant

On-Premises

Cloud Computing



Ongoing Costs

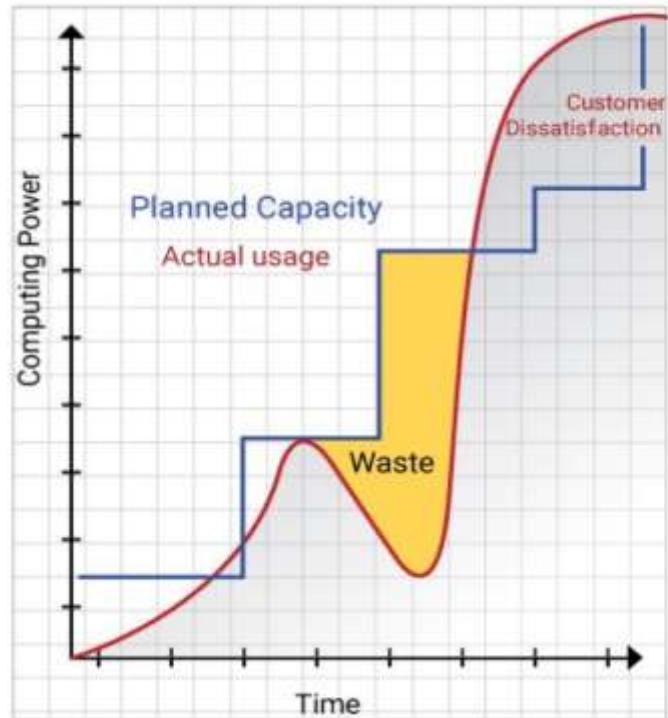
- Apply patches, upgrades
- Downtime
- Performance tuning
- Rewrite customizations
- Rewrite integrations
- Upgrade dependent applications
- Ongoing burden on IT (hardware)
- Maintain/upgrade network
- Maintain/upgrade security
- Maintain/upgrade database

Ongoing Costs

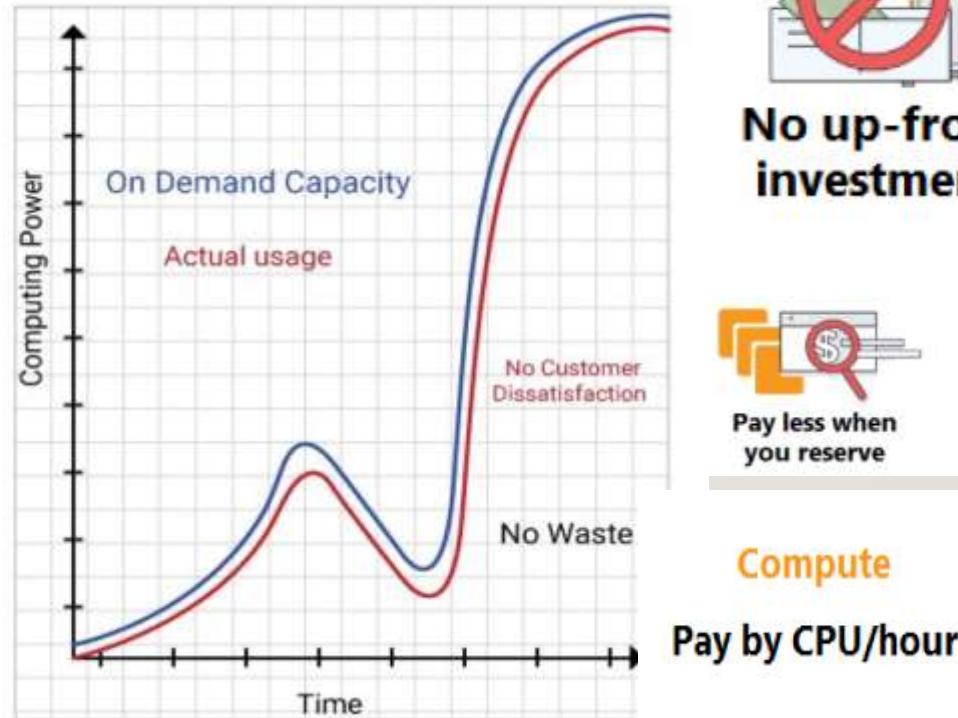
- Subscription fees
- Training
- Configuration
- System Administration

Consumption Based Model

Traditional Data Center



Azure



No up-front investment



Pay less when you reserve

Compute



Pay as you go



Pay less by using more



Pay per use



Pay less when Azure grows

Storage

Pay by GB

Data Transfer

Pay by GB for data out, not in

Applications

Middleware/OS

Servers

IaaS
host



Applications

Middleware/OS

Servers

PaaS
build



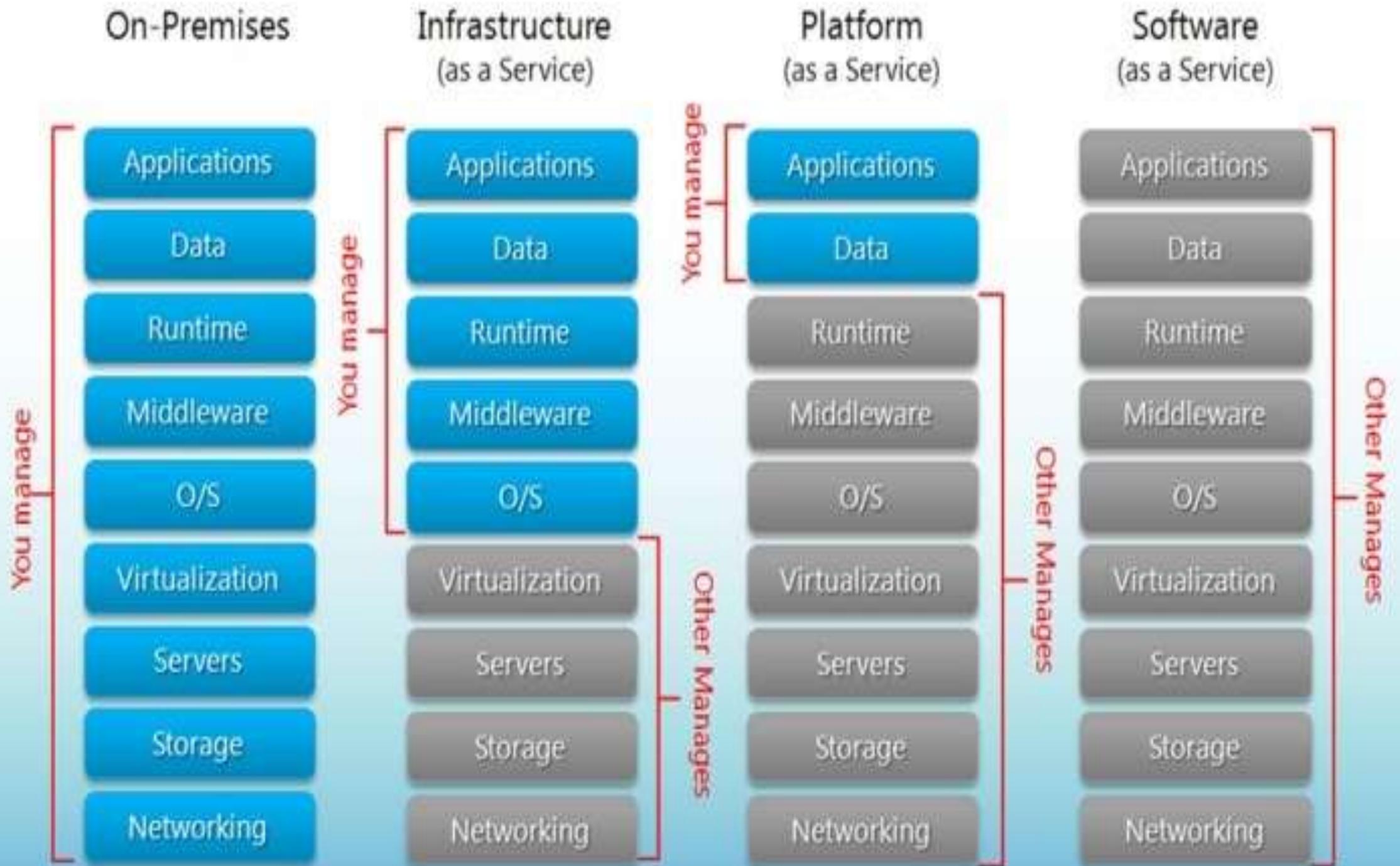
Applications

Middleware/OS

Servers

SaaS
Consume





Key Differences



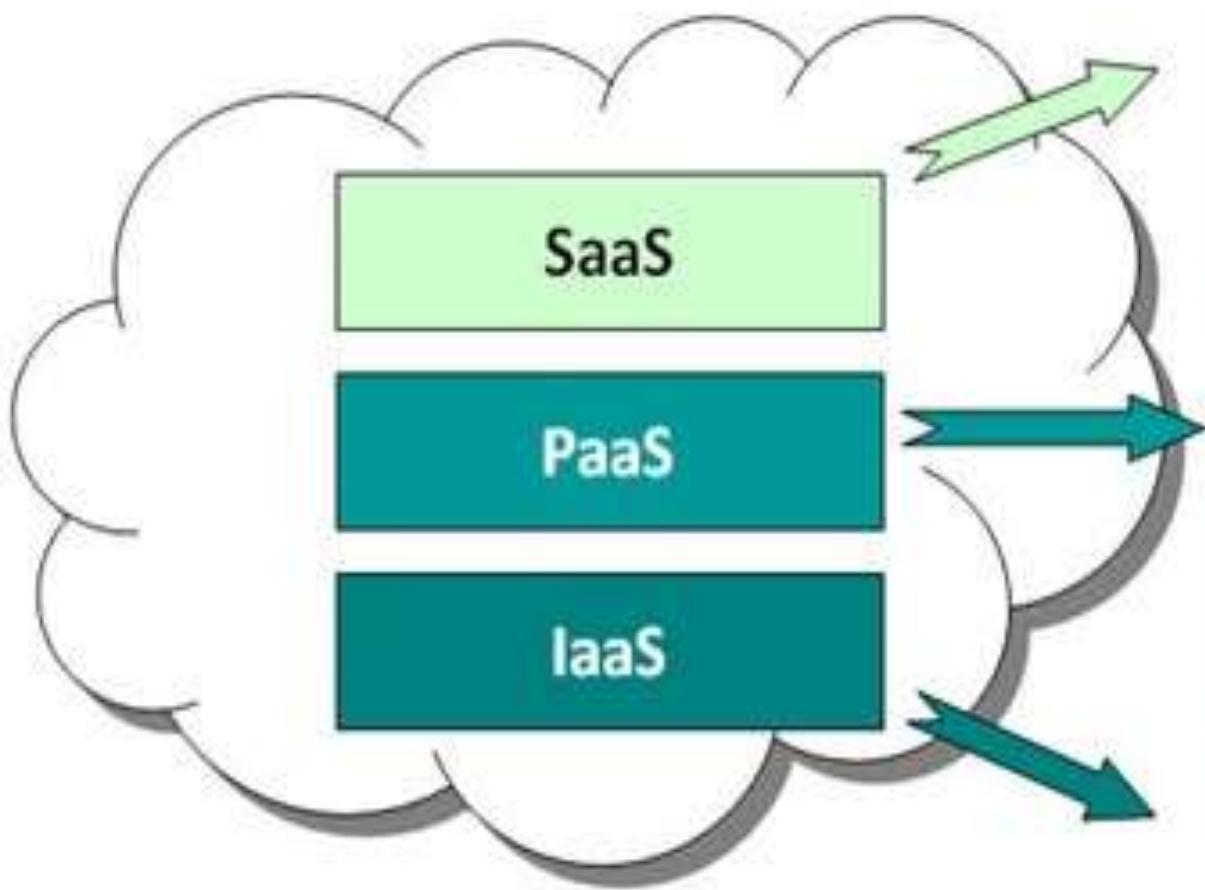
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

Host Build Consume

You Manage

Other Manages





Who Uses It	What Services are available	Why use it?
Business Users	EMail, Office Automation, CRM, Website Testing, Wiki, Blog, Virtual Desktop ...	To complete business tasks
Developers and Deployers	Service and application test, development, integration and deployment	Create or deploy applications and services for users
System Managers	Virtual machines, operating systems, message queues, networks, storage, CPU, memory, backup services	Create platforms for service and application test, development, integration and deployment



Common Examples of SaaS, PaaS, & IaaS

Platform Type	Common Examples
SaaS	Google Apps, Dropbox, Salesforce, Cisco WebEx, Concur, GoToMeeting
PaaS	AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine, Apache Stratos, OpenShift
IaaS	DigitalOcean, Linode, Rackspace, Amazon Web Services (AWS), Cisco Metapod, Microsoft Azure, Google Compute Engine (GCE)

Multi-Tenant Implementation

Owned and Operated by service provider

Bound by multi-tenant Data management policies

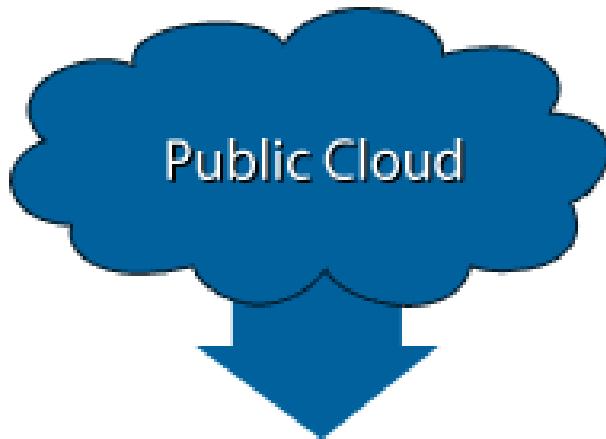
Similar self service and automation capabilities as Private Cloud

Pros

- No Up-Front Capital expenses
- No Maintenance
- High Reliability
- Easy Scalability

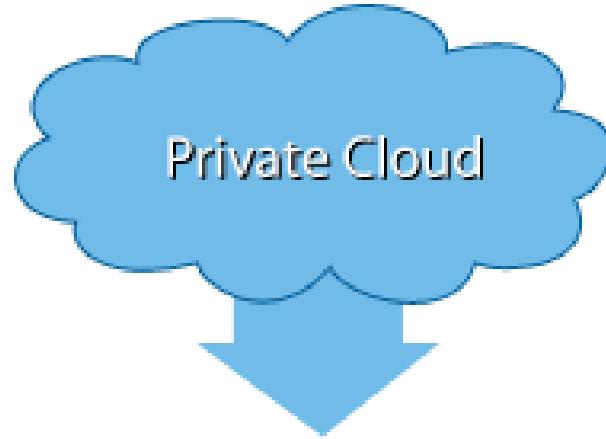
Cons

- Less Customizable
- Potential latency
- Potential governance issues



Public Cloud

- ✓ Hosted at a Service Provider Site
- ✓ Supports multiple customers
- ✓ Often utilises shared infrastructure
- ✓ Supports connectivity over the internet
- ✓ Suited for information that is not sensitive
- ✓ Can be cheaper than Private Cloud



Private Cloud

- ✓ Hosted at an Enterprise or a Service Provider site
- ✓ Supports one customer
- ✓ Does not utilise shared infrastructure
- ✓ Connectivity over private network/fiber or the internet
- ✓ Suited for information that requires a high level of security

What is a private cloud?



A private cloud consists of computing resources used exclusively by one business or organization. The private cloud can be physically located at your organization's on-site datacenter or it can be hosted by a third-party service provider. But in a private cloud, the services and infrastructure are always maintained on a private network and the hardware and software are dedicated solely to your organization. In this way, a private cloud can make it easier for an organization to customize its resources to meet specific IT requirements. Private clouds are often used by government agencies, financial institutions, any other mid- to large-size organizations with business-critical operations seeking enhanced control over their environment.

Advantages of a private clouds:

- More flexibility—your organization can customize its cloud environment to meet specific business needs.
- Improved security—resources are not shared with others, so higher levels of control and security are possible.
- High scalability—private clouds still afford the scalability and efficiency of a public cloud.

What is a private cloud?

- Single Tenant Implementation
- Owned and operated by IT organisation
- Define your own data management policies
- Self-Service and automated Capabilities provide new agility



Pros

Fully Customizable

Higher level of security

Better Performance

Cons

Higher up-front capital expense

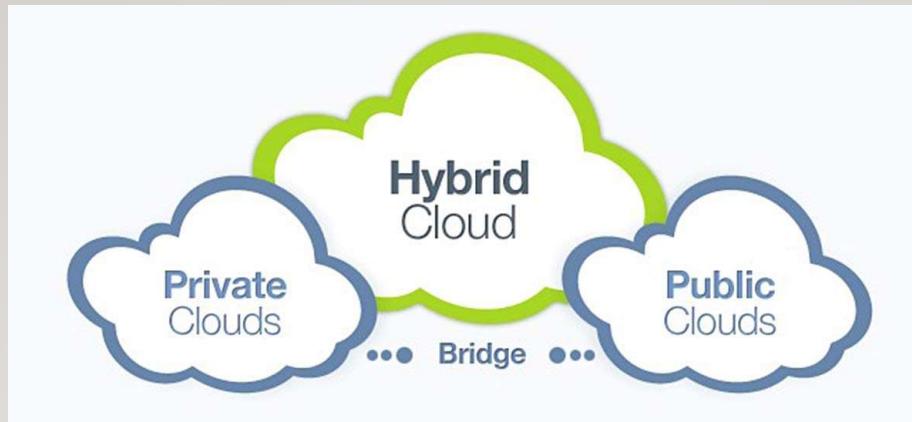
Risk under-utilization of resources

Higher ongoing costs

More maintenance







- ✓ Combination for Private and One or more Public clouds
- ✓ Allows IT organizations to become brokers of services

Pros:

- Greater Flexibility
- Resilience to outages
- No capacity ceiling
- Manageable security

Cons:

- Higher up-front capital expenses
- Risk under-utilization of resources
- Higher ongoing costs
- More maintenance
- Risk of less compatibility

Comparing Three Cloud Models

Public Cloud

Best Use case

- Transitioning to the cloud
- New applications or systems
- Standard workloads
- Systems that don't need much customization

- Multi-Tenant Implementation
- Owned and Operated by service provider
- Bound by multi-tenant Data management policies
- Similar self service and automation capabilities as Private Cloud

Private Cloud

Best Use case

- Transitioning to the cloud
- Systems that need enhanced security
- Systems that need some data, apps, or systems on-premises

- Single Tenant Implementation
- Owned and operated by IT organisation
- Define your own data management policies
- Self-Service and automated Capabilities provide new agility

Hybrid Cloud

Best Use case

- Highly secure applications or systems
- Systems that need some customization

- Combination for Private and One or more Public clouds
- Allows IT organizations to become brokers of services

Azure Architecture



Regions



Availability
Zones



Resource
Groups



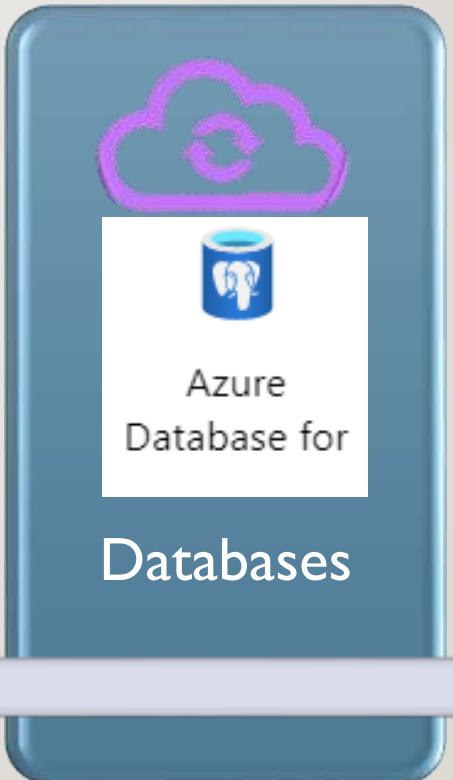
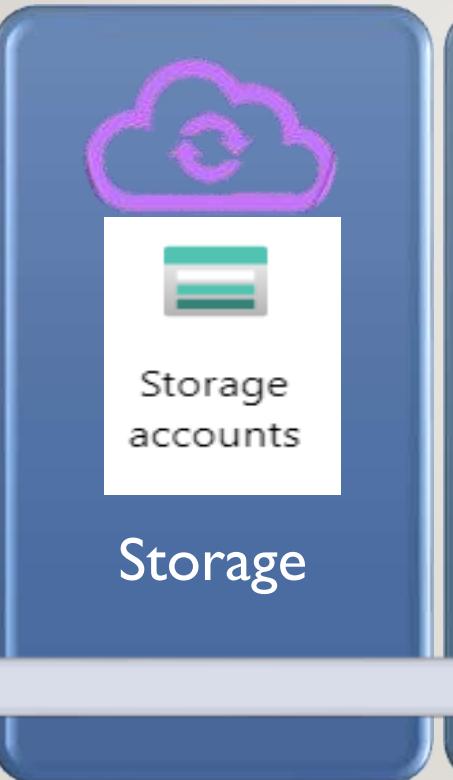
Azure
Resource
Manager



Azure
Architecture
Usage and
Benefits



Azure Products and Services



Azure Solutions



Internet of
Things - IoT



Artificial
Intelligence
- AI



Big Data
and
Analytics



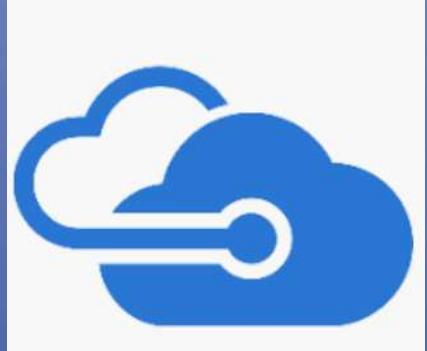
Server less
Computing



Azure
Solutions
Benefits



Azure Management Tools



Azure CLI



Azure
PowerShell



Azure Portal



Regions

A region is a set of datacenters deployed within a latency-defined perimeter and connected through a dedicated regional low-latency network.

Deploying your applications / systems to multiple regions allows for **resiliency to region-wide outages**.

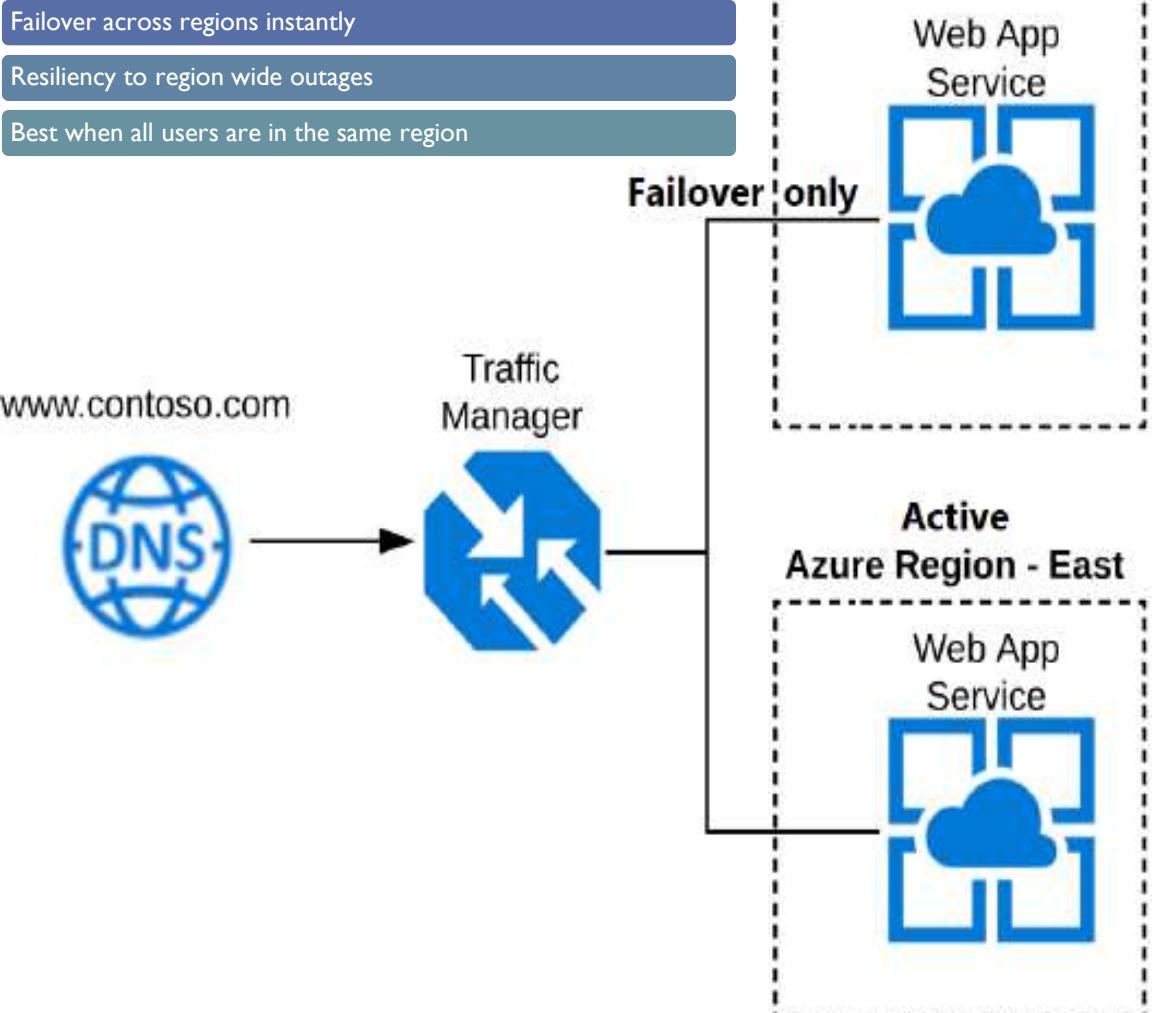
Multi-Region Failover (Active/Passive):

- ✓ Failover across regions instantly
- ✓ Resiliency to region wide outages
- ✓ Best when all users are in the same region

Multi-Region Deployments(Active/Active):

- ✓ Distribute traffic/ load across regions
- ✓ Resiliency to region wide outages
- ✓ Best when all users are in different regions

Multi-Region Failover (Active/Passive)



www.contoso.com



Traffic Manager



Failover only

Active
Azure Region - East

Web App Service

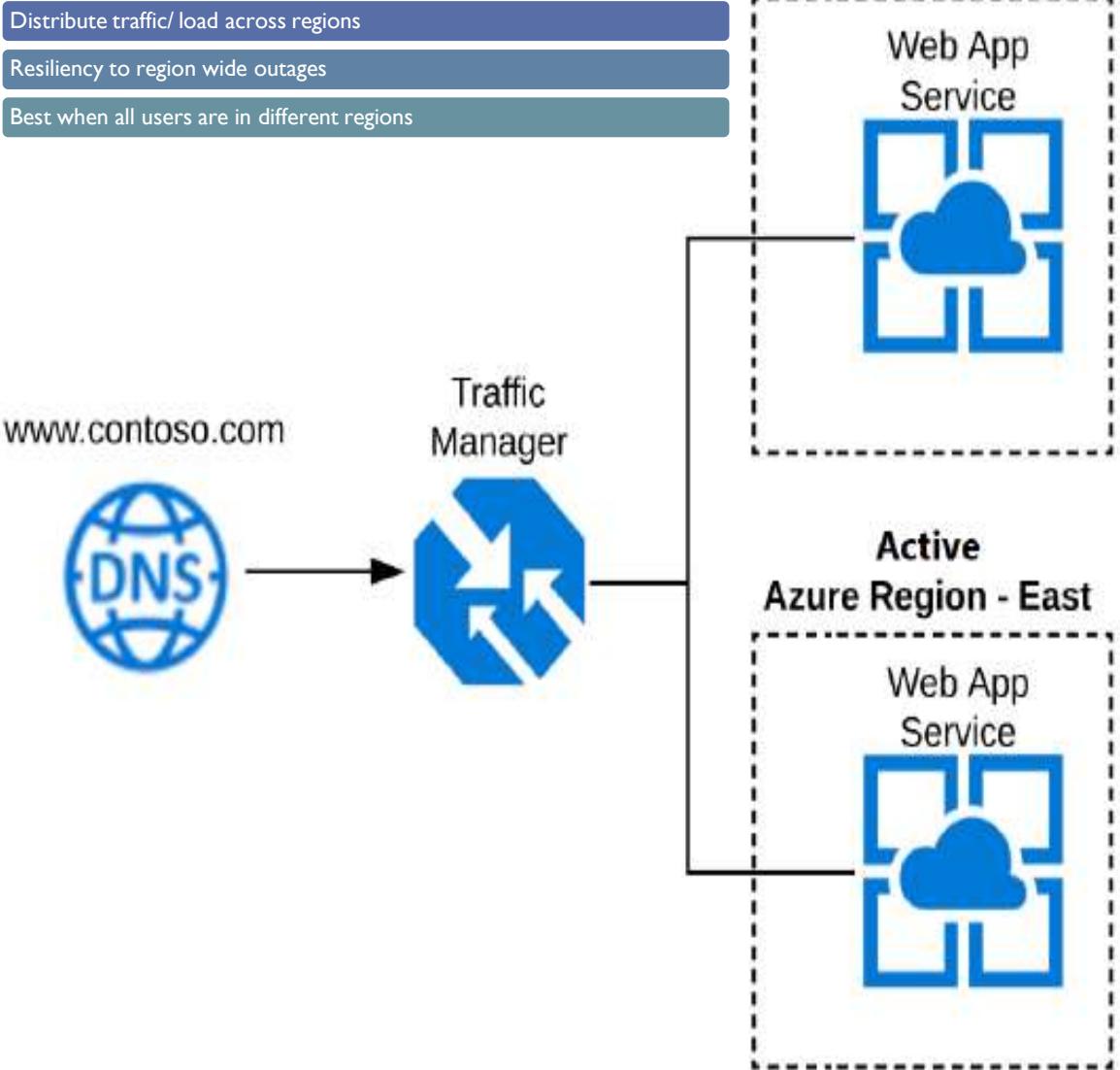


Passive
Azure Region - West

Web App Service



Multi-Region Deployments (Active/Active)



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Traffic Manager



Active

Azure Region - West

Web App Service



Active

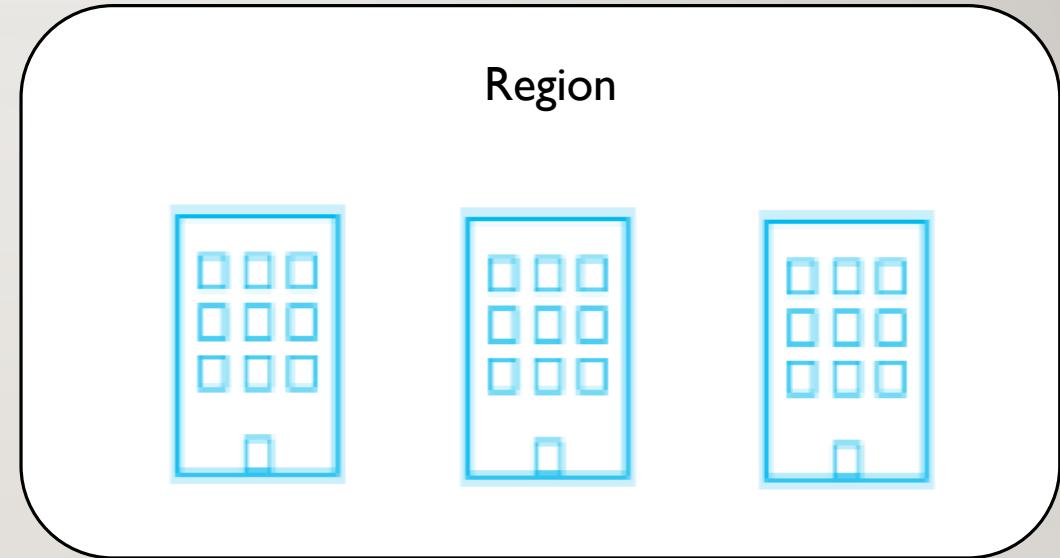
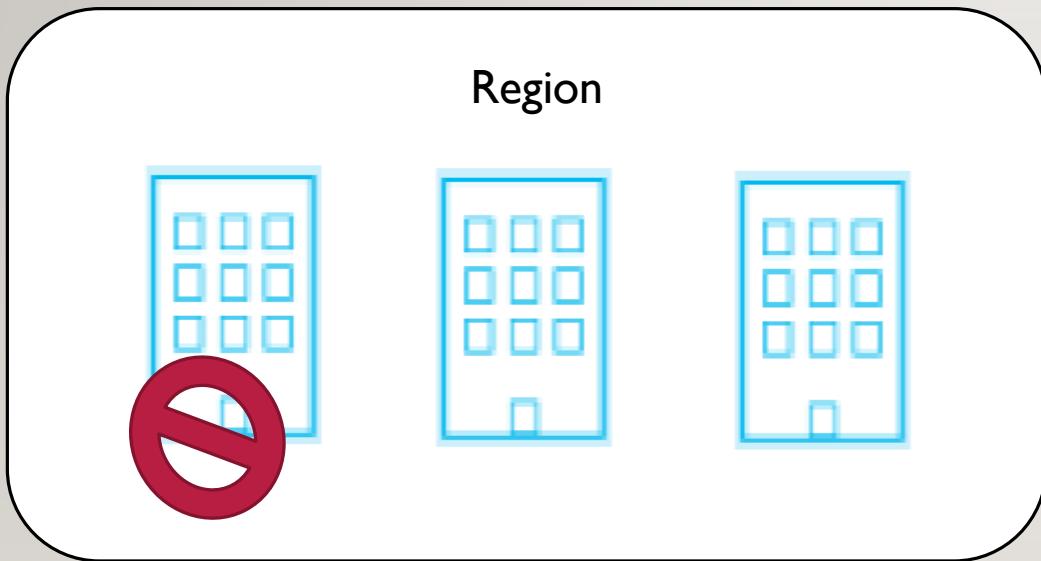
Azure Region - East

Web App Service



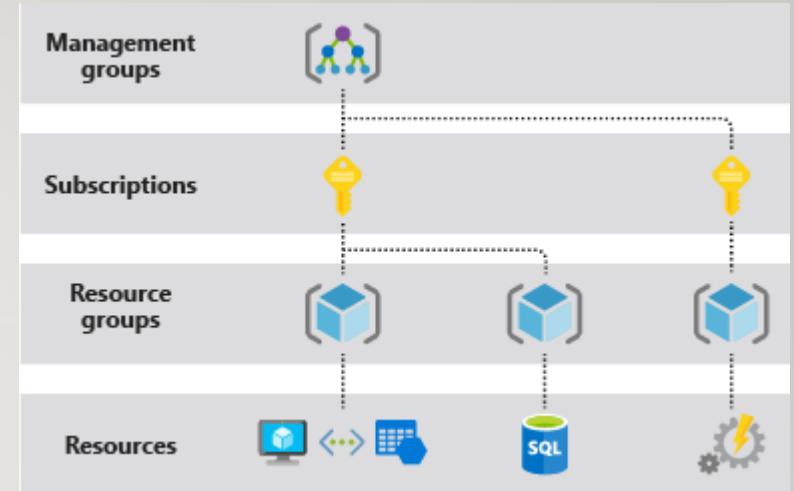
Availability Zones

- ✓ Unique physical locations within an Azure region made up of one or more data centers.
- ✓ Allow for high availability by protecting your applications and data from data center failures
- ✓ Some Azure services can be deployed to two or more Availability Zones within an Azure region.



Azure Resource Groups

- Containers of **related Azure Services** grouped together.
- All the resources in the group should share the same lifecycle
- They should be deployed, updated, and deleted together.
- A resource can only exist in **one** resource group.
- A resource group can contain resources that are located in different regions.
- A resource group can be used to scope access control for administrative actions.
- A resource can interact with resources in other resource groups.
(When two resources are related but don't share the same lifecycle; for example, web apps connecting to a database.)



Azure Resource Manager - ARM

- The Azure deployment and management service.
- Provides a consistent management layer that enables you to create, update, and delete resources in your Azure subscription, including with templates (ARM).
- You can use its access control, auditing, and tagging features to secure and organize your resources after deployment.



Azure Architecture



Regions



Availability
Zones



Resource
Groups



Azure
Resource
Manager



Azure
Architecture
Usage and
Benefits



Regions

- Deploying your applications / systems to multiple regions allows for high availability and resiliency to region-wide outages

Availability Zones

- Allow for high availability by protecting your applications and data from data center failures

Resource Groups

- Containers of related azure services grouped together for administrative and access control actions

Azure Resource Manager

- Single centralized deployment and management service that enables you to create, update and delete resources in your Azure subscription

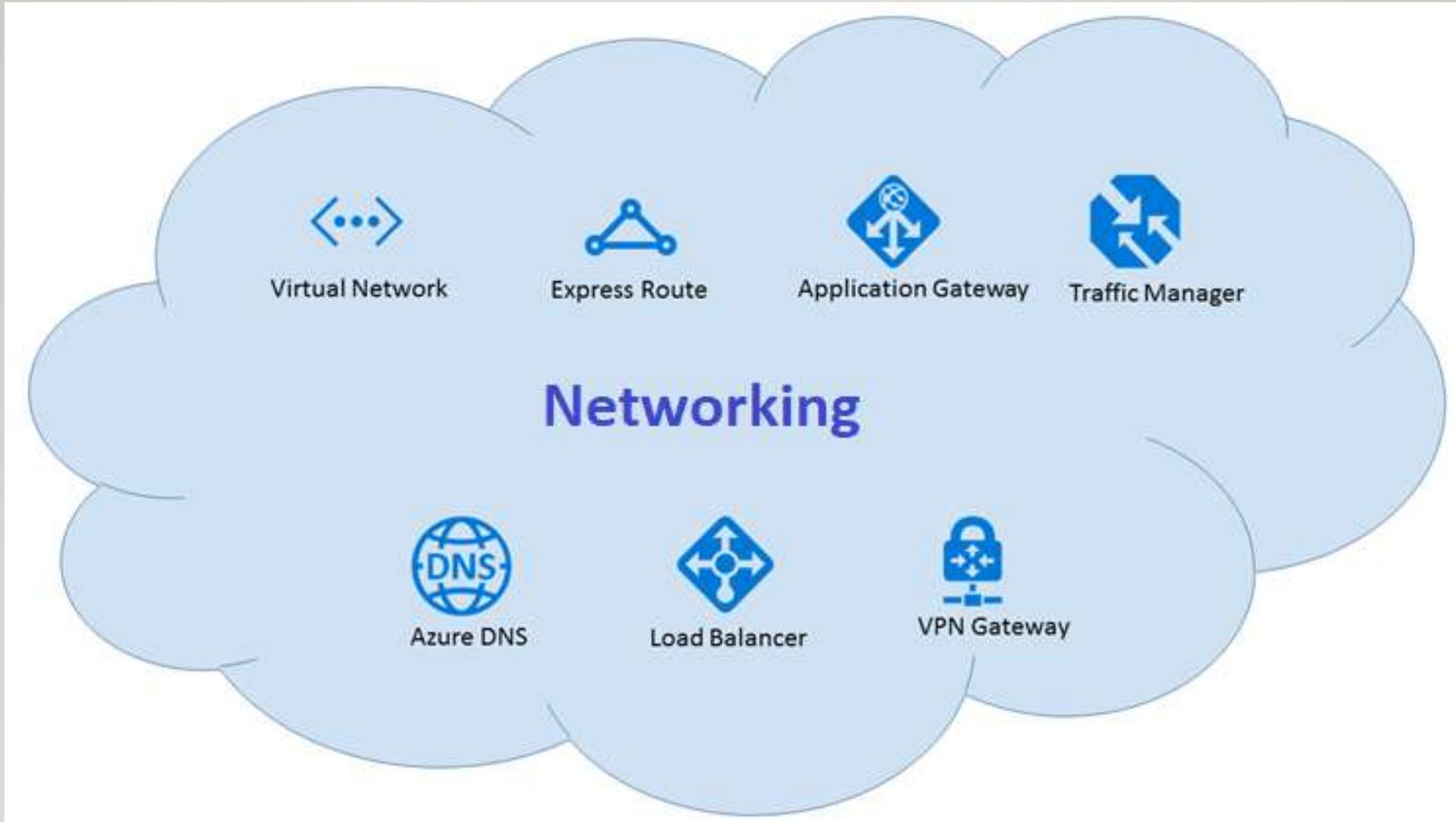
- 1. Azure Products and Services**
- 2. Azure Solutions**
- 3. Azure Management Tools**
- 4. Security, Privacy, Compliance, and Trust**
- 5. Azure Identity Services**
- 6. Azure Security Tools and Features**
- 7. Azure Governance**
- 8. Monitoring and Reporting in Azure**
- 9. Azure Privacy, Compliance, and Data Protection Standards**
- 10. Azure Subscriptions**
- 11. Planning and Managing Azure Costs**
- 12. Azure Support Options**
- 13. Azure Service Level Agreements (SLAs)**
- 14. The Azure Service Lifecycle**
- 15. Course Conclusion**

Networking

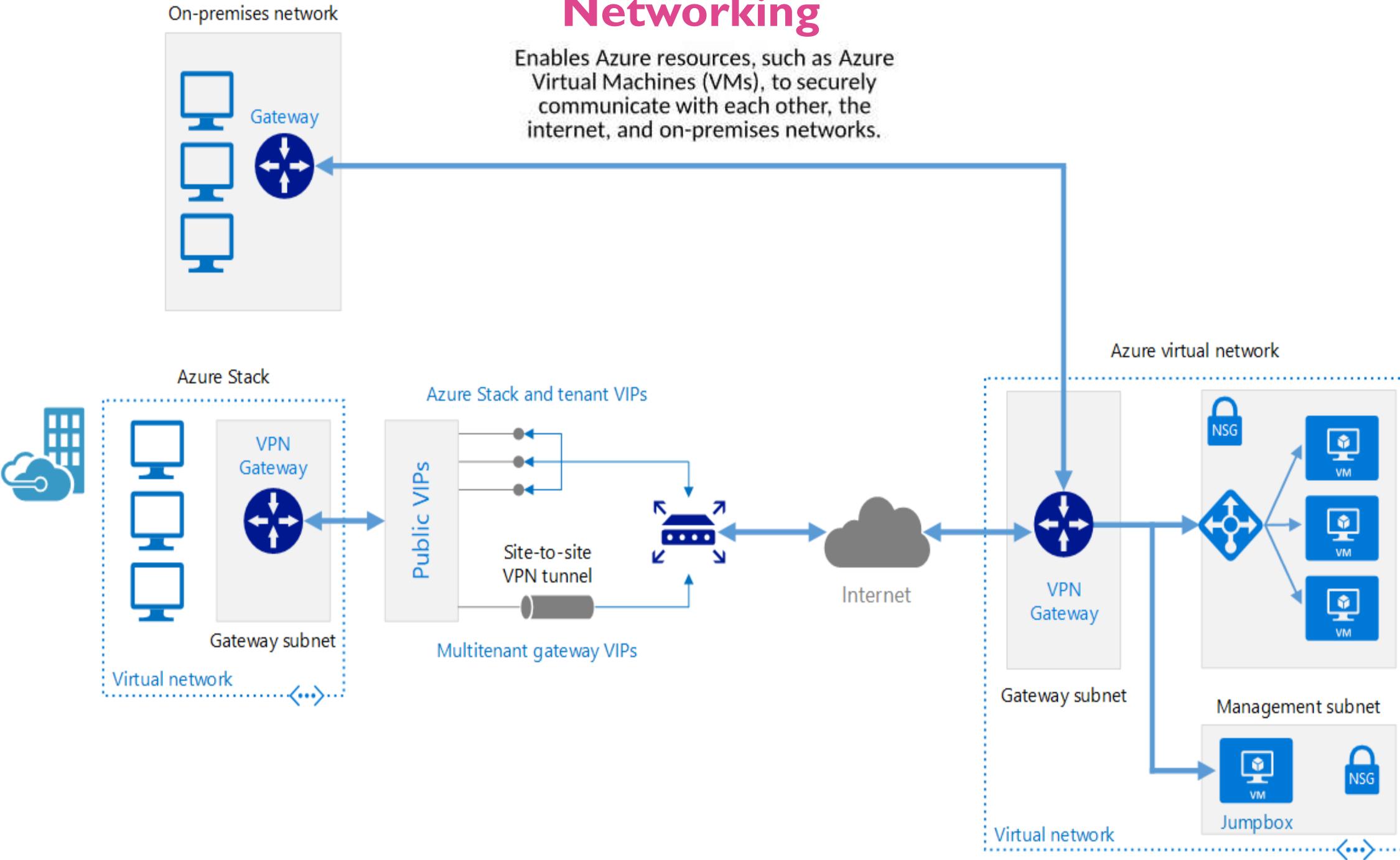
NETWORKING (31) —

-  Virtual networks
-  Application Gateways
-  DNS zones
-  ExpressRoute circuits
-  Network security groups (classic)
-  Public IP Prefixes
-  On-premises Data Gateways
-  Application security groups
-  Service endpoint policies
-  Private Link
-  Bastions
-  Virtual networks (classic)
-  Virtual network gateways
-  CDN profiles
-  Network Watcher
-  Network interfaces
-  Reserved IP addresses (classic)
-  Route tables
-  DDoS protection plans
-  Private DNS zones
-  WAF policies
-  Load balancers
-  Local network gateways
-  Traffic Manager profiles
-  Network security groups
-  Public IP addresses
-  Connections
-  Route filters
-  Front Doors
-  WAF policies
-  Virtual WANs

Networking

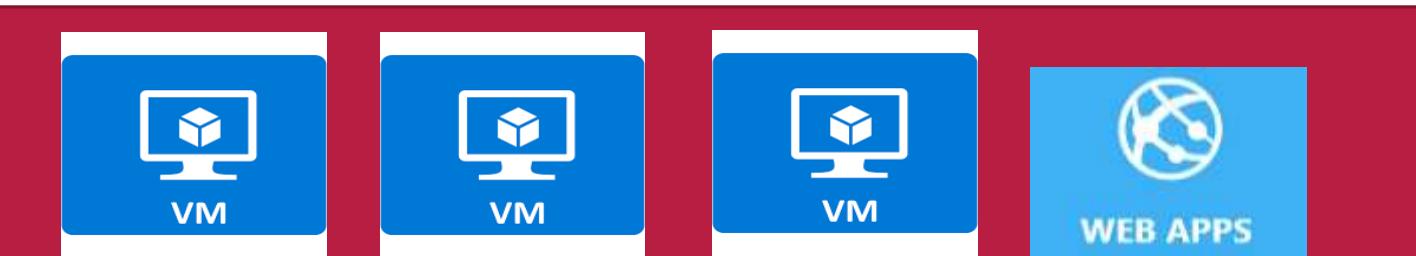


Networking





Subnet 1 10.1.0.0/24



Subnet 2 10.1.1.0/24

What is VPN Gateway?

A VPN gateway is a specific type of virtual network gateway that is used to send encrypted traffic between an Azure virtual network and an on-premises location over the public Internet.

Azure VPN Gateway

On Premises

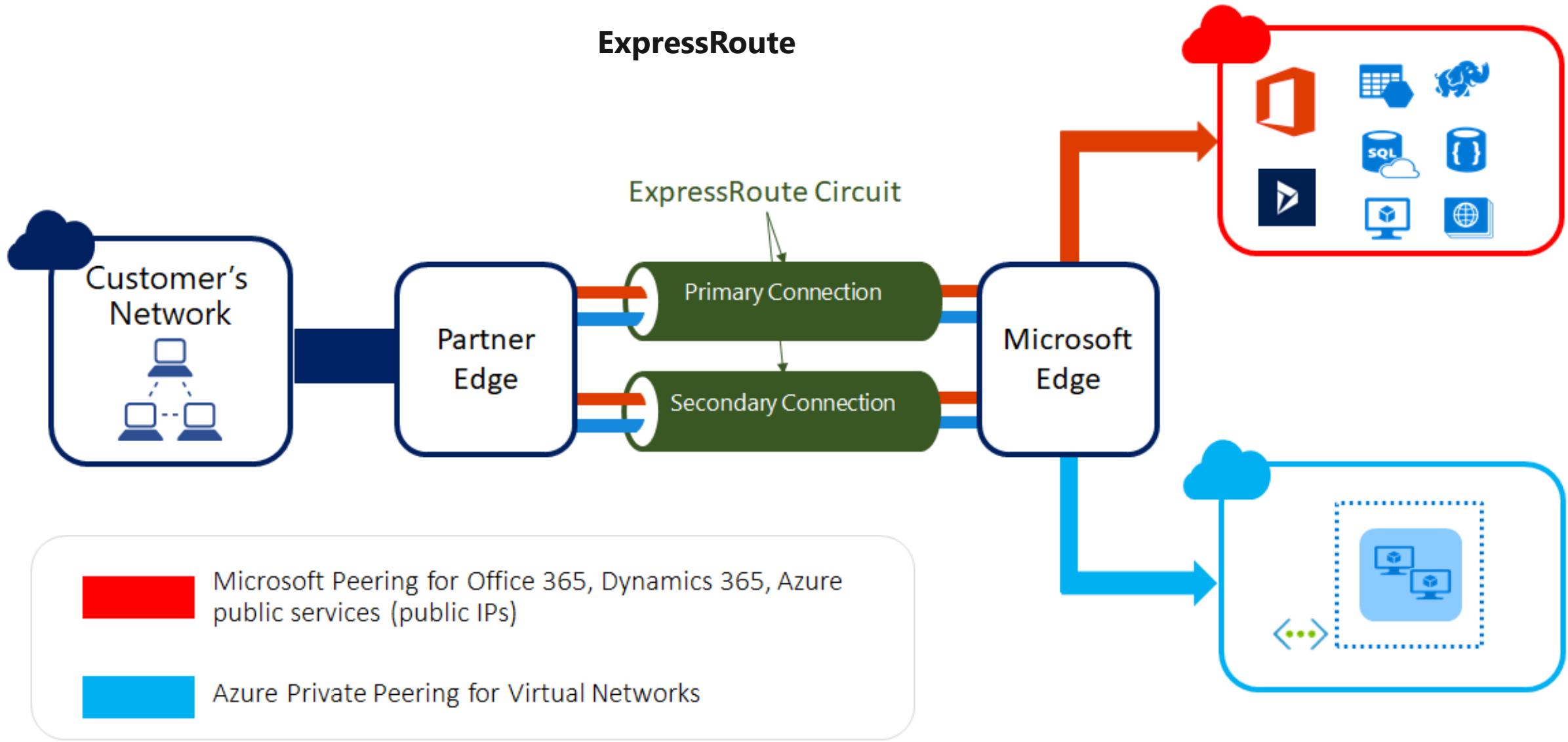


Used to send encrypted traffic between an Azure virtual network and an on-premises location over the public internet or between Azure virtual networks over the Microsoft network.

Site to Site VPN



ExpressRoute



ExpressRoute

ExpressRoute lets you extend your on-premises networks into the Microsoft cloud over a private connection facilitated by a connectivity provider

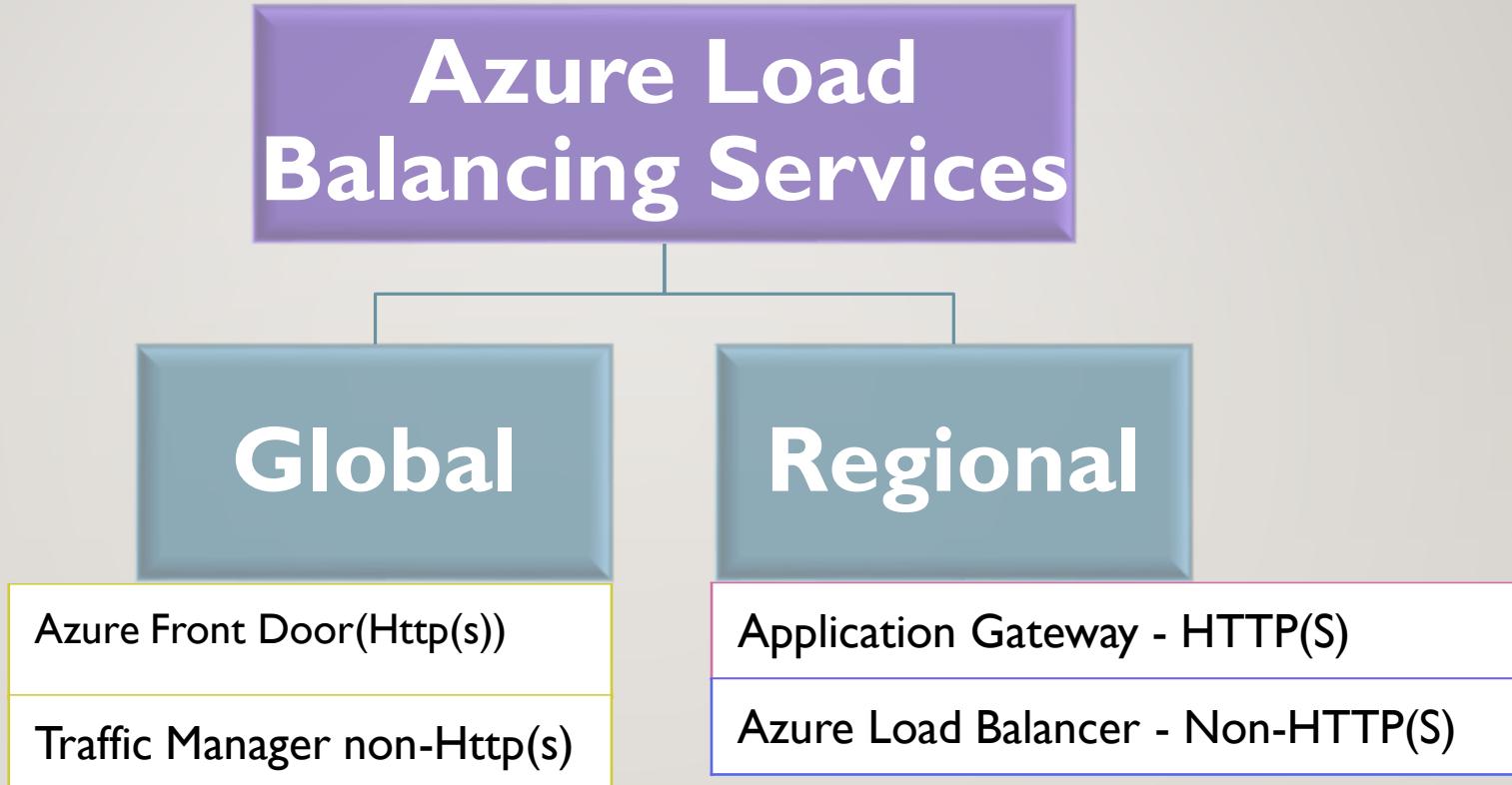
ExpressRoute connections do not go over the public Internet.

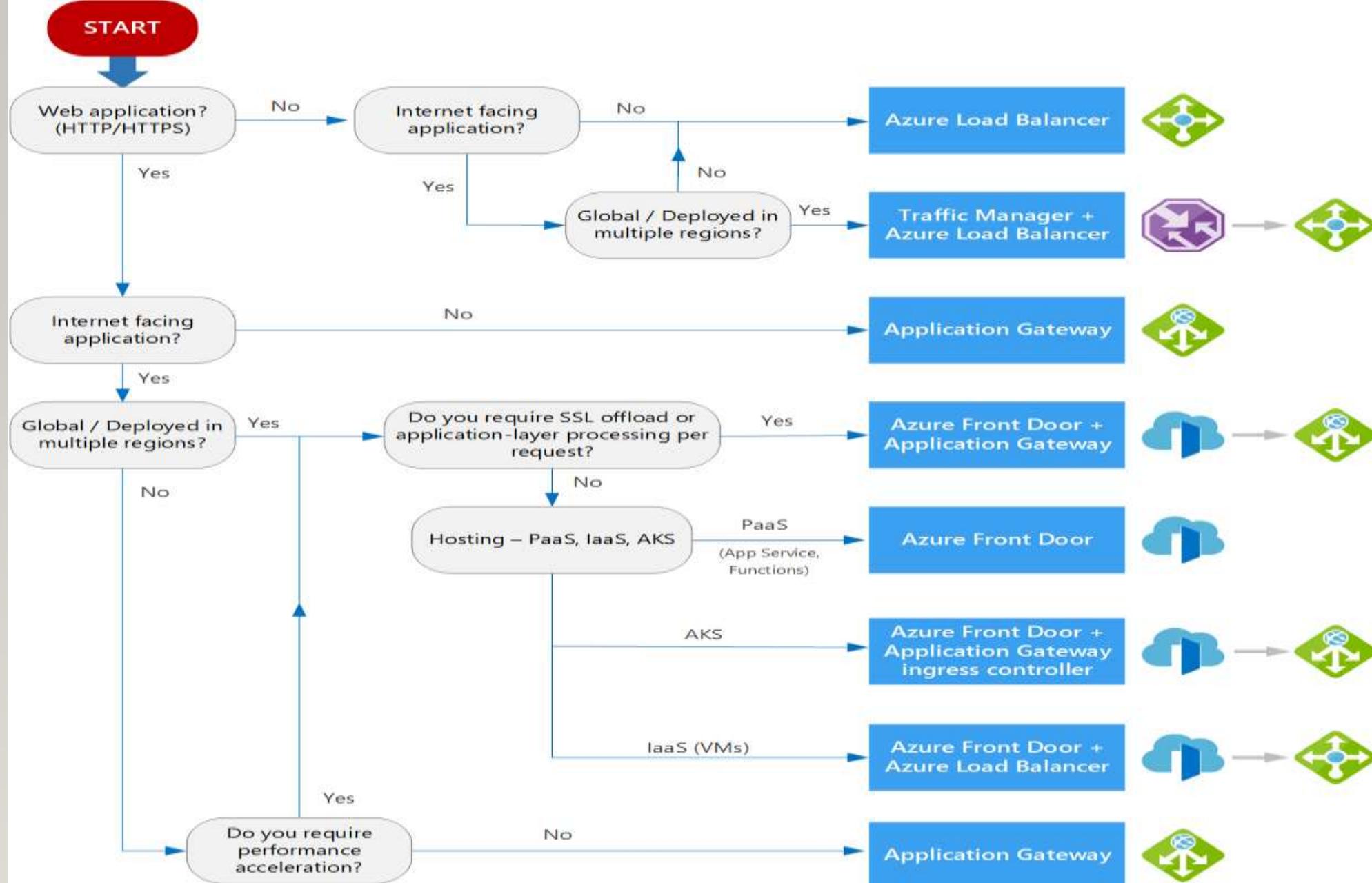
This allows ExpressRoute connections to offer more reliability, faster speeds, consistent latencies, and higher security than typical connections over the Internet.

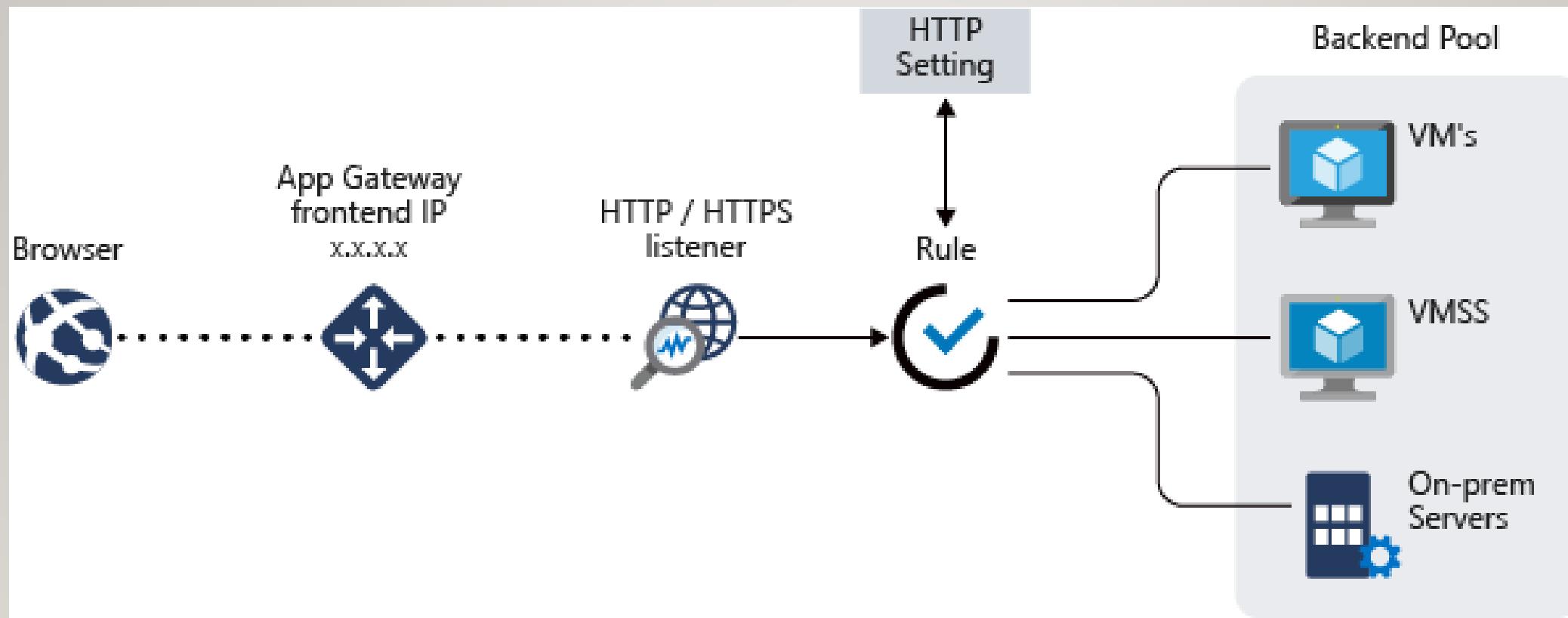
- Layer 3 connectivity between your on-premises network and the Microsoft Cloud through a connectivity provider. Connectivity can be from an any-to-any (IPVPN) network, a point-to-point Ethernet connection, or through a virtual cross-connection via an Ethernet exchange.
- Connectivity to Microsoft cloud services across all regions in the geopolitical region.
- Global connectivity to Microsoft services across all regions with the ExpressRoute premium add-on.
- Dynamic routing between your network and Microsoft via BGP.
- Built-in redundancy in every peering location for higher reliability.
- Connection uptime SLA.
- QoS support for Skype for Business.

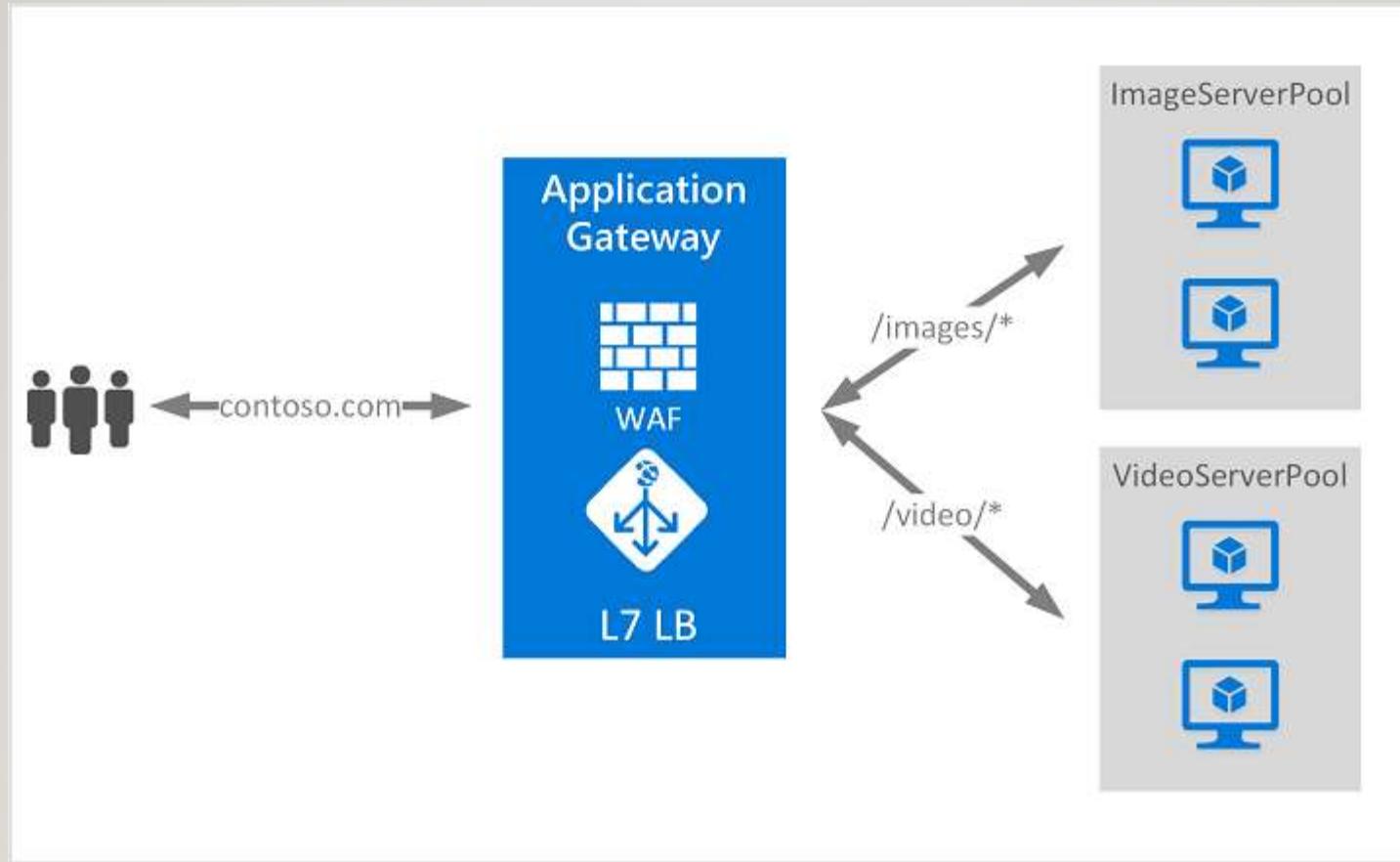
Azure Load Balancing Services

Load balancing refers to efficiently distributing load or incoming network traffic across a group of backend resources or servers.









IaaS

DISKS

- ✓ Persistent Disks for Azure IaaS VM's.
- ✓ Premium Storage Disks
 - ✓ SSD based, High IOPS, Low latency

FILES

- ✓ Fully Managed File Shares in the Cloud
- ✓ SMB and REST access

PaaS

Blobs

- ✓ Highly scalable, REST based object store
- ✓ Unstructured Data

TABLES

- ✓ Massive Auto-Scaling NoSQL Store
- ✓ Dynamic Scaling Based on Load
- ✓ Scale to PB's of the Table Data
- ✓ Fast key/Value lookups

Queues

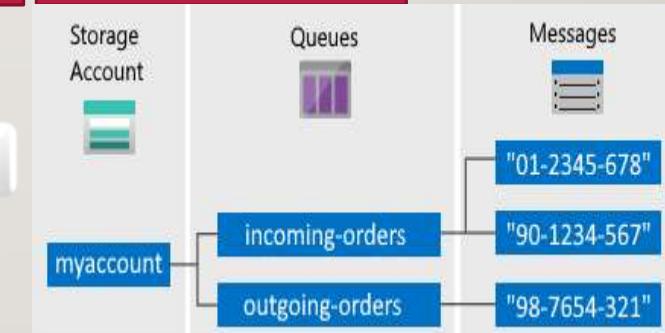
- ✓ Reliable queues at scale for cloud services
- ✓ Decouple and scale components

Storage Tiers

- Hot Tier
- Cool Tier
- Archive Tier

Storage Tiers

- Replication



IaaS

DISKS

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Queues

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Storage Tiers

- Hot Tier
- Cool Tier
- Archive Tier

Write Charges (Operation + Access)**SetBlobTier
Direction**

hot->cool,
hot->archive,
cool->archive

Read Charges (Operation + Access)

archive->cool,
archive->hot,
cool->hot

IaaS

DISKS

- ✓ Persistent Disks for Azure IaaS VM's.
- ✓ Premium Storage Disks
 - ✓ SSD based, High IOPS, Low latency

FILES

- ✓ Fully Managed File Shares in the Cloud
- ✓ SMB and REST access

PaaS

Blobs

- ✓ Highly scalable, REST based object store
- ✓ Unstructured Data

TABLES

- ✓ Massive Auto-Scaling NoSQL Store
- ✓ Dynamic Scaling Based on Load
- ✓ Scale to PB's of the Table Data
- ✓ Fast key/Value lookups

Queues

- ✓ Reliable queues at scale for cloud services
- ✓ Decouple and scale components

Storage Tiers

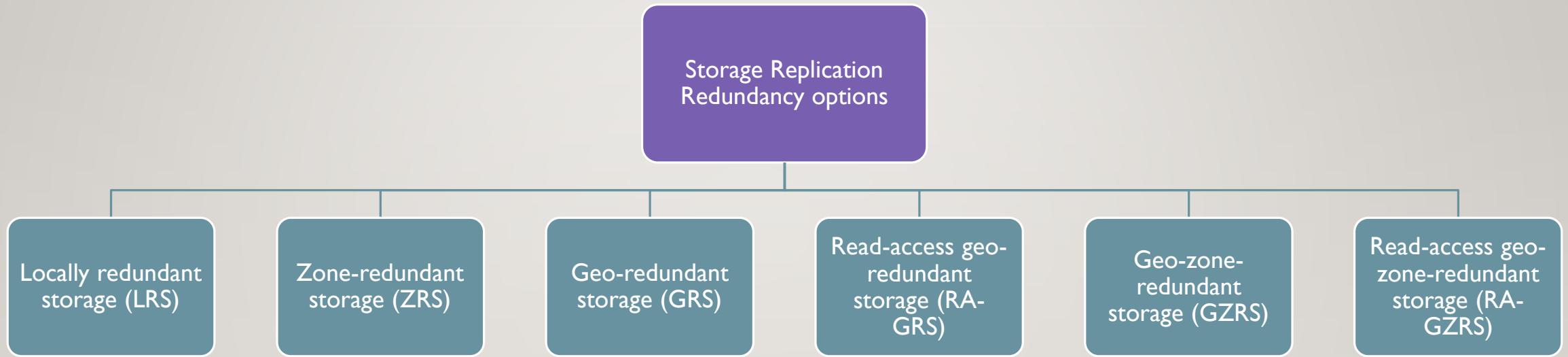
- Hot Tier
- Cool Tier
- Archive Tier

Storage Tiers

- Replication

		Premium	Replication	Access Tier
Standard				
Account Kind	Storage V2 - General Purpose V2	Yes	LRS,ZRS,GRS,RA-GRS,GZRS,RA-GZRS	Cool and Hot
	Storage - General Purpose VI	Yes	LRS, GRS and RA- GRS	NA
	Blog Storage	No	LRS, GRS and RA- GRS	Cool and Hot
	Premium			
Account Kind	Storage V2 - General Purpose V2	Yes	LRS	NA
	Storage - General Purpose VI	Yes	LRS	NA
	Block Blob Storage	Yes	LRS	NA
	File Storage	Yes	LRS	NA

Scenario	LRS	ZRS	GRS/RA-GRS	GZRS/RA-GZRS (preview)
Node unavailability within a data center	Yes	Yes	Yes	Yes
An entire data center (zonal or non-zonal) becomes unavailable	No	Yes	Yes	Yes
A region-wide outage	No	No	Yes	Yes
Read access to your data (in a remote, geo-replicated region) in the event of region-wide unavailability	No	No	Yes (with RA-GRS)	Yes (with RA-GZRS)
Designed to provide ___ durability of objects over a given year	At least 99.999999999% (11 9's)	At least 99.999999999% (12 9's)	At least 99.99999999999999% (16 9's)	At least 99.99999999999999% (16 9's)
Supported storage account types	GPv2, GPv1, BlockBlobStorage, BlobStorage, FileStorage	GPv2, BlockBlobStorage, FileStorage	GPv2, GPv1, BlobStorage	GPv2
Availability SLA for read requests	At least 99.9% (99% for cool access tier)	At least 99.9% (99% for cool access tier)	At least 99.9% (99% for cool access tier) for GRS At least 99.99% (99.9% for cool access tier) for RA-GRS	At least 99.9% (99% for cool access tier) for GZRS At least 99.99% (99.9% for cool access tier) for RA-GZRS
Availability SLA for write requests	At least 99.9% (99% for cool access tier)	At least 99.9% (99% for cool access tier)	At least 99.9% (99% for cool access tier)	At least 99.9% (99% for cool access tier)



Locally redundant storage (LRS): Low-cost data redundancy

Locally redundant storage (LRS) replicates your data three times within a single data center

LRS provides at least 99.99999999% (11 nines) durability of objects over a given year

Scenario Based example

If a datacenter-level disaster (for example, fire or flooding) occurs, all replicas in a storage account using LRS may be lost or unrecoverable. To mitigate this risk, Microsoft recommends using zone-redundant storage (ZRS), geo-redundant storage (GRS), or geo-zone-redundant storage (GZRS).

A write request to an LRS storage account returns successfully only after the data is written to all three replicas.

Use Cases

If your application stores data that can be easily reconstructed if data loss occurs, you may opt for LRS.

Some applications are restricted to replicating data only within a country/region due to data governance requirements. In some cases, the paired regions across which the data is replicated for GRS accounts may be in another country/region

ZONE-REDUNDANT STORAGE

Zone-redundant storage (ZRS) replicates your data synchronously across three storage clusters in a single region.

Each storage cluster is physically separated from the others and is located in its own availability zone (AZ)

Each availability zone—and the ZRS cluster within it—is autonomous and includes separate utilities and networking features.

A write request to a ZRS storage account returns successfully only after the data is written to all replicas across the three clusters.

What happens when a zone becomes unavailable?

Your data is still accessible for both read and write operations even if a zone becomes unavailable. Microsoft recommends that you continue to follow practices for transient fault handling. These practices include implementing retry policies with exponential back-off.

ZRS may not protect your data against a regional disaster where multiple zones are permanently affected. Instead, ZRS offers resiliency for your data if it becomes temporarily unavailable. For protection against regional disasters, Microsoft recommends using geo-redundant storage (GRS)

Geo-redundant storage (GRS)

Cross-regional replication for Azure Storage

Geo-redundant storage (GRS) is designed to provide at least 99.9999999999999% (16 9's) durability of objects over a given year by replicating your data to a secondary region that is hundreds of miles away from the primary region. If your storage account has GRS enabled, then your data is durable even in the case of a complete regional outage or a disaster in which the primary region isn't recoverable.

If you opt for GRS, you have two related options to choose from:

GRS replicates your data to another data center in a secondary region, but that data is available to be read only if Microsoft initiates a failover from the primary to secondary region.

Read-access geo-redundant storage (RA-GRS) is based on GRS. RA-GRS replicates your data to another data center in a secondary region, and also provides you with the option to read from the secondary region. With RA-GRS, you can read from the secondary region regardless of whether Microsoft initiates a failover from the primary to secondary region.

Build highly available Azure Storage applications with geo-zone-redundant storage (GZRS)

Geo-zone-redundant storage (GZRS) marries the high availability of zone-redundant storage (ZRS) with protection from regional outages as provided by geo-redundant storage (GRS). Data in a GZRS storage account is replicated across three Azure availability zones in the primary region and also replicated to a secondary geographic region for protection from regional disasters. Each Azure region is paired with another region within the same geography, together making a regional pair

- ✓ With a GZRS storage account, you can continue to read and write data if an availability zone becomes unavailable or is unrecoverable.
- ✓ Additionally, your data is also durable in the case of a complete regional outage or a disaster in which the primary region isn't recoverable.
- ✓ GZRS is designed to provide at least 99.9999999999999% (16 9's) durability of objects over a given year. GZRS also offers the same scalability targets as LRS, ZRS, GRS, or RA-GRS. You can optionally enable read access to data in the secondary region with read-access geo-zone-redundant storage (RA-GZRS) if your applications need to be able to read data in the event of a disaster in the primary region.
- ✓ Microsoft recommends using GZRS for applications requiring consistency, durability, high availability, excellent performance, and resilience for disaster recovery
- ✓ For the additional security of read access to the secondary region in the event of a regional disaster, enable RA-GZRS for your storage account

How GZRS and RA-GZRS work

When data is written to a storage account with GZRS or RA-GZRS enabled, that data is first replicated synchronously in the primary region across three availability zones. The data is then replicated asynchronously to a second region that is hundreds of miles away. When the data is written to the secondary region, it's further replicated synchronously three times within that region using [locally redundant storage \(LRS\)](#).

TABLES:

Provide structured storage. A table is a set of entities which contain a set of properties.

BLOBS:

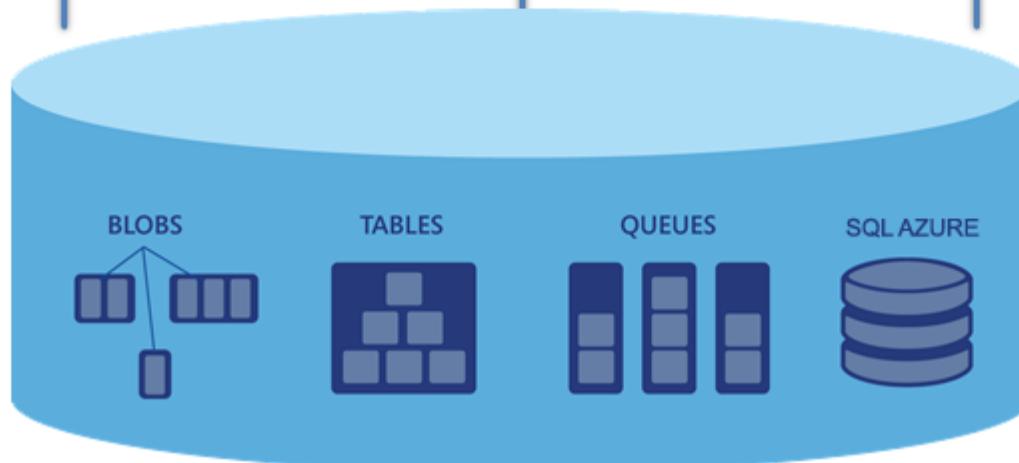
Provide a simple interface for storing named files along with metadata for the file.

QUEUES:

Provide reliable storage and delivery of messages for an application.

SQL Azure:

A relational database hosted in a MS data center, triply replicated.



Databases

Azure Cosmos DB

- Globally distributed, multi-Model NoSQL database Service
- Paas Service – Auto-Scalable Across multiple regions
- Supports API, Including SQL, MongoDB, Cassandra,Tables & Gremlin



Azure Sql Database

IaaS

- SQL Server on Azure VMs
- Pay-As-You-Go for SQL server license or use an existing licenses

PaaS

- Fully Managed SQL database Engine
- Available as Single Database, Elastic pool and Managed instances

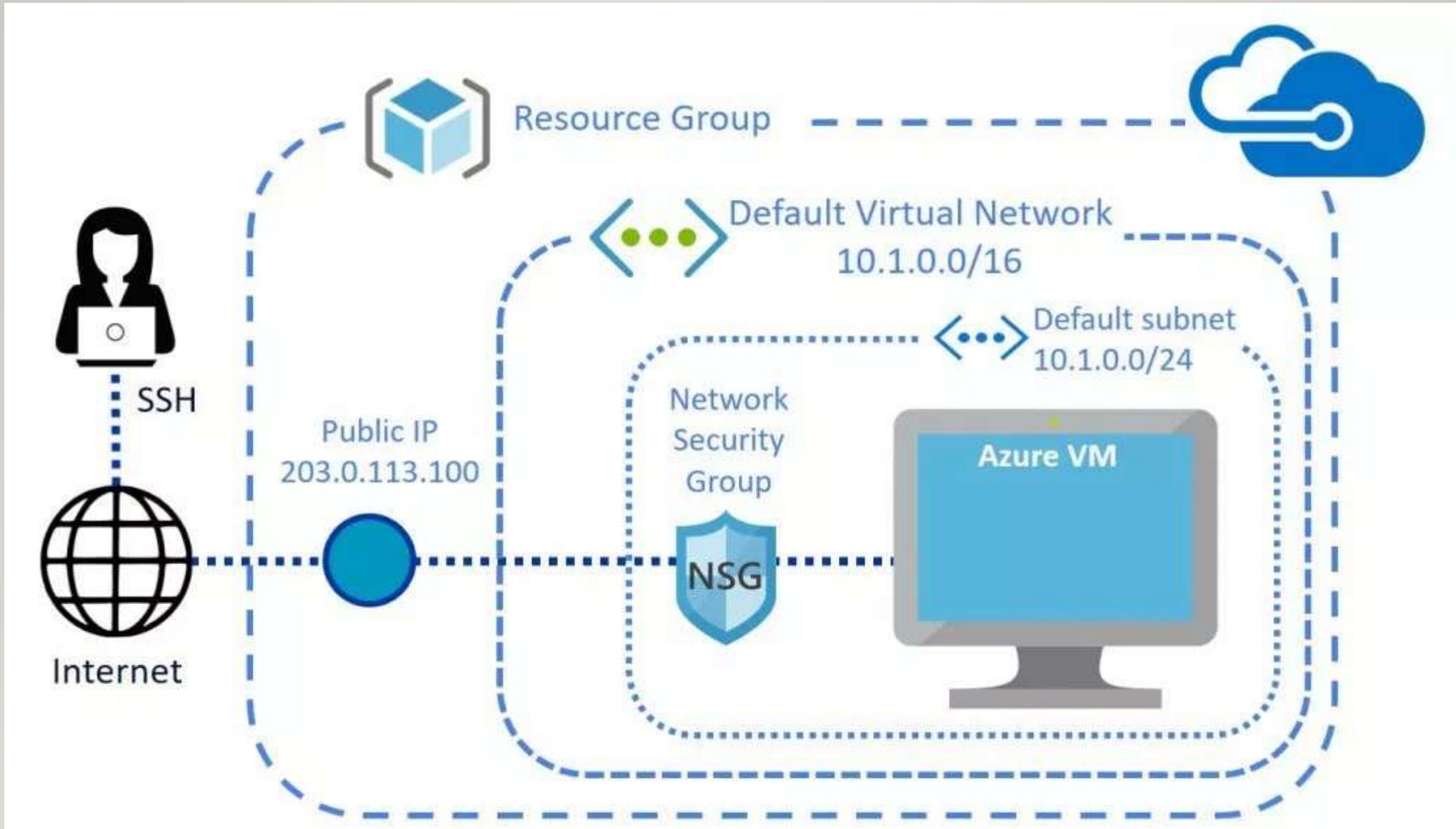
Azure SQL Data Warehouse

- Cloud Based Enterprise Data Warehouse – EDW
- Leverages massively parallel processing (MPP) to Quickly run complex queries across petabytes of Data
- Key component of a Big Data Solution

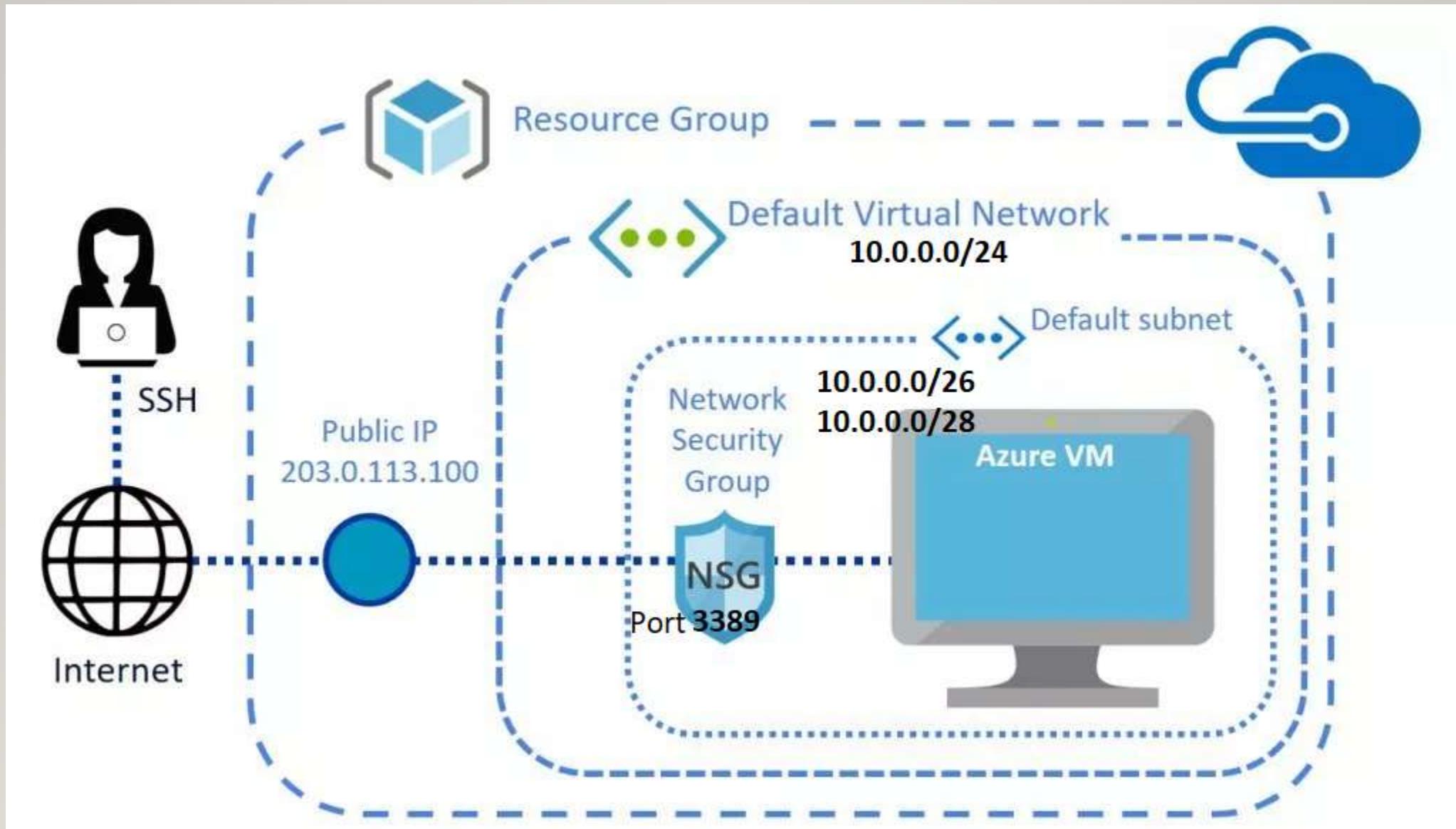
Azure Database Migration services

- Enables seamless migration from multiple databases sources to Azure Data platforms with minimal downtime
- Offline migration: Application downtime starts when the migration starts
- Online Migration: Downtime is limited to the time to cur over at the end of the migration

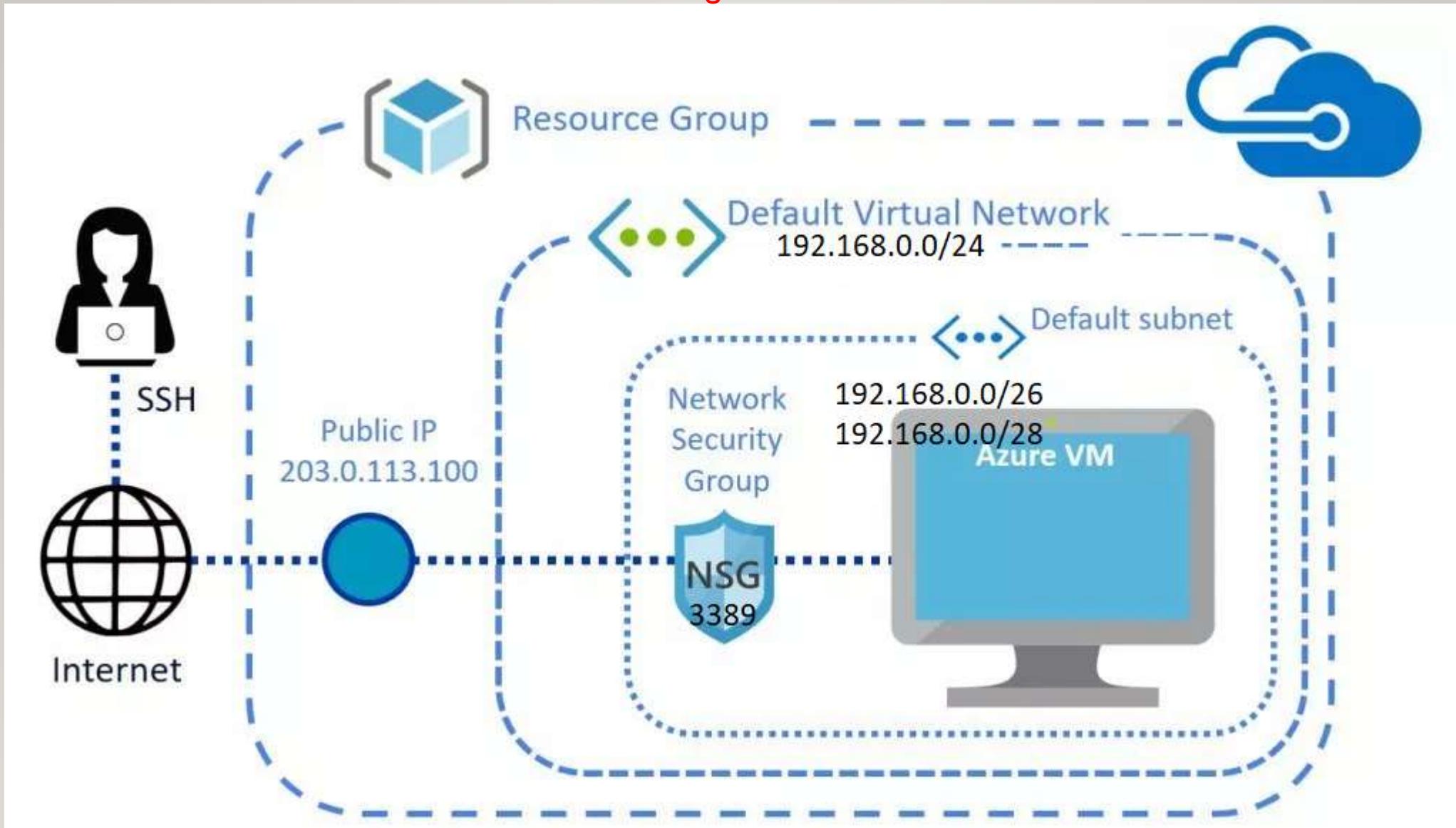
Creating Your First Azure Virtual Machine -Step By Step – Try Yourself



LAB Demo - Creating Azure Virtual Networks



LAB Demo - Creating Azure Virtual Networks



Intro to Using Azure Blob Storage

<https://tinyurl.com/paddymaddy26>

Internet of
Things – IoT

BigData And
Analytics

Artificial
Intelligence –
AI

Serverless
Computing

Azure
Solitons
Benefits

Internet of Things (IoT)

- An IoT Solution is made up of one or more IoT devices and one or more back0end services running in the cloud that communicate with each other
- Devices usually have sensors and connect to the internet



<https://tinyurl.com/paddymaddy26>

Internet of Things (IoT)

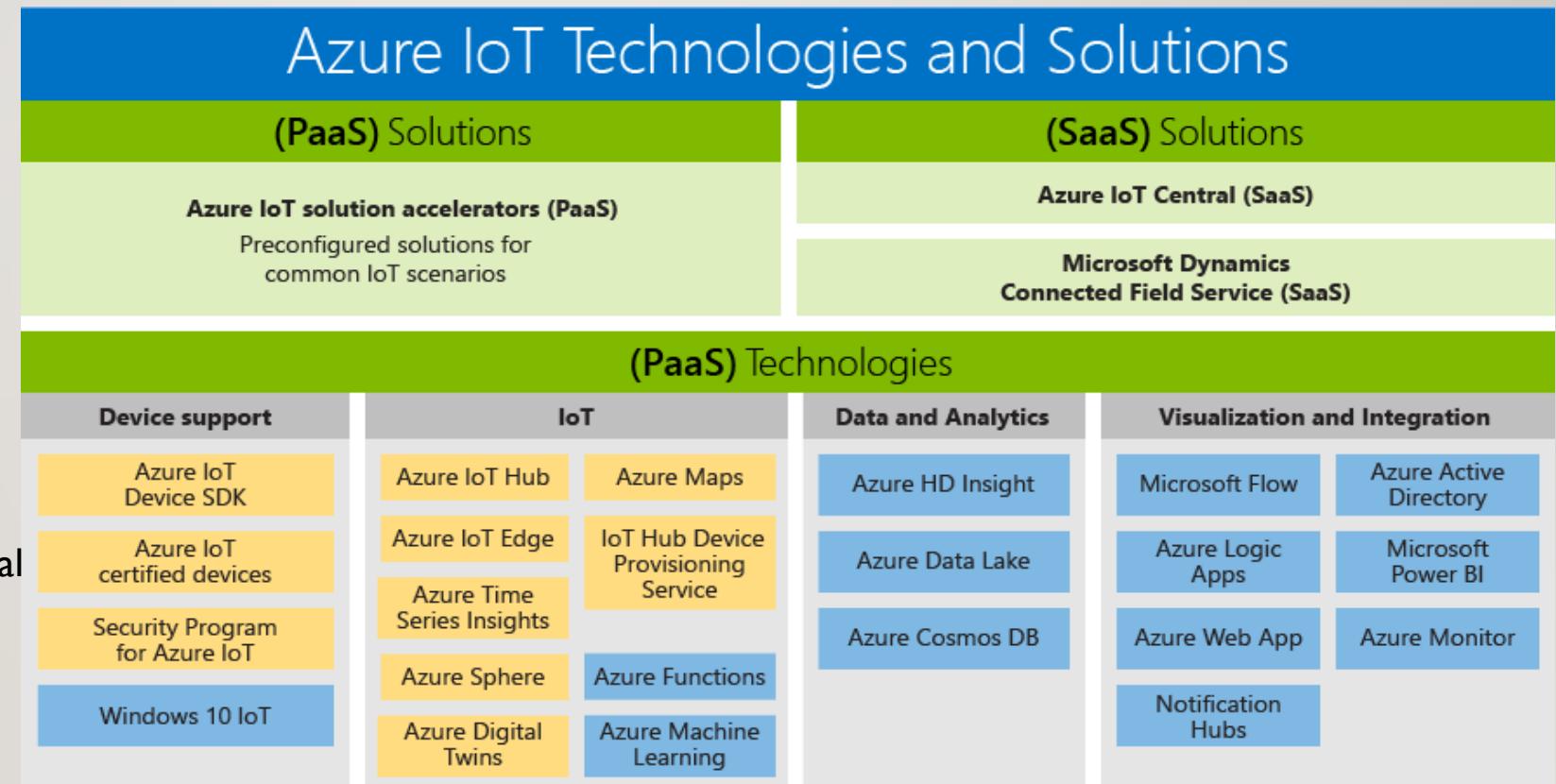
- An IoT Solution is made up of one or more IoT devices and one or more back-end services running in the cloud that communicate with each other
- Devices usually have sensors and connect to the internet

IOC Central

- Fully managed SaaS Solution
- Easily connect, Monitor and manager your IoT Devices / Assists at scale.
- Collaborative drag and Drop visual workspace where you can build test and deploy IOT Solutions without needing to write code

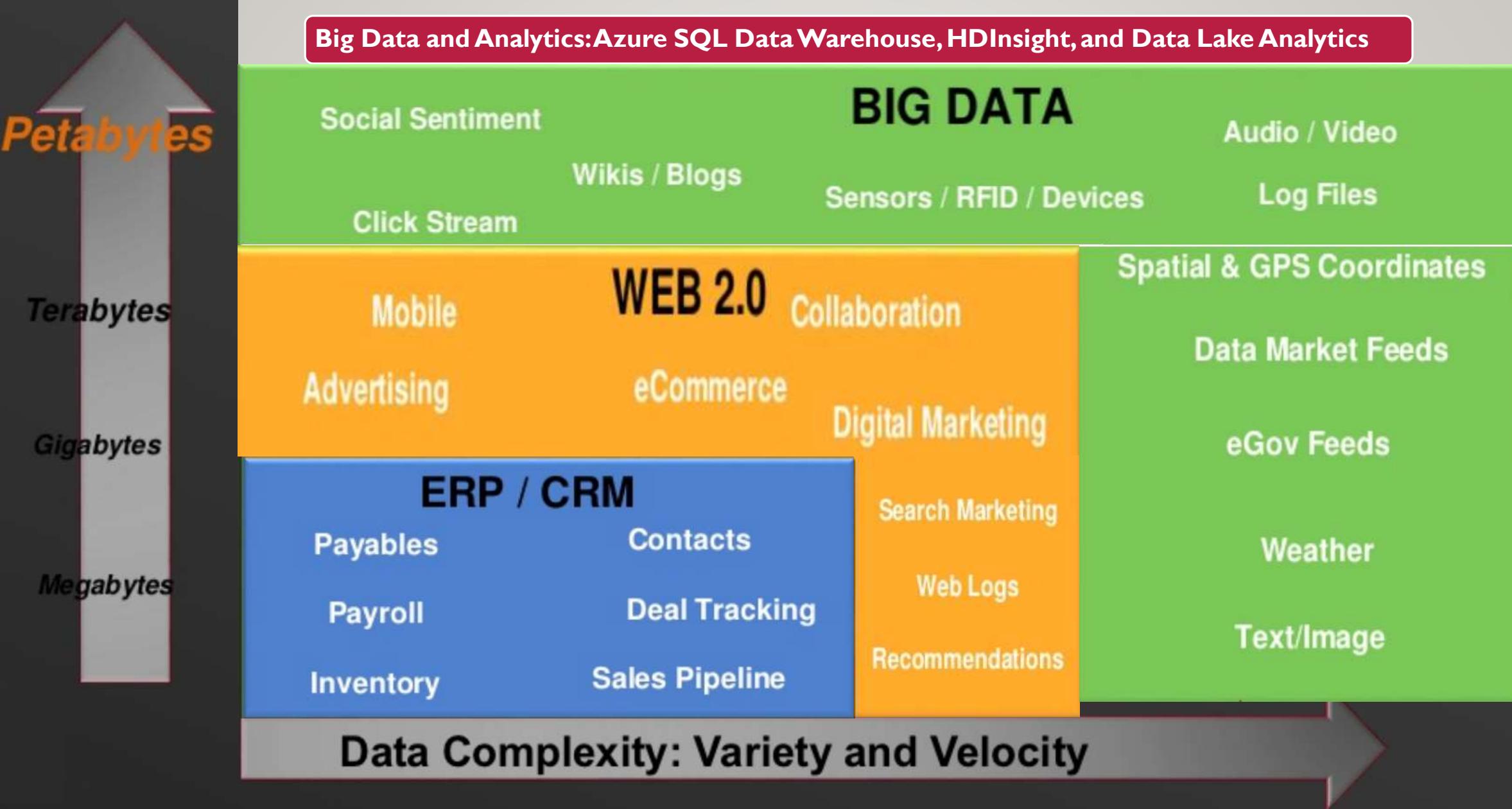
IOT Hub

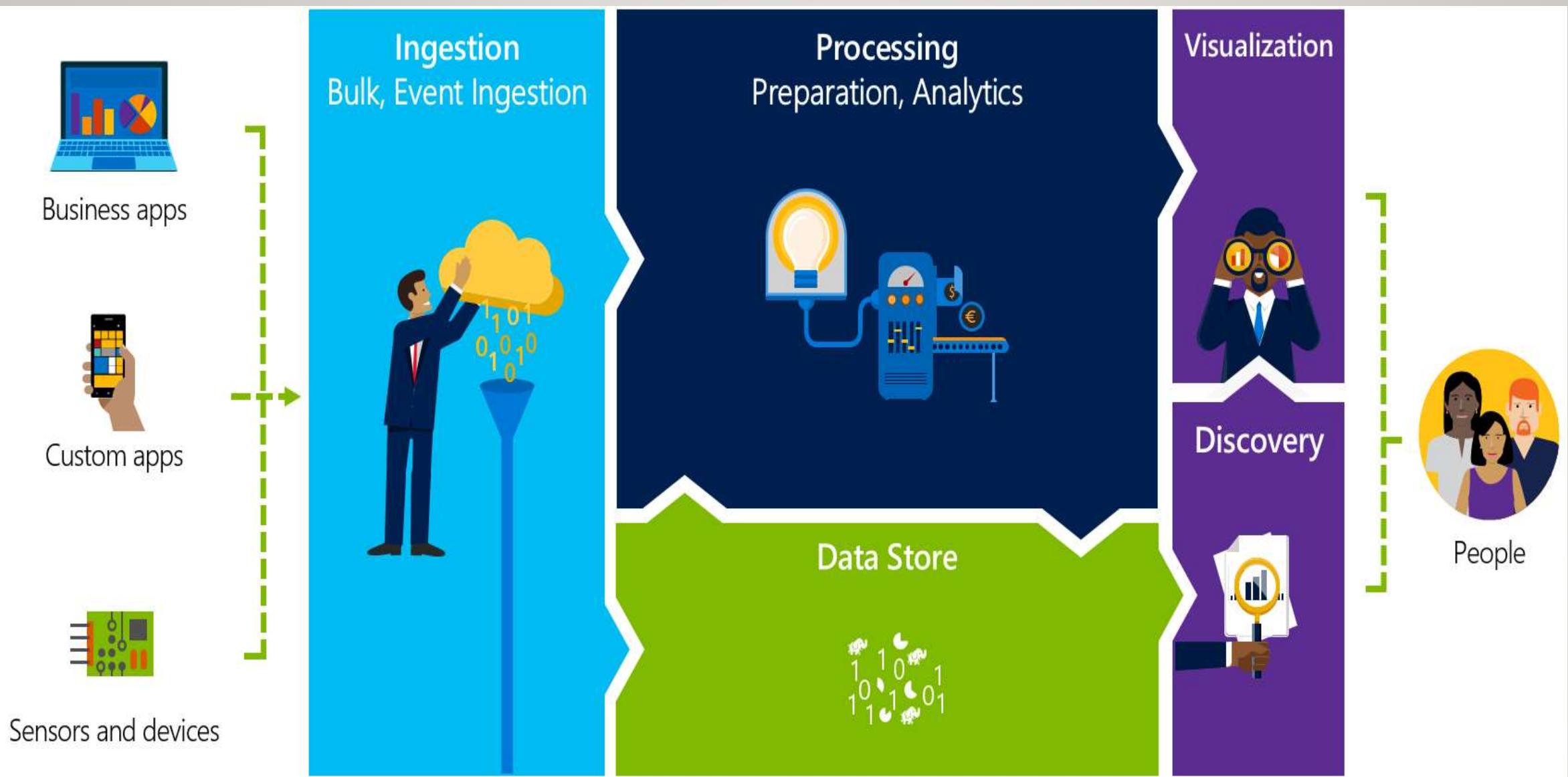
- Core Azure PaaS Messaging Service used by Azure IOT Central
- Enables reliable and secure bidirectional communications between millions of IoT Devices and a Cloud Solution





Big Data and Analytics: Azure SQL Data Warehouse, HDInsight, and Data Lake Analytics

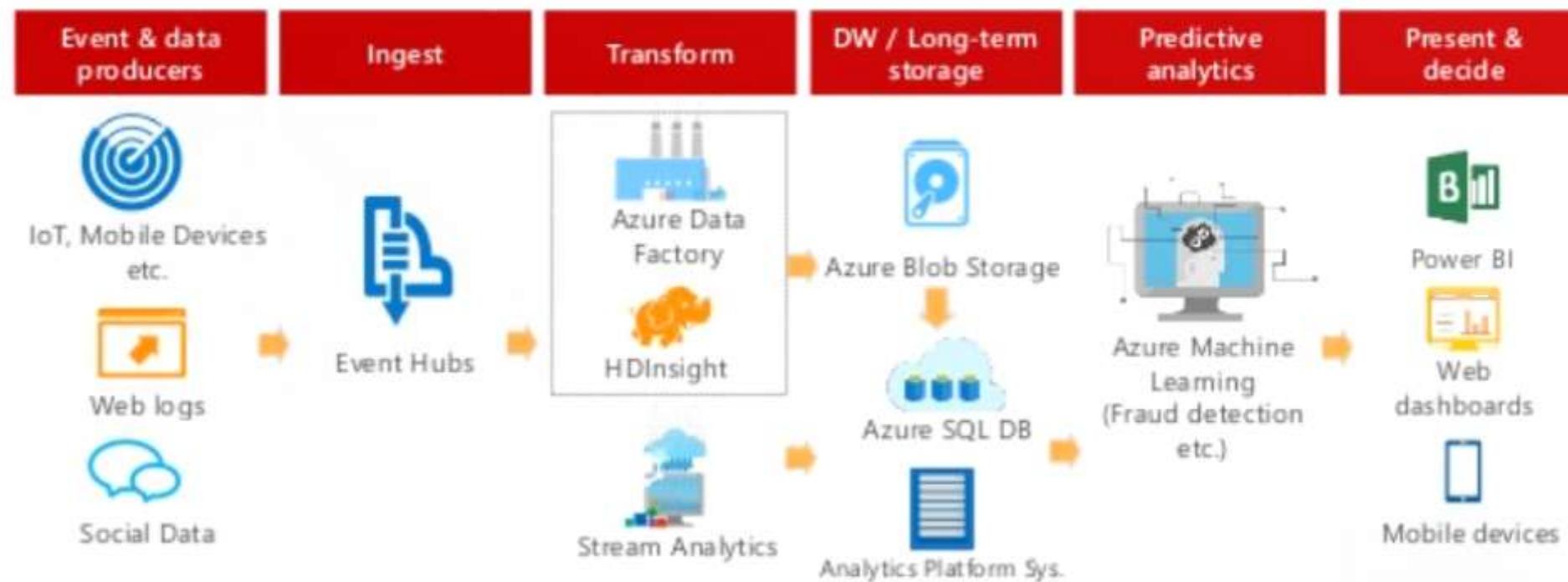




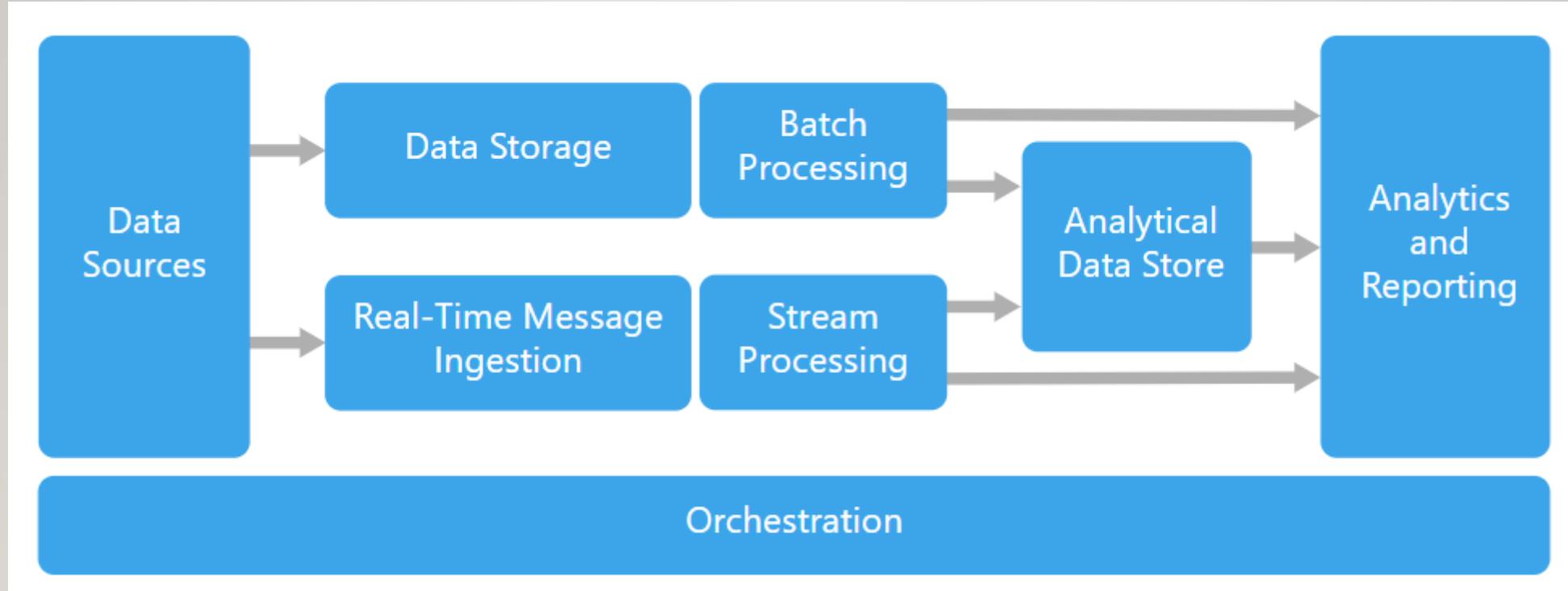


INTELLIGENCE

Example overall data flow and Architecture

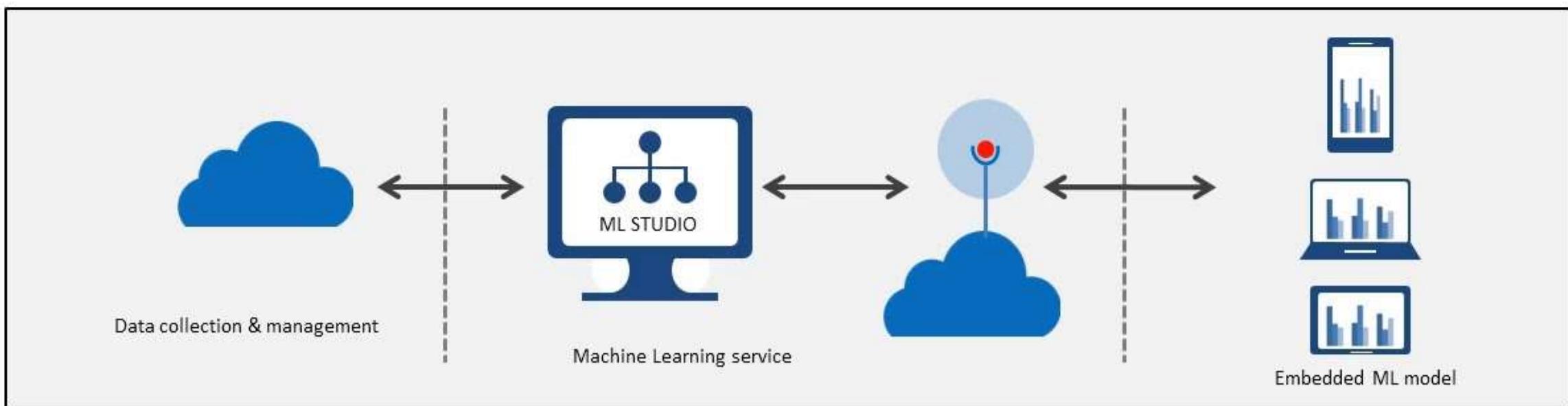


BIG DATA ARCHITECTURE STYLE

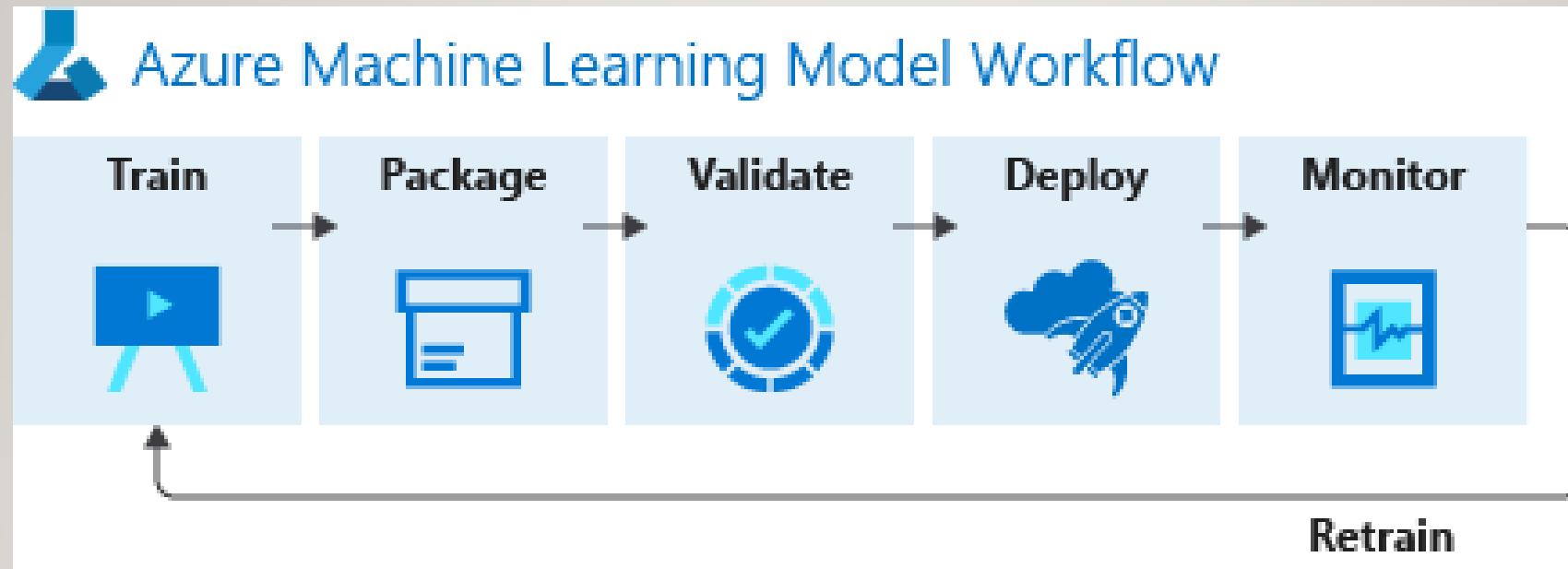


Azure Machine Learning Workflow

- Data collection and management using database applications
 - Massive data stores (Azure Data Lake)
 - Relational data (Azure SQL database)
 - Blobs and tables (Azure Storage)
 - Hadoop (Azure)

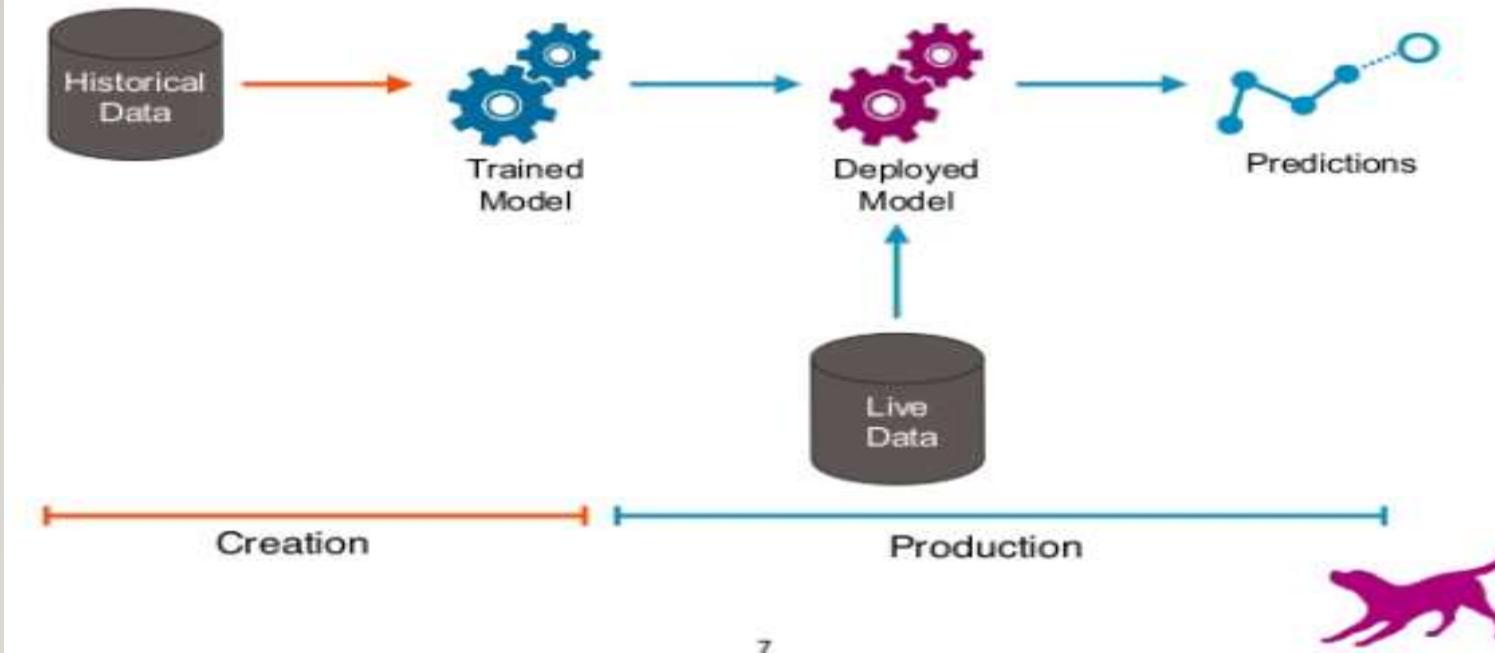


Azure Machine Learning



Azure Machine Learning

ML in Production - 101



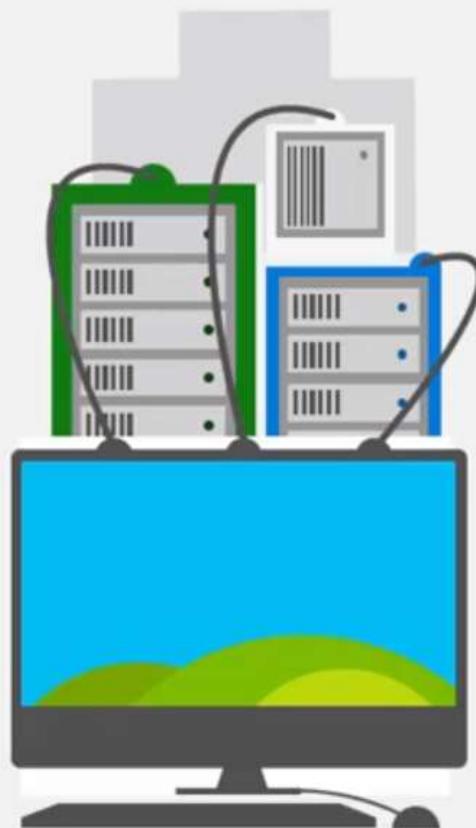
7

Azure Machine Learning

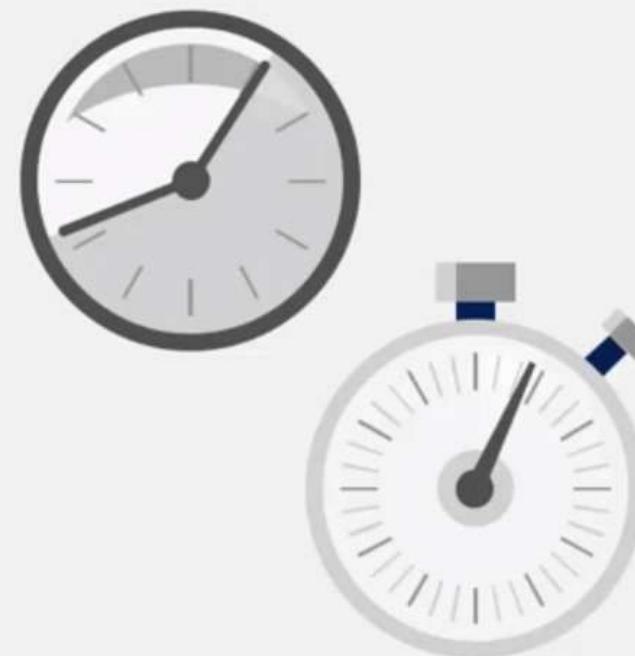
Machine
Learning Service

Machine
Learning Studio

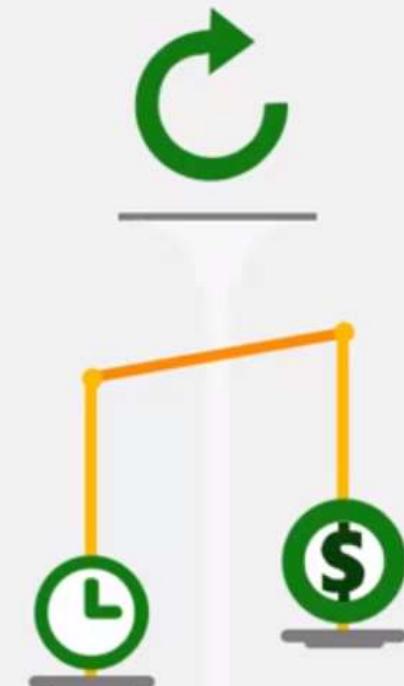
Serverless Technologies



Reduced
devops



Reduced time
to market



Per action billing

Azure serverless Computing



Azure Functions



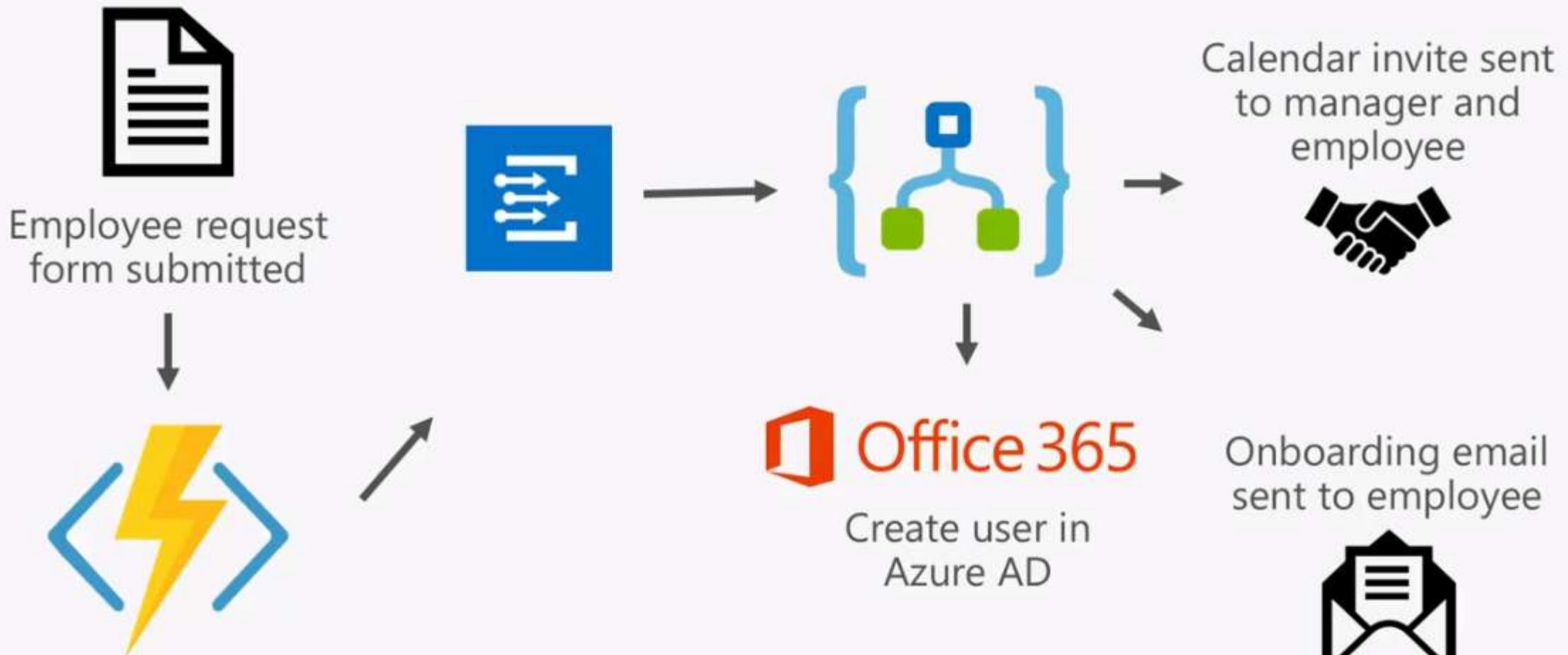
Azure logic Apps



Azure Event Grid



Employee Onboarding



Azure Solutions



Azure Management Tools

Azure
PowerShell

Azure
Portal

Azure CLI

Azure CLI

The Azure CLI is a command-line tool providing a great experience for managing Azure resources. The CLI is designed to make scripting easy, query data, support long-running operations, and more

Windows <https://aka.ms/installazurecliwindows>

macOS

Linux

Commands to create a VM with CLI

Steps to Create a VM

```
az group create --name myResourceGroup --location eastus
```

```
az vm create \  
  --resource-group myResourceGroup \  
  --name myVM \  
  --image win2016datacenter \  
  --admin-username azureuser \  
  --admin-password myPassword
```

```
az vm open-port --port 80 --resource-group myResourceGroup --name myVM
```

```
    Install-WindowsFeature -name Web-Server -IncludeManagementTools
```

```
az group delete --name myResourceGroup
```

Azure PowerShell

Azure PowerShell works with

- PowerShell 5.1 or higher on Windows
- PowerShell Core 6.x and later on all platforms

Find Version

- \$PSVersionTable.PSVersion

If you're on Windows 10, you already have PowerShell 5.1 installed

- Install-Module -Name Az -AllowClobber -Scope AllUsers

For Offline save and Install

- Save-Module -Name Az -Path '\\someshare\PowerShell\modules' –Force

To login with Azure from Powershell

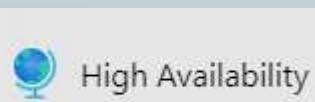
- Connect-AzAccount

Update the Azure PowerShell module

- Install-Module -Name Az -AllowClobber -Force

Azure
Portal

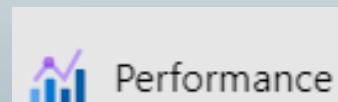
Azure Advisor



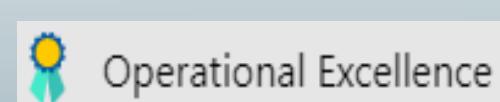
High Availability



Security



Performance

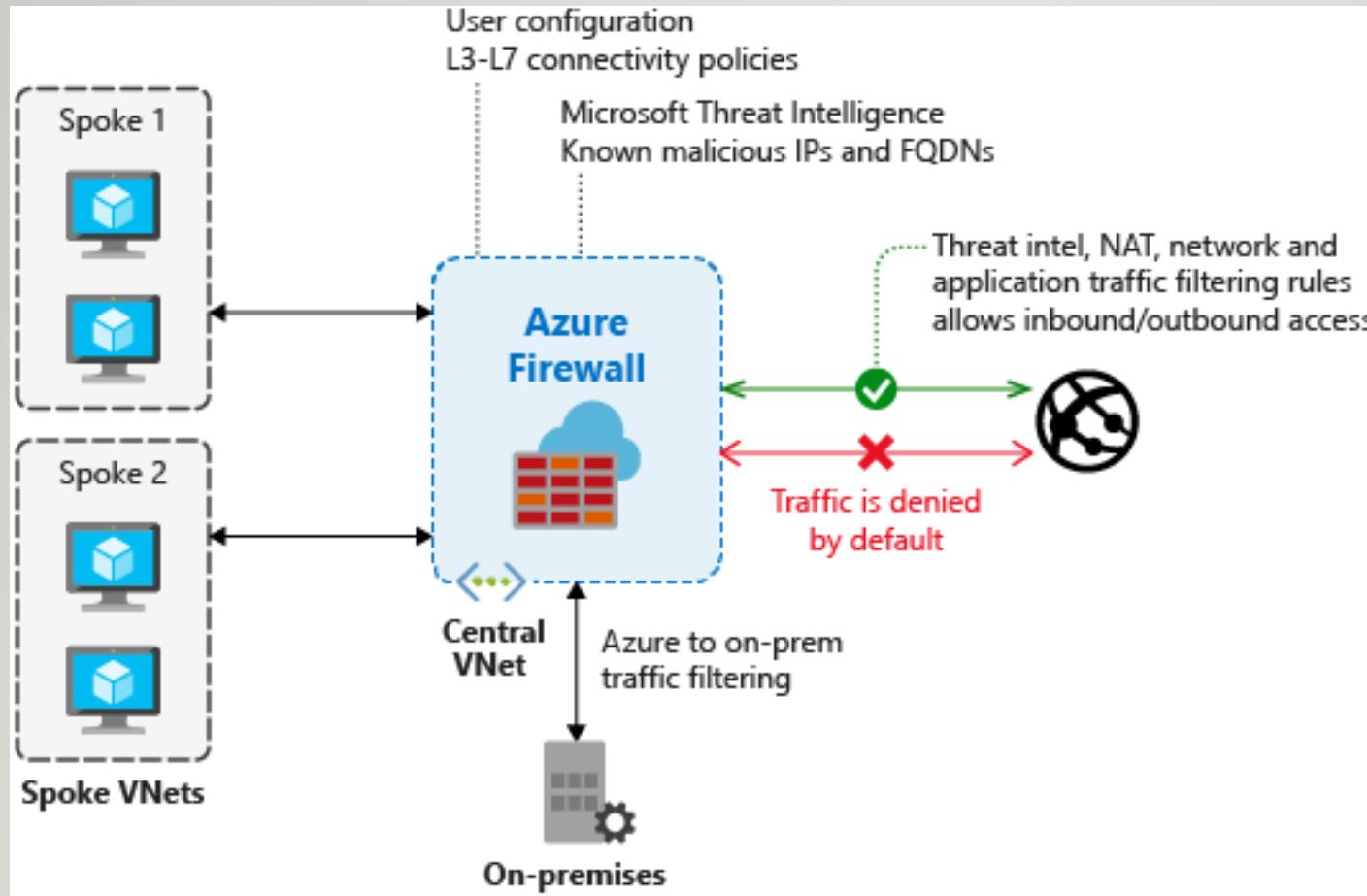


Operational Excellence



Cost

Azure Firewall



Azure DDoS Protection



Protecting your application from DDoS attacks



Within the VNet



Within Azure

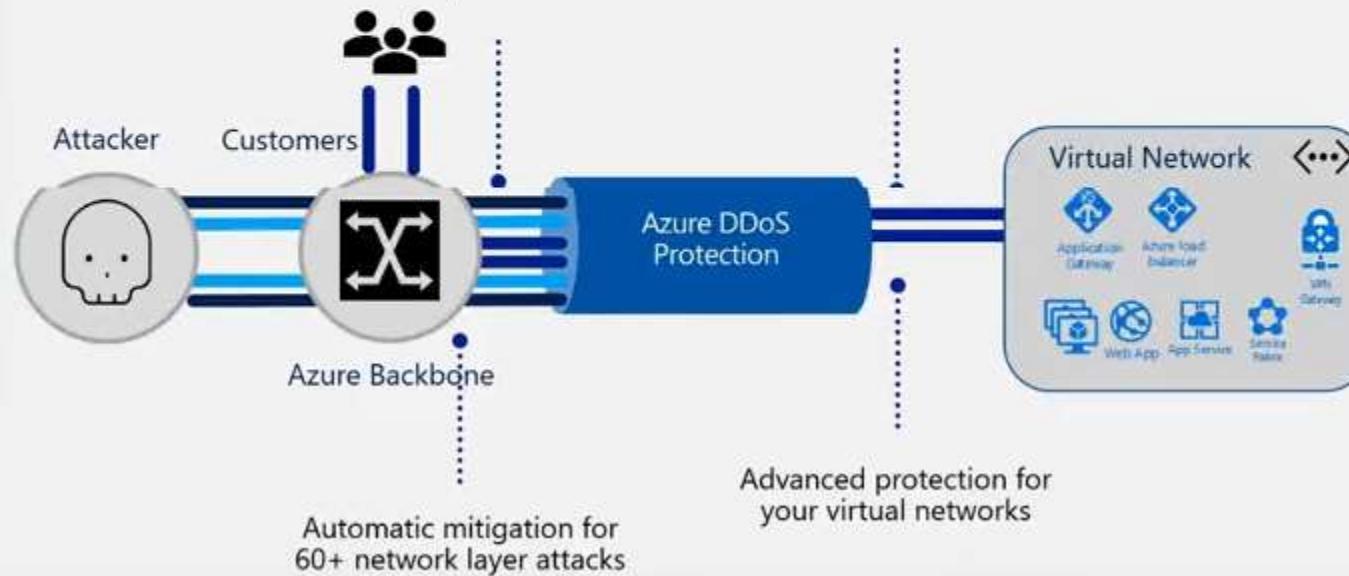


From the Internet

Azure DDoS Protection

Adaptive tuning based on platform insights and application traffic patterns

Any injected workload in the VNet is automatically protected



Reliable proven success



Scalable global capacity

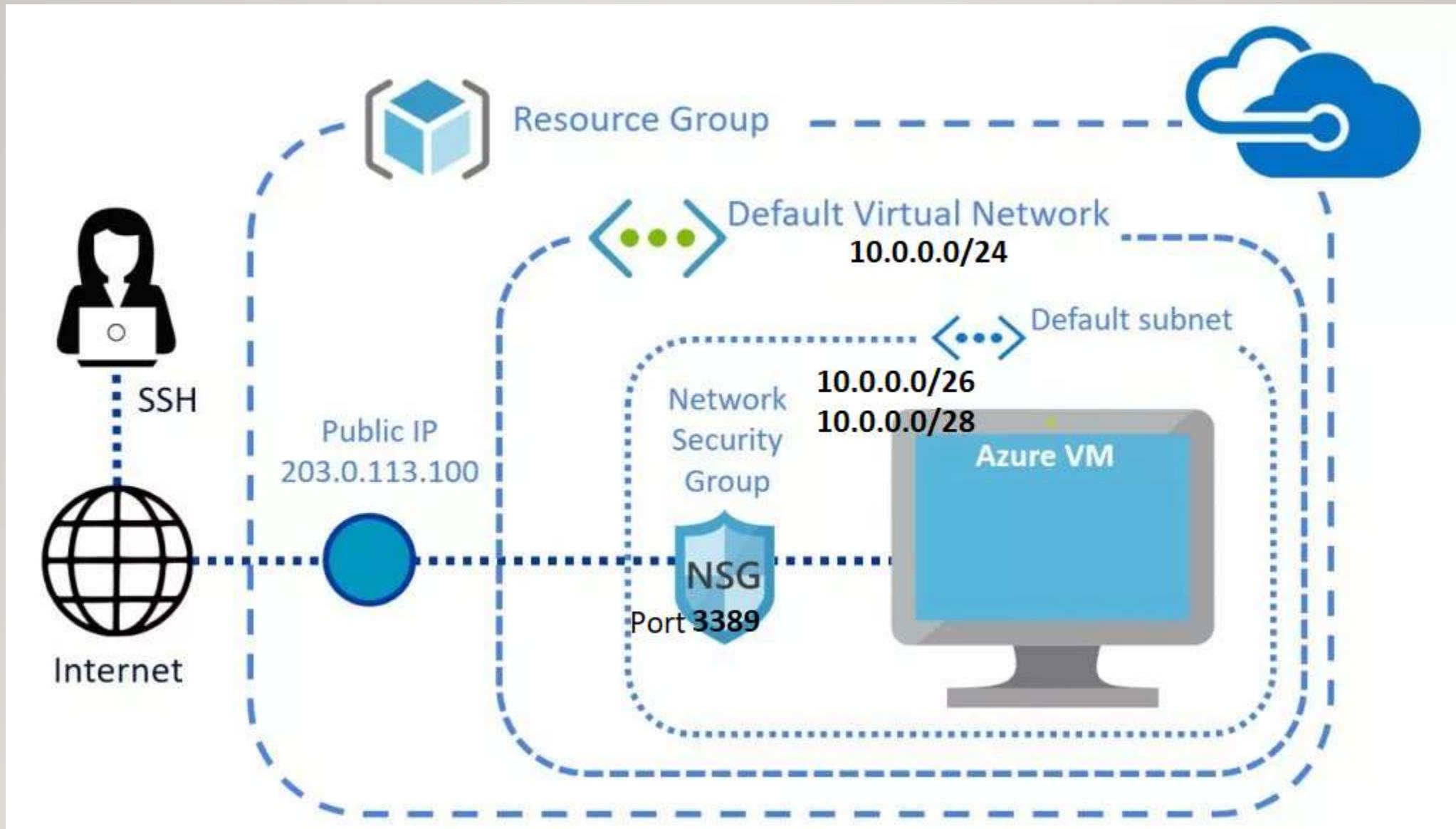


Automatic simple, automated

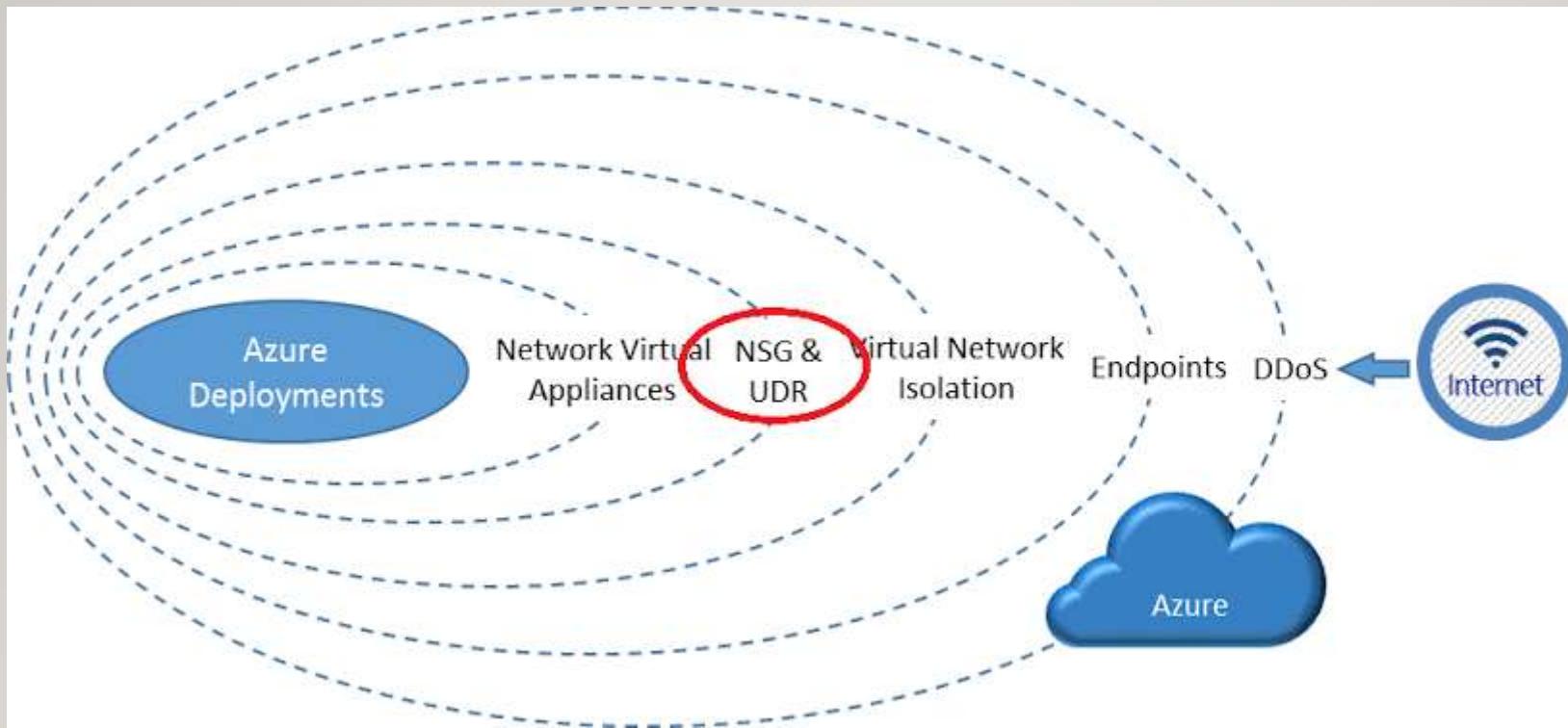


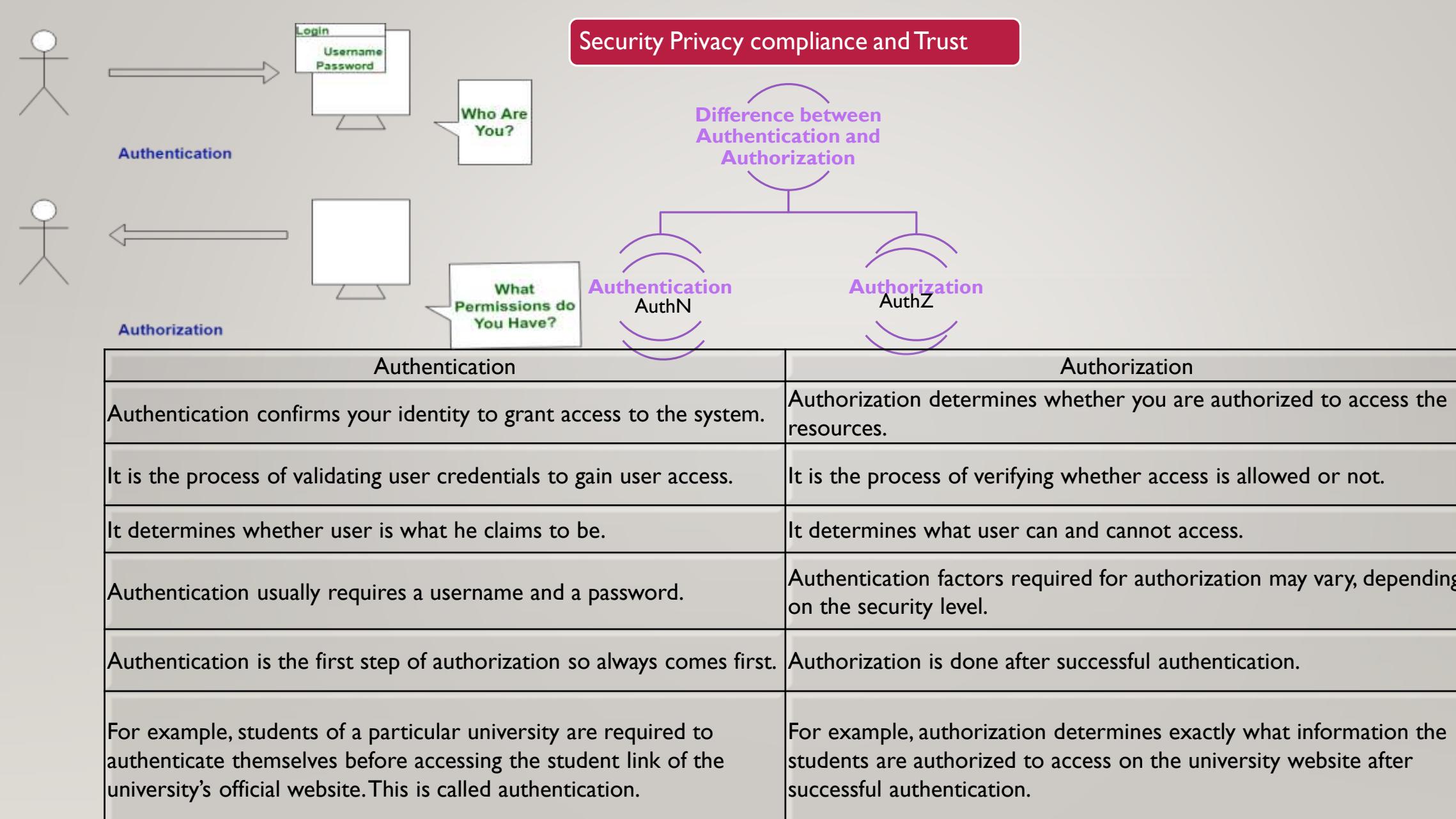
Adaptive real time tuning

LAB Demo - Creating Azure Virtual Networks

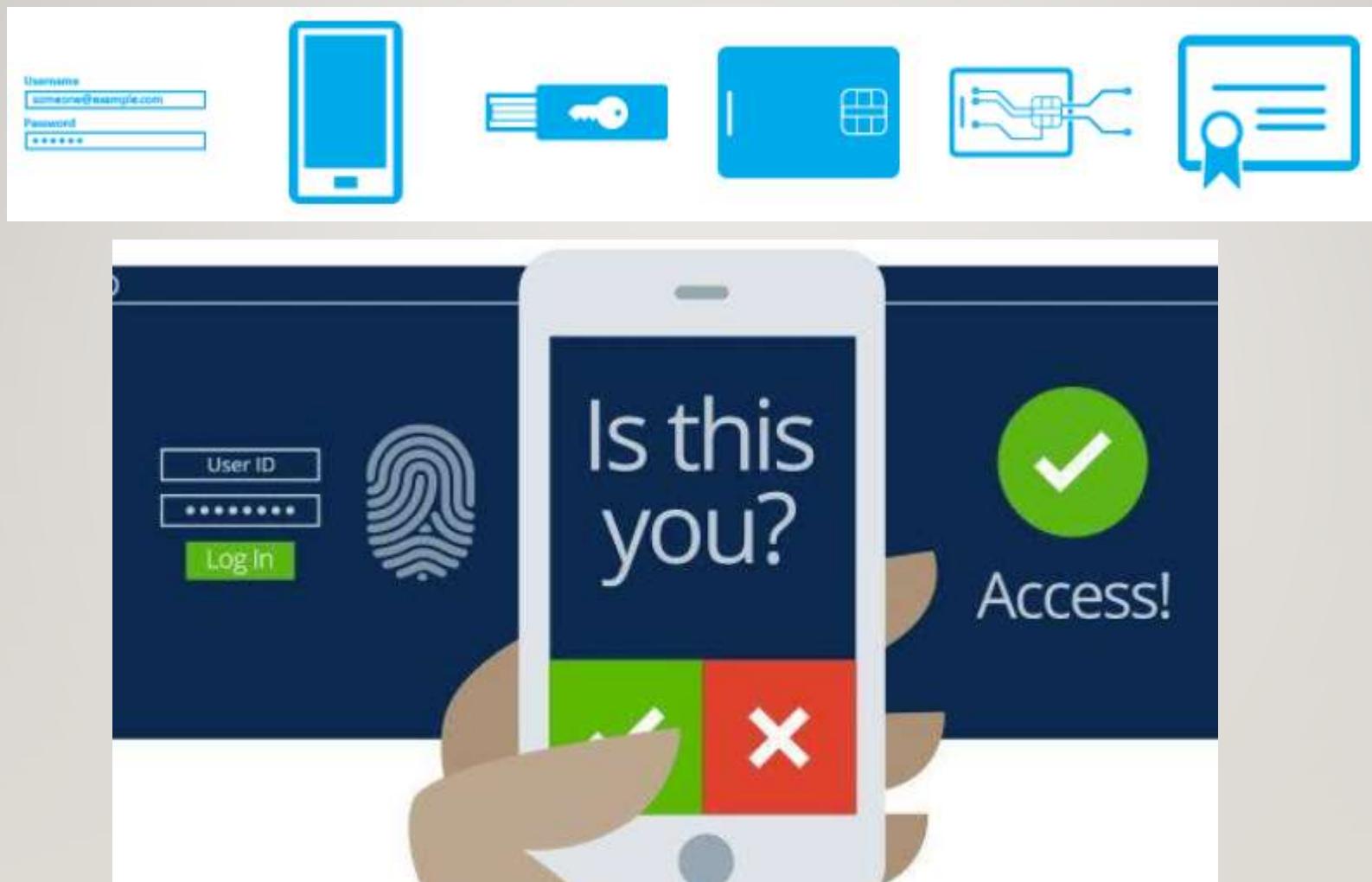


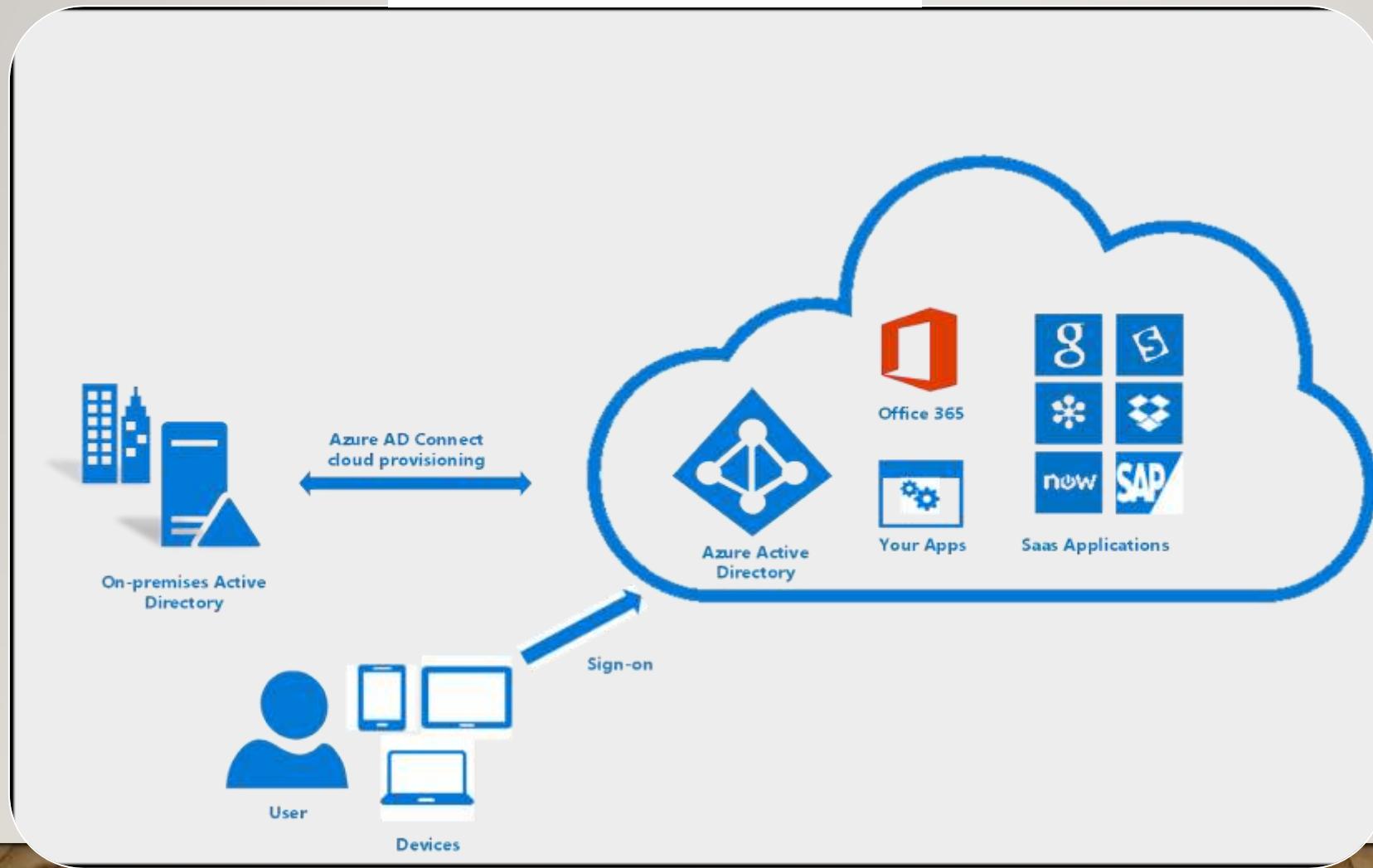
Inbound security rules						
Priority	Name	Port	Protocol	Source	Destination	Action
101	⚠ Port_8080	81	Any	Any	Any	Allow
102	⚠ Port_80	80	Any	Any	Any	Allow
1000	⚠ default-allow-rdp	3389	TCP	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny
Outbound security rules						
Priority	Name	Port	Protocol	Source	Destination	Action
65000	AllowVnetOutBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowInternetOutBound	Any	Any	Any	Internet	Allow
65500	DenyAllOutBound	Any	Any	Any	Any	Deny

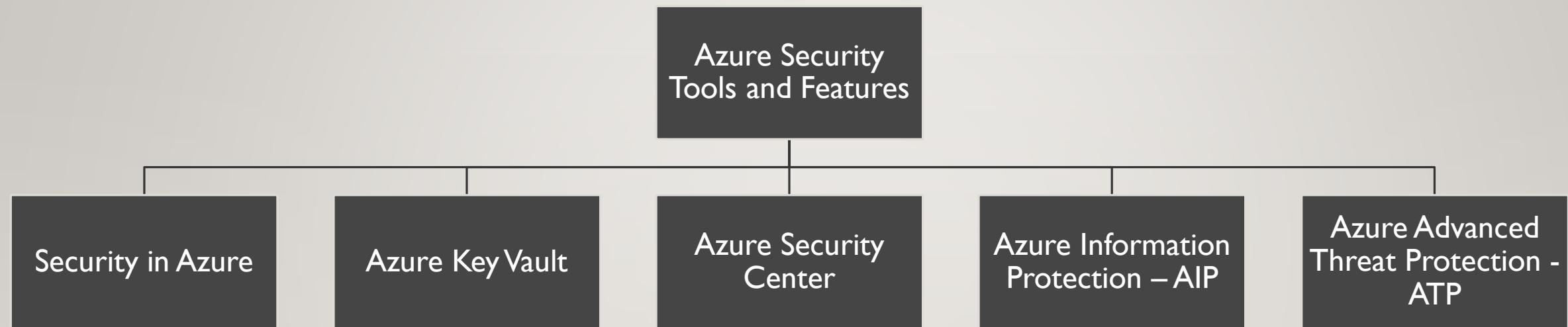




Azure Multi-Factor Authentication







Azure Security Tools and Features

Security in Azure

Azure Key Vault

Azure Security
Center

Azure Information
Protection – AIP

Azure Advanced
Threat Protection -
ATP

Security Services and Technologies available on Azure

General Azure security

- Azure Security Center
- Azure Key Vault
- Azure Monitor logs
- Azure Dev/Test Labs

Storage security

- Azure Storage Service Encryption
- StorSimple Encrypted Hybrid Storage
- Azure Client-Side Encryption
- Azure Storage Shared Access Signatures
- Azure Storage Account Keys
- Azure File shares with SMB 3.0 Encryption
- Azure Storage Analytics

Database security

- Azure SQL Firewall
- Azure SQL Cell Level Encryption
- Azure SQL Connection Encryption
- Azure SQL Always Encryption
- Azure SQL Transparent Data Encryption
- Azure SQL Database Auditing

Identity and Access Management

- Azure Role Based Access Control
- Azure Active Directory
- Azure Active Directory B2C
- Azure Active Directory Domain Services
- Azure Multi-Factor Authentication

Backup and Disaster Recovery

- Azure Backup
- Azure Site Recovery

Networking

- Network Security Groups
- Azure VPN Gateway
- Azure Application Gateway
- Web application firewall (WAF)
- Azure Load Balancer
- Azure ExpressRoute
- Azure Traffic Manager
- Azure Application Proxy
- Azure Firewall
- Azure DDoS protection
- Virtual Network service endpoints

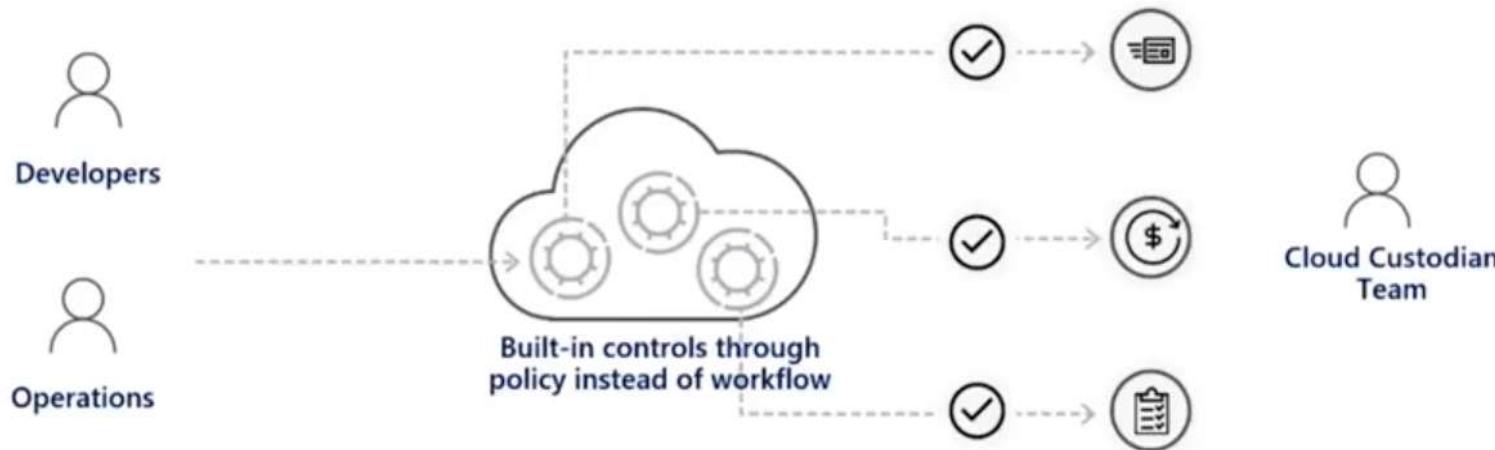
Need to Govern

Your team runs an Azure Environment with:

- Multiple Engineering Teams (deploying to & operating in)
- Multiple Subscriptions
- Need to standardize/enforce how cloud resources are configured
- Due to regulatory compliance, cost control, security or design consistency

Cloud-native governance

Removing barriers to compliance and enabling velocity



Azure policy for enterprise-level compliance



- Turn on built-in policies or build custom ones for all resource types
- Real-time policy evaluation and enforcement
- Periodic & on-demand compliance evaluation

Enforcement & Compliance



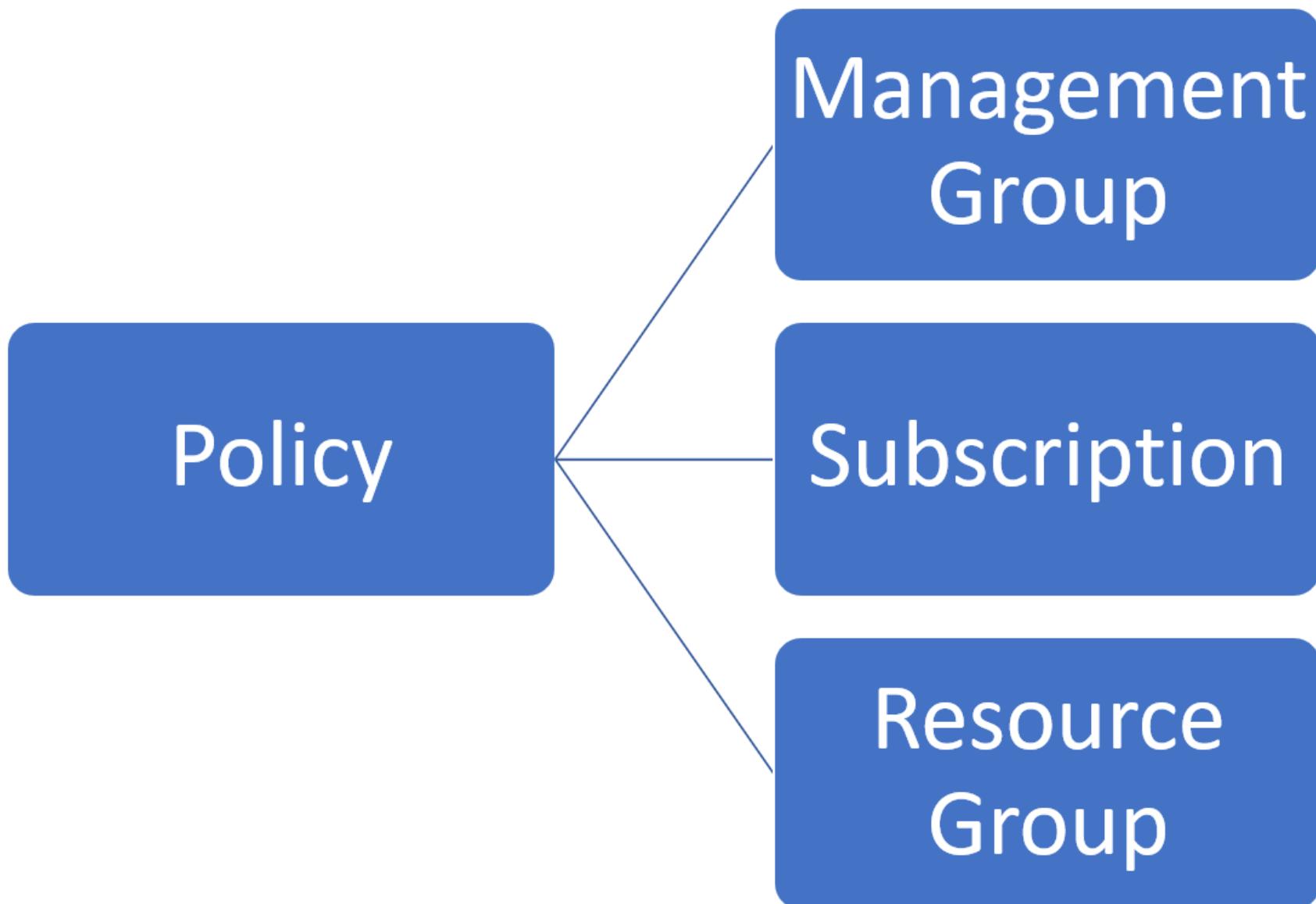
- Apply policies to a Management Group with control across your entire organization
- Apply multiple policies and aggregate policy states with policy initiative
- Exclusion Scope

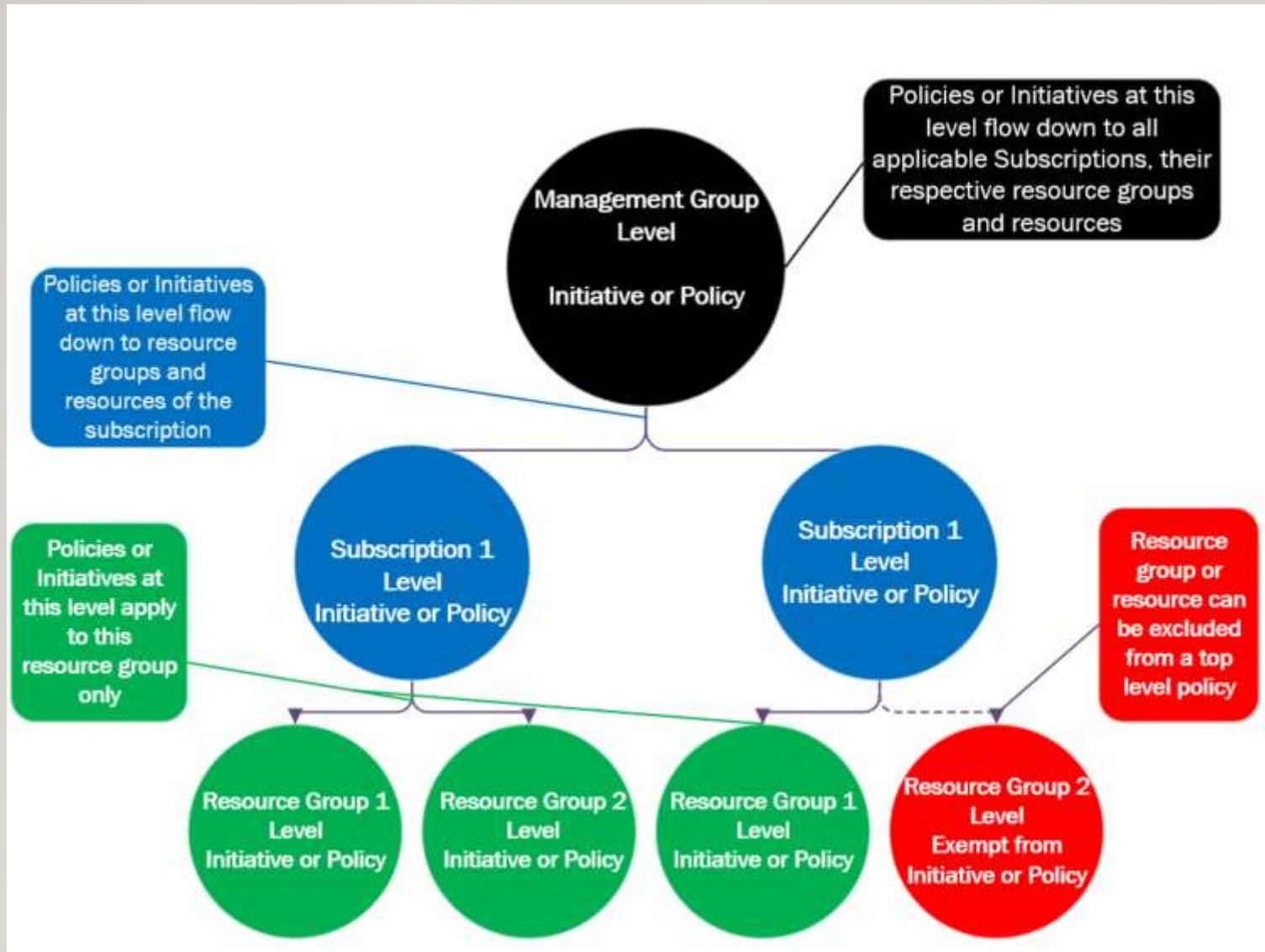
Apply policies at scale

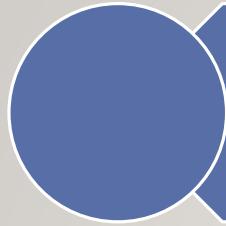


- Real time remediation
- Remediation on existing resources

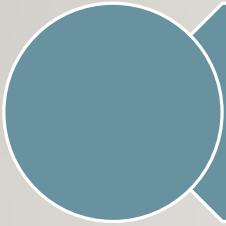
Remediation







Access management for cloud resources is a critical function for any organization that is using the cloud. Role-based access control (RBAC) helps you manage who has access to Azure resources, what they can do with those resources, and what areas they have access to.



RBAC is an authorization system built on Azure Resource Manager (ARM) that provides fine-grained access management of Azure resources.

What can I do with RBAC?

- ✓ Allow one user to manage virtual machines in a subscription and another user to manage virtual networks
- ✓ Allow a DBA group to manage SQL databases in a subscription
- ✓ Allow a user to manage all resources in a resource group, such as virtual machines, websites, and subnets
- ✓ Allow an application to access all resources in a resource group

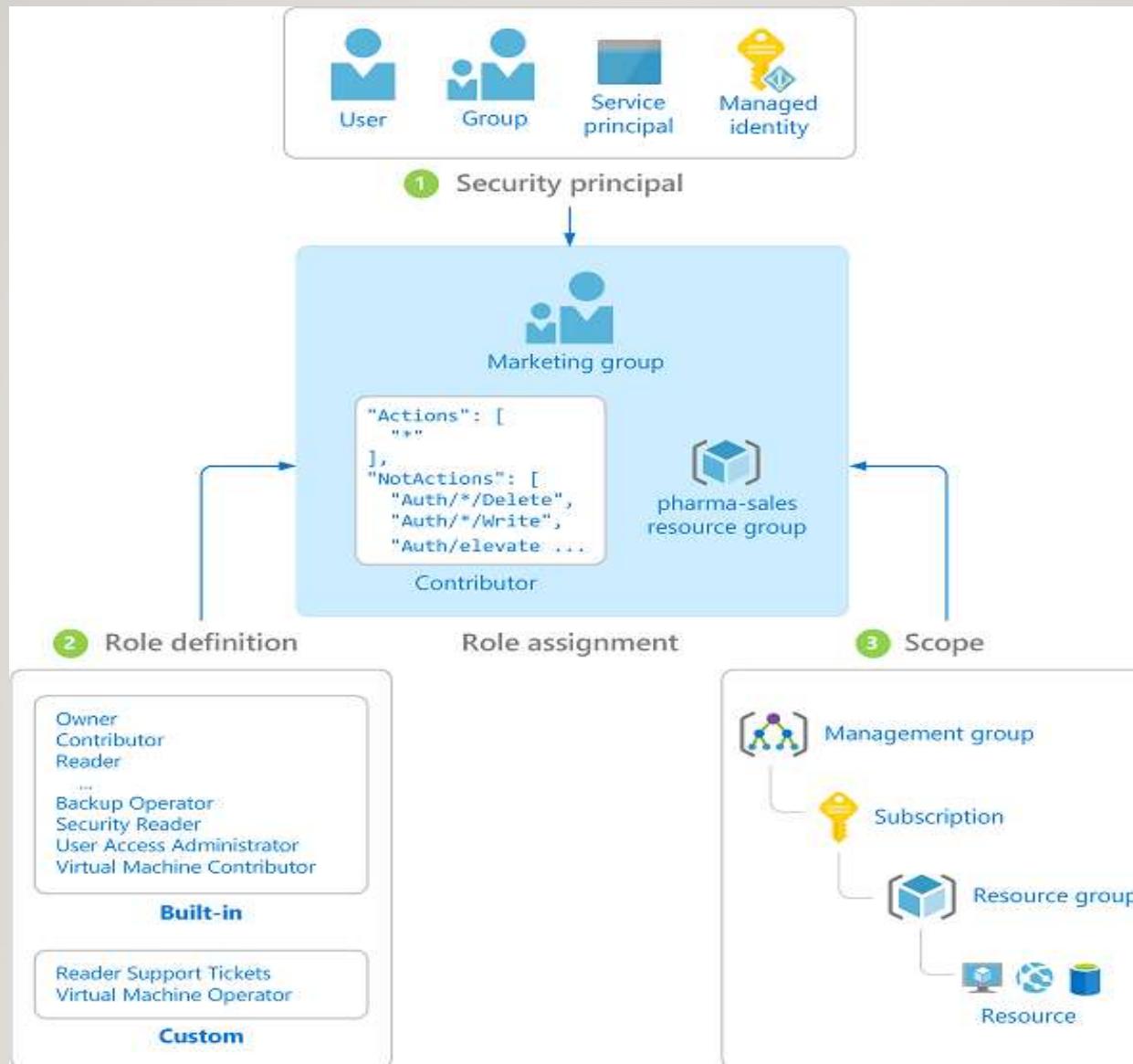
Best practice for using RBAC

Using RBAC, you can segregate duties within your team and grant only the amount of access to users that they need to perform their jobs. Instead of giving everybody unrestricted permissions in your Azure subscription or resources, you can allow only certain actions at a particular scope.

		Role		
		Reader	Resource-specific or custom role	Contributor
Scope	Subscription	Observers	Users managing resources	Admins
	Resource group	Automated processes		
	Resource			

- **Owner** - Has full access to all resources including the right to delegate access to others.
- **Contributor** - Can create and manage all types of Azure resources but can't grant access to others.
- **Reader** - Can view existing Azure resources.
- **User Access Administrator** - Lets you manage user access to Azure resources.

RBAC



Multiple role assignments



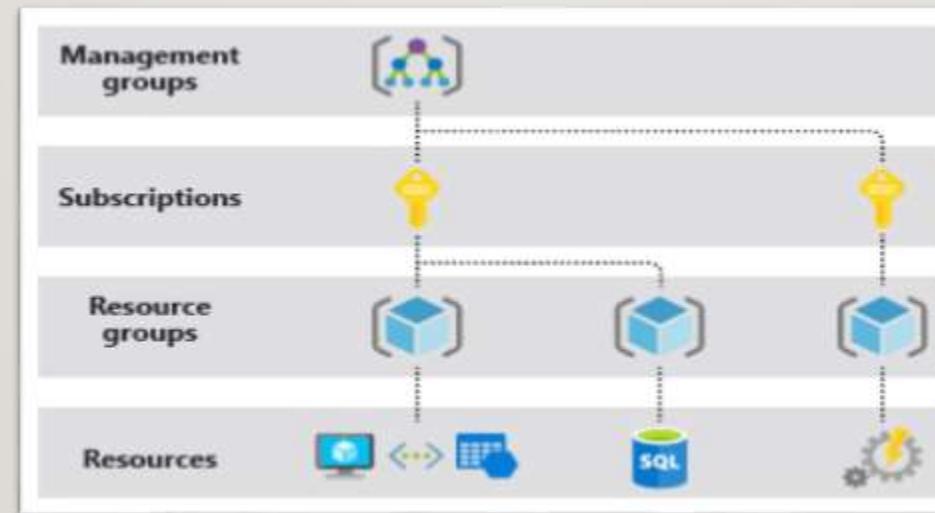
Lock resources to prevent unexpected changes

As an administrator, you may need to lock a subscription, resource group, or resource to prevent other users in your organization from accidentally deleting or modifying critical resources.

You can set the lock level to **CanNotDelete** or **ReadOnly**. In the portal, the locks are called **Delete** and **Read-only** respectively.

CanNotDelete means authorized users can still read and modify a resource, but they can't delete the resource.

ReadOnly means authorized users can read a resource, but they can't delete or update the resource. Applying this lock is similar to restricting all authorized users to the permissions granted by the **Reader** role.



Security Center VS Azure Advisor

Advisor recommendations

[Download as CSV](#) [Download as PDF](#) [Configure](#)

Subscriptions: 1 of 14 selected -

Contoso IT - demo All types Active No group

Overview High Availability (5) Security (20) Performance (1) Cost (2) All (28)

High Availability

5 Recommendations

1 High impact, 4 Medium impact, 0 Low impact

44 impacted resources

Security

20 Recommendations

20 High impact, 0 Medium impact, 0 Low impact

69 impacted resources

Performance

1 Recommendation

1 High impact, 0 Medium impact, 0 Low impact

2 impacted resources

Cost

2,575 USD savings/mo *

2 Recommendations

2 High impact, 0 Medium impact, 0 Low impact

24 impacted resources

Tips & tricks

- You can customize Advisor to process recommendations for resources that matter to you the most.
- You can create elastic database pools to reduce your monthly Azure spend.
- You can improve the performance of your SQL Azure databases.
- You can enable virtual machine backup to protect your data from corruption or accidental deletion.

[Download recommendations as PDF](#)

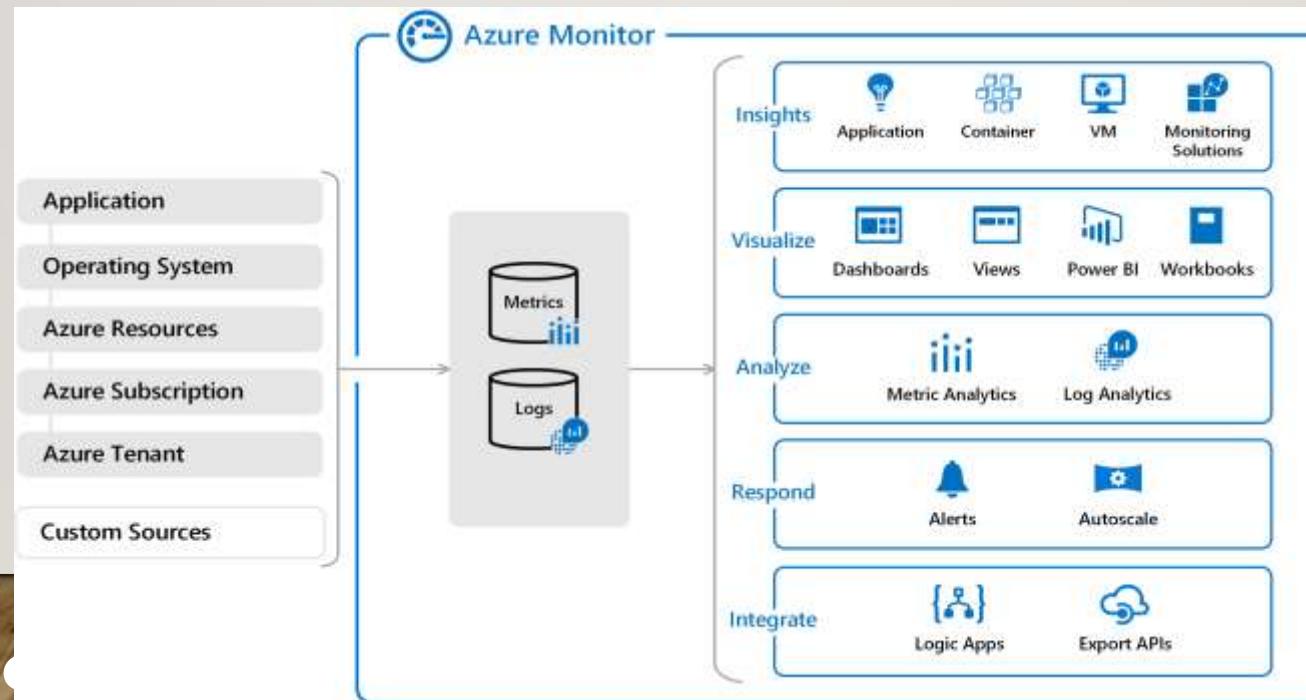
[Download recommendations as CSV](#)

Azure Monitor

Azure Monitor maximizes the availability and performance of your applications and services by delivering a comprehensive solution for collecting, analyzing, and acting on telemetry from your cloud and on-premises environments. It helps you understand how your applications are performing and proactively identifies issues affecting them and the resources they depend on.

Examples

- ✓ Detect and diagnose issues across **applications** and **dependencies with Application Insights**.
- ✓ Correlate infrastructure issues with Azure Monitor **for VMs** and Azure Monitor **for Containers**.
- ✓ Drill into your monitoring data with **Log Analytics** for **troubleshooting** and **deep diagnostics**.
- ✓ Support operations at scale with **smart alerts** and **automated actions**.
- ✓ Create visualizations with Azure **dashboards** and **workbooks**.

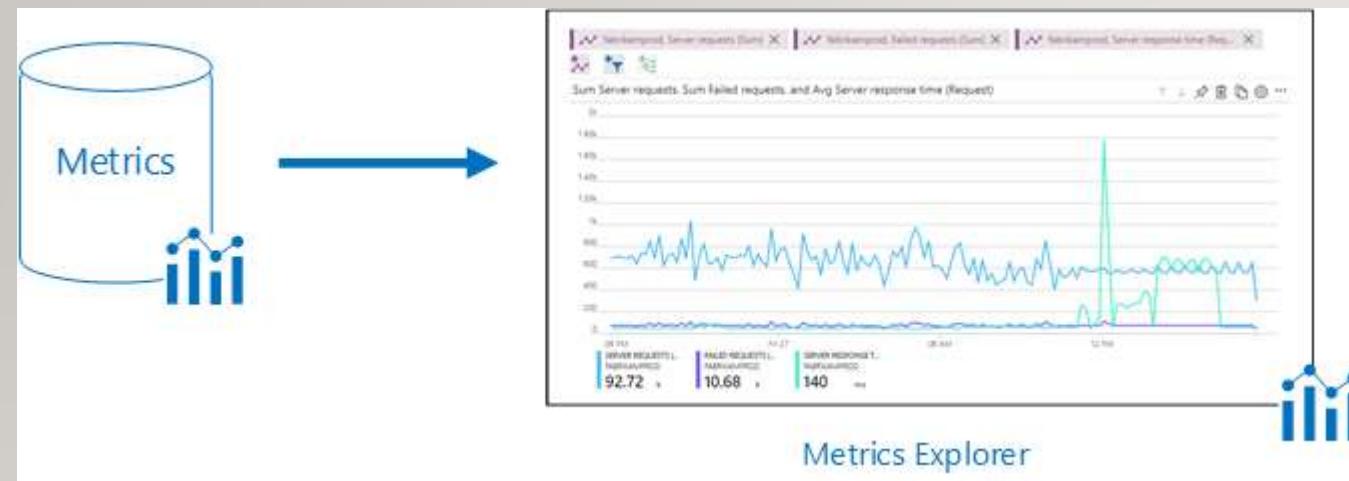


What data does Azure Monitor collect?

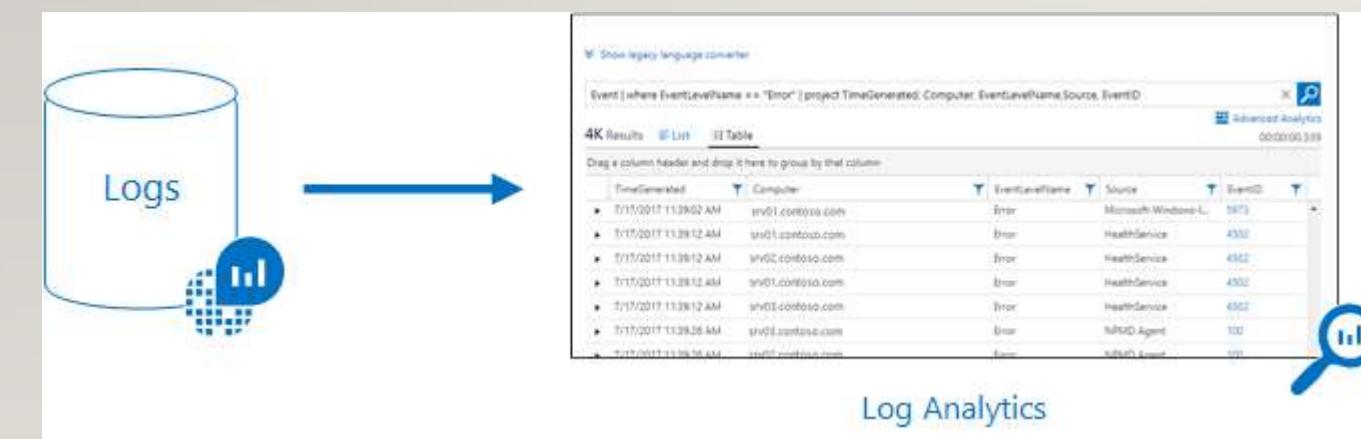
Azure Monitor can collect data from a variety of sources. You can think of monitoring data for your applications in tiers ranging from your application, any operating system and services it relies on, down to the platform itself. Azure Monitor collects data from each of the following tiers:

- **Application monitoring data:** Data about the performance and functionality of the code you have written, regardless of its platform.
- **Guest OS monitoring data:** Data about the operating system on which your application is running. This could be running in Azure, another cloud, or on-premises.
- **Azure resource monitoring data:** Data about the operation of an Azure resource.
- **Azure subscription monitoring data:** Data about the operation and management of an Azure subscription, as well as data about the health and operation of Azure itself.
- **Azure tenant monitoring data:** Data about the operation of tenant-level Azure services, such as Azure Active Directory.
- **Custom sources**
 - Azure Monitor can collect log data from any REST client

Monitoring data platform



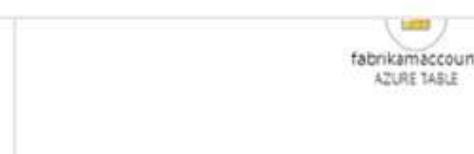
Metrics Explorer



Log Analytics

Show data for last: 30 minutes 1 hour 6 hours 12 hours 1 day 3 days 7 days 30 days

Application Insights



App Service Home Page
Last 24 hours (30-minute granularities) - fabrikamprod

EDIT TEST Time range Refresh Download web test ➤ Enable ■ Disable Delete

Add Service Home Page test summary

Time range or select a specific location. To see all the results, use Search by name or location.

The dashboard displays a dependency tree with the following components and their status:

- fabrikamaccount AZURE QUEUE**: 1 instance, 10.4 ms, 85K calls.
- fabrikamaccount AZURE BLOB**: 111 calls, 24.3 ms, 15% tests.
- fabrikamprod**: 1 instance, 25.8 ms, 75K calls, 6.6K tests, 25% availability.
- fabrikamxyz SQL**: 2 instances, 20 ms, 51% tests.

Below the tree, the availability status for different regions is shown:

Region	12 PM	6 PM	24 H	32 H
South Central US	100%	100%	100%	100%
UK West	100%	100%	100%	100%
West US	100%	100%	100%	100%

Monitoring solutions

Last 24 hours

Filter by name...

Active Directory Health Check

2Servers Assessed
in last 21 days**0**

High Priority Recommendations

2

Low Priority Recommendations

106

Passed checks

AD Replication Status

0

Critical Replication Errors

0

Total Replication Errors

Agent Health

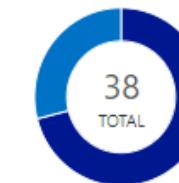
38

Total count of agents

0

Count of unresponsive agents in the last 24 hours

Agents



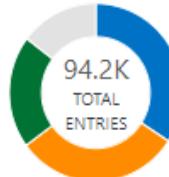
Windows
27
Linux
11

Antimalware Assessment



Active Threats
0
Remediated Threats
0
Insufficient Protection
13

Application Insights



Request
32.2K
PageView
29K
Availability
19.3K

Azure Activity Logs

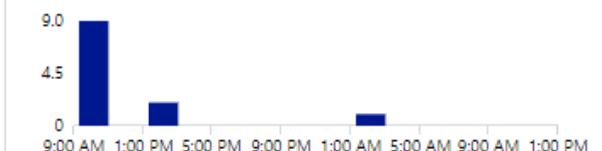
40.9K

Number of Activity Records

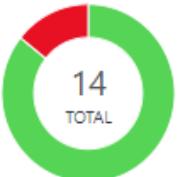
Azure Application Gateway Analytics

9 CLIENT ERRORS

- SERVER ERRORS

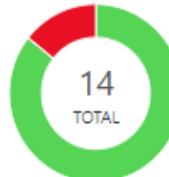


Azure Backup Monitoring Solution



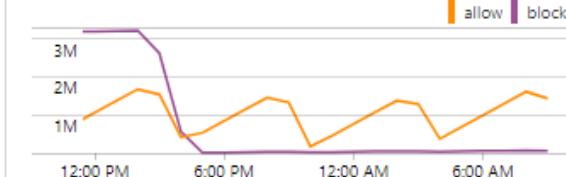
Completed
12
Failed
2

Azure Backup Monitoring Solution Copy



Completed
12
Failed
2

Azure Network Security Group Analytics



Azure SQL Analytics (Preview)

2

Total Azure SQL Databases

0

Total Azure SQL Elastic Pools

Monitoring & Analytics ▾ + New dashboard ⌂ Upload ⌂ Download Edit Unshare Full screen Clone Delete

Add filter

Dashboards

Application

Total of Failed requests by Operation name
CONTOSORETAILWEB

OPERATION ...	TOTAL	% TOTAL
GET Cust...	285	75.4%
GET Servi...	29	7.7%

Failed requests
Sep 10 6 AM 12 PM 6 PM
FAILED REQUESTS (SUM)
FABRIKAMPROD 10.42k

Server response time
Sep 10 6 AM 12 PM 6 PM
SERVER RESPONSE TIME (AVG)
FABRIKAMPROD 64.97 ms

Server exceptions and Dependency failures
Sep 10 6 AM 12 PM 6 PM
SERVER EXCEPTIONS...
FABRIKAMPROD 10.4k
DEPENDENCY FAILUR...
FABRIKAMPROD 11.13k

Average processor and process CPU utilization
Sep 10 6 AM 12 PM 6 PM
PROCESSOR TIME (A...)
FABRIKAMPROD 7.86%
PROCESS CPU (AVG)
FABRIKAMPROD 0.64%

Application map
CONTOSORETAILWEB - LAST 24 HOURS

Live Stream
CONTOSORETAILWEB

4 servers

Edit

Security

Users
CONTOSORETAILWEB - USERS - 3 DAYS

UNITED STATES 14.1k
UNITED KINGDOM 4.58k

Jul 30 Jul 31 August

Security Center
Showing subscription 'MSDIX SCOM'

Antimalware Assessment

Category	Count
Active Threats	0
Remediated Threats	0
Insufficient Protection	10

10 NEED ATTENTION

System Update Assessment

Category	Count
Need Critical Updates	11
Need Security Updates	3
Need Other Updates	20
Up To Date	15

49 COMPUTERS ASSESSED

Azure Network Security Group Analytics

allow block

30M 20M 10M 6:00 PM 12:00 AM 6:00 AM 12:00 PM

Infrastructure & Network

Service Map

9 Machines reporting (Last 30 min)

11 All-time machines reporting

11 0

Network Performance Monitor

⚠ Network Monitoring Requires Attention

3 ! of 14 Service Connectivity Tests Unhealthy

Edit

View S

Container Monitoring Solution

118
TOTAL
Running 107
Failed 8
Deleted 3

Container Status

118
TOTAL
Running 107
Failed 8
Deleted 3

COMPUTER	IMAGE	FAILED CONTAINERS
k8s-agent-8...	oms	2
k8s-agent-8...	nginx	1
k8s-agent-8...	google_contai...	4
swarm-maste...	azure-vote-fr...	1

[See all...](#)

CONTAINER LOGS

8.7M 4.4M 59.3M STDERR 922.4K STDOUT

Feb 24 Feb 25 Feb 26 Feb 27 Feb 28 Mar 1 Mar 2 Mar 3 Mar 4

CONTAINER NODE INVENTORY

2 Total Orchestrator Types 7 Total Container Nodes

COMPUTER	DOCKERV...	ORCHEST...	COUNT
k8s-ag...	1.12.6	Kubern...	11
k8s-ag...	1.12.6	Kubern...	12
k8s-ag...	1.12.6	Kubern...	23
k8s-ma...	1.12.6	Kubern...	15
k8s-ma...	1.12.6	Kubern...	16
k8s-ma...	1.12.6	Kubern...	16
swarm-...	17.03.2...	Swarm	6

[See all...](#)

CONTAINER IMAGES INVENTORY

37 Total Images 24 Image Type Count

IMAGES	IMAGETAG	COUNT
oms	Feb6th	2
oms	Feb5th	0
oms	Jan31st	0
oms	Jan29th	0
oms	samistest	0
oms	Jan25th	0
oms	Jan24th_2	0
oms	Jan24th_1	0
oms	Jan24th	0
oms	23rdJan	0

[See all...](#)

IT Operations

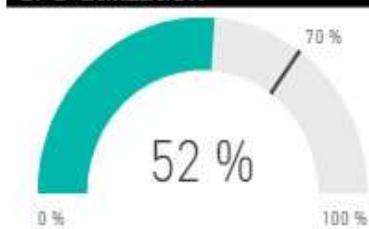
Power BI

Resource usage and availability

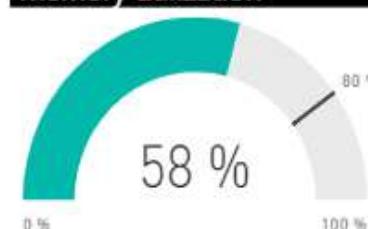
Server

- DBServer-1
- DBServer-2
- DBServer-3
- DBServer-4
- WebApp-1
- WebApp-2
- WebApp-3
- WebApp-4
- WebApp-5

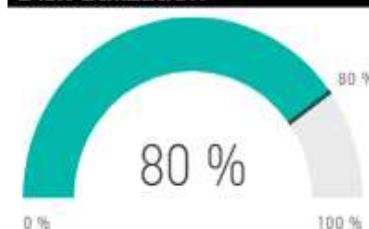
CPU utilization



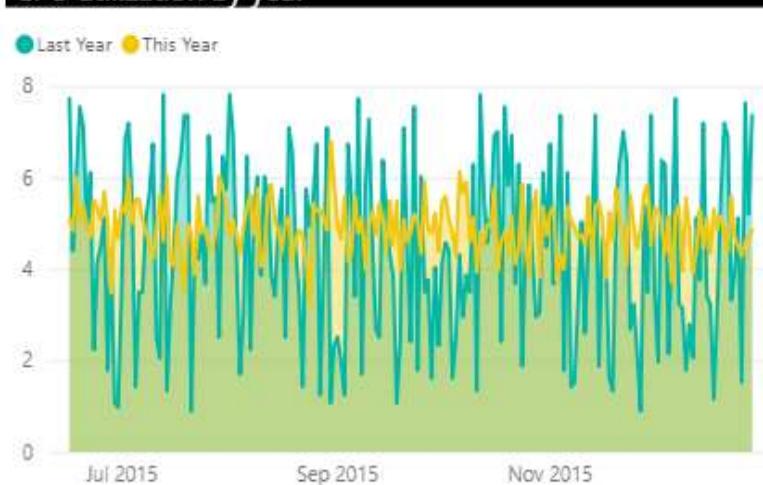
Memory utilization



Disk utilization



CPU utilization by year



Total DBs

275

Database Backups

271

Backups Run

3

Backups Failed

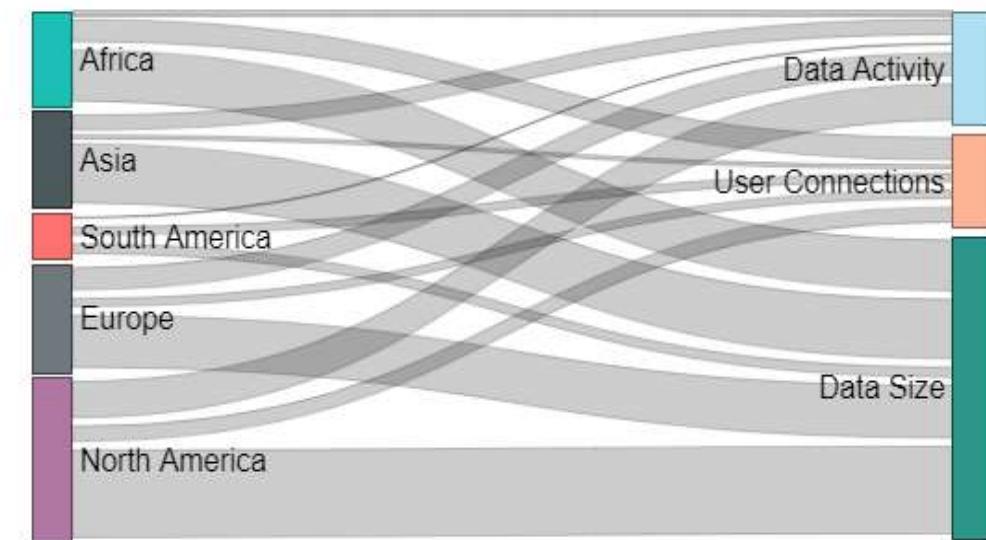
346782

Backup Size (GB)

Usage Type

- Data Activity
- Data Size
- User Conne...

Usage by type and region



Network usage by location



Service Health

Service Health provides you with a customizable dashboard which tracks the health of your Azure services in the regions where you use them. In this dashboard, you can track active events like ongoing service issues, upcoming planned maintenance, or relevant health advisories. When events become inactive, they get placed in your health history for up to 90 days. Finally, you can use the Service Health dashboard to create and manage service health alerts which proactively notify you when service issues are affecting you.

Service Health tracks three types of health events that may impact your resources:

Service issues - Problems in the Azure services that affect you right now.

Planned maintenance - Upcoming maintenance that can affect the availability of your services in the future.

Health advisories - Changes in Azure services that require your attention. Examples include when Azure features are deprecated or if you exceed a usage quota.



GDPR

General Data Protection Regulation

A regulation in EU law on data protection and privacy for all individuals within the European Union and the European Economic Area

Aims to give control to individuals over their personal data

Addresses the export of personal data outside the EU and the security of personal data saved



ISO

International Organization for Standardization

International standard-setting body composed of representatives from various national standards organizations

ISO 27001 - framework of policies and procedures that includes all legal, physical and technical controls involved in an organisation's information risk management processes



NIST

National Institute of Standards and Technology

Provides the set of standards for recommended security controls for information systems at federal agencies

In many cases, complying with NIST guidelines and recommendations will help federal agencies ensure compliance with other regulations, such as HIPAA, FISMA, or SOX

The Microsoft Privacy Statement

<https://tinyurl.com/paddymaddy26>

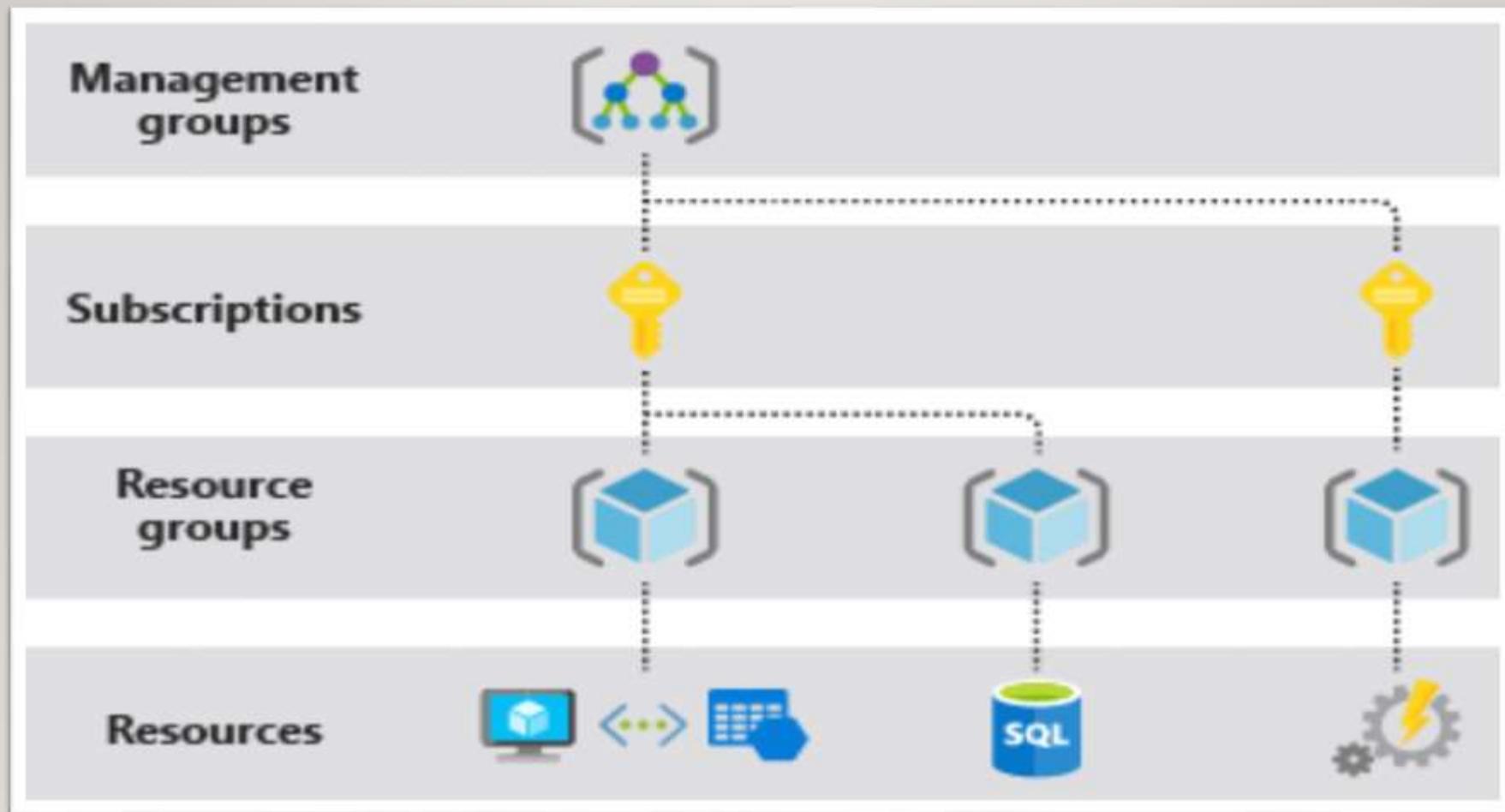
Here's what you find at the Microsoft Trust Center:

- [Security](#) – Learn how all the Microsoft Cloud services are secured.
- [Privacy](#) – Understand how Microsoft ensures privacy of your Data in the Microsoft cloud.
- [Compliance](#) – Discover how Microsoft helps organizations comply with national, regional, and industry-specific requirements governing the collection and use of individuals' data.
- [Transparency](#) – View how Microsoft believes that you control your data in the cloud and how Microsoft helps you know as much as possible about how that data is handled.
- [Products and Services](#) – See all the Microsoft Cloud products and services in one place
- [Service Trust Portal](#) – Obtain copies of independent audit reports of Microsoft cloud services, risk assessments, security best practices, and related materials.
- [What's New](#) – Find out what's new in Microsoft Cloud Trust
- [Resources](#) – Investigate white papers, videos, and case studies on Microsoft Trusted Cloud

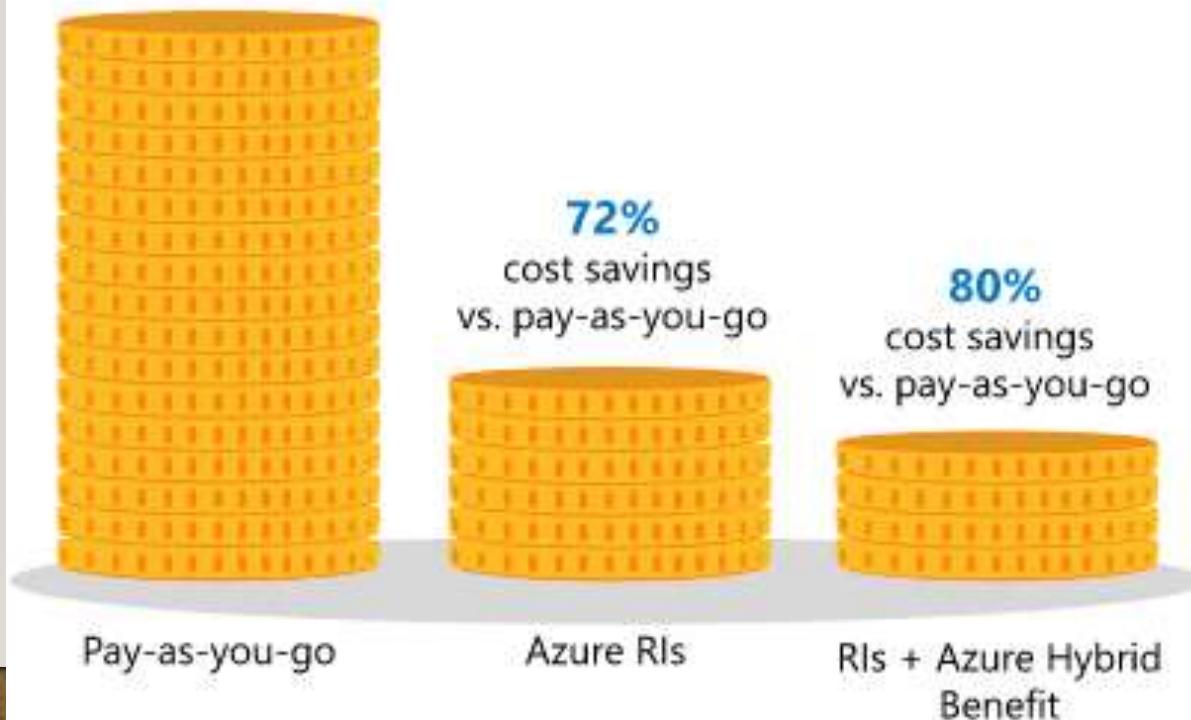
Microsoft Service Trust Portal

- Part of the Microsoft Trust Center
- Provides a variety of content, tools, and other resources about Microsoft security, privacy and compliance practices
- Obtain copies of independent audit reports of Microsoft cloud services, risk assessments, security best practices, and related materials
- Contains details about Microsoft's implementation of controls and processes that protect cloud services and the customer data therein

Azure Subscriptions



Save up to **80%** with RIs and Azure Hybrid Benefit



Minimizing Azure Costs



- [Create a resource](#)
- [Home](#)
- [Dashboard](#)
- [All services](#)
- [FAVORITES](#)
- [All resources](#)
- [Resource groups](#)
- [App Services](#)
- [Function Apps](#)
- [SQL databases](#)
- [Azure Cosmos DB](#)
- [Virtual machines](#)
- [Load balancers](#)
- [Storage accounts](#)
- [Virtual networks](#)
- [Azure Active Directory](#)
- [Monitor](#)
- [Advisor](#)
- [Security Center](#)
- [Cost Management + Billing](#)
- [Help + support](#)
- [Cost Management](#)
- [Application Insights](#)
- [Policy](#)

[Home > Cost Management: Trey Research - Cost analysis](#)

Cost Management: Trey Research - Cost analysis

[Search \(Ctrl+ /\)](#)[Refresh](#)[Export](#)[How satisfied are you with cost analysis?](#)[Scope : **Trey Res...**](#)[Custom view](#)[Feb 2019](#)[Granularity : Daily](#)[Group by : Provider](#)[Add filter](#)

TOTAL

BUDGET: NONE

\$184.7K

--

\$8K

\$7K

\$6K

\$5K

\$4K

\$3K

\$2K

\$1K

\$0

Feb 1

Feb 3

Feb 5

Feb 7

Feb 9

Feb 11

Feb 13

Feb 15

Feb 17

Feb 19

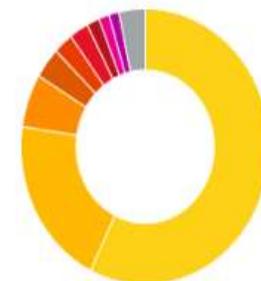
Feb 21

Feb 23

Feb 25

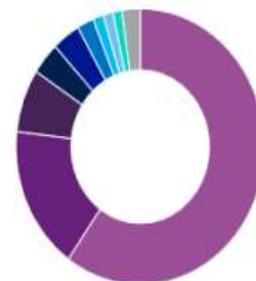
[aws](#)[azure](#)

Service name



Service Name	Cost (\$)
amazon elastic.com...	\$105.7K
virtual machines	\$37,082
expressroute	\$11,558
hdinsight	\$6,724
storage	\$4,706
azure app service	

Location



Location	Cost (\$)
us-east-1	\$110.5K
br south	\$31,225
us west	\$13,752
us central	\$7,008
eu west	\$6,752
us west 2	

Subscription name



Subscription Name	Cost (\$)
trey research financial	\$111.4K
trey research delta	\$50,999
trey research it/eds	\$6,725
trey research alpha	\$4,703
trey research corp	\$3,440
trey research corp	

Subscriptions

Microsoft



Showing subscriptions in Microsoft. Don't see a subscription?
Switch directories

My role 1Status 18 selected ▼ 3 selected ▼**Apply** Show only subscriptions selected in the global subscriptions filter 1 Search to filter items...SUBSCRIP... ▼ SUBSCRIPTION ID ▼

Trey Resear... 586f1d47-9dd9-4...

Trey Resear... ed570627-0265-4...

Trey Resear... 73c0021f-a37d-43...

Trey Resear... 9ec51cf8-5ca7-4d...

Trey Resear... d08df488-ca06-4...

Cost Manag... 1caa5a3-2b66-4...

Trey Resear... 64e355d7-997c-4...

Contoso IT ... e4272367-5645-4...

CloudOps G... a6383be3-f0e8-4...

Cost Management Research - Cost analysis

Subscription



Refresh



Tour



Export Cost by resource

Scope : Cost Man...

Custom view ▼Feb 2019 ▼Granularity : Accumulated ▼Group by : None ▼

Add filter

TOTAL **\$3,171****BUDGET: GARD...** **\$3,000** /mo

Last month	Feb 2019
This month	Mar 2019
This quarter	Jan-Mar 2019
This year	2019
Custom >	

\$3.5K

\$3K

\$2.5K

\$2K

\$1.5K

\$1K

\$500

\$0

Feb 1

Feb 3

Feb 5

Feb 7

Feb 9

Feb 11

Feb 13

Feb 15

Feb 17

Feb 19

Feb 21

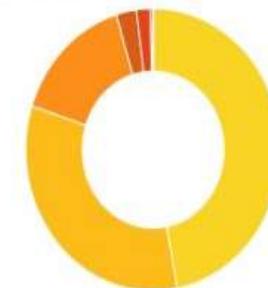
Feb 23

Feb 25

Accumulated cost

Monthly budget

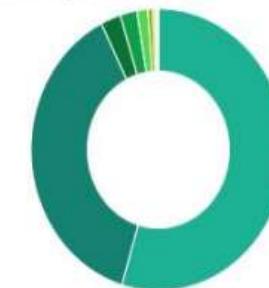
Overage

Service name ▼

storage	\$1,489
virtual machines (lic...	\$1,048
virtual machines	\$485.91
security center	\$80.64
storage	\$55.54

Location ▼

us north central	\$1,567
us east 2	\$1,489
us east	\$80.64
us west	\$20.22
us central	\$13.31

Resource group name ▼

garda1hourbill	\$1,732
formatica	\$1,205
defaultresource	\$80.64
moderatm	\$67.13
mar-ccm	\$43.89

- Create a resource
- Home
- Dashboard
- All services
- FAVORITES
- All resources
- Recent
- Blueprints
- Policy
- Cost Management + Bill...
- Security Center
- Management groups
- Resource groups
- Virtual machines
- App Services
- SQL databases
- Virtual machines (classic)
- Cloud services (classic)
- Subscriptions
- Automation Accounts
- Stream Analytics jobs
- Storage accounts
- IoT Hub

Home > Cost Management + Billing - Cost analysis

Cost Management + Billing - Cost analysis

Microsoft - PREVIEW

Search (Ctrl+ /)

Refresh Tour Export

How satisfied are you with cost analysis? →

Scope : SAB BVT ... Custom view Feb 2019 Granularity : Daily Group by : Service name Add filter

TOTAL BUDGET: SRIVATSK-MONTHLY...

\$10.6M \$328.8K /day (est)

Feb 1 Feb 3 Feb 5 Feb 7 Feb 9 Feb 11 Feb 13 Feb 15 Feb 17 Feb 19 Feb 21 Feb 23 Feb 28

hdinsight sql database storage cloud services bandwidth azure cosmos db
sql data warehouse redis cache virtual machines event hubs Others Est daily budget

Service name hdinsight \$4.8M
sql database \$1.4M
storage \$1.3M
cloud services \$1.2M
bandwidth

Location us east \$5M
us west \$3.4M
us west 2 \$816.2K
us east 2 \$455.8K
eu north

Enrollment account name aipdepth@microsoft.com \$4.9M
aipdeptq@microsoft.com \$3.1M
aipdept@microsoft.com \$1.4M
ai-admin@microsoft.com \$780.2K
aipdepte@microsoft.com

Azure support plans

	BASIC Request support	DEVELOPER Purchase support	STANDARD Purchase support	PROFESSIONAL DIRECT Purchase support	Premier Contact Premier
Scope	Available to all Microsoft Azure accounts	Microsoft Azure:	Microsoft Azure:	Microsoft Azure:	All Microsoft Products, including Azure:
		Trial and non-production environments	Production workload environments	Business-critical dependence	Substantial dependence across multiple products
Customer Service, Self-Help and Communities	24x7 access to billing and subscription support, online self-help, documentation, whitepapers and support forums	24x7 access to billing and subscription support, online self-help, documentation, whitepapers and support forums	24x7 access to billing and subscription support, online self-help, documentation, whitepapers and support forums	24x7 access to billing and subscription support, online self-help, documentation, whitepapers and support forums	24x7 access to billing and subscription support, online self-help, documentation, whitepapers and support forums
Best Practices	Access to full set of Azure Advisor recommendations	Access to full set of Azure Advisor recommendations	Access to full set of Azure Advisor recommendations	Access to full set of Azure Advisor recommendations	Access to full set of Azure Advisor recommendations
Health Status and Notifications	Access to personalised Service Health Dashboard and Health API	Access to personalised Service Health Dashboard and Health API	Access to personalised Service Health Dashboard and Health API	Access to personalised Service Health Dashboard and Health API	Access to personalised Service Health Dashboard and Health API
Technical Support	Not available	Business hours access to Support Engineers via email	24x7 access to Support Engineers via email and phone	24x7 access to Support Engineers via email and phone	24x7 access to Support Engineers via email and phone
Who Can Open Cases	Not available	Unlimited contacts / unlimited cases	Unlimited contacts / unlimited cases	Unlimited contacts / unlimited cases	Unlimited contacts / unlimited cases
Third-Party Software Support	Not available	Interoperability and configuration guidance and troubleshooting	Interoperability and configuration guidance and troubleshooting	Interoperability and configuration guidance and troubleshooting	Interoperability and configuration guidance and troubleshooting
Case Severity/Response Times	Not available	Minimal business impact (Sev C): <8 business hours	Minimal business impact (Sev C): <8 business hours Moderate business impact (Sev B): <4 hours Critical business impact (Sev A):	Minimal business impact (Sev C): <4 business hours Moderate business impact (Sev B): <2 hours Critical business impact (Sev A):	Minimal business impact (Sev C): <4 business hours Moderate business impact (Sev B): <2 hours Critical business impact (Sev A):
		<1 hour	<1 hour	<1 hour	
				<15 minutes (with Azure Rapid Response or Azure Event Management)	
Architecture Support	Not available	General guidance	General guidance	Architectural guidance based on best practice delivered by ProDirect Delivery Manager	Customer specific architectural support such as design reviews, performance tuning, configuration and implementation assistance delivered by Microsoft Azure technical specialists.
Operations Support	Not available	Not available	Not available	Onboarding services, service reviews, Azure Advisor consultations	Technical account manager-led service reviews and reporting
Training	Not available	Not available	Not available	Azure Engineering-led web seminars	Azure Engineering-led web seminars, on-demand training
Proactive Guidance	Not available	Not available	Not available	ProDirect Delivery Manager	Designated Technical Account Manager
Launch Support	Not available	Not available	Not available	Not available	Azure Event Management (available for additional fee)
Pricing	Not available	\$29/mo	\$100/mo	\$1,000/mo	Contact us

Azure Service Level Agreements (SLAs)

- Uptime is guaranteed (not performance, bandwidth, or feature availability).
- Expressed as a percentage of the total time per month that the service is guaranteed to be up.
- If an incident causes the uptime to fall below the SLA guarantee, you are entitled to a credit towards your monthly service fees.
- Monthly Uptime % = $(\text{Maximum Available Minutes} - \text{Downtime}) / \text{Maximum Available Minutes} * 100$