Guide

Azure infrastructure for modern cloud applications

Microsoft Azure

Executive summary

Azure is the public cloud service from Microsoft that provides cloud infrastructure to any organization that needs to run its applications in the cloud.

Azure is next only to AWS in terms of cloud market share, and is used by all kinds of companies, from startups to Fortune 500 companies. With decades of experience providing enterprise software, Microsoft Azure is a leader in the cloud computing space.
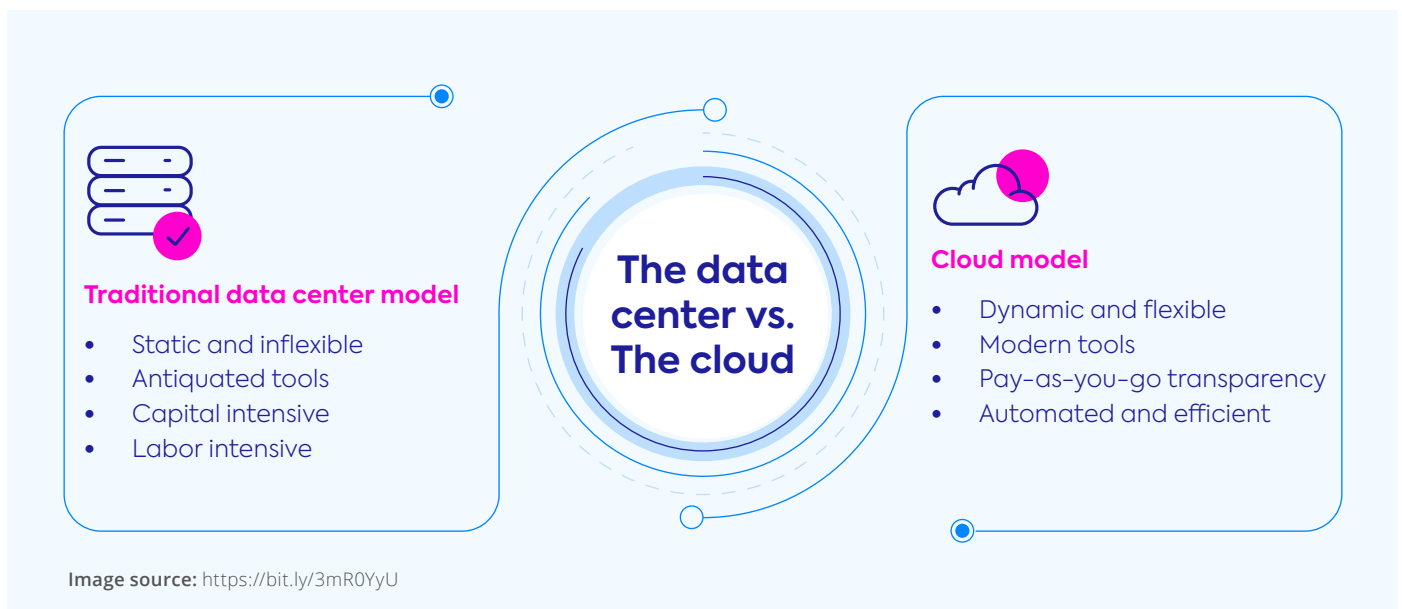
Some of the major services offered by Azure include Azure Virtual Machines, Azure Kubernetes Service (AKS), Azure Blob Storage, Azure Functions, and Cosmos DB. This list only scratches the surface in terms of what's offered. Azure offers numerous other cloud services to meet the diverse needs of its enterprise customers.

Azure is Microsoft's answer to the cloud and aims to make it easy for developers of all skill levels to create cloud-based solutions. This guide will take you through the basics of Azure cloud infrastructure and show you how to get started.

What is cloud infrastructure management?

Cloud infrastructure is different from traditional IT infrastructure, and it requires a different management approach. The term cloud infrastructure is used to describe a system of interconnected servers, storage devices, networking, and related services that allow a business to run their applications, and store and process their data from a remote location. With cloud infrastructure, a business can easily scale its software systems as needed. It reduces the complexity of sourcing, purchasing, and managing hardware and software.
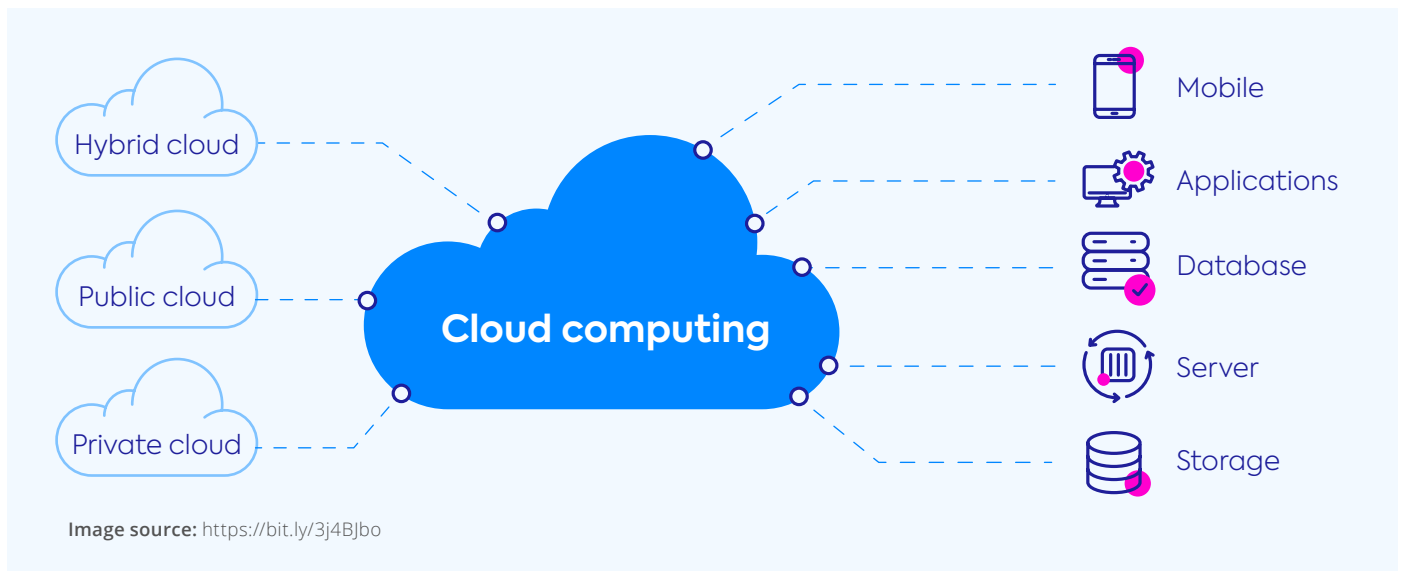
As the cloud continues to transform businesses, it is important to understand the requirements and components of cloud infrastructure. This includes creating resources and optimizing their usage, monitoring and reporting on performance and availability, load balancing traffic across the network, and mature service management to ensure cloud infrastructure can scale up or down based on business needs.

Traditional data center model

- Static and inflexible
- Antiquated tools
- Capital intensive
- Labor intensive

The data center vs. The cloud

Cloud model

- Dynamic and flexible
- Modern tools
- Pay-as-you-go transparency
- Automated and efficient

Image source: https://bit.ly/3mR0YyU

The two approaches above are quite different from each other. Many large organizations come from an era of on-premise-only but are now in the process of modernizing their infrastructure mix.

Traditional / On-prem infrastructure	Modern / Cloud infrastructure
Primarily server-centric (physical, or virtual)	Virtual instances or container instances
Own hardware servers	Rent cloud instances
Yearly, multi-year licensing	Pay-per-use for resources, pay-as-you-go hourly, or monthly subscription
Tightly coupled with data and application layers	Decoupled from data and application layers
Private - Used only by own organization	Public - shared with other organizations, although private options exist
Requires extensive support from vendor which is sometimes charged separately	Self-help using help center & forums, vendor support is available but not as necessary
Requires a large team in-house to manage	Hardware management is handled by the cloud provider
Company takes responsibility for security, and reliability of infrastructure	Cloud provider secures cloud resources while the company protects assets in the cloud

Today, cloud infrastructure is an important part of any organization's technology infrastructure, and it involves a large number of options and features. Cloud users have multiple options for compute, storage and networking. For example, with compute, you can choose between Azure Virtual Machines, Azure Container Instances, or Azure Functions. Azure offers many different types of virtual machines, including compute-optimized, memory-optimized and general purpose instances. The needs and constraints of your application will determine which kind of instance type you choose. Azure also offers three different ways to pay for your compute: pay-as-you-go, spot VMs, and reserved instances. Like instance type, pricing strategies are determined based on workload demands and business requirements.

Cloud computing

Hybrid cloud
Public cloud
Private cloud

Mobile
Applications
Database
Server
Storage

Image source: https://bit.ly/3j4BJbo

These are just the some of the compute decisions you need to make. You'll also need to choose a database type, storage type, networking, load balancing and much more. Managing all of this requires a keen understanding of your own business needs, and awareness of the various options avaialble in a cloud vendor like Azure.

Cloud infrastructure encompasses all the hardware, software, networking, and data services needed to support the development and deployment of software in the cloud. The goal of cloud infrastructure management is to seamlessly deliver applications and data to an organization's users and partners. Thus, cloud infrastructure management includes the maintenance, implementation, and improvement of hardware, software, networking, and data services, as well as the delivery of software.

To perform these tasks, administrators need real-time visibility into the health and performance of the cloud platform. They need the tools and capabilities to dynamically provision and optimize resources. They need automation to scale management tasks without growing their team size. All this, when done together, will result in a reliable, highly available cloud platform that is cost-efficient and ready to scale to meet changing application requirements and business goals.

Azure is a vast cloud platform with numerous infrastructure options and capabilities. This can be a challenge for organizations that are moving to Azure from a data center, or a different cloud platform such as VMware. The best practices practices below can help you take advantage of Azure's many benefits and unlock long-term value in the cloud.

Best practices for cloud infrastructure management

Real-time visibility

An important feature of Azure cloud infrastructure is real-time visibility into performance and availability of applications. This is especially important if your business relies on servers to be always up and running. If you're not aware of all the possible vulnerabilities, you can risk losing your customers to downtime. With real-time visibility, you'll know when an issue arises, what the issue is, and how to resolve it.

Dynamic resource management

Dynamic resource management enables organizations to improve their performance by optimizing the usage of the Azure infrastructure. When optimizing resources, it is important to ensure that workloads are not impacted. Dynamic resource management has many advantages for organizations, including increasing reliability and performance, reducing costs, and increasing agility and responsiveness.

Load balancing

Load balancing is a critical component of any large scale cloud application, and this is no different with Azure. Unless you have a small "green field" implementation, you'll likely need to balance the traffic for your application across multiple application servers. In some cases, you'll want to use a load balancer to redirect traffic to a "back end pool" of servers that are handling all of the data processing for a specific service. In other cases, you'll want to create a "front end pool" of servers so that the load balancer is handling all of the user traffic and then your application servers can simply pass along requests and responses. In either case, you need to choose the right load balancing option and set policies for balancing network traffic.

Reliability & high availability

An outage or downtime can have significant impact, from lost revenue to lost data, and degradation of user experience and application quality. Azure provides various services that help businesses build highly performant, secure environments where data is backed up and safe, and infrastructure is distributed to avoid a single point of failure.

Automation

When you automate the deployment of Azure resources, you can reduce the time it takes to add Azure virtual machines to your workload, and to recover from failures. The main goal of Azure Resource Manager is to automate infrastructure creation. This automation is done using templates defined in JSON files. Each template represents a set of resources. Further, Azure includes ways to autoscale nodes and pods in Kubernetes, which is essential for containerized infrastructure.
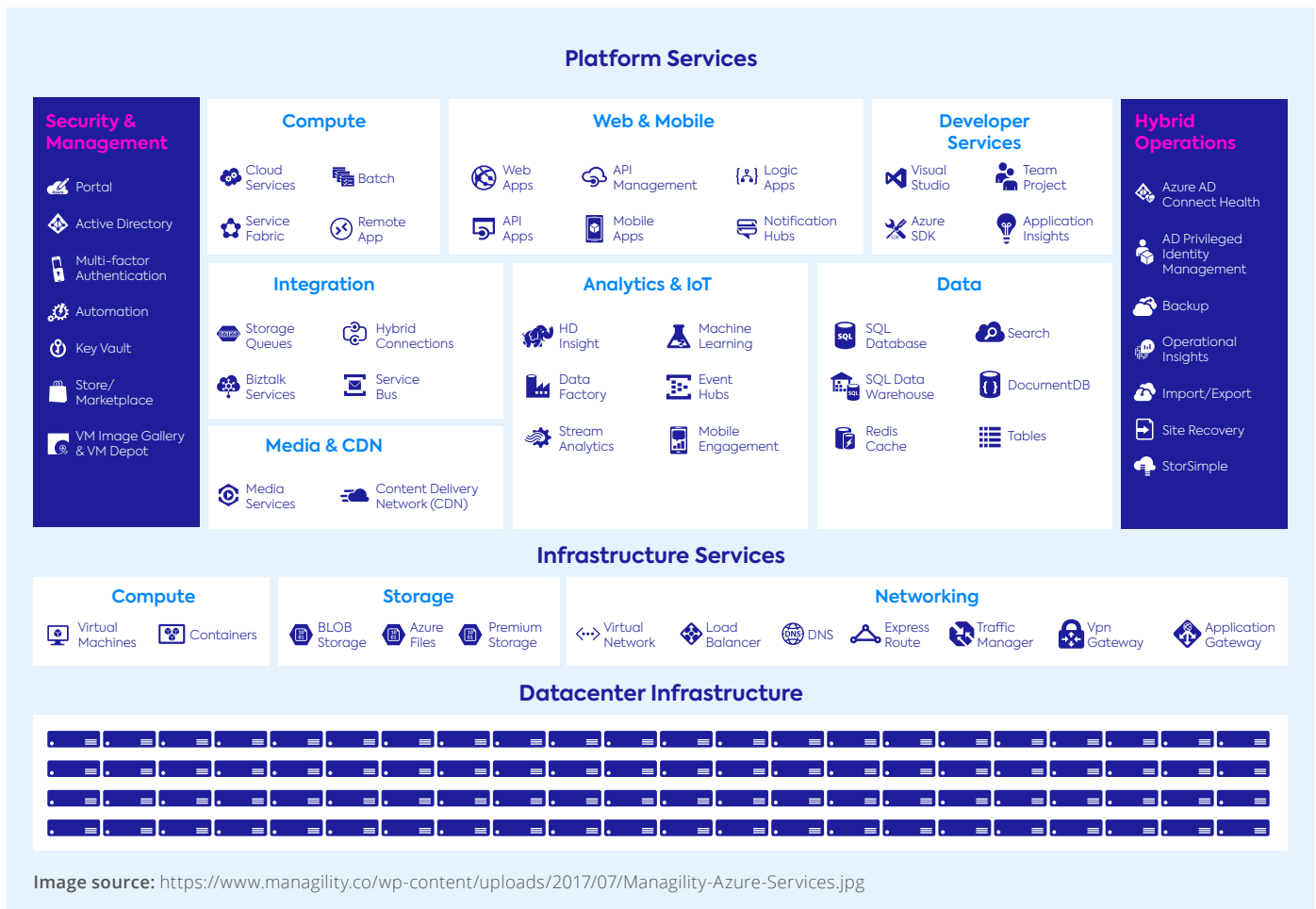
Cost efficiency

One of the most critical priorities companies are tackling is managing cloud spend and optimizng costs. Many organizations overspend on cloud infrastructure, and underutilize what they buy. Azure provides ways for users to understand their spending, and there are ways to lower the cloud bill, like using Azure Spot VMs. But there are other factors to cost optimization that Azure users have to take into consideration when tring to drive cost efficiency in the cloud.

Getting started with Azure cloud infrastructure

You can use Azure to run applications you've already built, to build new applications in the cloud, or to integrate cloud services with your existing applications. When getting started with Azure, it helps to know the key services of the platform and their function. Here is a list of the top Azure cloud services:

Azure service	Brief description
Azure Virtual Machines	Cloud server instances that are managed by Azure and rented on an hourly basis.
Azure Container Instances	Single or small-scale container instances that are easy to manage and quick to get started with.
Azure Kubernetes Service	Managed Kubernetes service that enables organizations to run containers at massive scale.
Azure Functions	Serverless computing solution to run code and applications without the hassle of underlying server instances.
Azure Blob storage	Object storage in the cloud for storing large volumes of data at low costs.
Azure Cosmos DB	Managed NoSQL database for data processing at scale.
Azure Active Directory	Single Sign-on (SSO) and MFA to manage user access and permissions.
Azure API management	Build and deliver APIs for internal or external-facing applications.
Azure Bot	Bot development service for automating business processes.
Azure Content Delivery Network	CDN service that delivers content across the world with low latency.
Azure Data Lake	Large-scale data storage for big data analytics.
Azure DevOps	DevOps tools that enable a CI/CD pipeline and more.
Azure AI	Build and deploy AI and machine learning models.
Azure IoT	Management platform for connected IoT hardware and the software that manages these devices.

This list is just a small part of the entire collection of Azure cloud services. You can see the full list here. With the numerous options to choose from, you need to know where to start, and what to look out for. That's what we outline in this guide.

Platform Services

Security & Management
- Portal
- Active Directory
- Multi-factor Authentication
- Automation
- Key Vault
- Store/ Marketplace
- VM Image Gallery & VM Depot

Compute
- Cloud Services
- Batch
- Service Fabric
- Remote App

Web & Mobile
- Web Apps
- API Management
- Logic Apps
- API Apps
- Mobile Apps
- Notification Hubs

Developer Services
- Visual Studio
- Team Project
- Azure SDK
- Application Insights

Hybrid Operations
- Azure AD Connect Health
- AD Privileged Identity Management
- Backup
- Operational Insights
- Import/Export
- Site Recovery
- StorSimple

Integration
- Storage Queues
- Hybrid Connections
- Biztalk Services
- Service Bus

Analytics & IoT
- HD Insight
- Machine Learning
- Data Factory
- Event Hubs
- Stream Analytics
- Mobile Engagement

Data
- SQL Database
- Search
- SQL Data Warehouse
- DocumentDB
- Redis Cache
- Tables

Media & CDN
- Media Services
- Content Delivery Network (CDN)

Infrastructure Services

Compute
- Virtual Machines
- Containers

Storage
- BLOB Storage
- Azure Files
- Premium Storage

Networking
- Virtual Network
- Load Balancer
- DNS
- Express Route
- Traffic Manager
- Vpn Gateway
- Application Gateway

Datacenter Infrastructure

Image source: https://www.managility.co/wp-content/uploads/2017/07/Managility-Azure-Services.jpg

Azure's virtualized services for compute can help you scale applications quickly and efficiently. You can run on Azure VMs, containers, or serverless. Under each of these, there are multiple options to choose from, each built for a different purpose.

Azure Virtual Machines

Azure Virtual Machines (VMs) are the building blocks of Azure, and a key part of cloud infrastructure. They offer a flexible and scalable way to run your enterprise workloads in the cloud. Azure offers a variety of VM sizes and pricing models to run any application in the Azure cloud platform. We'll take a closer look at the different Azure VM series and pricing models available for you to run your applications.

VM type	Ideal usage scenarios
A–Series Basic, budget VMs	To get started with Azure, or to run lightweight web servers and databases.
Bs–Series Budget-friendly, yet burstable VMs	Similar to A-series, but when you sometimes need 'burst' capability for compute.
D–Series General purpose compute	For production workloads and when you need a little more than the basic VMs.
E–Series In-memory optimized	Ideal for running SAP applications that are business critical and RAM–heavy.
F–Series Compute optimized	High-powered Intel processors that are ideal for batch processing or gaming.
G–Series Memory & storage optimized	These are for large databases and enterprise applications that are data centric.
H–Series High Performance Computing	HPC workloads that are analytics–heavy such as weather modeling, and seismic processing.
Ls–Series Storage optimized	Data-intensive workloads such as NoSQL databases and data warehousing.
M–Series Memory optimized	The more powerful alternative to the E series for running SAP applications and more.
Mv2–Series Largest memory optimized	Maximum RAM upto 12TB for the largest of SAP applications and more.
N–Series GPU enabled	Maximum compute power for tasks like video editing and deep learning.

As the table above shows, Azure offers VMs that are general purpose and ones that focus on economy, burstable scale, compute, or memory. With such a wide range of VMs to choose from, any organization is sure to find the right VM type for every job and every team.
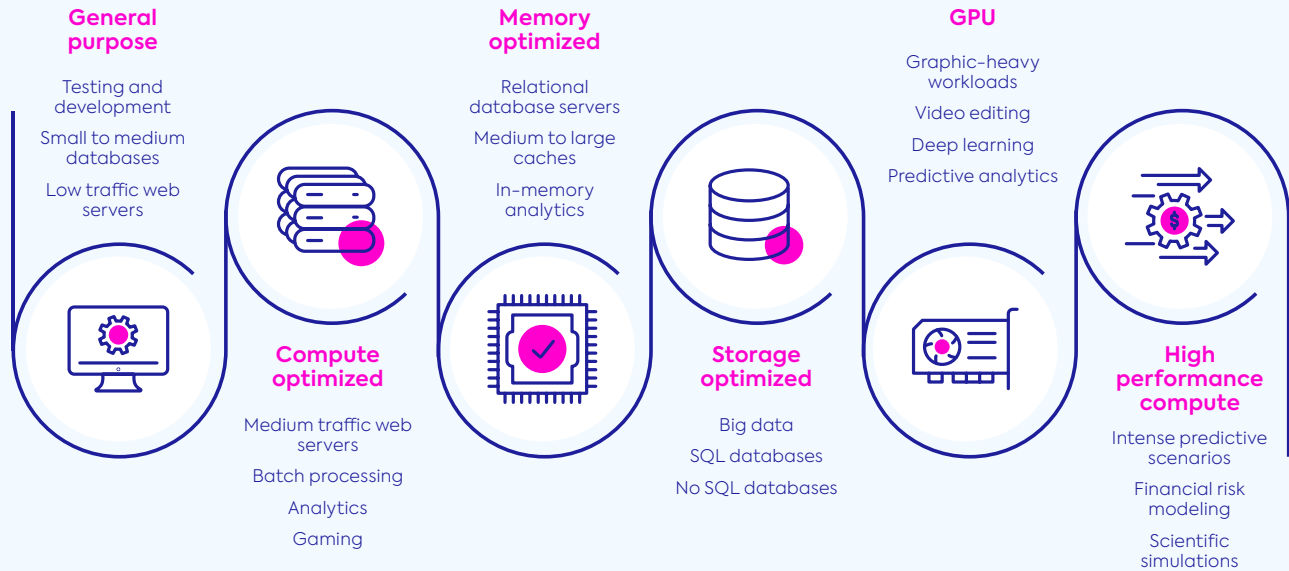
Azure Virtual Machine options

General purpose

Testing and development

Small to medium databases

Low traffic web servers

Compute optimized

Medium traffic web servers

Batch processing

Analytics

Gaming

Memory optimized

Relational database servers

Medium to large caches

In-memory analytics

Storage optimized

Big data

SQL databases

No SQL databases

GPU

Graphic-heavy workloads

Video editing

Deep learning

Predictive analytics

High performance compute

Intense predictive scenarios

Financial risk modeling

Scientific simulations

Image source: https://bit.ly/3aNLaY5

Available VM pricing models include pay-as-you-go, Reserved VMs, or Spot VMs.

Pricing model	Details
Pay-as-you-go	The default pricing option where VMs are charged full price by the hour.
1 year reserved	Reserve a VM for a year and save upto 43% on the pay-as-you-go price.
3 year reserved	Reserve a VM for 3 years and save upto 72% on the pay-as-you-go price.
Spot VMs	Excess capacity instances that are offered at 90% less than pay-as-you-go.

Cost savings vs. Pay-as-you-go

Pay-as-you-go		**0%** Savings
Azure RIs		**72%** Savings
Spot VMs		**90%** Savings

The pay-as-you-go pricing model is the most expensive option but offers full flexibility, which is ideal if you do not know how many VMs you will need at any given time. With an on demand approach, users spin up resources when they need them. Alternatively, if you know that you'll need a VM for a longer period of time, you can choose to reserve a VM for one or three years. Reserved pricing delivers up to 72% savings over pay-as-you-go.

Spot VMs, which are spare capacity VMs, are the least expensive with up to 90% savings over the pay-as-you-go option. Azure offers unused capacity as Spot VMs at a huge discount to maximize the overall utilization of their cloud. The downside, however, is that a Spot VM can be terminated with only a 30 second warning if Azure needs to reallocate those resources elsewhere. Because of their transient nature, spot VMs are typically ideal for batch processing, and fault-tolerant workloads.

Each pricing model has benefits that best fit certain workloads. If you'd like an exact estimate of the costs for your workload, try the Azure pricing calculator. To know more about how Azure's VM pricing works, refer to our Guide on Azure pricing.
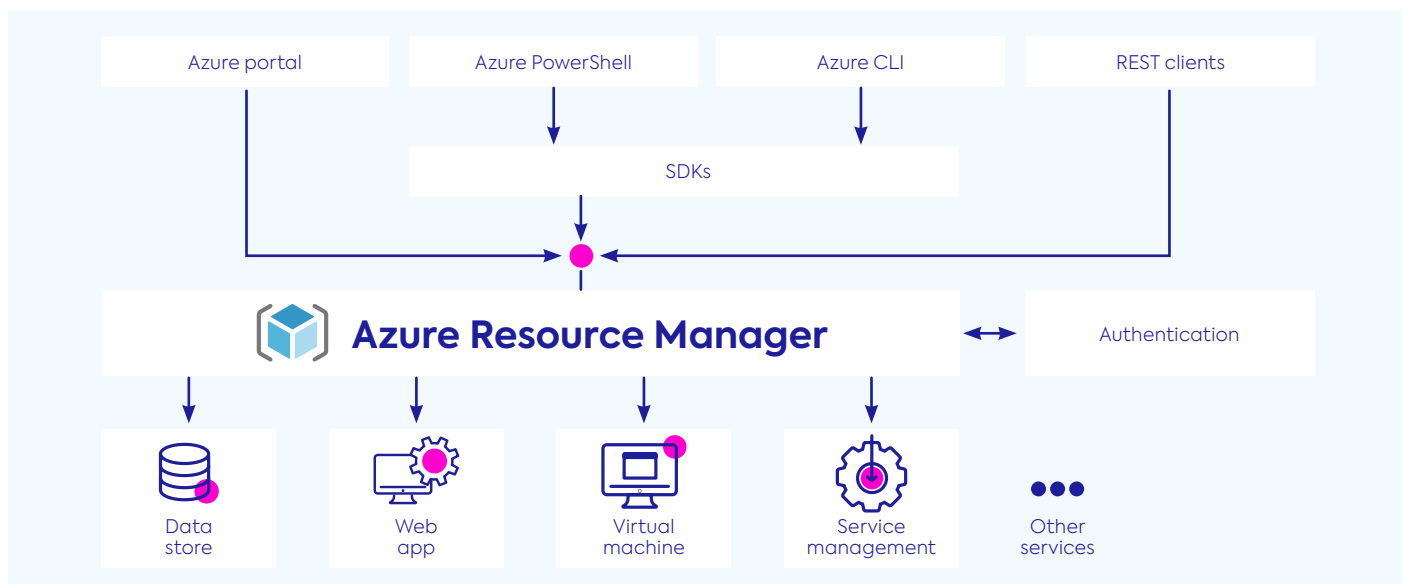
Managing Azure resources

Resource management is a vital part of any project. A resource is something that is of value to a project. In a project, a resource could be a person, a piece of equipment, a document or software. In Azure, a resource can be blob storage, a SQL database, a virtual machine, a web application, a virtual network, a load balancer, a backup vault, a network interface or a storage account.

In Azure, you can create, control, and manage the above-mentioned Azure resources in many ways. They range from a graphical interface to a CLI to a client in your favorite programming language.

Here are the options to manage your Azure resources:

Resource management method	How it works
Azure portal	A visual interface to control Azure resources from.
Azure CLI	A command line to manage Azure resources from.
Azure SDK	Manage Azure using your favorite programming language.
Terraform on Azure	Use Terraform templates to create & manage Azure resources.
Azure Resource Manager	Deploy & manage Azure resources using JSON templates.

Azure Resource Manager (ARM) is the central control plane through which all other managers can control Azure services. ARM provides a common interface to manage all Azure resources, with a consistent and predictable deployment and consumption model.


The ARM model can be used to manage all resources within a single Azure subscription or across subscriptions.

Now that we've covered some of the basics of Azure's cloud services, let's start using Azure cloud.

How do I get started?

Creating an Azure account

Creating an Azure account is as easy as signing up for an email address. Azure even offers a collection of free services for the first 12 months, making it possible to test the waters before committing to Azure as your preferred cloud platform.
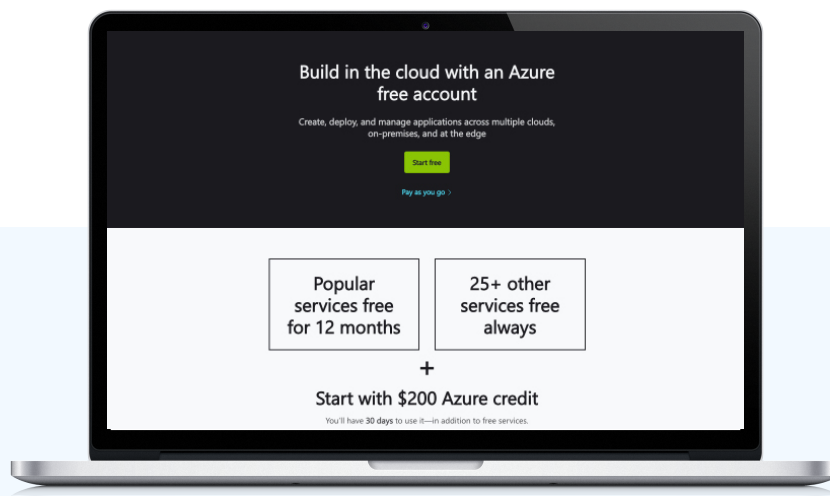
Once signed up, one of the first things you'll want to do is set up the key users and teams that will be using the platform. After this, you'll want to familiarize yourself with the Azure management options listed above.

Launching your first instance

To get started with Azure, you'll need to choose an Azure service that provides compute capacity. Then you'll create a resource group in Azure, which is a container for all Azure resources. You can then create a virtual network, which is a collection of isolated cloud services that you can use to deploy and manage your applications. Let's look at each of these in some detail.

The easiest way to create your first Azure VM is through the Azure Portal. Log into Azure portal, and search for 'virtual machine,' this will show you the Azure Virtual Machines service. In this service, click 'Create,' and you'll see a form with a list of options for your new VM. Enter the required details such as the name, size, and region of the new VM, and click 'Review + Create.' You'll now see that your first VM has been created.

Azure also offers some quickstart guides on VM creation for Linux and Windows.

Creating a load balancer

A key priority with networking and traffic management is load balancing. Load Balancing is used to monitor network traffic and distribute the load across multiple servers. Load balancing is useful if the user base of the application is increasing. Load balancing can spread the traffic across multiple Azure VMs so that the load is not concentrated on one VM. Load balancing is also useful if you want to use multiple VMs to serve the same content, or you want to use multiple VMs to perform different functions. In addition to load balancing traffic from the internet, load balancing can also be used to distribute traffic from services within a virtual network.

Once you have an application running in your Azure VM and traffic to this application, you can control the flow of traffic using a load balancer. To create a load balancer, log into Azure Portal and search for 'virtual network.' Once inside this service, you'll need to create a new virtual network. Then, going back to Azure Portal, you'll need to follow the same process to create a NAT gateway to manage outbound traffic.

Azure also offers a quickstart guide for creating a Linux load balancer.

Once these two steps are done, you're now ready to create your first load balancer. From Azure Portal, search for 'load balancer.' Once inside the service, create a new load balancer and define the various configurations for your load balancer. This will include IP addresses, availability zones, and traffic routing rules.

Users   Load balancer
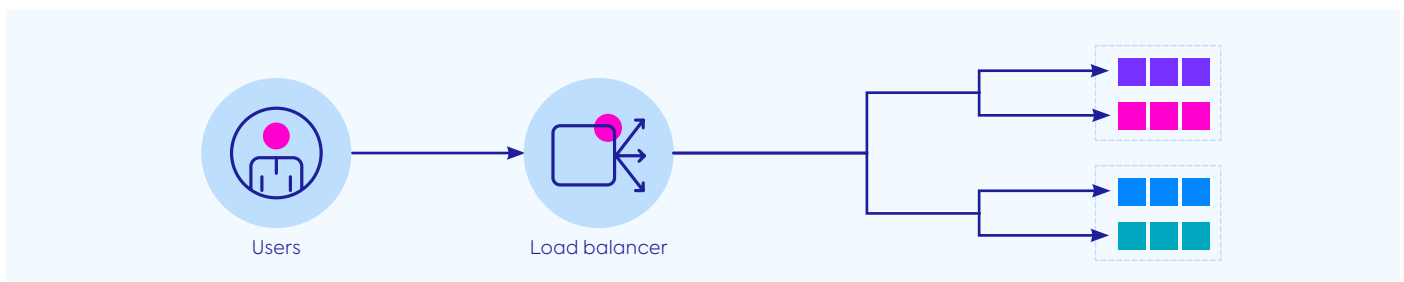
What's next?

Now that you have a good overview of the various services of Azure, and how to get started, the next step is to go beyond this initial phase and set up your cloud to better manage and optimize your infrastructure in Azure.

Learn about cost optimization

Saving money on Azure is what every IT executive wants. But it can be tough to know where to start. What are the best practices? Should you go all out and build a highly scalable app? Or should you only spend the bare minimum to get your site up and running? A lot of people don't realize that Azure can start small and inexpensive, but it can quickly become expensive and spiral out of control. To keep expenses down, you need to understand how to leverage resources like spot VMs, and how to maxmize resource utilization through strategies like right-sizing.

You can learn more about this in our guides for Azure cost and Right-sizing. It has pricing estimates for VMs as well as functions, as well as for pay-as-you-go, reserved, and spot instance pricing.

Conclusion

Azure is growing at a rapid rate, which is why many are interested in learning more about it. Azure supports a range of computing and infrastructure services such as compute, networking, database, storage, analytics, application services, management, and mobile. With multiple different services and features, Azure provides a lot of flexibility and options, but it can also be a little overwhelming.

This guide is your starting point for everything Azure. We hope it was able to guide you through some of the services and features of Azure and show you why so many people choose Azure for their cloud infrastructure needs. To learn more about cost optimization with Azure read our other guides on Azure pricing, autoscaling, and more.