Azure Virtual Machines - AZ-104 Learner Guide

# Overview of Azure Virtual Machines

Azure Virtual Machines (VMs) are one of the core Infrastructure-as-a-Service (IaaS) offerings in Microsoft Azure. They allow users to deploy and manage virtualized computing environments in the cloud, supporting both Windows and Linux operating systems.

# VM Sizes and Types

Azure offers a wide range of VM sizes optimized for different workloads:

- General Purpose: Balanced CPU-to-memory ratio (e.g., D-series)

- Compute Optimized: High CPU-to-memory ratio (e.g., F-series)

- Memory Optimized: High memory-to-CPU ratio (e.g., E-series)

- Storage Optimized: High disk throughput (e.g., L-series)

- GPU: Specialized for graphics and compute (e.g., NC, NV series)

- High Performance Compute: For intensive workloads (e.g., H-series)

# 3. Deployment Options

- Azure Portal

- Azure CLI / PowerShell

- ARM Templates / Bicep

- Terraform / Ansible / Chef / Puppet

- Azure DevOps Pipelines

# 4. Availability Sets and Zones

- Availability Sets: Protect against hardware failures within a datacenter using fault and update domains.

- Availability Zones: Physically separate datacenters within a region for higher availability.

- Use Availability Zones for mission-critical workloads requiring high SLA.

[Insert Diagram: Availability Set vs Availability Zone vs VMSS]

# 5. Virtual Machine Scale Sets (VMSS)

VMSS allows you to deploy and manage a set of auto-scaling, load-balanced VMs. Supports uniform and flexible orchestration modes.

- Uniform: Identical VMs, simpler management.

- Flexible: Mixed VM types, supports Spot VMs.

- Integrated with Azure Load Balancer and Application Gateway.

# 6. Cost Optimization Strategies

- Azure Reserved Instances (1 or 3 years): Save up to 72%.

- Azure Spot VMs: Save up to 90% for interruptible workloads.

- Azure Hybrid Benefit: Use existing Windows Server licenses.

- Auto-shutdown schedules and scaling policies.

[Insert Diagram: Cost Optimization Flow]

# 7. Backup and Disaster Recovery

- Azure Backup: Agent-based backup for VMs.

- Azure Site Recovery: Replication and failover across regions.

- Use ZRS or GRS for disk redundancy.

# 8. Networking and Security Best Practices

- Use NSGs and ASGs to control traffic.

- Enable Just-In-Time VM access.

- Use Azure Bastion for secure RDP/SSH.

- Encrypt disks and use managed identities.

# 9. Monitoring and Diagnostics

- Azure Monitor and Log Analytics.

- VM Insights for performance and health.

- Activity Logs and Alerts.

# 10. Automation Tools

- Azure Automation (Runbooks, DSC)

- Terraform, Bicep, ARM Templates

- Azure DevOps and GitHub Actions

- PowerShell and Azure CLI scripting