Module 1 – Course Introduction

Create Your Free Azure Account

Microsoft Azure Free Account

- Microsoft Azure Fundamentals AZ-900 – theoretical exam, no labs or practical activities included

- Goal of this course:
  - Prepare you for the AZ-900 exam
  - Help you get started and gain hands-on experience

- The best way to learn Azure Cloud is to practice ! Period !

- AZ-900 Fundamentals -> AZ-104 Administrator Associate

Microsoft Azure Free Account

- FAQ: I have an account already, do I need a new one ?

- What's included in the free tier account?
  - $200 credit to use in the first 30 days
  - 12 months of popular free services
  - 25+ Azure services that are always free

- Where to start ?
  - https://azure.microsoft.com/free/

- Let's create our account !

Module 1 – Course Introduction

AZ-900 Exam Format & Official Exam Blueprint

Microsoft AZ-900 Exam Overview

- Exam Format
  - ~ 40 questions, single or multiple-choice answers
- Exam Time
  - 60 minutes
- Exam Cost
  - $99 USD* (based on the country where exam is taken)
- Pearson VUE or Certiport Exam Test Centers

Microsoft AZ-900 Exam Overview

- Skills measured:
  - Describe cloud concepts (20-25%)
  - Describe core Azure services (15-20%)
  - Describe core solutions and management tools on Azure (10-15%)
  - Describe general security and network security features (10-15%)
  - Describe identity, governance, privacy, and compliance features (20- 25%)
  - Describe Azure cost management and Service Level Agreements (10- 15%)

- Official Exam landing page:
  - https://docs.microsoft.com/learn/certifications/exams/az-900

Module 2 – Azure Cloud Introduction

Module Completion & Exam Hints

Introduction to Cloud Computing

What is Cloud Computing ?

- Cloud computing is the delivery of computing services – including servers, storage, databases, networking, software, analytics and intelligence – over the Internet ("the cloud") to offer faster innovation, flexible resources and economies of scale (Microsoft)

- Cloud computing really represents renting resources (i.e. CPU, RAM, storage) from a cloud provider (Azure) and only paying for what you use – "pay-as-you-go"

Cloud Deployment Models

Cloud Deployment Models

- There are three different cloud deployment models:
  - Public Cloud
  - Private Cloud
  - Hybrid Cloud

Cloud Computing Models

Cloud Computing Models

- There are three major types of cloud services available:
  - IaaS – Infrastructure as a Service
  - PaaS – Platform as a Service
  - SaaS – Software as a Service

- Differences between them:
  - Flexibility and management
  - Tasks' ownership
  - Pricing model

Benefits of Microsoft Azure Cloud Computing

Azure Cloud Advantages

- Azure Cloud is:
  - Cost-effective
  - Scalable
  - Elastic
  - Current
  - Global
  - Secure
  - Reliable

CapEx versus OpEx

CapEx and OpEx

- CapEx and OpEx represent two approaches to how you make and investment; time and money

- CapEx – Capital Expenditure
  - Spend money upfront
  - Upfront cost for the company
  - Value reduced over time (tax)

- OpEx – Operational Expenditure
  - No upfront cost; pay-as-you-use; tax deduction in the same year

Economies of Scale

Economies of Scale

- Economies of scale - ability to operate more efficiently or at a lower-cost / unit when operating at a larger scale

- By using Azure cloud computing, you can achieve a lower variable cost than you can get on your own

- Usage from customers is aggregated in the cloud, providers such as Azure can achieve higher economies of scale, which translates into lower pay-as-you-go prices

Azure Global Infrastructure

Azure Global Infrastructure

- A region is a set of datacenters deployed within a latency-defined perimeter and connected through a dedicated regional low-latency network

- A geography is a discrete market, typically containing two or more regions, that preserves data residency and compliance boundaries

- Availability Zones are physically separate datacenters within an Azure region, with independent power, network and cooling

Azure Government & Azure China

Azure Government & Azure China

- Azure Government delivers a dedicated (separate) cloud, enabling government agencies and their partners to run mission-critical apps in the cloud

- Only entities in US can use Azure Government!

- Microsoft Azure operated by 21Vianet (Azure China) is a physically separated instance of cloud services located in China

- Meet specific laws and local regulations!

Subscriptions and Management Groups

Azure Subscriptions Overview

- An Azure subscription is a logical unit of Azure services that links to an Azure account

- One Azure account -> one or more Azure subscriptions, part of the same Azure account!

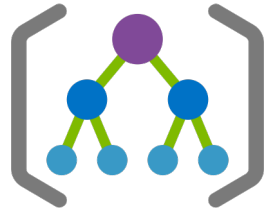
- Azure subscriptions use cases:
  - billing boundaries
  - access control boundaries

Subscription

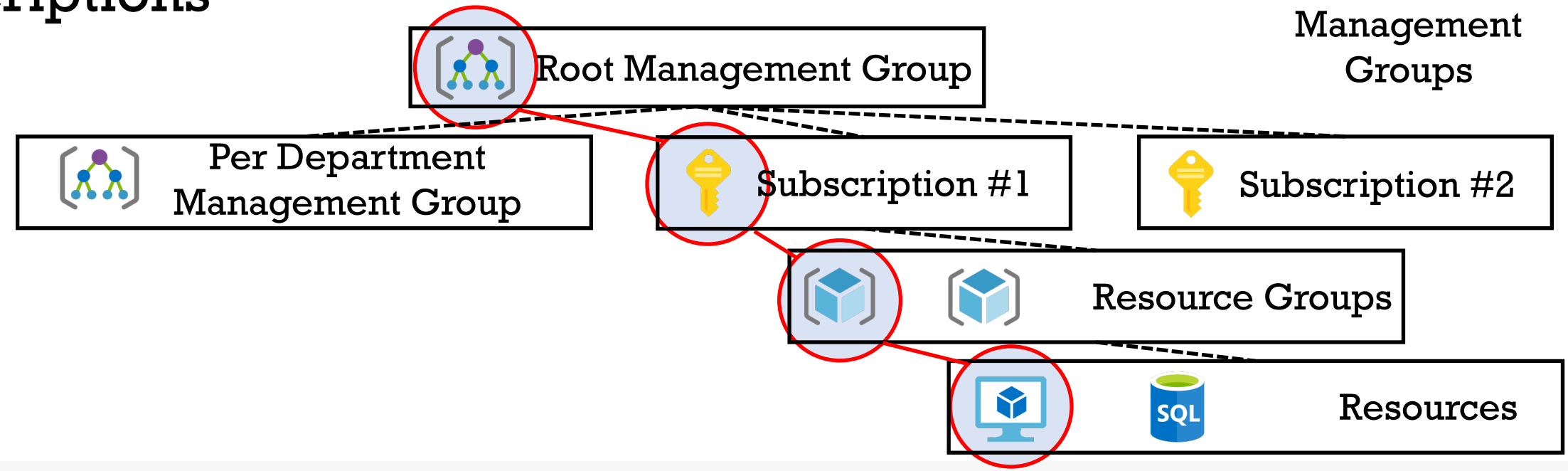
Management Groups Overview

- Azure resources hierarchy on levels: management groups, subscriptions, resource groups and resources

- Management groups – containers for multiple subscriptions



Management Groups



Azure Management Interfaces

Azure Management Interfaces

- Azure provides multiple distinct options in order to interact with the Azure Cloud Platform:
  - Azure Portal
  - Azure Command Line Interface (CLI)
  - Azure PowerShell module
  - Azure Cloud Shell
  - Azure SDKs
  - Azure Mobile app

Azure Cloud Introduction - Quiz

Microsoft Azure Fundamentals

Module 3: Azure Core Services - VMs

Module Completion & Exam Hints

Azure Compute Options

Azure Compute Options

- Azure compute is delivered through:
  - Virtual Machines

  - Containers

  - Azure App Service

  - Serverless Computing

Azure VMs Fundamentals

What's a Virtual Machine (VM) ?

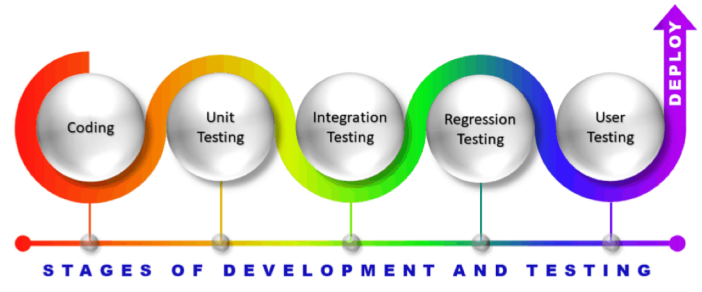
- Virtual machines, or VMs, are software emulations of physical computers

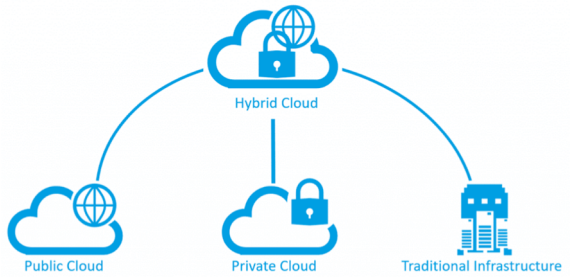
Hardware Equipment

VMs Use Cases

- Azure VMs - Infrastructure as a Service (IaaS)

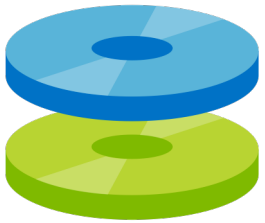
- VMs are great choice when:
  1. Total control over the OS
  2. Run custom software
  3. Development and testing
  4. Extend your datacenter





Storage for VMs

- Azure managed disks are block-level storage volumes that are managed by Azure and used with Azure VMs



Disks

- Managed Disks VS Unmanaged Disks
- Disk available options:
  - Standard HDD
  - Premium SSD
  - Standard SSD
  - Ultra disk
- Differences: Throughput and IOPS
  https://docs.microsoft.com/en-us/azure/virtual-machines/linux/disks-types

Azure VMs Overview – Types and Sizes

	Use Case	VM Configuration	Sizes
General purpose	• Testing and development • Small and medium DBs • Small web servers	• Balanced CPU-to-memory ratio	B, Dsv3, Dv3, Dasv4, Dav4, DSv2, Dv2, Av2, DC, DCv2, Dv4, Dsv4, Ddv4, Ddsv4
Compute optimized	• Medium traffic web servers • Network appliances • Application servers	• High CPU-to-memory ratio	Fsv2
Memory optimized	• Relational DB servers • Medium to large caches • In-memory analytics	• High memory-to-CPU ratio	Esv3, Ev3, Easv4, Eav4, Ev4, Esv4, Edv4, Edsv4, Mv2, M, DSv2, Dv2
Storage optimized	• Big Data, SQL, NoSQL • Data warehousing • Large transactional DB	• High disk throughput and IO	Lsv2
GPU	• Heavy graphics • Deep learning (ML)	• Single or multiple GPUs	NC, NCv2, NCv3, ND, NDv2, NV, NVv3, NVv4
HPC	• High performance compute	• Most powerful CPU • High-throughput NICs – RDMA	HB, HBv2, HC, H

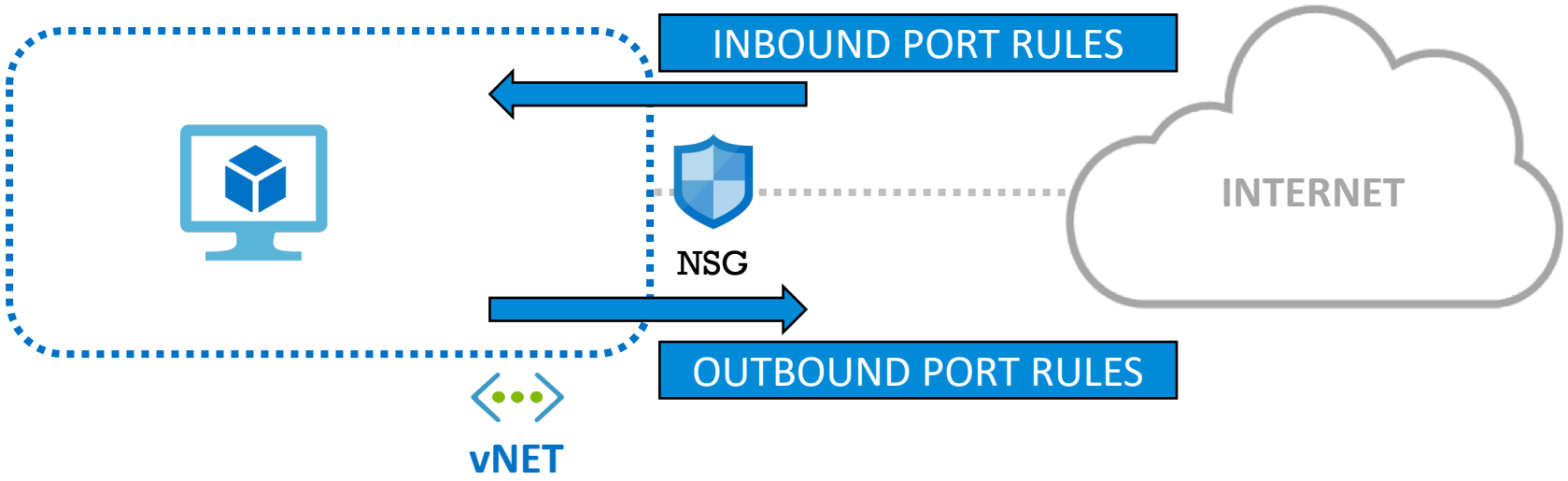
Network Security Groups

NSGs Overview

- Network Security Groups (NSGs) – fundamental building block in Azure security

- NSGs are used to filter network traffic to and from Azure resources, such as VMs

NSG



Rule Priority - Traffic Evaluation in NSGs

- NSG security rules are evaluated by priority using the 5-tuple information – source, source port, destination, destination port and protocol

NSG

- Rules are processed and evaluated top-down, first match wins;

Inbound port rules | Outbound port rules | Application security groups | Load balancing

Network security group Webserver01-nsg (attached to network interface: webserver01228)
Impacts 0 subnets, 1 network interfaces

Add inbound port rule

Priority	Name	Port	Protocol	Source	Destination	Action
300	SSH	22	TCP	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny

NSGs – Default Inbound Security Rules

- Default rules in every NSG:
  - 65000 – ALLOW traffic inside vNET
  - 65001 – ALLOW traffic from Azure LoadBalancer
  - 65500 – if not matched already, then DENY

Inbound port rules | Outbound port rules | Application security groups | Load balancing

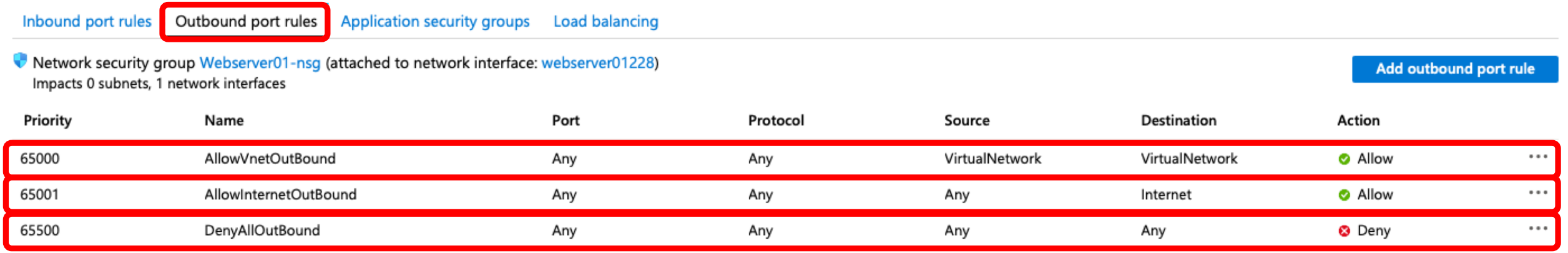
Network security group Webserver01-nsg (attached to network interface: webserver01228)
Impacts 0 subnets, 1 network interfaces

Add inbound port rule

Priority	Name	Port	Protocol	Source	Destination	Action
300	SSH	22	TCP	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny

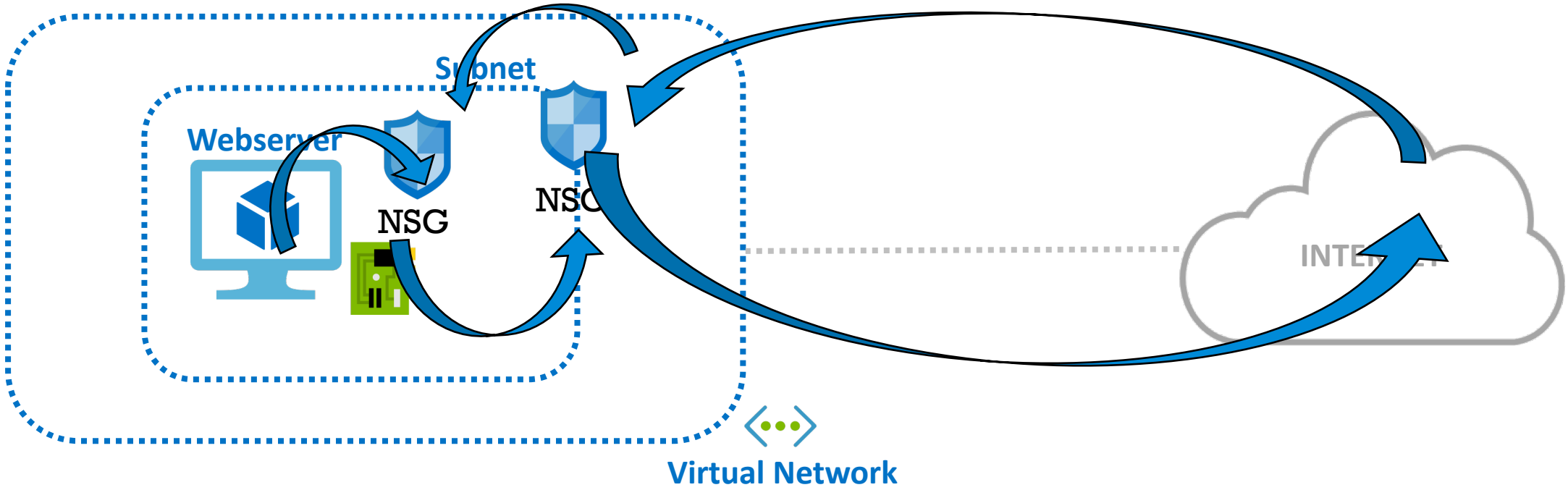
NSGs – Default Outbound Security Rules

- Default rules in every NSG:
  - 65000 – ALLOW traffic inside vNET
  - 65001 – ALLOW traffic to Internet
  - 65500 – if not matched already, then DENY



NSGs Order –Traffic Evaluation

- NSGs can be associated at two different levels:
  - Subnet level
  - NIC card level

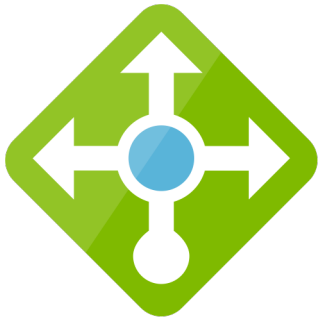


Azure Load Balancer

Load Balancing Introduction

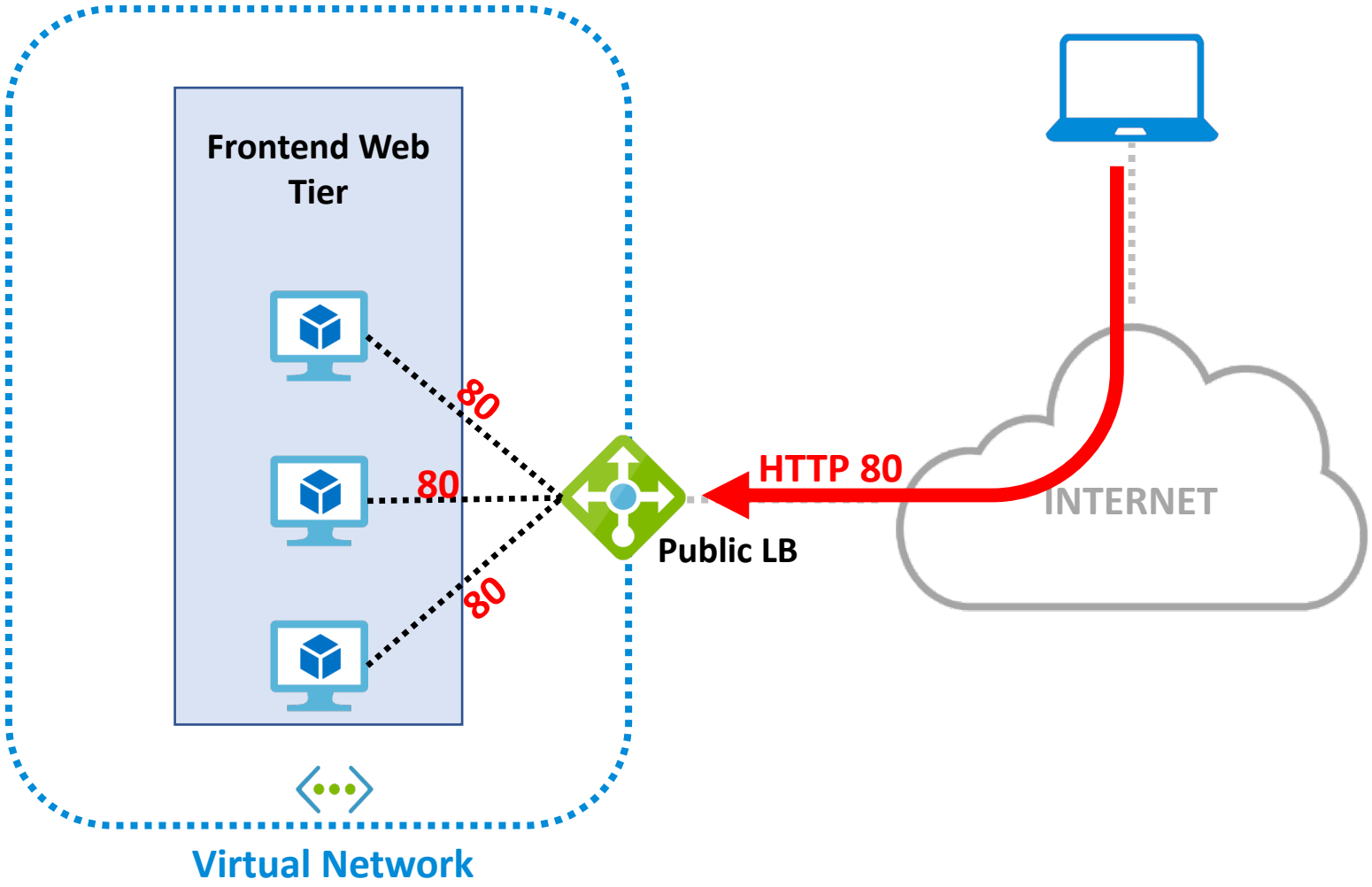
- Load balancing means equally distributing load (incoming traffic) to a group of servers (backend pool)

- Two types of LBs are available:
  - Internal LB
  - Public LB



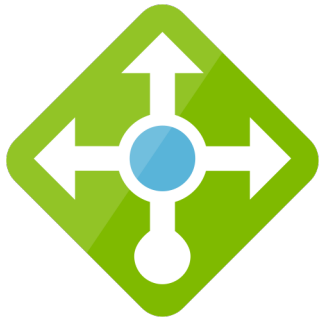
Load Balancer

Azure Load Balancer – Configuration steps



Configuration steps:

1. Load Balancer
2. Backend Pool
3. Health Probe
4. LB Rule



Load Balancer

Azure Virtual Machines - Quiz

Microsoft Azure Fundamentals

Module 4 – Additional Computing Options

Module Completion & Exam Hints

Azure Compute Options

- Azure compute is delivered through:
  - Virtual Machines

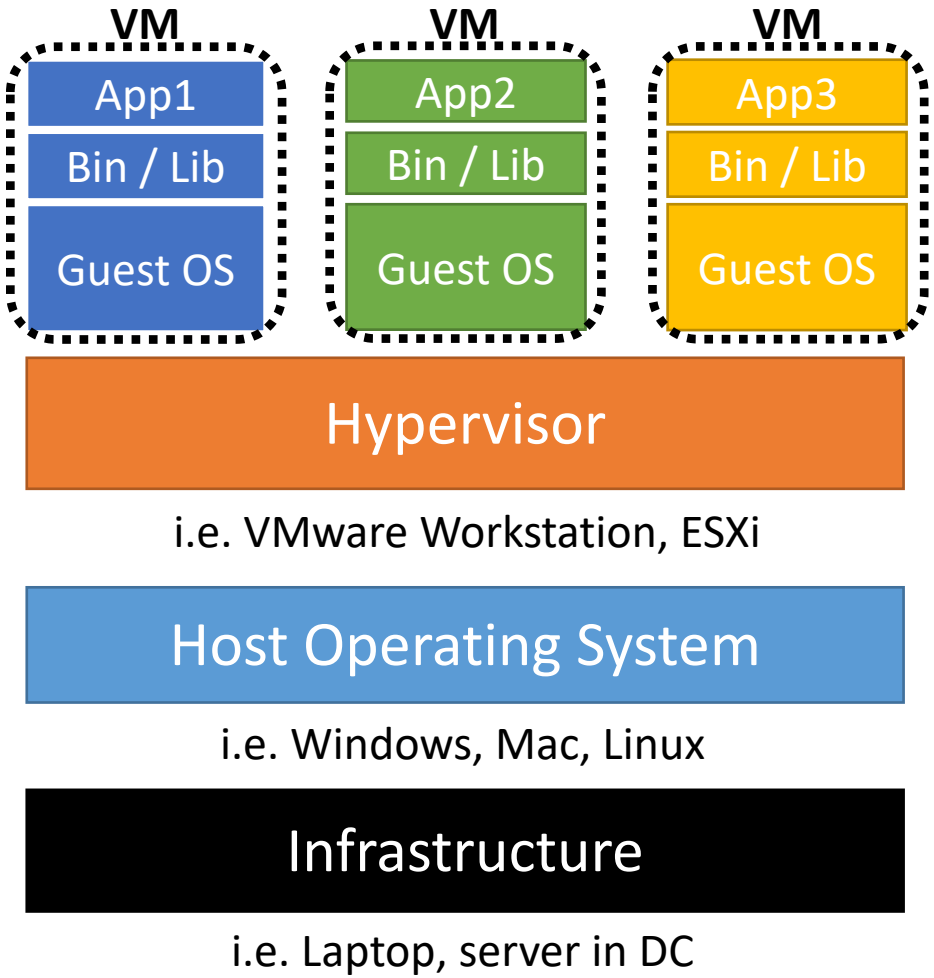
  - Containers

  - Azure App Service

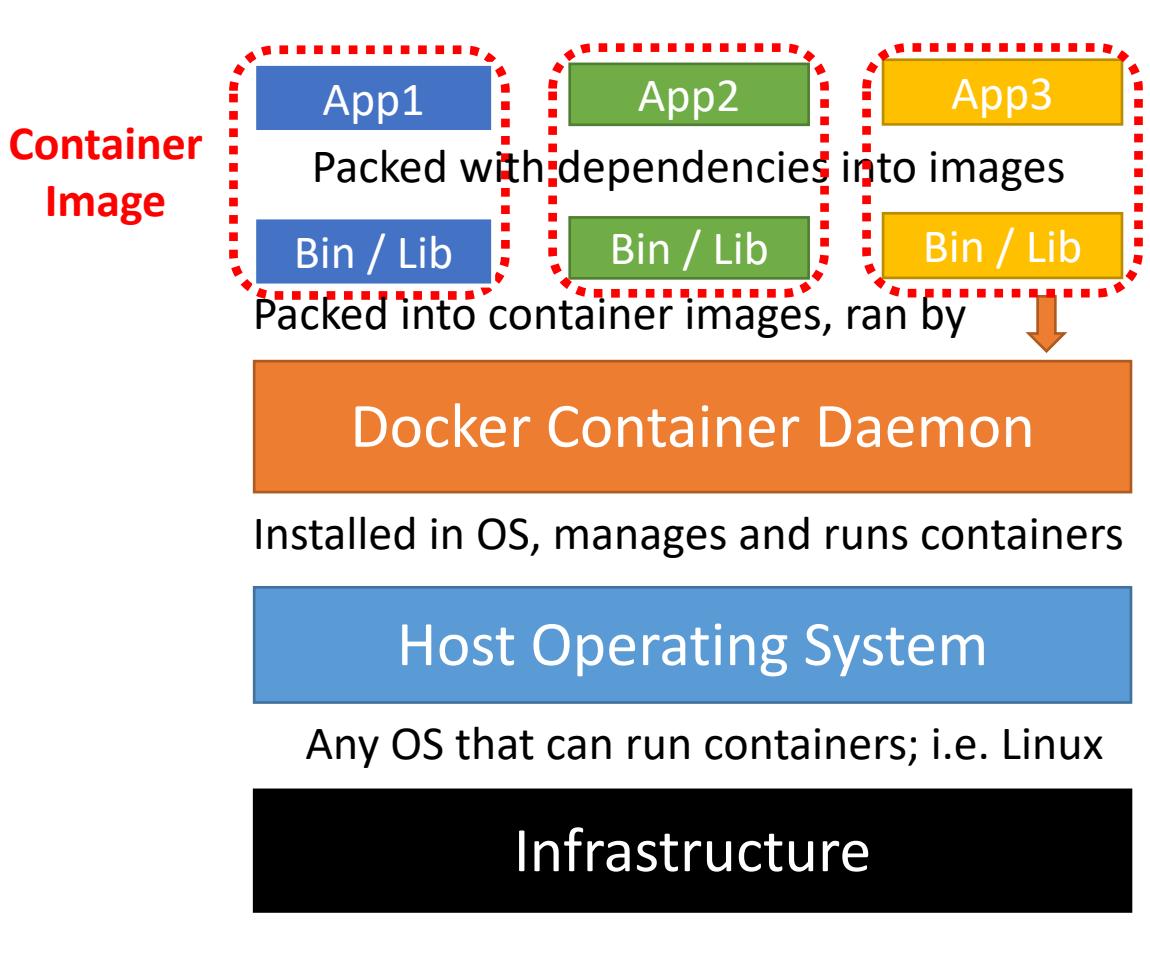
  - Serverless Computing

Azure Container Instances (ACI)

Virtual Machines VS Containers



Virtual Machines



Containers

Azure Containers Instances (ACI) Overview

- Azure Container Instances offers the fastest and simplest way to run a container in Azure
  - No VM or infrastructure to manage !

- ACI use cases:
  - Simple apps
  - Task automation
  - Build jobs

ACI Benefits

- 1. Fast startup times – with ACI, start in seconds
- 2. Container access
- 3. Compliant Deployments
  - Hypervisor-level security
  - Custom sizes
  - vNET deployment
  - Linux and Windows available

- Orchestration needed ? -> Azure Kubernetes Service (AKS)

Azure Kubernetes Service (AKS)

What is Kubernetes?

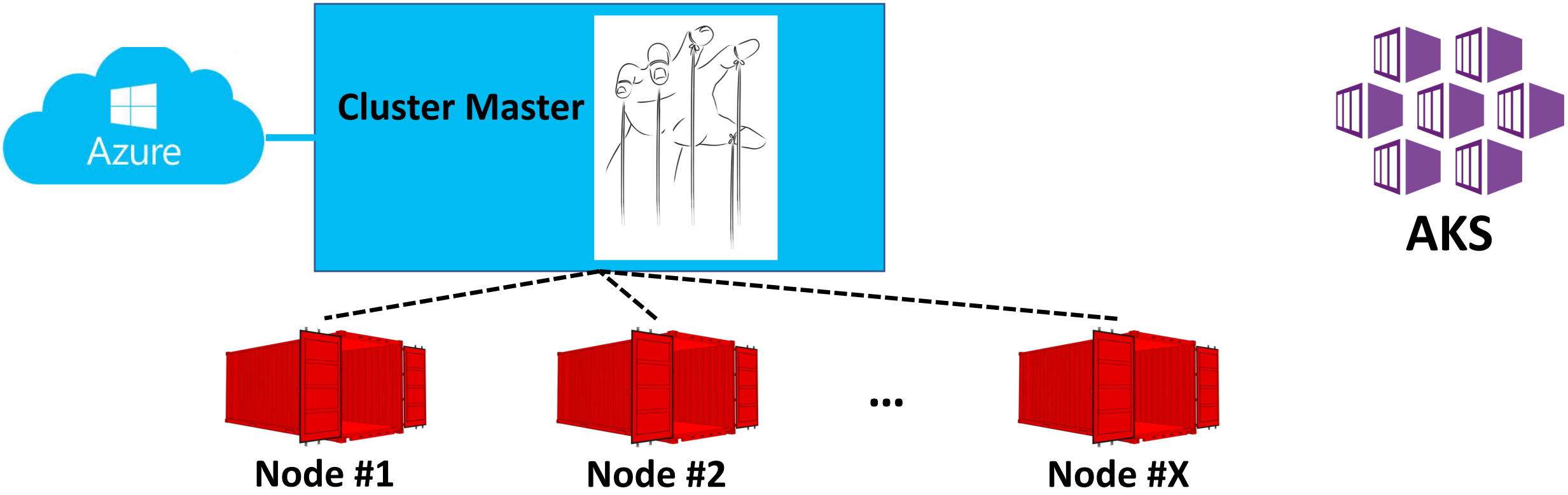
- Kubernetes is an open-source container orch. system for automating app deployment, scaling, and management

- Things to know:
  - You are responsible for deployment, scaling, load balancing, logging, etc.
  - Kubernetes doesn't provided DBs or storage
  - A Kubernetes deployment is configured as a cluster:
    - one master machine
    - one or multiple worker machines = (agent) nodes

Kubernetes

What is Azure Kubernetes Service (AKS)?

- Azure Kubernetes Service (AKS) manages your hosted Kubernetes environment and makes it simple to deploy and manage containerized apps in Azure



Azure App Service

App Service Overview

- Azure App Service is an HTTP-based service for hosting web applications, REST APIs and mobile back ends

- Available programming languages:

App Service

- Azure App Service – Azure PaaS offering

App Service Key Features

- 1. Multiple languages and frameworks
- 2. Managed production environment
- 3. Containerize app and run in App Service
- 4. Global scale with high availability
- 5. DevOps optimized
- Pricing – based on App Service Plan

App Service

App Service Plan Overview

- An app always runs in an App Service plan - defines a set of compute resources for a web app to run

- An App Service Plan defines:
  - An Azure region
  - Number & Size of VM instances (small, medium, large)
  - Pricing tier
    - shared compute
    - dedicated compute
    - isolated

App Service Plan

Azure Serverless Computing

Serverless Computing Main Pillars

- Abstraction of servers
  - No servers to manage
- Event-driven & Schedule, automate, orchestrate tasks
  - i.e. Run a function when it receives an HTTP request
  - i.e. Send email notification based on event occurrence
- Pay by the run time
  - You pay only for the duration your code runs
  - Times it was executed

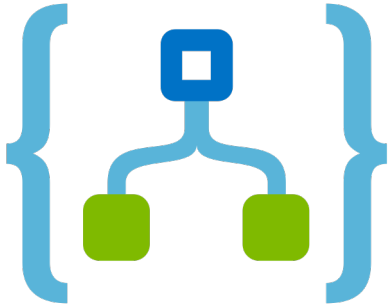
Azure Functions

- With Azure Functions you can run small pieces of code ("functions") without worrying about app infrastructure
- The function is triggered by an event
- Trigger examples:
  - Respond to data changes
  - Run a task on schedule
  - Run a function as response to HTTP request

Azure Functions

Azure Logic Apps Overview

- Azure Logic Apps is similar to Azure Functions, just that you don't have to write code
- You create Logic Apps workflows using a visual designer
- Workflow - Visualize, design, build, automate and deploy business processes as series of steps
- Azure Functions executes code, while Azure Logic Apps executes workflows, using prebuilt logic blocks

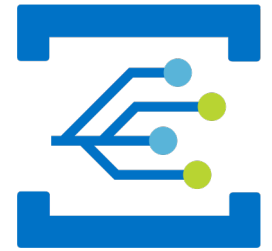


Azure Logic Apps

Azure Event Grid

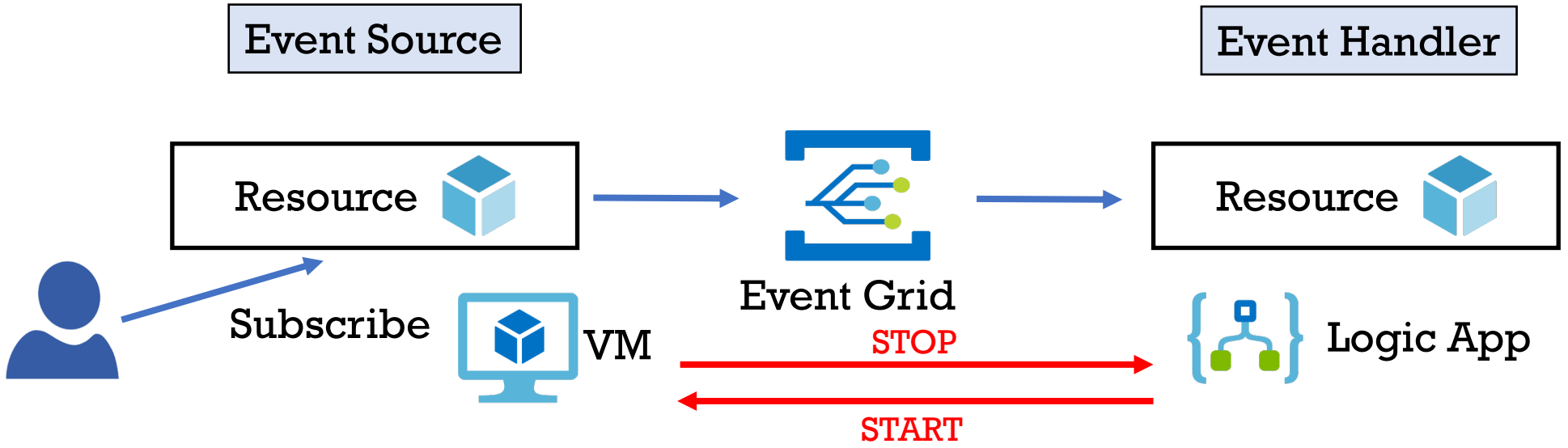
Azure Event Grid Overview

- Azure Event Grid allows you to easily build applications with event-based architectures



Event Grid

- Event occurs -> take action, do something



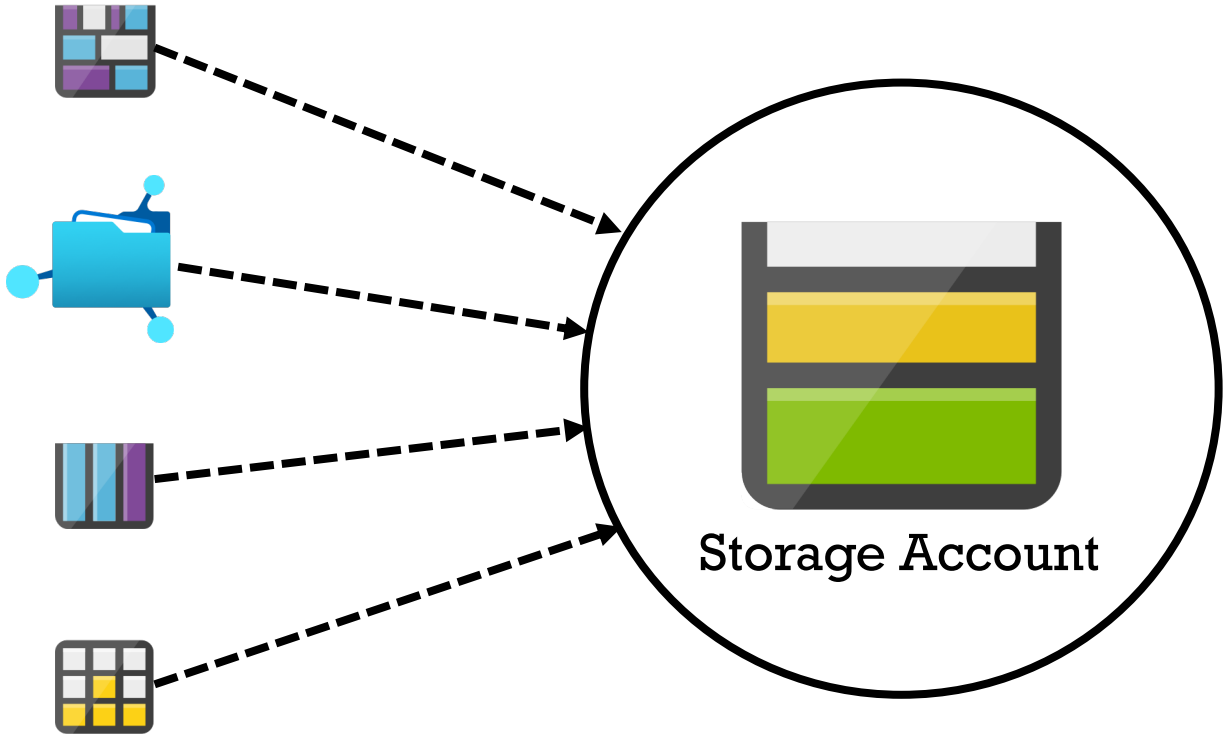
Azure Computing Options - Quiz

Module 5 – Azure Core Services - Storage

Module Completion & Exam Hints

Azure Storage Services Overview

- Azure Storage includes the following data services:
  - Azure Blobs ✓
    - scalable object store
  - Azure Files ✓
    - managed file share
  - Azure Queues ✗
    - messaging store
  - Azure Tables ✗
    - NoSQL structured data



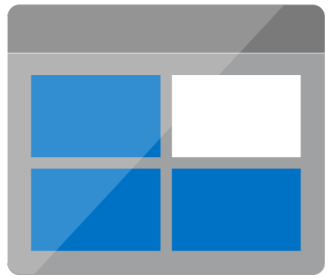
Azure Blob Storage

Azure Blobs Overview – Unstructured Data

- Azure Blob storage is Microsoft's object storage solution for the cloud, optimized to store massive amounts of unstructured data (text or binary data)

- BLOB – Binary Large Objects

- Unstructured Data ?
  - Any type of data can be stored, no restrictions



Blob Storage

Azure Blob Storage Lifecycle & Access Tiers

- Azure storage offers three access tiers:
  - Hot – frequently accessed data
  - Cool – infrequently accessed data (stored min. 30 days)
  - Archive – rarely accessed data (stored min. 180 days)

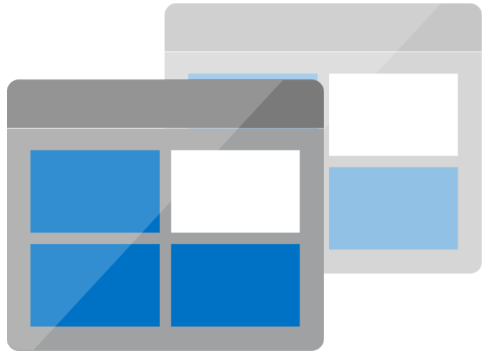
- Multiple access tiers available, we can build a storage lifecycle policy, which translates to cost-effective storage

- Policy: HOT -> COOL -> ARCHIVE

Blob Storage

Azure Storage Replication

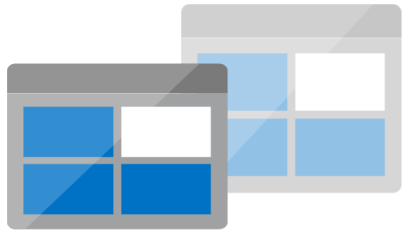
- Microsoft Azure always replicates data in your storage account to ensure durability and high availability
- Data can be replicated within the same DC, across zonal DCs within the same region or across geographically separated regions
- Multiple redundancy options exist, can be selected when storage account is created



Storage Replication

Azure Storage Replication Options - Summary

- Locally Redundant Storage (LRS) – 3 copies – same AZ/R
- Zone Redundant Storage (ZRS) – 3 copies – 3 AZs – 1R
- Geo-Redundant storage (GRS) = 6 copies – 2 AZs – 2 R
  - 3 copies in 1 AZ – primary region
  - 3 copies in 1 AZ – secondary region
- Geo-Zone-Redundant Storage (GZRS) = 6 copies
  - 3 copies in 3 AZs – primary region
  - 3 copies in 1 AZ – secondary region



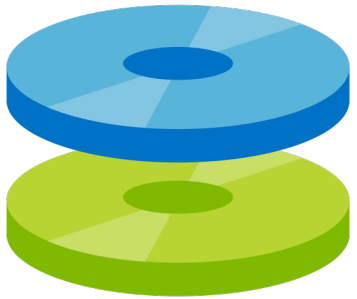
Storage Replication

Azure Managed Disks

Azure Managed Disks Introduction

- Azure managed disks are block-level storage volumes that are managed by Azure and used with Azure VMs

- Azure Managed Disks - Recommended
  - Azure will manage the storage account for you that stores the *.VHD file



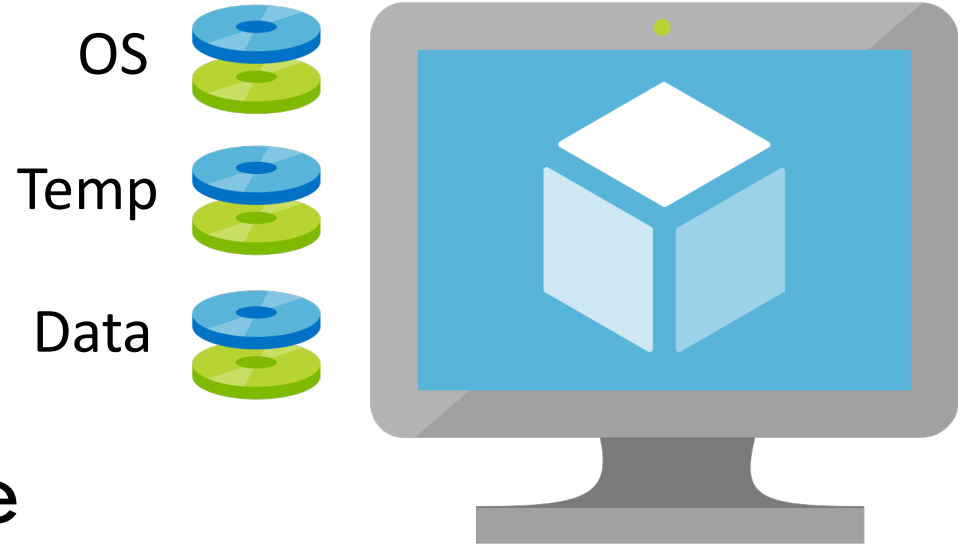
Disks

- You only need to specify the disk size, the disk type and provision the disk

- Options: Standard HDD/SSD, Premium SSD, Ultra Disks

Azure Disk Roles

- In Azure, there are currently three main disk roles:
  - OS disk
  - Temporary disk
  - Data disk

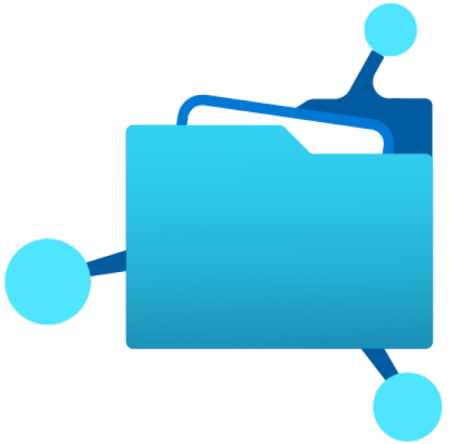


- OS disk – pre-installed OS
- Temporary disk – short-term storage
- Data disk – Persistent data

Azure Files Storage

Azure Files Overview and Benefits

- Azure Files offers fully managed file shares in the cloud that are accessible via SMB protocol – plug and play



Azure Files

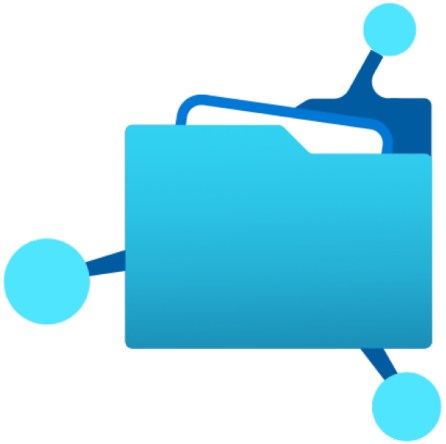
- Azure Files shares can be mounted (attached) by both on-premises and cloud machines
- Traditional file servers can be replaced with Azure Files or additional capacity can be added
  - Azure file shares can be mounted from any location
  - Works on Windows, Mac and Linux

Azure Files Benefits –Why Azure Files is Useful ?

- Managed service – Azure takes care of HW or SW updates, necessary upgrades and system patching

- Automate work
  - Multiple tools available for scripting
  - i.e. Azure CLI, PowerShell

- Always-on File Share
  - High available, highly scalable



Azure Files

Azure Storage - Quiz

Microsoft Azure Fundamentals

Module 6 – Databases in Azure

Module Completion & Exam Hints

Databases in Microsoft Azure

- Azure Databases briefly covered in this Module:
  - Azure Cosmos Database
  - Azure SQL Database
  - Azure Database for MySQL
  - Azure Database for PostgreSQL
  - Azure SQL Managed Instance
  - Azure Database Migration Service



Azure Cosmos Database

Azure Cosmos Database Overview

- Azure Cosmos DB is Microsoft's proprietary globally-distributed, multi-model database service "for managing data at planet-scale" (May 2017)

Azure Cosmos DB

- It is schema-agnostic, horizontally scalable and generally classified as a NoSQL database
- It's a document DB
  - Document format JSON (JavaScript Object Notation)

Azure SQL Database

Azure SQL Database Overview

- Azure SQL DB is a general-purpose relational database-as-a-service (DBaaS) based on the latest stable version of Microsoft SQL Server Database engine

- Provided as a managed service, you can create a highly available and high-performance data storage layer for the applications and solutions in Azure

Azure SQL DB

Azure SQL Database Deployment Models

- Azure SQL DB provides three deployment models:
  - Single
    - Fully managed, isolated database
  - Elastic Pool
    - Collection of single databases with a shared set of resources
  - Managed instance
    - Fully managed instance of SQL Server
    - Full SQL server capabilities (vs. Single)

Azure SQL DB

Azure Database for MySQL

Azure Database for MySQL Overview

- Azure Database for MySQL is a relational database service based on the MySQL Community Edition database engine (v5.6, v5.7 and v8.0)

Azure MySQL DB

- Key benefits:
  - Built-it high availability
  - Pay-as-you-go pricing
  - Scaling in just seconds
  - Built-in security for data at-rest and in-transit
  - Automatic bkp and point-in-time-restore up to 35 days
  - Enterprise-grade security and compliance

Azure Database for PostgreSQL

Azure Database for PostgreSQL Overview

- Azure Database for PostgreSQL is a relational database service based on the community version of open-source PostgreSQL database engine

- Currently three deployment options are available:
  - Single Server
    - Vertical scaling
  - Hyperscale
    - Horizontal scaling
  - Flexible server (preview)

Azure PostgreSQL DB

Azure SQL Managed Instance

Azure SQL Managed Instance Overview

- Azure SQL Managed Instance is a fully managed instance-as-a-service, with almost 100% feature parity with the SQL Server database engine

- Best for most migrations to Azure cloud:
  - allows existing SQL Server customers to lift and shift their on-prem apps to the cloud

Managed Instance

- Reduce management overhead and TCO – PaaS offering
  - Automatic patching, versioning and updates, HA - high availability

SQL MI Purchasing Model & Service Tiers

- vCore - Allows you to change compute and storage, based on your workload needs

- Azure SQL MI is available in two service tiers:
  - General purpose
    - Typical performance and I/O latency
  - Business critical
    - Low I/O latency
  - 99.99% availability

Managed Instance

Azure Database Migration Service

Azure DMS Overview

- Azure Database Migration Service is a fully managed service designed to enable seamless migrations from multiple database sources to Azure Cloud

- Azure Database Migration Service is designed to support different migration scenarios for both offline (one-time) and online (continuous sync) migrations

Azure DMS

Azure Databases - Quiz

Microsoft Azure Fundamentals

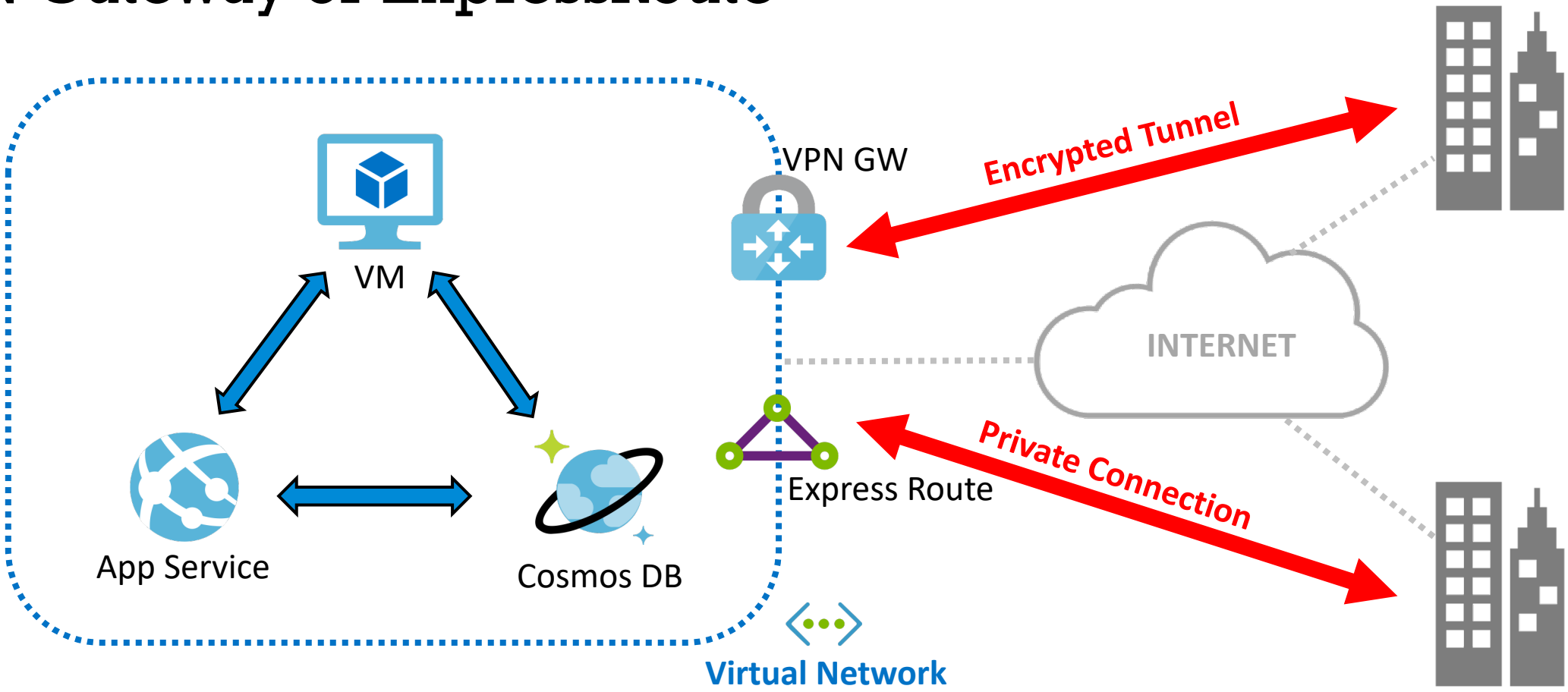
Module 7 – Other Azure Core Services

Module Completion & Exam Hints

Azure VPNs & ExpressRoute

Azure Connectivity Services – On-Prem DC

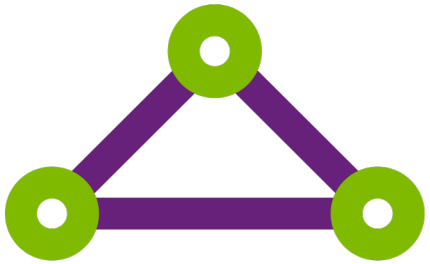
- Connect your on-premises network to a virtual network using VPN Gateway or ExpressRoute



Azure ExpressRoute Overview

- ExpressRoute lets you extend your on-premises networks into Azure Microsoft cloud

- ExpressRoute vs VPN ?!
  - ExpressRoute connections don't go over the public Internet network
  - Faster speeds, consistent latencies and higher security



ExpressRoute

Exam Hints!

- When using Azure ExpressRoute connection, inbound data traffic from on-premises network to Azure is always free

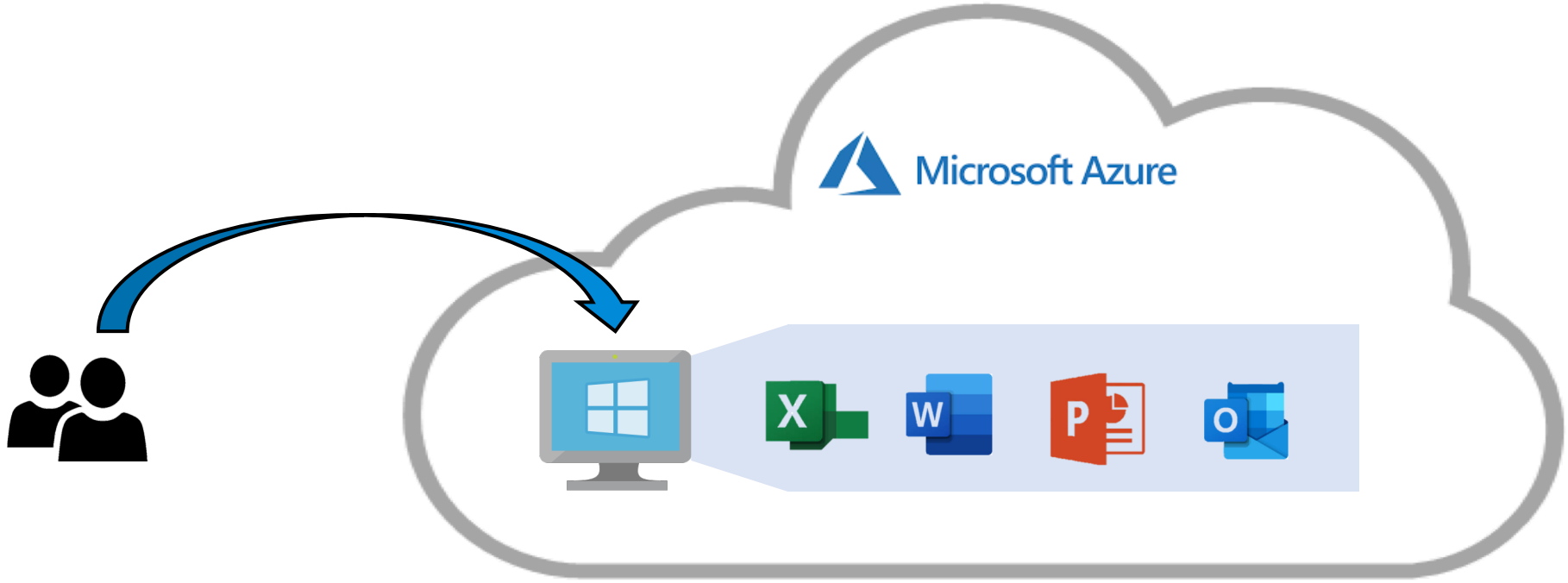
- Copying data to Azure from on-premises network to Azure over a VPN is free – no additional costs are incurred

- Why ?
  - Inbound data transfer to Azure is free, outbound data traffic is charged!

Azure Windows Virtual Desktop

What is Windows Virtual Desktop?

- Windows Virtual Desktop on Microsoft Azure is a desktop and app virtualization service that runs on the cloud

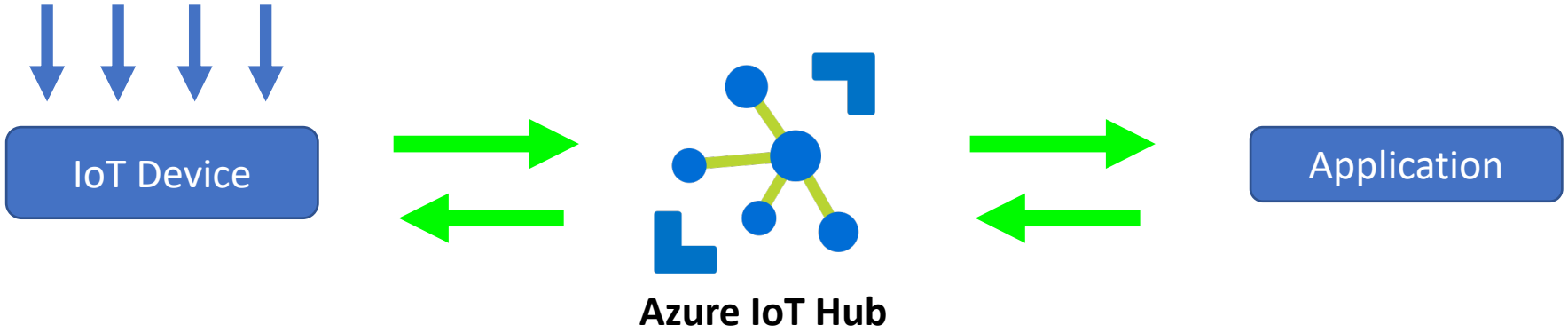


Windows Virtual Desktop

IoT in Azure

Azure IoT HuB & Azure Sphere

- IoT Hub is a managed service that acts as a central message hub for bi-directional communication between your IoT application and the devices it manages



- Azure Sphere - secure platform to develop, deploy, and maintain secure internet connected IoT solutions

Exam Hints!

- IoT Hub and Azure Data Lake work great together !
  - IoT Hub can receive data from millions of IoT devices
  - IoT Hub sends data to Azure Data Lake Gen 2 (storage purposes)

Big Data and Analytics in Azure

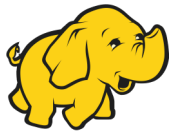
Big Data and Analytics in Azure

- Azure Synapse Analytics is a cloud-based enterprise data warehouse that you can use to quickly run complex queries across petabytes of data

- Azure Databricks is an Apache Spark-based analytics platform optimized for Microsoft Azure cloud platform

- Azure HDInsight - cost-effective enterprise-grade service for open source analytics; remember the open source benefit!





Exam Hints!

- Benefits - Azure Synapse Analytics (former name SQL Data Warehouse) is that HA is built into the platform

- Azure SQL Synapse Analytics
  - Cloud based service that leverages massively parallel processing (MPP) to quickly run complex queries across petabytes of data in a relational database

- Azure Databricks - Apache Spark-based analytics service

- Azure Databricks – big data analysis service for ML

Exam Hints!

- Azure HDInsight – open source framework for the distributed processing and analysis of big data sets in clusters

AI, ML and Cognitive Services in Azure

Machine Learning Overview

- Machine learning is a data science technique that allows computers to use existing data to forecast future behaviors, outcomes, and trends

- By using machine learning, computers learn without being explicitly programmed

• • • • •

1 million

It's a CAT,
I am 80% sure

AI and Cognitive Services in Azure

- Artificial Intelligence is the capability of a machine to imitate intelligent human behavior
- Through AI, machines can analyze images, comprehend speech, interact in natural ways and make predictions using data
- Azure cognitive services - comprehensive family of AI services and APIs that help building intelligent apps
  - Computer vision, face, speech translation, text analytics

Exam Hints!

- Machine Learning – uses past trainings to provide predictions that have high probability

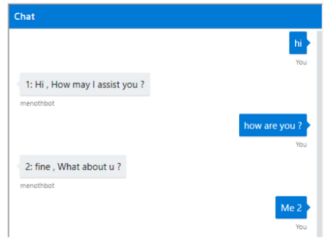
- Machine Learning in Azure
  - Azure Machine Learning Designer – build, test and deploy predictive analytics solutions

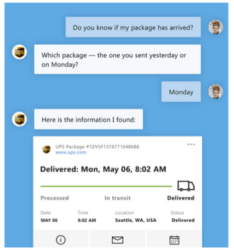
- Azure Cognitive Services
  - Simplified tools to build intelligent Artificial Intelligence (AI) applications

Azure Bot Service

Azure Bot Service Overview

- Azure Bot Service is Microsoft's artificial intelligence (AI) chatbot offered as-a-service





- Start simple … and grow in sophistication
- Azure Bot Service
  - Digital online assistant that provides speech support

Azure DevOps and DevTest Labs

How can Azure DevOps help ?

- Azure DevOps provides several tools you can use for better team collaboration

- Azure DevOps is a suite of services, that provide a solution to anyone who wants a tool to create a step-by-step production and continuous improvement chain

- 5 tools to remember:
  - Azure Boards, Azure Pipelines, Azure Test Plans, Azure Repos and Azure Artifacts

Azure Tools for DevOps

- Azure Boards - These are agile tools that help us plan, track and discuss our work, even with other teams

Azure Boards

- Azure Pipelines - These will let us build, test and deploy with CI/CD that works with any language, platform and cloud

Azure Pipelines

- Azure Test Plans – These are manual and exploratory testing tools

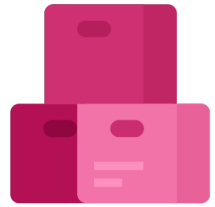
Azure Test Plans

Azure Tools for DevOps

- Azure Repos - provides unlimited, cloud-hosted private and public Git repos

Azure Repos

- Azure Artifacts - create, host and share packages

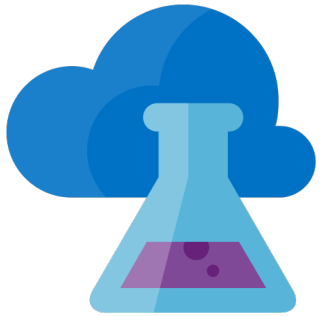


Azure Artifacts

Azure DevTest Labs

- Azure DevTest Labs enables developers to efficiently self-manage virtual machines (VMs) and PaaS resources without waiting for approvals

- With Azure DevTest Labs developers become autonomous and can create labs consisting of pre-configured resources



Azure DevTest Labs

- So, by using DevTest Labs, you can easily test the latest versions of your applications and speed up the process of creating and terminating the testing environments

Exam Hints!

- Azure DevOps – integrated solution for the deployment of code
- Azure Repos – provides a set of version control tools that you can use to manage your code
- Azure DevTest Lab - minimize the administrative effort required to deploy and remove virtual machines – testing environments

GitHub and GitHub Actions

GitHub and GitHub Actions

- GitHub is a graphical app repository system;
  - repo - location where all the files for a particular project are stored – access by URL

- GitHub Actions enables you to create custom software development life cycle (SDLC) workflows directly in your GitHub repository

- With GitHub Actions you can build end-to-end continuous integration (CI) and continuous deployment (CD) capabilities directly in your repository (CI/CD)

Other Azure Core Services - Quiz

Module 8 – ARM, Policies and Locks

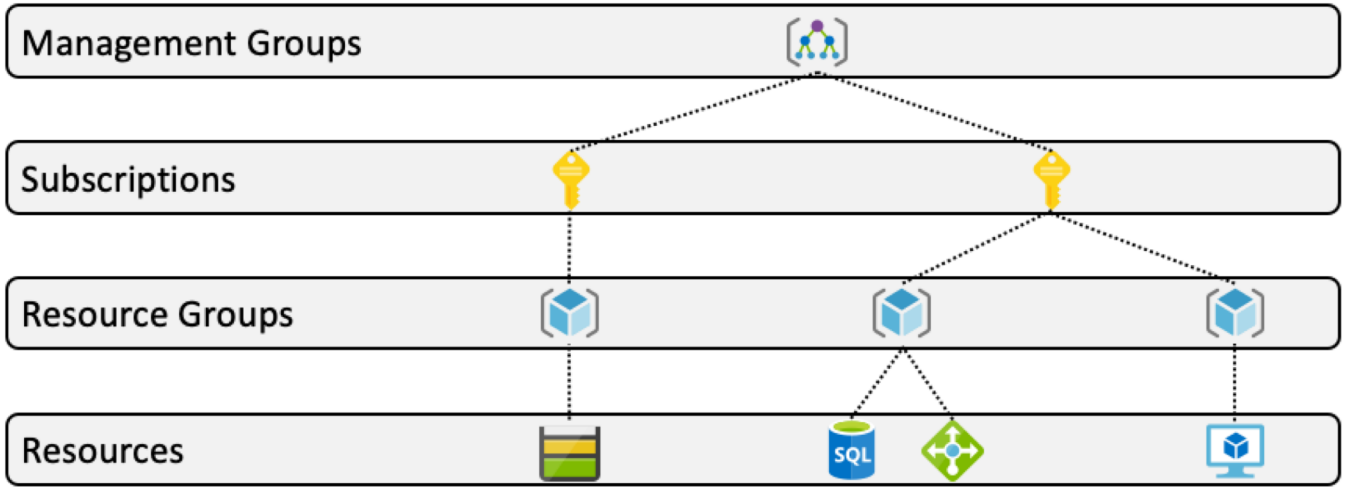
Module Completion & Exam Hints

Azure Resource Manager

Azure Resource Manager Overview

- Azure Resource Manager is the deployment and management service for Azure; it's a management layer that enables you to create, update and delete resources

- Management settings can be applied at any of these levels



Azure Resource Manager (ARM) Templates

- Declarative syntax
  - Deploy an entire infrastructure (vNET, VMs, etc.)
- Deployment Orchestration
  - Orchestrate the deployment of interdependent resources, so that they are deployed in the correct order
- Template is first validated, then deployed
- Create any resource in Azure and also supports integration with CI/CD tools

Azure Template - Create a Storage Account

```
"resources": [
 {
  "type": "Microsoft.Storage/storageAccounts",
  "apiVersion": "2016-01-01",
  "name": "mystorageaccount",
  "location": "westus",
  "sku": {
   "name": "Standard_LRS"
  },
  "kind": "Storage",
  "properties": {}
 }
]
```

- Resource provider - Resource
- Name
- Azure Region
- Type of Storage Account - LRS
- Resource Type - Storage

Azure Blueprints

Azure Blueprints Overview

- Azure Blueprints enables cloud architects to define repeatable sets of Azure resources that implement and follow an org.'s standards, patterns and requirements

- With Azure Blueprints, you deploy and update cloud environments in a repeatable manner, using composable artifacts – ARM templates, RGs, policy assignments, RBAC

- With Blueprints, the relationship between the blueprint definition and the blueprint assignment is preserved

Azure Blueprints

Azure Resource Groups

Resource Groups Introduction

- Resource Groups - logical containers for resources deployed in Azure
- All deployed resources (Azure services) are part of a single resource group; can be moved between RGs later on
- Resources in a RG can be deployed in different Azure regions, no restriction here

Resource Group

- In simple terms, we use RGs to better manage and organize our resources in Azure

Resource Groups – Organizing Principles

- Consistent Naming Convention for RGs
  - What it is used for ?
  - Types of resources in container ?
  - Type of the resource itself

- We can organize resources in many ways:
  - By environment: RG-Prod, RG-Dev/Ops, RG-Testing
  - By resource type: RG-VMs, RG-Storage, RG-VNETs
  - By department: RG-IT, RG-Marketing, RG-HR
  - By admin type: RG-Owner, RG-Contributor, RG-Reader
  - By lifecycle: RG-Project1, RG-Project2

Azure Tags

Azure Tags Overview

- Azure Tags - Tags are name/value pairs of text data that you can apply to resources and resource groups
  - Example: Name – "Environment", Value – "Production"

- You can attach/bind up to 50 tags to a resource

- Common use cases:
  - Cost center – who's paying ?
  - Department – HR, Finance, DevOps, etc.
  - Environment – Prod, Dev, Test, etc.
  - Automation start or shutdown – 9AM – 6PM

Azure Tags

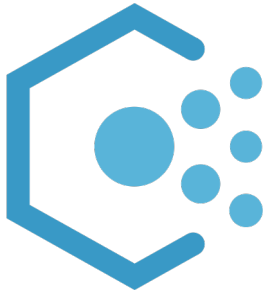
Azure Policy

Azure Policy Overview

- Azure Policy - establishes conventions or rules that resources must comply with

- Built-in Azure Policies are available by default, covering common scenarios

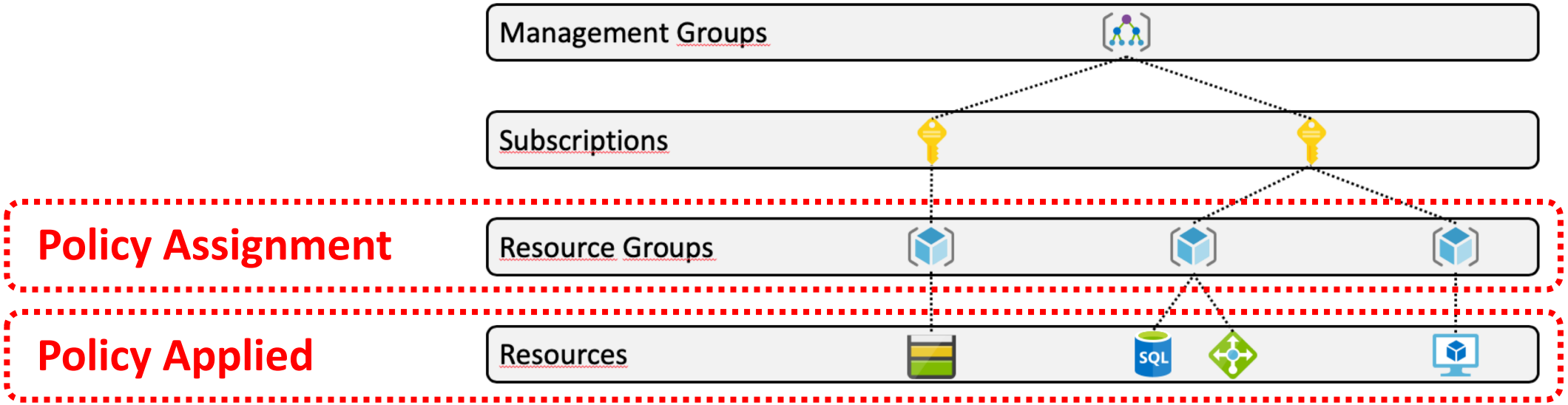
- Common examples:
  - Allowed Locations
  - Allowed Virtual Machines SKUs
  - Require a tag and its value on resources



Azure Policy

Azure Policy – Policy Assignment Scope

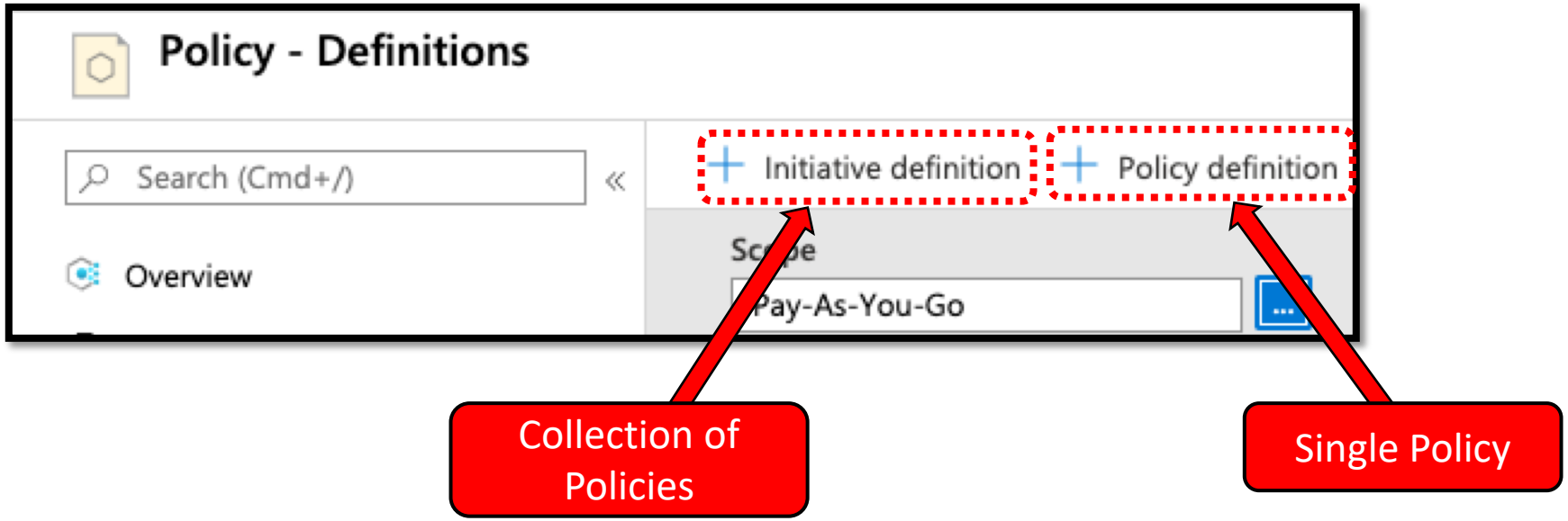
- Through policy assignment you apply the policy definition to a specific management scope



- Policy assignments are inherited by all child resources
  - Example: apply policy at RG level, then policy is applied to all resources in that specific RG (inheritance)

Initiative Definitions in Azure

- Initiative definitions group multiple policies together as one single item - initiative



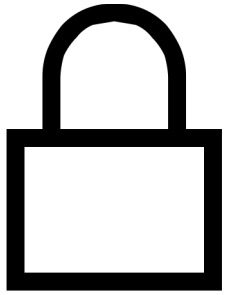
Azure Policy

Azure Locks

Azure Locks Overview

- Azure Locks – prevent users in your organization from accidentally deleting or modifying critical resources

- Two options are available:
  - Delete
    - Read and Modify a resource, can't Delete
  - Read-only
    - Read a resource, can't Modify or Delete



Azure Locks

Exam hints

Exam hints

- ARM templates provide a common platform for deploying objects to a cloud infrastructure and for implementing consistency across the Azure environment
- Azure Resource Manager templates is a great choice for automating the creation of the Azure resources
- Tags are NOT inherited by resources in a resource group
- Azure Policies enforce rules and guidelines, which take effect on new created resources

Exam hints

- Azure Locks apply to everyone, including global admins.
  - If you want to delete a resource or resource group that has a Delete lock applied, the lock must be removed first

ARM, Policies and Locks - Quiz

Module 9 – Monitoring, Privacy & Compliance

Module Completion & Exam Hints

Azure Compliance, Regulations & Standards

Azure Compliance, Regulations & Standards

- ISO – International Organization for Standardization
  - organization that defines international standards across all industries

- NIST – National Institute of Standards and Technology
  - organization that defines standards used by US government

- GDPR – General Data Protection Regulation
  - European policy that regulates data privacy and data protection

Azure Advisor

Azure Advisor – Exam Hints

- Azure Advisor
  - Tool that provides guidance and recommendations to improve an Azure environment – personal consultant

- Common use cases Azure Advisor covers:
  - View security recommendations
  - Reduce the cost of running VMs

Azure Monitor & Azure Service Health

Azure Monitor – Exam Hints

- Azure Monitor
  - monitor the health of Azure services

- Use cases Azure Monitor:
  - Monitor performance for Azure & on-prem resources
  - Monitor resources deployed in multiple subscriptions
  - Create and send alerts
    - i.e. based on data in Log Analytics Workspaces

Azure Service Health– Exam Hints

- Azure Service Health
  - View the health of all services in your Azure setup
  - Create rules to be notified if a service fails
  - Check planned maintenance events that affect your Azure resources

- Azure Service Health components:
  - Azure Status, Service Health and Resource Health

Microsoft Privacy Statement, OST and DPA

Privacy Statement, OST and DPA – Exam Hints

- Microsoft Privacy Statement - explains what data Microsoft processes, how Microsoft processes the data, and the purpose of processing the data

- The Online Services Terms (OST) provides terms or conditions for Online Services that are currently available

- DPA defines rules and obligations with respect to the processing and security of customer data and personal data in connection with Microsoft online services

Trust Center, STP and Compliance Manager

Trust Center, STP and Compliance Manager

- Microsoft Trust Center
  - compliance certifications list - determine whether Azure meets your company's regional requirements

- Compliance Manager from Service Trust Portal
  - evaluate if your company's Azure environment meets regulatory requirements

Monitoring, Privacy and Compliance - Quiz

Module 10 – Security in Azure Cloud

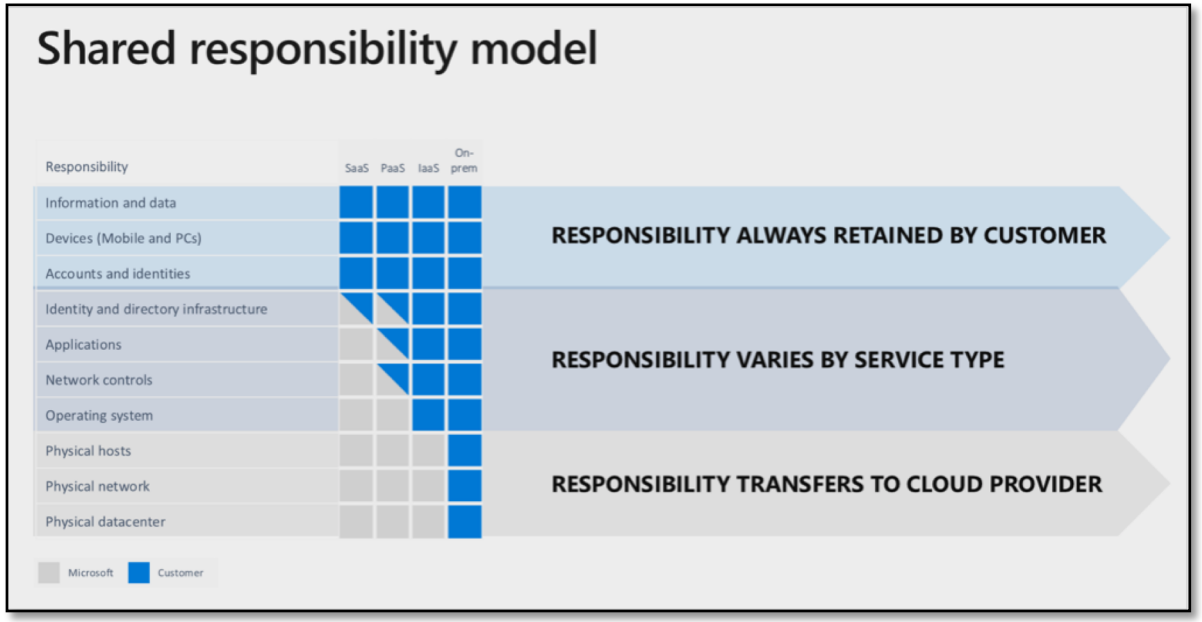
Module Completion & Exam Hints

Azure Cloud Shared Responsibility Model

Azure Cloud Shared Responsibility Model

- Responsibility + Security; it's about responsibilities and who manages Security in your cloud/hybrid environment

- Responsibility is shared between the cloud provider and the client



Azure Security Center

Azure Security Center Overview

- Azure Security Center is a monitoring service that provides threat protection across all of your services both in Azure and on-premises infrastructures

Azure
Security Center

- Security Center capabilities:
  - Just-in-time VM access
    - Enable time-based access
  - Adaptive app controls
    - Allow apps to run on Azure VMs
  - Adaptive network hardening - Fine-tune NSGs
  - File integrity monitor – monitors file changes on VMs

Azure Security Center Tiers

- Azure Security Center is available in two options:
  - Free and Standard

- Free Tier
  - Tier limited to assessments and recommendations
  - Azure Secure Score

- Standard
  - Continuous monitoring, threat detection, etc.

Azure Security Center

https://azure.microsoft.com/en-us/pricing/details/security-center/

Azure Active Directory

Azure Active Directory (AD) Overview

- Azure Active Directory (Azure AD) is Microsoft's cloud-based identity store; can integrate with your traditional on-premises Active Directory

- All your applications, running either in the cloud or on traditional infrastructures, can share the same credentials

- As a result of this, with Azure AD you centralize access control to all your apps and data, with a single pane of glass over identity management

Azure AD

Azure AD Capabilities

- Authentication
  - Identity verification for access to apps and resources

- Single-Sign-On (SSO)
  - Users can use a single identity (username and password) for authentication on all company apps

- User management
  - Customize and control how your users sign up, sign in; manage guest users and external partners, when using your apps

Azure AD

Azure AD Capabilities

- Conditional access to your apps
- Device management
  - Manage how your cloud and on-premises devices access your corporate data
- Privileged Identity Management (PIM)
  - Manage, control and monitor access within your organization

Azure AD

Azure Multi-factor Authentication

Azure MFA Overview

- Azure Multi-factor authentication (MFA) provides additional security for your identities by requiring two or more of the following authentication methods:
  - Something you know – e.g. password
  - Something you have – App on smartphone
  - Something you are – Biometrics; fingerprint or face scan

Azure MFA

- Azure MFA increases security of your identities, by requesting an additional authentication factor

Conditional Access and SSO

Conditional Access Overview

- Conditional Access – Azure AD capability that controls access to cloud apps based on conditions that you specify

Azure AD Conditional Access

- Conditional access policies
  - Allow or block access based on conditions
- Conditional Access policies are if-then statements

Conditions	Controls
When any user is outside the company network	They're required to sign in with multi-factor authentication
When users in the 'Managers' group sign-in	They are required be on an Intune compliant or domain-joined device

Single Sign-on Overview

- SSO allows users to login once and have access to various applications, no need to re-authenticate again

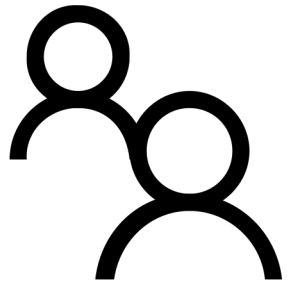
- SSO works with hybrid clouds (cloud + on-prem)
  - On-prem: Application Proxy
  - Cloud: Azure Active Directory

Azure Role-based Access Control (RBAC)

What is Role-based Access Control (RBAC)?

- RBAC - an authorization system that provides fine-grained access management to resources in Azure
  - How ? => Role assignments!

- RBAC Built-in Roles:
  - Owner – full access + assign permissions
  - Contributor – create and manages resources
  - Reader – can view resources
  - User Access Administrator – manage access to resources



Access Control (IAM)

How RBAC Works – Who, What, Where ?

- Role assignment – security principal + role + scope
- Security principal – WHO
  - User, group or application
- Role definition – WHAT
  - Collection of permissions
- Scope – WHERE
  - Where access applies to

Permissions are inherited

Azure Firewall and DDoS Protection

Azure Firewall Overview

- Azure Firewall is a managed, cloud-based network security service that protects your Azure Virtual Network resources
- You can use an Azure Firewall to grant access to resources in a VNET, based on the originating/source IP address
- Only sessions from these granted IP addresses will be allowed to the internal resource
- Access is permitted/denied through firewall rules that you create and specify ranges of IP addresses

Azure Firewall

DoS vs. DDoS. Azure DDoS Protection

- Denial of Service (DoS) is a type of attack that aims to overwhelm a network resource by sending huge number of requests, so that the resource becomes slow/unresponsive

- A Distributed Denial of Service (DDoS) attack occurs when multiple systems flood the bandwidth or resources of a targeted system, usually one or more web servers

- Azure DDoS protection provides defense against DDoS attacks

Azure Dedicated Hosts

Dedicated Hosts Overview

- Azure Dedicated Hosts allow you to provision and manage a physical server within Azure, that is dedicated to your Azure subscription

- Only your VMs run on the dedicated host!

- Pricing - per dedicated host !

Azure Key Vault

Azure Key Vault

- With Azure Key Vault we can ensure that the keys themselves are secure and store them in a centralized cloud service (AKV)

- Common use cases for Azure Key Vault:
  - Secrets Management – store tokens, passwords, certs.
  - Key Management – create and control encryption keys
  - Certificate Management – provision, manage and deploy private or public certificates

Azure Key Vault

Exam Tips !

Exam Tips !

- Azure Security Center can monitor Azure resources and on-premises resources
  - Not all Azure Security Center are free!

- From Azure Security Center, you can download a Regulatory Compliance report
  - Track and manage compliance over time

- Azure Security Center - Enable time-based access to VMs with Just-in-Time (JIT) VM feature (not free)

Exam Tips !

- Azure has built-in authentication/authorization services that provide secure access to Azure resources – Azure AD
- An Azure subscription is associated to only one Azure Active Directory (AD)
- Azure AD tenant is not deleted after your Azure subscription expires!
- Azure AD doesn't require implementing domain controllers on Azure virtual machines

Exam Tips !

- Azure AD supports Group Policies capability
- What devices can be Azure AD Joined?
  - Join Windows 10 devices only
  - IOS/Android not supported
- Azure Multi-factor Authentication (MFA)
  - Can be enforced for administrative and non-administrative accounts – i.e. Mary Jane and John Smith

Exam Tips !

- Azure Firewall – network traffic filtering across multiple virtual networks and multiple Azure subscriptions
- How many Azure Firewalls would you use to protect 100 VMs deployed in 10 virtual network? => only one ☺
- Azure Key Vault - Azure service that encrypts and stores credentials and certificates

Azure Security - Quiz

Microsoft Azure Fundamentals

Module 11 – Pricing and Cost Management

Module Completion & Exam Hints

Factors That Can Affect Costs in Azure

Factors that affect Costs in Azure

- Primary factors that affect your monthly cost in Azure are:
  - Resource type
    - Costs are resource-specific
  - Resource usage
    - Pay for what you use
  - Purchasing services on Azure
    - How you consume Azure (web direct, Enterprise, CSP)

Factors that affect Costs in Azure

- Location
  - Usage costs vary between locations

- Billing zone
  - Costs associated to data moving out of Azure DCs
  - Data going *into* Azure DCs is free, *outbound* data (data going out) is charged

Reducing Costs in Azure

Cost Reduction Best Practices - VMs

- Reserved Virtual Machine Instances
  - Purchase in advance a VM for 1y/3y in a specified region
  - Pay upfront and get up to 72% saving vs pay-as-you-go

- Spot Pricing
  - Purchase unused compute capacity
  - Up to 90% discount vs pay-as-you-go pricing

- Resize underutilized VMs
  - Over-sized VMs are a common unnecessary expense on Azure; make sure you right-size your VMs

Cost Reduction Best Practices - Infrastructure

- Run the VM only when needed
  - If the VMs are only used during normal office hours (9-18), schedule automatic shutdown

- Use low-cost locations and regions
  - Cost of Azure resources vary between regions and locations, choose wisely

- Change cloud deployment model
  - Where applicable, migrate to PaaS (vs IaaS), it's cheaper!

Cost Reduction Best Practices - Licensing

- Linux vs. Windows
  - Usually, Linux OS is cheaper
- Reuse Windows Server or SQL Server licenses
  - RTU to use existing licenses
- Use Dev/Test subscription offers – non-production
  - Save money on your Windows and SQL Server VMs
- Use SQL Server Developer Edition
  - Free product for nonproduction use

Azure Pricing & Azure TCO Calculators

Azure Pricing and TCO Calculators

- New or existing services - analyze and predict costs
  - Pricing calculator and Cost Management Advisor

- Workload migration to Azure – predict future costs/savings
  - Total Cost of Ownership (TCO) calculator

Azure Advisor & Cost Management

Azure Advisor Overview

- Azure Advisor is a free service built into Azure that provides recommendations on cost, security, reliability, operational excellence and performance

Azure Advisor

- 1. Resize or shut down underutilized VM instances
- 2. Eliminating unprovisioned ExpressRoute circuits
- 3. Buy reserved virtual machine instances
- 4. Delete unassociated public IP addresses

Azure Cost Management & Billing

- Azure Cost Management – Azure built-in free tool, that can be used to understand more about your spending in Azure

- Azure Cost Management main features:
  - Pay monthly bill
  - Download cost and usage reports
  - Cost analysis drill-down
  - Optimize spending

Cost Management

Exam Tips !

Exam Tips !

- Azure pay-as-you-go pricing is an example of OpEx, while reserved instances represent a CapEx cost
  - Deploying your own DC is also CapEx
- Payment is done on a monthly basis!
- An Azure free account has a spending limit - $200, and can contain a limited number of resources (hard coded)
- Configure Azure Budgets – set a specific spending limit and send email alerts when threshold/value is reached

Exam Tips !

- Resource groups or users in Azure AD are free to create
- Data transfers:
  - from on-prem to Azure, over a VPN, is free (inbound)
  - from Azure to on-prem, over a VPN is charged (outbound)
- Stopped VMs still generate costs – storage; pay less for VMs using Azure Reservations
- Two VMs of the same size (i.e. B2S) may generate different costs in a month period – think storage, data transfer, etc.

Exam Tips !

- Azure Advisor - tool that provides guidance and recommendations to improve an Azure environment

- Azure Advisor – DOES
  - how to reduce cost of running Azure VMs

- Azure Advisor - DOESN'T
  - improve your Azure AD security or VM config
  - generate list of VMs protected by Azure Backup
  - increase company secure score
  - force you to implement security recommendations

Azure Pricing and Cost Management - Quiz

Module 12 – SLAs and Service Lifecycles

Module Completion & Exam Hints

Azure Service Level Agreements (SLAs)

Azure SLA Overview

- Azure Service-level agreement (SLA) - formal agreement between Microsoft and the customer

- (Financially backed) SLA includes:
  - Commitments for uptime and connectivity
  - Service credits terms and conditions

- Composite SLA – result of multiple SLAs combined
  - SLA1 x SLA2 x … x SLAn = Composite SLA

Azure Service Lifecycle

Azure Service Lifecycle

- Service lifecycle defines how every Azure service is released for public use, as a production-ready service

- Two or three phases before General Availability (GA):
  - Private preview - optional
    - service available to some/certain customers
  - Public preview
    - Feature available to all Azure customers
  - General availability (GA)

Exam Tips !

Exam Tips !

- An Azure Service Level Agreement guarantees uptime!
- SLA guaranteed uptime for paid services is min. 99.9%
- Customers receive a (service) credit if their monthly percentage is below the guaranteed SLA percentage
- SLA is improved by adding services to multiple regions
- Composite SLA = product of individual SLAs
  - Composite SLA = SLA1 x SLA2

Exam Tips !

- Services in public preview are excluded from SLAs
- Private preview services are available to some customers, Public preview and GA services are available to everybody
- Private, public or GA services are available in Azure Portal
  - No SLA for private or public preview services
- Easy to distinguish public preview services - “preview”
- All preview services are migrated by Azure to GA

SLAs and Service Lifecycles - Quiz

Module 13 – Azure Account Cleanup

Let's Cleanup your Azure Account

Next Steps and Call to Action

- Cleaning up your Azure Account
- Practice before the real exam!
  - Two Exam Practice Tests – 1hour, 70% passing score
- Booking Azure Fundamentals AZ-900 Exam !

Thank you !