

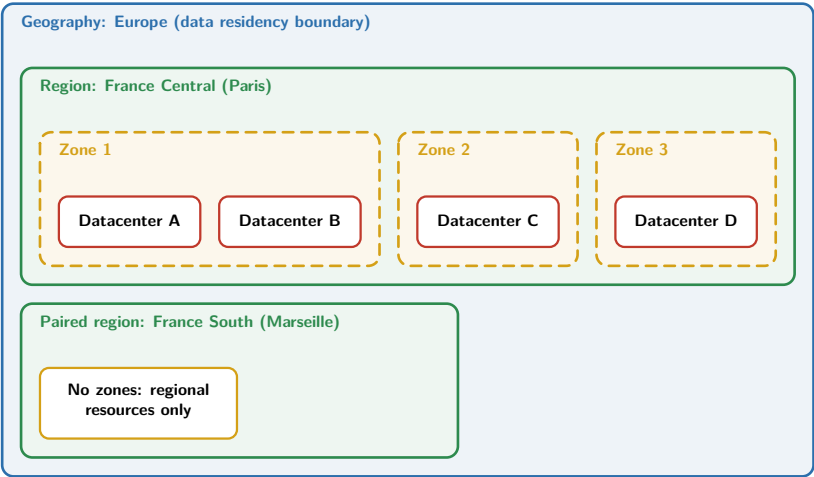


Azure Global Infrastructure

Azure regions, availability zones and reliability documentation, as of 2026 | Geographies, regions, region pairs, availability zones, datacenters, sovereign clouds, edge; choosing a region; SLAs and composite availability

- Azure
- Regions
- Availability zones
- AZ-900
- AZ-104
- AZ-305

From geography to datacenter



Geography — country or market; keeps data and compliance inside it (France, Germany, United States, Europe)

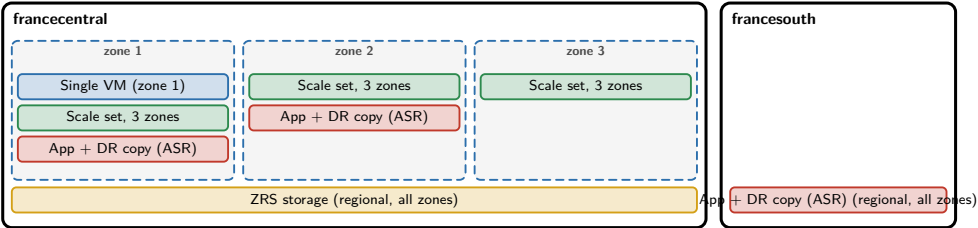
Region — what you pick in the portal: francecentral, westeurope, eastus2; prices and service lists differ per region

Availability zone — ≥ 3 per AZ-enabled region, each with independent power, cooling and network, close enough for synchronous replication

Datacenter — the building; you never choose it, Azure places resources inside the zone or region

Placement	You choose	Survives	Examples
Non-zonal (regional)	region only	a rack or host failure, not a zone failure guaranteed	VM without zone, LRS storage, Basic SKUs
Zonal	region + zone 1/2/3	nothing outside that zone; deploy one per zone yourself	VM in zone 2, managed disk, zonal public IP
Zone-redundant	region + 'zone redundant'	loss of one zone, automatically	ZRS storage, zone-redundant SQL Database, Standard Load Balancer front-end, Application Gateway v2
Always-available (global)	nothing	region loss for the service itself	Microsoft Entra ID, Azure DNS, Front Door, Traffic Manager

What survives which failure



Deployment	Zone 1 down	Region down
Single VM (zone 1) 1 replica, needs 1	fails 0/1 left	fails 0/1 left
Scale set, 3 zones 3 replicas, needs 2	degraded 2/3 left	fails 0/3 left
ZRS storage 1 replica, needs 1	survives 1/1 left	fails 0/1 left
App + DR copy (ASR) 3 replicas, needs 1	degraded 2/3 left	degraded 1/3 left

Survives = no replica lost; degraded = replicas lost but at least the minimum still healthy; fails = fewer healthy replicas than the minimum. A regional service survives any zone loss but not the loss of its region.

WARNING

Zone numbers are **logical per subscription**: zone 1 in subscription A may be a different physical zone from zone 1 in subscription B. Align them with `az rest` calls to the `checkZonePeers` API (or the portal's zone mapping) before spreading one application over two subscriptions.

Region pairs and regions without a pair

Region	Pair (as of 2026)	Note
West Europe (Netherlands)	North Europe (Ireland)	two most used EU regions, both zonal
France Central	France South	France South has no zones, limited services
Germany West Central	Germany North	Germany North restricted access
East US	West US	East US 2 ↔ Central US
UK South	UK West	same geography

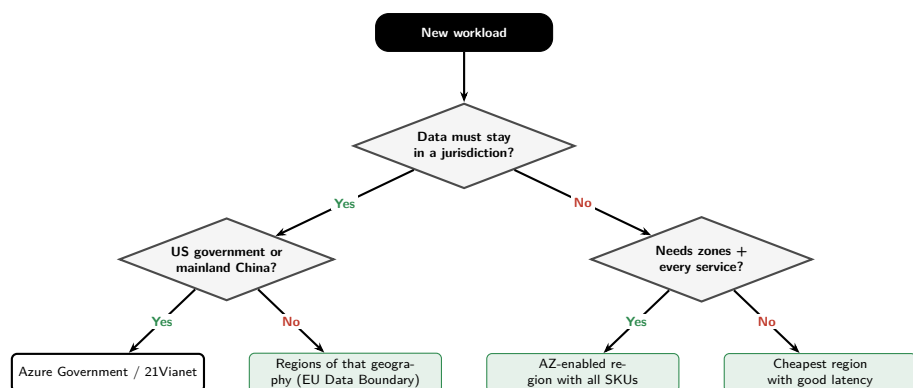
Brazil South	South Central US	exception: the pair is outside the geography
Italy North, Poland Central, Spain Central, Israel Central, Mexico Central	none (non-paired)	newer zonal regions: resilience comes from zones; geo-replication target chosen by you

- **Sequential updates** planned platform updates roll to one region of a pair at a time
- **Recovery priority** in a broad outage, one region of every pair is restored first
- **Geo-replication default** GRS / GZRS storage and some PaaS geo-backups copy to the pair (asynchronously)
- **Residency** pairs stay in the geography (Brazil South excepted), so geo-redundancy keeps data in-country

EXAM TIP

Region pairs protect against a **region** disaster; availability zones against a **datacenter / zone** failure; availability sets against **rack and maintenance** failures in one datacenter. The exam gives the failure scope and expects the matching construct.

Choosing a region



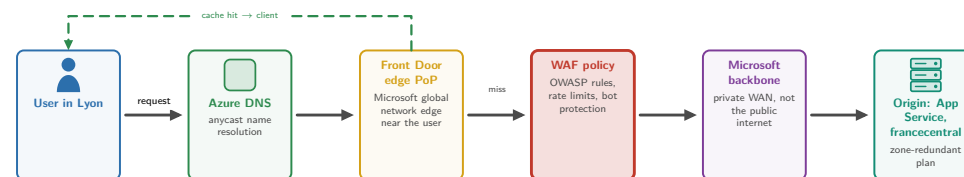
Criterion	How to check
Compliance and residency	Microsoft Service Trust Portal, data residency page per geography
Service and SKU availability	az vm list-skus -l francecentral --zone -o table; 'Products available by region' page
Latency to users	Azure network round-trip latency statistics page; test from user sites
Price	the same SKU can differ by 10-30 % between regions; compare in the pricing calculator
Zones and pair	az account list-locations --query "[?metadata.region Category=='Recommended'].name"
Capacity	new or small regions may refuse large SKUs: request quota early (az quota)

```

Explore regions from Cloud Shell
az account list-locations -o table
az account list-locations \
  --query "[?name=='francecentral'].metadata.pairedRegion[].name"
az vm list-skus -l westeurope --size Standard_D2s \
  --query "[].{sku:name, zones:locationInfo[0].zones}" -o table
az provider show -n Microsoft.Web \
  --query "resourceTypes[?resourceType=='sites'].locations"
  
```

Sovereign clouds and the edge

Cloud / footprint	What it is	When
Azure (global)	public cloud, portal.azure.com	default
Azure Government	isolated US instance for US government agencies and partners, screened US personnel, portal.azure.us	FedRAMP High, DoD IL, CJIS needs
Azure operated by 21Vianet	Azure in mainland China, operated by a Chinese company, portal.azure.cn	serving users in China
Sovereign / EU Data Boundary	data stored and processed in the EU and EFTA for Microsoft cloud services; Sovereign landing zone policies	EU customers with strict residency
Azure Extended Zones	small Azure footprint in a metro, attached to a parent region	single-digit-ms latency, local residency
Azure Local, Azure Stack Edge	Azure-managed hardware in your site (Azure Local was Azure Stack HCI)	disconnected, edge or on-premises needs



INFO

Traffic between Azure regions and datacenters stays on the **Microsoft global network** and is encrypted at layer 2 (MACsec) between Microsoft datacenters. Users enter it at the nearest edge point of presence (Front Door, CDN, ExpressRoute, or the closest peering point for internet traffic with Microsoft routing preference).

SLAs and availability arithmetic

VM deployment	Uptime SLA (as of 2026)	Allowed downtime / month (approx.)
Single VM, Premium SSD or Ultra disks on all disks	99.9 %	43.8 min
Two or more VMs in an availability set	99.95 %	21.9 min
Two or more VMs across two or more zones	99.99 %	4.4 min

$$D = (1 - A) \times T$$

where D = allowed downtime; A = availability as a fraction (99.9 % = 0.999); T = the period (year 8,766 h, month 730.5 h, week 168 h, day 24 h).

AVAILABILITY	NINES	PER YEAR	PER MONTH	PER WEEK	PER DAY
99.9 %	3.0	8 h 46 min	43.8 min	10.1 min	1.4 min
99.95 %	3.3	4 h 23 min	21.9 min	5.0 min	43.2 s
99.99 %	4.0	52.6 min	4.4 min	1.0 min	8.6 s
99.999 %	5.0	5.3 min	26.3 s	6.0 s	0.9 s

Series (all must work)

FORMULA $A = A1 \times A2 \times \dots \times An$

WORKED $A = 0.9999 \times 0.9999 \times 0.9995 = 0.999300 = 99.9300 \%$

DOWNTIME 6 h 08 min per year; weaker than the weakest part

Parallel (one is enough)

FORMULA $A = 1 - (1 - A1) \times \dots \times (1 - An)$

WORKED $A = 1 - 0.001 \times 0.001 = 0.999999 = 99.9999 \%$

DOWNTIME 31.6 s per year; stronger than the strongest part

where $A1 \dots An$ = availability of each component as a fraction.

Composite SLA of a three-tier web app

PROBLEM

Front Door → App Service (zone redundant) → Azure SQL Database (zone redundant). What availability can you promise, and what if you add a second region in active-passive?

1. Multiply the chain

⇒ $0.9999 \times 0.9995 \times 0.99995 = 0.99935$

why: every tier must be up: series

2. Convert to downtime

⇒ $(1 - 0.99935) \times 43\,800\text{ min} \approx 28.5\text{ min} / \text{month}$

why: 43 800 min = minutes in an average month

3. Second region for App + SQL

⇒ $A_{\text{r}} = 0.9995 \times 0.99995 = 0.99945$; $1 - (1 - 0.99945)^2 = 0.9999997$

why: two independent regions in parallel

4. Put Front Door back in series

⇒ $0.9999 \times 0.9999997 \approx 0.9999\text{ (99.99 \%)}$

why: the global entry point now dominates

GIVEN

- A_{FD} = Front Door SLA = 99.99 %
- A_{APP} = App Service SLA = 99.95 % (Standard and above, as of 2026 check)
- A_{SQL} = SQL Database zone-redundant SLA = 99.995 %
- Series rule: $A = A1 \times A2 \times A3$;
parallel rule: $A = 1 - (1 - A1)(1 - A2)$

ANSWER

≈ 99.93 % with one region;
≈ 99.99 % with two regions behind Front Door.

Check: The composite is always below the weakest link in series; parallel copies only help if failover is automatic and tested.

EXAM TIP

SLAs are **financial**: if Azure misses one, you claim service credits (10 % / 25 % / 100 % tiers for most services) through a support request; nothing is refunded automatically. Free and pre-view services have no SLA.

Recap and self-test

YOU MAY HEAR

"Every Azure region has availability zones"

BUSTED

✓ ACTUALLY

Only AZ-enabled regions do

France South, Germany North and others have none; check the list before designing for zones.

YOU MAY HEAR

"Geo-redundant storage fails over instantly and loses nothing"

BUSTED

✓ ACTUALLY

Replication to the pair is asynchronous

RPO is typically under 15 minutes; failover is customer-initiated or Microsoft-managed in a disaster.

YOU MAY HEAR

"Zone 1 is the same building in all my subscriptions"

BUSTED

✓ ACTUALLY

Zone numbers are mapped per subscription

Use the zone peers API to align zones across subscriptions.

YOU MAY HEAR

"A 99.99 % SLA means 99.99 % for my application"

BUSTED

✓ ACTUALLY

It covers one service only

Multiply the SLAs of every dependency; your code and deployments are not covered.

Tick a box only when you could explain the point to someone else



Geography → region → zone → datacenter

you choose the region, sometimes the zone, never the datacenter



Match the failure scope

rack → availability set, zone → zones, region → pair or second region



Zonal ≠ zone-redundant

zonal is pinned to one zone; zone-redundant spans them



Sovereign clouds are separate

Azure Government and 21Vianet have their own portals and accounts



Compute composite SLAs

series multiply, parallel $1 - \text{product of failures}$

Q1 Minimum number of availability zones in an AZ-enabled region?

A Three, each with independent power, cooling and networking.

Q2 Two VMs across two zones: what VM SLA?

A 99.99 % (availability set: 99.95 %; single VM with premium disks: 99.9 %).

Q3 Which region pair is the classic exception to 'same geography'?

A Brazil South, paired with South Central US.

Q4 Max fault domains and update domains in an availability set?

A Up to 3 fault domains and up to 20 update domains (default 5).

Q5 What do region pairs give you besides geo-replication?

A Sequential platform updates (one region at a time) and priority recovery of one region per pair in a broad outage.

Q6 How do you list the SKUs and zones a VM size has in a region?

A `az vm list-skus -l <region> --size <family> --zone -o table`.

Q7 Portal URL of Azure Government?

A `portal.azure.us` (Azure in China: `portal.azure.cn`).

Q8 Composite availability of two services in series at 99.9 % and 99.95 %?

A $0.999 \times 0.9995 = 99.85 \%$ (about 65.7 min downtime per month).

Q9 What is a zone-redundant public IP?

A A Standard SKU public IP served from all zones of the region, so it survives a zone loss.