

Manageability

HawkEye Data Solutions Inc

Manageability **of** the cloud

Manageability **in** the cloud

Manageability of the cloud



It's all about managing your cloud resources.



Manually deploy resources, or automatically through pre-set templates.



Get alerts around your cloud spends.



Monitor the health of resources.

Manageability in the cloud



HawkEye Data Solutions Inc



**It's all about how you're able to deploy
and manage cloud resources.**

Possible options are :

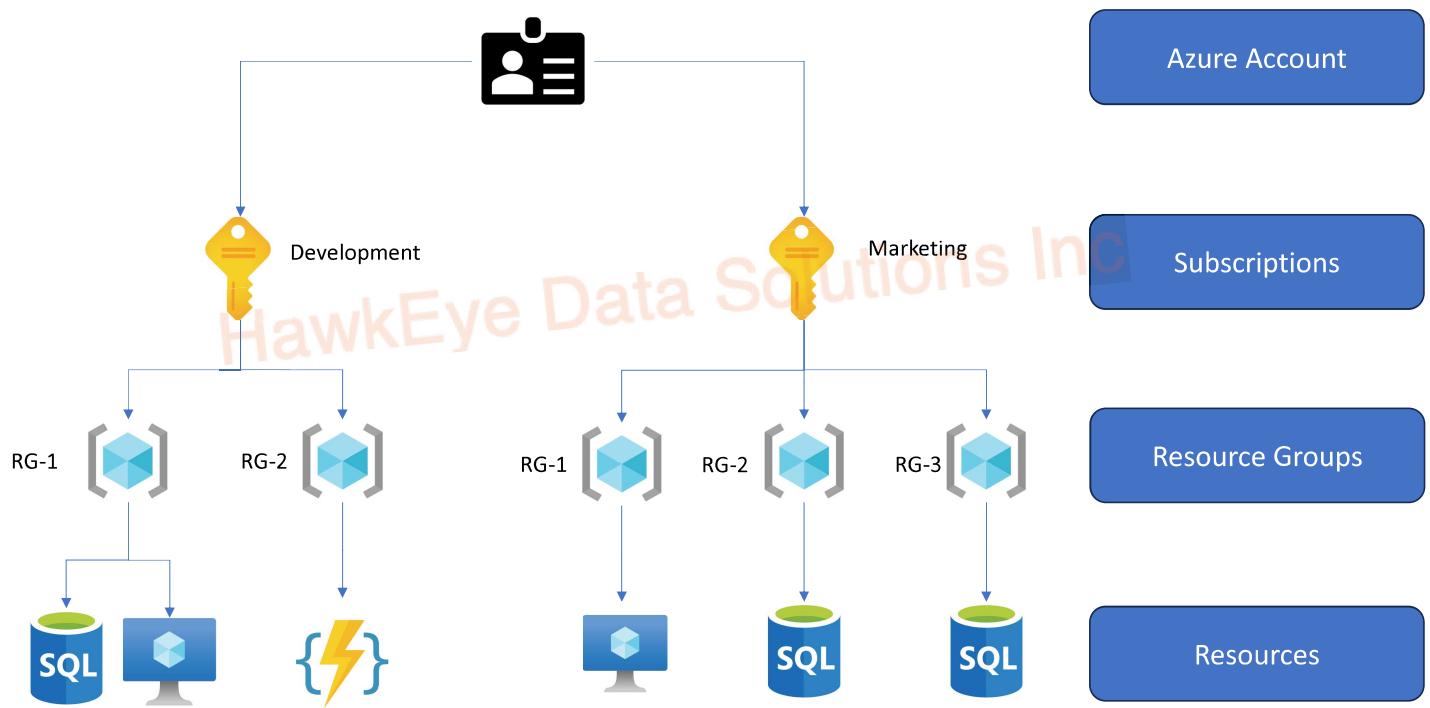
- Command Line Interface (CLIs)
- A Web Portal
- APIs



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**Let's take a quick look at
the Azure Portal!**

High level operating hierarchy



Free Azure Accounts?

1) Free Azure Account:

- Free access to popular Azure resources for 12 months.
- A credit that can be used within the first 30 days.
- Access to more than 25 services that are **ALWAYS** free!



Phone Number



Credit Card (Will not be charged)



GitHub/Microsoft Account

2) Student Azure Account:

- Free access to certain Azure resources for 12 months.
- A credit that can be used within the first 12 months.
- Access to certain developer tools.

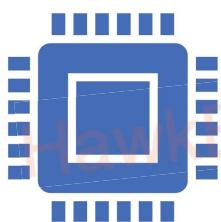


Phone Number



GitHub/Microsoft Account

What is Azure?



An expanding set of services, that help you deploy infrastructure and solutions with the click of a few buttons!



A huge variety of IoT, BI, AI, ML based services – the power is all in your hands now.



Physical Infrastructure

- Robust infrastructure at a global scale – data centers located **strategically** around the world.
- Physical facilities that house servers, storage devices, networking equipment with **dedicated** power, networking, cooling etc.
- This global presence has **2** big benefits: Disaster Recovery & Proximity to users.



Regions

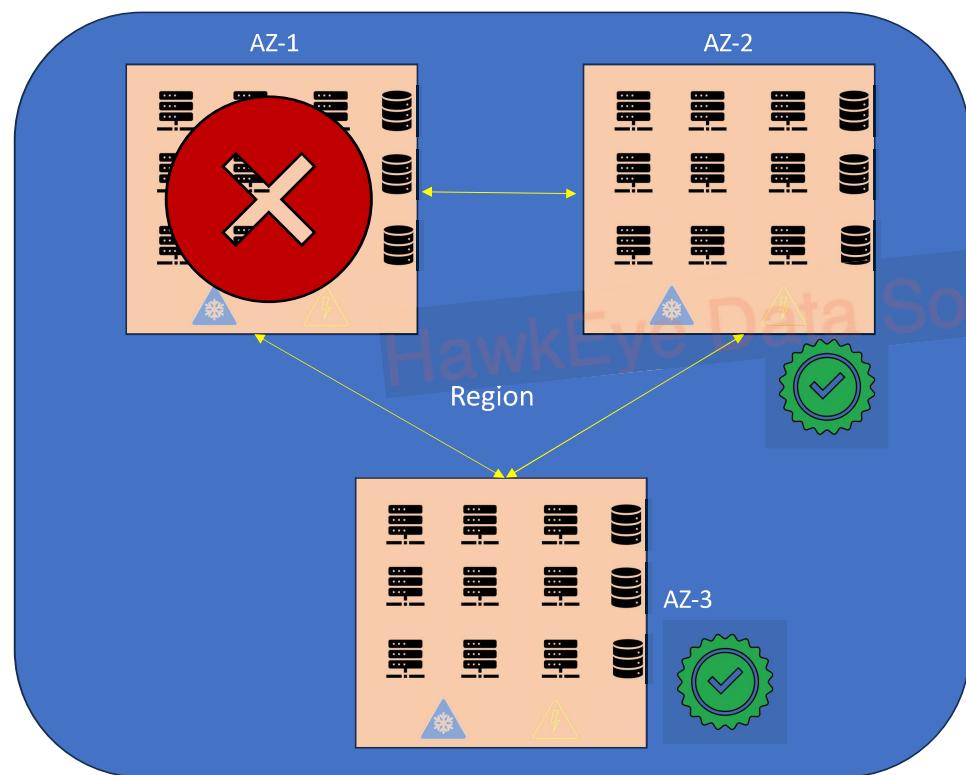
- A geographical area on the planet with **AT LEAST 1** but potentially multiple datacenters (connected using low-latency networks).

- When we deploy resources, we often need to choose the region for its deployment. (**Data residency & compliance**)

- Some Azure resources are available **ONLY** in certain regions.

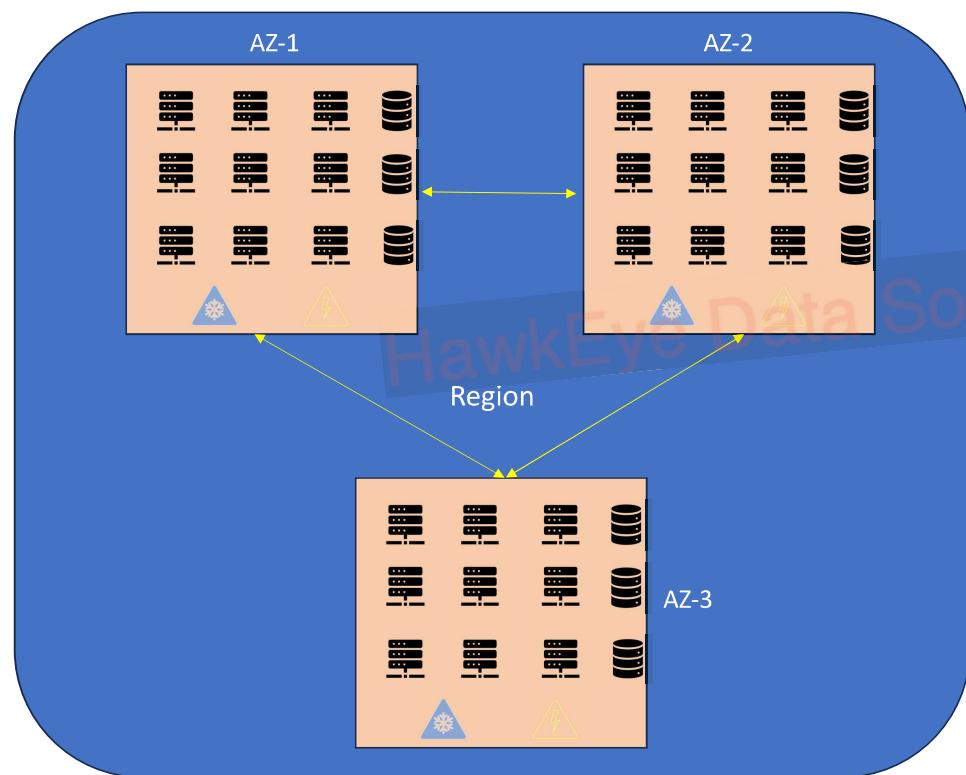
- Some global Azure services **don't** need us to specify a region.

Availability Zones (AZ)



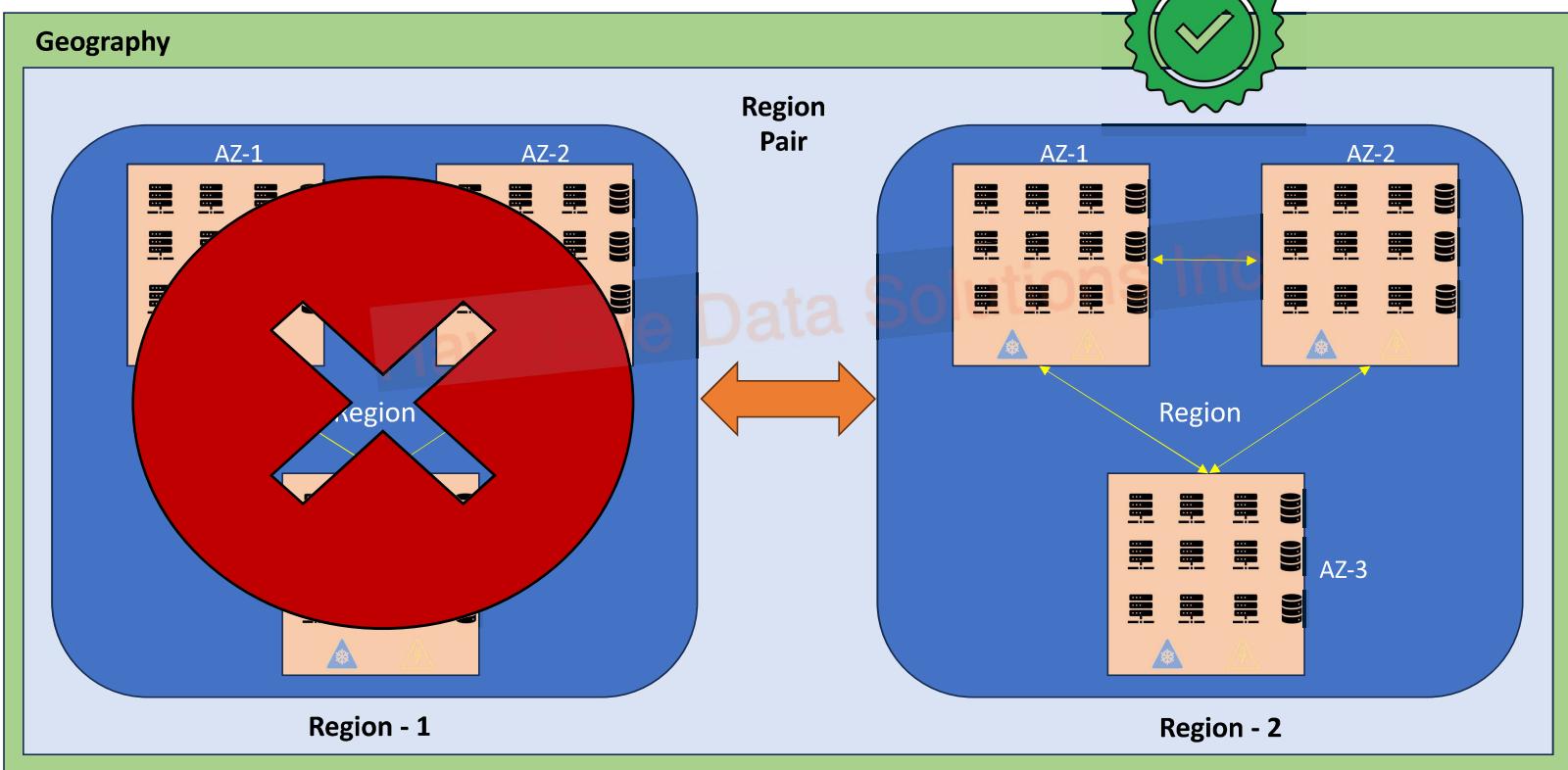
- Physically separate datacenters within an Azure Region.
- Each AZ is made up of 1 or more datacenters.
- These datacenters have independent cooling, power, networking.
- If one goes down, other acts as a backup.
- They're all connected through high-speed, low-latency fiber networks.
- A minimum of 3 AZ's are present in each Availability Zone enabled regions.
- Not all Regions support AZ's as of today.

Availability Zones (AZ)



- Data center locations selected using a rigorous vulnerability risk assessment criteria.
- Increased fault tolerance!
- Still a chance that a large-scale event occurs that impacts all the Availability Zones in a region. How to deal with that?

Region Pairs



Region Pairs

- Most Region are paired with another region in the same geography **at least 300 miles away**.
- All Azure services DO NOT automatically replicate or fallback to the other region, you must configure it for some cases manually.
- E.g. – West US + East US , South-East Asia + East Asia.
- Main advantages : Fallback, data resides in same geography for tax, jurisdiction laws etc. and to prevent outages when rolling out updates.
- Most pairs are bi-direction but NOT ALWAYS! E.g. – West India -> South India. South India's secondary region is Central India.

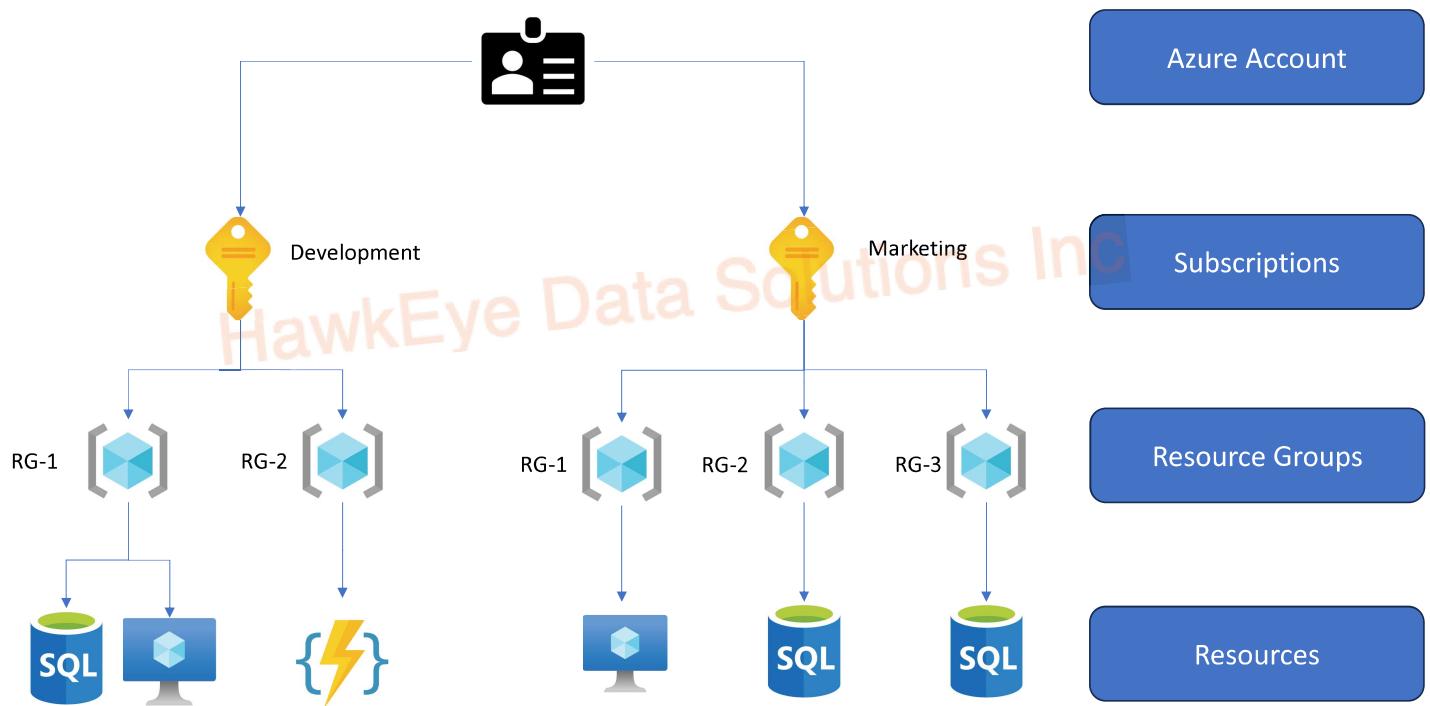


Sovereign Regions

- Instances of Azure that are isolated from the main Azure instance.
- Might be needed for compliance and regulatory purposes.
- Eg – US DoD Central, US Gov Iowa etc.
- Operated & maintained by screened US personnel only.
- China East, China North – Available through a partnership between Microsoft + 21Vianet. Microsoft doesn't maintain the datacenters.

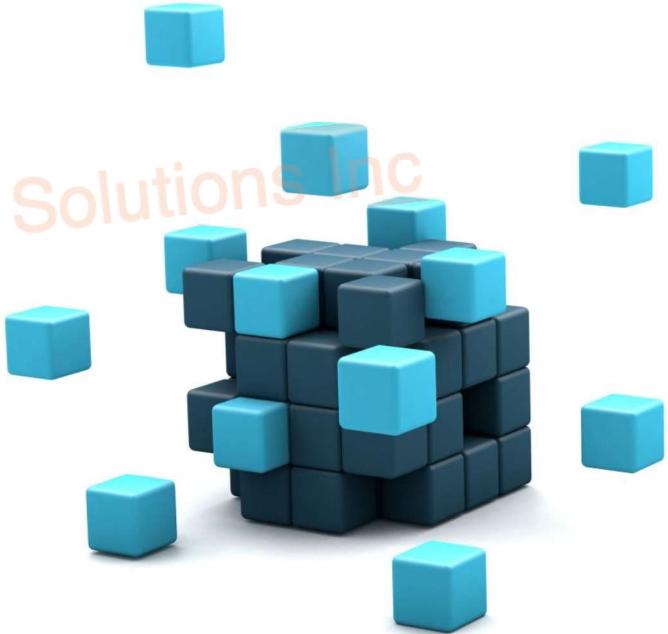


High level operating hierarchy



Resource Groups [cube]

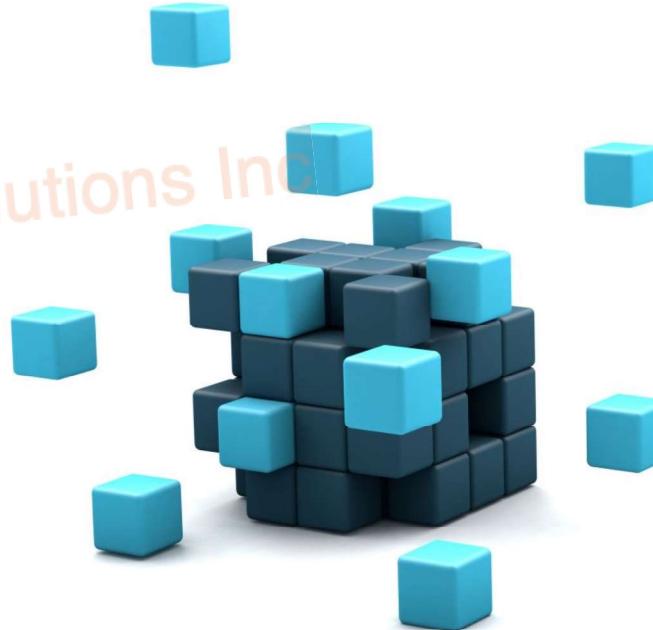
- Resource is the basic building block of Azure. Eg – VM, DBs etc.
- A resource group is a logical container for resources.
- When we create a resource, we are required to place it within a Resource Group.
- If we apply a policy/rule on a resource group, then all children (resources) inherit those rules!



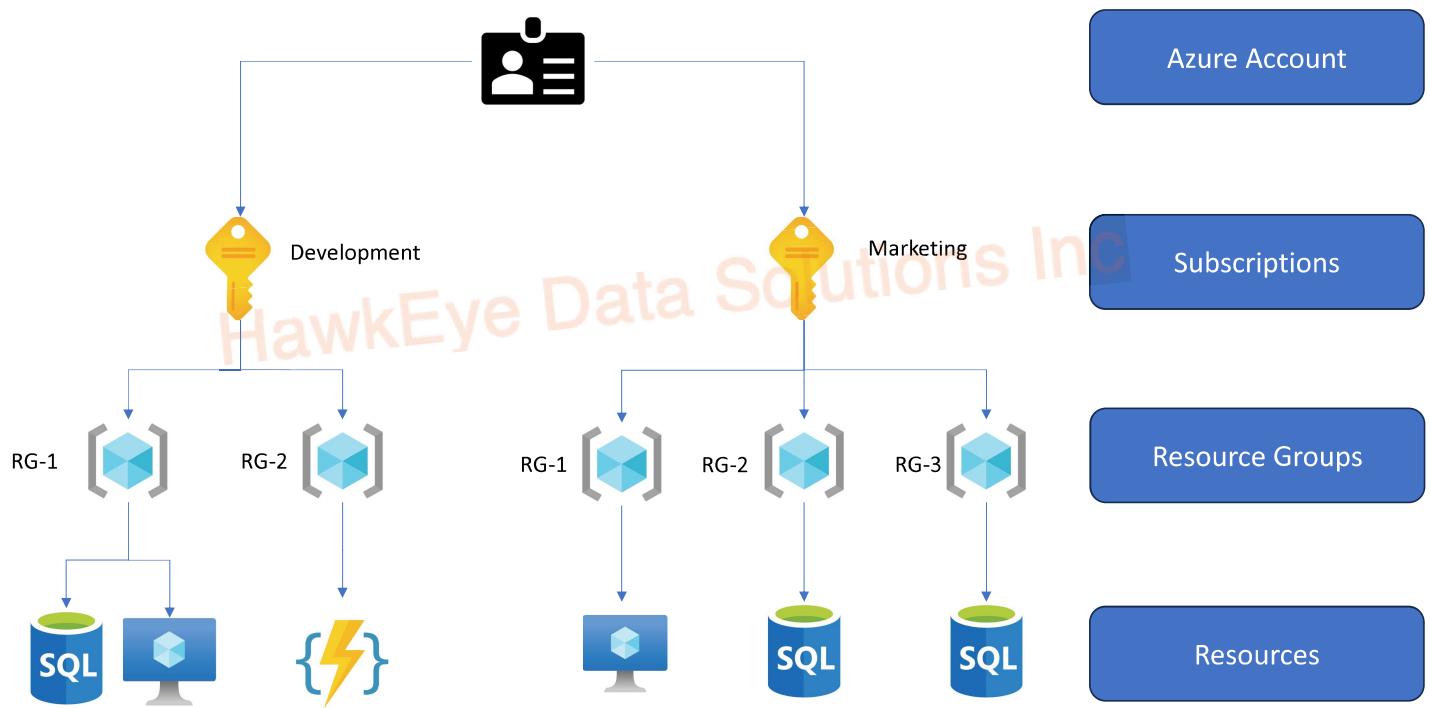
Resource Groups (RG) – Imp. Points



- A resource can only exist in 1 resource group.
- Resources can be added/removed from a RG at any time.
- A resource can be moved from one RG to another.
- A resource group can have a location different than the resources within it.
- You need to define a location for a RG upon creation.
- Resource Groups **cannot** be nested. E.g. – Resource Group 1 cannot contain Resource Group 2.
- An action applied to a RG affects all resources inside it. Eg – If a RG is deleted, all resources also get deleted.
- A resource in one resource group **can** connect to resources in other resource groups.
- We can apply tags (metadata elements) to a resource group. The resources **don't** inherit those tags.



High level operating hierarchy



Subscriptions

- Unit of management and billing.
- Allow us to organize resource groups & eventually resources.
- You **NEED** a subscription to use Azure. Can have 1 or more.

Advantages –

- 1) Billing: Track billing based on departments – billing reports!
- 2) Access Boundary: Demarcate boundaries and give access to certain individuals – Active Directory

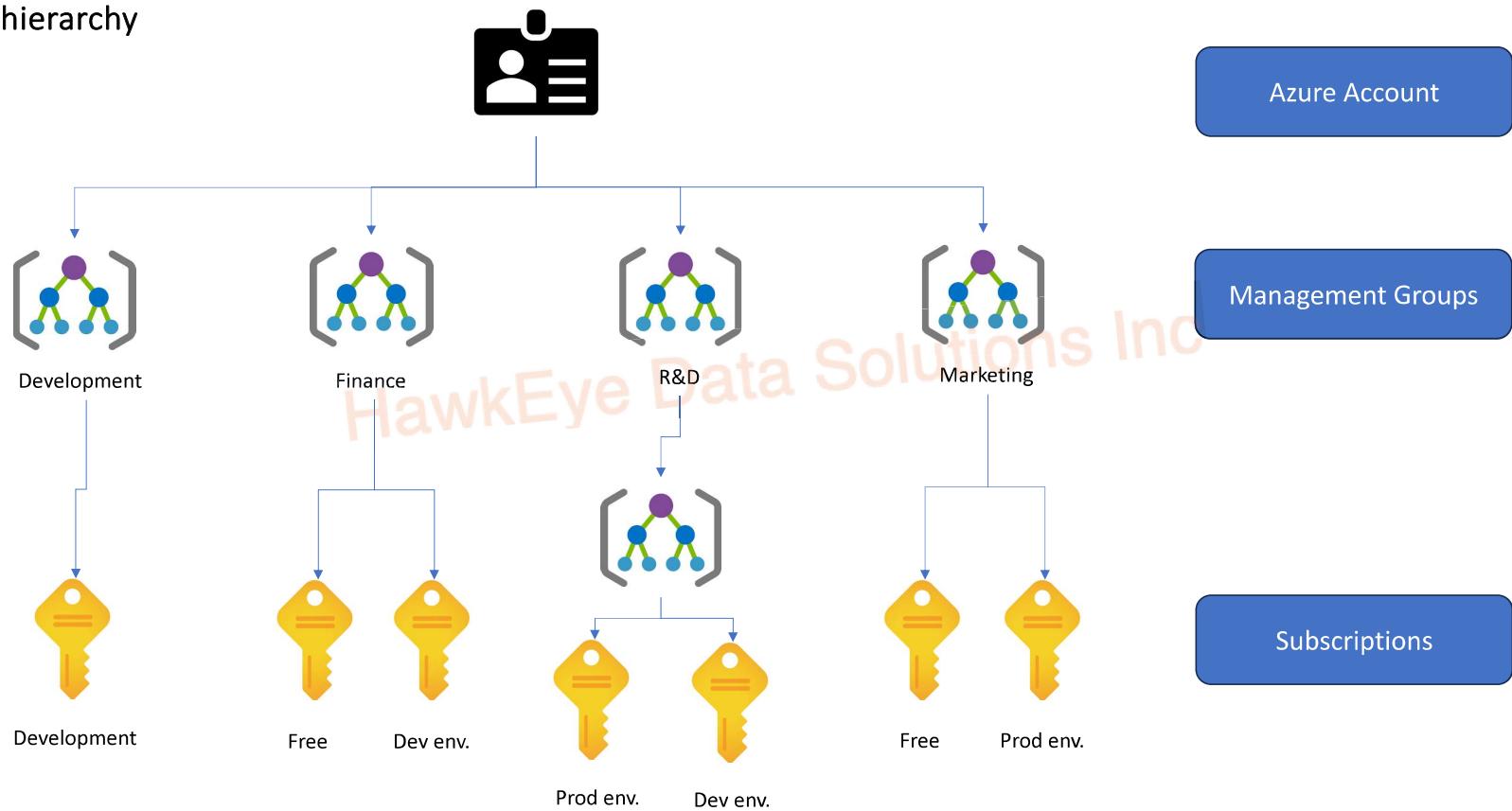




Multiple applications,
teams and countries.

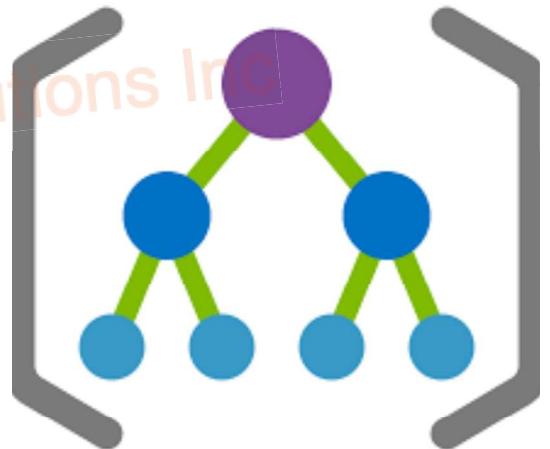
Don't you think tracking
will become difficult?

High level operating hierarchy



Management Groups – Imp. points

- All subscriptions inherit the rules/policies applied to a management group.
- Management groups CAN be nested!
- 10,000 management groups can be contained in a single directory.
- Each management group and subscription can support only one parent.
- A management group tree can support up to six levels of depth. This limit doesn't include the root level or the subscription level.



Virtual Machine

- It is a **virtualized instance** of a computer that can perform almost all the same functions as a computer, including running applications and operating system.
- **IaaS** offering – No need to buy physical hardware.
- Perfect when – need control over the OS, running custom software, custom hosting configurations.
- Suitable for various workloads – web apps, data processing etc.
- Can specify size (number of cores, amt. of RAM etc.) , storage disks (HDD, SSD etc.) and networking configs.
- Use pre-defined **images** to rapidly provision VMs.



Virtual Machine - Benefits

- Can be deployed using Azure Portal, Azure CLI, Azure Resource Manager (ARM) templates.
- **Choice of OS:** Windows, Linux, and specialized images available. Great for lift and shifts!
- **Scalability:** Easily scale resources up or down based on demand.
- **Cost-Efficiency:** Pay-as-you-go pricing model reduces infrastructure costs.
- **Security:** Robust security measures, including Azure Security Center.
- **Hybrid Flexibility:** Connect on-premises infrastructure seamlessly.

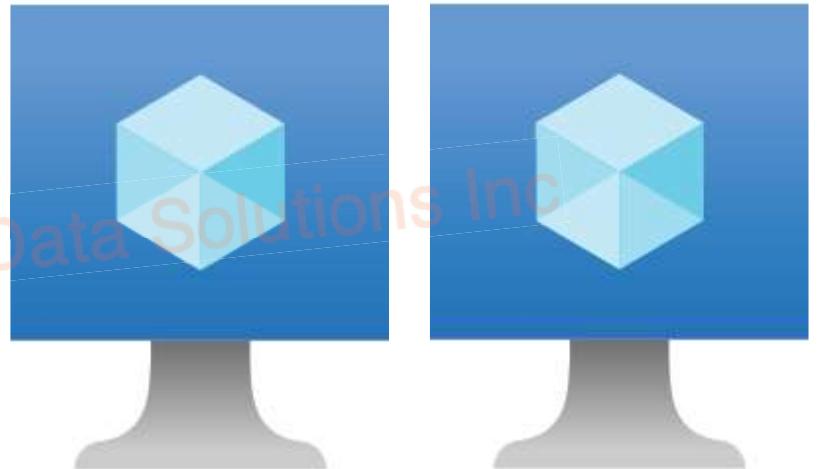


Azure VM Scale Sets

- Automated way to create and manage a group of identical, load-balanced VMs - HA & FT.
- Say you're running an app & need multiple same VMs – you need to ensure their configuration is the same, are identical etc.
 - With VM Scale Sets, Azure automates most of that work.
- Scale sets allow you to centrally manage, configure, and update a large number of VMs in minutes.
- More demand? More VMs can automatically be deployed.
- Less demand? # of VM's can be reduced.
- Load Balanced – Load is evenly distributed.
- We can also set auto scale based on a defined schedule.

Azure VM Availability Sets

- Again focused at High Availability & Fault Tolerance.
- Key idea – All VMs should not go offline due to power failure or updates. This is done in 2 ways –
 - 1) **Fault Domain** – VMs are grouped by power source & network switch. By default Azure will split our VMs into 3 fault domains with separate power sources.
 - 2) **Update Domain** – Groups VMs that can be updated at the same time. We can peacefully then update VMs knowing that only one group will be offline at a time. A group is given 30 mins to recover before this process begins for the next group.





Azure Virtual Desktops

- A cloud-based virtualization solution that enables secure **remote access to desktop environments**.
- Allows us to access a cloud-hosted version of Windows remotely from anywhere using an internet connection.
- Offers a flexible and cost-effective approach to remote work solutions.
- Apps & data (running in the cloud) are separated from the local hardware so way less chance of confidential data remaining on the personal device.

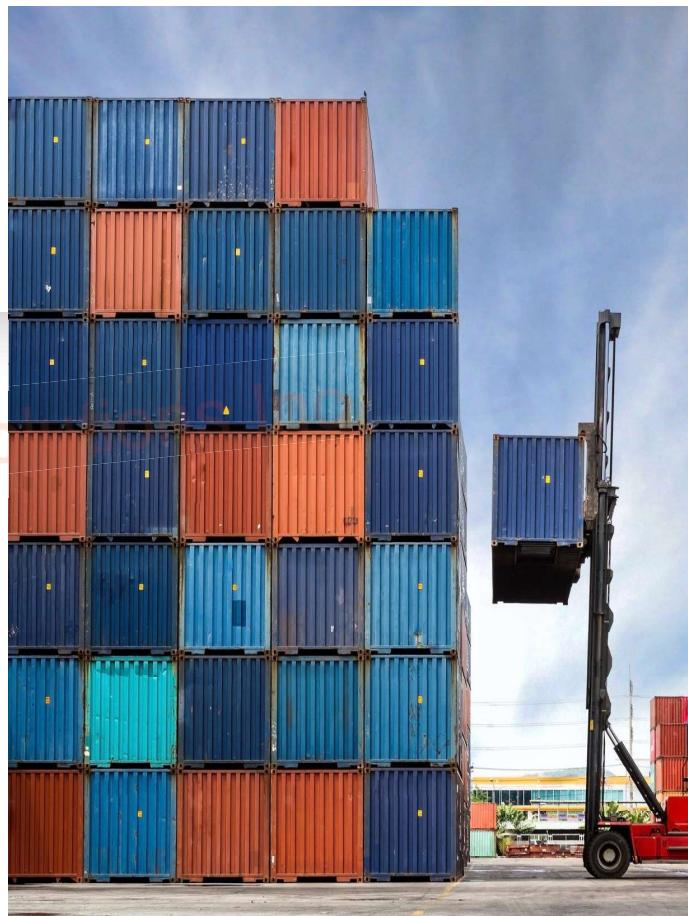


Azure Virtual Desktops - Benefits

- Remote Accessibility: Access desktops and apps from anywhere with an internet connection.
- Cost Efficiency: Pay-as-you-go pricing model, reducing the need for costly on-premises infrastructure.
- Remote Workforce Enablement: Empower employees to work from anywhere securely.
- Legacy Application Support: Run legacy apps in modern environments.
- Rapid Scaling: Quickly accommodate seasonal or temporary workforce needs.
- Multi-Session Windows 10: Cost-effective option for hosting multiple user sessions on a single VM.
- Windows 11 Single-Session: Dedicated VMs for users needing exclusive resources.
- Linux Virtual Desktops: Support for Linux-based environments.

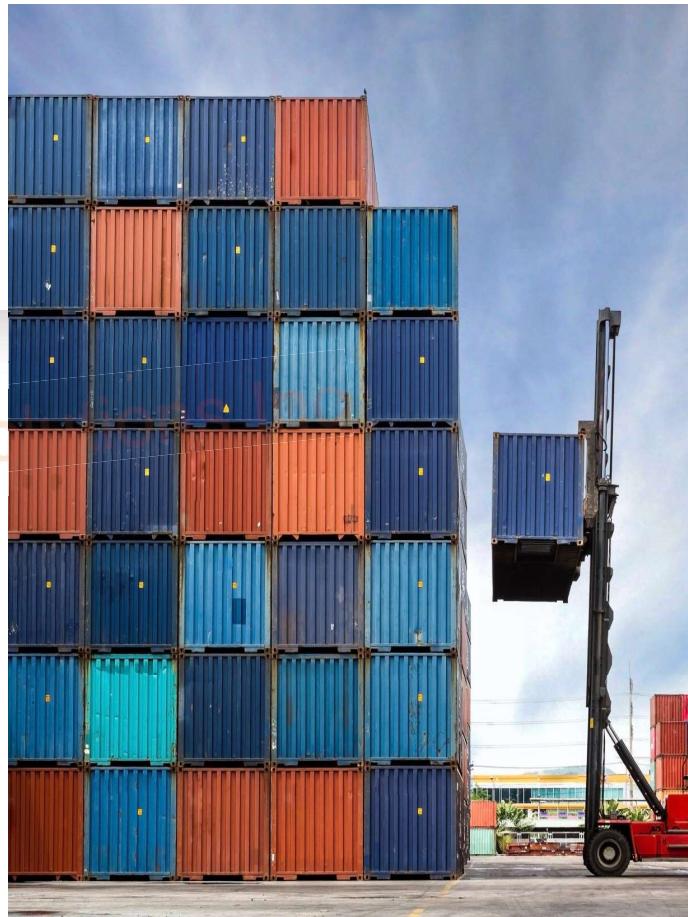
Azure Containers

- VMs are excellent choices to not manage physical hardware & pay as you go. Issue – One OS per VM.
- Containers – Run multiple instances of an app on a single machine.
- You don't manage the OS unlike a VM and containers are much more light-weight (package an app and all its dependencies as a single unit).
- Most popular container engine – Docker (supported)



Azure Containers

- Containers share the host operating system's kernel, which makes them extremely resource-efficient. They use fewer system resources compared to VMs.
- Containers provide process-level isolation. Each container runs as an isolated process on the host OS, but they all share the same OS kernel. This means they can run side by side without interfering with each other.
- They can start quickly, often in seconds, making them suitable for microservices architectures (break one big architecture into multiple small pieces) and dynamic scaling.



Azure Containers Instances

- Easiest way to run containers in Azure.
- PaaS offering (refer to the shared responsibility chart)
- Simply create containers & upload them – run them using this service.

Azure Containers Apps

- Think of it as containers – the container management overhead.
- PaaS offering (refer to the shared responsibility chart)
- Way more elastic – the ability to auto scale and load balance both are possible.

Azure Kubernetes Service

- Orchestration service.
- PaaS offering (refer to the shared responsibility chart)
- Very helpful when looking to deploy and manage a fleet of containers.

App Hosting Options

- ✓ Application Hosting: The process of deploying and running applications in a cloud environment.
- ✓ Most common ones – VMs & Containers. With VMs you have Full control over VM configuration, choice of OS, scalability options, and security features. Good for legacy apps requiring full OS control.

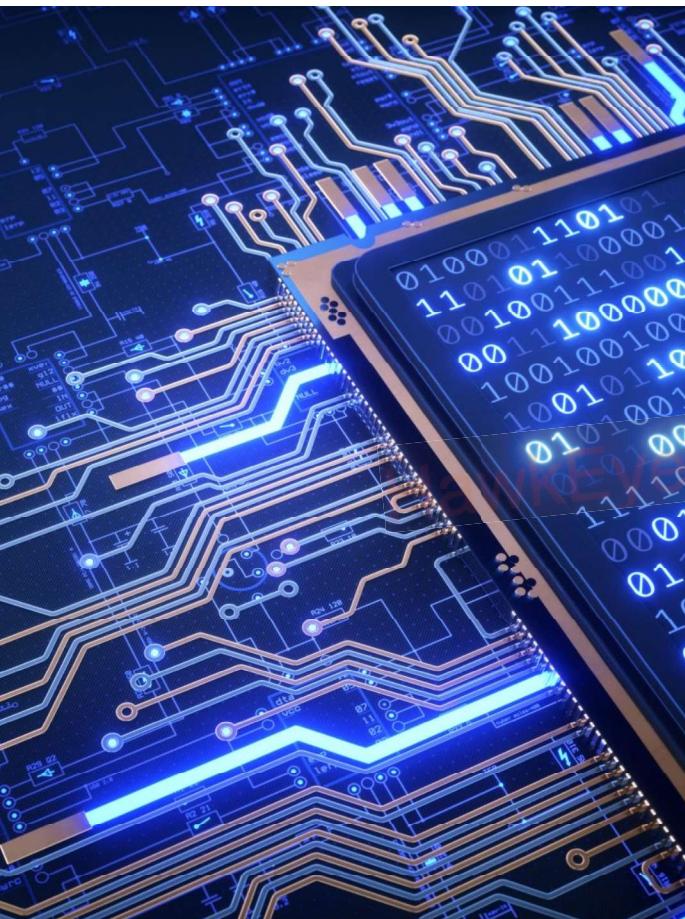


**Focus more on the app & go-live
than infrastructure overhead**



Azure App Service

- ✓ A solution to build and host web-apps, WebJobs, APIs and mobile apps!
- ✓ Supports both Windows & Linux + comes with auto-scaling and high availability.
- ✓ Supports multiple programming languages and has integrated CI/CD support.
- ✓ Full Swagger support to create Rest-based APIs.
- ✓ Use WebJobs to run a program (Python, Java etc.) or a script (Bash, Powershell etc.)
- ✓ Build a back-end for iOS and Android apps - Push Notifications, Authentication, SDK support for Xamarin, React Native, native iOS and Android apps!
- ✓ Full support for hosting web-apps Java, .NET, PHP, Ruby, Python etc.



Azure Functions

- ✓ Event-Driven serverless compute option that DOES not need a VM or Container.
- ✓ In most cases you need a resource to be running for your app to work – not with Azure Functions.
- ✓ An event will wake up your function, and you ONLY pay for the **CPU time** it takes to execute the code!
- ✓ As a developer, I only need to care about the code & not infrastructure.
- ✓ Scalable!
- ✓ E.g., Image compression website.

```
graph TD; A[An event occurs] --> B[Function wakes up]; B --> C[Code is executed]; C --> D[Function sleeps];
```

An event occurs

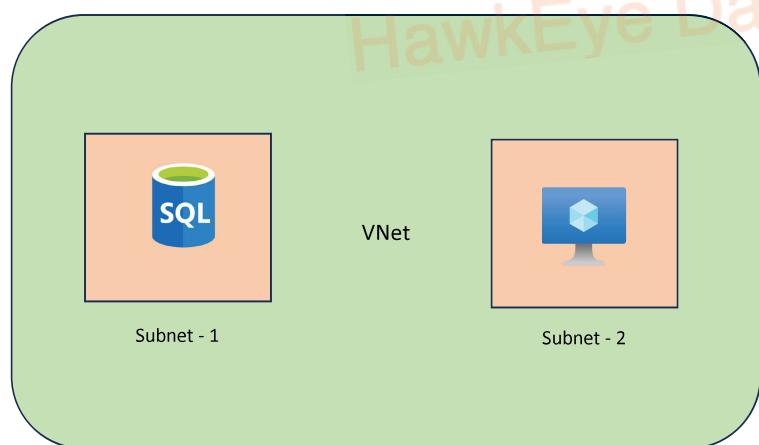
Function wakes up

Code is executed

Function sleeps

Azure Virtual Networks

- ✓ Fundamental component of Azure's infrastructure, providing the framework for creating and managing networks in the cloud.
- ✓ **Virtual Networks (VNets):** These are isolated, software-defined networks within Azure. They provide segmentation and isolation for your resources. VNets are the foundation for building your cloud infrastructure.
- ✓ **Subnets:** Within VNets, you can create subnets to further segment your network. Subnets help organize resources and control traffic flow.



Azure Virtual Networks

1. **The Digital Neighborhood:** Think of Azure Virtual Network as a digital neighborhood, just like the one where you live.
2. **Digital Houses:** In this neighborhood, you can build digital houses (virtual machines, servers, and services). These houses are like your online spaces.
3. **Digital Streets:** Azure Virtual Network has digital streets (networks) that connect all the houses. These streets are like the pathways for your digital devices to communicate.
4. **Friendly Neighbors:** Your digital devices, like your computer or phone, are like friendly neighbors who chat and share things with each other.
5. **Security Fences:** Just like you have a fence around your house, you can put up security measures to protect your digital houses from unwanted visitors (cybersecurity).
6. **Visitors Welcome:** You can invite digital visitors (cloud services) to your neighborhood and let them interact with your digital houses. It's like having guests over.
7. **Private Gardens:** Azure Virtual Network lets you create private gardens (subnets) within your neighborhood. You can decide which plants (resources) go where.



Azure Virtual Networks – Main Use Cases

- ✓ Isolation and segmentation
- ✓ Communication between resources
- ✓ Communication between the resources & the internet
- ✓ Communication between the resources & an on-prem deployment
- ✓ Filtering of Traffic
- ✓ Routing of Traffic



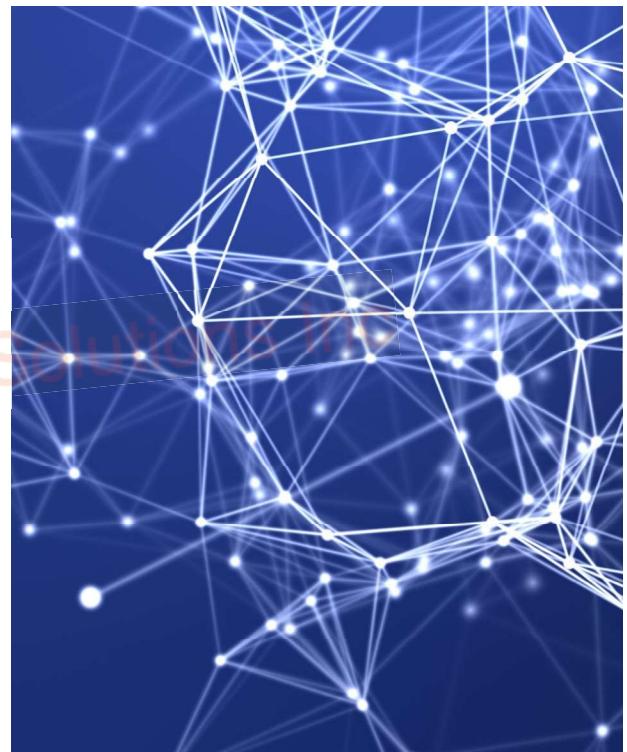
Isolation and Segmentation

- ✓ Breaking down one big monolithic network into chunks, smaller subsets.
- ✓ Keeping different sets of resources or entities separate from one another within a network to prevent unauthorized access, data leakage, or interference between them – Increasing manageability.
- ✓ **Subnet Segmentation:** Within a Virtual Network (VNet), you can create multiple subnets to group resources logically. Each subnet can have its own security policies and access controls.
- ✓ **Network Isolation:** Achieved through Virtual Networks (VNets) and Network Security Groups (NSGs) in Azure. VNets create isolated network segments, while NSGs define access controls.
- ✓ **Resource Isolation:** Azure provides various ways to isolate resources, including Virtual Machine Scale Sets, Azure Service Environment (ASE) for App Service, and more.



Communication between resources

- ✓ Through VNets – Resources can be deployed in a Virtual Network.
- ✓ Virtual Network Service Endpoints – Like a secure and direct tunnel between your Azure virtual network and specific Azure services, such as Azure Storage or Azure SQL Database. It allows resources within your virtual network to securely access these Azure services over a private network connection instead of going over the public internet.
- ✓ Virtual Network Peering – We can even connect 2 VNets to talk to each other / communicate. Bypasses the public internet & can even be in different regions!



Communication with On-Prem resources

- ✓ **Point To Site VPN** – A way for individual devices, like your computer or laptop, to securely connect to an Azure Virtual Network (VNet) over the internet. It's like having a secure and private road from your device to your Azure network, ensuring that your data is transmitted safely and privately. Use case – Remote Work
- ✓ **Site to Site VPN** – A Site-to-Site (S2S) VPN in Azure is a way to securely connect an entire on-premises network (like your office network) to an Azure Virtual Network (VNet). It creates a secure and encrypted connection between your on-premises network and your Azure VNet, allowing all devices in your local network to communicate with Azure resources as if they were part of the same network.
- ✓ **Azure ExpressRoute**

