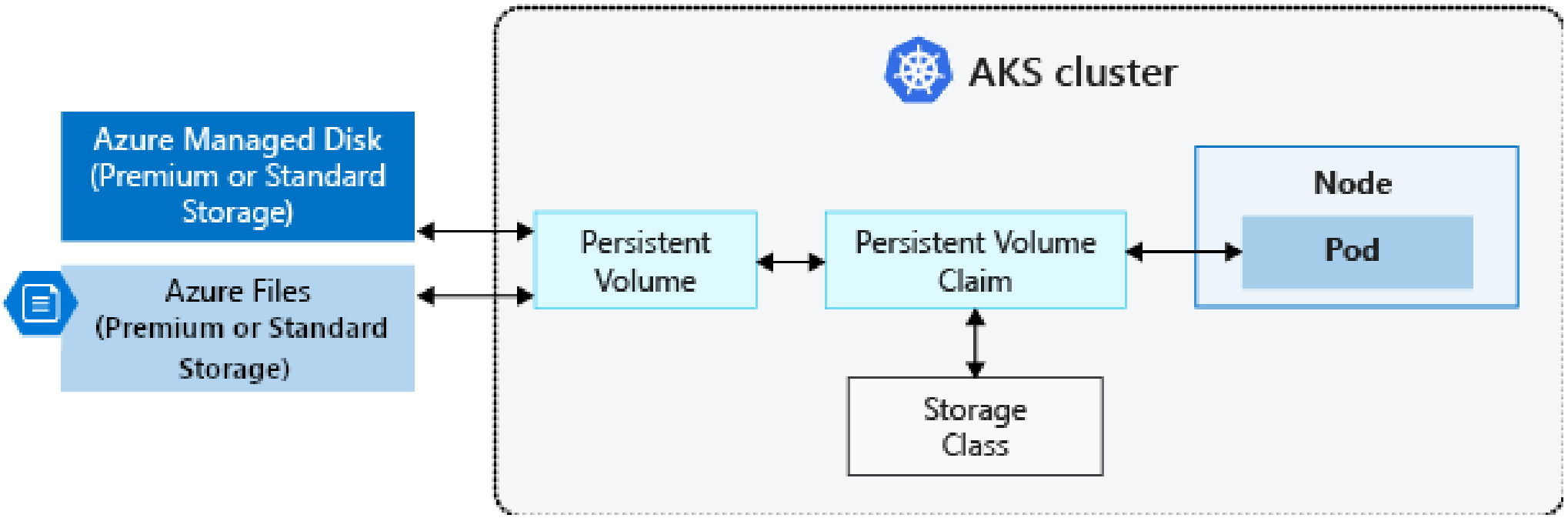
AKS storage using Azure Disk & Availability Zones

Applications needs to persist data.

Containers/Pods are ephemeral.

Persist data (database, files..) outside the pod.

How a pod request for Persistent Volume



Storage types available for AKS

Use case	Volume plugin	Read/write once	Read-only many	Read/write many	Windows Server container support
Shared configuration	Azure Files	Yes	Yes	Yes	Yes
Structured app data	Azure Disks	Yes	No	No	Yes
Unstructured data, file system operations	BlobFuse	Yes	Yes	Yes	No

Azure NetApp Files is also supported.

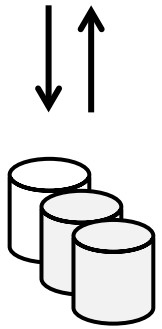
https://learn.microsoft.com/en-us/azure/aks/operator-best-practices-storage

Azure Storage Availability

Single Region

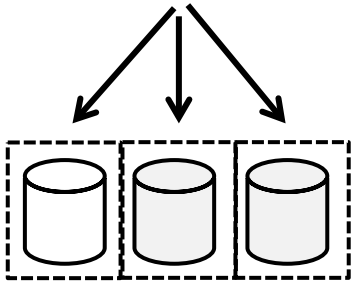
Dual Region

LRS



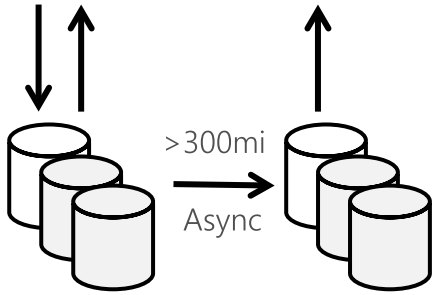
3 replicas
1 region

ZRS



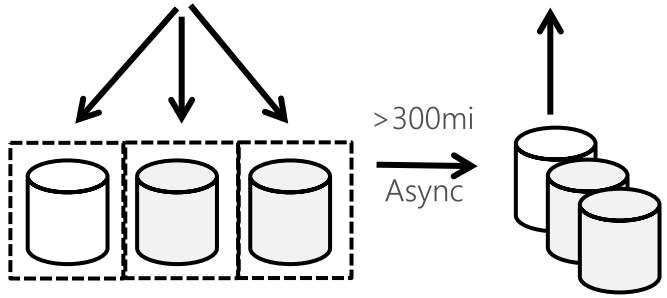
Multiple availability zones
3 replicas
1 region

(RA-)GRS



6 replicas
2 regions

(RA-)GZRS

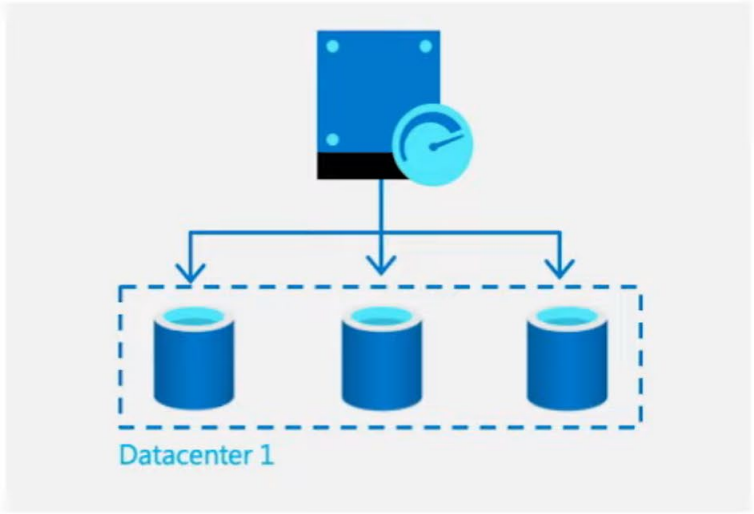


Multiple availability zones in primary single DC in secondary
6 replicas
2 regions

Lower ← Cost → Higher

Azure Disk: LRS vs ZRS

Locally Redundant Storage (LRS) Disks



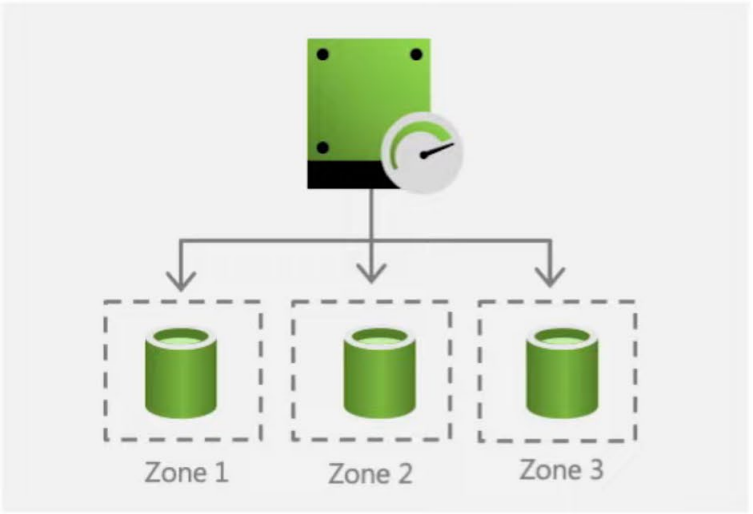
Synchronous writes to copies in the same datacenter

Protection against node, rack failures

Supported for all the disk types: Standard HDD, Standard SSD, Premium SSD and Ultra Disk.

Use cases: Latency sensitive databases, workloads with app level replication e.g., CassandraDB

Zone Redundant Storage (ZRS) Disks



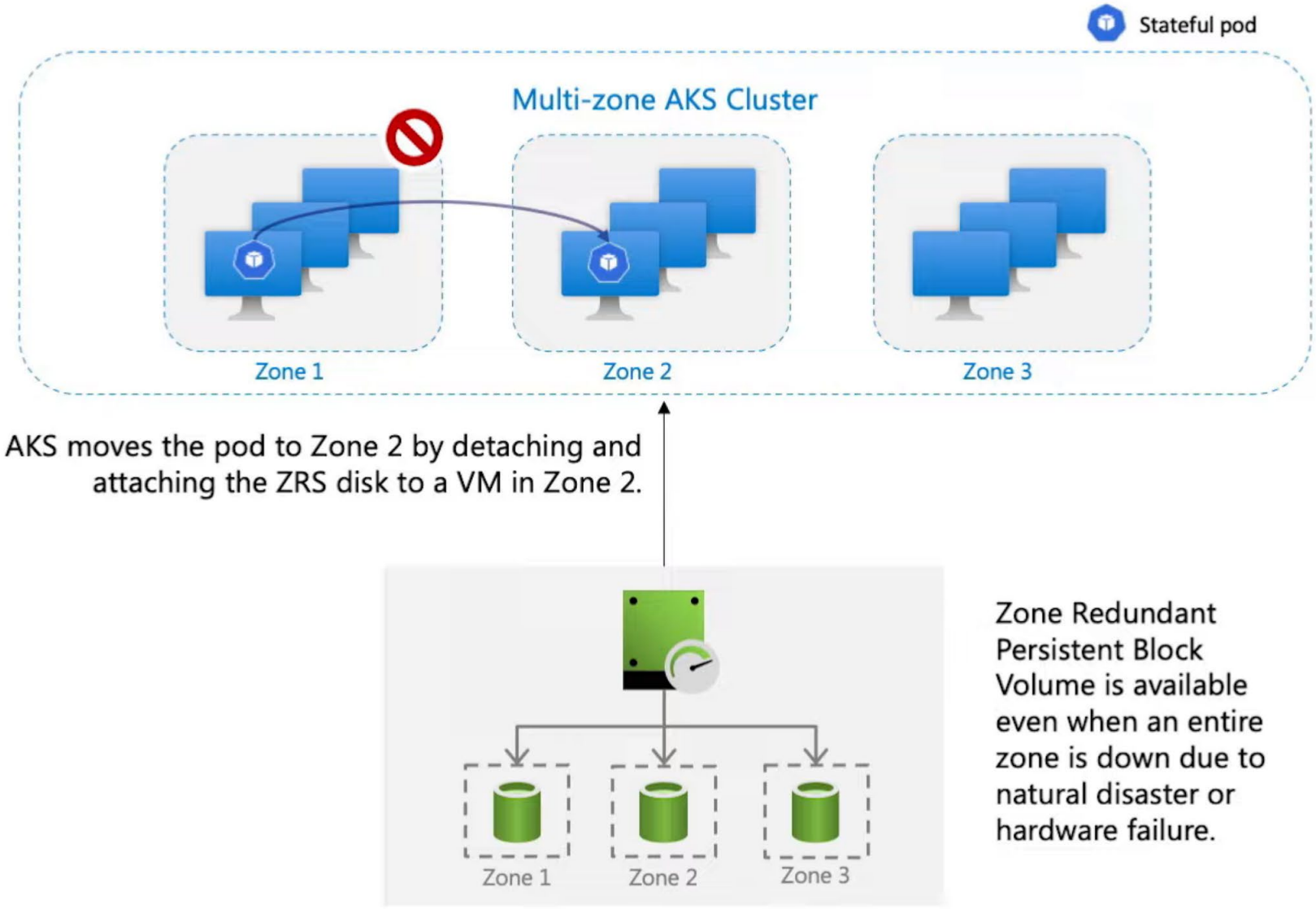
Synchronous writes to **three zones**

Protection against node, rack and **zone** failures

Supported for Premium SSD and Standard SSD disk types and priced 1.5x the LRS option.

Use cases: Clustered databases, legacy workloads with no application-level replication, stateful k8s apps running on multi-zone clusters

Multi-zone AKS cluster with Azure ZRS Disk



Zone Redundant Persistent Block Volume is available even when an entire zone is down due to natural disaster or hardware failure.

```yaml
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: managed-csi-zrs
parameters:
  skuname: StandardSSD_ZRS
provisioner: disk.csi.azure.com
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer
allowVolumeExpansion: true
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: azure-managed-disk-zrs
spec:
  accessModes:
  - ReadWriteOnce
  storageClassName: managed-csi-zrs
  resources:
    requests:
      storage: 5Gi
```

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-zrs
spec:
  selector:
    matchLabels:
      app: nginx-zrs
  template:
    metadata:
      labels:
        app: nginx-zrs
    spec:
      containers:
      - name: nginx
        image: nginx
        volumeMounts:
          - name: azuredisk-zrs
            mountPath: "/mnt/azuredisk"
      volumes:
        - name: azuredisk-zrs
          persistentVolumeClaim:
            claimName: azure-managed-disk-zrs
```

Azure Storage options for stateful container workloads

	 Azure Disk Storage	 Azure File Storage	 Azure Blob and Data Lake Storage	 Azure NetApp Files via Trident
Workloads	Databases, bigdata, cache, CI/CD	Shared/user workspace, CMS, databases, AI/ML	Analytics on data lake, HPC	Analytics, HPC, Custom apps currently using NetApp
Access protocol	SCSI	SMB, NFS v4.1 (preview)	Blobfuse, NFS v3.0	NFS v3.0, NFS v4.1
Model	Static, Dynamic	Static, Dynamic	Static, Dynamic	Static, Dynamic
SKUs	Standard HDD, Standard SSD, Premium SSD, Ultra (v1.21)	Standard HDD, Premium SSD	Standard HDD, Premium SSD	Standard, Premium, Ultra
Access modes	RWO, RWX (v1.21)	RWO, RWX	RWO, RWX	RWO, RWX
Container type	Linux, Windows	Linux, Windows, ACI	Linux	Linux
Availability	LRS, ZRS (preview)	LRS, ZRS, GRS, RAGRS	LRS, ZRS, GRS, RAGRS	Single-zone