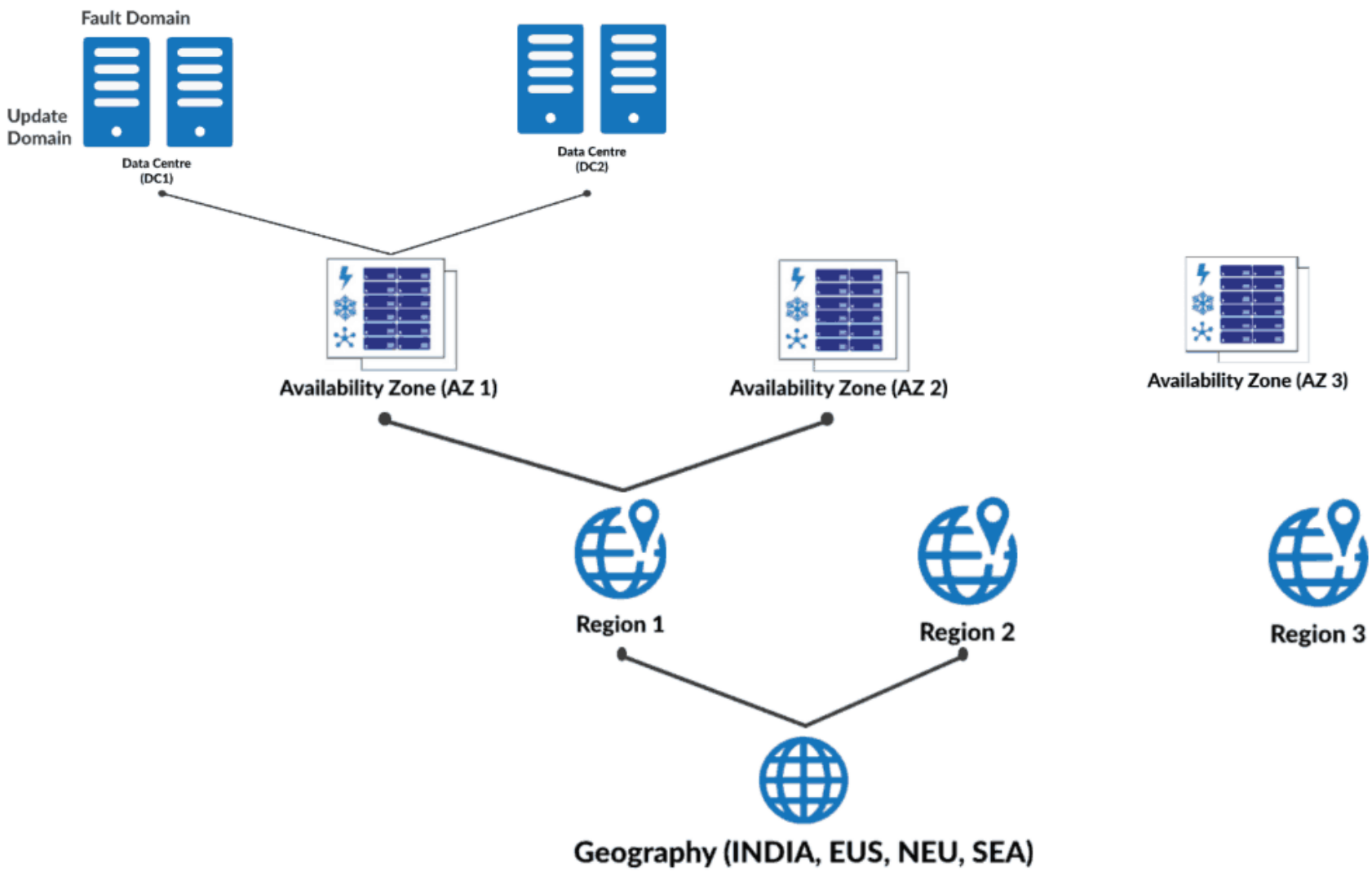
Microsoft Azure Architecture: Azure Regions and Availability Zones, Azure Geographies & Azure Region Pairs

Azure Global Infrastructure is a massive network of data centres strategically situated across the world that are intended to offer high availability, reliability, and performance for cloud services. It features regions, availability zones, and fault domains, which allow for more robust and fault-tolerant installations.

Topics covered in this blog are



SPEED TEST OF AZURE:

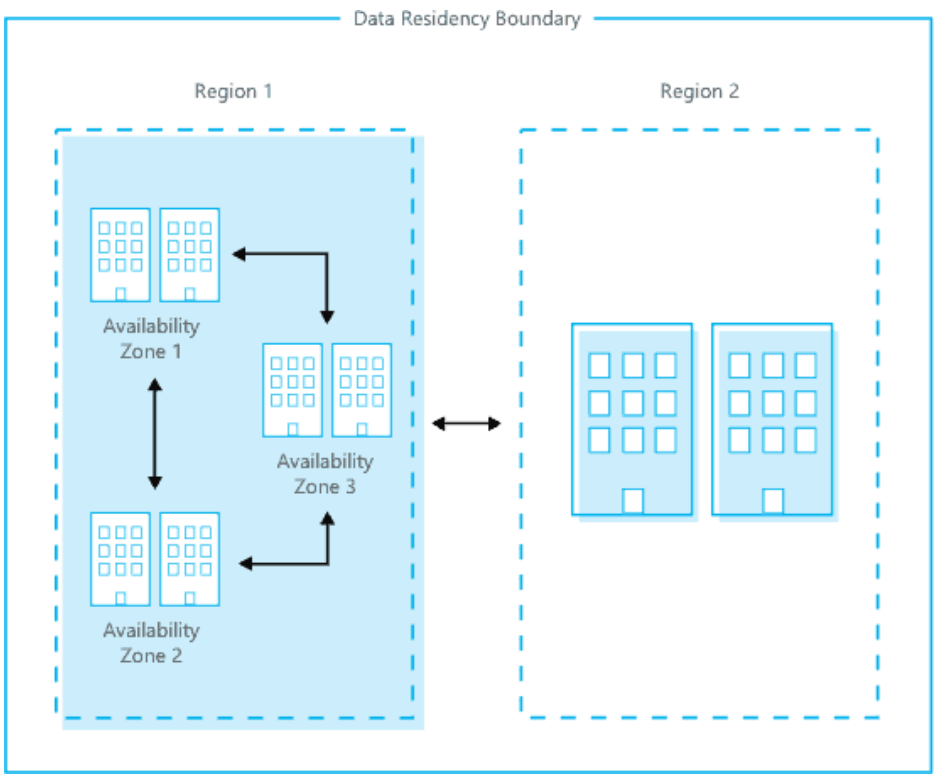
https://azurespeedtest.azurewebsites.net/

What Is A Region?

1. A **region** is a geographical area containing at least one, but potentially multiple datacenters that are nearby and networked together with a **low-latency network.**
2. When one deploys a resource in Azure, one needs to choose the region where you want your resources deployed.
3. **Examples of regions** are West US, Canada Central, West Europe, Australia East, and Japan West.

What Is Availability Zone?

1. Availability Zones are physically separate datacenters within an Azure region.
2. Each Availability Zone is made up of one or more data centers equipped with independent power, cooling, and networking. It is set up to be an *isolation boundary*.
3. Azure creates a duplicate of your data and resources so that the information is safe, in case of failure. If one zone goes down, the other continues working.
4. Resources are highly available through Availability Zones.
5. **Not every region has support for Availability Zones.** The **examples of Availability Zones** are Central US**,** East US 2, West US 2, West Europe, France Central, North Europe & Southeast Asia



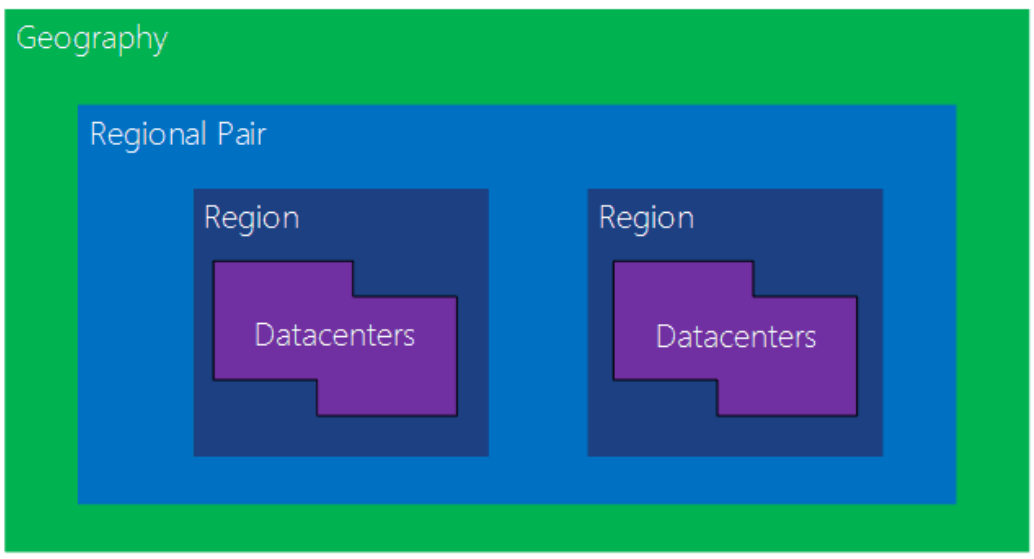
What Is A Regional Pair?

1. Each Azure region is paired with another region within the same geographical area, which is at least 300 miles away.
2. It allows replication of resources (such as VMs) which helps in reducing the interruptions due to natural disasters, civil unrest, power outages, or physical network outages.
3. Azure updates are rolled out to paired regions one region at a time to minimize downtime and risk of application outages.
4. **Examples of region pairs** are West US paired with East US, South-East Asia paired with East Asia.

Geography	Regional Pair A	Regional Pair B
Canada	Canada Central	Canada East
China	China North	China East
India	Central India	South India
Japan	Japan East	Japan West
North America	East US	West US

What Is Geography?

1. Azure divides the world into geographies that are defined by geopolitical/country boundaries typically containing two or more regions that preserve data residency and compliance boundaries.
2. Geographies allow customers with specific data residency and compliance needs to keep their data and applications close or within geographical boundaries.
3. Geographies are **fault-tolerant to withstand complete region failure** through their connection to dedicated **high-capacity**

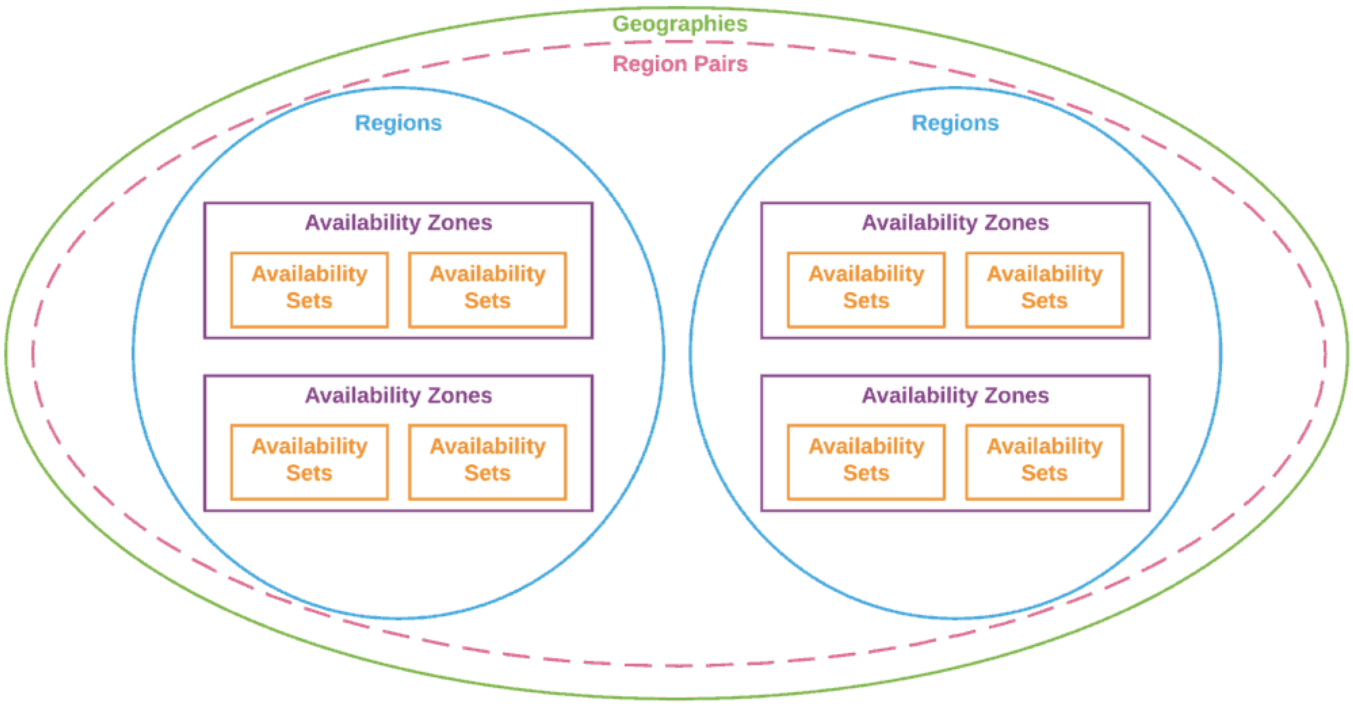


networking infrastructure.

What Is Availability Set?

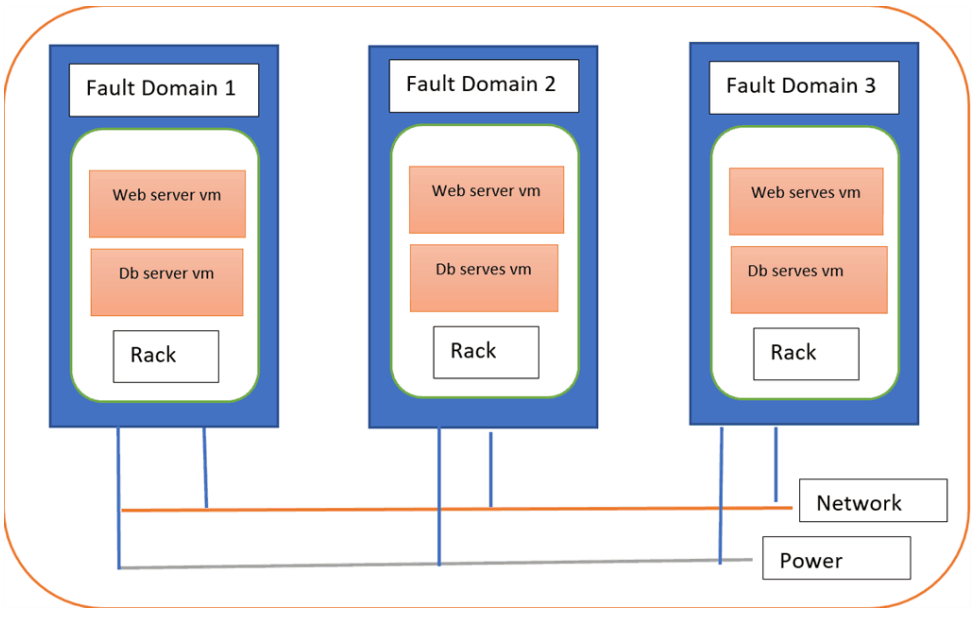
1. An Availability Set is a logical grouping capability for isolating VM resources from each other when they're deployed.
2. By deploying your VMs across multiple hardware nodes Azure ensures that if hardware or software failure happens within Azure, only a sub-set of your virtual machines is impacted and your overall solution is safe and in working condition.
3. It provides redundancy for your virtual machines.
4. The availability set spreads your virtual machines across **multiple fault domains** and **update domains**.

An **Update Domain** and **Fault Domain** is assigned to each VM in Availability Set by Azure platform.



What Is the Fault Domain?

1. Fault domains are the group of virtual machines that share a common power source and network switch.
2. Each and every fault domain contains some racks and each rack contains a virtual machine.
3. Each of these Fault domain shares a power supply and a network switch.
4. All the resources in the fault domain become unavailable when there is a failure in the fault domain.
5. You should place your VMs in such a way that each fault domain gets one web server, one database server, and like that.



What is an Azure Datacenter?

A distinct physical structure called an Azure data center houses hundreds of real servers and has its own power, cooling, and networking systems. These data centers are dispersed throughout the world. There are more than 160 Azure datacenters as of the time of this course recording.

China East, China East 2, China East 3, East Asia, Central India, South India, West India, Japan East, Japan West, Australia Central, Australia Central 2, Australia East, Australia Southeast, China North, China North 2, China North 3, East Asia, Japan East, Japan West,...

Why are azure geographies important ?

Each Azure geography has one or more regions and complies with regulations around data residency and compliance. This enables you to maintain close proximity of your business-critical data and applications on high-capacity, fault-tolerant networking infrastructure.

Azure regions are meant to provide both protection against regional or big geography disasters with disaster recovery and protection from localised disasters with availability zones.

Well, it's possible that regulated data, such as financial, health care, or credit data, cannot leave the country. According to the law, your business must keep such data in the nation where the operations are being conducted. So, if you choose a location, like India, for instance, Azure makes sure your data is not stored elsewhere. The data remains inside the states if you choose the United States. You have full control over the geographic areas where your data and applications will be used. You may rest certain that Microsoft won't keep client information outside the region you designate, with the exception of some non-regional services.

We advise using the available multiple enabled regions for apps that support multiple active areas. This procedure guarantees maximum application availability and cuts down on recovery time in the event of an event that reduces availability. Design your application to be as resilient and disaster-recovery-friendly as practicable whenever possible.

What is cross-region resiliency?

Numerous enterprises demand both the high availability offered by availability zones as well as protection from local and global disasters. Azure regions are built to provide protection against local disasters via availability zones, as was covered in the resiliency overview for regions and availability zones. However, they can also offer protection from local or widespread calamities through disaster recovery by utilizing a different region that makes advantage of cross-region replication.

One of several crucial foundations in the Azure business continuity and disaster recovery plan is cross-region replication. By employing availability zones within your primary Azure region for high availability, synchronous replication of your apps and data already takes place. Cross-region replication improves on this. For disaster recovery protection, cross-region replication asynchronously duplicates the same applications and data across different Azure regions.

We advise using the available multiple enabled regions for apps that support multiple active areas. This procedure guarantees maximum application availability and cuts down on recovery time in the event of an event that reduces availability. Design your application to be as resilient and disaster-recovery-friendly as practicable whenever possible.

What Is Update Domain?

1. Virtual machines get update domains automatically once they are put inside the availability set.
2. All virtual machines within that update domain will reboot together.
3. They are used for patching of the virtual machines.
4. Only one update domain can be updated at the time.

Why are Azure Regions important?

Azure regions are made to provide both localized disaster protection with availability zones and regional or big geographic catastrophe protection with disaster recovery by utilizing another region.

A region is a collection of data centers that are placed inside a latency-defined perimeter and linked by a specific, low-latency regional network. Azure offers customers the freedom to deploy apps wherever they are needed thanks to having more international regions than any other cloud provider.

Azure Zonal services and Zone-redundant services

Zonal, zone-redundant, and always-available services are three different categories of Azure services that enable availability zones. When developing your resilience strategy, you can incorporate all three of these architectural strategies.

- **Zonal services**: To meet more rigorous latency or performance criteria, a resource might be deployed to a particular, self-selected availability zone. By replicating applications and data to one or more zones within the area, resilience is self-architected. A zone can have resources pinned to it.
- **Zone-redundant services**: Resources are automatically replicated or dispersed across zones. Zone-redundant services, for instance, duplicate the data over three zones such that a failure in one zone doesn't impair the data's high availability. Zonal, zone-redundant, and always-available services are three different categories of Azure services that enable availability zones. When developing your resilience strategy, you can incorporate all three of these architectural strategies.
- **Services that are always accessible**: Always accessible throughout the whole Azure geography and resilient to both zone- and region-wide failures. See Products available by region for a comprehensive list of Azure's non-regional services, also known as always-available services.

Benefits of paired regions

- **Physical separation between datacenter :** Microsoft rigorously limits physical access to the places where your data is held when designing, constructing, and running datacenters. Microsoft is committed to assisting in the security of the datacenters that house your data because it recognizes the value of keeping your data secure. At Microsoft, we have a whole division devoted to planning, constructing, and managing the physical infrastructure that supports Azure. This group is committed to upholding cutting-edge physical security.
- **Region recovery in the event of an outage :**Regions are the conceptual and physical divisions of Azure. A region is made up of several closely spaced data centers. Availability zones, which can be utilized to increase resilience against outages in a single data center, are supported by many areas and services. To increase the availability of your solution, think about employing regions with availability zones. In exceptional cases, it is possible for all of the facilities within a region or availability zone to become unreachable, for example because of network outages. Or, a natural calamity, for instance, could result in the complete loss of facilities. Applications that are deployed across zones and regions can be created using Azure. This dispersal lessens the likelihood that a failure in one zone or region could have an impact on other zones or regions.
- **Automatic Platform-provided replication**: Replication that is automatically provided by the platform: Services like Geo-Redundant Storage automatically replicate data to the paired area. This has many advantages. You still have access to the data from the other region in the region pair in the event that one of the regions goes down.
- **Data residency, compliance and legal requirements azure**: Data residency is a compliance requirement that places emphasis on a company's data being stored in a certain geo-location. This obligation may exist for a variety of reasons, but it is typically controlled by government compliance, such as the GDPR in Europe.
- **Sequential system updates:** Azure releases platform updates on a regular basis to enhance the host infrastructure for virtual machines' dependability, performance, and security. These updates serve a variety of purposes, including as upgrading networking hardware, decommissioning hardware, or patching software components in the hosting environment.
  The hosted VMs seldom ever experience updates. Azure selects the least disruptive technique for updates when they do have an effect: If the update doesn't call for a reboot, the VM is either halted while the host is updated or it is live-migrated to a host that has previously undergone the update.
  You are informed of the scheduled maintenance if it necessitates a reboot. Azure additionally gives you a window of time within which you can initiate the maintenance on your own, whenever it is most convenient for you. For Host machines, the self-maintenance window is normally 35 days unless the work is essential. Azure is investing in technology to lessen the frequency of planned platform maintenance situations where

the VMs need to be rebooted. Handling planned maintenance provides guidelines for handling planned maintenance notifications using the Azure CLI, PowerShell or portal..

Azure regions with availability zones

The largest global presence of any cloud service, Azure is introducing new regions and availability zones quickly. Availability zones are presently supported in the following areas.

Americas	Europe	Middle East	Africa	Asia Pacific
Brazil	France Central	Qatar Central*	South Africa North	Australia East
Canada Central	Germany West Central	UAE North		Central India
Central US	North Europe			Japan East
East US	Norway East			Korea Central
East US 2	UK South			Southeast Asia
South Central US	West Europe			East Asia
US Gov Virginia	Sweden Central			China North 3
West US 2	Switzerland North			
West Us 3				

Sample Questions

Here are a few sample questions from the **Microsoft Azure Fundamentals Certification Exam[AZ-900]** that you should be able to solve after reading this blog.

Q1.HOTSPOT: For each of the following statements, select Yes if the statement is true. Otherwise, select No.

Note: Each correct selection is worth one point.

Statements	Yes	No
If you have Azure resources deployed to every region, you can implement availability zones in all the regions.	○	○
Only virtual machines that run Windows Server can be created in availability zones.	○	○
Availability zones are used to replicate data and applications to multiple regions.	○	○

Correct Answer:

Statements	Yes	No
If you have Azure resources deployed to every region, you can implement availability zones in all the regions.	○	○
Only virtual machines that run Windows Server can be created in availability zones.	○	○
Availability zones are used to replicate data and applications to multiple regions.	○	○

Explanation:

1. Not every region has multiple Availability Zone. Some regions may have only one Availability Zone.
2. One can run both Linux and Windows virtual machines created in the availability zone.
3. Availability zones are used to replicate data and applications in the same region.

Q2. This question requires that you evaluate the text to determine if it is correct.

“An Azure region contains one or more data centers that are connected by using a low-latency network.”

Instructions: Review the underlined text. If it makes the statement correct, select “No change is needed”. If the statement is incorrect, select the answer choice that makes the statement correct.

1. No change is needed
2. Is found in each country where Microsoft has a subsidiary office
3. Can be found in every country in Europe and the Americas only
4. Contains one or more data centers that are connected by using a high-latency network

Correct Answer: A

Check out the next topic **Azure Resources Group**.

FAQ’s

Q.1) How many regions and availability zones are in Azure?

Ans) There are currently 54 Azure regions available in 140 countries. For each Azure area that is supported, there are three Availability Zones. Each Availability Zone has its own network, cooling system, and power source. You may safeguard your applications and data from the loss of a data centre by configuring your solutions to employ replicated VMs in zones.

Q.2) Does all Azure regions support availability zones?

Ans)A distinct geographical area within an Azure region is known as an Azure Availability Zone. One or more datacenters with separate power, cooling, and networking make up each availability zone. Availability Zones do not exist in all Regions. There are three types of Azure services that support availability zones: zonal, zone-redundant, and non-regional services.

Q.3)What is the difference between availability zone and availability set?

Ans) Applications are protected from hardware failures within an Azure data Centre by availability sets, but they are also protected from whole data centre failures by availability zones. A specific geographical area that exists within an Azure region is known as an availability zone. Set availability is free of additional fees. Only the computational resources are charged for. There is no additional cost for scale sets. Only the computational resources are charged for.

Q.4)Are Azure availability zones free?

Ans) Your Azure subscription gives you access to Azure availability zones. However, travelling between regions could result in fees.With your Azure free account, you are entitled to a set number of complimentary services each month. The free amount runs out at the end of the month and does not carry over to the following one. You are given 5 GB of file storage, for instance, per month. The remaining 3 GB do not carry over to the following month if you only utilize 2 GB in a month.

Q.5)How do Azure availability zones work?

Ans)A high-performance network with a round-trip latency of less than 2ms connects Azure availability zones. When things go wrong, they keep your data synchronized and accessible. One or more datacenters with separate power, cooling, and networking infrastructure make up each zone. Your Azure subscription gives you access to Azure availability zones. However, travelling between regions could result in fees.