Azure Core Services

Azure Virtual Machines

Cloud Computing

The present of computing

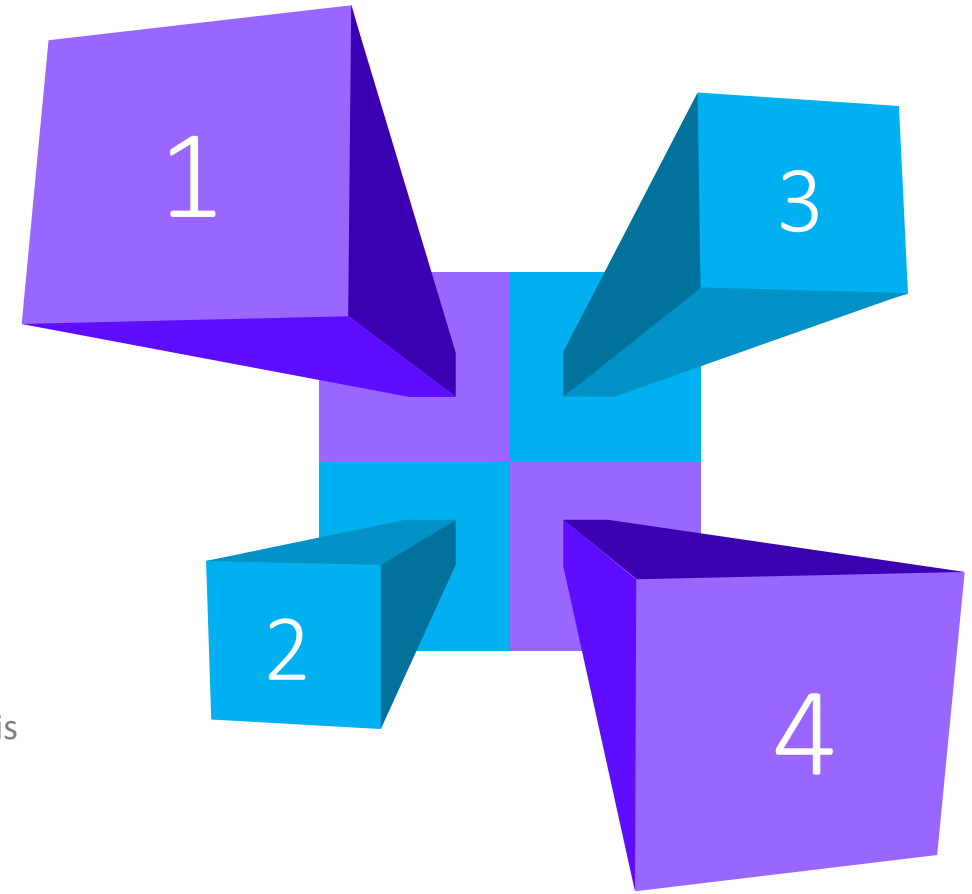
What is cloud computing

Delivery

This is the delivery of computing services – servers , storage , databases, networking, software and more

Cloud

The delivery of these services is done over the Internet.



Payment model

Here you pay for how much you use.

Be ahead of the competition

Allows for faster innovation, flexibility and faster delivery of services.

Traditional
Data Centers

1. **Less management** — Don’t manage Large machine
2. **Less investment** — Don’t need to invest in hardware
3. **Less operations** — Don’t need to invest in managing the data center
4. **Focus on business** — You get to focus on your business and applications

Forecast

Cloud Services

Worldwide end-user spending on public cloud services forecast for 2021

332.3 billion

23.1 %

Growth in 2021

Table 1. Worldwide Public Cloud Services End-User Spending Forecast (Millions of U.S. Dollars)

	2020	2021	2022
Cloud Business Process Services (BPaaS)	46,131	50,165	53,121
Cloud Application Infrastructure Services (PaaS)	46,335	59,451	71,525
Cloud Application Services (SaaS)	102,798	122,633	145,377
Cloud Management and Security Services	14,323	16,029	18,006
Cloud System Infrastructure Services (IaaS)	59,225	82,023	106,800
Desktop as a Service (DaaS)	1,220	2,046	2,667
Total Market	**270,033**	**332,349**	**397,496**

https://www.gartner.com/en/newsroom/press-releases/2021-04-21-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-grow-23-percent-in-2021

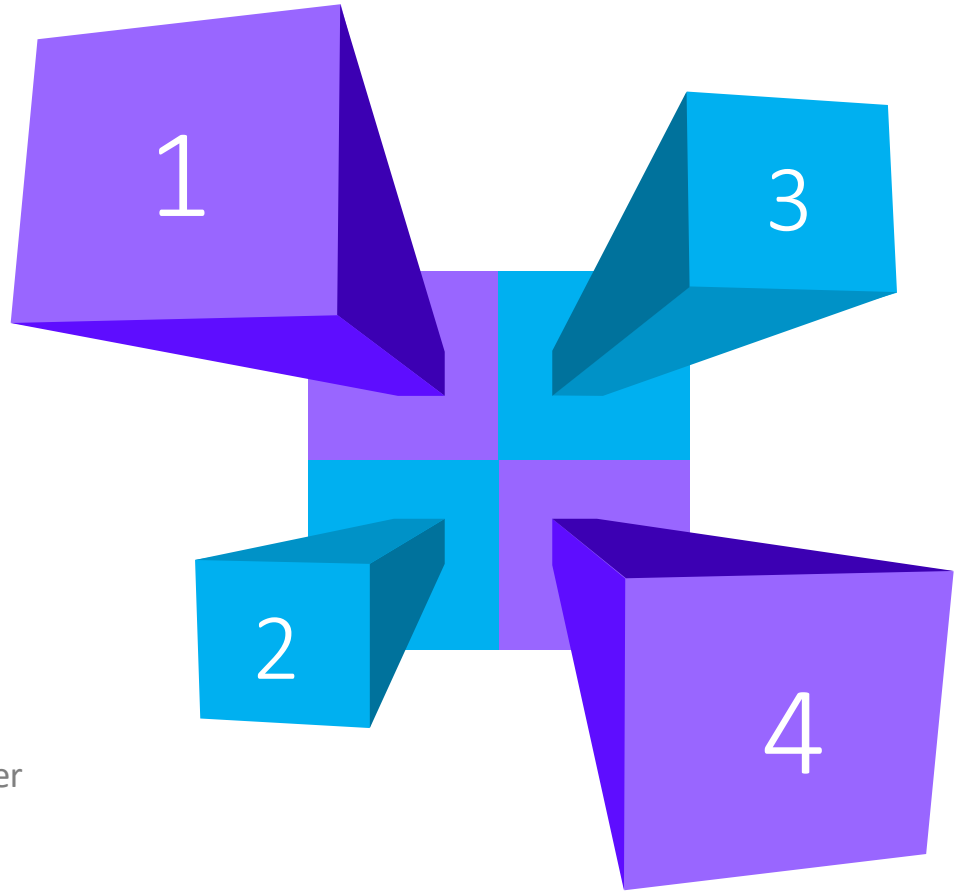
Virtual Machine

Compute service

Virtual Machine service

Compute

This is your compute service on the Azure platform. Here you can create compute resources on-demand.



Lifecycle

You can create the machine whenever you want. You can also terminate the machine whenever required.

Operating System

You can choose from operating systems such as Windows Server 2019 and different flavors of Linux.

Workload

You can then install different workloads on the machine.

Azure
Virtual Machines

1. **Less management** — You don't manage the infrastructure.
2. **Less investment** — You only pay for how much you use.
3. **Less operations** — Don't need to invest in managing the data center
4. **Configure** — You can configure various aspects of your virtual machine

Azure virtual machine deployment

Virtual Network	Public IP Address	Network Security Group	OS Disk
Isolated network On the cloud	Allows to contact the machine from the Internet	Filters traffic to and from the machine	Used to store the operating system

Availability options

High Availability

What are availability sets

This feature helps to protect your machines against infrastructure level failures.

An unplanned event wherein the underlying infrastructure fails unexpectedly. The failures could be attributed to network failures , local disk failures or even rack failures

Planned maintenance events , wherein Microsoft needs to make planned updates to the underlying physical environment. In such cases , a reboot might be required on your virtual machine

You can increase the availability of your application by making use of availability sets. Each virtual machine that is assigned to the availability set is assigned a separate fault and update domain.

Fault domains

These are used to define the group of virtual machines that share a common source and network switch.

You can create up to 3 fault domains

Update domains

These are used to group virtual machines and physical hardware that can be rebooted at the same time

You can create **up to 20 update domains**

What are availability zones

This features help provides better availability for your application by protecting them from datacenter failures

Each Availability zone is a unique physical location in an Azure region

Each zone comprises of one or more data centers that has independent power, cooling, and networking

Hence the physical separation of the Availability Zones helps protect applications against data center failures

Using Availability Zones, you can be guaranteed an availability of 99.99% for your virtual machines. You need to ensure that you have 2 or more virtual machines running across multiple availability zones.

Azure Core Services

Networking

Networking

Review

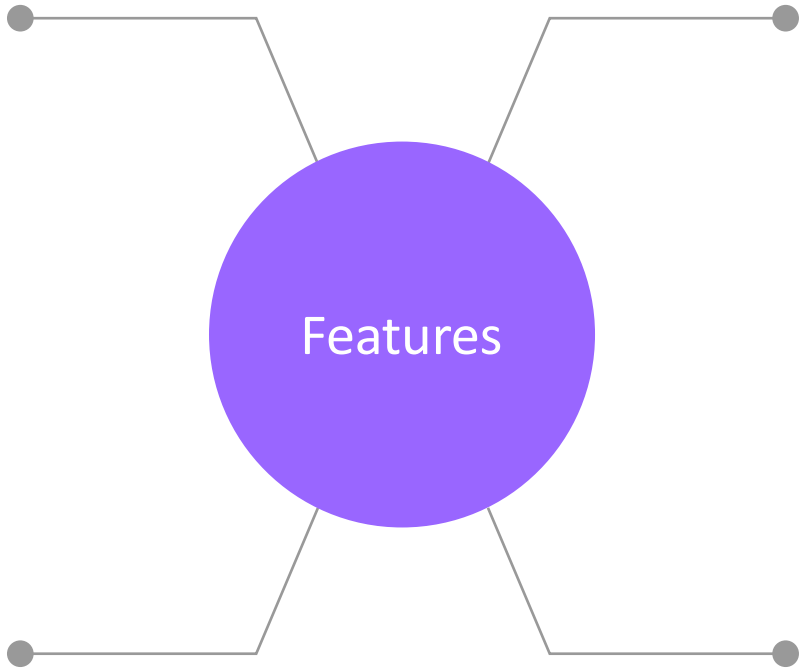
Network Security Group

Attachment

It can be attached to a network interface or a subnet

Security

It is used to filter Inbound and Outbound traffic



Rules

It consists of Inbound and Outbound rules

Action

Here you can either Allow or Deny traffic

What is virtual network peering

Virtual Network Peering is used to connect two Azure virtual networks together via the backbone network

Azure supports connecting two virtual networks located in the same region or networks located across regions

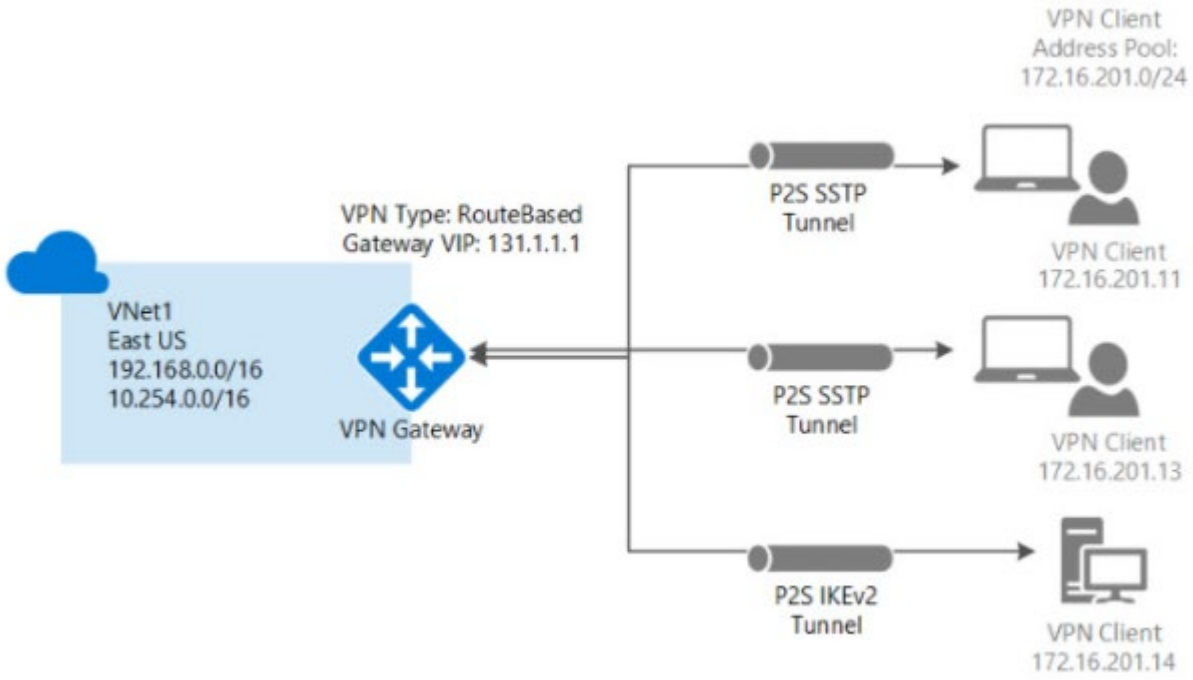
Once you enable virtual network peering between two virtual networks, the virtual machines can then communicate via their private IP addresses across the peering connection

You can also peer virtual networks that are located across different subscriptions

The virtual networks can't have overlapping CIDR blocks

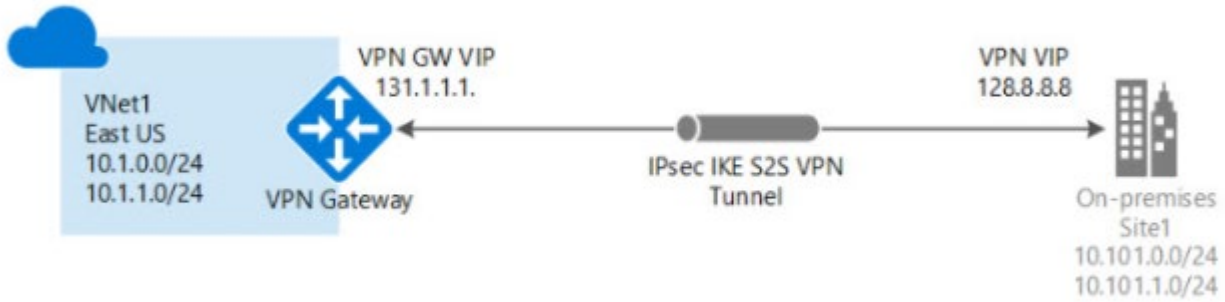
Point-to-Site VPN

A Point-to-Site VPN connection is used to establish a secure connection between multiple client machines and an Azure virtual network via the Internet.



Site-to-Site VPN

A Site-to-Site VPN connection is used to establish a secure connection between an on-premise network and an Azure network via the Internet



Azure Core Services

Azure Storage

Azure Storage accounts

Cloud storage

What are Azure storage accounts

This service allows you to store objects on the cloud.

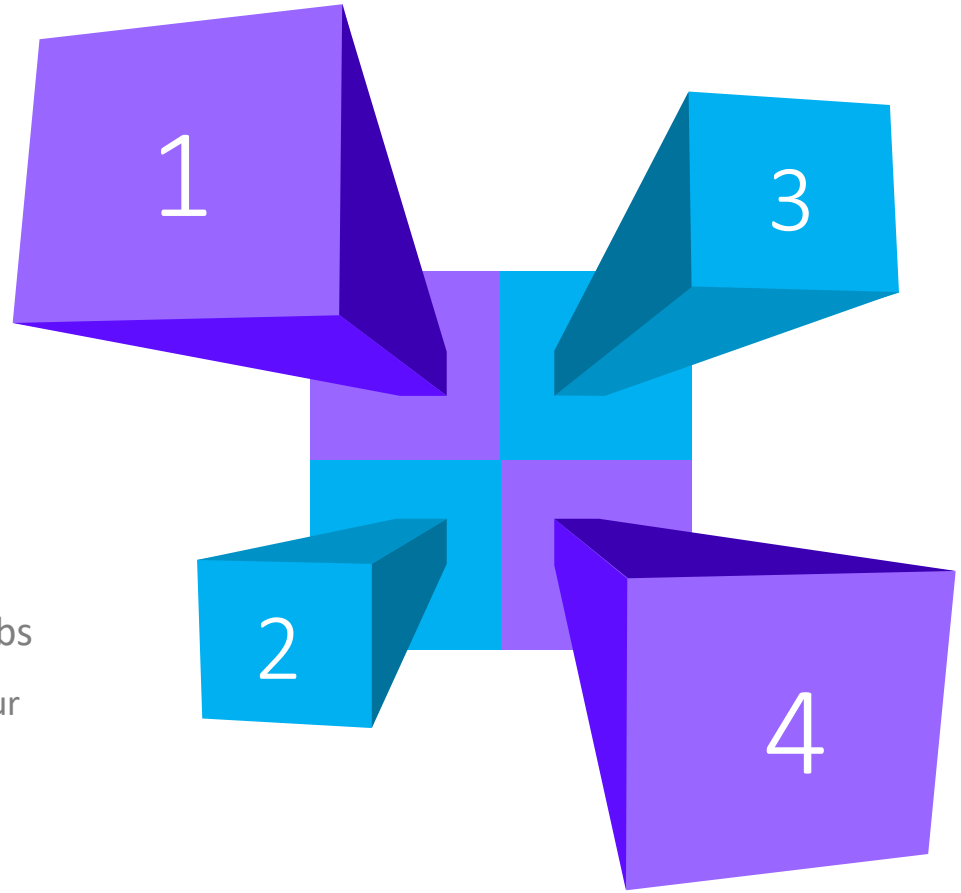
Here you can make use of different services – Blob, Queue, File and Table.

There are also different types of storage accounts.

Storage account types

Standard-general purpose v2

Gives you access to Blob, Queue, Table and File service



Premium file shares

This is a premium storage account for your file shares.

Premium block blobs

This is premium storage for your block blobs

Premium page blobs

This is premium storage for your page blobs

What is Blob storage

This service is optimized for storing large amounts of unstructured data.

Use case examples – storing images, videos, log files, documents.

In the blob service, you will create a container. This is used to organize a set of blobs.

Block blobs – This is used to store text and binary data.

Page blobs – This is used to store virtual hard drive files that are used as disks for your Azure virtual machines.

What is the File service

This is used for hosting file shares on the cloud.

This shares can be accessed via the SMB – Server Message Blob protocol.

You can mount the file shares from Windows, Linux and macOS clients.

Block blobs – This is used to store text and binary data.

Page blobs – This is used to store virtual hard drive files that are used as disks for your Azure virtual machines.

What is Azure Queue storage

This service is used for storing large amounts of messages.

These messages can then be accessed from anywhere in the world via the HTTP or HTTPS protocol.

You can store millions of messages in the queue.

What is Azure Table storage

This service is used for storing non-relational structured data.

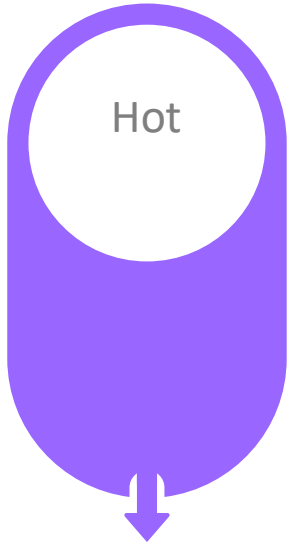
Its ideal for storing flexible data sets because it does not conform to any sort of schema.

In the table , you store an entity which is a set of properties.

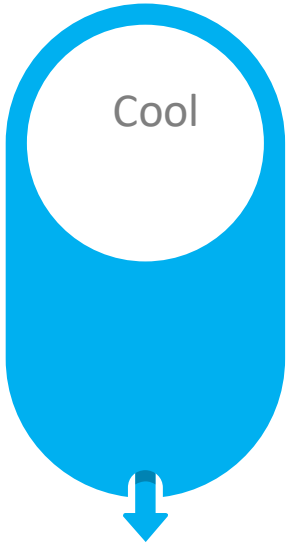
A property is nothing but a name-value pair.

The partition key is used to split the data across various partitions. And the row key is used to identify an item within a partition.

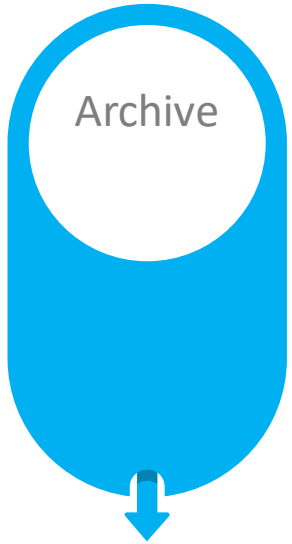
Access tiers



This is optimized for data that is accessed frequently.



This is optimized for data that is infrequently accessed and stored for at least 30 days.



This is optimized for storing data that is rarely accessed and stored for at least 180 days.

Data Redundancy

Locally redundant storage

Here data is copied synchronously three times within a single physical location in the primary region

Zone-redundant storage

Here data is copied synchronously across three Azure availability zones in the primary region

Geo-redundant storage

Here data is copied synchronously three times within a single physical location in the primary region using LRS. It then copies your data asynchronously to a single physical location in the secondary region

Geo-zone-redundant storage

Here data is copied synchronously across three Azure availability zones in the primary region using ZRS. It then copies your data asynchronously to a single physical location in the secondary region

Azure SQL database

Managed database service

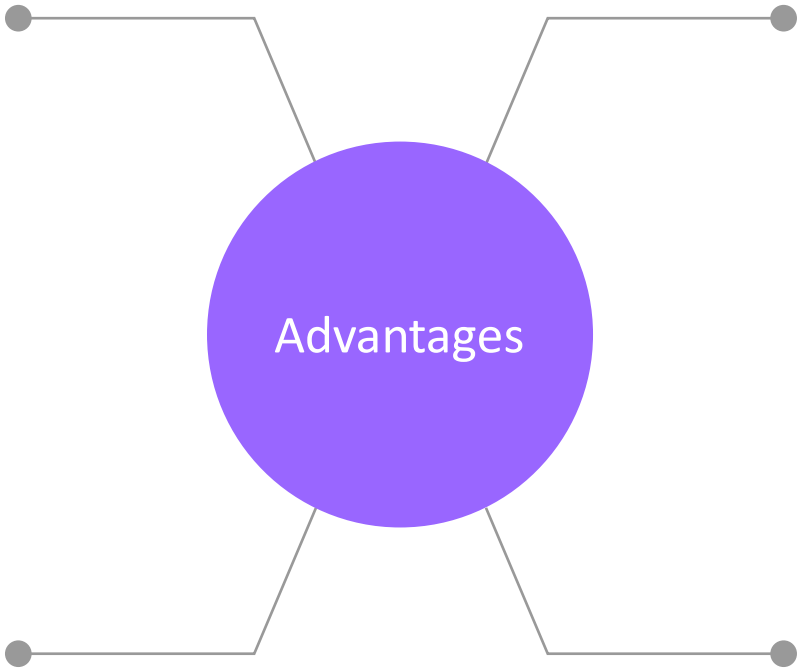
Your own server

Full control

You have full control over the underlying database engine

Security

You get to control all of the security aspects



Any version

You can use any database version

Integration

You can install custom tools for integration purposes

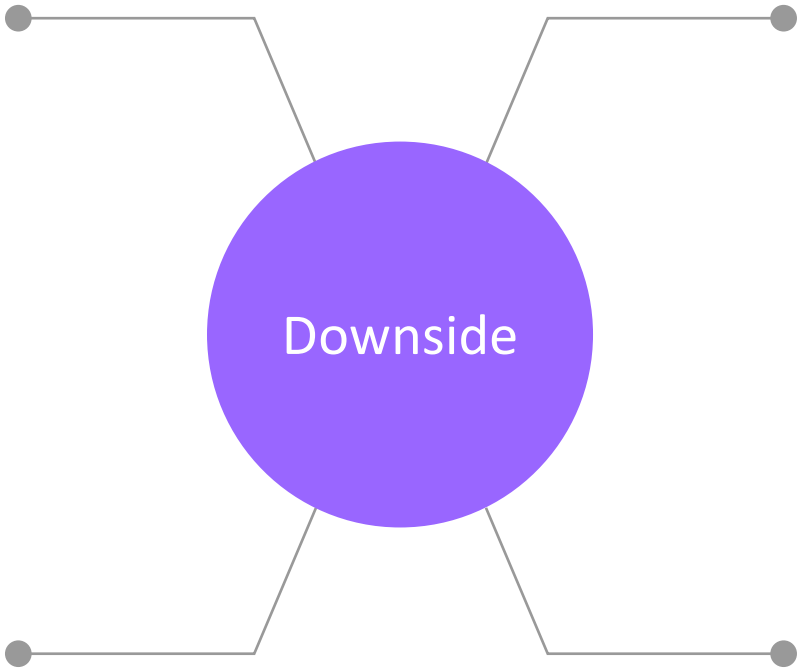
Your own server - Downside

Management

You have to manage the underlying infrastructure

Backups

You need to implement backups



High Availability

You need to manage high availability

Patching

You need to install updates

Azure SQL Database – Pricing Tiers

DTU – Database Transaction Units.

This is a blended measure of CPU, Memory and Input/Output.

There are different pricing tiers when it comes to the DTU model.

Azure SQL Database – Pricing Tiers

	Basic	Standard	Premium
Target workload	Development and production	Development and production	Development and production
Uptime SLA	99.99%	99.99%	99.99%
Maximum backup retention	7 days	35 days	35 days
CPU	Low	Low, Medium, High	Medium, High
IOPS (approximate)*	1-4 IOPS per DTU	1-4 IOPS per DTU	>25 IOPS per DTU
IO latency (approximate)	5 ms (read), 10 ms (write)	5 ms (read), 10 ms (write)	2 ms (read/write)
Columnstore indexing	N/A	S3 and above	Supported
In-memory OLTP	N/A	N/A	Supported

Reference - https://docs.microsoft.com/en-us/azure/azure-sql/database/service-tiers-dtu

Azure SQL Database – Pricing Tiers

vCore-based purchasing model.

Here you can independently scale compute and storage.

You can make use of the hybrid benefit model. Here you can save on costs if you have existing SQL Server licenses.

Azure SQL Database – Managed Instance

This is a deployment model that provides native integration with the Azure virtual network service.

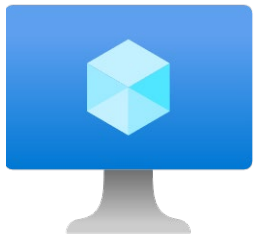
It provides near 100% compatibility with the latest SQL Server features.

Here again the infrastructure is managed for you.

Companies can also easily migrate their existing on-premises databases to the Managed Instance.

Azure SQL Database

IaaS vs PaaS



Virtual Machine

Infrastructure as a service

Here you install the database engine on a virtual machine.

Here you can install any database flavor and version.

You have complete control over the machine – Here you can manage the security aspects of the machine

Sometimes it becomes easier to migrate an existing on-premises database

Advantages

You have to maintain the environment

You have to look at aspects of scalability and high availability

Disadvantages

Azure SQL Database

platform as a service

Advantages

You don’t need to manage the infrastructure.

You get features such as high availability and backups in place.

You have flexible pricing options

Disadvantages

You can’t login into the underlying infrastructure.

Migrating from an on-premises instance to the Azure SQL database could pose a challenge

Database options

Hosting databases

Azure database for MySQL

MySQL is an open-source relational database management system.

You can store your data in the form of tables.

You can query for data using the Structured Query Language (SQL).

Azure Database for MySQL is a fully managed database service.

Here the underlying platform is managed by the service itself.

Here you also get high availability, backups and patching as well.

Azure database for PostgreSQL

PostgreSQL is a free and open-source relational database management system.

It has support for transactions that follow the ACID concepts – Atomicity, Consistency, Isolation and Durability.

It also has support for views, foreign keys, triggers and stored procedures.

Azure Database for PostgreSQL is a fully managed database service.

Here the underlying platform is managed by the service itself.

Here you also get high availability, backups and patching as well.

Azure Cosmos DB

NoSQL database

What is Azure Cosmos DB

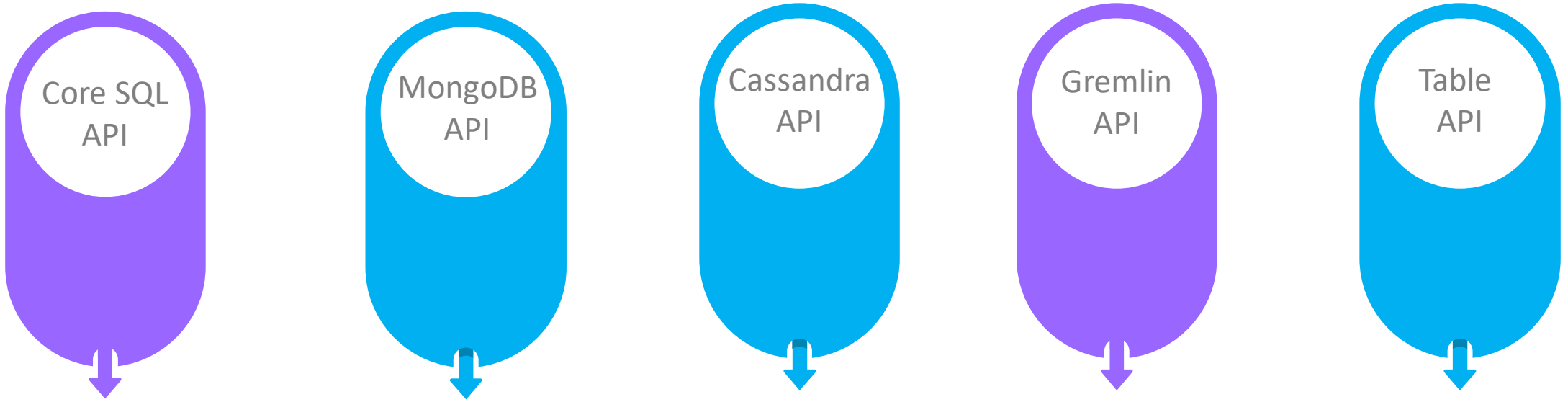
This is a fully managed NoSQL database.

The database provides fast response time and is highly scalable.

Here the underlying infrastructure is completely managed by Azure.

Commonly used for web, mobile, gaming and IoT applications that need to handle massive amounts of data.

Cosmos DB API



If you need to query for items using Structured query language

If you need to host a MongoDB compatible database

If you need to host a Cassandra compatible database

If you need to host a graph-based database

If you need to store data in the form of tables

Azure Databricks

Data Analytics

Azure Databricks

This is a fully-managed, cloud-based platform used for Big Data and Machine Learning.

Databricks itself is a tool that is used to analyze your data.

This tool is based on Apache Spark.

Apache Spark is a processing engine that is used to analyze big data using SQL, machine learning, graph processing or real-time stream analysis.

Azure Databricks is a managed version of Databricks.

Cloud Concepts

Understanding

Cloud Model types

Understanding the cloud

Public Cloud

These are services that are offered over the public internet

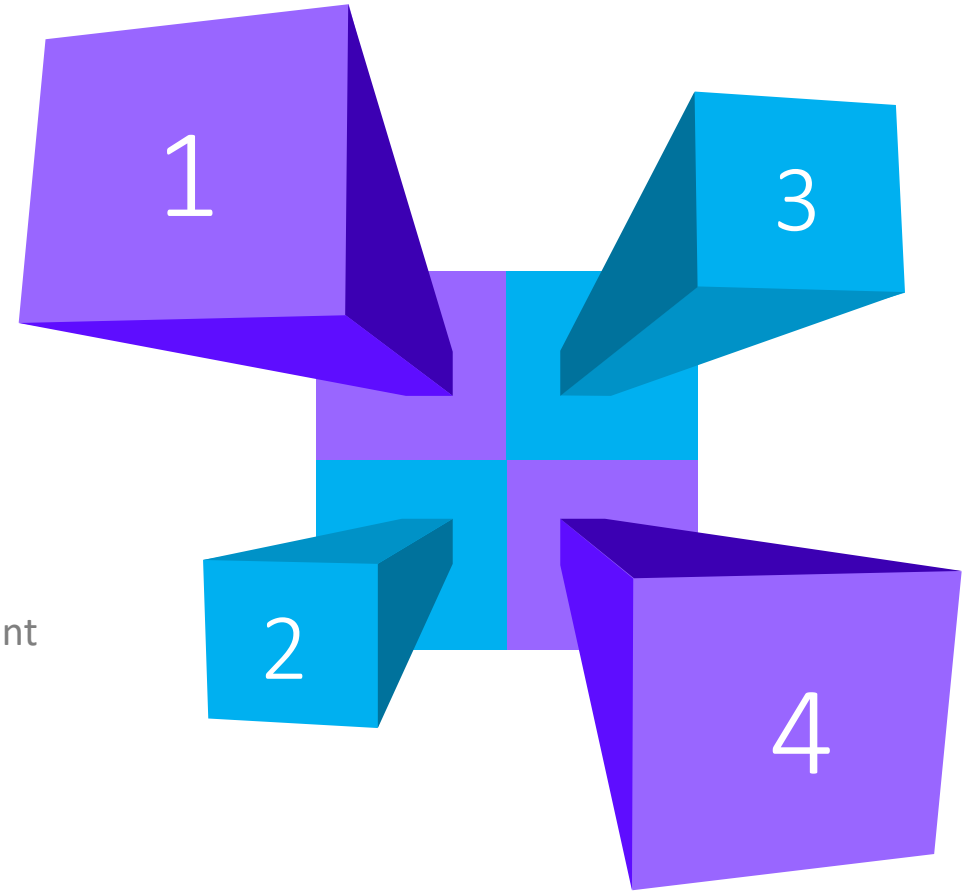
It’s available to anybody who wants to use them. Users then pay based on service they use.

Here all the servers and storage is managed by the cloud provider.

Public Cloud Advantages

Investment

No need for a capital investment – You normally don't pay any money upfront to use a cloud service. Most of the services are based on a pay-as-you-go model



Reachability

Cloud providers such as Azure have data centers located at different regions across the world.

Management

You don't need to manage the underlying physical infrastructure. Hence on-going maintenance costs are also reduced.

Ease of use

You can quickly provision resources on the cloud. It allows you to get up and running in no time.

Private Cloud

These are set of services that are normally only used by users of a business or organization.

The private cloud could be hosted either on the company’s on-premise environment. Or it could be provided by a third-party service provider.

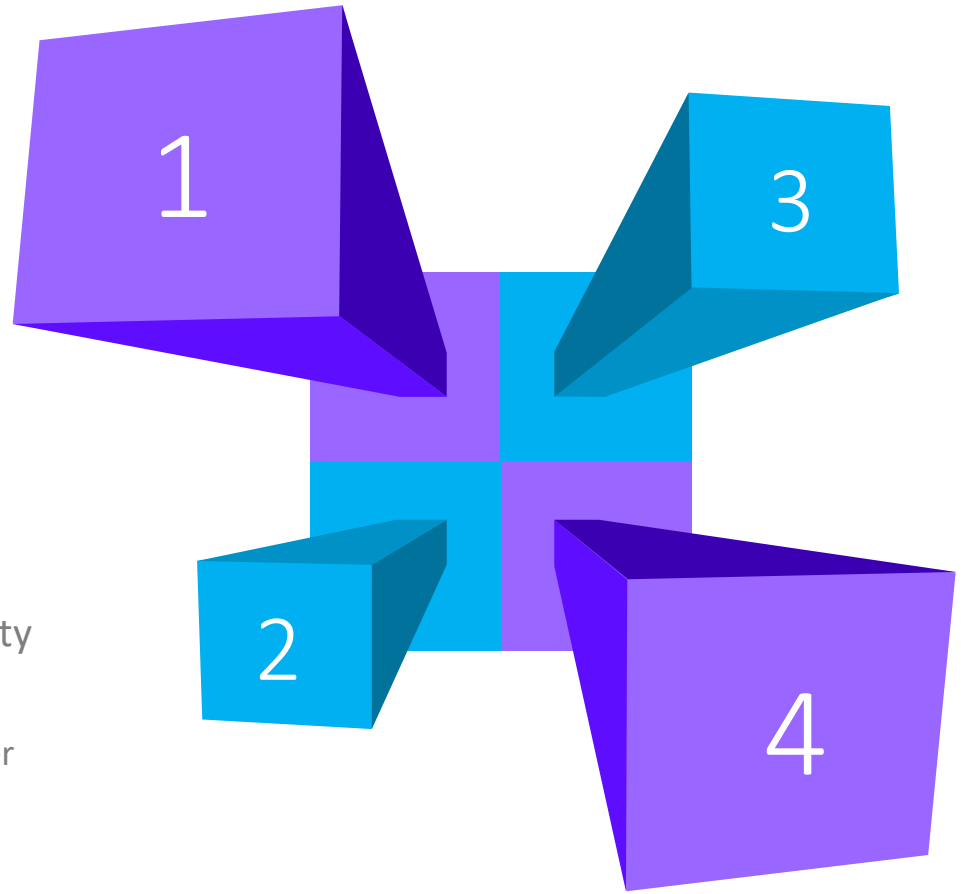
Private Cloud Advantages

Control

The business has complete control over the environment.

Data

The data held in the environment is in complete control by the business.



Security

They can implement their own security protocols at every layer to secure the environment.

Flexibility

You can implement various technologies and not bound to any platform.

Hybrid Cloud

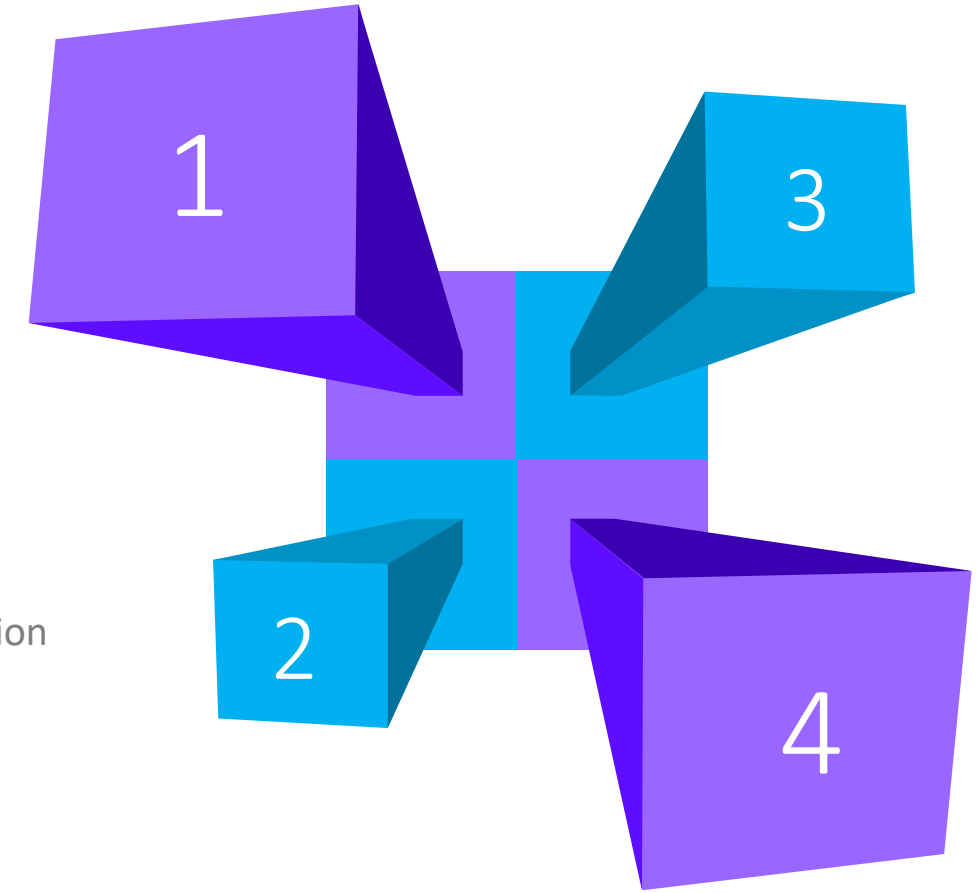
This is a combination of both the public and private cloud.

It allows data and applications to be shared across both cloud environments.

Hybrid Cloud Advantages

Current Investment

Businesses can still leverage their existing on-premise environment. This is important if they have already made a substantial investment in getting their environment in place.



Data

They can keep data which needs to be secured by their standards in their on-premise environment.

Extension

They can extend their infrastructure to the cloud without making a further investment.

Migration

They can move workloads to the cloud gradually.

Cloud Service Models

Understanding the cloud

Infrastructure as a service

An example is the Azure virtual machine service.

Here you don’t need to manage the underlying infrastructure.

The physical servers and storage is managed for you.

This helps remove the capital expense and reduces ongoing cost.

The Virtual Machine also has an SLA. To achieve that SLA for any on-premise server would require a lot of work.

Infrastructure cloud services also allow you to scale based on demand

Platform as a service

An example is the Azure SQL Database service or the Azure Web App service.

Here you don’t need to manage the infrastructure or even the underlying operating system and platform components.

You can just start hosting your data or your web application.

Reduces development time.

You can use an array of database technologies available in the case of Azure.

All of these services use a Pay-as-you-go model.

Software as a service

An example is Microsoft Office 365.

Here you don’t need to manage the infrastructure or even the underlying operating system, platform components or even the software.

Here you just start directly using the software.

You can access your application data from anywhere.

You don’t have the headache of managing anything.

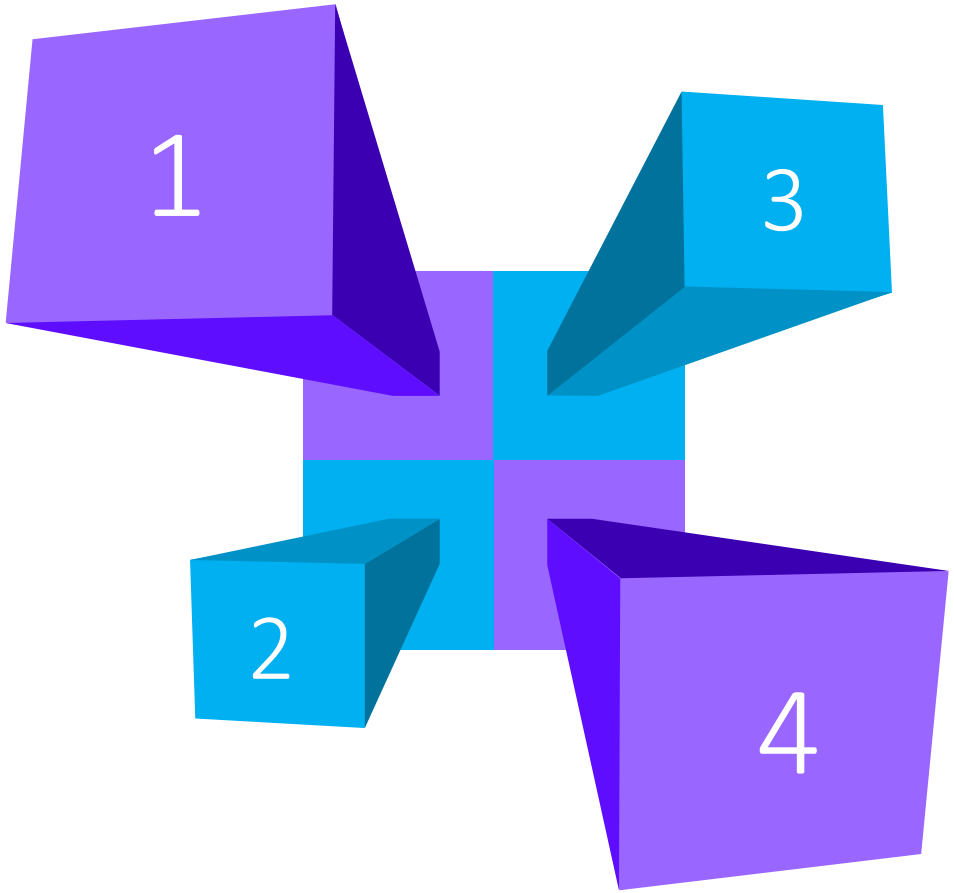
Economies of Scale

Understanding

Economies of Scale

Basics

This is the ability to carry out tasks more efficiently or at a lower-cost per unit when operating at a large scale.



Benefit

This becomes a benefit to the customer wherein the discounts can be passed to the customer.

Discount

When the demand increases, cloud providers can then get hardware at discount prices.

Service cost

If the number of customers increase the chances of services costs can go down.

Capital Expenditure

This is when you pay money upfront

- Server Costs
- Storage Costs
- Software Licenses
- Datacenter costs

Operational Expenditure

Ongoing money spent on services

- Human Resources
- Maintenance
- Software Support
- Datacenter Costs - Cooling

Azure Core Services

Part 1

Azure Web App

Hosting web applications

What is the Azure Web App service

This is an HTTP-based service used for hosting web applications.

Here your applications can be in .NET, .NET Core, Java, Ruby, Node.js or Python.

Applications can run both on Windows or Linux-based platforms.

This is a platform-as-a-service where the infrastructure is managed for you.

App service plan defines the set of compute resources that are used to run the web application.

Azure App Service Plans

Free, Shared

Here the infrastructure is shared with other customers. You only get certain CPU quotas to run per day.

Basic, Standard Premium

Here you get dedicated Azure VM's to run the applications. Depending on the tier you can also scale out your web applications.

Isolated

Here your apps run on dedicated Azure virtual machines and Azure virtual networks

Azure Load Balancer

Network Distribution

What is the Azure Load Balancer

This service is used to distribute the incoming network traffic across a group of backend resources of servers

You can define two types of load balancers – Public or Private Load Balancers

You have 2 SKUs for the Load Balancer – Standard and Basic Load Balancer

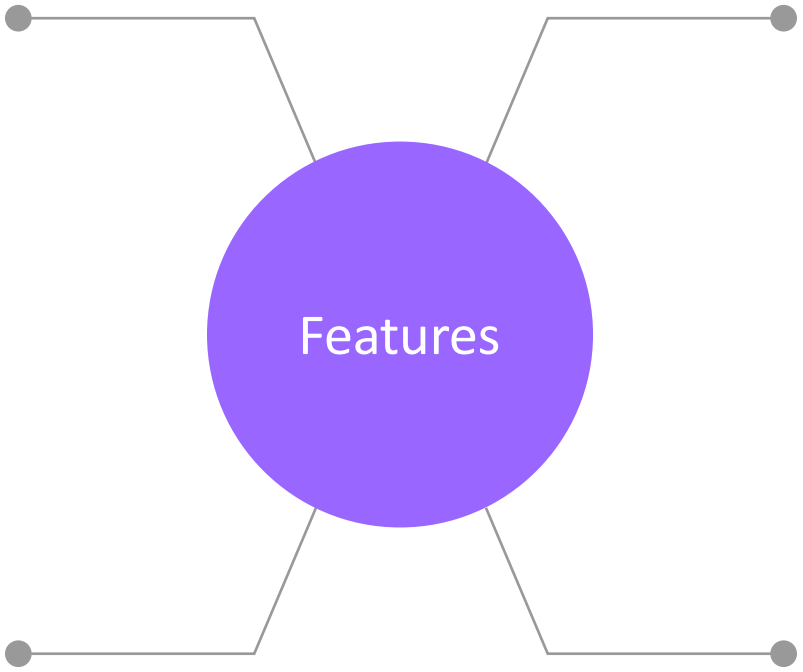
Basic Load Balancer

Pricing

You are not charged for the Load Balancer

SLA

There is no SLA



Backend machines

Here the machines need to be part of an availability set or scale set

Support for zones

There is no support for availability zones

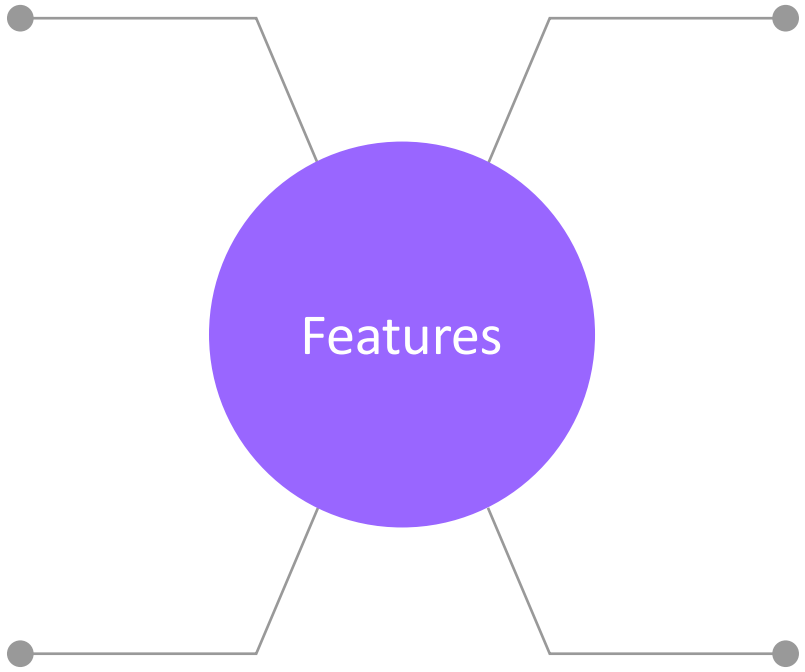
Standard Load Balancer

Pricing

There is a price per hour

SLA

There is an SLA of 99.99%



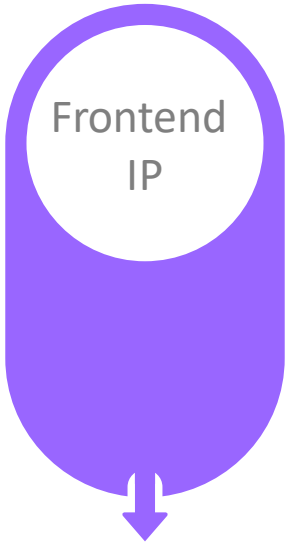
Backend machines

Here the machines need to be part of an availability set or scale set or they can be individual machines

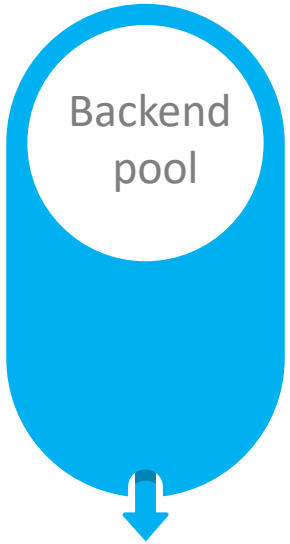
Support for zones

Here you get support for availability zones

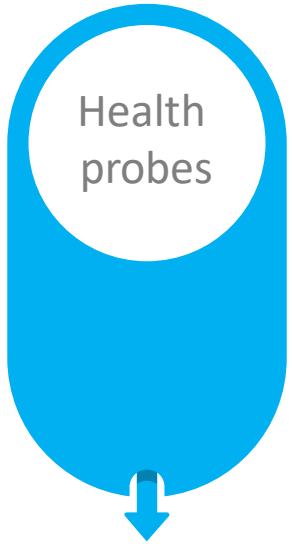
Components of a Load Balancer



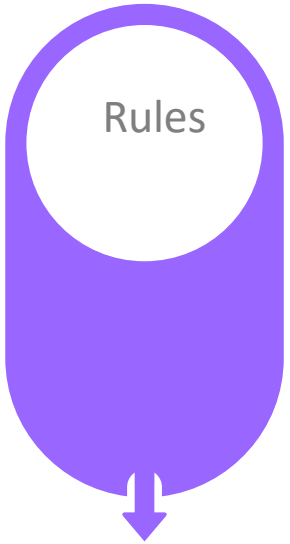
Here you define an IP address for the load balancer



This contains the backend virtual machines



This helps to check the status of the backend pool



The Load Balancing rules define how to distribute the incoming traffic

Azure Functions

Serverless computing

Azure Functions

This service allows you to run small pieces of code as functions.

Here you just develop and upload the code to an Azure Function.

You only get billed for the amount of time the code is run.

You can use a variety of programming languages in Azure Functions.

C#, Java , JavaScript, PowerShell and Python.

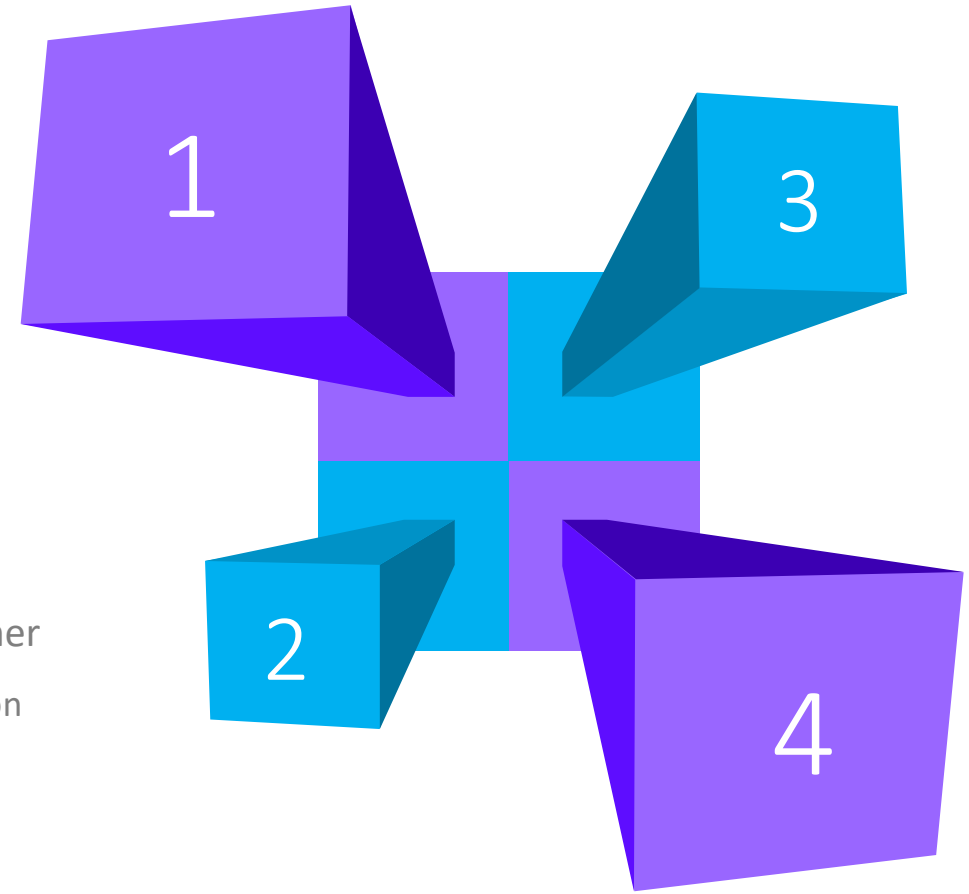
Azure Functions

HTTP trigger

Here an HTTP call can be made to the function

Timer

Here the function can be run on a schedule



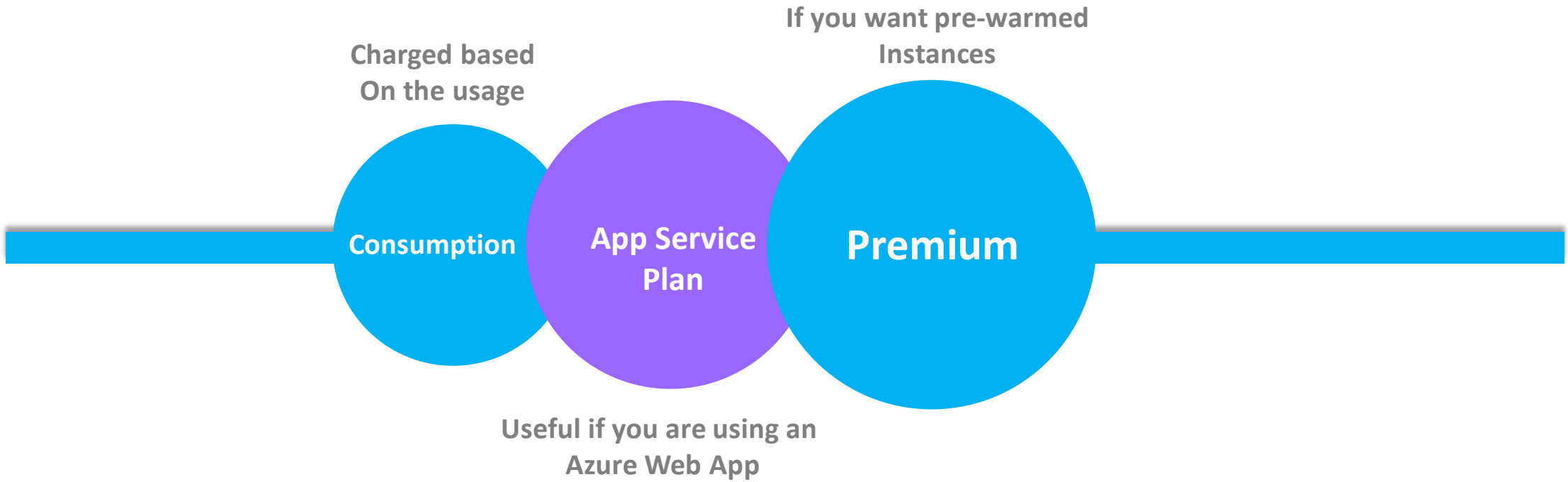
Blob storage

Whenever a blob event occurs

Azure services

Azure Event Hubs, Azure Service Bus

Pricing plans



Azure Core Services

Part 2

Azure IoT Hub

Managing IoT devices

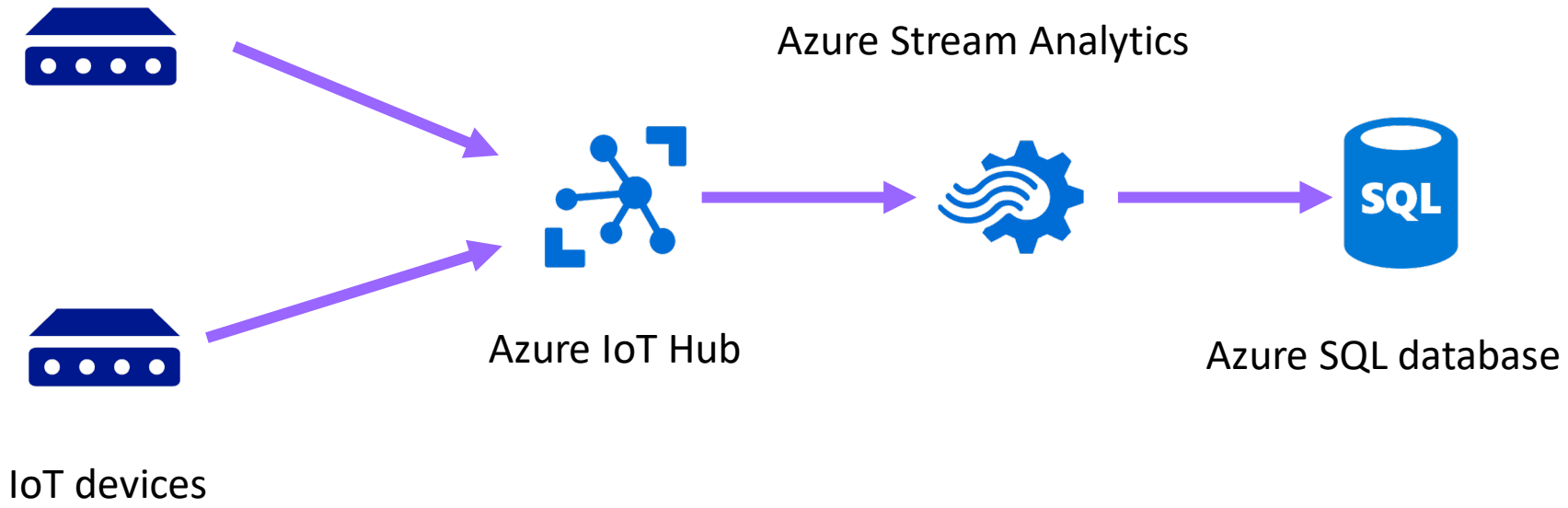
Azure IoT Hub

This is a managed service that can be used as a central message hub for bi-directional communication between managed devices and an IoT application.

The IoT hub supports communication both from the device to the cloud and from the cloud to the device.

The IoT hub also gives a secure communication channel for devices to send data.

Azure IoT Hub



Azure DevTest Labs

Overview

What is Azure DevTest Labs

This service allows developers to efficiently self-manage virtual machines and PaaS resources without the need to wait for approvals.

The DevTest Labs can be used to create labs consisting of pre-configured bases or Azure Resource Manager templates.

With DevTest Labs, you can quickly provision Windows and Linux based environment through the use of reusable templates and artifacts.

You can easily create load testing environments and create environments for training and demos.

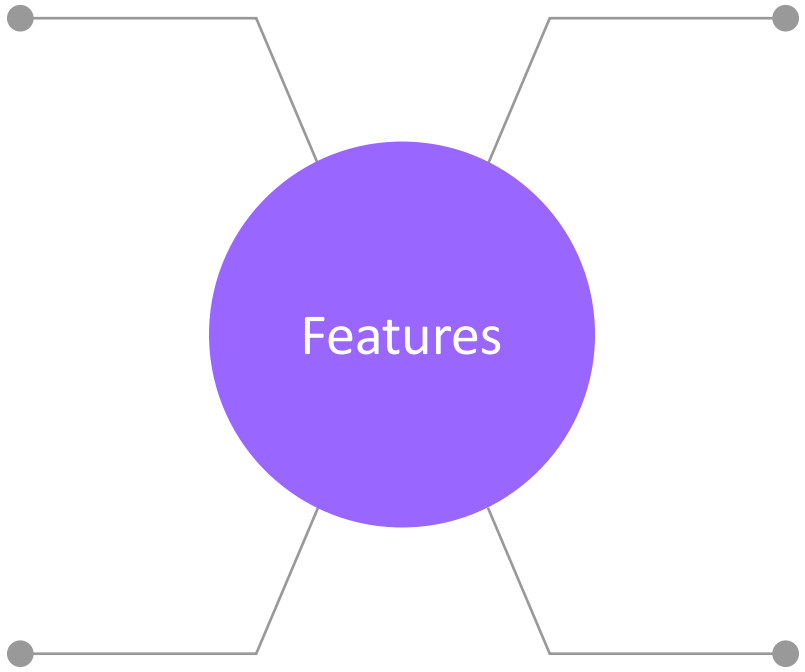
Cost optimization

Schedules

You can perform an auto-shutdown or auto-start for your machines

Costs

Easily track costs



Policies

Set a policy on number of machines to create

Templates

Use in-built templates for the machines.

Azure DevTest Labs

Security, privacy, compliance

Understanding

Azure Blueprints

Deployment

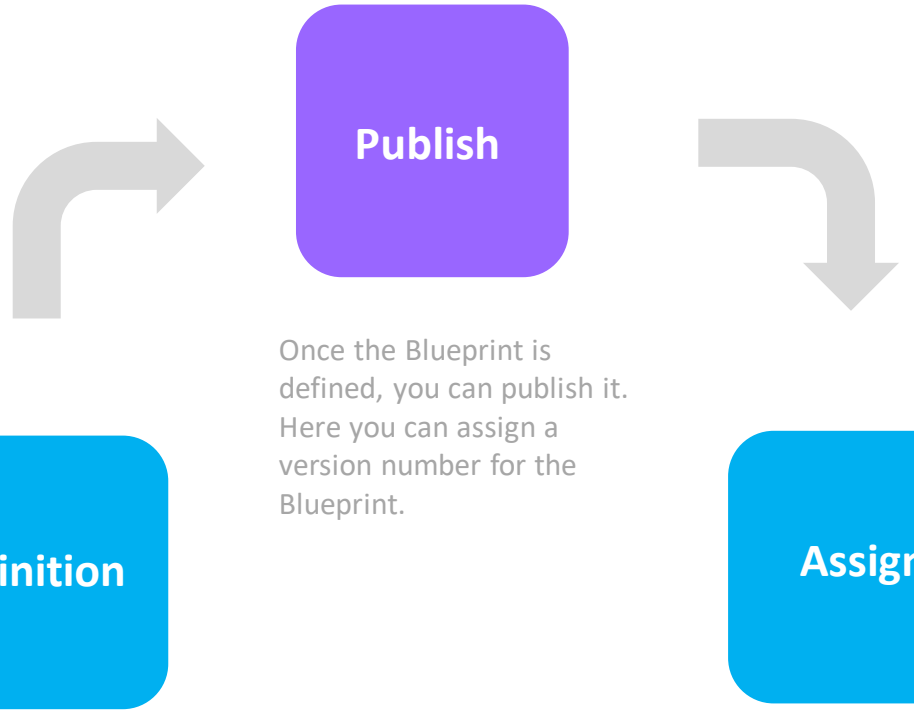
What are Azure Blueprints

Helps to define a repeatable set of processes that can adhere to an organization's standards and patterns.

You can declaratively define artifacts such as

- Role Assignments
- Policy Assignments
- Azure Resource Manager templates
- Resource groups

Stages of Azure Blueprint



Here you define the Blueprint itself. The Blueprint needs to be saved to either a management group or a subscription

Once the Blueprint is defined, you can publish it. Here you can assign a version number for the Blueprint.

Here the Blueprint is then assigned to a subscription.

Azure Sentinel

Threat protection

What is Azure Sentinel

This is a cloud service that provides a solution for SEIM (Security Information Event Management) and SOAR (Security Orchestration Automated Response)

This provides a solution that helps in the following

Collection of data – Here you can collect data across all users, devices, applications and your infrastructure. The infrastructure could be located on-premise and on the cloud.

It helps to detect undetected threats.

What is Azure Sentinel

It helps to hunt for suspicious activities at scale.

It helps to respond to incident rapidly.

Once you start using Azure Sentinel, you can start collecting data using a variety of connectors.

You have connectors for a variety of Microsoft products and other third-party products as well.

You can then use in-built workbooks to get more insights on the collected data.

Azure Security Center vs Azure Sentinel

Azure Security Center

Azure Sentinel

Azure Security Center

Resource locks

Protecting resources

Resource locks

Locking resources can help ensure users don’t accidently delete or modify resources.

There are two types of locks

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

ReadOnly - authorized users can read a resource, but they can't delete or update the resource.

Azure Pricing and support

Understanding

Saving on costs

Compute costs

Reserved pricing

Here you can save on money by committing to a one-year or three-year plan.

Reservations can significantly reduce your resource costs by up to 72% from pay-as-you-go prices.

Reservation discounts are applied to your bill and don’t impact your resources.

You can also exchange a reservation or request for a refund.

Spot virtual machines

Spot virtual machines have a lower pricing than the pay-as-you-go model pricing.

Here you get machines based on spare capacity that is available on the Azure platform.

At any point in time when Azure needs the capacity back, the Azure infrastructure will evict Azure Spot Virtual Machines

Spot machines are good for workloads that can handle interruptions – batch processing jobs, or workloads that run on development/test environments.