AZ-900: Microsoft Azure Fundamentals

Study Guide With Practice Questions & Labs

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About the Authors:

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Career Report: This report is a step-by-step guide for a novice who wants to develop his/her career in the field of computer networks. It answers the following queries:

What are the current scenarios and future prospects?
Is this industry moving towards saturation, or are new opportunities knocking at the door?
What will the monetary benefits be?
Why get certified?
How to plan, and when will I complete the certifications if I start today?
Is there any career track that I can follow to accomplish specialization level?

Furthermore, this guide provides a comprehensive career path towards being a specialist in networking and highlights the tracks needed to obtain certification.

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Our Products

Study Guides

IPSpecialist Study Guides are the ideal guides to developing the hands-on skills necessary to pass the exam. Our workbooks cover the official exam blueprint and explain the technology with real-life case study-based labs. The content covered in each workbook consists of individually focused technology topics presented in an easy-to-follow, goal-oriented, step-by-step approach. Every scenario features detailed breakdowns and thorough verifications to help you completely understand the task and associated technology.

We extensively used mind maps in our workbooks to visually explain the technology. Our workbooks have become a widely used tool to learn and remember information effectively.

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Our highly scalable and innovative virtualized lab platforms let you practice the IPSpecialist Study Guide at your own time and your own place as per your convenience.

Quick Reference Sheets

Our quick reference sheets are a concise bundling of condensed notes of the complete exam blueprint. It is an ideal and handy document to help you remember the most important technology concepts related to the certification exam.

Practice Questions

IP Specialists' Practice Questions are dedicatedly designed from a certification exam perspective. The collection of these questions from our Study Guides are prepared keeping the exam blueprint in mind, covering not only important but necessary topics as well. It's an ideal document to practice and revise your certification.

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About Our Products

Microsoft Certifications

Microsoft Azure Certifications are industry-recognized credentials that validate your technical Cloud skills and expertise while assisting you in your career growth. These are one of the most valuable IT certifications right now since Azure has established an overwhelming growth rate in the public cloud market. Even with the presence of several tough competitors such as Amazon Web Services, Google Cloud Engine, and Rackspace, Azure is going to be the dominant public cloud platform today, with an astounding collection of proprietary services that continues to grow.

In this certification, we will discuss cloud concepts where we will learn the core benefits of using Azure like high availability, scalability, etc. We will talk about the Azure Architecture in which cloud resources are put together to work at best; Azure Compute where you will learn how to run applications in Azure; Networking in which the discussion is on how Azure resources communicate with each other; Storage, where you put all of your data and have different ways of storing it. We will also be covering Databases that are used for the storage of data, its efficient retrieval as per demand, and to make sure that the users have the right access to the resources. Also, we will counter some complex scenarios with their solutions. We will have discussions on important topics like; Security, which makes Azure the best secure choice for your applications and functions; Privacy, Compliance, and Trust that make sure how services ensure privacy and how you stay compliant with standards; As well as, Pricing in Azure to stay ahead on cost.

AZ-900 is the first certification of Microsoft Azure, which is the foundational certificate in Azure. After this certification, you can

prove to the world that you are proficient and have the credibility to reach the highest point of your professional life.

Value of Azure Certifications

Microsoft places equal emphasis on sound conceptual knowledge of its entire platform, as well as on hands-on experience with the Azure infrastructure and its many unique and complex components and services.

For Individuals

Demonstrate your expertise in designing, deploying, and operating highly available, cost-effective, and secured applications on Microsoft Azure.
Gain recognition and visibility of your proven skills and proficiency with Azure.
Earn tangible benefits such as access to the Microsoft Certified Community, get invited to Microsoft Certification Appreciation Receptions and Lounges, obtain Microsoft Certification Practice Exam Voucher and Digital Badge for certification validation, Microsoft Certified Logo usage.
Foster credibility with your employer and peers.

For Employers

Identify skilled professionals to lead IT initiatives with Cloud technologies.
Reduce risks and costs to implement your workloads and projects on the Azure platform.
Increase customer satisfaction.

Types of Certification

Role-based Certification

Fundamental - Validates overall understanding of the Azure Cloud. Technical role-based certifications. No pre-requisite is required. Highest level technical role-based certification.

About Microsoft Certified: Microsoft Azure Fundamentals
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The Microsoft Certified: Candidates for this exam should have the foundational knowledge of cloud services and how those services are provided with Microsoft Azure. The exam is intended for candidates who are just beginning to work with cloud-based solutions and services or are new to Azure. Azure Fundamentals exam is an opportunity to prove knowledge of cloud concepts, Azure services, Azure workloads, security and privacy in Azure, as well as Azure pricing and support. Candidates should be familiar with the general technology concepts, including concepts of networking, storage, compute, application support, and application development. Azure Fundamentals can be used to prepare for other Azure role-based or specialty certifications, but it is not a prerequisite for any of them.

This exam measures your ability to accomplish the following technical tasks:

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%)

Recommended Knowledge

Identify the benefits and considerations of using cloud services
Describe the differences between categories of cloud services
Describe the differences between types of cloud computing
Describe the core Azure architectural components
Describe core resources available in Azure
Describe core solutions available in Azure
Describe Azure management tools
Describe Azure security features
Describe Azure network security
Describe Azure governance features
Describe privacy and compliance resources
Describe methods for planning and managing costs
Describe Azure Service Level Agreements (SLAs) and service lifecycles

All the required information is included in this Study Guide.
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Course Introduction

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AZ-900 is the first certification of Microsoft Azure, which is the foundational certificate in Azure. After this certification, you can prove to the world that you are proficient and have the credibility to reach the highest point of your professional life.

Chapter 01: Introduction to Azure

Introduction:

Azure, like Google and Amazon Cloud Platforms, is Microsoft's Cloud Platform. It is typically a platform that allows us to use Microsoft tools. We need tremendous amount of money, energy, physical space, etc. to set up the huge IT infrastructure. In such circumstances, Microsoft Azure comes to our rescue. It offers us virtual machines, fast data processing, analytical tools, and monitoring instruments to simplify our work. Azure pricing is also simpler and cheaper. It is commonly referred to as "Pay as You Go", meaning you only pay for the services when you are using them. Microsoft launched Azure's Windows at the beginning of October 2008 but it became live in 2010. Microsoft later changed the name to Microsoft Azure in 2014, from Windows Azure. It has become one of the leading cloud services used today and is only growing bigger by the day.

What is Cloud Computing?

Cloud Computing is basically storing data and accessing the computers over the internet. It is the delivery of different computing services like servers, software, analytics, databases, and storage via the internet. Computing resources are delivered on-demand through a cloud service platform with pay-as-you-go pricing. The companies that are providing services termed as "Cloud Providers". There are numbers of cloud providers like Amazon, Google and Azure.

Benefits of Cloud Computing

We all know that Cloud Computing has brought a major change in the traditional business thinking for IT resources. There are many benefits of using Cloud Computing. Some of which are:

Cost

Cloud computing eliminates the capital cost of buying hardware and software and of building and running in-house data centers – server racks, 24 hours' electricity for power and cooling, etc.

Scale Globally

Cloud computing services have the capacity to scale with elasticity. In cloud, it means that IT resources are provided more or less computing power, storage, bandwidth – as per requirement and from the right place.

Increase Speed and Agility

New IT resources are readily available so that resources can be scaled up infinitely according to demand. This leads to a dramatic increase in agility for organizations.

Reliability

Cloud computing allows data backup, disaster recovery and business continuity as data can be replicated in the network of the cloud supplier on multiple redundant sites.

Security

The protection of their data is one of the main problems for any organization regardless of its size and industry. Infringements of data and other cyber-crimes can devastate the revenue, customer loyalty, and positioning of a company. Cloud provides many advanced security features to strengthen the security of the overall company. It also helps in protecting your data, application, and infrastructure.

The Economy of Cloud Computing

In the traditional environment of organizations, as there is a need for large investments on CapEx, Cloud is the best way to switch to the pay-as-you-go model. Cloud reduces the Capital Expenditure (CapEx) cost and also gives some other benefits. With Cloud Computing, you should move toward Operational Expenditure (OpEx).

Mostly in Azure, the pricing is based on an hourly basis like VMs, App Services, etc. There is also consumption based pricing which is on the basis of per execution of function, per second use of resource, or both. An example of consumption based pricing is Azure Function.

Exam tip:

Capital Expenditure (CapEx) is the expenditure to maintain or acquiring fixed assets by spending money. This includes land, equipment, etc.

Operational Expenditure (OpEx) is the cost of a product or a system that is running on a day-to-day basis like electricity, printer papers, etc.

Technical Terms

To understand Cloud Computing, you need to understand some technical terms.

High Availability (HA) - it is the core of cloud computing. As we know that in traditional server environments, companies own a number of hardware and the workload is limited to this hardware capacity. In case of extra load, capacity cannot be increased whereas, sometimes this hardware seems extra for the workload. In cloud, you do not own any of the hardware and addition in servers is just a click away. This way, you get high availability for your servers by replacing instantly the failed server with the new one. HA depends on the number of VMs that you set up to eventually cover in case one goes down

Fault Tolerance - for resilience in the cloud, fault tolerance is also an important factor. Fault tolerance gives you zero down time. Fault tolerance means that if there is any fault from the Azure side, then it is immediately mitigated by Azure itself

Disaster Recovery (DR) - in case of any catastrophic disaster like cyber-attack. There is a plan in DR to recover your business from these critical systems or in normal operation if such an event occurs. DR has designated time to recover and a recovery point

Scalability - in cloud computing, scalability means addition or removal of the resources in an easy and quick way as per demand. It is important in such a situation where you do not know the actual number of resources that are needed. Auto-scaling

is an approach for scalability depending on your requirement by defining the threshold

Elasticity - Elasticity is the capacity to dynamically extend or minimize network resources to respond to autonomous working load adjustments and optimize the use of resources. This can contribute to overall cost savings for services

Agility - Agility is the capability to adapt quickly and efficiently to changes in the business environment. Agility also refers to the ability to quickly develop, test and deploy business-led software applications. Instead of providing and managing services, Cloud Agility lets them concentrate on other issues such as security, monitoring, and analysis

Exam tip:

From the Exam perspective, one must be familiar with all the terms like HA, Fault Tolerance, DR, Elasticity, Scalability, and Agility.

Types of Cloud Computing

The cloud computing services are divided into four broad categories: IaaS, PaaS, Serverless, and SaaS. These are also known as a stack in cloud computing because each of them is built on top of another. Let's discuss each of them.

Infrastructure as a Service (IaaS)

It gives you a basic IT infrastructure for Cloud IT like VMs, Data Storage, Networks, OS on a pay-as-you-go model.

Platform as a Service (PaaS)

Cloud computing platforms that provide an on-demand environment to build, test, deliver and manage software applications are referred to as Platform as a Service. PaaS is designed to facilitate the fast development of web or mobile apps for developers without the concern of setting or maintaining the underlying server, storage, network, and database infrastructure that are needed for development.

Serverless

Overlapping PaaS, serverless computing concentrates on creating application functionality, without continually spending time maintaining the required server and infrastructure. The cloud provider is responsible for the configuration, capacity planning,

and server governance. The highly scalable and event-based serverless architectures only use resources when a particular task or trigger takes place.

Software as a Service (SaaS)

Both servers and code are taken over by cloud providers. Cloud providers are hosting and maintaining the applications and underlying infrastructure for SaaS and handling updates such as software upgrades, and security patches. Users link the app over the Internet, usually through their phone, tablet or PC through their web browser.

Figure 1-01: Iaas, PaaS and SaaS Overview

tip

IaaS- servers, storage, and networking

PaaS-servers, storage, networking, and management tools

SaaS- a complete application like Office 365

Serverless- no need of server; there is a single function that is hosted, deployed and managed on its own

Cloud Computing Deployments Models

We know that all clouds are not the same and not every business requirement for cloud computing is the same. So, in order to meet the requirements; different models, types and services have been used. Firstly, you have to decide how the cloud service is being applied by finding out the cloud deployment type or Architecture. There are three different types of Cloud Computing: Public, Private and Hybrid.

Figure 1-02: Types of Cloud Computing

Figure 1-03: Public, Private and Hybrid Cloud

What is Azure?

Microsoft Azure is known as Windows Azure and it is a Public Cloud. We have already learned in the above discussion about Public Cloud. As for Azure, it is an expanding cloud service that helps the companies to meet their challenges. It is free to build, manage and deploy applications with your favorite tools and frames in a huge, global network. Azure is considered for offering both IaaS and PaaS. Azure offers over 100 services, from the execution of existing applications on virtual machines to exploration of new tech paradigms like smart bots and mixed reality.

In order to use Azure, you first need to setup an Azure account directly by going to "Azure.com" or with the help of a representative. You can sign-up to Azure as a Free account with free USD 200 credit and 25+ free services.

Azure, for example, offers AI and machine learning tools that can communicate with your customers through vision, hearing, and speech. It also offers solutions for the storage of massive amounts of data, which are increasing rapidly. Azure services gives solutions that without Cloud resources, are much expensive.

Figure 1-04: Azure Benefits

Azure Market Place

The Azure market place offers technical solutions and services from Microsoft and partners to build and extend Azure products and services. It has all kinds of services and applications like VMs, Templates, apps, and Azure managed services etc. There is an Azure App Store in your mobile for buying cloud services, where you have a variety of solutions including base OS, database, security, networking and developer tools. For accessing all of these you can either go directly to the website of market place or use Azure CLI or integrate with Powershell. From the catalog, you can add anything to subscription. Some services are free and some are charged. In order to publish your own product in the Market Place, you need to become partner with Microsoft so that it becomes a distribution channel for your business.

Global Footprint

Azure has more global regions than any other cloud provider — which offers the scale required to bring users around the world closer to applications, preserve residency and provide customers with comprehensive compliance and resilience options. There are 54 regions of Azure that are available around the world with 140 regions.

Regions

Regions are geographical areas where Azure is present to deploy the Azure resources. It is a set of data centers with latency-defined perimeter connected via a dedicated regional low-latency network. There are region specific services but some core services like storage and VMs are by default live in all regions.

Exam tip:

Dedicated Regional Low Latency network means there is a fiber connection between data centers in the region.

Figure 1-05: Azure Geographical Region

How to Choose a

When you are choosing a region, you need to think about three things mainly:

in order to reduce the latency, choose a region closest to the user
all features are not available in all regions, so select a region where your specific feature is available
service prices in Azure vary from region to region

Geographies/Paired Regions

Geography is a distinct market that usually conserves data residence and compliance boundaries with two or more regions within the same geographic area.

Geographies enable customers with particular data residency needs to maintain their data and apps in close proximity. Geographical areas are fault tolerant to whole failures in the field by linking them to Azure's dedicated networking infrastructure. So

if the primary region goes down, it failovers to the secondary region. In the paired region, only one region is updated at a time. For some services, paired regions are used as replications.

Availability Set

An Availability Set is a logical grouping function that can be used to separate VM resources from each other. Azure must ensure that your VMs are operating across several physical servers, device tables, storage units and network switches within an availability set. If a hardware or software failure occurs, only the VMs will be impacted, and the overall solution will remain operational.

Availability Zone

Availability Zones (AZ) are locations within an Azure region that are physically separate. An availability zone is composed of one or more independently operating power, and network data centers. Each region has a minimum of three zones.

Availability zones allow clients to run high-availability and low-latency mission-critical applications.

Figure 1-06: Region, AZ, and Paired Region

Azure Resource Manager (ARM)

It is an underlying service where the Azure resource deployment and management is done. It provides a management layer, which lets you create, upgrade, and uninstall your Azure subscription tools. You use management features such as access control, locks, or tags to ensure that your resources are protected and organized after deployment.

A Resource is a manageable item that is available in Azure like VM, storage, databases, etc. Each resource can reside only in one resource group

Resource Groups are the place where you deploy your resources. Here, you need to identify which resource group you want to deploy a resource. It is like a container where all resources of a solution or the resources that you want to manage in a group reside. The resource from the resource group can be added or removed at any time. You can move your resources from one group to another and the resource from multiple regions can be in one resource group as well. With the resource group, you have access control to the resource. The resources in different resource groups can interact with each other

Resource Provider is a service that supplies the resources that you can deploy for a manageable resource for the resource manager

Resource Manager Template is a JavaScript Object Notation (JSON) file that defines the resources deployed in the resource group. It also defines the dependencies between the deployed

resources. With this template, resources can be deployed in a consistent and repeatable way

ARM Benefits

You have group resource handlings like deploying, management, and monitoring
You get consistency; For example, when you deploy resources, it will be happening in the same way as every time
Dependencies of each resource so no other will get into the resource
Access Control, which is built-in to assign access to the users
Tagging, which makes it easier to identify the resource in the future
For billing, you can use tagging to stay on top

Exam tip

The resource group itself is not a resource, it helps in the structure of Azure Architecture.

Azure Services

There is a number of available services and features in Azure. The most commonly used categories are:

Compute
Networking
Storage
Mobile
Databases
Web
Internet of Things
Big Data
Artificial Intelligence
Security and Identity
Monitoring and Management

Figure 1-07: Azure Services

Compute

In Azure, there is a number of options that are available for application and service hosting. Azure Compute provides you an infrastructure where you can run your applications.

Azure Virtual these are Linux and Windows VMs on demand with your desired configuration hosted in Azure. The supported Linux distributions are CentOS, Oracle Linux, RHEL, Debian, openSUSE, SUSE LES, and Ubuntu. There are 6 types of VMs with 28 families. There is a set amount of Memory, vCPUs and Temporary Storage. You can also attach additional data disks to these VMs. Pricing is based on per minute billing. Reserved VMs are also available for significant discounts, like you can get discounts up to 72% on a pay-as-you-go model

App Service - it is a PaaS that provides a fully managed platform for creating cloud applications for web and mobile. It is used to host web applications, mobile app back ends, RESTful APIs and automated business processes. The programming languages that are supported by App Service are .NET, .NET Core, Ruby, Java, PHP, Node.js and Python

Azure Function – a serverless compute that enables you to automatically run code on demand. Azure Function is an event driven service for accelerating app development. It is FaaS that executes the code in response to an event or trigger. Its billing is done when code is executed; in the idle state, it is not charged. Its supported languages are C#, F# and JavaScript, and currently Java is in preview state. Azure Function is a part of App Services that can run in App Service Plans (from free to isolated plan). In free account, the first 1 million executions/month are free

Azure Batch - a managed service for batch processing jobs like for running large-scale parallel and High-Performance Computing (HPC) applications. It has the ability to scale to tens, hundreds, or thousands of virtual machines as per requirement. It supports both windows and Linux compute nodes. This service is free and you only need to pay for the resource that are used in your task

Azure Kubernetes Service - a managed Kubernetes Container Orchestration for simplifying the deployment, management, and operations of Kubernetes. It gives you automatic upgrades and patching. Azure Kubernetes Service enables you to manage the cluster of VMs on which containerized app is running. It also supports other orchestration like DC/OS, Docker, and Un-managed Kubernetes, but these are not managed. Here, you only need to pay for agent nodes not for the master node

Azure Container Instance - a containerized service that is used to run an application on Azure without provisioning the VMs and servers. You can easily run the container with a single command. It gives you an individual container as a service. Azure Container Instance is the fastest and easiest way to run a container in Azure. It is good for applications that run in an isolated container. The applications are publically addressable and the container spec can be designed by you. The billing is per-second based

Service Fabric - a distributed network framework that is capable of operating in various environments, Azure and on-site. It creates Windows and Linux micro services and orchestrates containers. Service Fabric is used by multiple Azure and Microsoft services like Skype, CosmosDB, Cortana, etc. It supports both stateful and stateless micro services. Its supported community is .NET but it also supports other languages and containers

Cloud Services - a managed service for cloud applications. It is actually a PaaS offered by Azure. It is similar to App Services but with the difference that you can remote it into VMs. It creates highly available, flexible cloud applications and APIs to concentrate on software rather than hardware. It has two types of services: Web Roles that are websites and web apps, and Worker Roles that are for asynchronous processing

Figure 1-08: Azure Compute

Networking

The key function of Azure networking is the relation of compute resources and access to applications. In Azure, a network interface includes a number of options in global Microsoft Azure data centers that link the outside world to services and apps. There are various networking services in Azure that can be used individually or together. Azure networking provides you the most secure environment for your data as compared to any other Cloud Platform.

Virtual Networks - allows your Azure resources to communicate with each other over the internet or on-premises network, in a secure way. It is also known as VNET and is an isolated network where you host your VMs, VM Scale Sets and App Service environments. Virtual Networks are composed of subnets with user defined routes where you define the route to send the traffic and the destination from where it comes in. With Virtual Network, you can add Security Groups and outbound internet access to the resources. In Virtual Network, you have the capability of VNET Peering, where you connect two VNETs together. VNET peering can be done within the same region or across the region for global coverage. However, across-region VNET peering is supported in only a few regions currently. There is also a Service Endpoint feature that enables you to access the services within your VNET by creating a private connection to that resource rather than using the internet. This endpoint feature is only available in Storage account and SQL databases

Azure Load Balancer - balances the incoming and outgoing traffic to and from the application resources and service endpoints. It gives basic load balancing features to your VMs and operates at layer 4 (Transport layer of the OSI model). It has a public or internal load balancer. A public load balancer is internet facing while internal load balancer is used within the VNET. Azure Load Balancer provides regional load balancing by routing traffic over availability zones and into your VNets. It provides internal load balancing by routing traffic across and from your local resources within VNET. It has HTTP or TCP based probes for health checks and availability. It uses hash based load balancing to balance the load inside the VMs that are behind your load balancer

Application Gateway – s a cloud load balancing device to handle web app traffic. It is Layer 7 load balancing that uses HTTP

based Round robin. It optimizes application server delivery while increasing security for applications with a web application firewall. It also offers some other features like SSL Offloading, stickiness for some cookies based session affinity at the backend to maintain the state for the user between the connection of user with a single VM. It also provides support for client connected applications by Web Socket. It has internal and external load balancing, similar to the public and internal load balancer but they are at higher level

VPN Gateway - sends encrypted traffic across the public internet between an Azure virtual network and an on-site location. Azure Virtual Networks are accessed through high performance VPN Gateways in a secure way over the internet. VPN Gateway supports both Site-to-Site VPN and Point-to-Site VPN. You have one VPN gateway per VNET then you have the ability to have multiple connections per VPN Gateway. In that, you can perform Static or Dynamic Routing

Azure DNS - hosts DNS domains with the same credentials of Microsoft Azure infrastructure to provide name resolution with fast DNS response and high domain availability. In Azure DNS, you cannot purchase the Domain name. For DNS, you pay per zone, per month, and then per million queries. The pricing of per zone changes depending upon the zone. Private domain support currently is in preview state

Traffic Manager – is a global traffic router that distributes DNS-based traffic to services across the Azure region in order to get the best available endpoint, providing high availability and responsiveness. It supports 4 routing methods: priority, weighted, geographic and performance. Depending on the routing method and health checks, the traffic will be sent. It can be used to build multi-region architecture like web applications

Content Delivery Network (CDN) - provides users with high bandwidth content. To reduce latency, CDNs save cached content on edge servers at POP locations near to end users. Edge servers are the smaller data centers. It is mainly used for static assets like media, images, etc. It also supports Dynamic Site Acceleration by optimizing the route between the requester and the origin for dynamic content because it does not cache the dynamic content on the edge servers. In Azure, CDN is actually provided by Akamai and Verizon. The billing is based per Gb outbound per month and the rates can change on zone basis

Express Route - ExpressRoute allows you to extend your on-premises networks to Microsoft Cloud by a connectivity provider's private connection. This is a private connection. There is no traffic going on the internet. Connections to cloud services such as Microsoft Azure, Office 365, and Dynamics 365 can be built with ExpressRoute through stable high bandwidth connections. The dedicated link is up to 10Gbps. With that, you have two options: either you have connectivity to MPLS or to the on-premises network. This is good for DR or hybrid cases

Figure 1-09: Azure Networking

Storage

Azure Storage is a cloud storage system from Microsoft that helps to store up-to-date files. Azure Storage offers an extremely scalable data object store, a cloud file system service, a reliable message store, and a NoSQL store. Azure Storage is secure, highly available and durable, scalable, managed and accessible. You must first create an account in Azure to use any kind of storage there, the storage account is the parent object. You can move your data to and from your storage account after your account has been established. You can also build a storage account for up to 500TB of cloud data because it has a limit of 500TB per storage account. To manage your expenses, use a Blob storage account and hot or cold access tiers depending on how often the object data is accessed. A storage account can be of two types: Standard and Premium accounts.

In Azure Storage, there are multiple types of replication: Locally Redundant Storage (LRS), Zone Redundant Storage (ZRS), Geo-Redundant Storage (GRS) and Read Access Geo-Redundant Storage (RA-GRS). In Azure Storage, there are also various tiers of

Storage: Archive (for Blob only), Cool Storage (for infrequently accessed data) and Hot Storage (for frequently accessed data).

Blob Storage - Azure Blob Storage is Microsoft's cloud object storage solution. Blob storage is for storage of large volumes of unstructured data, like text or binary data. It is an internet accessible Objet Store via HTTP or HTTPS. In that, you have an option to make your data either public or private. The hierarchy is like: Storage Account -> Containers -> Blobs. A blob is an object which is in the container. It also has an archiving tier available

Queue Storage – Azure Queue Storage is a data store for queuing and for the reliable provisioning of messages. It is a managed queuing service through which you get secure storage for communication between apps based on the message. Messages in the queue can be up to 64 KB and millions of messages can be stored in a single queue. A queue is generally used to store asynchronous lists of messages. It is useful for de-coupling applications. The life time of a message in the queue is 7 days

File Storage- Azure File Storage makes the use of a regular SMB (Server Message Block), to set up a highly available network of file shares. You also can read files via the REST interface or libraries for the storage client. The cloud or on-site implementations of Windows, Linux, Mac OS installs Azure file shares concurrently. Azure file shares can also be cached with Azure file sync on Windows Servers for easy access close to the data point. You can also use it as a shared file system for the apps that lift and shift into the cloud. The maximum file share size is 5TB

Table Storage- Azure Table Storage is a service that stores NoSQL unstructured data in the cloud and offers a schema less design for providing a key/attribute database. Since table storage is

schema less, the development of your application will make it easy for you to adapt your data. In table storage, there can be as many entity and tables as you like. The maximum entity size can be up to 1MB. Access to table storage data for many types of applications is fast and cost effective and is typically lower than conventional SQL for similar data volumes. It has now become a part of Cosmos DB. A new Azure Cosmos DB Table API is introduced in addition to the Azure Table storage service, which offers tables, global distribution and automated secondary indexes.

Disk Storage – Azure Disk Storage provides a managed or unmanaged disk for your VMs. Managed disk takes care of the storage account and disks for you, and you pay for what you provisioned while in un-managed disk, as you have to manage the disk itself but you only have to pay for what you use. It has 99.999% availability with three replicas. The available types of disk storage are Ultra-Disks, Premium Solid-State Drives (SSDs), Standard SSDs, and Standard Hard Disk Drives (HDDs). In premium, you have an option of disk IOPS that are provisioned and these are mapped on disks not on VMs. However, not all VM families support the premium disk type. In Standard disk, the IOPS are not provisioned via disk so it varies with VMs. The size for the disk storage is from 32 GB to 4 TB, but you can attach multiple disks to a VM

Figure 1-10: Azure Storage

Data and Analytics

Data is available in all sizes and formats. Big Data refers to large volumes of information, for example, the hundreds of gigabytes of data produced by weather systems, communications systems, genome analysis, imagery platforms, and many other scenarios. The volume of data makes it difficult to interpret and determine. It is often so large that it is no longer appropriate for traditional methods of processing and analysis.

To cope with these large data sets, Open Source cluster technologies have been developed. Microsoft Azure offers a wide range of Big Data and analytics tools and services.

HDInsight - is an open source fully managed analytic service. It processes huge amounts of data in the cloud with managed Hadoop clusters. The 99.9 % SLA for your business is given by this. It is basically a Hadoop component from HDP (Hortonworks Data Platform). It is used for running streaming and historical data analytics. The open framework for HDInsight includes hive,

spark, Kafka, storm, etc. The use cases for this service are batch processing, data science, and many more

Event Hub - is a large scale telemetry ingestion that allows you to run millions of events per second. You can use it to load a large amount of data in to the cloud in real time. It captures data into the Azure Blob or Data Lake and then publishers send this data into the event hub. Then from these hubs, the consumer reads data. The retention period of an item in hub is 7 days

Data Lake Store and Analytics - Azure Data Lake provides all the capabilities to make storing data of any scale, shape, and speed and processing and analytics across platforms and languages simple for developers, data scientists, and analysts. This eliminates the complexity of ingesting and processing all your data and makes the process of batching, uploading, and immersive analysis easier. Data Lake Store is a repository for the analytics workload, is HDFS compatible, and can integrate with HDInsight. It has no data storage limit. Data Lake Analytics is a completely managed pay-per-job analysis service with corporate security, auditing, and support. It uses U-SQL language, specifically designed for Data Lake Analytics, that combines SQL and uses C# code to perform analytics. Data Lake Analytics can work with Data Lake Store and others.

Data Factory - is a fully managed cloud based data integration service. Big data demands for the service to organize and operationalize processes and refine these huge raw data stores into operational business insights. This is an integrated cloud service for complex hybrid Extract-Transform-Load (ETL), Extract-Load-Transform (ELT), and data integration projects. It is a service that automates the data movement along its process through various systems. SQL Server Integration Service built-in V2 of Data Factory is in preview, which is the transformation process of ETL

Azure Analysis Service - is an analytic engine as a service for enterprise grade. It uses advanced computing and mashup to combine data from several data sources, set metrics, and secure data in an advanced single table of the semantic data model for query purpose. The data model makes searching vast volumes of data for ad hoc data analysis easier and quicker for users. It supports hybrid network and it has built-in SQL Server Analysis Service

Figure 1-11: Data and Analytics

Databases

Azure Database is a fully managed service. It has business-grade efficiency with integrated high availability that ensures you can easily scale and hit global distribution without needing to pay attention to costly downtime.

SQL DB - is a fully managed relation database with high availability and performance data storage for applications. In that, you have two deployment options: Single DB and Elastic Pools. In Single DB, you pick a single service and scale it up or down in a single database while in Elastic Pools, a pool of resources is shared across number of databases. With Elastic Pool, you get better optimization. It has Database Transaction Unit (DTU) purchasing model. The purchasing model DTU provides a mixture of computing, storage and I/O services in three levels, supporting light to large databases. SQL DB shares its code base with MS SQL server, which means that SQL DB gets updated first before rolling out to the MS SQL server, this way, it will be up to date with the feature of an SQL server. It has built-in intelligence via auto tuning

Azure DB for MySQL and Postgre SQL - Both of the databases are fully managed and relational databases. They both are scalable databases with security and high availability. They both have a pay-as-you-go pricing model

SQL Data Warehouse - This is a managed petabyte data warehouse with complete security at all levels without additional costs. It uses a massively parallel processing technique to run complex queries along with this data. The data is imported into the Data Warehouse by Polybase. The data storage is in Columnar storage in a relational database that reduces the query time as well as storage. The billing is on compute Data Warehouse Unit (cDWU). There are two performance tiers: one is Elasticity, which is for short burst and peak activity. The other is Compute Optimized performance, which uses SDD for frequently accessed data and is recommended for fat performance requirements. You can map any type of data on SQL Data Warehouse.

Cosmos DB - This is a non-relational database with low latency and high availability. It is a globally distributed and multi-model service which includes SQL, MongoDB, Cassandra, Table, and Germlin (raph). It gives you a guaranteed throughput and, within a single region, it gives you 99.99% availability. It offers you turnkey global replication. Cosmos DB replicates your data transparently wherever your users are so that they can interact with a replica of the data closest to them. It offers you five consistency models, from Strong SQL to relax NoSQL (the models include strong, bounded staleness, session, consistent prefix, and eventual consistency). It also automatically indexes all your **Cache -** It is managed in-memory cache service with quick, scalable, open-source compatible data store for applications. It frequently uses caches and static data to minimize storage and latency of the application. It comes in three tiers: basic tier that is with a single node and used for test and dev, and non-critical workloads with volume of up to 350GB. Standard tier is two replicated nodes in primary and secondary configurations with a high-availability SLA (99.9%) and is managed by Microsoft. Premium tier offers caches with more functionality and with lower latencies and higher throughput. Premium tier caches are used on more powerful hardware that performs better than the basic or standard tier. It is useful for snapshots and VNET integration. Its size can be up to 530GB

Figure 1-12: Azure Databases

Web and Mobile

A great web experience is important in today's business. Azure provides premium support for the creation and management of web applications and HTTP-based web services. Azure build engaging cross platforms for Android, iOS, and Windows applications with no compromises that will suit your business needs and reach your customers wherever they are. You can power your apps with smart back-end services and simplify your development cycle faster and more confidently.

App Service - is PaaS in Azure. It allows you to create and host web apps, mobile back ends and RESTful APIs without network maintenance in the programming language of your choice. It supports both Windows and Linux, automatic deployment from GitHub, Azure DevOps and any Git repo. It offers high availability and auto scaling. The supported languages are .NET, .NET Core,

Ruby, Java, PHP, Node.js and python. App Service runs in various "App Service Plans" from free to isolated

API Management - API Management (APIM) is a way of creating reliable and functional back-end API gateways. API Management enables companies to publish APIs to external, partner, and internal developers to unlock their data and service potential. API Management consist of the following components:

API Gateway has a tunnel feature that accepts the API calls and routes it to the backend. API gateway offers authorization and caching.

Developer Portal is for developers that are used for developing the API. It is provided with documentation and different level or access requirements.

Azure Portal is for the user to develop the API. Users can import existing APIs and create API products.

Media Services - Cloud-based media workflow platforms allow you to build solutions requiring encoding, packaging, content protection and live broadcasting of events. The protection of the content is done via encryption. It also has streaming URLs that you provide to the user to download the streaming asset

Notifications Hub - gives you an ability to send mobile push notifications from any back-end (cloud or on-site) to any platform (iOS, Android, Windows, Kindle, Baidu, etc). For both corporate and customer applications, the Notification Hubs work well. You can also segment the user notification on the basis of tags so that certain notifications are sent to a certain group of users. You can also tailor your notification using user's language and their

location. Scheduling of notification is also available. With this, you can also send silent push notifications to your application

Azure Search - Azure Cognitive Search is the only cloud search service that has built-in AI capabilities, enriching all kinds of information for easy content recognition and discovery. It also performs a full text search using simple or lucent query syntax. The data uploaded is in JSON format. It also has the ability to auto crawl various Azure services to get the data automatically. The supported services are Azure SQL DB, Cosmos DB, and Azure Blob Storage. It supports filter, paging, and sort for searches. It also has the ability for geo-based searches.

Figure 1-13: Web and Mobile

Security and Identity

We know that safety is one thing in the cloud and it is very important to have accurate and timely Azure Security information. Azure has a wide range of security tools and features that make it the best reason to use for your applications and services.

Integrated Azure security services protect data, applications, and infrastructure quickly, this includes unparalleled security intelligence to help in identifying rapidly changing threats earlier, so you can react faster.

You can protect Azure identity and access management solutions for your applications and data on the front door. Defend malicious login attempts and secure passwords through risk-based access controls, identification security tools, and efficient authentication options, without interrupting productivity.

Azure Active Directory - is a cloud-based identity and access management service in Azure. It is one of the core services of Azure. With this service, the user can sign in and access the internal or external resources. The access can be role based and controlled access on various resources. With this, you can SSO for multiple clouds based SaaS applications with your company credentials. You can also authenticate your own applications by integrating it with this. You can also integrate your on-premises Windows AD

Azure Active Directory B2C - gives consumer identity and access management for your consumer based application. Your consumers can use their favorite social, company or local identity accounts to access your apps and APIs in an SSO interface. It is different from normal AD as it uses consumers to login and authenticate. It supports multiple languages

Azure Active Directory Domain Service - Azure Active Directory Domain Services (Azure AD DS) offer fully Windows Server Active Directory-compatible, managed domain services such as Domain Join, Group policy, Lightweight Directory Access Protocol (LDAP) and Kerberos. There is no need of installing, maintaining and

patching domain controllers in the cloud. You can use these domain services without a domain controller. It can be used in Cloud Only and Hybrid as well

Key Vault - This is a security service that can be used for key management in encrypted form. When you deploy an application in the cloud, there are secrets and keys that are needed to access the DB or third-party systems so you need some service to store them. A key vault is the most secure place for this. Keys in the key vault are protected by HSMs. For your own keys, it uses FIPS 140-2 Level 2 validated HSMs. With this, you can get real time usage logs of keys.

Security Center - is a centralized network security management system that improves the security position of your data centers and provides advanced threat safety through your hybrid cloud workloads–whether in Azure or on site. It continuously checks your resources against the policy in order to inform you about any incident at its earliest. If it finds any incident, it gives you a recommended action in order to resolve the issue. It also gives you a prioritized alert functionality as well. It comes in two tiers: free or standard. The standard is $15 per server/month.

Figure 1-14: Security and Identity

Monitoring and Management

Azure management and governance tools help system managers and developers to secure resources and maintain compliance, both in-house and on the cloud. During the IT cycle, it monitors the infrastructure, software, system provision and set-up, app-updating, vulnerability detection, backup resources, disaster recovery, policy implementation, process automation, and even the management of costs.

Azure Policy - through this you can set and manage policies across the resources and monitor compliance

Azure Monitor - provides basic monitoring of Azure resources. It helps you understand how your applications work and recognize challenges and tools that impact them proactively. With this, you can monitor metrics, activity log and diagnostic log

Application Insights - a feature of Azure Monitor, is a robust APM (Application Performance Management) tool for Developer and Technical DevOps. You can use it for live application monitoring. This operates with applications on a wide range of different platforms, including. NET, Node.js and Java EE, hosting on site, hybrid, and other public clouds

Log Analytics - collects data from various sources and visualizes the data from sources like on premise and cloud. Log Analytics is the primary tool for collecting interactive analysis of log queries within the Azure portal

Azure-Site Recovery - is a service used for business continuity and DR. It gives highly available and built-in DR solutions. It has failover and failback capability as well

Azure Backup - is a service in Azure that provides backup against data loss in cloud and on-premises. For backup, you have multiple options available

Figure 1-15: Monitoring and Management

Internet of Things

IoT or the Internet of Things is a network of devices, internet-connected, that communicate with each other (transfer and/or receive information) through embedded sensors through the cloud. Azure IoT or Azure Internet of Things is a collection of cloud services, managed by Microsoft, that connect, monitor, and control tons of IoT assets.

IoT Hub – IoT Hub is a cloud-hosted managed service that functions as the main message hub for bi-directional communication between the IoT solutions and the devices it handles.

The IoT Hub allows for highly secure and efficient connectivity between the IoT solution and its controlled devices. For linking IoT computers, the Azure IoT Hub offers a cloud-hosted backend solution. IoT Hub enables you to expand your solution with per-user security, centralized device control, and scaled provisioning from the cloud to the edge.

The Azure IoT Hub facilitates safe and efficient communications between the devices it operates and your IoT solution. A cloud-hosted solution backend for linking devices with per-user authentication, device control, and scaled provisioning is supported by IoT Hub.

IoT Central - IoT central is the collection of Microsoft-managed cloud services that can connect, monitor, and control a device. Templates are available to deploy custom IoT Central Solution that requires minimal experience.

Device Provisioning Service (DPS) - The Device Provisioning Service (DPS) is a very important service connected with Azure IoT Hub. With this service, you can automate the process of provisioning service to your devices. It is also called helper service that enables zero touches and adjusts time provisioning to the right IoT Hub giving you the ability to provision millions of devices in a scalable and secure way.

IoT Devices - IoT devices are connected to the Cloud gateway, or IoT Hub is a managed service that is hosted within Azure that is there to acts as the bi-directional communicational messenger hub between the devices and the application.

Azure Sphere – Azure Sphere is the Microsoft service that lets the vendors to enhanced and improve the protection and security of the Azure cloud-based environment through continuous monitoring.

Azure Maps – It contains a bunch of geospatial services and SDKs that can be used to depict the data into context form for the web and mobile applications. Additionally, this service can be used to build and deploy location-based solutions in the Internet of Things (IoT) and Artificial Intelligence (AI) domains.

Figure 1-16: IoT Services

Mind Map

Figure 1-17: Mind Map

How to Interact with Azure

Azure Portal

Azure Portal is the most common way to interact with Azure. Portal is just a website where you fill your Microsoft account ID and password and log in to Azure. With the portal, you get access to all the resources in Azure as well as all its features. With the Azure portal, you can build, manage, and monitor everything from simple to complex apps in a single console.

There are many benefits of using the Azure portal, some of which are:

You can personalize your Azure dashboard, layout, and workflow with colors.
You can accurately choose an access control on all resources that makes your management and governance easier.
Cost management keeps an eye on the current and projected cost of resources.
It is like a One Stop shop where you have a single portal, single login for all of your Azure assets.
It has quick feature updates on products.
It has multi-platforms; it is available on the web and many other mobile devices.

Azure CLI

Azure CLI is another tool that helps to interact with Azure services and features. It is only a text entry tool. In CLI, you need to enter a command to perform any action. Most Azure

professionals use it frequently. Azure CLI can be downloaded from the website. The benefits of using Azure CLI are:

It is stable, meaning commands do not change and can be used reliably
The commands are structured in a logical way and all will follow the same pattern
It is cross-platform, so it can work on Windows, Mac, and Linux
As the command changes rarely in CLI, you can automate the commands for future purposes
With CLI, you can keep track of who did what with the CLI command

You can always test the CLI that you installed to see if it has the proper version by running az—version. The CLI is designed to simplify scripting, query details, long term operations and more. The current version in use is 2.0.79. To login to azure, the first thing you need to do is write the "az login" command. A browser window will open asking you for login credentials. After logging in, you will see a list of all subscriptions associated with your account.

In order to install Azure CLI, write "Invoke-WebRequest -Uri https://aka.ms/installazurecliwindows -OutFile .\AzureCLI.msi; Start-Process msiexec.exe -Wait -ArgumentList '/I AzureCLI.msi /quiet'" in Windows PowerShell.

You can also use the following link to download the CLI: https://docs.microsoft.com/en-us/cli/azure/install-azure-cli-windows?view=azure-cli-latest

Azure PowerShell

This is just like Azure Command Line Interface (CLI). PowerShell is pre-installed in your Windows machine, though if it is not, simply install it from the internet. PowerShell lets you use cmdlet, small light weight groups of command, through which you can perform simple tasks by calling a script, for example, to create a VM, you use command "New-AzVm". With PowerShell, you can also use Azure Resource Manager just like the Azure portal. It can be used for any other task as well. PowerShell version 5.1 or higher works on Windows while PowerShell core6.x and later versions work on any other platform. In order to check the PowerShell version, type: $PSVersionTable.PSVersion:

Figure 1-18: Windows PowerShell

Azure Cloud Shell

This is an interactive browser-accessible shell for managing Azure resources. The shell experience is the best option whether you work in Bash or PowerShell as it offers flexibility. With Cloud Shell, you can either use a fully standalone browser or use the

portal component to experience Bash, which is similar to Azure CLI or PowerShell. With Cloud Shell, you get authenticated and secure access to resources using any web or mobile app from anywhere. Choose between Bash (CLI) or PowerShell. Tools included are interpreter, Azure tools, modules, and different language support such as Node.js, Python, or .NET. In order to persist the data between sessions, it has its own dedicated storage. It also has an integrated file editor.

Figure 1-19: Azure Cloud Shell

Creating an Account on Azure

Create an account in Microsoft using your email address then go to

Click on **Start** Now Sign-in with your email address.

Go to the window of the sign-up process for creating a new account. In the **About You** page, enter all the required details for sign-up then click

Now, in **Identity verification by** enter the number with country code. You will get a message or call option to get the verification code.

After verifying the code, enter the card information in **Identity verification by**

Click

Now you have an agreement. Select the agreement then select

After signing up, click on **Go to** You will now get a pop-up window, **Welcome to** with **start tour** or **maybe later** options.

In the top corner, you also have the **Cloud Shell** button.

You also have the **Directory and Subscription** filter in the top corner.

Note: The free Azure Account is limited to free services for 12 months with credit expiration after 30 days

Mind Map

Figure 1-20: Mind Map

Practice Questions

Any service you use on Azure has a consumption component as part of the pricing is known as consumption-based pricing. True or false?

True
False

What does Infrastructure-as-a-Service mean?

Services on Azure that are updated automatically to provide a stable infrastructure for your applications
The layer of services that enable a complete cloud infrastructure for your business
Any hardware service provided by Azure such as Virtual Machines and Virtual Networks
Any service on Azure that you can rent and do not have to buy upfront

Which Azure service should you use to correlate events from multiple resources into a centralized repository?

Azure Log Analytics
Azure Monitor
Azure Events Hub
Azure Analysis Service

What is Cloud Agility?

To automatically improve the fidelity of resource usage and utilize the platform better

Quickly scale resource as per demand
Focus on business rather than provisioning and maintaining the resources
Using cloud elasticity to increase the return on investment

As resource demand increases, Azure can split the demand over more resources and scale the application. True or false?

True
False

In case any resource goes down, then instantly replacing it with a new one is known as_____.

Scalability
Elasticity
Fault Tolerance
High Availability

What is the difference between OPEX and CAPEX?

OpEx is the cost for acquiring or maintaining assets. CapEx is an ongoing cost for running a business
OpEx has a better return on investment in the short term. CapEx has a better return on investment in the long term

OpEx is an ongoing cost for running a business. CapEx is the cost of acquiring or maintaining assets
OpEx is a cost on services you do not own, such as cloud computing. CapEx is a cost of ownership

What is an Availability Zone?

One or more datacenters equipped with independent power, cooling, and networking
A collection of software that can enable high scalability at short notice
A set of data centers close together
One of the more datacenters that are close together to provide backup

How many zones must each region have?

2
3
5
6

What is Azure Region?

One or more datacenters equipped with independent power, cooling, and networking
A collection of software that can enable high scalability at short notice
A set of datacenters close together

One of the more datacenters that are close together to provide backup

A cloud server is being migrated to Azure. External users can access the web application. To reduce the administrative effort needed to manage the web application, which would you suggest from the following?

IaaS
SaaS

FaaS
PaaS

Azure VM resource is a PaaS. True or false?

True
False

For daily operations, Azure resources are needed for every business unit. The same form of Azure services is expected for all businesses. To automate the development of Azure resources, which solution would you suggest?

Azure API Management Service
Resource Manager Template
Management Groups
None of the above

What is the limit of the amount of storage in Azure Storage?

30TB
500TB
500GB
10TB

Which Azure Service is relevant to the AWS IAM service?

Azure VM
Azure Blob
Azure MySQL DB
Azure Active Directory

From the following option, which is the best reason to use the Azure CLI?

It makes it cheaper to use Azure, as you do not have to pay for the Azure Portal
You can use products and services that are not available in the Azure Portal
It rarely changes, and the commands stay the same for the most part
You can use Azure CLI with more than one cloud provider

Why would you prefer to use Cloud Shell rather than CLI or PowerShell?

The Cloud Shell can be used entirely in a web browser and can be used across multiple devices

The Cloud Shell gets new features first
The Cloud Shell is free for 12 months
You can update the Cloud Shell independently of Azure CLI and Azure PowerShell

What is the limitation of Azure free account?

Azure free accounts are valid only for certain times of promotion such as the launch of new services
Credit will expire after 30 days and free resources expire after 12 months
Free account resources can only be created when using the USA address
You are only allowed to create resources for 30 days

What is a PowerShell cmdlet?

A PowerShell scripting language specifically for Azure
A piece of advice from Microsoft about PowerShell updates
A lightweight version of PowerShell that can run on mobile devices
A small lightweight group of commands to perform an action

Only products that are available globally can be accessed through Azure Portal. True or false?

True
False

Chapter 02: Compute

Introduction

In advance compute means activities, applications, or workloads that involves processing more resources than its memory requirements. In general, compute is used to describe concepts and objects focused on computation and processing. For example, CPUs, APUs, and GPUs are considered compute resources while graphics processing applications like 3-D rendering and video games are defined as compute-intensive applications.

Compute is commonly encountered in advance computing concepts such as cloud computing and big data technologies where resources are used or served in the server and datacenters. With respect to Azure, compute is a term that covers all services, which enable computation in the cloud. This lesson will cover the topics including Virtual Machines (VMs), Scale Sets, App Services, Container Instances, Kubernetes Service and Azure Functions.

Microsoft Azure has a variety of Linux based machines that help you to use and explore some new ways to run web applications.

Azure Virtual Machines

Microsoft Azure is very flexible, it gives an option to have the functionality as required. Resources can be computed as up and down as needed. You only pay for the resources that you used. Azure virtual machine is the cloud-based computing service that Azure offers. This computing service includes a processor, memory, storage, and networking resources. The main benefit of the Azure virtual machine is that you can easily configure this machine and stop the running process when required. Azure portal or Azure CLI does the configuration of Azure virtual machine. The web application running on the virtual machine can operate via the Remote Desktop Protocol (RDP) or Secure Shell (SSH).

Linux Based Machine in Azure

It is very easy to create Linux based virtual machine in Microsoft Azure. The Azure platform has a variety of Linux images that provide you a way to create virtual machines. These Linux images are built from the variety of Linux distributions like Ubuntu, Red Hat, and others.

Windows Based Machine in Azure

The Azure virtual machine is a raw server that you get from your cloud service provider. In Azure, this service provides you to scale from even tens or hundreds to thousands of servers. This service works on-demand so you can purchase it whenever you need it. In addition, there are a bunch of tools available in Azure that allows you to work with virtual machines very easily. The Azure virtual machine provides its own virtual hardware including CPU, hard drive, memory, network interface, and other devices. The main advantage of the Windows Azure virtual machine is that you can control your virtual machine by using the Azure portal or with Azure Command Line Interface (CLI).

You can also use Remote Desktop Protocol (RDP) which is the graphical terminal for remote desktop to connect directly to the Windows desktop User Interface (UI).

Features

Following are the features provided by Azure to deploy the virtual machines on their own:

Infrastructure as a Service: Virtual machines are a part of the IaaS offering on Azure where you can manage everything except the hardware. You have complete control on the operating system, application installation and maintenance. It provides networking for VM as well.

Tools: If you want to buy your own hardware and run your own services with Azure, you can add additional tuning to manage up to thousands of VMs. Use the Azure Portal to control your hybrid cloud that includes VMs on Azure and on premises.

Compliance: You can ensure virtual machines compliance with your company guidelines by using Azure blueprints, these blueprints give instructions on how to create VMs.

Recommendations: Azure recommendations of improvements to ensure better security, higher availability, lower cost and greater performance.

Choice: Azure offers you to run VMs on both Linux or Windows, you can choose the amount of RAM and number of CPUs of your choice.

choice. choice.

Pricing

Azure charges for Virtual Machines on hourly basis and the resources you used. In simpler word, the more CPUs and RAMs on your VMs you use, the larger the amount you have to pay per hour.

Use Cases

Before you create a VM, you have all the necessary information regarding the VM that includes both its pros and cons.

Pros

Control: You need to control all aspects of an environment or machine before using virtual machines.

Application: you must install specific applications on your Windows or Linux machines.

Existing Infrastructure: You can move existing resources and virtual machines to Azure from on-premises or another cloud provider.

Cons

Not for Everything: If you want to use different service on Azure like hosting a website with an App service, then you do not need a VM.

Maintenance: If you have your own VM, a lot of maintenance requirements is involved such as operating system updates, patches, security concerns, and others.

Scale Sets

Azure virtual machine scale sets allow you to create and manage a group of load balanced VMs that are identical. In this, a single VM is provided as baseline with which you can create VMs instantly. In response to demand or a given schedule, the number of VM instances will automatically increase or decrease. Scale sets make your applications highly accessible and allow you to centrally manage, configure and upgrade a large number of VMs. You can create significant services with virtual machine scale sets for the areas including compute, big data, and container workloads.

Benefits

Azure virtual machine scale sets provide management capabilities for applications running through multiple VMs, automated resource scaling, and traffic load balancing. The following key benefits are offered by the scale sets:
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Easy to create and manage multiple VMs

It is important to maintain a consistent configuration across your environment when you have multiple VMs that operates your application. The VM size, disk configuration, and device configurations should be the same across all VMs for reliable performance of your application
All VM instances are created from the same base OS image and configuration in the scale set. This approach allows you to easily control hundreds of VMs without additional network management or configuration tasks
Scale sets allow the use of the Azure load balancer for basic layer-4 traffic distribution, and Azure Application Gateway for further advanced layer-7 traffic distribution and SSL termination

Allows your application to automatically scale as resource demand changes

Customer demand for your application may change frequently. Scale sets will increase the number of VM instances automatically as application demand increases to fulfil customer demand, and also decrease the number of VM instances as demand decreases This ability of auto-scaling helps to reduce costs and create Azure resources efficiently as needed

Works at large-scale

Scale sets support up to 1,000 VM instances. If your own custom VM images are created and uploaded, the limit is 600 VM instances
Use Azure Managed Disks to achieve the highest performance for development workloads

Use Case

Imagine you are running an online store, everyday customers come, browse your shop and buy your items. As it is with online habits, your traffic usually increases in the evening or in the weekends. Obviously, your sells and traffic increase further. Your part of online store runs on VM that process the data. As demand increases, so does the data you need to process. If you are scaling manually as well as creating new VMs when needed, you would be constantly doing it and you probably would be very accurate. Scale set would be monitoring usage constantly to make sure you have both enough resources and VMs as well as removing them when they are not needed. In effect, you would save more money.

App Services

Azure App Service is a fully managed Platform as a Service (PaaS), which means servers, networks, storage and other fundamental infrastructures are all managed and control by Azure; you just have to focus on business values and logics.

Azure App Service is an HTTP-based service for hosting web applications, REST APIs, and mobile backends. You can develop it in your favorite programming languages, like .NET, .NET Core, Java, Ruby, Node.js, PHP, or Python. Applications run and scale easily on both Windows and Linux-based environments.

App Service not only adds the features of Microsoft Azure to your application, such as security, autoscaling, load balancing, and automated management but also take benefits of its DevOps capabilities, such as continuous deployment from Azure DevOps, GitHub, Docker Hub, and other sources, package management, staging environments, custom domain, and SSL certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates. certificates.

Features

Some key features of App Service are outlined here:

Multiple Languages and Frameworks: App Service has exceptional support for Java, Ruby ASP.NET, ASP.NET Core, Node.js, PHP, or Python. You can also run background services like PowerShell and other scripts or executables.

DevOps Optimization: Set up ongoing Azure DevOps, GitHub, BitBucket, Docker Hub, or Azure Container Registry integration and deployment. Encourage updates via environments for testing and staging. Using Azure PowerShell or the cross-platform Command-Line Interface (CLI) to control the applications in App Service.

Global Scale with High Availability: Scale up or down manually or automatically. Host your apps anywhere in the global data center infrastructure of Microsoft, and the App Service SLA assures high availability.

Connections to SaaS Platforms and On-premises Data: Choose from over 50 interfaces for enterprise (such as SAP), SaaS (such as Salesforce) and Web (such as Facebook) applications. Use Hybrid Connections and Azure Virtual Networks to access on-premises data.

Security and Compliance: App Service is compatible with ISO, SOC, and PCI. Authenticate users with Azure Active Directory or social login (Google, Facebook, Twitter, and Microsoft). Build limitations on IP addresses and control identities of the service.

Application Templates: Choose from a wide-ranging list of application templates in the Azure Marketplace, such as WordPress, Drupal and Joomla.

Visual Studio Integration: Dedicated tools in Visual Studio streamline the development, deployment, and debugging work.

API and Mobile Features: App Service provides RESTful API scenarios with turn-key CORS support and simplifies mobile app scenarios by allowing authentication, offline data sync, push notifications, and more.

Serverless Code: Run a code snippet or on-demand script without having to provide or manage resources directly, and pay only for the compute time your code uses.

App Services Categories

Azure App services divided into three main categories:

Web Apps

Web Apps, as supported by Azure App Service, is a fully managed platform that allows you to create, deploy and scale Web Apps in seconds to enterprise-grade.

These are the main features:

Runs on both Windows and Linux environment
Supports a lot of languages such as.NET, Java, PHP, Node.js, Python and Ruby
Has built-in auto-scale and load balancing
High availability with auto-patching
Continuous deployment with Git, TFS, GitHub
Web Apps Gallery: WordPress, Umbraco, Joomla, Drupal

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Web Apps for Containers

Web Apps for containers allow deploying and running containerized applications in Azure. A container is a self-contained unit of software. All the code programs and applications are shipped inside the container. This means, you can deploy your applications anywhere with consistent experience. Web Apps for Containers allow developers to bring their own Docker formatted container images and easily deploy and run them at scale with Azure. Containers makes software run reliably between environments.

Following are the features of Web Apps for containers:

Easily deploy and run containerized applications that scale with the business
Take benefit of built-in auto scaling and load balancing
Use a fully-managed platform to achieve infrastructure maintenance
Update CI/CD with Docker Hub, Azure Container Registry and GitHub

GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub GitHub

API Apps

API App is an efficient way to connect and expose any data backend you have. API is an Application Programming Interface that does not have graphical user interface, i.e., no user interface, no frontend. API provides the interface to connect other applications programmatically. API Apps offered by Azure App Service provide a rich framework and ecosystem for developing, using and distributing APIs in the cloud and on-premises.

The main features provided are as follows:

Incorporate with SaaS and business applications
Generate client proxies or APIs in your chosen language
Automate API provisioning and deployment
Safe APIs through OAuth Active Directory and Single Sign-On
Exchange APIs internally through corporate galleries

galleries galleries

Azure Container Instances

In Microsoft the container is the standardized unit of software, which means it is a package of software that is able to run reliably and quickly from one computing environment to another computing environment. With containers, you can easily deploy and manage the number of complex and sensitive applications in the cloud. Containers require less development overhead, reduced and simplified updates, and faster startup set up to deploy the applications.

Azure Container Instances (ACI)

Container instance service in Azure is the most simple service for running containers without managing any infrastructure and without having to configure any high-level services.

Azure Container Instances is a great solution for any situation that can be used in isolated containers, including simple apps, task management and job building.

ACI Features

Manage Application Dependencies

All the dependencies for an application are included in the container image. You can manage the application and its dependencies with confidence.

Less Overhead

Virtual machines require a lot more maintenance and updates. Containers do not have any operating system components that require maintenance.

Increased Portability

Applications running on containers can be deployed easily to multiple different operating systems and hardware platforms.

Efficiency

Containers are much more efficient when it comes to the development life cycle of deploying and maintaining them. Scaling and patching is much simpler as well.

Consistency

The operations team can rely on containers being the same every time, regardless where they are being deployed to.

Container in Azure Workflow

The workflow to using a Container in Azure is following:

Software Development Cycle: Develop a desired software application through various processes of software development cycle. When it is ready, it will go through the container placement phase.

Application Placed in Container: When the software application is ready for deployment or publishing, it is placed in a container image.

Azure Container Instances: When the software application is placed in a container, it can be deployed or published to Azure Container Instances (ACI).

Benefits of ACI

Azure Container Instances (ACI) have following benefits:

Run containers without managing servers

By running your workloads in Azure Container Instances (ACI), you can concentrate on designing and building your applications instead of managing the infrastructure.

Increase agility with containers on demand

Deploy unparalleled flexibility and speed containers to the cloud — with a single command. Use ACI to provide additional computation whenever you need challenging workloads.

Secure applications with hypervisor isolation

Gain the security of virtual machines for your container workloads, while keeping the efficiency of lightweight containers. In order to ensure that containers operate in isolation without sharing a kernel, ACI provides hypervisor isolation for each container group.

Works with your favorite tools

Azure Container Instances can be accessed by using Azure Portal, Azure CLI or PowerShell, whichever you like the most.

EXAM TIP: Azure Container Instances (ACI) is the container as a service that helps to create and manage the containerized application with less resource consumption and requires a small set of commands to build applications.

Azure Kubernetes Service

Kubernetes

Kubernetes is an container orchestration system for automating application deployment, management, and scaling.

Let's briefly understand the above terms;

Open Source: It is an open source platform, which means the code based is public and anyone can submit the fixes and provisioned and get involved and invested to the product.

Orchestration: It orchestrates a cluster of Azure VMs; Scheduled containers automatically manages service discovery, incorporates load balancing and tracks resource allocation. It makes sure that all the configuration of containers is correctly configured to work properly.

Automatic Application Deployment: Kubernetes will deploy more images of containers as demanded. This will be needed as per demand of your application.

Automatic Scaling: Automatic monitoring of application load to determine when to increase or decrease the number of containers.

Azure Kubernetes Service

Azure Kubernetes Service (AKS) enables the simplest deployment of a managed Kubernetes cluster in Azure. AKS eliminates the complexity and operating overheads of Kubernetes management by offloading many responsibilities to Azure. Azure performs essential tasks such as health monitoring and maintenance for you as a hosted Kubernetes provider. The masters of the Kubernetes are managed by Azure. Only the agent nodes are managed and maintained by you. As a managed Kubernetes service, AKS is free; you only pay for the agent nodes within your clusters, not for the masters.

In the Azure portal, you can build an AKS cluster with the Azure CLI, or template-driven deployment solutions such as templates for Resource Manager and Terraform. The Kubernetes master and all nodes will be deployed and configured for you when you deploy an AKS cluster. Additional features such as advanced networking, integration with Azure Active Directory, and monitoring during the deployment process can also be configured.

Azure Container Registry

ACR is a service that keeps track of current valid container images. It manages files and artifacts for containers. When your Azure container instances and Kubernetes service need to create a new container, the images come from ACR. You can use Azure identity and security features as well to make sure the container images are safe.

AKS Cluster Architecture

Azure Kubernetes Service cluster architecture is based on the following main components:

Node

You need a Kubernetes node to run your applications and support services. An AKS cluster has one or more nodes, an Azure Virtual Machine (VM) running the components of the Kubernetes nodes and container runtime.

Node Pools

Nodes of the same configuration are grouped together into node pools. A cluster of Kubernetes contains one or more node pools. Once you create an AKS cluster, which generates a default node pool, you specify the initial number of nodes and size. This default node pool in AKS contains the underlying VMs that run your agent nodes.

Pods

Kubernetes uses pods to run an application instance. A pod represents a single application instance. Pods usually have a 1:1 container mapping, although there are advanced cases where several containers may be found in a pod. Such multi-container pods are arranged on the same node together, and allow containers to share similar resources.

Figure 2-01: AKS Cluster Architecture

AKS supports Kubernetes clusters running multiple node pools to support varied operating systems and containers on the Windows Server (currently previewed). Linux nodes run a customized Ubuntu OS image and a modified Windows Server 2019 OS image runs on Windows Server nodes.

As demand for resources change, the number of cluster nodes or pods that run your services can automatically scale up or down. You can use both the horizontal pod auto-scaler or the cluster auto-scaler. This approach to scaling lets the AKS cluster

automatically adjust to demands and only run the resources needed.

As the demand for resources increases, you can automatically scale up or down the number of cluster nodes or pods running your services. You can use either the pod auto-scaler or the cluster auto-scaler. This scaling approach allows the AKS cluster to adapt to demands automatically and only run the necessary resources.

Applications of Azure Kubernetes Service (AKS)

The container-based workload and containerized applications are ordinary to manage in the cloud. The enterprises and network developing companies use container-based workloads by using the Kubernetes service which works as an orchestration platform. Azure Kubernetes Service (AKS) enables the deployment, configuration, and monitoring of containerized applications using a Kubernetes service in the Azure platform.

Azure Kubernetes Service (AKS) allows the flexible migration of projects from on-premises to the cloud. There are two types of migration provided by AKS. One is a "lift and shift" migration that requires setting up the features that are compatible with your demands. The second migration method is the "green field" migration that allows evaluating the AKS based on the default features.

Many features increase the demands of services provided by Azure Kubernetes. Each of these features plays an enthrall role that makes you use AKS for your system.

Identity and Security Management

When you are working with some existing Azure resource and want to make the use of Azure Active Directory for your project, you can create the AKS cluster that allows you to use the integrated Azure resource and Azure AD with the existing identity and security groups.

Combined Registration and Management

Azure Kubernetes Service (AKS) permits the Azure monitor to continuously monitoring the performance of the container

instances present on your AKS cluster. With custom Kubernetes installation, you can use the monitoring solution that requires both the installation and configuration for the logging and management.

Auto Cluster Node and Pod Scaling

Sometimes, the scaling of the complex and sensitive containerized application becomes difficult to configure. Therefore, an automatic configuration approach is required to be used in such cases. Azure Kubernetes Service (AKS) offers two auto cluster scaling options.

Horizontal Pod Autoscaler
Cluster Autoscaler

Horizontal Pod Autoscaler (HPA)

The horizontal pod autoscaler is one of the scaling options to scale the cluster. It monitors the scale demands of the pod and also increases or decreases the pod based on the observed CPU utilization and memory consumption to meet the required demand.

Cluster Autoscaler

Cluster autoscaler automatically resize the cluster node based on the demand of the workload. When the demand is high, it automatically scales out or adds a scheduled node to the system and when the demand goes down, the scaling method automatically scales back the schedule nodes to its original number. This scaling option increases the availability of your workload when you need it.

Cluster Node Improvement

The cluster node upgrade is necessary to manage and monitor the nodes for the running applications. For reliable and fast configuration, it is very important to minimize the cluster management task. AKS monitors the Kubernetes software improvements and the action of cordoning off the cluster nodes and draining the interference of the nodes to active applications. Once AKS completes the monitoring, all the cluster node are upgraded successively.

GPU Enabled Nodes

Azure Kubernetes Service (AKS) supports GPU enabled nodes to monitor the compute-intensive and graphics-intensive workloads.

Persistent Storage

If your running application is stateful and functioned as stateless. In such cases, the storage volume support is required for persistent storage. AKS supports both static and dynamic storage volumes. Based on the demands of the workload, all the available pods can be attached or reattach to the created storage volumes present on different nodes.

Virtual Network (VNet) Support

Another most beneficial edge of AKS is that it allows the pod-to-pod communication and communication with an on-premises network by deploying the AKS cluster to the existing Virtual Network (VNet).

Access with the Support of HTTP Application Routing

The AKS cluster supports HTTP application routing policies for the deployment of such AKS containerized applications that are publicly accessible.

Support of Docker Image

Azure Kubernetes Service (AKS) supports the format of the Docker container image that can be used to deploy and develop any workload. The creation of workload is composed in a container and the container is deployed as a Kubernetes pod.

Private Container Registry

Azure Kubernetes Service (AKS) integrates with Azure Container Registry (ACR). AKS is also capable to be used with other container repositories either public or private.

Note: All the above-defined features of the Azure Kubernetes Service (AKS) are used when you create the AKS cluster or use the existing deployment.

Azure Functions

Azure Function is smallest compute on Azure. It is a single function and an easy way to run small pieces of code or "functions" in the cloud. For the problem at hand, you can write only the code you need without worrying about a whole application or the infrastructure to run it. Functions can make development even more productive, and you can use your development language of choice, such as C#, Java, JavaScript, PowerShell, and Python. It is invoked by a standard web address URL. It triggers the events to run at once and then stops.

Azure Functions is the serverless computing service that is hosted on the public cloud of Microsoft Azure. In general, Azure Functions and serverless computing are designed to accelerate and simplify the development of applications. The idea behind serverless computing, also known as function as a service, is to remove the infrastructure for user considerations. A user can create and upload code with serverless, and then define the triggers or events to execute the code. Triggers may come from a wide variety of sources, including the application of another user or other cloud services, such as databases, events and hubs for notification.

Figure 2-02: Azure Functions

It is the responsibility of the cloud provider to load the code into a suitable execution environment once a trigger or event occurs, then run the code and release the computing resources. Servers are still involved, but the user no longer has to provide or manage instances. In addition, users pay for serverless computing based on the amount of time a function runs in a given billing cycle instead of paying for those compute instances and other associated resources each month.
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Use Case

A website named funnyferret lets users upload pictures. These images need both processing and optimization for web display and storage. When a user uploads a picture on the funnyferret website, Azure function receives that image. The job of function here is to process the image to compress it and change into the correct file format. The function then places the image in the database of the online application for future use.

Features

Here are some key features of Functions:

Choose Write functions using C#, Java, JavaScript, Python, and other languages of your choice.

Pricing Model for Pay-per-use: Only pay for the time spent running the code.

Integrated Security: Protects functions enabled by HTTP with OAuth providers such as Azure Active Directory, Facebook, Google, Twitter, and Microsoft Account.

Simplified Integration: Azure infrastructure and Software-as-a-Service (SaaS) systems can be easily leveraged.

Open-source: The functions runtime is open-source and available on GitHub.

Lab 2-01: Azure App Services

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Mind Map

Figure 2-03: Mind Map

Practice Questions

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Questions

Chapter 03: Networking

Introduction

Networking creates long-lasting connections with others. It is the connecting point between the entities for resource sharing or other purposes as well. In cloud computing, networking is the base. Multiple networks are present in the cloud to provide high speed connection opportunities for users to use its services and play online game, use online Photoshop and other applications. Cloud networking enables cloud computing in order to develop network with low latency, better security and storage capabilities, and optimized performance.

Keep in mind that Microsoft Azure is a PaaS (Platform as a Service) cloud provider, that provides the number of services for their customers as discussed in chapter 01. This chapter is concentrated to give an overview of networking services that Microsoft Azure has to offer for its users when running and building their on-demand applications in the cloud. All of the networking services provide a high level based service for the customer to fulfil their demands. Azure networking is considered as the key component in building a successful public cloud into Microsoft Azure and its fundamental part. The networking service of Microsoft Azure not only provides the connectivity toward users and serves as connectivity between the service elements. Most of the money bank companies use Microsoft Azure networking services for fulfilling the monitoring and management responsibility of the networks.

So with Networking, you can give your users and customers a best possible experience by connecting the cloud and on-premises infrastructures.

All networking services provided by Microsoft Azure offer a variety of featured services that are discussed in the following sections systematically. Figure 3-01 gives a summarized overview of the networking services offered by Microsoft Azure.

Figure 3-01: Azure Networking Services

Virtual Network

A Virtual Network (or VNet) is used as a networking service to host the infrastructure resources within Microsoft Azure. It is the most essential part of Azure network. It is a logical isolation of the Azure cloud dedicated to your subscription. You can use VNets to provision and manage virtual private networks (VPNs) in Azure.

Azure Virtual Network or VNet enables many Microsoft Azure resources like Azure Virtual Machines (VM), to safely communicate with each other over the internet and on-premises network without any access to the physical hardware. Figure 3-02 shown a simple Virtual Network containing two VMs along with the internet.

Figure 3-02: Virtual Network

IP Address

Without the while sending a letter, there is a letter that is sent to the letterbox and after it is processed, the letter is delivered to the right destination using the address that is already written in the letter. With the internet, the same procedure is followed, with the addition of an IP address. Each traffic has its own IP address, which ensures that traffic delivers to the right destination (server). An IP address serves two main functions: network interface and address.

A virtual network is similar to the traditional network when operating from the datacenter. VNet consists of four main aspects.

Address Space

An address space is the range of IP addresses. Every resource, service or connected device that is present on a particular VNet has its own IP address on that VNet within the address space. This way, services in the subnet can communicate with each other. Address space assigned to VNet will automatically get an IP address by each entity present on that VNet.

Subnets

A subnet is a feature that enabling segmentation. A virtual network is divided into two or more virtual subnetworks and assigned a range of IP addresses (address space) for each subnet. Therefore, multiple networks can operate simultaneously within the same virtual network.

The major advantage of the subnetting is to make the virtual network more route efficient, reliable. Management control groups and security groups can play important insecuring the individual subnet as well..

Subnet Regions

Each virtual network within Azure belongs to a single region. Therefore, the resources and service on VM must be physically present in that particular region. VNet can be connected to provide communication across regions.

Subscription

Each virtual network has only one subscription and every subscription has multiple virtual networks.

The virtual network including the above defined features is shown in Figure 3-03.

Figure 3-03: Azure Virtual Network

Cloud Advantages

Scaling: Virtual network is the fundamental part of Microsoft Azure. It is also beneficial for scaling due to a wide range of address space that helps in generating more subnets or you can add more VNets

Isolation: Resources and Services can be managed, organized and isolated more efficiently in VNets using subnets and network security groups

Security: The inbound and outbound traffic can be control by VNets, virtual subnets, and VMs to ensure high security

High Availability: In VNet, the peering feature of the network ensures high availability of services and resources. Peering means connecting of two networks together. VNets can communicate via a load balancer or a Virtual Private Network (VPN) gateway

TIP

VNet is an essential part of Azure infrastructure, responsible for communicating the resources and services that are present in your VNet.

VNet is in a single region and belongs to a single subscription.

Load Balancer

Consider an example as shown in Figure 3-04. There is an online booking app introduced by a client. The app is working well. At a time, the app is simultaneously accessing by he large number of customers. Initially, there is only single virtual machine responsible for processing the data. As the simultaneous traffic demands increases, virtual machine becomes overloaded. To overcome this problem, another virtual machine is added. The addition of second virtual machine creates another problem that how traffic is shared between the two VM. A load balancer is used in front of two VM to access the data before reaching the destination. Therefore, multiple users can access the service at the same time more efficiently.

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Load balancer in general is used to distribute the traffic arrived on front end to the backend pool as per rules and health status.

Figure 3-04: Scenario-Load Balancer

Azure load balancer serves the load-balancing feature to the connected virtual machines within Microsoft Azure. It operates at the transport layer (Layer 4) of the OSI model. When there are multiple VMs serving an application within VNet, a load balancer decides which VM belongs to the particular user.

The two types of load balancers are public and internal. Public load balancer converts the private IP address of VM to public IP address for outbound access and internet-facing. Whereas, internal load balancer is capable of managing the traffic inside the VNet. For example, load balancer is only used when there is a private IP address required only. For checking the availability, HTTP and TCP based probes are used by the load balancer.

Technical Terms of Load Balancer

Inbound Flow: Inbound flow is traffic that comes from either the internet or local network. This traffic is then received by the load balancer

Outbound Flow: Outbound flow is used for establishing the connection between public frontend and virtual machine backend

Frontend Pool: Frontend pool connects clients to the load balancer via IP addresses. It manages traffic to the VM. All the traffic arrives here first

Backend Pool: Backend pool allows VM to receive the traffic from a load balancer

Rules and Health Probes: Rules refer to the load balancer rule for directing the traffic and health probes ensure that VM is ready to receive traffic before the load sends any, as load balancer always sends traffic to healthy VM. Health probe can be HTTP, HTTPS or TCP

Figure 3-05: Technical Terms of Load Balancer

Benefits of Load Balancer

Internet Traffic: It helps to balance internet traffic when there is a large number of users

Internal Network: Balances the traffic that is generated from internal running applications within Azure

Port Forwarding: Serves as a forwarding point of traffic. We can easily forward traffic to specific port or specific machine in a backend pool

Outbound Traffic: Load balancer also ensures the outbound connectivity for the VM in the backend pool

Figure 3-06: Benefits of Load Balancer

VPN Gateway

VPN Stands for Virtual Private Network, a VPN gateway is useful for establishing the private connection between Azure resource and an on-premises environment, offices, the cloud or other premises within the cloud in order to establish a private secure connection. In Microsoft Azure, VPN gateway provides the managed services within the cloud. VPN gateway is used for site-to-site connection, point-to-site or multi-site connection. It is also used for generating the encrypted connection between services. The encrypted connection can be used between Azure to on-premises or Azure-to-Azure connections. There is only a single VPN gateway per Virtual Network (VNet). VPN gateway is responsible for two types of routing, one is static and the other is dynamic routing.

Considering that there are two services with data for the company, some of the data is available on-premises and some data is available at the Azure cloud to run the applications more reliably and increase scalability. For the connection between two entities, there is a need for adding a gateway, which is the VPN gateway. Figure 3-07 shows a simple VPN gateway within the network, which provides encrypted communication between on-premises and Azure. For secure, available, and hybrid cloud architecture, VPN gateway is a key part.

Figure 3-07: Network with VPN Gateway

Virtual Network Gateway

VPN gateway is a specific type of virtual network gateway. A virtual network gateway is composed of a number of virtual machines (VMs) within the specific subnet called Gateway Subnet. A gateway subnet has a range of IP addresses and VM within that subnet containing the address under the designed specific range. A typical example of VNet with gateway subnet is shown in Figure 3-08.

Figure 3-08: VNet Gateway

Components of VPN Gateway

The main components of the VPN gateway consist of Azure VNet, VPN gateway, VPN tunnel, and on-premises services. Within Azure VNet, there is a VPN gateway present. VPN gateway has its own public IP address. A secure connection called a tunnel is responsible for enabling multiple encrypted connections for security purposes. VPN Tunnel provides encrypted communication between the on-premises network and Azure VNet. On on-premises network, there is complementary gateway that accepts encrypted data. Figure 3-09 shows a network employing all the components of the VPN gateway. The network in Figure 3-09 is called site-to-site connection between two entities.

Figure 3-09: Site-to-Site Connection

One possible network configuration is also shown in figure 3-10, which is called a multi-site connection between two entities. In such a network, there is a single VPN gateway with multiple on-premises networks connected.

Figure 3-10: Multi-Site Connection

TIP

VPN gateway can provide efficient cloud computing services within the hybrid cloud infrastructure. VPN gateway is composed of VNet gateway and virtual private network.

Application Gateway

One type of VPN gateway is the application gateway. It is considered as the most advanced load balancer that enables the balancing of web traffic to manage the web applications using an HTTP request. Because of its services, the gateway is called layer 7 load balancer within Microsoft Azure. It also supports ADC (Application Delivery Controller) functionality. Figure 3-11 shows a network specifying the contribution of the application gateway. In figure 3-11, with application gateway, routing decisions are based upon additional characteristics of the HTTP request. This request is in the form of data format so that any type of internet traffic would be able to receive the request. Uniform Resource Identifier (URI) is the web address while host request is the piece of information that is sent with the request. The configured network is able to send a request to a specific web address to a specific machine present at the backend pool.

Figure 3-11: Network with Application Gateway

Benefits of Application Gateway

The benefits of the application gateway are as follows;

Scaling: Application gateway can be scaled due to the abrupt change of traffic load
High Availability: The use of a layer 7 based load balancer increases the availability of resources for the web application in Microsoft Azure
Encryption: Application gateway is responsible for providing the end-to-end encrypted communication between the services. You can enable or disable the traffic encryption to backend pool to improve the processing time
Zone Redundancy: Application gateway supports multiple zones to improve flexibility and fault resiliency
Multi-Site Hosting: By using multi-site hosting, a single application gateway is used for a number of web applications and providing a secure connection between the entities
SSL Offload: After routing traffic to the right destination, SSL offloads are supported by the application gateway to provide relief towards the webserver
Cost-Effective: As an application gateway, hosting multiple web applications results in saving cost and minimizing complexity
Session Affinity: Application Gateway allows keeping the user on the same web server by directing the user traffic on the same web server

Web Socket Support: Application gateway allows web socket for client connected applications. Web socket pushes specific client

applications within a browser

Web Application Firewall: Application gateway also provides protection features like web application firewall that protect internet requests and applications

Figure 3-12: Benefits of Application Gateway

TIP

Application gateway is more efficient in delivering web application services as compared to other gateways.

It works on HTTPS rather than IP address/port.

Content Delivery Network

When the users are present far from datacenters (online resource) in which they want to get data from, one way of getting the data is that user accesses the data but that takes much time and provides a low performance of the application due to the distance. Another way of getting the data is by using the Microsoft Azure service called Content Delivery Network (CDN). It is a distributed network of servers that can deliver web content close to users. Within Azure, CDN places the duplicates of data at the datacenter present closer to the user side and users can easily log into the application into which they want. The datacenters present closer to the users is called edge nodes/edge servers containing a cache of files that provide the edge of the internet closest to the users. The information present in these edge nodes is limited for a few days because each node has an expiry date. Using edge nodes, users can easily access data from datacenters. One problem behind the edge node is how users get informed by the update. The solution for this is that when information is about to expire, the user will get the updated data from far datacenter at once such that the user can create a new datacenter in which all the update is available.

The main reason behind the use of Content Delivery Network (CDN) is to deliver data to the user with the lowest latency by providing data that is present at edge nodes. The data usually consist of image, file, media, etc. The delivery of data content can be improved by using a feature called Dynamic Site Acceleration (DSA). DSA finds the best route for the request of the traffic

from the user to the server. DSA in Content Delivery Network stores the dynamic contents for improving the performance of the network.

Figure 3-13 shows the concept of Content Delivery Network (CDN). The given network is spread over the geographical area and users from any area can access the data such as logs of an online application using edge node. The edge node is the service of Azure CDN.

EXAM TIP

Origin server is the original location of files such as web application that hold the master copy of all data.

Figure 3-13: Concept of CDN

Benefits of CDN

Global Coverage: Content Delivery Network (CDN) provides global coverage using the multiple edge node across the region
Better Performance: Providing optimized performance due to the fast delivery of data and increased user experience
Scaling: CDN can be scaled up or down due to the instantaneous high traffic load and provide protection by hidden other data from the backend
Distribution: Edge nodes help deliver less content from the main server to the user, all of the request data can be easily achieved by the user from edge nodes

TIP

Cache is a collection of duplicate copies of a file. The main purpose of the cache is to provide fast online application services to end-users.

Express Route

Express route is the private connection that could be used in on-premises datacentres within the Microsoft azure. It is able to provide a dedicated connection of up to 10Gbps. This type of routing is helpful in between two or more than two azure regions and replaces the utilization of VPN and VNet peering. Express route also provides the disaster recovery and hybrid feature Express route providing two types of routing facilities.

Private link routing provides the exchange facility usually in between datacentre and azure.
Express route also provides the global routing feature that is most helpful for the organization employing MPLS networks.

Traffic Manager

The traffic manager is responsible for the management and monitoring of the routing traffic globally within the Azure infrastructure. It needs Azure DNS to select the best possible endpoint (internal or external) for routing traffic. The traffic manager distributes the load over multiple regions because of multiple web applications present across the region.

The traffic manager employs four routing processes, which are:

Geographic-based routing in which traffic load is routed over the geographic region depends on demand.
Priority-based routing that routes the traffic load according to the service requirement.
Weighted routing, that distributed the traffic load in the different backend.

Performance-based routing, which is beneficial to find the best possible route for directing the traffic load to the backend.

Azure DNS

Microsoft Azure DNS is Domain Name System, hosting domain within azure. The major advantage of DNS is that there is no need to host within DNS providers as well as azure. Azure DNS allows monitoring the DNS records using the same authorization, other support within the Azure service. Azure DNS is also responsible for fast managing the communication between domain and DNS servers. Figure 3-14 shown the utilization of Azure DNS for providing high availability and improved performance.

Figure 3-14: Utilization of Azure DNS

Lab 3-01: Creating a Virtual Network Connection

Scenario:

An organization wants to deploy a secure network in Azure Cloud for its application. How can this be done?

Solution:

Using the VNet and VM, you can deploy your application in a secure network.

Log in to the Microsoft Azure portal and go to the portal menu. Now click on "Virtual networks" from the portal menu.

Click on "Add" for the creation of a virtual network.

Once the virtual network window appears, write the name of VNet and address space.

Now, click on “create new” and write the name of the resource group.

Write the range of IP addresses that are in a group.
Leave the remaining options as it is, and click on “Create”.

Your VNet will now be created, click on “Refresh” to see the created VNet.

After creating the VNet, again switch to the portal menu to add another resource to this VNet.

To add a virtual machine to VNet, click on “Virtual machines”.

A virtual machine window will appear, click on “Add” for the creation of a virtual machine to VNet.

Write the name of the resource group for which the virtual machine is going to be created.

Now, add a name for the virtual machine.

Choose the window machine from the “Image” option.

Add Username and Password.

Leave the remaining options as it is. Click on “Next : Disks >”.

After that, click “Next : Disks >”, the disk tab will open.
Click on “Next : Networking >” to move on the networking tab.

A virtual network and subnet have already been selected. This means a virtual machine is created within “Ipsvnet”.

Leave the remaining options as default.

Click on “Review + create”.

It will take some time to check the validity of entered properties.

Once the validation is passed, click on “Create” for the creation of the virtual machine.

Once the deployment of a virtual machine is done, click on “Go to resource” to check and see the properties of a virtual machine.

The virtual network and subnet are the same as those that were configured before.

Properties of a virtual machine show that a virtual machine is created within "Ipsvnet".

Similarly, other Azure resources may also be added within the same network.

EXAM TIP

Resources should be delete after being used by the customer from the Azure portal otherwise, the customer will be highly charged according to the subscription criteria.

Mind Map

Figure 3-15: Mind Map

Practice Questions

What is Azure Networking?

Representation of a network in the cloud
The network made up optical fiber
It provides 4G connectivity
None of these

Which of the following Azure networking service is similar to the load balancer service?

VPN Gateway
Virtual Network (VNet)
Application Gateway
Traffic Manager

Which feature of CDN helps to improve performance?

Dynamic Site Acceleration (DSA)
Provides data such as image, files, media, etc.
Is able to work with internet
Has resource management capabilities

Which networking service launches edge nodes?

Azure Load Balancer

Azure DNS
MPLS Network
Content Delivery Network (CDN)

If a person wants to use their data that is present on both Azure and on-premises, how can a secure connection between the entities be possible?

By using VPN Gateway
By adding extra resources to VNet
By adding traffic router
By utilizing the cipher key

Which problem will be solved by adding the application gateway?

Web traffic management
Equally balances the traffic
Creating a private connection
Performance degradation

What type of information is provided by the Content Delivery Network (CDN)?

Encrypted data in binary format
Images, file, and media
Sequence of alphabets
Characteristics of VM

What is the purpose of the VPN gateway in Azure?

Distributes the traffic load
Manages the power of all entities in the network
Provides encrypted connection
None of these

If a virtual network is configured in such a way that it has a number of subnets, then which additional feature does it possess?

Delivers multiple networks features
Saves power
Cost-effective
All of the above

Which service is responsible for managing the traffic flow in the network?

Traffic Manager
Express Route
Load Balancer
Azure DNS

Why do we need the Azure portal?

To manage the resources
To create VNet with Azure services
To configure a network with Azure services
All of the above

Which of the following provides better security and storage capabilities?

Cloud Networking
Local Area Network
Logical Network
None of the above

For how many connections, a VPN gateway can be used?

2

3
4
10

Which of the following services is provided by a VPN gateway?

Offers open-source availability
Creates multiple layers of service for security purpose
Is used in private cloud architecture only
Provides a secure connection between Azure resources and the on-premises network

Which of the following main resources and services should be present in a VNet?

VM, internet, on-premises network

10 internet users only
Traffic manager, route finder and online services
All possible gateways

Which of the following is not suited for networking service?

Network failure
Abrupt behaviour of VM
Scalability
Global coverage

Which of the following services is offered by a load balancer?

Encrypts the incoming traffic among services
Provides internet connection for the communication
Works as a port forwarding point
None of these

While creating a VNet using the Azure portal, what specific things should be assigned in the network?

User name and password
Address space, resource group, subnets and location
App services only
Compute resources

We can add a maximum of two resources in Azure to VNet. True or false?

True
False

How is a load balancer different from an application gateway?

Layer 1, layer 5
Layer 7, layer 2
Layer 4, layer 7
Layer 3, Layer 6

Chapter 04: Storage

Introduction

As we know that no matter what compute we perform, we need some form of storage. We need storage for transient data, data that is used for a single session, storing user details, storing customer data, storing orders, and everything else. In this chapter, we will discuss four ways to create Storage on Azure. These ways include Blob, which is used in tons of different scenarios and is incredibly flexible; Disk Storage, which is just like a disk for you to stored data; File Storage, which is a fully managed file storage in cloud used to extent your on-premises storage. In addition, the last one is Archive Storage, which is a cheap way to store massive archived data. You need to make the right decision in storage as it makes your application sufficient. Choose the right storage option for your required job is one of the most critical steps. Nowadays, storage is scaling up constantly and we need modern storage solutions. Therefore, Microsoft introduced Azure Storage, which provides us the best solution.

Storing data in the cloud omits the need for any hardware or physical space and makes scaling of storage as per requirement very easy. By storing data in cloud, you can also increase the availability of data.

Storage Account

Before we go deep into Azure Storage, we need to understand what Storage Account is. A Storage Account is like an access point for Azure Storage. All of your Azure Storage Data Objects like blobs, files, queues, tables, and disks are on an Azure storage account. The storage account provides a unique namespace for your Azure Storage data, which is available via HTTP or HTTPS from anywhere in the world. Data on your Azure Storage Account are durable, highly accessible, safe, and scalable. The unique namespace means that every storage data has its webpage with its unique name. It is written in the format:
“https://..core.windows.net. The name of the storage account must be unique all over Azure. It is a base for all storage types, as we know. The limit size of the Storage Account was already discussed in Chapter 1. All storage accounts are encrypted for data at rest using SSE (Storage Service Encryption). While naming your Storage Account, you must remember two things:

The name length must be in between 3 to 24 characters and may only contain numbers and lowercase letters
Your name for your storage account must be Azure-specific. There can be no two storage accounts with the same name

Two types of storage accounts are available. Users have access to Blob Storage, Table Storage, Queue Storage, and File Storage through the "Standard" storage account. The alternative is a

"Premium" account, which is a new option that allows users to save data on SSD drives to boost IO capacity. There are 5 different types of storage account available that depende on different features and pricing.

General-purpose v2 accounts
General-purpose v1 accounts
BlockBlobStorage accounts
FileStorage accounts
BlobStorage accounts

Azure Storage

Azure Storage is a Microsoft Cloud storage for storing data. It is a highly scalable object store and a message store for messaging. It also offers file system service. It is a NoSQL store that provides a number of benefits like:

Durability and Highly Availability - in case of hardware failure, it provides you replicas by placing the data in a replicated form in different geographical locations. So your data is always highly secure and available

Security - the data stored in Azure Storage is not able to access as it provides encryption of all data stored in Storage. It has restricted access to the data

Accessibility - the data stored in Azure Storage can be accessible from anywhere in the world over HTTP or HTTPS

Scalability - it can easily scale in order to meet the performance requirements

Exam tip

You must first create an account in Azure to use any kind of storage; the Storage account is the parent object.

Blob Storage

Blob means Binary Large Object, which is used for storage of Binary or text data. It is used for storage of huge amounts of data. Inside the storage account, these blobs are stored in a container. A container is a place of organizing a set of blobs. Within the storage account, you have unlimited containers with unlimited capacity for storing blobs. As we have seen earlier that each object has its unique address, so here individual blob also has its unique address.

In different scenarios, you can use blob storage like for storing images, which belong to different sizes and formats, for storing all kind of file with distributed access to them via Azure Storage. It can be used for streaming audio and video directly from blob storage, for writing logs files regardless of size and frequency of writing, for storing backup data, for restoring, for DR or any other sort of archiving, and much more. For further basic information about Blob storage, you can refer to Chapter 1 “Storage” in Azure Services.

Figure 4-01: Blob Storage

In Azure, three types of Blobs are supported;

Block blobs store text and binary data up to 4.7TB. It is made up of blocks of data that can be managed individually. In one block blob, you can have 50,000 blocks.
Append blobs are used for log data and can be up to 195GB in size. It is usually used for optimizing the append operation.
Page blobs are used for frequent read and write operations on data. It sizes up to 8TB. The files stored in page blobs can be accessed with any part of the file at any time. It is used for storing virtual hard drive then serves as a disk for the virtual machine.

During the time of creation, you need to select the type of a storage account, which is based on different pricing options.

Figure 4-02: Pricing Model

Hot Tier - it is for frequently accessed data and is the most optimized. The access costs are low (read-write) but storage costs are the highest.

Cold Tier - it is for data that is not frequently accessed. Data is stored in cold tier for 30 days. Its storage cost is low but accessing cost is high. It is used for short term backup or for telemetry data.

Archive Tier - it is used to store rarely accessed data and it has the lowest cost for storage but the highest accessing cost.

The archive tier can be set to blob only while the Hot/Cool tier is enabled at the storage account level or blob level. All three levels of storage access can be found in the same storage account and a blob default level is inherited from the account level setting. However, blob-level tier can be used to set the level of the object.

Exam tip

Blob Storage is a general kind of storage in which you can store any kind of data. Mainly, it has three pricing tiers: Hot, Cold and Archive.

Disk Storage

It is a disk to which you can store your data. A managed disk is the disk that is attached to your VM. Here, managed means that Azure will look after this disk for you and managed the uptime and backup. You also do not need to take care of the size and performance, as it is a part of the agreement with Microsoft Azure. With disk storage, you can easily upgrade the disk size and type. Managed disks provide you with two kinds of encryptions: Storage Service Encryption and Azure Disk Encryption.

There are four different types of disk.

HDD - it's a spinning hard drive. It is a low cost storage option for data that are accessed infrequently. It is suitable for backups and testing

Standard SSD - it is generally for the production environment. It gives you a lower latency than HDD with improved reliability and better scalability

Premium SSD - it is a super-fast and high performance storage for critical workloads. It is recommended for database installation in particular with low latency. It is better than the standard SSD. Only VM series that are compatible with premium storage can use premium SSDs

Ultra Disk- it is for the most demanding and data intensive workload. It provides extremely scalable performance with sub milliseconds latency. It can be up to 64TB in size. It is recommended for analytical models, gaming, etc.

Comparison between all disk types:

types: types:

types:

types: types: types: types:

types: types:

types: types:

types:

Table 4-01: Comparison between Disk Storage Types

File Storage

We know that mostly companies have a file storage where they store the company's assets. In order to work with these files, they can upload, delete, synchronize and more. But on-premises storage can have issues like disk limitation for storage amount. You also need to configure and maintain backups. Security of data at on-premises storage is also difficult to maintain and you may need to hire security specialists for this. Also, file sharing across the team and organization becomes difficult. So by using file storage, all of these issues can be resolved. With File Storage, you get the following benefits:

Share files across multiple Azure machines and be able to connect with the on-premises infrastructure
It is fully managed and you do not need to worry about OS or hardware
Highly available with super resistance against outages
It has built-in redundancy

Some common scenarios in which you can use file storage are:

In a hybrid network where your on-premises storage is out of space
For lift and shift of existing file storage to Azure
It can also be used as a centralized location for monitoring logs and config. files.

Figure 4-03: File Storage System

Exam tip

File Storage mitigates the on-premises file storage system.

Archive

Azure Archive Storage is used generally for archiving data and paying less for it. Most of the company's policies, legislations and recovery scenarios storing a large amount of archive data is required, so Azure Archive service can prove to be really handy for them. It is one of the lowest priced storage in Azure, which means you can store terabytes of data in just few dollars per month; with Azure Archive, growth in business data does not necessarily have to mean that there should be a growth in the cost of storage. It is a good storage option for the data that are not needed frequently, it is durable, encrypted and stable. With archive storage option, you can free up the most important storage in on-premises. It is secure for storing any personal data like banking data, medical data etc. It secures data at rest with 256-bit AES keys.

In the first chapter, we mentioned that archive storage is blob storage so the tools that even work for blob can work for archive data.

Use cases for Archive Storage are:

Security and public safety data retention
Magnetic tape replacement
Healthcare Data Archiving
Long term backup retention
Digital media content retention

Exam tip

Archive Storage is a blob storage type.

Lab 4-01: Creating a Storage Account

Scenario:

John has an organization for which he wants storage in Azure Cloud to store important documents. Which storage option can he use to store the documents?

By using Azure Storage, he can store his organization's important documents.

Login to the Azure portal and go to the "Storage Account" service.

portal.azure.com/#home
Search resources, services, and docs (G+/)
Create a resource
Home
Dashboard
All services
FAVORITES
All resources
Resource groups
App Services
Function App
SQL databases
Azure Cosmos DB
Virtual machines
Load balancers
Storage accounts
Virtual machines
Virtual networks
SQL databases
Azure Database for PostgreS...
Type
Last Viewed

Click “Add”

Select your subscription and go to “Create new” in the resource group option.

Enter the name of the resource group and click “OK”.

In the instance detail, enter “Storage account name” (the name should be in lowercase).

Leave everything else by default and click on “Review + create”.

Click “Create”.

Now your storage account has been deployed. Go to “Deployment details”.

Click on the resource that you created. You will see the overview of the storage account.

Microsoft Azure
Search resources, services, and docs (G+/)
Home > Microsoft.StorageAccount-20200113103510 - Overview
Microsoft.StorageAccount-20200113103510 - Overview
Deployment
Delete
Cancel
Redeploy
Refresh
Your deployment is complete
Deployment name: Microsoft.StorageAccount-20200113103510
Subscription: Pay-As-You-Go
Resource group: IPS-storage
Start time: 1/13/20
Correlation ID: 3bc
Deployment details (Download)
Resource
Type
Status
Oper
ipsteststorage1
Microsoft.Storage/stora...
OK
Oper
Next steps
Go to resource

Now, you will see the service option where you get multiple storage options. Click on “Containers”.

Click on “Container”.

Enter the name and leave the public access level default. Click on "OK".

The container has now been created.

Go to the container and click on “Upload”.

Now, upload a file in the container by selecting a file and click on “Upload”.

You will see that the file has been uploaded inside the container. If you want to change the access level, then go to the “Change access level” option.

Change it to read only access for blobs. Click “OK”.

You can now access this file over the internet by its URL. Click on the file and copy the URL.

Paste it in the browser and then you will see that the file is accessible over the internet.

blobs.png - Microsoft Azure
blobs.png (1391×1091)
ipsteststorage1.blob.core.windows.net/ipstestcontainer/blobs.

Storage
Account
Container
Blob

Mind Map

Figure 4-04: Mind Map

Practice Questions

In order to create a VM, you need a storage service that is used to store data of VM disk. Which storage option should you use?

Blob
File
Queue
Disk

In blob container, what type of data can you store?

Only binary known format
Binary files that comply with the Azure data types defined for the storage type
Any sort of binary files
The binary file that is less than 500KB

A network drive will be mapped from multiple computers running Windows 10 to Azure Storage. For the planned mapped drive, you need to create a storage solution in Azure. Which storage option is suitable for this?

Blob
File
Queue
Disk

From the following option which storage is also known as Archive storage?

File Storage
Blob Storage
Archive its own
Disk Storage

When creating a storage account, the name must contain a capital letter and special characters? True or false?

True
False

When creating an Azure storage account, what is the most significant?

The name you give the storage account becomes the main web address for accessing the files in it. It must be unique across all of Azure
The name you give the storage account becomes the main web address for accessing the files in it. It must be unique within your Azure subscription
Each storage account name is linked to a set of users that can access it
No significance. You can name a storage account as you want

From the following options, which storage solution can you use as an extension to your on-premises storage.

Blob
Queue
File
Disk

From the following, what are the types of disk storage? (Choose 2)

Slow HDD
Ultra disk
Premium HDD
Standard HDD

In the storage account, encryption of data at rest is done via RSA. True or false?

True
False

Which type of blob you can use to store log data?

Page Blob
Fast Blob
Block Blob
Append Blob

Which pricing model of blob storage can you use to store the most frequently accessed data?

Cold
Hot
Archive
All of the above

Which disk storage type gives super-fast and high performance storage for critical workloads?

Standard HDD

Standard SSD
Premium SSD
Ultra Disk

What URL format can Blobs be accessed from?

http://account>.blob.core.windowsazure.net//
http://account>.core.windows.net//
http://account>.blob.core.windows.net//
http://account>.core.windowsazure.net//

You need to create a Storage account first before using any Azure Storage option. True or false?

True
False

The maximum size of data that you can store in block blob storage is _____.

10TB
15TB
45TB
4.7TB

Chapter 05: Databases

Introduction

In modern we know that managing data is much more important as a huge amount of data is collected from various sources and you want these data stored safely at a database. Azure has a service known as Azure Databases that fulfils your business requirement. In this chapter, we will discuss some keys that Azure databases offer, which are important from the exam perspective. We will discuss Cosmo DB, which scales globally and is a fully managed database service. It has fast read and write capability. Azure SQL is managed database, which will discuss in this chapter. We also learn about MySQL database, which is one of the most popular community databases. We will also learn about the PostgreSQL database, which is an open source database with some unique features.

In this chapter, we learn about the migration of databases to Azure by using Database Migration Services. With database, your data will be stored in a organized manner so that you get exactly the data you want at no time at all.

Databases

Microsoft Azure helps you unlock your potential, wherever you have your data. You can support quick growth and save innovation time by supporting open source database engines with a secure, corporate-grade, fully managed database service. Azure provides a variety of data types and volume storage facilities. In addition, this data is available to users immediately via global connectivity. No matter what you create, Azure helps you get it to the market quickly, distribute it widely and handle it with ease and confidentiality. There are multiple Azure Database Services provided by Azure, which are:

Cosmos DB
Azure SQL
Azure Database for MySQL
Azure Database for Postgre SQL

Exam tip:

Users can create multiple databases on a single MySQL server, and there is no limit to the number of databases that can be created.

Figure 5-01: Relational Database

Cosmos DB

Cosmos DB is a global service provided from the beginning. With Cosmos DB, you can put the data closest to the user. This is one of the key features with great user experience as well. To put the databases at multiple locations can be such a difficult thing with synchronization. With Cosmos DB, Azure takes care of this synchronization. With a single click, you can add your Cosmos DB to more regions. Then Azure takes care of keeping that data and keeps it in Sync with the other region. The pricing of Cosmos DB is dependent on the throughput and consumed storage per hour.

All the data stored in Cosmos DB are encrypted at rest or in motion.

Multi-data templates can be provided with one backend. It is therefore ideal for documents, key values, relational, and graph models. It is a NoSQL database more or less because it does not rely on schemas. Nonetheless, as it has SQL-like query language and can easily support ACID transactions, some people have categorized it as a NewSQL database type.

Figure 5-02: Globally Distributed

Latency

We all know that latency is the time taken by the data to travel. The higher the latency, the longer the data takes time to reach the user. With Cosmos DB, the latency is limited to a single digit millisecond (0-9) to anywhere in the world.

Scalability

With Cosmos DB, you can scale your database automatically to infinity when the requirement goes up in order to meet the resources. When you add more resources, then there is no limit on the number of users it can support. Scaling is automatic but you only need to pay for what you use, which means it is available at the lowest price.

Connectivity

With Cosmos DB, you can work in various ways for example, if you are a developer, then you can choose from multiple built-in ways in order to connect to Cosmos DB such as SDKs or APIs. You can also use different languages such as C#, Java or Node.js. It can also integrate with SQL, MongoDB or Cassandra.

Exam tip

With Cosmos DB, a disadvantage is that it gets really expensive even though you have to pay for what you use; As the Cosmos DB scales up, the cost automatically increases.

When you are embedding data in Azure Cosmos DB, then treat your data as a self-contained document in JSON.

Lab 5-01: Creating Cosmos DB

Scenario:

John wants to create a database for the storage of data for his company and also needs that database to scale as per requirement. The scaling of that particular database must be global and easy. How he can do that?

Solution:

Using Cosmos DB as a database gives you benefit of scaling your database by replicating multiple geographical locations in single click.

Login to Azure Portal and go to the "Azure Cosmos DB" service.

portal.azure.com/#home
Create a resource
Home
Dashboard
All services
FAVORITES
All resources
Resource groups
App Services
Function App
SQL databases
Azure Cosmos DB
Virtual machines
Load balancers
Storage accounts
Virtual machines
App Services
SQL databases

Click on “Add”.

Click on “Create new” in the resource group. Enter the name of the resource group then click “OK”.

Now enter the name of the account and leave everything by default. Click on “Review + create”.

Microsoft Azure
Home > Azure Cosmos DB > Create Azure Cosmos DB Account
Create Azure Cosmos DB Account
A resource group is a container that holds related resources for an Azure solution.
Name *
ips-database
OK
Create new

Click “Create”.

Once the deployment is complete, click on “Go to resource”.

You can see the URL here, which you can use to access the data in Cosmos DB if accessing outside Azure.

Now, click on “Replicate Data Globally”.

Here, you can enable more datacenters. The blue ticks in the map indicate where your actual data center is.

Now, click on the region where you want to replicate the data, then click “Save”. After that, the data is replicated all across the two regions.

Microsoft Azure
Home > ipscosmosdb - Replicate data globally
ipscosmosdb - Replicate data globally
Azure Cosmos DB account
Save
Discard
Manual Failover
Automatic Failover
Click on a location to add or remove regions from your Azure Cosmos DB account.
* Each region is billable based on the throughput and storage for the account. Learn more

Azure SQL

Azure SQL database was launched in 1989 and is now one of the most stable products. It is a managed Azure SQL service. For a wide range of hybrid cloud applications, SQL Database can be a good choice, because it helps you to handle both relational and non-relational data structures like graphs, JSON, spatial, and XML. It is a managed Database as a Service, as another service in Azure takes care of hardware and IaaS levels. Azure SQL is on top of this and provides you basic business logic and functions as per requirement. A cloud-based Database Management System (DBMS) is provided in the Microsoft Azure SQL Database. With Azure SQL, you can easily migrate your on-premises SQL database to Azure SQL and get benefits of that. All of this is done without any change in code and with a frictionless process. This technology allows on-site and cloud apps to store data in Microsoft datacenters. Like other cloud-based services, a company pays for only what it requires, increasing and reducing usage and cost as per requirements. The use of a cloud service, therefore, helps capital expenditure such as storage and DBMS investment to be translated into operating costs. With Azure SQL, you can store 100TB of data within a minute.

Integrated with ML

With Azure SQL, you can also take advantage of integrated Machine Learning tools. Depending on the usage pattern, database optimization and performance improvement suggestions are given. With ML, you get the benefit of getting notified about any degradation or anything bad happening in your database.

Scalability

As it is a cloud based service, it also offers excellent scalability through which you get high availability. And, it gives 99.995% availability. Azure SQL Database enables you to easily scale your database by adding more compute power (scale-up) or adding more database units (scale-out).

Security

With Azure Cloud Platform, security is a built-in feature that gives you benefit in terms of security of your data. Improved data security in a single glass window, includes discovery and authentication of files, vulnerability identification, and automated threat detection. You can get continuous security from the Azure Security Center with deeper insights.

Azure Database for MySQL

Azure Database for MySQL is the database built-in by the community while Azure SQL is Microsoft's product. MySQL is an open source project where anyone can contribute to the community. It is a relational database like SQL, which means that data is related to itself or other connections in it via defined connections. Currently, there are millions of MySQL database used as it is mature and proven architecture for stability.

Azure MySQL platform provides a full-managed, business-ready MySQL cloud database. The MySQL Community Version quickly upgrades and migrates into the cloud with the choice of your language and framework, of which, some of the most popular are PHP or WordPress. Therefore, high flexibility and robust scaling are built in to help you adapt easily to changes in customer requirements. In fact, the protection and security, including the Azure IP advantage, as well as the leading market scope of Azure are incomparable. With a transparent price model, you can pick services without any hidden costs for your workload. Azure Server for MySQL was designed to provide high availability with 99.99% SLA and does not require additional setup, replica features or costs to guarantee that your apps run as necessary. It has automated batching and backup with monitoring. All of these are included without any cost.

Azure database for MySQL is PaaS, which is managed by Microsoft. By using this, you can focus on developing the business strength rather than focusing on managing servers or networks.

You can also use all security features of Azure with Azure database for MySQL like advance threat protection, monitoring, and identity management.

Use Cases

Web Application
E-Commerce
Mobile Application
Digital Marketing
Finance Management
Gaming

Azure Database for Postgre SQL

It is an open source relational database similar to MySQL. The first version of this database is based on ingress and the latest version can post, that is why it is named as PostgreSQL. SQL is the language that is used to query the data in the database. PostgreSQL is in the market since 1996 and it is free. It is a default database from MacOS. It is good for mission-critical workloads with predictable performance, security, high availability, and dynamic scalability. It is deployed as a single server and as a Citus cluster. The Hyperscale (Citus) choice scales queries in a horizontal manner through multiple sharding tools and offers more scaled and productive applications.

Features

You can integrate this database with lots of extensions like JSONB (Binary version of JSON), geospatial functions, rich indexing and integration with code like Ruby, Python, etc.
With this, you can perform horizontal scaling, which gives you very high performance in order to access the distributed data sets across many PostgreSQL instances. You can scale also up to 100 nodes with no application reads and writes
The performance recommendation in this is based on the usage of data on the database. It has a feature that detects the disruptive events that effect performance on which you can perform actions

Similar to Azure Database for MySQL, it also offers fully managed database services like automatic patching, automatic backups, and

built-in monitoring

Use Cases

Financial Applications - it is good for online transactions and integrates with mathematical software such as MATLAB
For geometric data (GIS) the government mostly uses Postgres. PostGIS is the GIS extension that gives hundreds of functions to process geometric data in multiple formats
It provides automatic failover or full redundancy, which is good for manufacturing purposes

Database Migration Service

We already know that we can migrate our data server in particular Azure SQL servers but how? By using Database Migration Services, you can do that. In Azure, you have a dedicated tool for migrating databases from on-premises to Azure. With a single tool, you can move your existing SQL server; there is no need to use multiple tools. In order to do that, you have step-by-step documentation. There is also complete documentation for non-Microsoft database migration. The Azure Server Migration Service is a fully managed program that permits smooth migration to Azure Data systems with minimal downtime from various server providers. The service is currently available in general, with ongoing efforts for growth focused on:

Reliability and performance
Addition on source/target pairs
For friction, free migration use for continuous investment

Figure 5-03: Migration Process Overview

Use Case

Consider a company that has everything on its on-premises location. The current database in use is Microsoft SQL. With the use of Database Migration Services, you can easily move your SQL server to a managed Azure SQL instance in cloud. Similarly, if you have MySQL server, then you can also move that too.

Figure 5-04: Azure DMS

Azure Big Data and Analytics

Big data is the field of technology that helps with the extraction, processing, and analysis of information that is too large or complex to deal with traditional software. Therefore, Azure provides a wide range of technologies and services to handle large and complex datasets. The most commonly used services are:

Azure Data Lake Analytics
Azure Databricks
Azure Synapse Analytics
Azure HDInsights

Azure Data Lake Analytics

Azure Data Lake normally functions in two modes – data storage and data analytics. Business owners used Azure Data Lake to run big data applications. Azure Data Lake Storage is a service that is specifically designed for big data analytics of data stored on Azure blob storage. Data Lake Storage allows the storage of relational and non-relational data from any device, video, or web application.

Azure Databricks

Databrick is the data analytics service used in the cloud-based platform. Azure Databrick promises the fast transformations of data in the cloud whether it can be steam, data batch, and experiment related to data science. It also allows a collaborative working environment for data processing and implementation.

Azure Synapse Analytics

Azure Synapse is a data warehouse that blends the data warehouse, big data analytics, and data integration into a single unified service that provides end-to-end analytics at a cloud scale. It stores big data with size of petabytes and runs queries on relational and non-relational data.

Azure HDInsights

Azure HDInsights is the fully-managed open-source analytics service with a lot of supported frameworks and tools like Hadoop, Spark, Kafka, etc. The main purpose of this analytics service is to allow you to provision clusters with multiple services so that you can easily perform the specific task.

Mind Map

Figure 5-05: Mind Map

Practice Questions

Cosmos DB is a Relational DB. True or false?

True
False

Latency is the time when you keep inserting data until the complete data is uploaded True or false?

True
False

How much latency is guaranteed by CosmosDB?

Single digit milliseconds
Two digit milliseconds
Single digit second
Single digit minutes

From the following DBs, which is best suited for migrating on-premises DB to Azure DB with all benefits?

Cosmos DB
Azure DB for MySQL
Azure DB for PostgreSQL
Azure SQL DB

How much data can you store with Azure SQL DB in a minute?

100GB
100MB

100TB
10TB

With Azure SQL DB, you can get the benefits of ML. True or false?

True
False

Azure DB for MySQL provides high availability with SLA _____.

99.9%
99.95%
99.89%
99.99%

From the following options, which one is an open-source database in Azure?

Cosmos DB
Azure SQL
Azure DB for MySQL

None of the above

Azure database for MySQL is _____, which is managed by Microsoft.

IaaS
FaaS
PaaS
SaaS

From the following, which one is the default database for MacOS?

SQL
PostgreSQL
MySQL
None of the above

From the following options, which one is the best reason to choose a database as storage of data?

You can store more data in less space due to the compression algorithms used by databases
Databases are more secure for storing data than regular Azure Storage
You can manage access to data in a database more granularly than for any other type of storage
It is a very powerful way of getting the data out in the exact format you want

Cosmos DB offers very low latency and can work with many tools like SDKs, APIs, etc. True or false?

True
False

From the following options, which are the targets for DMS?

HDInights
Azure Data Lake
Azure SQL

Microsoft SQL Server

How many methods of configuring Azure DB for MySQL are there?

2
3
4
5

From the following, which database is used for geometric data?

SQL
MySQL
PostgreSQL
All of these

If you want to store data that are frequently accessed, which data storage layer would you use?

Data Warehouse
Data Lake
Azure Cosmos DB
All of the above

Which of the following analytic services stores big data of petabytes?

Synapse
Data Lake
HDInsights

Databricks

Chapter 06: Authentication and Authorization

Introduction

Any technology service with IT applications that control the access of data from illegal users is very important to provide a secure environment. In addition, it is also very critical to find which user access which part of the infrastructure. In this chapter, we will discuss the fundamentals of authentication and authorization of users in Azure. Both of them are two major steps for ensuring network security. Authentication is a way of finding out whether the user exists in the database or not. Once the user is found from the database user ID and password, the next step is to ensure how many services that user has right to access.

Authentication and Authorization in Azure includes:

Identity Services: Identity services identify the platform for the user and ensures user validations for the application

Azure Active Directory: This directory service is able to provide access and control of access to users with different directory services

Multi-Factor Authentication: Provides security features by getting multiple information about the user for authentication

Figure 6-01: Azure Authentication and Authorization

Identity Services

When any user uses an online service that has any privacy criteria, then the user requires at least a username (that is the User ID) and password. Identity services include authentication, authorization and access management policies.

Figure 6-02: Identity Services

Authentication

Authentication is a way of identifying the user with the help of a user ID and password from the database. For example, if a user wants to use the Yahoo mail service, he/she cannot just access it easily by opening the Yahoo mail page. The user must have a valid ID and password to log in to the Yahoo mail page and then he/she will be able to use its services such as view Newsbeat, send an email, etc. In short, Authentication confirms the validity

of the user by using its ID and password for the desired application.

Authorization

Authorization is the process that is conducted after authentication. When the user is authenticated, then the next step is to find which kind of data access is available for the authenticated user. For example, an Azure user is restricted to use limited Azure resources and services such as SQL Database, Virtual Network or Virtual Machine. If that Azure user tries to use those resources for which he/she is not authorized, Azure will not give access to that resources. Likewise, if a diabetes person visits an online shopping app, Azure service has the profile of the diabetes person. According to his profile, he is only allowed to purchase sugar-free items. That's is, a person is authorized to buy only sugar-free items.

The process of identity service is clearly shown in the scenario defined in figure 6-03.

Figure 6-03: Process of Identity Management

Authentication vs Authorization

Authentication and authorization have very little differences. The summarized table shows the difference between these two entities. entities.

entities. entities. entities. entities. entities. entities. entities. entities. entities. entities. entities. entities.

entities. entities. entities. entities. entities. entities. entities. entities. entities. entities. entities.
entities. entities. entities.
entities. entities. entities. entities. entities. entities. entities. entities. entities. entities.

Table 6-01: Authentication vs. Authorization

EXAM TIP:

Authentication is the process of verification of users using user ID and password. Authorization is the method of providing the rights to authenticated users.

Access Management

Access management is a critical part of any cloud infrastructure as it ensures the restriction of access to service toward other users. It provides confidentiality, integrity, and availability. This means that access to any online application should be confidential for an unauthorized user and immediately available to the authorized users. Access management policies should also be responsible for the following:

Authentication and Authorization: User must be authenticated first, then authorized for the particular application

Faraway from Unauthorized Users: Access management policies must be designed in such a way that no unauthorized person can access the information. Azure provides a number of ways to access management depending upon the application.

Azure Active Directory

Azure Active Directory (AAD) is the main tool to manage and monitor the dedicated users' information present in Microsoft Azure.

Active Directory

Active Directory (AD) is a directory service formed by Microsoft for the storage of information about the user, resources and other things present in the network. AD is commonly used in offices, educational institutes, and management departments.

Limitation of Active Directory: Active Directory provides information for authentication and authorization, but it has some limitations;

Traditional Use Only: Active Directory provides directory services for physical access only. It is most commonly used in the on-premises network

Not Permitted for Web Applications: Active Directory is not applicable to serve its services for web applications

Authentication: Active Directory provides such directory services for authentication that is not available on Azure

Figure 6-04 shows the conceptual view of the Microsoft Active Directory (AD) services.

Figure 6-04: Active Directory Services

Azure Active Directory

Azure Active Directory (AAD) is different from the Active Directory (AD). AD provides its directory service to those companies who designed this service. Whereas, Azure Active Directory services are available for everything present on Azure. It is the first service given when a user creates an account in Azure.

Figure 6-05: AD and AAD

AAD Services

Mandatory Service: Users on Microsoft Azure are unable to create an account without AAD services

First User: Every Azure account has the first user and owner. To become an Azure user, AAD service is needed

EXAM TIP

Microsoft Active Directory (AD) is the identity management solution for an on-premises network whereas, Azure Active Directory (AAD) is the Azure service for identity management.

Tenant

A tenant is the representation of an organization in Azure. A tenant is a dedicated instance of AAD service. It is the first ADD service when a user creates an account in Azure. Each AAD tenant is separate from other AAD tenants. A single user belongs to one tenant only. Each tenant contains a user or group of users. All users and tenants are a part of the AAD instance. Users may become a guest for other tenants for some duration.

Figure 6-06: Concept of Tenant

TIP

Tenant is a particular instance of AAD. It is the first AAD instance generated when a user creates an Azure account. Each user belongs to a single-tenant at a time.

Subscription

All Azure services require subscription in order to get access to using Azure resources and services.

Billing Entity: All the resources used by the user in Azure is charged according to the subscription criteria

Cost: A user can have multiple subscriptions within a single tenant to pay separately

Subscription Blockage: Subscription of the Azure user may be blocked for a time until he/she pays the bills

Figure 6-07: Azure Subscription

Hybrid Cloud Architecture

Within a hybrid cloud architecture, there are some services present on-premises and some services hosted on the cloud. When a user wants to set the hybrid cloud infrastructure, AAD instance can be used in hybrid cloud architecture. AAD can help users manage services on both the on-premises network and on cloud. It is considered a significant part of a hybrid cloud infrastructure and is allowed for any organization. There are several services that AAD uses on Azure for management purposes.

Figure 6-08: Hybrid Cloud Architecture

EXAM TIP

A hybrid cloud architecture can be achieved by using AAD instance, which provides the connection between Azure and on-premises networks.

Multi-Factor Authentication

Multi-Factor Authentication (MFA) provides a layer-based authentication using more than one form of authentication. This means, if one is compromised by attackers then they will still not able to get in. MFA is recommended as a default. It is a part of AAD that enables other ways to authenticate users. MFA is needed in organizations that have a large number of users, devices, and resources. To avoid any collapse, extra security is required for protection and efficient throughput.

How MFA Works

Multi-Factor Authentication (MFA) conducts the authentication of the user in multiple steps. The first step is to verify the user with user ID and password. The second step is to send a code on the user's phone for further verification. The third step is the biometric verification. This step is optional.

For example, an Azure user wants to log in to the online booking web app. A large number of people are already accessing that web application due to its efficient throughput and fast response. Using MFA, the simplest way to use the application requires the user to put user ID and password for verification. Once the ID and password are correctly entered by a user, the second step of MFA verification is to confirm the user's credentials from the database by sending code on user phone., A combination of numbers in the form of code is sent to the user's phone to confirm the user. When the user gets the code, he/she is required to put the code in the given area to confirm the validity. Once the code is entered, the authentication of the user

is complete. Another way to authenticate the user is biometric verification but this step is only needed for highly advanced security purposes. Figure 6-09 shows the layer-based services offered by MFA.

Figure 6-09: Multi-Factor Authentication

TIP

Multi-Factor Authentication (MFA) provides the combined version of authentication that results in an advanced level of security and protection.

Lab 6-01: Azure Active Directory

Scenario:

An organization has multiple users that are using Azure resources and services via the Azure portal. A new user joined this organization. How can he use Azure resources and services?

Solution:

Within an organization, a new user must first register into the default directory list using Azure Active Directory. Then the user will be able to use Azure resources and service via the Azure portal. This lab is a step-by-step procedure to register a new user into the Azure Active Directory.

Log in to the Microsoft Azure portal and go to the portal menu. Click on “Azure Active Directory” from the portal menu.

The current Active Directory is opened, AAD is the first resource that is created with a user's Azure account. The Default Directory shows an overview of the active directory.

Now click on “Users” from the left side bar of the default directory.

The “Users” tab shows the list of all users that are currently in the tenant. Tenant is the first Azure Active Directory.

To add a new user to this active directory, click on the “+ New user” tab.

Write the names given in the “Identity” option.

Write user name, name, first name, and last name of your own choice.

After filling out the names section, click on “Auto-generated password” in the “Password” option.
Then click “Create”.

After clicking “Create”, the notification of “Successfully created user” will appears

The "New_user" has been created on Azure Active Directory.

Now, click on "New_user" to see the entered details.

The profile of “New_user” is opened. Now, you can assign access to other parts of the Azure account.

Microsoft Azure
Search resources, services, and docs (G+/)
Home > nomykhannedianhotmail (Default Directory) > Users - All users > New_user - Profile
New_user - Profile
User
Edit
Reset password
Delete
Diagnose and solve problems
Manage
Profile
Assigned roles
Groups
Applications
Licenses
Devices
Azure resources
Authentication methods
Activity
Sign-ins
Audit logs
Troubleshooting + Support
New support request
Got a second? We would love your feedback on user profile →
New_user
IPS_user@nomykhannedianhotmail.onmicrosoft.com
NE
User Sign-ins
100
50
0
2020
Group memberships
0
Identity edit
Name
New_user
First name
IP
Last name
Specialist
User name
IPS_user@nomyk...
User type
Member
Object ID
74ef3498-...
Source
Azure Active Direct

Mind Map

Figure 6-07: Mind Map

Practice Questions

Which service is responsible for providing the platform to users for verification?

Identity Services
Authentication
Azure Active Directory (AAD)
Multi-Factor Authentication (MFA)

The two main steps toward a secure environment in Azure are _____.

Encryption and Decryption
Authentication and Authorization
Authentication and Encryption
All of the above

Identity service is responsible for which one of the following?

Managing the traffic load
Routing Services
Subscription and Directory
Access Management

The identity of a user is called _____.

Authorization
User profile
Authentication
None of the above

Which term allows an authenticated user to access data?

Authentication
Authorization
Security
Azure Active Directory

Which principle is followed by MFA for providing the advanced level of security?

Something you know, you have, you are
The code of 6 letters
Non-repudiation
Keystroke Monitoring

The user cannot be authorized until the user has gone through the process of _____.

Modulation
Encryption
Authentication
Data Diddling

What is the first AAD instance after creating an account in Azure?

Tenant
Credential
Proxy Server
None of the above

Which directory service is commonly used in traditional offices?

AWS Directory Service
Google Directory Service
Microsoft Directory Service
Opera Directory Service

If a user has some data on Azure cloud and some present on the on-premises network, which service enables us to build an hybrid cloud architecture?

Content Delivery Network (CDN)
Multi-Factor Authentication (MFA)
Azure DNS
Azure Active Directory (AAD)

How many authentication ways are provided by MFA?

Only one
Two or more
At least four
Depends on the security requirement

Which of the following is a granular part of the identity service?

Active Directory (AD)
Tenant
Authorization
Cipher key

How is AAD different from AD?

AD is unable to provide service toward web apps
Both directory services are the same
AAD is easy to use
All of the above

If the subscription charges are not paid in time, the user will not able to use Azure resources. True or false?

True
False

Which of the following type of authentication processes are present in MFA?

Binary codes
Use of alphabets only
User must say “Security”
Biometric

Which of the following is responsible for providing the restriction of access to the data towards unauthorized users?

Authorization
Access Management
Traffic Manager
None of the above

Which of the following is considered as a compulsory service within Azure?

Multi-Factor Authentication

Azure DNS
Azure Active Directory
Account Creation

Which service is responsible of managing user's information?

Traffic Manager
Azure Active Directory (AAD)
Express Route
Identity Service

Which of the following is the limitation of Microsoft Active Directory (AD)?

It is used for traditional offices only

It is unable to provide a secure environment
It supports administration and control
None of the above

A single user may belong to how many tenants at a time?

Two
More than five
Only one
At least three

Chapter 07: Azure Solutions

Introduction

Microsoft Azure is also known as Windows Azure and it is the public cloud-computing platform used by Microsoft. It provides a variety of cloud services, including computing, analytics, storage, and networking services. Users can choose to build and scale new applications in the public cloud or run existing applications, from these services. Microsoft Azure offers both a Platform as a Service (PaaS) and an Infrastructure as a Service (IaaS).

Azure has a lot of products, features, and services. In this lesson, we will focus on some of the core products of Azure. You will learn about some of the most cutting-edge technologies available today in Azure, which includes the Internet of Things (IoT), Big Data, Artificial Intelligence (AI), serverless computing in Azure, and DevOps. These are all solutions built by Azure to solve their clients' problems.

Choosing the Best Azure IoT Service for Your Application

Internet of Things

The Internet of Things (IoT) is a collection of interconnected computing devices, mechanical and digital machines, objects, or individuals. All of them are equipped with Unique Identifiers (UIDs) and the ability to transfer data over a network without requiring any human intervention.

Azure Internet of Things (IoT) is a collection of cloud services managed by Microsoft, which connects, monitors, and controls billions of IoT assets. Simply, an IoT solution is made up of one or more IoT devices and one or more back-end services running in the cloud that communicate with each other.

Identify the product options

IoT allows devices to collect and then deliver information for data analysis. Smart devices are decked with sensors that gather data. A few common sensors that measure attributes of the physical world are mentioned below:

Environmental sensors that capture temperature and humidity levels
Barcode, QR code, or Optical Character Recognition (OCR) scanners
Geo-location and proximity sensors
Light, color, and infrared sensors
Sound and ultrasonic sensors
Motion and touch sensors
Accelerometer and tilt sensors
Smoke, gas, and alcohol sensors
Error sensors to identify when there is a problem with the device
Mechanical sensors that detect anomalies or deformations
Flow, level, and pressure sensors for measuring gasses and liquids

By utilizing Azure IoT services, devices that are equipped with these kinds of sensors and that can connect to the internet could transfer their sensor readings to a specific endpoint in Azure via a message. The message's data is then gathered and aggregated and converted into reports and alerts. On the other hand, all devices could be modernized with new firmware to fix issues or add new functionality by relaying software updates from Azure IoT services to each device.

Many services can support and drive end-to-end solutions for IoT on Azure.

IoT Services

There are many IoT related services that Azure offers to help you out. Two of the main IoT services are described here.

IoT Hub

IoT Hub is a managed service that serves as a central hub, which collects the data feeds from all devices. It is for bi-directional communication between your IoT application and the devices it manages. Using Azure IoT Hub, you can build IoT systems with efficient and secure communication between millions of IoT devices and a cloud-hosted backend solution. Virtually, any computer can be connected to an IoT Hub.

As we know, it supports bi-directional communication, which means from cloud to device and device to cloud. IoT Hub monitoring helps you keep your solution healthy by tracking actions such as device creation, device failures, and device connections.

The capabilities of IoT Hub help you build scalable, full-featured IoT applications such as controlling industrial equipment used in manufacturing, tracking valuable healthcare assets, and monitoring the use of office buildings.
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IoT Hub Features

Scaling: IoT Hub scales to millions of connected devices simultaneously and millions of events per second to support your IoT workloads
IoT Hub gives you a secure communication channel for your devices to send data
It is a Platform as a Service in Azure

To build complete, end-to-end solutions, you can integrate the IoT Hub with other Azure services

Ease of Deployment: With an array of built-in features, you can control your devices connected to an IoT Hub

IoT Central

Azure IoT Central is a fully managed, highly scalable IoT SaaS solution that reduces the complexity and costs of developing, managing, and maintaining IoT solutions of an enterprise-grade nature. Built with Azure IoT Central, it allows you to concentrate on your time, money, and energy on transforming your company with IoT data, rather than simply maintaining and upgrading a complex and constantly evolving IoT infrastructure as it does not need code to deploy your infrastructure. In this, you have pre-made connectors that you can use in IoT Central.

Its user-friendly interface allows easy monitoring of device requirements, developing guidelines, and managing millions of devices and their data over their life cycle. Additionally, it enables you to act on device insights by extending IoT intelligence into line-of-business applications.
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So in short, we can say that to start an IoT project, you need two ways: IoT Hub, which is the solution where you need more control over the IoT process that means collecting and processing. While IoT Central is the solution that provides all the dashboards your infrastructure needs to create an IoT solution without any cloud nor IoT knowledge.

Azure Sphere

Azure Sphere generates an end-to-end, extremely safe IoT solution for customers that contains everything from the hardware and operating system on the device to the reliable process of conveying messages from the device to the message hub. Azure Sphere has built-in communication and security features for internet-connected devices.

Azure Sphere has three parts:

The first part is the Azure Sphere Micro-Controller Unit (MCU), which is qualified for processing the operating system and signals from attached sensors.
The second part is a customized Linux Operating System (OS) that manages communication with the security service and can execute the vendor's software.
The third part is Azure Sphere Security Service, also identified as AS3. Its function is to make sure that the device has not been maliciously jeopardized. When the device attempts to connect to Azure, it first must verify itself, per device, which it does by applying certificate-based authentication. If it validates successfully, AS3 checks to guarantee that the device has not been tampered with. After it has confirmed a secure channel of communication, AS3 pushes any OS or authorized customer-developed software updates to the device.

After the Azure Sphere system has verified the authenticity of the device and confirmed it, the device can communicate with

other Azure IoT services by transferring telemetry and error information.

Analyze the decision criteria

In this section, we will examine the guidelines that experts apply when they determine which IoT service to employ for a given business requirement. Knowing the criteria can also assist us in better understanding the nuanced distinctions between each product.

Is it critical to ensure that the device is not compromised?

No manufacturers or customers would want their devices to be maliciously jeopardized and used for wicked purposes, but it is more crucial to guarantee the integrity of an ATM as compared to a washing machine. When security is a significant factor in our product's design, the most suitable product option is Azure Sphere that provides a complete end-to-end solution for IoT devices.

As we discussed previously, Azure Sphere guarantees a reliable channel of communication between the device and Azure by controlling everything from the hardware to the operating system and the authentication process. This ensures that the integrity of the device is uncompromised. After a reliable channel is placed, messages can be obtained from the device securely, and messages or software updates can be sent to the device remotely.

Do I need a dashboard for reporting and management?

The following decision will be based on the level of services you want from your IoT solution. If you simply want to connect to your remote devices to obtain telemetry and occasionally push updates, and you do not need any reporting functionality, you might favor performing Azure IoT Hub by itself. Your

programmers can still generate a customized set of management tools and reports by using the IoT Hub RESTful API.

But, if you require a pre-built customizable user interface using which we can observe and manage our devices remotely, you may prefer to start with IoT Central. With this solution, you can control a single device or all devices at once, and even install alerts for specific situations, such as a device failure.

IoT Central blends with many different Azure products, including IoT Hub, to produce a dashboard including reports and management characteristics. The dashboard is based on starter templates for common industry and usage scenarios. We can apply the dashboard that is generated by the starter template without changing or customizing it to meet our demands. We can have various dashboards and target them for a diversity of users.

Use IoT Hub

Let us consider an example, the Tailwind Traders senior leadership team has chosen to partner with a leading appliance manufacturer to produce an elite, high-end brand that guarantees a preemptive maintenance service agreement. This novel characteristic would distinguish Tailwind Traders appliances in a crowded, competing market. The characteristic also makes the brand profitable, because an annual subscription would be needed. To create a strong brand standing, the appliances will transmit telemetry information to a centralized location, where it can be examined and maintenance can be scheduled.

The devices will not need a remote control. They will only be transferring their telemetry data for analysis and proactive maintenance.

Because Tailwind Traders already has software in place for handling appliance maintenance requests, the company aspires to combine all functionality into this existing system.

Which service should you choose?

Let's implement the decision criteria we discussed previously.

First, is it critical to ensure that the device or, in this case, each appliance, is not compromised. It is favored, but not significant, that the devices are not jeopardized. The most damaging thing that could happen is that a hacker learns the current temperature of the customer's refrigerator or the number of loads of laundry the washing machine has made.

Even if the customer calls and states unfamiliar behavior with their appliance, a technician could reset or renew the

microcontroller. It might not justify the extra expense or engineering support that would be needed to employ Azure Sphere.

Second decision criterion: do I need a dashboard for reporting and management? In this situation, no. Tailwind Traders requires to combine the telemetry data and all other functionality into an existing maintenance request system. In this circumstance, Azure IoT Central is not needed.

So, given the responses to the decision criteria, Azure IoT Hub is the most suitable choice in this situation.

Why not use Azure IoT Central?

Azure IoT Central presents a dashboard that enables companies to control IoT devices separately and aggregate, view reports, and install error notifications through a GUI. But, in this situation, Tailwind Traders wants to combine the telemetry it accumulates and other analysis functionality into an existing software application. Moreover, the company's appliances will be collecting data by sensors only and do not require the capacity to update settings or software remotely. Consequently, the company does not require Azure IoT Central.

Why not use Azure Sphere?

Azure Sphere presents a complete solution for situations where security is important. In this situation, security is favored but not significant. The appliances cannot be updated with new software remotely. The sensors simply list usage data. In conclusion, Azure Sphere is not required.

Use IoT Central

Let us consider an example where Tailwind Traders keeps a fleet of delivery vehicles that move products from warehouses to distribution centers, and from distribution centers to stores and homes. The company is aiming for a complete logistics solution that takes data shipped from an onboard vehicle computer and turns it into actionable information.

Moreover, shipments can be equipped with sensors from a third-party vendor to collect and control ambient conditions. These sensors can accumulate information such as the temperature, humidity, tilt, shock, light, and location of a shipment.

A few objects of this logistics system are as follows:

Shipment monitoring with real-time tracing and tracking
Shipment integrity with real-time ambient condition monitoring
Protection from theft, loss, or damage of shipments
Geo-fencing, route optimization, fleet management, and vehicle analytics
Forecasting for predictable departure and arrival of shipments

The company would favor a pre-built solution to accumulate the sensor and vehicle computer data and present a graphical user interface that presents reports about shipments and vehicles.

Which service should you choose?

We will implement the decision criteria that we learned about previously.

First, is it crucial to ensure that the device or, in this instance, each appliance, is not compromised. Ideally, each sensor and vehicle computer would be impervious to interference. However, security is not named as a critical matter at this point. The vehicle computers and sensors are created by a third-party vendor and, unless Tailwind Traders needs to build its own devices (which they do not), the company will be limited to using hardware that is already prepared.

Second, does Tailwind Traders require a dashboard for reporting and management? Yes, a reporting and management dashboard is a must.

Based on these responses to the decision criteria, Azure IoT Central is the most suitable choice in this situation. The Connected Logistics starter template presents an out-of-box dashboard that will meet many of these conditions. This dashboard is preconfigured to showcase the significant logistics device operations activity. The dashboard might require to be reconfigured to remove sea vessel gateways, but the truck gateway functionality would be almost exactly what Tailwind Traders needs.

Why not use IoT Hub?

If Tailwind Traders employs IoT Central, the company would be adopting an IoT hub that is preconfigured for its particular needs by the Connected Logistics starter template. Otherwise, the company would require to do a lot of custom development to build its own cloud-based dashboards and management systems on top of Azure IoT Hub.

Why not use Azure Sphere?

Azure Sphere provides a comprehensive solution for situations where security is crucial. In this situation, security is ideal, but not a significant preference. Even though Azure Sphere presents

an end-to-end solution that includes hardware, Tailwind Traders will use hardware from a third-party vendor. So, in this situation, Azure Sphere is not needed.

Use Azure Sphere

Let us consider an example, Tailwind Traders requires to perform a touchless point-of-sale solution for self-checkout. The self-checkout terminals should be, above all else, safe. Each terminal must be invulnerable to malicious code that could produce false transactions, make the company take the systems offline during a heavy shopping period, or transmit transactional data to a spying organization. The terminals should also report back essential information on the company's health and allow secure updates to its software remotely.

After evaluating many potential solutions during a request for proposal process, Tailwind Traders concludes that it requires characteristics that vendors have yet to achieve. Instead of using an existing solution, the company elects to operate with a leading engineering firm that concentrates on IoT solutions. This strategy enables the company to formulate a uniquely secure terminal that gives it a retail platform to build on going forward.

Although most of the company's focus is on the terminal itself, Tailwind Traders recognizes that it wants a solution that can assist it to make sense of all the data that will be produced by these terminals across all of its retail stores. And, it wants an easy way to push software updates to its terminals.

Which service should you choose?

We will implement the decision criteria as we have been doing.

First, is it critical to ensure that the device or, in this case, each point-of-sale terminal, is not compromised. Device security is the main requirement.

Next, does Tailwind Traders require a dashboard for reporting and management? Yes, the company needs a reporting and management dashboard.

So, given the answers to the decision criteria, the IoT engineering firm will make a platform on top of both Azure IoT Central and Azure Sphere. Even though no specific starter template is possible in Azure IoT Central for this situation, one can easily be adapted to support the kinds of reports the company wants to see and the management actions it wants to execute.

Why not choose IoT Hub?

By using IoT Central, Tailwind Traders would be utilizing Azure IoT Hub behind the scenes as well.

Big Data

Big Data is a term used to describe the collection of millions of data that is large in size and keeps growing exponentially over time. Although collecting data from a large number of sources is not such a difficult thing, but getting any value from any of these data is difficult. That is why Big data is ideal here. It is a combination of structured, semi-structured, and unstructured data collected by companies that can be stored for information and used in predictive modeling, machine learning projects, and other advanced analytics applications. Systems that process and store big data have become a common component of data management architectures in organizations. Big data in terms of business value is used for better service, better products, and more profits.

In Azure, there are many services and tools that deals with Big Data, some of them are defined below:
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Azure Data Lake Analytics

Azure Data Lake Analytics is an on-demand job analytics service that simplifying big data. The data lake is a very large body of data on which you can perform analytical procedures. In Data Lake analytics, there is parallel processing, which means that the same data is processed by two or more processors at the same time. Instead of hardware tuning, deploying, and configuring, you write queries to transform the data and abstract valuable insights.

Data Lake Analytics works for the highest performance, throughput, and parallelization with Azure Data Lake Storage and works with Azure Storage blobs, Azure SQL Database, and Azure Warehouse.

HDInsight

Azure HDInsight is Microsoft's cloud-based big data analytics service, which helps organizations process large amounts of streaming or historical data. Azure HDInsight allows storing massive amounts of data easily, efficiently, and cost-effectively. It is similar to Azure Data Lake Analytics but it uses the most popular open-source frameworks such as Hadoop, Spark, Hive, LLAP, Kafka, Storm, R, and more. With these frameworks, a wide range of scenarios such as Extracting, Transforming, and Loading (ETL), data warehousing, machine learning, and IoT can be enabled.

Azure Databricks

Azure Databricks is an analytics platform based on Apache Spark, which is an open source cluster computing framework to enhance the Microsoft Azure platform. Databricks is integrated with Azure to provide a one-click configuration, an open workspace, and streamlined workflows that enable data scientists, data engineers, and business analysts to collaborate. Databricks run and process a dataset on many computers simultaneously. When using Databricks, you do not need a lot of computers nor its maintenance. Azure provides all the computing powers and the integration with other Azure Storage Services, such as Azure Data Lake Storage, Azure Blob Storage, Azure SQL Data Warehouse, or Azure Cosmos DB. The data from all these storages are used to find insights and analyze the data in Apache Spark.

Big Data Outcomes

Collectively, the services of big data can bring the following outcomes for you.

Speed: Speed and efficiency for processing a large amount of data, provided by the big data on Azure is the real value. You can find trends and insights to act accordingly.

Cost Reduction: Big data technology, such as cloud-based analytics brings significant cost advantages when it comes to storing a large amount of data.

Better Decision Making: Faster and better decision making with the speed of in-memory analytics combined with the ability to analyze new sources of data.

New Products and Services: Understand the customer demands and provide them with much better products and services.

Choosing the Best AI Service for Your Needs

Artificial Intelligence

Artificial Intelligence (AI) is the capability of a machine to imitate intelligent human behavior. With AI, machines can analyze images, comprehend speech, interact in natural ways and make predictions using data. In Microsoft, AI is often called Machine Learning or AI is the sub-category of Machine learning, although AI and Machine learning are often placed in the same bucket.

Microsoft focuses on three main parts to how machine learning can be used on the cloud platform.

Models

The definition of what your machine learning application is learning - A model is a set of rules that define how to use the data provided. The model finds patterns based on the rules.

Knowledge Mining

Use Azure Search to finding existing insights in your data. File relationships, geography connections, and much more.

Built-in Apps

Azure has several built-in apps that you can use for machine learning and AI straight away. These include cognitive services and bot services.

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Identify the product options

AI is a general classification of computing that enables a software system to understand its environment and take action that maximizes its likelihood of successfully completing its goals. A goal of AI is to produce a software system that is able to acclimate or learn something on its own without being explicitly programmed to do it.

There are two primary strategies for AI. The first is to apply a deep learning system that is modeled on the neural network of the human mind, allowing it to explore, learn, and grow through experience.

The second approach is machine learning, a data science method that uses existing data to train a model, test it, and then apply the model to new data to determine future behaviors, outcomes, and trends.

Note: Virtually, every device or software system that collects textual, visual, and audio data could feed a machine learning model that makes that device or software system smarter about how it functions in the future.

Azure product options

At a high level, there are three main product contributions from Microsoft, each of which is intended for a particular audience and use case. Each option presents a different set of tools, services, and programmatic APIs. In this section, we will only scratch the surface of the options' abilities.

Azure Cognitive Services

Cognitive services bring AI within every developer's reach — without requiring expertise in machine learning. All it takes is an API call to embed the feature to see, hear, speak, search, understand, and accelerate decision-making into your apps. We can use Azure Cognitive Services to resolve common problems, such as analyzing text for emotional sentiment or analyzing images to identify objects or faces. You do not require special machine learning or data science knowledge to practice these services. Developers access Azure Cognitive Services through APIs and can easily incorporate these characteristics in just a few lines of code. Azure Cognitive Services can be classified into the following kinds:

Vision

Identify and recognize the pictures, images, and digital ink automatically.

Decisions

The apps make content-based decisions by detecting the potential offensive languages, IoT anomalies and leverage data analytics.

Speech

Integrate speech processes into apps and services by converting speech into the text as transcription. It also identifies unique voices and even verifies as a speaker based on the speech.

Language services

Allow your apps to process natural language with pre-built scripts, assess sentiment, and learn how to identify what users require.

Azure Machine Learning

Azure Machine Learning is a platform for making predictions. It has tools and services that enable you to connect to data to train and test models to discover one that will most precisely predict a future result. After you have run experiments to examine the model, you can deploy and use it in real-time through a web API endpoint.

With Azure Machine Learning, you can do the following:

Create a process that describes how to gather data, how to manage missing or bad data, how to divide the data into either a training set or test set, and deliver the data to the training process.

Train and assess predictive models by employing tools and programming languages familiar to data scientists.

Build pipelines that determine where and when to run the compute-intensive experiments that are required to score the algorithms based on the training and test data.

Deploy the best-performing algorithm as an API to an endpoint so it can be consumed in real-time by other applications.

EXAM TIP: Opt for Azure Machine Learning when your data scientists need complete control over the design and training of an algorithm using your own data.

Azure Machine Learning Studio

The Azure Machine Learning Studio is the top-level tool for the machine learning service. It is a visual tool through which you can manage all of your needs for ML. It provides a centralized location for data scientists and developers to work with all the artifacts for developing, training, and deploying machine learning models.

In this, you have pre-made modules that you can use is as they are ready to be used immediately. Some use cases for Azure Machine Learning Studio are Twitter Sentiment analysis, movie recommendation, and photo grouping.

Machine Learning Services

End-to-End Service: The service to use AI and machine learning almost anywhere on Azure.

Tooling: The Machine Learning service is a collection of tools to help you build AI applications.

Automation: Azure automatically recognizes trends in your applications and creates models for you.

Azure Bot Service

Azure Bot Service and Bot Framework are platforms for building virtual agents that understand and respond to questions exactly like a human. Azure Bot Service differs a bit from Azure Machine Learning and Azure Cognitive Services in that it has a specific use case. Namely, it forms a virtual agent that can intelligently converse with humans. Behind the scenes, the bot you make applies other Azure services, such as Azure Cognitive Services, to learn what their human counterparts are asking for.

Bots can be used to shift simple, repetitive tasks, such as making a dinner reservation or gathering profile information, onto automated systems that might no longer need direct human intervention. Users converse with a bot through text, interactive cards, and speech. A bot interaction can be a quick question and answer, or it can be an advanced conversation that intelligently provides access to services.

Analyze the decision criteria

In this section, we will examine the criteria that experts apply when they choose an AI service for a particular business need. Understanding the criteria can also help us better understand the nuanced differences among the products.

Are you building a virtual agent that interfaces with humans via natural language?

Use Azure Bot Service when you want to create a virtual agent to associate with humans by utilizing natural language. Bot Service combines knowledge sources, natural language processing, and form factors to enable interaction across different channels.

Bot Service solutions normally depend on other AI services for such things as natural language understanding or even translation for localizing replies into a customer's favored language.

Before you jump in to create a custom chat experience by using Bot Service, it might make sense to seek prebuilt, no-code solutions that cover common situations. For instance, you can use QnA Maker, which is obtainable from Azure Marketplace, to build, train, and publish a sophisticated bot that employs FAQ pages, support websites, product manuals, SharePoint documents, or editorial content through an easy-to-use UI or by REST APIs.

Similarly, Power Virtual Agents combines with Microsoft Power Platform so that you can utilize hundreds of prebuilt connectors for data input. You can extend Power Virtual Agents by building custom workflows with Power Automate, and if you feel that the out-of-the-box experience is too restricting, you can still produce more complex interactions with Microsoft Bot Framework.

Do you need a service that can understand the content and meaning of images, video, or audio, or that can translate text into a different language?

Apply Azure Cognitive Services when it comes to general-purpose tasks, such as delivering a speech to text, integrating with search, or recognizing the objects in an image. Azure Cognitive Services is general-purpose, meaning that many different kinds of customers can profit from the work that Microsoft has already done to train and test these models and offer them inexpensively at scale.

Do you need to predict user behavior or provide users with personalized recommendations in your app?

The Azure Cognitive Services Personalizer service views your users' actions within an application. You can use Personalizer to predict their behavior and present relevant experiences as it recognizes usage patterns. Here again, you could capture and collect user behavior and design your own custom Azure Machine Learning solution to achieve these things, but this method would need much effort and cost.

Will your app predict future outcomes based on private historical data?

Choose Azure Machine Learning when you need to examine data to predict future results. For example, assume you need to examine years' worth of financial transactions to identify new patterns that could help you generate new products and services for your company's clients and then propose those new services during routine customer service calls. When you are working with proprietary data, you will possibly need to create a more custom-tailored machine learning model.

Do you need to build a model by using your own data or perform a different task than those listed above?

Employ Azure Machine Learning for maximum flexibility. Data scientists and AI engineers can utilize the tools they are familiar with and the data you present to develop deep learning and machine learning models that are tuned for your particular demands.

Use Machine Learning for decision support systems

Let us consider an example, the Tailwind Traders e-commerce website permits its customers to scan and purchase items that can be transported or picked up from a retail store nearest to their location.

The Marketing team is assured that it can improve sales dramatically by recommending add-on products that complement the items in a shopper's cart at the time of checkout. The team could hard-code these recommendations, but it feels that a more organic path would be to utilize its years' worth of sales data as well as new shopping trends to determine what products to present to the shopper. Additionally, the suggestions could be affected by product availability, product profitability, and other circumstances.

The Marketing team's existing data science experts have already done some primary analysis of the problem domain, and have concluded that its plan might take months to prototype, and probably a year to roll out.

Which service should you choose?

Let's implement the decision criteria you learned about previously to find the best option.

First, is Tailwind Traders building a virtual agent that interfaces with humans through natural language? No, it is not, so Azure Bot Service is not a suitable competitor for this situation.

Second, does Tailwind Traders require a service that can understand the content and meaning of images, video, audio, or translate text into a different language? No, it does not, so the relevant Cognitive Services will not accommodate the company.

Third, does Tailwind Traders require to predict user behavior or provide users with personalized recommendations? Yes, it does. But, producing recommendations based on user behavior is only part of the condition. Tailwind Traders wants to create a complex model that combines historical sales data, trending sales data, inventory, and more. Azure Cognitive Services Personalizer service can play a role, but it cannot manage the entire breadth of the project alone.

Fourth, will the Tailwind Traders app foretell future results based on private historical data? Yes, and that is why in this situation, Azure Machine Learning is likely the best choice.

The success of this effort would depend principally on the capacity of the model to select accurately the right up-sale products to recommend to the shopper. Because the model would need to be tweaked and tuned over time, an off-the-shelf model would likely not satisfy.

Lastly, it sounds like the Marketing team already uses some data science experts, and the team is ready to make at least a year-long commitment to building, testing, and tweaking the models to be used.

Use Cognitive Services for data analysis

Let's consider an example where the first generation of the Tailwind Traders e-commerce website was available solely in English. But, when the Marketing team sponsored a demographics research for the company's brick-and-mortar locations, it determined that, on average, only 80 percent of possible customers speak English. In some neighborhoods, that number drops to 50 percent. The team sees the addition of multiple languages as an excellent chance to assist non-English speakers with the identical online e-commerce experience as English speakers.

Which service should you choose?

As in the previous section, implement the decision criteria you learned about earlier to find the right option.

First, is Tailwind Traders building a virtual agent that interfaces with humans via natural language? No, it is not, so Azure Bot Service is not a valid competitor for this situation. But, should Tailwind Traders ever implement a customer service agent, it might want to contemplate using the Translator API to present real-time translation to serve customers who are not English speakers.

Second, does Tailwind Traders require a service that can learn the content and meaning of images, video, audio, or translate text into a different language? Yes, it does. Translating textual content from one language into another is a general-purpose task that you can simplify by utilizing the Azure Cognitive Services Translator service. The service is easy to mix into your applications, websites,

tools, and solutions. It permits you to add multilanguage user experiences in more than 60 languages, and you can utilize it on any hardware platform with any operating system for text-to-text language translation.

Azure Cognitive Services is possible the best option for this situation, but let's proceed to apply the decision criteria to make sure.

Third, does Tailwind Traders want to predict user behavior or provide users with personalized recommendations? No, it does not, so the Azure Cognitive Services Personalizer is not a suitable candidate for this situation.

Finally, will the Tailwind Traders app need to predict future outcomes based on private historical data? No. Although it is probable to build a Machine Learning model for multilanguage translation, it would be expensive and time-consuming for Tailwind Traders to strive to build translation models themselves. The team has neither the deep learning competency nor the linguistic data that is needed to train the models.

Now that you have considered all the expert criteria, you can assuredly select Cognitive Services as the most suitable product option for this situation.

Use Bot Service for interactive chat experiences

The Customer Service team has long requested for a virtual agent to control the vast majority of questions it gets asked. No matter how obvious it makes the answers to the most frequently asked questions on the website, shoppers are anxious and comprehend contact in a chat window as saving them time.

The team wants shoppers to think as though they are interacting with a real human. When it becomes apparent that the virtual agent cannot provide an answer, the chat session should be assigned to a human.

Giving a virtual agent would reduce the amount of time it takes for all shoppers to obtain answers. The virtual agent could answer most questions, which would free up human customer service agents to grant support for more complex questions or thorny account-related issues.

Which service should you choose?

Once again, employ the decision criteria you are now accustomed to, to find the best product.

First, is Tailwind Traders building a virtual agent that interfaces with humans through natural language? Yes, it is. Azure Bot Service should be adopted in this situation to implement a virtual agent chat experience. Bot Service could avail from the information on the website's Frequently Asked Questions page, along with thousands of chat sessions that have been saved between shoppers and customer service representatives. Customer Service supervisors can test and tweak the answers to continue to refine the chat experience.

Even though you have likely found the best option for this situation, keep implementing the decision criteria to see whether any further options might work.

Second, does Tailwind Traders require a service that can understand the content and meaning of images, video, audio, or translate text into a different language? Possibly, yes. In this situation, Azure Cognitive Services could be utilized along with Bot Service to build the solution. To facilitate implementation, the developers could explore using prebuilt solutions, such as QnA Maker (part of Cognitive Services) or Power Virtual Agents. Additionally, any Azure Bot solution would possibly implement several Azure Cognitive Services, such as Language Understanding (LUIS) and possibly Translator, to translate from the shopper's language to English and back again.

Third, does Tailwind Traders need to foretell user behavior or provide users with personalized suggestions? No, it does not. Azure Cognitive Services Personalizer is not a good competitor for this situation.

Finally, will the Tailwind Traders app need to predict future results based on private historical data? No. Although Tailwind Traders does have historical data to supply into a model, which would make it feasible to apply Azure Machine Learning to create a chat solution, another option is already tailored for the chatbot experience.

Choosing the Best Azure Serverless Technology for Your Business Scenario

Serverless

Serverless is such an important part of modern cloud computing. The serverless model allows developers to build applications faster by eliminating the need for them to manage the infrastructure. It is an extreme PaaS. The cloud service provider automatically offers, scales, and manages the infrastructure required for running the code with serverless applications.

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workload requirements.

Faster Time to Market: Serverless applications reduce the dependencies of operations on each development cycle, increasing the agility of development teams to produce more features in less time.

More Efficient Use of Resources: Shifting to serverless technology allows companies to reduce TCO and resource reallocation to speed up the pace of innovation.

Identify the product options

In this section, we will study two Azure serverless computing services: Azure Functions and Azure Logic Apps.

Azure Functions

Azure Functions is the compute component of serverless services offered by Azure. It is called function as it has a single task to perform every time. This means that you can use Functions to write code without having to worry about deploying that code or creating VMs to run your code. The code runs only once for every invocation. Apps using Azure Functions are often referred to as Function Apps. It can be able to run millions of times per second if needed. Using an event-driven model, serverless functions accelerate development, with triggers that automatically execute code to react to events and bindings to seamlessly incorporate extra services.

Azure Logic Apps

Azure Logic Apps is a cloud service that connects the systems both inside and outside the Azure Platform; you can integrate apps, data, and services or even an entire system across organizations. With this, you can automate, and orchestrate business processes, tasks, activities, and workflows. Unlike Function Apps, to create some efficient workflows with Logic Apps,

you do not have to write the code. Everything is customizable in Azure Portal. Logic Apps simplifies how you design and build flexible applications for application integration, data integration, system integration, Enterprise Application Integration (EAI), and Business-to-Business (B2B) communication, whether in the cloud, at the premises, or both.

Use Case

Every time a new order is created in your ordering system, you can create a logic app to create a record for how long it took. It inserts that into a database and sends an email to the requested person. You can also have a conditional path, like when an order is over 100$, you can send a different email to customer service to ask them to thank the customer. You can connect a ton of applications either manually or using templates, there is no code need, no service to setup and you can get started very quickly.

Azure Event Grid

An event, in a computing concept, is an action or occurrence that can be identified by a program and has significance for system application. Azure Event Grid lets you easily build applications with event-based architectures. First, pick the Azure resource you would like to subscribe to, and then send the event to the event handler or WebHook endpoint. Event Grid has built-in support for events such as storage blobs and resource groups, coming from Azure services. Event Grid also supports your own events, using custom-made themes. Event Grid is a serverless service so there is no need for the management of infrastructure.

You can use filters to route specific events to different endpoints, multicast to multiple endpoints, and ensure your events are reliably delivered. Azure Event Grid is deployed to maximize availability by native distribution across multiple fault domains in every region and across availability zones. Event Grid connects

data sources and event handlers. You can use Event Grid to trigger a serverless function that analyzes images when added to a blob storage container.

Analyze the decision criteria

With two viable serverless choices, it can be tough to identify which is the most suitable one for the job. In this section, we will examine the criteria that experts employ when they are adopting a serverless service to utilize for a given business need. Understanding the criteria can also help you better understand the nuanced differences between the products.

Do you need to perform an orchestration across well-known APIs?

As we saw earlier, Azure Logic Apps was created with orchestration in mind, from the web-based visual configurator to the pricing model. Logic Apps exceeds at connecting a large array of diverse services via their APIs to pass and process data through many steps in a workflow.

It is probable to create the same workflow by using Azure Functions, but it might take a significant amount of time to investigate which APIs to call and how to call them. Azure Logic Apps has already componentized these API calls so that you only provide some details and the details of calling the required APIs is abstracted away.

Do you need to execute custom algorithms or perform specialized data parsing and data lookups?

With Azure Functions, you can utilize the full expressiveness of a programming language in a compact form. This allows you concisely build complicated algorithms, or data lookup and parsing operations. You would be accountable for maintaining the code, handling exceptions resiliently, and so on.

Although Azure Logic Apps can make logic (loops, decisions, and so on), if you have a logic-intensive orchestration that wants a complex algorithm, implementing that algorithm might be more verbose and visually overwhelming.

Do you have existing automated tasks written in an imperative programming language?

If you already have your orchestration or business logic expressed in C#, Java, Python, or another popular programming language, it might be simpler to port your code into the body of an Azure Functions function app than to create it again by using Azure Logic Apps.

Do you prefer a visual (declarative) workflow or writing (imperative) code?

Eventually, your decision comes down to whether you favor working in a declarative environment or an imperative environment. Developers who have expertise in an imperative programming language might want to think about automation and orchestration from an imperative mindset. IT professionals and business analysts might want to work in a more visual low-code/no-code (declarative) environment.

Use Azure Functions

Let us consider an example, Data about each product that is sold at Tailwind Traders is packaged as a JSON message and transferred to an event hub. The event hub spreads the JSON message to subscribers, which enables various systems to be notified.

Tailwind Traders wants to upgrade its e-commerce site to incorporate real-time inventory tracking. Currently, the website updates product availability nightly at 2:00 AM. A Windows service that's written in C# contains all of the necessary logic to do the following:

Retrieve messages
Parse the JSON
Accomplish a lookup across multiple databases to find additional product information
Possibly, send notifications to the purchasing department so that they can reorder quantities that fall below certain levels

The Windows service runs in a virtual machine that's hosted on Azure.

Most of the time, this system works fine. Nevertheless, some products are in great demand, and some products are kept in fewer quantities at each store. Many times a day, customers drive to a store to pick up an item just to find that it is no longer in stock.

Rather than running the algorithm nightly, the company aspires to run the inventory updater each time a product is purchased.

Which service should you choose?

Since the Tailwind Traders developers team has already drafted the logic in C#, it would be reasonable to copy the relevant C# code from the Windows service and port it to an Azure function. The developers would bind the function to trigger each time a new message arrives on a specific queue.

Why not choose Azure Logic Apps?

It is reasonable to perform the same logic in Azure Logic Apps. However, because the team has now spent time building the service in C#, it can apply the same code in an Azure function.

Use Azure Logic Apps

Let us consider an example where Tailwind Traders grants its customers an invitation to engage in a customer satisfaction survey randomly after a purchase. Currently, the customer satisfaction results are aggregated, averaged, and charted. However, its customer service department sees an opening to reach out proactively to customers who provide low scores and leave comments with a negative feeling.

Ideally, negative customer satisfaction scores would cause a customer retention workflow. First, a sentiment analysis would be generated based on the free-form comments, an email would be sent to the customer with an apology and a coupon code, and the message would be routed to the Dynamics 365 customer service team so that it could schedule a follow-up email.

Regrettably, no Tailwind Traders developer resources are available to carry on this project even though the customer service team works with several clouds and IT professionals who might be able to create a solution.

Which service should you choose?

In this situation, Azure Logic Apps is likely the most suitable solution. A cloud or IT professional could use existing connectors to execute a sentiment analysis by applying the Azure Cognitive Services connector, send an email by using the Office 365 Outlook connector, and create a new record and follow-up email by utilizing the Dynamics 365 customer service connector.

Because Azure Logic Apps is a low-code/no-code service, no developers are required. A cloud or IT professional should be able to build and support this workflow.

Why not choose Azure Functions?

Even though it is likely to build the whole solution by using Azure Functions, this method might be difficult if no software developers can be allocated to this project.

This is an excellent scenario for Azure Logic Apps. Connectors already exist for each of the steps described in the workflow. It would take quite a bit of study, development, and testing for a developer to formulate a solution that employs all these disparate software systems.

Choosing the Best Tools to Help Organizations Build Better Solutions

DevOps

DevOps is a combination of the development and operations of the term, meant to reflect a collective or cooperative approach to the activities performed by the application development departments of an organization and IT operations. The term DevOps is used in various ways, it is an organizational concept in its broadest sense that promotes better coordination and collaboration between these teams and others within an enterprise to generate a better and more reliable product.
product. product.

Understand your Product Options

In this section, we will concentrate only on the Microsoft tools that can help achieve some of the DevOps goals. Alternately, organizations that are not ready to fully welcome the potential of DevOps can assist technical teams in their cloud development activities.

Microsoft offers tools to enable source-code management, continuous integration and continuous delivery (CI/CD), and automating the creation of testing environments. Sometimes, it seems as though these tools overlap in functionality, so in this section, you will learn about several product choices, and when to pick one product over another.

Product options

At a high level, there are three main offerings, each of which is aimed at a particular audience and use case and provides a diverse set of tools, services, programmatic APIs, and more.

Azure DevOps

Azure DevOps offers developer tools to support teams in preparing projects, working on application creation, and designing and deploying new products.

Azure DevOps provides integrated features that can be accessed via your web browser or client IDE. Depending on your business needs, you may use one or more of the following services:

Azure Boards: Allows the project manager to keep track of work tasks, timelines, planning and monitoring, code bugs, and issues.

Azure Pipelines: Provides services to develop and test, automatically and continuously.
Azure Repos: Provides the source control of your code to Git repositories or Team Foundation Version Control (TFVC). It is a store where your code is securely managed.
Azure Test Plans: Provides various tools for testing the software, including manual/exploratory testing and continuous testing automatically.
Azure teams to share public and private Maven, Npm, and NuGet packages and incorporate package sharing into your CI/CD pipelines.

GitHub and GitHub Actions

GitHub is arguably the world's most successful code repository for open-source software. Git is a decentralized source-code management tool, and GitHub is a hosted variant of Git that works as the primary remote. GitHub grows on top of Git to present related assistance for coordinating work, reporting and discussing issues, producing documentation, and more. It offers the following functionality:

It is a shared source-code repository, containing tools that allow developers to deliver code reviews by appending comments and questions in a web view of the source code before it can be assimilated into the main codebase.

It expedites project management, including Kanban boards.
It supports issue reporting, discussion, and tracking.
It emphasizes CI/CD pipeline automation tooling.
It comprises a wiki for collaborative documentation.

It can be run from the cloud or on-premises

Most important for this section, GitHub Actions allows workflow automation with triggers for various lifecycle events. One such case would be automating a CI/CD toolchain.

A toolchain is a mixture of software tools that help in the delivery, development, and management of software applications throughout a system's development lifecycle. The output of one tool in the toolchain is the input of the next tool in the toolchain. Typical tool functions range from implementing automated dependency updates to building and configuring the software, delivering the build artifacts to multiple locations, testing, and so on.

With such similarity between many GitHub and Azure DevOps characteristics, you might question which product to pick for your organization. Sadly, the answer might not be straightforward.

Although both Azure DevOps and GitHub support public and private code repositories, GitHub has a long history with public repositories and is trusted by tens of thousands of open-source project owners. GitHub is a lighter-weight tool than Azure DevOps, with a center on individual developers contributing to the open-source code. Azure DevOps, on the opposite, is more focused on enterprise development, with heavier project-management and planning tools, and fine-grained access control.

Note: Your choices are not limited to Azure DevOps Services or GitHub and GitHub Actions. In practice, you can mix and match these services as needed. For example, you can use GitHub Repos with Azure Boards for work item tracking.

Azure DevTest Labs

Azure DevTest Labs helps team developers handle Virtual Machines (VMs) and PaaS tools effectively, without waiting for approvals. It focuses in environment management. With this, developers and engineers are allowed to create an environment for test and development.

DevTest Labs creates labs that consist of pre-configured bases or templates for Azure Resource Manager. These have all the tools and applications you can use to create environments. You can create environments in a couple of minutes, instead of hours or days. It is also helpful for cost management as it minimizes the waste of resources in accounts. The creation of an environment can also be automated.

Analyze the decision criteria

In this section, you will examine the criteria that experts employ when they adopt DevOps tools or services to address particular business needs. Understanding the criteria can also help you better understand the nuanced differences between each product.

Do you need to automate and manage test-lab creation?

If you intend to automate the making and administration of a test lab environment, consider choosing Azure DevTest Labs. Amongst the three tools and services we've outlined, it is the only one that offers this functionality.

Nevertheless, you can automate the provisioning of new labs as part of a toolchain by applying Azure Pipelines or GitHub Actions.

Are you building open-source software?

Although Azure DevOps can print public code repositories, GitHub has long been the favored host for open-source software. If you are creating open-source software, you would likely choose GitHub if for no other purposes than its distinctness and general approval by the open-source development community.

The remaining decision criteria are particular to deciding between either Azure DevOps or GitHub.

Regarding source-code management and DevOps tools, what level of granularity do you need for permissions?

GitHub works on a simplistic model of read/write permissions to each feature. Meantime, Azure DevOps has a much more granular kit of permissions that enables organizations to define who can make most operations across the entire toolset.

Regarding source-code management and DevOps tools, how sophisticated do your project management and reporting need to be?

Even though GitHub has work items, issues, and a Kanban board, project management and reporting is the domain where Azure DevOps shines. Azure DevOps is extremely customizable, which enables an administrator to append custom fields to obtain metadata and additional information beside each work item. In contrast, the GitHub Issues characteristic applies tags as its main way of supporting a team to classify issues.

Regarding source-code management and DevOps tools, how tightly do you need to integrate with third-party tools?

Although we make no particular suggestions about third-party tools, it is necessary for you to know your organization's existing investments in tools and services and to assess how these dependencies might influence your choice. Most vendors that create DevOps tools likely create hooks or APIs that can be utilized by both Azure Pipelines and GitHub Actions. Even so, it is plausibly worth the trouble to verify that theory.

Use Azure DevOps to manage the application development lifecycle

The software development team at Tailwind Traders operates on various diverse projects, both for internal and external usage. The team requires to give project sponsors and managers executive-level reporting, containing burndown charts, track progress against epics, and track custom information that is particular to Tailwind Traders in each work item and bug report.

As Tailwind Traders grows and hires contractors and outside vendors for short-term work, the upper management team aspires to ensure that these individuals have admittance only to the information they require to do their work.

Which services should we choose?

Implement the decision criteria you learned about in the previous section to find the best option.

First, does Tailwind Traders need to automate and manage test lab creation? No. So, in this situation, Azure DevTest Labs is not a competitor, because it is not designed for this particular use case.

Second, is Tailwind Traders building open-source software? Though it is not declared explicitly, Tailwind Traders is developing internal and external systems, such as their e-commerce system, which is not open source. So, that is not a factor in this situation.

Third, what level of granularity do Tailwind Traders require for permissions? Previously, we affirmed that Tailwind Traders will employ temporary employees and vendors for short-term work, which makes a granular permissions requirement an essential

point for upper management. Based on our account in the previous unit, this characteristic would secure Azure DevOps as a leading candidate. By adopting Azure DevOps, Tailwind Traders administrators would also have a more sound set of options for managing permissions across the complete portfolio of work.

Fourth, does Tailwind Traders want sophisticated project management and reporting solution? Yes, robust project management and reporting characteristics are fundamental considerations. Here again, due to the number of work-item customization and reporting the management team wants, Azure DevOps would possibly be a valid choice.

Fifth, does Tailwind Traders want tight integration with any third-party DevOps tools? Tool integration was not registered as a primary concern for this situation. As you studied in the previous unit, most third-party DevOps tools combined with both Azure DevOps and GitHub make it plausible that the team will find the tools it requires.

Use GitHub to contribute to open-source software

Tailwind Traders aspires to issue an API that would permit third parties to combine their own inventories of new and used items. This plan would enable Tailwind Traders to extend a more extensive assortment of products directly from their e-commerce site.

Although the internal implementation of the API is closed source, Tailwind Traders desires to produce a collection of examples that call the API to execute various actions. The team requires a platform to share sample code, gather feedback on the API, permit contributors to report issues, and develop a community around feature requests.

Which service should you choose?

Apply the decision criteria you studied earlier to find the best option.

First, does Tailwind Traders need to automate and manage test lab creation? No. In this situation, Azure DevTest Labs is not a competitor because it is not intended for this use case.

Second, is Tailwind Traders building open-source software? Yes. As we saw in a previous section, developers are used to seeing this sort of content available on GitHub. With GitHub, Tailwind Traders developers can publish their code, acquire community contributions to enhance the code examples, receive feedback and bug reports, and more. Because this scenario includes open-source code, GitHub is a leading candidate.

Third, what level of granularity does the Tailwind Traders team need for assigning permissions? Though it is not declared

explicitly, the fact that Tailwind Traders will be receiving community contributions, issuing reports, and usually attempting to create a community of developers around their API examples, the company's permission requirements are basic: users can either view only or view and write. This is another reason why GitHub would be a great candidate for this situation.

Fourth, does Tailwind Traders want sophisticated project management and reporting solution? Again, because of the status of this project, the team does not require a sophisticated project management and reporting solution. In this situation, the power of Azure DevOps Services is not needed.

Fifth, does Tailwind Traders require tight integration with any third-party DevOps tools? Tool integration was not registered as a principal concern for this situation and does not pass or disqualify either tool.

GitHub is the most suitable option for this situation. Although you could employ Azure DevOps to make the repository public, some of the other characteristics that include the development community, such as feedback or bug reports would be less available.

Use Azure DevTest Labs to manage testing environments

Tailwind Traders requires being more systematic and precise when it launches new versions of its e-commerce website to production. The company will grow its Quality Assurance (QA) team, and it will utilize the cloud to build and host virtual machines. Through this method, it will produce testing environments that match the production environment.

The management team has concerns about the prices of a more automated test environment. For example, it wants to make sure that the QA professionals are not losing time configuring the testing environment to match the production environment. The team desires to ensure that the VMs are destroyed when they are no longer in practice. It wants to restrict the number of VMs that each QA professional is permitted to spin up. In addition, the team wants to ensure that each environment is configured accurately and compatible with the production environment.

Which service should you choose?

Once again, start by implementing the decision criteria you studied earlier to obtain the correct product.

First, does Tailwind Traders want to automate and control test lab creation? Yes. This looks like a job for Azure DevTest Labs because it can do everything that the team requires to achieve in this situation.

We could proceed with evaluating the decision criteria, but neither Azure DevOps nor GitHub is required for this situation. Recollect that either Azure DevOps or GitHub could be utilized to

produce product releases that can automatically be included in any VMs that you build for testing purposes.

Choosing the Best Monitoring Service for Visibility, Insight, and Outage Mitigation

Identify your product options

Following are the questions that companies face while using the cloud:

Are we utilizing the cloud correctly? Can we get more production out of our cloud spend?
Are we paying more than we need to?
Do we have our systems correctly secured?
How resilient are our resources? If we encounter a regional outage, could we failover to another region?
How can we diagnose and repair issues that occur intermittently?
How can we quickly ascertain the reason for an outage?
How can we study planned downtime?
Fortunately, by applying a mixture of monitoring solutions on Azure, you can:
Gain answers, insights, and alerts to help guarantee that you've optimized your cloud usage.
Determine the root reason for unplanned issues.
Plan ahead of time for planned outages.

The product options

At a high level, there are three main Azure monitoring offerings, each of which is aimed at a particular audience and use case and gives a diverse set of tools, services, programmatic APIs, and more.

Azure Advisor

Azure Advisor assesses your Azure resources and gives suggestions to help enhance reliability, security, and performance, realize operational excellence, and lessen costs. The advisor is intended to help you conserve time on cloud optimization. The recommendation service covers suggested actions you can exercise immediately, delay, or dismiss.

Note: The recommendations are available through the Azure portal and the API, and you can install notifications to inform you of new recommendations.

When you are in the Azure portal, the Advisor dashboard presents personalized guidance for all your subscriptions, and you can apply filters to choose recommendations for particular subscriptions, resource groups, or services. The recommendations are classified into five categories as follows:

Reliability: Used to secure and enhance the continuity of your business-critical applications.
Security: Used to identify threats and vulnerabilities that might drive security breaches.
Performance: Used to increase the speed of your applications.
Cost: Used to optimize and decrease your overall Azure spending.
Operational Excellence: Used to assist you to achieve process and workflow efficiency, resource manageability, and deployment best practices.

Azure Monitor

Azure Monitor is a platform for gathering, analyzing, visualizing, and possibly taking action based on the metric and logging data from your complete Azure and on-premises environment.

The diagram below demonstrates just how extensive Azure Monitor is.

Figure 7-01: Azure Monitor

On the left is a list of the sources of logging and metric data that can be obtained at every layer in your application architecture, from the application to the operating system and network.
In the center, you can see how the logging and metric data are saved in central repositories.
On the right, the data is used in plenty of ways. You can view real-time and historical performance over each layer of your architecture, or aggregated and detailed information. The data is presented at various levels for diverse audiences. You can observe high-level reports on the Azure Monitor Dashboard or create custom views by applying Power BI and Kusto queries.

Additionally, you can utilize the data to help you react to crucial events in real-time, by alerts delivered to teams through SMS, email, and so on. Or you can implement thresholds to trigger autoscaling functionality to scale up or down to match the demand.

Some popular products, such as Azure Application Insights that is a service for transmitting telemetry information from application source code to Azure, uses Azure Monitor under the hood. With Application Insights, your application developers can take advantage of the strong data-analysis platform in Azure Monitor to gain deep insights into an application's operations and diagnose errors without having to wait for users to report them.

Azure Service Health

Azure Service Health presents a personalized design of the health of the Azure services, regions, and resources you depend on. The status.azure.com website, which presents only the main issues that broadly influence Azure customers, does not present the full picture. But Azure Service Health presents both major and smaller, localized issues that concern you. Service issues are rare, but it is important to be equipped for the unexpected. You can set up alerts that aid you in triage outages and planned maintenance. After an outage, Service Health grants official incident reports, called Root Cause Analyses (RCAs), which you can share with stakeholders.

Service Health assists you in keeping a focus on several event types:

Service issues are problems in Azure, such as outages, that concern you right now. You can drill down to the concerned services, regions, updates from your engineering teams, and find ways to share and track the latest information.

Planned maintenance events can influence your availability. You can drill down to the affected services, regions, and details to show how an event will influence you and what you need to do. Most of these events occur without any consequence to you and are not shown here. In the unusual case that a reboot is needed, Service Health enables you to determine when to perform the maintenance to reduce the downtime.

Health advisories are issues that need you to act to evade service interruption, including service retirements and breaking changes. Health advisories are declared far in advance to enable you to plan.

Analyze the decision criteria

In this section, you will examine the criteria that experts employ when they adopt an Azure monitoring service for a particular business requirement. By understanding the criteria, you can better assess the nuanced differences among the products.

Do you need to analyze how you are using Azure to reduce costs? Improve resilience? Harden your security?

Pick Azure Advisor when you want for an analysis of your deployed resources. Azure Advisor examines the configuration and utilization of your resources and gives suggestions on how to optimize for reliability, security, performance, costs, and operations based on experts' best practices.

Do you want to monitor Azure services or your usage of Azure?

If you want to keep an eye on Azure itself, particularly the services and regions you rely on, you want to pick Azure Service Health. You can observe the current status of the Azure services you rely on, future planned outages, and services that will be sunset. You can insert alerts that assist you in staying on top of incidents and upcoming downtime without having to visit the dashboard regularly.

But, if you want to keep track of the performance or issues related to your specific VM or container instances, databases, your applications, and so on, you should visit Azure Monitor and create reports and notifications to help you understand how your services are performing or diagnose issues related to your Azure usage.

Do you want to measure custom events alongside other usage metrics?

Select Azure Monitor when you require to measure custom events alongside other collected telemetry data. Custom events, such as those attached in the source code of your software applications, could assist in identifying and diagnosing why your application is performing a certain way.

Do you need to set up alerts for outages or when autoscaling is about to deploy new instances?

Here again, you would apply Azure Monitor to set up alerts for key events related to your particular resources.

Use Azure Advisor

Let us consider an example Tailwind Traders requires to optimize its cloud cost. Additionally, the organization is concerned about security violations because it saves customer data and historical purchase data in cloud-based databases. As the organization ramps up its cloud expertise, it wants to get a better understanding of its use of the cloud and best practices and pinpoint "easy wins" where it can lessen its cloud cost and tighten security measures.

Which service should you choose?

Implement the decision criteria you studied in the previous section to find the best option.

First, in this situation, does Tailwind Traders need to analyze its Azure usage for the sake of optimization? Yes. Tailwind Traders recognizes that it might be paying too much, is concerned about its security measures, and wants to have its cloud usage examined against industry best practices. Hence, Azure Advisor is the ideal option for this situation.

Although you might have found the correct product option, let's continue assessing the decision criteria for this situation.

Second, in this situation, does Tailwind Traders want to monitor the health of Azure services that affect all customers or the resources that are deployed on Azure? This situation is not concerned with operations. However, Azure Advisor does analyze and give recommendations for attaining operational excellence.

Third, in this situation, does Tailwind Traders want to measure custom events alongside other usage metrics? No, measuring

custom events is not specified as a necessity and is not a factor in this situation.

Fourth, in this scenario, does Tailwind Traders want to set up alerts for outages or when autoscaling is about to deploy new instances? Again, this situation is not concerned with operations. However, Azure Advisor does analyze and provide recommendations for attaining operational excellence.

Azure Advisor is the best product option to help Tailwind Traders properly understand and optimize both its cloud spend and its cloud security posture. This product might assist the organization with other areas of its cloud usage as well.

Use Azure Monitor

Let us consider an example The Tailwind Traders e-commerce website is encountering intermittent errors, and the team is uncertain of the reason. Because of the character of the errors, the team speculates that it is either a database or caching problem. What are the events surrounding the errors? Does it occur only during peak usage times? What is the state of the team's Azure SQL instance? What is the state of its Redis caching server? How can it track the issues to a root cause?

Which service should you choose?

As in the previous section, implement the decision criteria you studied earlier to determine the correct option.

First, in this scenario, does Tailwind Traders require an analysis of its Azure usage for optimization? No, optimization is not the team's goal in this situation, so Azure Advisor is not a nominee.

Second, in this scenario, does Tailwind Traders want to monitor the health of Azure services that affect all customers or the resources deployed on Azure? Because this issue occurs intermittently, it is unlikely to influence an entire Azure region or service. It is more probable that a logic problem exists somewhere in their e-commerce website code, or another problem is creating database failures or caching locks. In this situation, the team could employ Azure Monitor to pinpoint a particular user session and view the performance of each service that is involved in the issue.

Third, in this situation, does Tailwind Traders want to measure custom events alongside other usage metrics? Yes. Software

developers can send supplementary information about the state of the web application through Application Insights to assist in locating the root cause of the issue. Application Insights depends on the Azure Monitor platform to save custom event information.

Fourth, in this scenario, does Tailwind Traders want to set up alerts for outages or for when autoscaling is about to deploy new instances? No, alerting is not their goal in this situation.

Azure Monitor is the most suitable option for supporting Tailwind Traders track this intermittent issue. The team can utilize a wealth of tools to help it gain insight into the application's performance at a high level and dive deep into particular issues.

Use Azure Service Health

Let us consider an example where Tailwind Traders desires to operationalize its cloud environment. Particularly, its cloud operations team desires to let stakeholders understand about future planned downtime in advance. The team also needs its solution architects to be alerted about any Microsoft plans to sunset services so it can re-architect its software products respectively.

When outages occur, the team needs to promptly determine whether the issue is particular to their services or a service interruption that touches many Azure customers. The team also wants to provide key stakeholders with reports that explain how and why the incident occurred, and so on.

Which service should you choose?

Again, implement the decision criteria you studied earlier to obtain the correct product.

First, in this situation, does Tailwind Traders need to analyze its Azure usage for the sake of optimization? No, so Azure Advisor is not a competitor in this situation.

Second, does Tailwind Traders desire to monitor the health of Azure services that affect all customers or the resources deployed on Azure? In this situation, the condition is to stay informed of future planned downtime. Additionally, the team wants to capture official incident reports. For this reason, Azure Service Health is the most powerful candidate to pick for this situation.

Although it is possible that you would prefer Azure Service Health, let's continue assessing the remaining decision criteria.

Third, in this situation, does Tailwind Traders want to measure custom events alongside other usage metrics? No, measuring custom events is not mentioned as a condition and is not a concern in this situation.

Fourth, in this situation, does Tailwind Traders need to set up alerts for outages or when autoscaling is about to deploy new instances? Setting up alerts for outages is a condition in this situation, but generating alerts for other events such as autoscaling is not in scope. Use Azure Service Health to set up alerts that are particular to Azure outages that influence all Azure customers. Adopt Azure Monitor to set up alerts for outages and other events that influence only your particular resources.

In this situation, Azure Service Health is the right option to choose.

Choosing the Best Tools for Managing and Configuring your Azure Environment

Identify the product options

At a high level, there are two general categories of management tools: visual tools and code-based tools.

Visual tools present full, visually pleasant access to all the functionality of Azure. But, visual tools might not be as beneficial when you are attempting to set up a huge deployment of resources with interdependencies and configuration options.

When you are trying to promptly set up and configure Azure resources, a code-based tool is normally the better choice. Although it might take time to learn the right commands and parameters at first, after they've been accessed, they can be stored into files and used regularly as required. Also, the code that implements setup and configuration can be saved, versioned, and managed along with application source code in a source code-management tool such as Git. This method to managing hardware and cloud resources, which developers apply when they compose application code, is referred to as infrastructure as code.

There are two approaches to infrastructure as code: imperative code and declarative code. Imperative code describes each individual step that should be implemented to accomplish the wanted outcome. In comparison, declarative code details just a desired outcome, and it enables an interpreter to determine how to properly accomplish that outcome. This difference is necessary because tools that are based on declarative code can present a more robust approach to deploying dozens or hundreds of resources simultaneously and reliably.

Your product options

Microsoft offers a mixture of tools and services to maintain your cloud environment, each directed at different situations and users.

The Azure Portal

By adopting the Azure portal, a web-based user interface, you can obtain practically every feature of Azure. The Azure portal presents a pleasant, graphical UI to observe all the services you are utilizing, build new services, configure your services, and view reports. The Azure portal is how most users first experience Azure. But, as your Azure usage grows, you will possibly prefer a more repeatable code-centric way to manage your Azure resources.

The Azure Mobile App

The Azure mobile app gives iOS and Android access to your Azure resources when you are off of your computer. By using it, you can do the following:

Monitor the health and status of your Azure resources.
Inspect for alerts, promptly diagnose and repair issues, and restart a web app or a virtual machine.
Run the Azure CLI or Azure PowerShell commands to handle your Azure resources.

Azure PowerShell

Azure PowerShell is a shell with which developers and DevOps and IT professionals can perform commands called cmdlets (pronounced command-lets). These commands call the Azure Rest API to deliver every conceivable management job in Azure. Cmdlets can be performed independently or merged into a script file and executed together to orchestrate:

The routine setup, teardown, and management of a single resource or various connected resources.
The deployment of a complete infrastructure, which might include dozens or hundreds of resources, from imperative code.

Capturing the commands in a script makes the method repeatable and automatable.

EXAM TIP: Azure PowerShell is available for Windows, Linux, and Mac, and you can access it in a web browser via Azure Cloud Shell.

The Azure CLI

The Azure CLI command-line interface is an executable program with which a developer, DevOps professional, or IT professional can perform commands in Bash. The commands call the Azure Rest API to deliver every possible management task in Azure. You can run the commands individually or merged them into a script and executed them together for the routine setup, teardown, and maintenance of a single resource or an entire environment.

In many regards, the Azure CLI is almost identical to Azure PowerShell in what you can achieve with it. Both run on Windows, Linux, and Mac, and can be accessed in a web browser through Cloud Shell.

EXAM TIP: The main difference between Azure CLI and Azure Powershell is the syntax you apply. If you are already skilled in PowerShell or Bash, you can use the tool you favor.

ARM templates

Although it is possible to compose imperative code in Azure PowerShell or the Azure CLI to set up and tear down one Azure resource or orchestrate an infrastructure containing hundreds of resources, there is a more reliable way to achieve this functionality.

Using Azure Resource Manager templates (ARM templates), you can specify the resources you want to utilize in a declarative JSON format. The advantage is that the complete ARM template is checked before any code is executed to guarantee that the resources will be created and connected accurately. The template then orchestrates the creation of those resources in parallel. That is, if you need 50 instances of the same resource, all 50 instances are created at the same time.

Ultimately, the developer, DevOps professional, or IT professional needs only to define the desired state and configuration of each resource in the ARM template, and the template does the rest. Templates can even execute PowerShell and Bash scripts before or after the resource has been set up.

Analyze the decision criteria

In this section, you will examine the criteria that experts apply to help them determine which Azure management tools to employ to meet their business requirements. Understanding the criteria can help you to better understand the nuanced differences among the products.

Do you need to perform one-off management, administrative, or reporting actions?

Azure PowerShell and the Azure CLI are Azure management tools that enable you to promptly obtain the IP address of a virtual machine you have used, reboot a VM, or scale an app. You might want to hold custom scripts for both tools handy on your local hard drive for specific operations that you need to execute many times.

Opposite to the Azure CLI and PowerShell, Azure Resource Manager templates (ARM templates) determine the infrastructure demands in your application for repeatable deployments. Although ARM templates are not meant for one-off scenarios, it is possible to use them for this purpose. However, for one-off scenarios, you may prefer more agile tools like PowerShell, Azure CLI scripts, or the Azure portal.

Keep in mind that ARM templates can cover both PowerShell and/or Azure CLI scripts, which will supply you with the knowledge to use scripts for tasks that may not be achievable with the ARM template itself. The capability to combine Azure management tools gives flexibility in choosing the best tool(s) for your precise need.

The Azure portal can fulfill most, if not all, management and administrative actions. If you are just learning Azure and/or need to set up and manage resources occasionally (or prefer a visual interface for viewing reports), it makes reason to take the help of the visual presentation that the Azure portal offers.

Though, if you are in a cloud management or administrative position, it is less effective to rely only on visual scanning and clicking. To immediately locate the settings and information you need to work with, the Azure CLI or PowerShell will give you the most flexibility for repeatable tasks.

The last management tool to consider is the Azure mobile app, which you can access through an iOS or Android phone or tablet. Because it is full-featured, it is possibly the most suitable choice when a laptop isn't immediately available and you want to view and triage issues instantly.

Do you need a way to repeatedly set up one or more resources and ensure that all the dependencies are created in the proper order?

ARM templates determine your application's infrastructure demands for a repeatable deployment that is prepared in a logical manner. A validation step guarantees that all resources can be created in the correct order based on dependencies, in parallel, and idempotent.

By contrast, it is entirely reasonable to use either PowerShell or the Azure CLI to set up all the resources for deployment. But, there is no validation action in these tools. If a script meets an error, the dependency resources cannot be rolled back simply, deployments happen serially, and only some operations are idempotent.

When you are scripting, do you come from a Windows administration or Linux administration background?

If you or your cloud administrators have Windows administration experience, you may favor PowerShell. If you or your cloud administrators have a Linux administration history, you may favor the Azure CLI. In practice, either tool can be used to fulfill most one-off administration tasks.

Use the Azure portal to visually understand and manage your cloud environment

Let us consider an example where Tailwind Traders employs Azure largely throughout its entire organization. To ensure that both the technical and executive teams are informed of the company's cloud cost, the director of cloud operations will start to meet weekly with the Chief Financial Officer (CFO) to talk about their cloud spend.

Discussions might begin at a high level, but the two officers might want to jump deep during the meeting to obtain more insight into how Azure resources are being utilized. Ideally, they would be able to see the data presented visually, but also be able to run custom reports in real-time. Which tool can they apply during their meeting?

Which service should you choose?

Implement the decision criteria you studied in the previous unit to find the best option.

First, in this situation, does Tailwind Traders need to conduct one-off management, administrative, or reporting actions? Yes, and given the necessity to view data visually and generate custom reports throughout the meeting, the Azure portal is the most suitable choice. The meeting attendees can promptly find answers to their problems by using a wealth of reporting possibilities.

The next two decision criteria do not pertain to this situation, because the director of cloud operations and the CFO would not be deploying or configuring any resources.

The Azure portal is the right product option for this situation.

Use Azure PowerShell for one-off administrative tasks

Let us consider an example, Tailwind Traders uses technologists with many diverse skills. A unit of developers and administrators creates and maintains a collection of intranet applications that are essential to the business. The team members have strong credentials in Windows development and network administration.

The team migrated its applications to the cloud, and it now requires a way to perform one-off testing, management, and administrative tasks in its intranet environment. The team instantly recognized that managing Azure from the portal takes too much time and is not repeatable. Which tool should the company apply for one-off tasks?

Which service should you choose?

Implement the decision criteria you studied earlier to find the best option.

First, in this situation, does the Tailwind Traders team want to deliver one-off management, administrative, or reporting tasks? Yes. But, the team already understands that it does not want to depend on the Azure portal for these one-off actions. Hence, both Azure PowerShell and the Azure CLI are great options. We will hone in on which tool the team should apply in a moment.

Second, in this situation, does Tailwind Traders need a repeatable and reliable means of deploying its entire infrastructure? No, not in this situation. Hence, Azure Resource Manager templates are not the correct choice.

When the Tailwind Traders team is doing scripting, does it come from a Windows administration or Linux administration

background? This team has Windows administration experience. It would probably be most convenient using Azure PowerShell because this tool permits it to utilize the syntax it is most comfortable with to perform one-off administration tasks.

Azure PowerShell is the most suitable choice for this situation.

Use the Azure CLI for one-off administrative tasks

As we saw in the previous section, Tailwind Traders uses technologists with many diverse skills. The DevOps team is mainly concerned with keeping external systems, such as the company's e-commerce site, up and running. This team has Linux administration experience. It often needs to complete administrative tasks associated with the health of the cloud environment. The team soon understood that managing Azure from the portal takes too much time and isn't repeatable. Which tool should it apply for one-off tasks?

Which service should you choose?

Implement the decision criteria you studied earlier to find the correct option.

Because this scenario is almost the same as the one in the previous unit, you can jump over the first two criteria. In other words, you can instantly drop Azure Resource Manager templates and the Azure portal as possible choices for this situation. So, let's go to the third decision criterion.

Selecting the best option in this situation should be determined by the team's history. Because this team has a Linux administration background, it would probably be most suitable to use the Azure CLI. The Azure CLI permits the team to utilize the Bash shell and its syntax to execute one-off administration tasks.

The Azure CLI is the most suitable choice for this situation.

Use the Azure mobile app to manage Azure on the go

Tailwind Traders encounters surges in e-commerce traffic that match with national holidays and weekends. In the company's first few years, managers of critical systems had to assemble at the office of the director of cloud operations during these crucial times. But, now that Tailwind Traders has successfully operationalized the most important systems, the director desires to relax this condition and enable employees to spend these dates with their families. Is there a product that can assist in supporting this scenario?

Which service should you choose?

Let's go through our decision criteria again.

First, does Tailwind Traders require to perform one-off management, administrative, reporting actions? Yes. The real question is, how? A phone or tablet answer could support key employees keep an eye on the health of the cloud environment when they are not in the office. The Azure mobile app is probably a great compromise because it allows employees to be absent from work and still deliver essential, one-off management and administrative tasks.

We can skip the rest of the decision criteria in this unusual situation. The Azure mobile app is the best choice

Use ARM templates to deploy an entire cloud infrastructure

Tailwind Traders aspires to operationalize their cloud deployments. The company requires a repeatable, safe way to scale its operations during top sales times. Because you will be picking a process for scaling your production environment, you want to guarantee that your chosen service:

It is effective and can create many resources in parallel
Creates all dependencies in the correct order
Can be utilized without worrying that it crashed in the middle of provisioning the necessary infrastructure

Which service should you choose?

Let's go through the decision criteria one more time.

First, in this scenario, does Tailwind Traders need to perform one-off management, administrative, or reporting actions? This time, we are not looking to help with one-time or one-off management or administration tasks. We are aiming for a technology to automate the deployment of complete infrastructure, as required.

Second, does Tailwind Traders need a repeatable and reliable way to deploy its entire infrastructure? Yes, this is precisely what the company requires. Our decision criteria guide us to adopt Azure Resource Manager templates for this situation.

You could apply Azure PowerShell or the Azure CLI, but these scripting technologies have notable limitations when it comes to deploying infrastructure. ARM templates can aid in overcoming these limitations.

The third decision criterion believes that you require to write a script by utilizing imperative code. However, when you utilize ARM templates, you determine your infrastructure declaratively by using JSON code. In some cases, you still might require imperative code for configuration or clean-up tasks. In these situations, you can trigger the execution of scripts by utilizing either Azure PowerShell or the Azure CLI to execute these tasks.

In this situation, ARM templates are the right choice.

Lab 7-01: Azure AI Service

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Mind Map

Figure 7-02: Mind Map

Practice Questions

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Chapter 08: Security

Introduction

Microsoft is responsible for the security of the cloud. User as a cloud administrator is responsible for the security in the cloud. Azure security is the most important part of the Azure. Azure security services provide the protection of data, technologies, and infrastructure to work simultaneously. With Microsoft, security can successfully achieve by the role of both Microsoft and a cloud administrator. Microsoft administrator follows the principle of security, compliance, and integrity to ensure the protection of customer's data and their access. To get access to data, the administrator needs to follow the rules and regulations according to the Microsoft trusted cloud.

Why Security is important?

Security is a set of policies or rules, which allow the traffic to directed to the network in the right way. Security of the network is very important, especially when there is a communication of infrastructure with the internet. On the internet, multiple access is possible at a time, so there a need to secure the cloud infrastructure with a set of security rules.

For example, there are multiple subnets present in VNet as shown in Figure 8-01. By default, all virtual machines within the subnet are communicating with each other. Within the same VNet, some virtual machines (VM) storing complex and sensitive data. For this, especially security policies are required for the protection of data within the same network. For security purposes, the VM with sensitive data is separately available in a subnet with no connection with other subnets in VNet.

Figure 8-01: VNet with Security feature

This chapter explains the Azure security aspect that makes strong cybersecurity of the cloud.

Figure 8-02: Azure Security Services

Azure security services include:

Securing Network Connectivity: Network connectivity can be efficiently secured by Azure build-in resources and services. Azure user can make secure entire network or small parts of the network depends on their cloud architecture need.

Azure Security Center: Azure Security Center help and guide Azure user to make secure Azure platform for the utilization of optimum services.

Azure Key Vault: Azure Key Vault is an amazing way to hide and save key passwords and uses key hardware for the provision of security when needed.

Azure Information Protection: Azure Information Protection (AIP) provides the protection of e-mail, complex information, and

sensitive data.

Advanced Threat Protection (ATP): Advanced Threat Protection (ATP) identifies special users and device activity. It enables the protection of sensitive data and applications against hacking approaches. It also provides a way of single-console management for protection.

Defense in Depth

Having just a solitary security measure for cloud infrastructure is never enough. Defense in depth is always required. Let's start with a scenario from the pages of history. A castle with a king, for example. Now, the king is the prize the attackers want, and he must be defended at all costs. There is often a moat around the castle. It has bare walls with no doors. There are guards at the top. They might have hot oil. There is an inner wall. The throne room is fortified, and so on. There are many layers of defense for the king. This is defense in depth.

Let's move a bit closer to the cloud with on-premises infrastructure. This is where you are in charge of all your physical hardware, buildings, staff, and computing capabilities. Just like with the castle, it needs to protect your on-premises assets and will have several layers of defense. You will have swipe cards to get into the building, security guards, restricted access to servers, usernames, passwords, firewalls, and so on. Most of the defense of your assets is up to you because you own the infrastructure.

Some key points of Defense in Depth:

Strategy to slow the advance of an attack to get unauthorized access to information
Layered approach: Each layer provides protection, so if one layer is breached, a subsequent prevents further exposure
Applied by Microsoft, both in physical data centers and across Azure services

There are seven general layers of security in cloud computing, and that goes for Azure:

Figure 8-03: Defense in Depth

Physical

This is the actual datacenter or the first step of defense. Only authorized personnel has access. It is used for building security & controlling access to computing hardware.

Identity and Access

It relates to the Azure Active Directory that controls all access to Azure and the identity of all users, applications, and connections.

Control access to infrastructure and change control
Access granted is only what is needed
Use single sign-on and multi-factor authentication
Audit events and changes

Perimeter

It is the protection against DDoS attacks, volumetric attacks, protocol attacks, and so on.

Use Distributed Denial-of-Service (DDoS) protection to filter large-scale attacks before they can cause a denial of service for end-users.
Use perimeter firewalls to identify and alert on malicious attacks against your network.

Network

It is the filter of traffic to and from Azure using virtual networks and applying security standards.

Limit communication between resources
Deny by default. It allows only what is required
Restrict inbound internet access and limit outbound, where appropriate
Implement secure connectivity to on-premises networks

Compute

The compute component protects against intruders trying to get into your virtual machines or databases.

Secure access to virtual machines
Implement endpoint protection and keep systems patched and current
Malware, unpatched systems, and improperly secured systems open your environment to attacks

Application

It is the gateways and firewalls that provide security to your Azure applications.

Ensure applications are secure and free of vulnerabilities
Store sensitive application secrets in a secure storage medium
Make security a design requirement for all application development
Integrate security into the application development life cycle

Data

The data on Azure is encrypted and protected against anyone unauthorized reading it or making sense of it.

In almost all cases attackers are after data
Data can be in the database, stored on disk inside VMs, on a SaaS application such as Office 365, or in cloud storage
Those storing and controlling access to data ensures that it is properly secured
Often regulatory requirements dictate controls & processes
To ensure confidentiality, integrity, and availability.

So, Defense-in-depth on Azure is how Microsoft has given you multiple layers of security for your cloud infrastructure.

Securing Network Connectivity

The networks on Azure gives access to everything for the user. All the resources and services of Microsoft Azure are connected to a network to provide communication between users, processes and other services. To run this, smooth network behavior is required that efficiently provides all the network services within Azure. In order to achieve optimum network performance, secure network connectivity is very important. Figure 8-04 shows ways to ensure secure network connectivity.

Figure 8-04: Ways of Secure Network Connectivity

Azure Firewall

An Azure firewall is a crucial service that protects and safe the network from unwanted traffic load.

Rules: Azure firewall must have a certain set of rules that gives permission to allow and not allow the traffic according to the connected devices and services attached to the network.
Variation: The firewall may have certain hardware and software according to the size of the network.
Compulsory bit: To ensure network security, a firewall is considered as a compulsory section in the network.

Figure 8-05 shows the network performance employing network security with the help of the Azure firewall.

Figure 8-05: Network Configuration with Azure Firewall

Distributed Denial of Service Attacks (DDoS)

History: In 2012, six banks of the USA were targeted with a series of Distributed Denial of Service (DDoS) attacks. Banks were located in a small town and other areas as well. The attack was created from a large number of hacker's servers with each creates a 60 Gb traffic load per second. In 2014, the security provider and content delivery network "Cloud Flare" was targeted with DDoS attacks. The attack was created with a 400 Gb traffic load per second. In 2018, a famous development platform "GitHub" was targeted by DDoS attack with 1.35 Tb of traffic load per second. All these DDoS made the companies suffered from a massive disaster. Companies lost business and user's trust due to this attack. In addition, companies also need to invest billions of dollar to remake the networks.

Figure 8-06: Companies affected by DDoS Attack

DDoS Scenario

Distributed Denial of Service (DDoS) is the most common attack on services attached to the internet. Let suppose, there is a website running on a server as shown in Figure 8-07. This server has the ability to serve the limited number of user requests. The number of users in the given network is 50,000 and the web server serves at most 5000 requests every second. When the entire users send the request at the same time, the webserver would not be able to serve the demands of the user request. In the end, webserver suddenly stops working due to a large number of user requests. This is because of the Denial of Service (DoS) attack. If the same number of requests received by the webserver from many different sources and computers, then web servers would suddenly, stop working due to the multiple simultaneous requests. This type of attack on the service is called a Distributed Denial of Service (DDoS) attack.

Figure 8-07: DDoS Attack

DDoS Protection Service

Target a website: A lot of servers target the same website or computer in order to stop its working. For example, GitHub was a target with 127 Mb requests every second.

Azure Protection Service: Microsoft Azure has protection service against DDoS attacks. This service has a different level of protection services depending upon the user needs of the

application. Azure protection service detects DDoS attacks and work against it.

No Halt: Azure Protection service would not interrupt the routine process of other services on the website due to Azure global presents.

EXAM Azure Firewall controls which traffic comes inside and outside the network based on a set of rules.

The DDoS attack is an attack of a huge amount of traffic from many different sources to a single website and server. Azure protection service protects from this type of attack globally with no downtime.

Network Security Groups

The security group provides a secure management environment for the network. Network Security Group (NSG) is required in the configuration of a virtual network (VNet) where different virtual machines (VM) within the subnet are connecting with each other.

Resource Firewall: NSG has a private resource firewall that allows the connection of VNet, subnet or another network interface with VM.
Rules: NSG has a set of security rules that enable some special VMs to allow or not allow the inbound and outbound traffic load from other resources.

Figure 8-08 illustrates the concept of the Network Security Group (NSG) in the network. There is a virtual machine (VM) present in the network (VNet). The network can be behind the Azure firewall for the protection of everything (i.e. complex information, sensitive data, resources or devices) present on the network. Virtual machine (VM) has its own NSG that specify the rules and regulation for the machine.

Figure 8-08: Network Configuration with NSG

Application Security Group

Network Security Group (NSG) protects the traffic flow from and to the specific virtual machine (VM) or subnet in the network. Application Security Group (ASG) protects the application running on that particular VM or subnet in the network. ASG provides the security of application and NSG provides the security of traffic flow.

Shielding Application ASG is responsible for providing security to the application (website or Azure resources) running on a particular VM in the network.
Natural Integration: With ASG, network performance is optimized with multiple levels of security rule for application and traffic flow. VMs from a different subnet, combined into NSG based on the application running on those VMs.

Figure 8-09 shows a network configuration with both NSG and ASG.

Figure 8-09: Network with ASG and NSG

Network Security Group (NSG) is required in the configuration of a virtual network (VNet) where different virtual machines (VM) within the subnet are connecting with each other. NSG uses Access Control List (ACL) rules to allow or deny the access of network traffic to subnet or VM.

Application Security Group (ASG) protects the application running on that particular VM or subnet in the network.

Azure Security Center

Azure Security Center allows users to monitor the security features for the Azure resources and on-premises as well. The security of each part of cloud infrastructure is a big challenge to handle. Azure Security has itself a portal within the Azure portal known as Azure Security Center. Azure Security Center indicates a threat alert that Azure detects and finds a way to protect from these threats. Azure Security center works in a hybrid cloud infrastructure too. The security center can monitor all the security posture of on-premises data and Azure data. All VMs on a network has a special agent that sends the data towards a security center. Azure can analyze this data to make sure that data is free from all threats.

Azure Security Center portal contains a summarized view of policy, compliance and subscription coverage, networking, and Resource integrity hygiene as shown in Figure 8-10.

Figure 8-10: Security Center

Sections in Azure Security Center

Each section in the Azure Security Center portal shows an individual performance behavior of security features in graphical representation.

Policy, compliance and Subscription Coverage: Policy, compliance, and Subscription coverage are monitored by Azure, There is a secure score that represents the implementation of the Azure resource as secure as possible.

Figure 8-10(a) – Species of Security Center

Integrate with Other Cloud Providers: With this, you can get security information from multiple cloud providers like AWS and GCP directly into Azure Security Center.

Alerts for resources security: If any of the VM is not update, the security center quickly updates the VM, stores encrypted data that have an IP address and traffic loads for processing.

Figure 8-10(b) – Species of Security Center

Networking: The configuration of secure resources in the network within Azure is successfully represented in the networking block of the security center.

Figure 8-10(c) – Species of Security Center

How to use the Security Center?

To take advantage of Azure Security Center for the security of cloud infrastructure, Azure users need to follow these three-step process.

Define Policies: User needs to define the security policies that Azure can use to monitor cloud infrastructure. Security policies are a set of rules (such as Access Control List) that Azure can use to evaluate the valid configuration of service.
Resource Protection: Users must need to protect resources and security centers that can help the user to protect the resources against a threat.
Response: In case of any security incident, the security center can raise the alerts. Users can investigate the traffic load within Azure implementation after the security alert.

EXAM Azure Security Center is a portal within the Azure portal that monitors the resource security hygiene for Azure VMs resources. It contains a security alert timeline that defines the policy for efficient protection response in case of any incident.

Key Vault

As most of the cloud user needs multiple numbers of id and passwords as per their usage. It is very difficult to remember the entire list of passwords. One option is that users may share their password with different people for which users need to rely on them. However, there is a problem that how many people remember multiple passwords and secrets for different users? As the number of secret increases, this approach became fail to protect the user's key from hackers.

To hide the key password and other information, Microsoft gives you a service known as Azure Key Vault. It is the best option for key storage. With Azure Key Vault you can share your secrets with others without revealing the actual secrets. Azure Key Vault is present in the storage account of VM. Storage account store keys in disk-encrypted form. Azure Key Vault allows user to store their key passwords in an encrypted form that nobody can view the password. This key protection is defined by some set of rules and should follow the access policy criteria. On the application level, the app developer needs such type of protection based on their information that no one can expose it.

Figure 8-10 shows the application of the Azure Key Vault. There is a database in a network. The data in the network is successfully used for internal services such as application. A user wants to share the access of the network to other trusted outsiders. However, outsiders need id and password for accessing the application. One way is that a password is a place in Azure Key Vault that efficiently allows an outsider to access individual

applications easily. The application identifies itself using the Azure Key Vault to grant access to the database. In this way the password is never sent itself to others.

Figure 8-11: Azure Key Vault

Features of Key Vault

Azure Key Vault has a number of key features.

Secure Hardware: Azure Key Vault has hardware and software protection. Azure Key Vault used Hardware Security Module (HSM) to stores a password and a secret that no one can see it.
Application Isolation: Using Azure Key Vault, applications cannot pass on secrets. Access to the application can be removed easily without having to change the password.
Global Scaling: Azure Key Vault can be scaled globally as other managed Azure services resulting in cryptographic high performance.

EXAM Azure Key Vault is a secure way to share secrets and passwords to applications and other resources outside the organization using a defined access policy. It can be scaled globally and not even Microsoft can reveal the actual secret.

Azure Information Protection

When you stored your data on the company's server then how could you know who can access that data? Azure Information Protection (AIP) provides a way of protected sharing of resources. Azure Information Protection enables the sharing of files, documents and sensitive information inside and outside an Azure with maintaining full control over that data. Microsoft 365 takes full advantage of Azure Information Protection service. It makes a lot of new enhancement with AIP such as support PDF document protection, outlook relicensing, and message protection for the shared mailbox.

With Azure Information Protection, the data can be secure in the following ways:

Data Configuration: An organization can establish data and protection parameters according to AIP services for security purposes.

Classification of Organisation can make more secure data by classifying it according to sensitivity and priority. This can be done automatically by Azure Information Protection services or manually by users themselves.

Track Activities: With AIP, an organization has full control over data activities. If there is some irregular activity that occurs, an organization may cancel the access to that data.

Share data with others: An organization has full control over data sharing. In addition, an organization managed and carefully supervised that who can edit, view, print and forward it.

Integration: Control, protecting and classifying are integrated with applications like Microsoft Office and other applications that give the security of data and document within a click.

An application of Azure Information Protection (AIP) is discussed in the scenario as shown in figure 8-12. There are two users, User 1 and User 2. User 1 wants to send an email with a sensitive document attachment to User 2 within Azure. The security of a document can be guaranteed by using Azure Information Protection services. User 1 uses a secure label that is defined in Azure to tag the document and create a link to information protection then the email will be securely received by User 2. If User 2 is a valid user, then the document will be opened.

Figure 8-12: Azure Information Protection

Advanced Threat Protection (ATP)

Advanced Threat Protection (ATP) is the advanced and secure option for providing the security of the links as compared to the standard one. It gives an extra layer of security and management of the users in order to make a more secure and protected system.

Are Users Unreliable?

The need for Advanced Threat Protection is due to the users, whether they are customers or employees. If users have access to the organization's server, file or document then they might be a weak link to attackers or hackers. For example, an organization has continuously received threats from the user side as shown in Figure 8-13. A Business Corporation has some sensitive data that make the attacker target that corporation. One way to get sensitive data is through users. Users often have the weakest link within the organization and attackers usually take this as their target point. Attackers continuously pin one specific user to give them access to a corporation and hack the sensitive data.

Figure 8-13: Attacker's Target in the Network

Features of Advanced Threat Protection (ATP)

Azure Advanced Threat Protection (ATP) has a number of features that provide the safety of links and analyzed the security threats.

Monitor Users: Azure ATP helps to monitors users in an on-premises environment and their behavior. Azure ATP analyzes user's activity and information across the network including permission and membership across each user.

Supervised User's Behaviour: Azure ATP continuously focusing on user's activities. If there is some irregular activity occurs, ATP will be logged as a doubtful activity.

Propose Changes: ATP also offers some suggestions regarding security policy to provide the best security practices. Profiling and analyzing users will help to reduce the risk against threats both on-premises and in the cloud. ATP will make changes based on the required security policy.

Cyber-Attack Kill-Chain

The cyber-attack kill chain is a chain of phases that define how the attack is prepared and execute. This deployed model called Cyber-Attack Kill-Chain allows detecting and reacting upon the attack. The model reveals seven stages according to which reaction and detection on cyber-attack are available.

Figure 8-14: Cyber-Attach Kill-Chain

Azure Advanced Threat Protection is responsible for monitoring any aspect of cyber-attack kill-chain. Here we will discuss the Cyber Attack kill chain as per Azure.

Reconnaissance: If the user is carrying out reconnaissance, mean searching the device IP address and finding the other's information to check out the system. ATP will raise the alert to protect the system from any inappropriate incident.

Brute Force: Identifying attempts to compromise user's credentials using brute force that is trying various combinations of user

names and passwords.

Increasing Privileges: Any attempt to gain access to a user with access to more resources and areas within the network

EXAM Azure Information Protection (AIP) enables the secure sharing of the file, document and sensitive data inside and outside an organization using protection labels and tags. Azure users have full control that who can edit, view, print the information.

Azure Advanced Threat Protection (ATP) provides advanced-level security to prevent the network from threats. It monitors user behavior and creates a baseline and immediately report in case of any anomalies.

Azure Sentinel

Sentinel is a security information and event management tool, often just called S-I-E-M or SIEM. This is a commonly used tool for any cloud infrastructure. Azure Sentinel involves five working steps as described below:

Figure 8-15: Steps in Azure Sentinel

The initial step is to collect data from a range of sources, such as your network controllers, virtual machines, DNS traffic managers, and much more. The data is aggregated and normalized.

EXAM TIP: Azure Sentinel has suggested queries, you can find samples, or build your own. Another option is which is more interactive and has the potential to use your data science analysis.

Sentinel is a Security Information and Event Management (SIEM) tool.

This only means that it is sorted and made a bit more usable. The important data is analyzed and any threats are detected. Sentinel will do 90% of the heavy lifting before you even start investigating a potential security alert. One of the features that set Sentinel apart from other SIEMs is behavioral analytics. Using artificial intelligence, Sentinel will learn about patterns and behaviors to identify if something is out of the ordinary. With AWS integration, you can get all the data from your AWS services fed directly into Sentinel for analysis and threat detection with limitless speed and scale.

EXAM TIP: For triaging using the same detection methodology in conjunction with events investigation. Later you will have a case created for the incident.

Sentinel will take advantage of the huge resources on Azure to be even faster and scale to match your needs. Sentinel comes with a free Netflix subscription for all plans. No, that is not true, but Netflix could use Sentinel to protect their infrastructure. Of course, there are a million features in Sentinel that make sense to the security professionals who use it. Sentinel also protects your cloud functionality as well.

EXAM TIP: By using connections from multiple vendors or operating systems, Azure Sentinel collects security events and data and keeps them for 31 days by default. This is extendable up to 730 days.

Azure Dedicated Host

Azure Dedicated Hosts is a full physical server that you get full control over. You provision it just like a VM in Azure, but there are, of course, some significant differences and benefits.

The hardware isolation is at the physical layer, so no one else can sneak onto your server.
No other VMs will be placed on the hardware unless they are the ones you choose and you create.
Control over the maintenance schedule. You will have some choice in when sensitive workloads are updated, and this can reduce the impact on your service a lot.

There are lots of advantage of cloud computing benefits, like:

Availability Zones
Fault Isolation
High Availability
Scale Sets

You can use Windows, Linux, or SQL Server as your VM image. Save some coins as well by using existing software licenses that you might have for, for example, Windows Server or SQL Server. A Dedicated Host is a good alternative to the hardware-conscious cloud user, but it can also get expensive. Use it wisely.

Lab 8-01: Azure Key Vault

Scenario:

An organization needs to share a secret with a third party for business enhancement. To ensure secure internet traffic, how can an organization build an access policy for others to share its secret without revealing the encryption and security rules?

Solution:

Azure Key Vault is considered as a very useful tool for managing and sharing the secret. In the given situation, the organization can allow others access to the secret without revealing the actual secret by using Azure Key Vault. First Azure Key Vault is created, then a secret is built in the given Key Vault that can be accessible to others.

Log in to the Microsoft Azure portal and go to the search bar and type “Key Vaults” in the given space.

"Key Vaults" tab appears. Click on "+ Add" to create a Key Vault.

Click on "Create new" to enter the Resource group.

Write the name of the Resource group as “keyvaultrg”.
Then click on “OK”.

Write “Key Vault name*”, “Region*” and “Pricing tier*” in the “Instance details”.

Now, click on “Next : Access policy >”.

The access policy tab appears. Now, click on “Review + create”.

Once the validation is passed, click on “Create”.

"IPSKeyvault1" has been created.
Click on "Go to resource".

The details of the created Key Vault have appeared.

To add a secret, click on “Secret” from the left side of the IPSkeyvault1 tab.

Click on "+ Generate/Import" to add a secret.

Select "Manual" from Upload options.

Write "Name*" and "Value*" of the secret.

Click on "Create".

The secret “IPSsecret” has been successfully created.

Microsoft Azure
Search resources, services, and docs (G+/)
Home > IPSkeyvault1 - Overview > IPSkeyvault1 - Secrets
IPSkeyvault1 - Secrets
Key vault
Generate/Import
Refresh
Restore Backup
The secret 'IPSsecret' has been successfully created.
Name
Type
Status
Expiration Date
IPSsecret
Enabled

Mind Map

Figure 8-16: Mind Map

Practice Questions

What is the most crucial part of Microsoft Azure in the configuration of a network?

Security
Networking
Authentication and Authorization
Computation

How many ways of securing network connectivity can be possible in Microsoft Azure?

Only one
Four
One hundred
Infinite

What is the purpose of the Azure Firewall?

Protection of sensitive information
Helps to monitor user's behavior in on-premises and cloud environment
Set of rules to provide the security of network resources.
All of the above

Which of the following Azure service may use secure hardware to make the password and secret secure?

Azure Information Protection
Network Security Group
Advanced Threat Protection

Azure Key Vault

"There is a web server that receives a consecutive number of requests from different sources at the same time; these continuous requests make the server stop working abruptly". This type of attack is called _____.

Cross-site scripting (XSS) Attack
Password Attack
Distributed Denial-of-Service (DDoS) Attack
Malware Attack

How Network Security Group is different from the Application Security Group?

NSG defines traffic policies and ASG defines network security based on application policies.
NSG is responsible for tracking the attacks whereas ASG configures attacks.
ASG is limited to two VMs whereas NSG has unlimited resources
None of the above

Which of the following service uses the Access Control List (ACL) to allow or deny the access of network traffic to subnet or VM?

Azure Key Vault
Azure Firewall
Network Security Group
Azure Information Protection

Which of the following is responsible for the protection of subnet or VM?

Azure Privacy Services
Secure Network Connections
Azure Key Vault
Azure Active Directory

What is the function of the Azure Key Vault?

Provides secure access to secrets
Ensures the network connectivity
Allows sharing of user's credential
Prevents the use of resources

Which of the following services is helpful for sharing files, sensitive information inside or outside Azure?

Advanced Threat Protection
Azure Key Vault
Application Security Group
Azure Information Protection

Which Azure service can monitor the user's behavior?

Azure Firewall
Azure Security Center
Advanced Threat Protection
Azure Networking Services

Which Azure service can you use to share the secret with the third party without revealing the actual secret?

Azure DNS
Azure Key Vault
Azure Monitor
Azure ATP

Which of the following service has its own portal within the Azure portal?

Azure Security Center
Azure Key Vaults
Azure Active Directory
Azure SQL

In 2018, a popular developer platform "GitHub" was targeted by DDoS attack with _____.

60 Gb traffic per second
400 Gb traffic per second
1.23 Gb traffic per second
1.35 Tb traffic per second

Which Azure service acts as a resource firewall?

Azure Monitor
Azure DNS
Network Security Group
Content Delivery Network

Which Azure service configures network security as a network extension of an application structure?

Network Security Group

Application Security Group
Azure Firewall
Advanced Threat Protection

Which of the following service gives the single unified view of security in hybrid cloud architecture?

Azure Active Directory
Storage Account
Azure Security Center
SQL Database

When data is stored in company servers and resources, both customers and employees are eligible to get that data and share it inside and outside the company. Which service can you use to provide the protected sharing of data?

Azure Information Protection
Advanced Threat Protection
Azure App Services
None of the above

Why does Azure ATP need a security alert timeline?

To protect resources from threats
To enable attackers to get access to resources through users.
To monitor the protection of sensitive data
All of the above

Which of the following allows us to limit the access of Key Vault to the users?

Networking Policy
Access Policy
Tags
All of the above

Which of the following allows to encrypt and protect data against anyone unauthorized reading it or making sense of it?

Physical
Application
Network
None of the above

Which of the following is a key element in Defense in Depth?

Strategy to slow the advance of an attack to get unauthorized access to information
Each layer provides protection, so if one layer is breached, a subsequent prevents further exposure.
Both A & B
None of them

Which of the following is a famous DDoS attack against the developer on which website where attackers sent 127 million requests per second?

website GitHub in 2018
website GitHub in 2020

website Amazon in 2018
website Amazon in 2020

Which of the following service is the protection against DDoS attacks, volumetric attacks, protocol attacks?

Physical
Identity and access
Perimeter
Network

Which of the following service is the filter of traffic to and from Azure using virtual networks and applying security standards?

Physical

Identity and Access

Perimeter

Network

Chapter 09: Privacy, Compliance, and Trust

Introduction

Every company has a need for privacy of its data. They want to trust that their data is stored quickly and privacy is looked after. In Azure, you have a service that performs the privacy, trust and compliance factor for your company. In this chapter, we will discuss Governance in Azure; what is its context, why it needs to be done with perfection, and which tools Azure provides you for governance. Azure Monitor has a collection of tools to detect, diagnose, visualize and analysis the response and integrate the data from Azure services' logs and metrics.

As we all know that down time is a serious problem in the world, with Azure Service Health, you can ensure the maximum uptime of your business. We will also discuss the compliance and privacy of your applications. In Azure, Microsoft has its own Trust Center, which they want you to read in order to get more trust.

Build a cloud governance strategy on Azure

Azure Resource Manager enables us to organize, monitor all the resources after deployment. Azure Resource Manager (ARM) template is used to specifies the deployment parameters, list of variables, list of resources, and output. It also provides the file named JSON for the faster deployment of resources.

Governance

We all know that most of the companies use the Azure platform for its agility to make it easier for the developers to create, manage, update and delete the resources as per requirement. However, sometimes unwanted access to the resource may cause unintended cost consequences. In order to overcome this, Azure provides a solution of resource access governance, which is the process of managing, monitoring and auditing the resource usage in order to meet the goals and requirements.

Consider you have developers and a system administrator who both have their own thoughts of upgrading the resource at its best. This may cause a mess and there is a lot of resources that maybe wrongly created. So by using Governance, you can overcome this, as it has a set of rules, policies and roles that define acceptable use of Azure resources. In order to implement good governance, Azure provides you multiple tools.

Exam tip:

Governance keeps you compliant and out of trouble.

Concept of resource groups

Azure Resource Manager (ARM) has several features that you can use to organize the resources, enforce standards, and protect your critical Azure resources from accidental deletion. Resource groups are the containers for the resource deployed on Azure. By placing resources of similar usage, type, or location in the same resource groups, you can provide some order and organizations to your Azure resources. Tags allow you to improve the organization of your resources even further. You can use tags to associate the custom details with a resource or resource group such as the cost center and billing department. Resource groups and tags are great for helping in organizing the existing resource and resource group.

Azure policies ensure that new resources use the same tags as existing resources, keeping things organized. To protect the resources after their deployment, the Role-Based Access Control (RBAC) policy provides fine-grained access management for your Azure resources, allowing you to grant users the specific rights they need to perform their jobs. IT personal can easily managed settings, developers can have read-only access, and the administrator can have complete control all at the same time. You can even prevent resources from being deleted accidentally by enabling resource locks. You can block the ability to delete a resource or prevent changes to it by marking it as read-only. Azure Resource Manager provides you with the tools you need to keep your resources organized and secure.

Resource Groups

The resource group is like a bucket, that holds all the components that you would want to manage together from initiation, all the way to retirement. For example, it is a lot easier to delete a resource group and all of the objects that contain it rather than to delete the VM, then the disk storage counts the virtual network and all the objects individually.

Logical Grouping

The main purpose of the resource group is that you can group resources and perform bulk action upon that group. Different resource groups may be present to perform some specific task. Each resource group is isolated logically from another resource group. There is complete security available for each of the resources present inside the resource group.

Figure 9-01: Resource group

Life cycle

The resource group contains several users with the same region and other specifications. When you are doing some experiment and after completion, you can easily delete all the resource by just remove the resource group contains those resource. It saves time and manual processing.

Authorization

Resource groups also enable the security policies when you applying a Role-Based Access Control (RBAC) policy into that

resource group. With RBAC access, you can easily restrict unauthorized users to access the resource group.

Use resource groups for Organization

Following are some guidelines that help to create a resource group when working with the organization.

Compatible naming convention

For your organization, you can easily start by creating multiple resource groups. Each resource group contains several resources that are specific to perform a certain task.

Organizing principles

For example, your solution will consist of several virtual networks, virtual machines, and databases. To simplify the implementation, you can create three resource group, one is responsible for holding the VMs only, other is responsible for holding VNets and third hold the database with some unique resource group name as shown in Figure 9-02.

Figure 9-02: Segregated Resource groups

You could also organize the resources into the resource in such a way that if you have three tasks to implement and each of

them requires one VM, one VNet, and one Database. So, to simplify this type of implementation, you can organize the resources in the resource group.

Figure 9-03: Organize resource in the resource group

In addition, If your solution requires the same resources on the input and output side, you could organize these resources into the resource groups as follows.

Figure 9-04: Input/Output resource group

Some factors are very important to consider when you organize the resources in the resource group.

Organizing for Authorization

To make the resource as secure as possible, you could organize the resources and use the RBAC policy that allow only authorized users to access this resource group.

Organizing for Lifecycle

You can organize the resources into resources that provide you easy working environment with the resource groups. Once you have done with the implementation and built a solution successfully, you will require to delete the resources otherwise they will be charged you according to the Pay-As-You-Go model. You can easily remove resources from the resource groups by just eliminating the resource group. This will immediately remove all the resources present inside the resource group at once and minimize the manual process as well.

Organizing for billing

If you organized your resources in the resource group in such a way that they correspond to a single task. So, with this approach, you can easily understand and estimate the billing report that is produced due to those resources.

Tagging

As earlier discussed that we can organize several resources into the resource group. What happens, if your resources in the resource group are responsible for performing several tasks. Tags play an important role to distinguish the same resource according to the task.

What are Tags?

Tagging in Azure is a label with key-value pairs that can be assigned to the resources so that resources can be easily identified. Key indicates the name ad value contains some specified number.

If you are using multiple virtual machines, you can easily identify VM type using tags.

A single resource can have a maximum of 50 tags. The length of the tag name is limit to 512 characters. You can use 512 character length for the name. This allows for all types of resources present in the resource group. However, storage resources have a name limit of 128 characters. The value length of 256 characters is allowed. The tags features can not apply to all types of resources except the classic resources.

You can create tags to the resources by using Azure Portal, Azure CLI, Azure Powershell, ARM templates, and SDKs like REST API. For example, If you are using Azure CLI, you can easily use the tag to a virtual network resource by executing the following set of commands.

```
az resource tag—tags Department=Finance \
—resource-group msftlearn-core-infrastructure-rg \
—name msftlearn-vnet1 \
```

—resource-type "Microsoft.Network/virtualNetworks"

EXAM Azure Policy automatically adds a resource tag to the resources that you created for your Azure solution. The tags are added according to the policy rules that you define.

Apply tags to resources

To apply resource tags to the resources, follow the given steps.

Go to the home portal page of Azure.
Navigate to your created resource group.
Inside the resource group, you will see the list of resource that this resource group hold.
To simplify the responsibilities of these resources, you can apply tags.
Select any resource from the list and go to the top to give options.
Click on “Assign tags”.
The tag tab will appear, requiring you to give the key-value pair for that resource.
Give the unique name and value to this resource and click on “Save”.
After that, go back to the resource. You will see the same resource with the tag.

Edit tags

To edit the tag, follow the given steps.

Go to the portal menu.
Click on “Resource groups”.

The list of several created resource group will appear.

Click on the resource group in which your tagged resource is present.
Open the resource in which you apply the tag.
Click on the “Edit tags”.
Edit tags dialog box will appear. You can easily change the name and value and click on “Save”.

To see the resources of the same tags in the Azure portal, follow the given steps.

Go to the portal home page, click on “All resources”.
The “All resources” page will appear containing multiple resources.
Select “Add filter” present at the top of the page.
In the “Tags”, select “your assigned key and value”, you will immediately see the resources that have that assigned tag.

Use tags for Organization

Similarly, if you are working for an organization that contains several resources and some resources have multiple responsibilities to perform, you can simplify the work by assigning the tags with name and value. For example, if one storage account hold data in blob form and the other one hold data in queue form, you can assign the tag to distinguish the performance of the storage account.

Secure resources with RBAC

As earlier discussed that Azure policy restricts the access of resource and allow the resource access to only specified users. To control the resource security, Role-Based Access Control (RBAC) can be used.

In Microsoft Azure, a role is a list of actions that you can or cannot do. Your role definition could allow you to create and manage a virtual machine. However, it prevents you from deleting them. The following are the most common and known back role:

Owner – Provides full access to resources in Azure and you can delegate access to other users
Contributor – It is like an owner role, it provides full access to resources in Azure. However, you cannot delegate control. The reader can only view the resources
User Access Administrator – It is granted permission to manage access to Azure resources

In addition, using RBAC you can:

Allow a single user to manage and control the virtual machine in the given subscription and other users to manage the virtual network
The database administrator group is responsible to manage the SQL databases in the subscription
A single user can manage and control all the resources present in the resource group such as VM, VNet, Storage account, etc.

Allow an application to access all the available resources present in the resource group

View access permission

To view the access permission, go to the “Access control (IAM)” option of your resource group.

In this panel, you can see, who can access and area and their assigned role. You can add and remove the role access as well.

Therefore,

Define access using RBAC

Role-Based Access Control (RBAC) uses an allow model to define access. When you are assigned to a role, you can easily read, write, and delete the resources. Thus, if one role assignment gives you to read resources, and another role assignment allows you to write in the same resource group. You will have both the permission to read and write in the resource group.

Best Practices for RBAC

The following are some best practices for RBAC.

Separate responsibilities within your squad and allow only the amount of access to users that they required to use to perform

their duties

It is not good to restrict the users from using any resource in the subscription. Instead, you should assign a single role to the user so that they can access at a particular scope
Plan your access control strategy in such a way that grants users the least privilege access that they required to perform their jobs
Use of resource locks. It restricts the users from deleting and modifying any resource

Use locks to protect resources

Locking the Azure resources is the ultimate way of protecting the resource. It prevents you from deleting and changing any resource mistakenly.

Resource Locks

In Azure, resource locks are the setting that can be applied to restrict the user from unneeded modification and deletion. These locks have two types of modes. One is to delete and the other is read-only. With delete lock, you will allow doing all the changes in that resource except to delete it. With read-only access, you can view the resource and cannot change, modify, and delete. Resource locks can be applied to subscription, resource group, or any resource present in the resource group.

Note: The "Rean-only" lock can create some unpredicted outcomes due to the additional actions required for a read operation.

When the resource lock is applied to any particular resource, you first remove the lock from that resource to perform any operation. Resource locks prevent your resource from any accidental actions and also helps you to protect from doing something that may not have intended to do. This type of lock is applied regardless of RBAC permissions.

How to create a resource lock?

To create a resource lock in the resource group, follow the given steps.

Go to the portal page of Azure. Navigate to the resource group. On the resource group pane, note the available resources.

From the left side given menu, click on “Locks” present inside the “Settings” option.

Click on “+Add” to create a lock.

Write the “Lock name” and “Lock type”.

Click on “OK”.

Select any resource present in that resource group and delete it. You will see the following error message.

Note: To remove any resource from the locked resource group, you should have to first delete that lock and then delete the resource.

Use resource locks in practices

The use of resource lock is a way of protecting from being any accidents. To delete any resource, you have to first move the lock. This feature is usually used to protect some special resources of Azure that could have a large impact they are accidentally deleted or modified. Examples of such resources are ExpressRoute circuit, domain controller, virtual network, databases, etc.

Secure Azure resources with RBAC

Introduction

The protection of Azure resources such as virtual networks, websites, virtual machines, storage, etc is very difficult for any company or organization especially when they are using the cloud. Companies and organizations are using Azure-based resources and services to build their solutions. In addition, they want to securely and protect their resource from any accidental issues such as loss of data, hacking, etc. Companies are also able to grant resource access to their employees so that they can easily perform their duties.

To manage and secure the Azure resource and grant these resource access to multiple employees and also allow them to access this resource in a certain location, Role Based Access Control (RBAC) is used. RBAC is the authorization system that provides security and protection to your Azure resource and also grants access to the employees and manages who has access to these resources and where they can access (location).

Role Based Access Control (RBAC)

To understand the Role Based Access Control (RBAC), it is necessary to understand what is the role?

Usually, when you are using Microsoft Azure to build any type of solution you are required to use certain Azure resources. For example, you have multiple resources like disk, virtual machine, SQL databases, and web applications. For all of these services, you can perform certain actions like you can create a disk, update the disk maybe attach it to a virtual machine, start and stop the virtual machine, scale-up SQL database, or deploy a web app. All these things that can do with the Azure resources are called actions. Actions define what can be done with a certain type of service. Potentially, you could assign specific actions to users and applications to allow them to manage Azure resources. However, this process becomes very time consuming as the number of resources increases.

In Azure, it is easier to create a bundle of actions so you can combine the actions like update disk, start or stop VM, attach disk and create a role with a certain name like VM operator. In the same way, you can create as many roles as you want for your organization. You can fine-grain for permissions for your applications and users by using roles. Azure comes with several built-in roles allowing you to manage your access to your resource.

Azure Subscription

When working with RBAC, Azure Active Directory (Azure AD) is also used for identity and access management. When you start

working work Azure, it is mandatory to use an Azure subscription. Azure subscription is linked with a single Azure Active Directory. Users, groups, and several applications in that particular directory can manage and control the Azure resources in the Azure subscription. Each Azure subscription uses a single Azure AD directory for sign-on (SSO) and access management. You can increase your on-premises AD directory to the cloud by using the Azure feature called Azure AD Connect. This feature allows us to manage and monitor Azure subscription with the existing work identities.

Note: When you disable the on-premises AD account, you will lose access to the Azure subscription connected with Azure AD.

Azure Active Directory (Azure AD) and Role Based Access Control (RBAC) work together because Azure AD is the centralized service for identity and access management and that access management for Azure resources is done with the RBAC feature.

EXAM Azure Active Directory services are available for everything present on Azure. It is the first service given when a user creates an account in Azure.

RBAC

Role Based Access Control (RBAC) can easily secure your Azure resources. A virtual machine, websites, network, storage, and all of the critical resources for any organization using a cloud. When it comes to protecting these types of resources, security is paramount. These certain resources and asserts need to be locked down and secure. However, it is also very to grant employees and partners, the access they need to perform their duties. Role-Based Access Control is used to grant access from one resource to another. RBAC is the security system that controls and manages who can access the resource.

RBAC role is used to grant access to Azure resources. The following figure illustrates how classic subscription administrator, RBAC roles, Azure AD administrator roles are related to each other. In the given figure, a subscription role has an Azure AD tenant with users or a group of users. An Azure AD tenant has access to the root management group that allows users or groups of users to access certain resources present within the resource group.

Figure 9-05: Example of RBAC

What we can do with RBAC?

The Role-Based Access Control (RBAC) policy provides fine-grained access management for your Azure resources, allowing you to grant users the specific rights they need to perform their duties.

In addition, using RBAC you can:

Allow a single user to manage and control the virtual machine in the given subscription and other users to manage the virtual network

The database administrator group is responsible to manage the SQL databases in the subscription

A single user can manage and control all the resources present in the resource group such as VM, VNet, Storage account, etc.

Allow an application to access all the available resources present in the resource group

RBAC in Azure Portal

With the Azure portal, you can do identity and access management by creating the role assignment. The steps to use Role Based Access Control (RBAC) using the Azure portal are:

Log in to the Azure portal with your credentials.

Create a resource group by filling in all the required details.

After the deployment of the resource group, open the overview page.

Go to the left side given menu, click on the “Access control (IAM)” option.

Initially, no access will be assigned to any resource. Open the “Role assignments” tab.

You will see the following list which categorizes the role assignment with respect to Contributor, Owner, and User Access Administrator.

Note: From the "+ Add" option, you can create your own custom role.

How does RBAC work?

The way you control access to resources is to create a role assignment. You can enforce the permissions by creating a role assignment. There are three elements required to create a role assignment.

Security principal
Role definition
Scope

Security principal

The security principal is for users, groups, or an application that you want to grant access to. This element is not just for people, one application can be a principal that has access to another resource. The visualization of the security principal is shown in Figure 9-06.

Figure 9-06: Security principal

Role definition

What can the service principal do is specified with role definition? Role definition is a collection of permission or actions. It is also referred to as role. It lists the permissions that you are allowed to perform such as read, write, and delete. Azure has multiple different roles that you can use such as an owner or virtual machine contributor. An example of the role definition is shown in Figure 9-07.

Figure 9-07: Role definition

There are several roles define in the role definition The four most common built-in roles are:

Owner – It has full access to all Azure resources including reading and write the resources or delete access to others
Contributor – This role can create and manage all the Azure resources. However, this role is unable to delete access to others
Reader – The role can only view the existing Azure resource. Cannot be able to delegate the resource or access to others
User Access Administrator – This role allows you to control and manage the user access to Azure resources

EXAM If the common built-in role does not match with your requirements, you are allowed to create your own role called a "custom role".

Scope

After defining the service principal and role definition, you are required to given access. This is called scope. In Azure, you can specify a scope at multiple levels such as a management group, subscription, a resource group, or individual resources, and those permissions are inherited to sub-levels. The parent-child structure given by scope is shown in Figure 9-08.

Figure 9-08: Scope

Role assignment

When you are done with the service principal (who has access), role definition (what can access), and scope (where they can access). You combine these three elements to grant access with a role assignment. You can easily create a role assignment by using the Azure portal, Azure CLI, Azure PowerShell, or by using other methods.

The role assignment method combines a role to a security principal at some particular scope to grant access. The following figure defines the role assignment by combining the security principal, role definition, and scope that is defined earlier.

Figure 9-09: Role assignment

You grant access to a resource by creating a role assignment and revoke the granted access by removing the same role assignment.

RBAC uses allow model

Role-Based Access Control (RBAC) uses an allow model to define access. When you are assigned to a role, you can easily read, write, and delete the resources. Thus, if one role assignment gives you to read resources, and another role assignment allows you to write in the same resource group. You will have both the permission to read and write in the resource group.

Role Based Access Control has several permissions. One of which is “NotActions”. With “NotActions” permission, you can easily create a set of several allowed permission to a specific bunch of users or groups of users. This type of access is granted by defining a role, the powerful permission. You can easily create this type of role assignment by removing the “NotActions” operations from the “Actions” operation.

For example, usually “Contributor” role has both “NotActions” and “Actions” permissions. When you open the list of permissions in the Azure portal, you will see wildcard “(*)” in the “Actions” operation indicating that the assigned users or group can perform all types of operations. To make effective permission, you will be required to move the following permissions.

Delete and create roles and role assignments
Create, update and delete blueprint artifacts
Grants the User Access Administrator at the AD tenant scope

Azure Policy

Azure Policy is used to create policies in Azure. With Azure Policy, you can manage and assign policies to the resources with multiple rules, so that specific resources are complaint with your business standard and SLAs. You can use Azure Policy to make sure that the use of resources does not become a mess. Azure Policy is a default allow and explicit deny system.

If you have a group of resources with the policies for each of the resource, then Azure Policy is a service, which ensures that these resources are compliant with the policies. Azure enforces that.

Exam Azure Policy ensures that policies applied to the resources are compliant.

A policy is set of rules to ensure compliant resources.

Use Policies to Enforce Standards

When you have built multiple resources in the resource group and assign tags to some resources. You can easily simplify the working responsibilities of these resources. But, what if you implement the new resource in the same resource group and how do you ensure that the new resource will follow the same tagging and grouping rule? With Azure policy, you can easily design certain rules that apply to your Azure environment.

Azure Policy

When an Azure Policy is assigned to a particular resource group. The resources in the resource group would remain to exist as it is. Azure Policy is responsible for highlighting the issues of some particular service using a definition that affects the resource present Resource Groups.

When normally use Azure policies to enforce things like creating a policy or rule that allowing access to only a specific resource or resource group. You can also create a policy that assigns tags to such resources that belong to some specific region. In this section of the chapter, you will learn how to create an Azure policy and use it to enforce standards.

Create a Policy

There are three steps involved in the creation of the Azure policy.

Create a policy definition
Create a policy assignment
Test out a policy

Create a policy definition

The first step in the creation of policy is to create a policy definition. The following steps could be used to create a policy definition.

Go to Azure Portal, click on "Policy" from the resources available.

The policy page will appear. Click on "Definitions" present inside "Authority".

To create a custom policy, click on “+ Policy definition” present at the top given options.

On the "Policy definition" page, select the definition location (subscription) by clicking on the right corner option present there.

Select your subscription and click on “Select”.

Give the policy name and write a description. This is optional.
Select the “General” category from the given list.
Create a “Policy rule” in JSON format.

```
{
"mode": "Indexed",
"policyRule": {
"if": {
```

```
"field": "[concat('tags[', parameters('tagName'), ']')]",
"exists": "false"
},
"then": {
"effect": "deny"
}
},
"parameters": {
"tagName": {
"type": "String",
"metadata": {
"displayName": "Tag Name",
"description": "Name of the tag, such as 'environment'"
}
}
}
}
```

Click on “Save”.

Note: Your custom policy will be created.

Create a policy assignment

After creating a policy definition, the next step is to create a policy assignment. For policy assignment, follow the given steps.

Go to Azure Portal, click on “Policy” from the resources available.

The policy page will appear. Click on “Assignments” present inside “Authority”.

In the “Assign Policy” pane, you will assign the policy to your resource group. Click on “Assign Policy” present at the top given options.

Select subscription and resource group.

Click on “Save”.

For the policy type, select the “Custom” type from the list. Select “Enforce tag a resource” and click on “Select”.

Now, verify the "Basic" details.
Click on "Next".

Select your region from the list and click on “Review + create”.

When the validation is passed, click on “Create”.

After creation, you can verify the policies.

Test out a policy

After assigning the policy, you can test this policy by creating any resource into that resource group to which you assigned the policy.

Go to Azure Portal, click on “Create a resource”.

The Azure Marketplace page will appear. On the search bar, search and open “Storage account”.

Click on “Create”.

Enter the "Basics" details. Select your subscription and resource group.

Give a unique name to your storage account.
Leave all the remaining options as default.

Click on “Review + create”.

The following error will occur.

Note: This happened due to the assigned policy.

Go back to the "Tags" pane from the top.
Enter the key-value pair of your own choice.
Click on "Review + create".

Now, the validation will definitely pass. When the validation is passed, click on “Create”.

When the deployment is completed, click on “Go to resource”.

You can verify the configuration details from the overview page of the storage account.

The main purpose of Azure policy is to restrict access from an unauthorized source. Organizations normally use this type of policy to secure their resources and these type of policies are designed with legal and regulatory restrictions. Resources are controlled by these assigned policies. For example, you can assign an Azure policy that says that your organization can create only Linux-based VMs. If anyone from your organization tries to create a Windows-based VM or another type of VMs, this policy will not allow him to create such virtual machines.

Azure Blueprint

It is a template for creating Azure resources. Everything you need to deploy in the standard cloud environment of Azure is defined in the blueprint. Consider an example where you have to create a new Azure environment and you have to meet specific governance rules and regulations. Now, doing this manually can be quite difficult. Azure Blueprints enables cloud architects and central information technology groups to define a repeatable set of Azure resources that implements and adheres to an organization's standards, patterns, and requirements.For some common scenarios, they have built-in samples like situations with specific governance, regulations and guidelines.

Exam tip:

To create a standard Azure Environment, Azure Blueprint is used.

Azure Advisor for Security Assistance

Azure Advisor is a separate portal within Azure that has Security Assistance as a part of the Azure Security Center. You already know about the Azure Security Center, as we discuss it in chapter 8.

Figure 9-10: Azure Advisor

Azure Monitor

In order to improve your Azure experience, Azure Monitor uses the telemetry data. Azure Monitor maximizes flexibility and application efficiency by offering a comprehensive solution to capture, monitor, and use the cloud and on-site telemetry. It helps you understand how your applications operate and detect problems and the resources on which they depend proactively.

We know that managing cloud services means lots of resources and a lot of individual processes. And on top of that, you need to monitor the health of system in order to check whether things are running smoothly or not. In a scenario where one of the services is not performing well or it fails, then identifying it becomes the aim of the Azure Monitor.

Telemetry is the collection of measurements of other data that are at remote or inaccessible points and their automatic transmission to receive equipment for monitoring. It is the information about how services or devices are performing. This information is then passed to the central server in order to perform analysis.

The data collected in Azure of two types: logs and metrics. Metrics are in the form of numerical value while logs are different kinds of data like events or traces.

Figure 9-11: Pushing Telemetry Data to Azure Monitor

In Azure, all the telemetry data goes into Azure Monitor. Consider an example in which multiple VMs are running, Azure Monitor verifies that all of them are running smoothly. If any one VM is not performing, then you need to know which one and for that, you need telemetry data about the machine. This telemetry data constantly feeds into the Azure Monitor. Through Azure Monitor, you can analyze all of your data in one place. It is a fully managed centralized service. You can also use interactive query language in order to query the telemetry data. For detecting problem faster, you can use Machine Learning with your resources.

Figure 9-12: Working process of Azure Monitor

Outcomes

The outcome of using Azure Monitor:

Maximize performance
Maximize availability
Identify issue

Azure Service Health

Whenever there is a plan of maintenance or service incident, you get notified about it with the use of Azure Service Health. The Azure platform needs to be updated and maintained like any infrastructure by mitigating the risk and taking necessary steps to protect your infrastructure and applications. Downtime is one of the enemies of your application or service. To help with this, there is a Service Health Dashboard in Azure.

With Azure Service Health, you get notified about the planned or unplanned maintenance of the platform. It has the following features:

Dashboard – There is a personalized dashboard to highlight the service issues which effects your resources
Custom Alerts – There are custom alerts to notify about any outages. These are simple to setup and customize
Real-time Tracking - In case any issue occurs, it finds the root cause of the issue in real-time and after resolving the issue, it downloads the official report.
Free Service – It is a free service.

Figure 9-13: Service Health Dashboard

Demo: Azure Monitor

Login to Azure Portal and go to “Monitor”.

Here is an overview of the monitor.

Now, go to “Service Health” from the left side of the window.

Currently, it shows that no issue is found. It will alert you of any issue in the services if found.

If you click on “Planned maintenance”, it will show any coming or scheduled planned maintenance events.

Compliance

The general principle that cloud services deliver must adhere to the requirements faced by cloud customers is strongly compliant. This is a very important issue with new cloud computing services, and many IT professionals are looking at it very thoroughly. If any company in the EU does not take compliance seriously, they then have to pay a massive fine. For example, if any company is dealing with paying customers and does not comply with privacy and regulations about personal data, the company could be fined 4% of the annual global turnover. There are different standards and regulations that cloud customers need to comply.

Exam Compliance is not negotiable.

Industry Compliance

This refers to the legislation and rules the industry, in general, has to comply with. The most common three legislations and rules are:

General Data Protection Regulation (GDPR) - Its main objective is to protect individuals and the processing of their data. With this, you get personal data to get back to an individual rather than company that owning In order to control consumer's data, it forces companies to implement a lot of tools to protect data.

Exam GDPR compliance is needed to interact with EU-based customers.

ISO Standards - ISO is the International Standardization Organization and they have a huge number of compliance categories. Generally, it is compliant with quality and customer satisfaction, which is ISO 9001:2008

NIST – NIST it is the National Institute of Standards and Technology and it focuses purely on the technical industry. NIST guidelines are designed in such a way that compliance with NIST also means compliance with multiple Federal US regulations. CyberSecurity Framework is one of the most famous frameworks there is.

Exam GDPR, NIST, and ISO are the regulations and standards that ensure your application legislation.

Azure Compliance Manager

In Azure, for provides you theAzure Compliance Manager, because Azure knows about compliance and as it knows about your resources, so it can easily combines the tools and gives you a recommendation as per that. There are many benefits of using Compliance Manager, some of which are:

It gives you a recommendation on ensuring compliance with GDPR, NIST, ISO, or others
It also assigns tasks to your team and tracks the progress of the task; each member is responsible for a certain compliance area
With that, you have a compliance score to chase perfect compliance
It gives you secure storage for uploading the compliance documents to prove compliance
It also gives you a report on compliance of data so that you can give that report to your managers and auditors

Azure Government Cloud

In order to know what is compliance, who make guidelines bodies and framework, and how Azure manages it all, you have two regions and offerings that are unique when there is compliance.

First is Azure Government Cloud, if you are US government body or are contracted for one, then you can get access to Azure resources in Azure Government Cloud regions. They are separate dedicated datacenters. With these dedicated datacenters, you get guaranteed that only US federal, state and local government have access to this dedicated instance with operations control by Screened US citizens.

It ensures compliance with required US government agencies and level 5 Department of Defense approval. With this, you can get all the benefits of Azure like HA, scalability, and managed resources.

Exam Azure Government Cloud provides dedicated datacenters purely for US government bodies.

China Region

It is the second specific region when it comes to compliance. As a country, China has very specific and strict requirements when there is data, internet, or online entities, so when you need to provide cloud services here, you have to use the China region in Azure. This means that Azure has physically separated datacenters located in China without any connection to the other regions of Azure. All data is stored in China at all times, for example if China is included in the region for DynamoDB then it will not work on a global scale. Within that, you are completely compliant with all Chinese regulations. All of these physically separated locations are managed by Chinese companies.

Exam Azure China region is fully compliant with Chinese regulation; both datacenters, and data.

Privacy

Privacy is an extension of compliances. In Azure, privacy is the core power of the platform so there is no single service or place for it. Microsoft also has its own privacy statement which you can see from the following link: Instead of building privacy control including tools and services.

Azure Information Protection - it is used for classifying, labelling and helping protect data based on its sensitivity
Azure Policy – as discussed earlier, it is used to define and enforce the rules to ensure regulations and privacy
Guides - when dealing with GDPR privacy request from European user data, then Guides are used on Azure to comply with these Use Compliance Manager in order to follow the privacy guidelines

Trust

In Azure, there are two services in terms of Trust. One is Trust Center and the other is Service Trust Portal. Trust Center is a shortcut of knowing all the things that Microsoft does to make sure that you do not lose trust in Azure and other services. With this, you have a link to learn about security, privacy, GDPR, location of your data, compliance and more. With this link, you get know more about security implementations, privacy implementations and so on.

Service Trust Portal is a location to review all the independent reports about Azure. It is a portal of proof that they are compliant with many millions of different standards and certifications. It is crucial to know that Azure is compliant with all of the various quality and security standards, in fact, more than any other cloud provider. In short, we can say that it is a one-stop shop for security, regulatory and compliance, and privacy information related to Azure Cloud.

Mind Map

Figure 9-14: Mind Map

Practice Questions

Which two customers can develop a cloud solution using Azure Government?

A European government entity
A Canadian government contractor
A European government contractor
A United States government entity

From the following options, which one provides organizations the ability to manage compliance of Azure resources across multiple subscriptions?

Azure App Service Plans
Azure Policy
Azure Resource Group
Management Group

If you want to restrict access to Azure resources as per the policy of company so that only the admin is allowed to create a resource in the region where their office is located, then which Azure resource will you use to define this policy?

A Reservation
A Management Group
An Azure Policy
Read the only lock

For migrating the services from on-premises to Azure cloud, you need to identify the compliance of Azure with your organization's regional requirement. From the following which one is helpful?

Azure Trust Center
Azure Portal
Azure Market Place
None of the above

For what region the GDRP compliance is needed?

US Region
EU Region
Asia Region
All of the above

From the following, which one is used for tracking an incident in real time and then getting its report.

Azure Network Watcher
Azure Policy
Azure Service Health
Azure Blueprint

RBAC has a feature to define which action is allowed to be performed by which user on specific resources. True or false?

True
False

In Azure Monitor, which services can feed data?

On-premises

Azure Services
Both On-premises and Azure Services
Only Premium Services

In Azure, what types of locks can you apply? (Choose 2)

Closed
Read-only
Update
Create only
Delete

In order to trust more on Azure Portal, you can view the Service Trust Portal and Azure Privacy Portal in Azure. True or false?

True
False

In the China region, all Azure Services are globally located. True or false?

True

False

In RBAC, how many elements are present?

2
3
4
5

In order to create a standard Azure Environment, you can take help from _____.

Azure Advisor
Azure Policy
Trust Center
Azure Blueprint

For compliance in Azure, which service can be used?

Azure Trust Center
Azure Privacy Portal
Azure Compliance Manager
Azure Monitor

In order to classify, label, and help protect data based on its sensitivity, which Azure Service can you use?

Key Vault

Security Center

Azure Dedicated HSM

Azure Information Protection

Chapter 10: Pricing

Introduction

For migration to the cloud; we have discussed a lot of topics but we did not examine the primary concern, which is pricing. It is one of the most important part of any Cloud computing. Pricing does not only mean understanding the price of Azure services. Organizations often want to know about the cost of computing services before applications are deployed to the cloud. After the application is deployed, they want to reduce costs as much as possible and have insights in Azure's resource costs.

There are some areas in pricing that you need to be familiar with, i.e., Subscriptions, Cost Management, Pricing Factors, and Best Practices in Azure for managing costs.

Azure Pricing Structure

Azure pricing structure depends upon the following criteria:

Pay for the resources you access
Pay for the number of hours you use
Pay depending upon the size of the resource
Service payment is tiered
Pricing as per the location of service

Subscriptions

The pricing structure of Microsoft Azure works on a subscription price that is tied to what you are using within the Azure infrastructure. All resources in Azure resides within the subscription, you cannot access any resources until you are subscribed.

Once you sign up for Azure, you immediately get an Azure subscription, and all the services you create are created within that subscription. Additional subscriptions are useful in cases where you want to have some logical groupings for Azure resources, or if you want to be able to report on resources used by specific groups of people.

You can manage your subscription in the Azure portal like any other Azure resources. You can monitor and manage costs, you can give access to it through RBAC to other users, you can add locks to it, and much more.

Subscription in Azure can be defined as:

Multiple Subscriptions: Any Azure account can have multiple subscriptions. It is very useful for organizing who pays for what.

Billing Admin: One or more users can be a 'billing admin', which manages anything and everything that has to do with billing and invoicing on Azure. It ensures invoice separation of responsibility.

Billing Cycle: A billing cycle on Azure is either 30 or 60 days.

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days. days.

Offer Types

At any given time, Azure has a lot of active offer types. You can get the offer depending upon your subscription type. Popular subscription type such as pay-as-you-go and enterprise level agreement, you can get many more offers as well. You can check the offer types when you are signing up for Azure.

Figure 10-01: Azure Offer Types

Management Groups

Management Groups is a very useful feature on Azure when it comes to subscription. Management groups may indicate the following:

Group Subscriptions: You can group your subscriptions to allow taking actions in bulk across subscriptions. This is very useful in organizations that deal with many subscriptions.

Organize: You can manage access, policies, and compliance in multiple subscriptions at the same time.

Billing Logic: You maintain the billing associated with the right budgets. You have the Nest management groups to indicate the hierarchy, which means each management group has a single parent group but many child groups and their relationship.

Cost Management

We know that when resources and services are running, its cost management can be quite an expensive task. In order to manage all of these costs, you have cost management. When you use resources or services in Azure you need to buy them as without that you cannot use it. You need a service that automates the cost management because tracking of every single cost is such a difficult thing to do. When you start thinking about moving to the cloud, the first thing you will probably want to do is decide what the cost of the resource. Once you have started deploying and using Azure services, it becomes important to manage your costs to remain within your budget. Azure has tools to help you schedule and manage your Azure costs. The management of cost in Azure can be done in many different ways; some of these are given below:

Azure Free Account

If you have never had a free Azure trial and have never been a paying Azure user, then you are eligible for a free Azure account. A free account gives you free access to the most popular Azure services for 12 months, and many other Azure services offer free usage even after the 12 months have passed. You also get a $200 credit, which you can use for a 30-day span of Azure services after you sign up for a free account.

Free accounts provide a range of benefits such as 12 months' free access which includes 750 hours of computing on virtual machines, 5 GB of storage, 250 GB of SQL database, 5 GB storage on Cosmos DB and a bundle of Artificial Intelligence services.

Microsoft places a $200 free-account spending limit. If you reach the spending limit, you are allowed to upgrade your subscription to a Pay-As-You-Go subscription with which you can create additional resources.

At the end of the 30-day span, any resources that are not free for 12 months or more are automatically deleted. So if you want to continue using your resources, you must make sure you upgrade your Azure subscription before the 30 days expire.

Azure Cost Management

Azure Cost Management is a handy tool in Azure that allows the study of your costs on a granular level. Cost management allows you to create a budget for your Azure expenses, set up configurable notifications as so you will know if you are hitting a budgeted limit and evaluate your costs in detail.

Azure Cost Management is accessible from the Azure portal. You can get a detail view of the current and future projected costs of all the resources that are within your area of accountability. Azure Cost Management is free of cost and included with all Azure subscriptions.

You can download reports on spending and get recommendations on how to save on costs and analyze them. You can optimize your current resources to save money and also monitor the charges of other cloud service providers such as Amazon Web Services.

To get started with Cost Management, open the Azure portal and search for Cost Management, and click on Cost Management + Billing.

Figure 10-02: Azure Cost Management

Pricing Factors

Pricing in cloud computing is very tricky to predict and calculate. Any Azure account has a lot of resources such as networks, connections, virtual machines, firewalls, storage accounts, functions, etc.

When you plan your Azure deployments; you should keep in mind the factors that can influence your costs. The primary factors influencing costs are the size of resources, type of resource, the Azure regions you are using, and the bandwidth.

Resource Size

The pricing depends upon the size of the resource. A more powerful virtual machine will cost more than the less powerful one.

Resource Type

Resource type is also an important factor in pricing. This also makes sense as there is a very big difference in the number of hardware resources needed to run a virtual machine compared to a machine learning service or big data analytics, and there is also big difference in the complexity of maintaining and running various Azure services.

Location

Azure has a global network of datacenters from US to Australia and from Norway to South Africa, they are all treated equally with slightly different pricing. Exchange rates, labor costs, etc. have an influence on the prices.

Bandwidth

The least influencing factor is bandwidth. The bandwidth your services are using incurs a cost as well.

Zones & Bandwidth

To make things clear, Azure has designed three billing zones, each of these zones has many Azure regions. Any data transfer between the regions located in the same billing zone is free, this process is called Ingress. Any data transfer between two different billing zone is charged, this process is called Egress.

Figure 10-03: Data Transfer in Billing Zones

Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones Zones

Zones Zones

Pricing Calculator

The Azure pricing calculator helps you get an estimate of costs depending on the products that you plan to use, as well as where those products will be deployed, and so on. You can access the pricing calculator by going to

Figure 10-04: Pricing Calculator

Steps for Using Pricing Calculator

The first step in calculating your Azure expense estimate is to select which products you wish to use. Some of the more popular Azure products are shown by default, and by clicking on its tile, you can select any of those products.

Then scroll down to customize the specifics of each service after you select the products you want to use. These specifics vary according to how Microsoft pays for the product.
Clicking on “Pricing Details” will open the product pricing page in a new tab.
You can also click on “Product Details” or “Documentation” to read more about the service to help you make better decisions about the options you select.
Once you have configured the product according to your needs, you can click the “Clone” button to add another instance of the product to your estimate.
To check your estimate of prices, scroll down to the bottom of the page.
You can pick a support plan to add to your estimate.
You can click “Export” to save your estimate as an Excel file, then select “Save” to save your estimate in the price calculator to make changes later, or select “Share” to build a sharable link to your estimate so that others can view it too.

Total Cost of Ownership (TCO) Calculator

The pricing calculator is helpful for estimating your expenses for new applications in Azure, but if you have on-premises applications that you want to migrate to Azure and you want an estimate of how much you can save, the TCO calculator is a better choice. You can access the TCO calculator by browsing to:

Information about your on-premises servers, databases, storage and network usage should be included when using the TCO calculator. Figure 10-05 configures an on-premises server for a Web App.

Figure 10-05: TCO Calculator

Your TCO report shows you how much you can save by moving your app to Azure over the next 5 years, as shown in Figure 10-

06.

Figure 10-06: TCO Report

A TCO report includes detailed charts of expenses. You will also find a breakdown of on-premises costs and Azure costs at the bottom of the report so that you can easily determine where you will be saving money.

$23,588
Cost over 5 year(s)

$9,239
Cost over 5 year(s)

On-premises cost breakdown summary

Category	Cost
Compute	$11,433.10
Hardware	$7,038.00
Software	$962.50
Electricity	$1,841.40
Virtualization	$1,591.20
Database	$0.00
Data Center	$6,045.40
Networking	$1,416.09
Storage	$476.80
IT Labor	$4,217.05
Total	**$23,588.00**

Azure cost breakdown summary

Category	Cost
Compute	$3,187.44
Data Center	$0.00
Networking	$0.00
Storage	$4,134.91
IT Labor	$1,917.05
Total	**$9,239.00**

Figure 10-07: TCO Report Chart

Lab 10-01: Estimate TCO with Azure TCO calculator

This lab demonstrates how to estimate the Total Cost of Ownership with the Azure TCO calculator.

Go to the web browser and go to the Total Cost of Ownership website.

https://azure.microsoft.com/en-us/pricing/tco/calculator/

The default page of the TCO calculator will appear.
Click on “Start assessment”.

There are three steps to estimate cost savings. To estimate any cost, you will first need to define the workload weightage.

To define the workload, click on **+Add server +Add** and **+Add**

Note: Enter the details of the current on-premises server infrastructure, database infrastructure, storage infrastructure, and network bandwidth.

After defining the workload, click on

After defining the workload, the next step is “Adjust assumptions”. Select the currency of your choice.

Select other assumptions according to your choice. Click on

After defining the workload and adjusting assumptions, the last step is to view the report.

You will see the details of the costs in graph form, as shown below:

Total Cost of Ownership (TCO) Ca
azure.microsoft.com/en-us/pricin...
Paused
Over 5 year(s) with Microsoft Azure, your estimated cost savings could be as much as $83,368
Total on-premises vs. Azure cost over time
Savings from running workloads in Azure accrue over time. The following shows how those savings add up over years.

Best Practices for Minimizing Azure Costs

Cost management is an operational challenge and should be an ongoing practice that begins before spending money on cloud services. In order to implement cost control effectively and reduce costs, you need to:

Be equipped with the right tools for performance
Be responsible for costs
Take appropriate action to reduce expenses

Spending Limits

Azure spending limits are the recommended means to manage your Azure subscription's total spending and doesnot spend over the credit amount. When your usage leads to charges that exhaust your spending limit, the services you deployed will be disabled for the rest of that billing period.

Default Limit: Some Azure accounts with monthly credits, will have default spending limits. This could be 0$ for a free account and 150$ for Microsoft subscription account. When the credits are used, the limit kicks in.

No Increase: When the credits are gone, either remove the spending limit entirely or leave it in effect.

No Spending Limit: Pay-as-you-go subscription has no spending limit functionality.

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Quotas

A quota is the limit on certain properties of an Azure service. For example, a maximum of 100 namespaces per subscription is allowed for Event Hub. The quotas are necessary to ensure Azure can maintain its high service level. If you need to increase the quota for a particular service, you can ask Microsoft to increase them.

Tags

Tags are non-functional labels attached to resources or resource groups in order to manage the cost of resources. You can attach as many to each resource as you want. Tags provide an excellent way of attributing costs. The tags can be used as a filter and as well as when you analyze data to evaluate costs, you can use them to group together. They are non-functional attributes.

Some common best practices for using tags are:

Identify Roles: Protect sensitive data by defining which roles can access a resource.

Related Resources: To make bulk processing and updating easier, define which resources are related.

Filter: Filter resources per project, customer, or for reporting purposes.

Unambiguous: Create a list for tags used that includes: description, tag name, and potential values.

EXAM TIP

Pay-as-you-go is a very common pricing model in which you pay only for what you use on per month basis. It is one of the most expensive model for Azure usage.

Reserved Instances

With Reserved you are allowed to prepay for the virtual machine or SQL Database computing capacity for one or three years. Pre-paid allows you to get a discount on the resources you are using. You cannot reserve all the services. It will dramatically reduce the cost of computing up to 72 percent on pay-as-you-go pricing with an upfront commitment of one year or three years. Reservations offer a discount on billing does not affect the runtime status of your instance.

Azure Advisor

Azure Advisor is a tool that detects the low-usage virtual machines from a CPU or network cost standpoint. From there, you can choose to either shut down or resize the system to continue running the machines, based on estimated costs. Advisor also makes recommendations for purchases in reserved instances. The recommendations are based on your virtual machine usage for the last 30 days. With the help of this recommendation, you can reduce your expenditure when you act upon them.

Figure 10-08: Azure Advisor

Lab 10-02: Using the Pricing Calculator

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Calculator

Mind Map

Figure 10-09: Mind Map

Practice Questions

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Chapter 11: Core Azure Architectural Components

Introduction

This chapter is concern with the Azure core architectural components including Resource Groups, Resource Manager Template, Geography, and Azure App Service. The ARM template is a JavaScript Object Notation (JSON) file, which is a deployment code that defines the resources deployed in the resource group.

Hopefully, by the end of this chapter, you will get a great understanding of the core components and their purposes, as well as learn how to manage and use Azure Resource Manager (ARM) templates and the importance of other core architectural components.

Azure Resource Groups

Azure Resource Groups contain a different number of Azure resources. Azure Resource Groups helps to monitor, manage, and provide access control of resources. With the resource group, all resources within the resources group can span different Azure regions.

Azure Resource Group provides a managed group of Azure resources like Virtual Machine, SQL Database, storage account, etc. Resource groups allow to easily add and remove resources as well as apply role-based access information. Within a resource group, the same type of resources is created depending upon the company's requirements. There is no extra charge required for the creation of resource groups.

Azure Resource Manager

Azure Resource Manager enables us to organize, monitor all the resources after deployment. Azure Resource Manager (ARM) template is used to specify the deployment parameters, list of variables, list of resources, and output. It also provides the file named JSON for the faster deployment of resources.

Purpose of ARM Templates

It is an underlying service or interfaces where the Azure resource deployment and management take place. It provides a management layer, which lets you create, upgrade, and uninstall your Azure subscription tools with a single action Azure resource group and does not allow you to consider all the related resources as a single item. You can use management features such as access control, locks, or tags to ensure that your resources are protected and organized after deployment. The main purpose of ARM templates includes:

Figure 11-01: Purpose of ARM

Infrastructure as Code

When we are using the ARM templates, the main goal is referred to as "Infrastructure as Code". We can use ARM templates by trying to declare a certain infrastructure of a solution. It is a text-based (declarative JSON) representation of Azure resources and configuration that is used for the creation of a solution. We use ARM templates by defining the JSON script because it provides many benefits.

Consistent Deployment

With ARM we can achieve consistent deployments. It makes the repeatable deployment of infrastructure with clearly defined input and output.

For example, to deploy any type of resource, ARM gives you a common language. You do not need to be careful about the tools or SDKs for deploying as ARM makes the deployment of the necessary resources to build your solution.

Automation

With ARM we can automate the deployments. ARM templates provide the automation and orchestration deployments through scripts and Azure services.

For example, when you manage an Azure subscription, you have certain projects and each project needs some common resources like a virtual network, virtual machine, and storage accounts. For this case, if you have been regularly deploying this infrastructure, you have to spend some time on the deployment of these resources regularly as well. To avoid this, you can deploy these common resources with ARM templates and automate the deployment of that infrastructure using Azure Automation, PowerShell, CLI, etc.

EXAM ARM template is a JSON format file in which you define each resource of the Resource Manager that needs to be deployed. With a single action, you can define this template in the Resource Manager.

Structure of ARM Templates

Resource as Code

With the ARM we can deploy any resource in terms of code.

For example, when you want to create a virtual machine, the first thing that needs to be considered is to create a virtual machine to define the resource group. The resource group will hold this VM. The ARM template will define what will exist in terms of Azure resources and configuration within a resource group, where you will define the resource (virtual machine). After that, you define some important properties of a virtual machine like name, location, and size in terms of code. For functionality, you will have to define operating system images like Linux, data disk, and a network interface. The pictorial representation of this example is shown in Figure 11-02.

Figure 11-02: Example: Resource as Code

The creation of the resource (VM) can be obtained by using the code shown below.

```
Resource: "Virtual Machine" {
Virtual Machine Properties: {
Name: "vm1"
Location: "US East"
Size: "DS1 V2"
Storage: {
OSImage: "Linux"
DataDisk: "DataDisk1"}
Network: {
NIC: "NIC1"}     }   }
```

Template Format

When we use an ARM template, everything is defined in a specified format.

```
{
"$schema":
"contentVersion": "1.0.0.0",
"parameters": {.....},
"variables": {.....},
"resources": [.....],
"outputs": {.....},
"functions": [.....],
}
```

Azure Resource Manager Template is a simple template that contains: $schema, contentVersion, Parameters, variables, functions, resources, and outputs.

$schema

It is an important and necessary element that needs to define the location of the JSON schema file. It describes the language of the template.

contentVersion

It describes the details and format of the template. It is used by Microsoft to define the template structure.

Parameters

Parameters define the custom value which is taken as input when the template runs for resource deployment. There is a limit of 256 parameters in a template. Examples of parameters are VM name, location, size, etc.

Variables

It is where you define the specific values that can be used in the entire template, largely to help simplify the template usability and readability. For example, you can use multiple virtual machines in the same virtual network, instead of going into each virtual machine and configuring the details you can use variables. You can set the VM name as a variable that can be used throughout the template. When you need to change the name, you just go and change the variable.

Resources

The resources section in the ARM template is a necessary element where you define the resource that you need to deploy through the ARM template. The resources can be deployed by following Microsoft's definition of each of these resources. This is because there is a range of different properties that are needed during the configuration of resources. For example, a VM or VNet.

Outputs

The output allows you to return values from the ARM template deployment. For example, let's consider you are deploying five virtual machines. When you create your ARM template, you do not know what are the public IP addresses and private IP addresses. If you are automating the deployment of the ARM template, you can set the output section that returns only the IP addresses.

Note: You must define the output name and type for outputs. In value, you define from where you got the value, which is evaluated and returned to output.

Functions

You can define the complex expressions through functions that do not need to be used repeatedly in the template. You can

create your user-defined functions, which are different from the standard (built-in) template function. A user-defined function is usually used repeatedly throughout the ARM template.

EXAM With functions and variables, you can maintain your template easily.

Example – VM Resource

The ARM template in terms of Visual Studio code is shown in Figure 11-03 (a) and (b). This code specifically defines the "resources" section of the virtual machine.

File ▾ Quickstarts Looking for the previous version?

```
"resources": [
  {
    "type": "Microsoft.Storage/storageAccounts",
    "apiVersion": "2019-06-01",
    "name": "[variables('storageAccountName')]",
    "location": "[parameters('location')]",
    "sku": {
      "name": "Standard_LRS"
    },
    "kind": "Storage",
    "properties": {}
  },
  {
    "type": "Microsoft.Network/publicIPAddresses",
    "apiVersion": "2020-06-01",
    "name": "[parameters('publicIPName')]",
    "location": "[parameters('location')]",
    "sku": {
      "name": "[parameters('publicIpSku')]"
    },
    "properties": {
      "publicIPAllocationMethod": "[parameters('publicIPAllocationMethod')]",
      "dnsSettings": {
        "domainNameLabel": "[parameters('dnsLabelPrefix')]"
      }
    }
  },
  {
    "type": "Microsoft.Network/networkSecurityGroups",
    "apiVersion": "2020-06-01",
    "name": "[variables('networkSecurityGroupName')]",
    "location": "[parameters('location')]",
    "properties": {
      "securityRules": [
```

Figure 11-03_(a): ARM Template

```
},
"storageProfile": {
  "imageReference": {
    "publisher": "MicrosoftWindowsServer",
    "offer": "WindowsServer",
    "sku": "[parameters('OSVersion')]",
    "version": "latest"
  },
  "osDisk": {
    "createOption": "FromImage",
    "managedDisk": {
      "storageAccountType": "StandardSSD_LRS"
    }
  },
  "dataDisks": [
    {
      "diskSizeGB": 1023,
      "lun": 0,
      "createOption": "Empty"
    }
  ]
},
"networkProfile": {
  "networkInterfaces": [
    {
      "id": "[resourceId('Microsoft.Network/networkInterfaces', variables('nic
    }
  ]
},
"diagnosticsProfile": {
  "bootDiagnostics": {
    "enabled": true,
    "storageUri": "[reference(resourceId('Microsoft.Storage/storageAccounts',
```

Figure 11-03 (b): ARM Template

There are different key components present inside the resource section. The description of each key component is explained in table 11-01.

11-01.

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Table 11-01: Key Components in Resource Section

In this template, you can see different parameters like resource type, location, size, etc. To deploy resources from templates, you can use automation scripting tools like the Azure CLI, Azure PowerShell, or even the Azure REST APIs with your favorite programming language. You can also use Visual Studio, Visual Studio Code, and Azure portal to deploy your templates.

In the above example, the resource section specifies the version of the definition of the resource from Microsoft. Then, you must define the resource name in terms of a variable. After that, define the resource group location. Figure 12-04 defines the general definition of the resource section.

```
},
"resources": [
  {
    "type": "Microsoft.Storage/storageAccounts",
    "apiVersion": "2019-06-01",
    "name": "[variables('storageAccountName')]",
    "location": "[parameters('location')]",
    "sku": {
      "name": "Standard_LRS"
    },
    "kind": "Storage",
    "properties": {}
  },
```

Figure 11-04: General Resource Section

Properties

This section resides in the resources. It holds osProfile, hardwareProfile, storageProfile, and networkProfile.

osProfile – It defines the computer name, username, type of authentication that is used.

storageProfile – It defines the type of image that is used for the VM. This section also contains some terms to define the marketplace image that will be used to build the operating system for the virtual machine.

The publisher can be a Linux operating system or Microsoft Windows Server.

Offer is the actual type of image. For example, Ubuntu, Windows, etc.

SKU defines the version of the operation system.

The version shows the current version of an image. Usually, "latest" is used.

osDisk – The code shows, there is only an operating system attached to the virtual machine. There is no data disk associated with the virtual machine.

```
"storageProfile": {
  "imageReference": {
    "publisher": "MicrosoftWindowsServer",
    "offer": "WindowsServer",
    "sku": "[parameters('OSVersion')]",
    "version": "latest"
  },
  "osDisk": {
    "createOption": "FromImage",
    "managedDisk": {
      "storageAccountType": "StandardSSD_LRS"
    }
  },
```

Figure 11-05: storageProfile Section

networkProfile – Once we depend on the resource, we need the pre-built network interface card.

At last, the resource section includes the Azure Monitor to monitor the virtual machine. Azure Monitor stores the diagnostic information in the storage account.

```
"networkProfile": {
  "networkInterfaces": [
    {
      "id": "[resourceId('Microsoft.Network/networkInterfaces', variables('nic
    }
  ]
},
"diagnosticsProfile": {
  "bootDiagnostics": {
    "enabled": true,
    "storageUri": "[reference(resourceId('Microsoft.Storage/storageAccounts',
```

Figure 11-06: networkProfile Section

EXAM Use https://azure.microsoft.com/en-us/resources/templates/ to explore other Azure templates and understand how to deploy resources using ARM templates.

Working with ARM Templates

After understanding the concept of the ARM template and what is present inside it, in this section, we will learn how to retrieve ARM templates, how to export the ARM template, and how to deploy resources using Cloud Shell.

When using the ARM template, you should perform the following deployments.

Deploy to a Resource Group

ARM templates are commonly used to represent the resources within a single resource group. The deployment defines what are the resources and what are configurations within the resource group.

If you have multiple resource groups, you can also deploy them using an ARM template. However, the deployment of multiple resource groups has become advanced and complex. For such cases, you can use linked ARM templates.

Deployment Modes

If you have already used the ARM templates and you want to deploy the resource in the resource group, the condition is that you have to deploy multiple resources within the same resource. To do so, there are two different ways available.

Complete Mode – ARM template will delete all the resources, which do not exist in the template or is no longer in use.
Incremental Mode – This deployment will not delete anything. It will only update the properties of the resources that reside in the resource group. This is a default mode.

Deployment Tools

There are several different options available when working with Azure Resource Manager (ARM) template. You can use Azure Portal, Visual Studio Code, Azure PowerShell, Azure CLI, etc. You can get advanced integration with tools like Visual Studio Code, CI/CD, and Azure pipelines.

Figure 11-07: Working with ARM Template

Deploy a resource with Azure CLI

There are two options available to deploy a resource by using Azure CLI.

Standalone Template

You can deploy any resource by using a single standalone ARM template. With this option, the ARM template contains all the information required to deploy resources within a single file. This is the common way to deploy any resource with the ARM template.

```
# Standalone deployment
az deployment group create \
—name “deployvm” \
—resource-group “ips-rg” \
—template-file “ips.json”
```

Template with Parameters File

The second option is to deploy a resource with a parameters file. The parameters file can be used to provide some flexibility towards consistent deployment. With this template, there is a separate command argument used to specify the parameters file.

```
# With parameter file
az deployment group create \
—name “deployvm” \
—resource-group “ips-rg” \
—template-file “ips.json” \
—parameters “@devparams.json”
```

Both templates can be used with Azure CLI. For example, when you want to build a solution, you can build a template that defines a range of resources that are used to build a solution. You might set a range of properties within the ARM template as parameters. If you want to build high-performance resources, use an ARM template to deploy the solution both in production and development. Then, you can use the ARM template to build a high-performance resource for both production and development using the above CLI commands.

Lab 11-01: Working With ARM Template

This lab will demonstrate how to create an ARM template with Azure CLI.

Log in to the Microsoft Azure portal and go to the portal menu.

Go to options, present at the top of the portal.

Click on “Azure Cloud Shell”.

Click on “Create Storage”.

Note: Azure Cloud Shell requires an Azure files share to persist files. This will create a new storage account with some monthly costs.

The Cloud Shell session will start in a moment.

Type “ls” to see the list of available items.

You will see the .json file available in the drive with the name of “ips”.

Note: “ips.json” contains the Visual Studio code within the Cloud Shell.

To see the code, open code editor by typing “ips.json”.

You will see the available code in the ips.json file.

Microsoft Azure

Bash

ips.json

```
1  {
2      "$schema": "https://schema.management.azure.com/schemas/2
3      "contentVersion": "1.0.0.0",
4      "parameters": {
5          "storageAccountType": {
6              "type": "string",
7              "defaultValue": "Standard_LRS",
8              "allowedValues": [ "Standard_LRS", "Standard_GRS"
9
10         }
11     },
12     "variables": {
13         "storageAccountName": "ipsstorage01"
14     },
15     "resources": [
16         {
17             "type": "Microsoft.Storage/storageAccounts",
18             "name": "[variables('storageAccountName')]",
19             "apiVersion": "2018-02-01",
```

Microsoft Azure

Bash

ips.json

```
19             "apiVersion": "2018-02-01",
20             "location": "[resourceGroup().location]",
21             "sku": {
22                 "name": "[parameters('storageAccountType')]"
23             },
24             "kind": "Storage",
25             "properties": {
26             }
27         }
28     ],
29     "outputs": {
30         "storageAccountName": {
31             "type": "string",
32             "value": "[variables('storageAccountName')]"
33         }
34     }
35 }
```

The code is created with ARM Template. There is a resource section available here. In the resource section, there is a storage account. The name of the storage account is defined in the variable section.

Press “CTRL+Q” to close the code editor.
In the Cloud Shell session, type the following command to create a resource group.

“az group create—name “Myips”—location “eastus”

You will see the output in JSON format.

```
Requesting a Cloud Shell.Succeeded.
Connecting terminal...

hanif@Azure:~$ code ips.json
hanif@Azure:~$ az group create --name "Myips" --location "eastus"
{
  "id": "/subscriptions/797152d3-23c4-499f-bfef-bb103da7d054/reso
urceGroups/Myips",
  "location": "eastus",
  "managedBy": null,
  "name": "Myips",
  "properties": {
    "provisioningState": "Succeeded"
  },
  "tags": null,
  "type": "Microsoft.Resources/resourceGroups"
}
hanif@Azure:~$
```

Note: The output defines the configuration details in the form of subscription ID, location, name, properties, tags, and type.

After the resource group, we will deploy the resource in that resource group according to the “ips.json” code.
To do that, run the following sets of commands:

az deployment group create \
—name “ipsdeploy” \
—resource-group “Myips” \
—template-file “ips.json”

Note: You can pass the parameters under the template file or can pass in the separate parameters file as "@paramfile.json"

This command will take some time to complete the execution.

After the execution process, the following output will appear.

Microsoft Azure

Bash

```
hanif@Azure:~$ ls
clouddrive  ips.json
hanif@Azure:~$ az deployment group create \
> --name "ipsdeploy" \
> --resource-group "Myips" \
> --template-file "ips.json"
{- Finished ..
  "id": "/subscriptions/797152d3-23c4-499f-bfef-bb103da7d054/res
rceGroups/Myips/providers/Microsoft.Resources/deployments/ipsdep
y",
  "location": null,
  "name": "ipsdeploy",
  "properties": {
    "correlationId": "3533385b-779a-4a63-a79d-87d7f4220a7f",
    "debugSetting": null,
    "dependencies": [],
    "duration": "PT22.8757893S",
    "error": null,
    "mode": "Incremental",
    "onErrorDeployment": null,
    "outputResources": [
      {
```

Microsoft Azure

Bash

```
            "capabilities": null,
            "defaultApiVersion": null,
            "locations": [
              "eastus"
            ],
            "properties": null,
            "resourceType": "storageAccounts"
          }
        ]
      }
    ],
    "provisioningState": "Succeeded",
    "templateHash": "2977034500708418398",
    "templateLink": null,
    "timestamp": "2020-10-26T08:01:25.449752+00:00",
    "validatedResources": null
  },
  "resourceGroup": "Myips",
```

```
  "tags": null,
  "type": "Microsoft.Resources/deployments"
}
hanif@Azure:~$
```

After the resource deployment, minimize the Cloud Shell session.

Go to the Azure Portal page, open “Resource groups”.

The list of the created resource groups will appear.

Click on the resource group that was just created from the CLI session.

The overview page of the resource group will appear. The page will define all the same configuration details that appeared in the CLI session.

Note: You will see that the storage account that exists in this resource group. Whenever there is a resource created with the CLI or PowerShell session, no notification appears on the portal page.

Go to the options present at the left corner of the page.
Click on "Deployments" present inside "Settings".

You will see the same deployment that was created in the CLI session.

Note: This is a common administrative task. Past and present deployments can be monitored, including access to ARM templates.

Click on the deployment.

From the left corner option, click on “Template”.

You will see that you are able to get access to the ARM template that was deployed using CLI.

```
17      "resources": [
18          {
19              "type": "Microsoft.Storage/storageAccounts",
20              "apiVersion": "2018-02-01",
21              "name": "[variables('storageAccountName')]",
22              "location": "[resourceGroup().location]",
23              "sku": {
24                  "name": "[parameters('storageAccountType')]"
25              },
26              "kind": "Storage",
27              "properties": {}
28          }
29      ],
30      "outputs": {
31          "storageAccountName": {
32              "type": "String",
33              "value": "[variables('storageAccountName')]"
34          }
```

Note: This is an actual ARM template that we saw in the CLI session. With this deployment, you can monitor the parameters, variables, and resources. You can download the ARM template, or even add it to the library.

To see another important point, go back to the portal home page. Click on “Resource groups”.

Now, click on another resource group.

In this resource group, there exists a virtual machine.

From the left corner option, click on “Deployments” present inside “Settings”.

You will see the default template.

There is another option called “Export template”.

Note: With this option, we can export the automatically generated ARM template for a resource or resource group within Azure. This is a "snapshot" of the current configuration.

Go back to the Azure home portal page and click on "Template".

Note: The template option allows us to use a template that can be integrated with CD/CI tools such as Azure DevOps, or more simply within the Azure Portal.

To create a template, click on "+ Add".

Write the template name and fill the description section.
Click on "OK".

The creation of a new template will take some time.

After validation, you will receive a notification.

Now, on the template page, click on “Refresh”.

You will see that your created template will appear. Click on it.

You will see the “Publisher” and “Modified” fields.
Click on “View Template” to view it.

You will see the template, and you can edit it as well.
With the template option, you can easily deploy a template again after editing.

When you click on “deploy”, you will see the “Custom deployment”, which will allow editing the template and parameters.

After editing the template, you will be required to agree to the "Terms and Conditions" and deploy a new template.

Note: ARM templates are very commonly used with Azure DevOps and with Azure pipeline. This is an infrastructure as code, so we might use it with GitHub, CI/CD, etc.

Azure Marketplace

Azure Marketplace is an online store that contains thousands of VMs, developer services, and applications. Cloud-based solutions can easily sell to others using Azure Marketplace. It also enables the development of applications by seeking help and by using tools available in Azure Marketplace.

Azure Datacenter

If you purchase services in Azure whenever this is SQL database, web hosting virtual machine, or one of the many services in Azure. All these run on a physical infrastructure underneath some sort of services, a physical facility that hosts these services is called a datacenter. It is used to host a group of network servers, a typical datacenter has its own power pooling and networking infrastructure.

Geography

Azure divides the world into geographies that are defined by geopolitical boundaries or country borders. Azure geography is a discrete market typically containing two or more regions that preserve data residency and compliance boundaries.

This division has several benefits.

Geographies allow customers with specific data residency and compliance needs to keep their data and applications close.
Geographies ensure that data residency, sovereignty, compliance, and resiliency requirements are honored within geographical boundaries.
Geographies are fault-tolerant to withstand complete region failure through their connection to dedicated high-capacity networking infrastructure.

Azure Regions

The datacenters are the building blocks of global Azure infrastructure; a group of datacenters is connected with high throughput internet connectivity called the region.

Key Characteristics of Region

The geographical area on the planet
Contains more than one datacenters connected with the low-latency network (less than 2 milliseconds)
It defines the location (physical server) where you can put your services
Some services are restricted to certain regions only
Some services are global, as such are not assigned or deployed in a specific region

Region Pairs

Each region is paired with another region making it a region pair
Region pairs are static and cannot be chosen
Each pair resides within the same geography
Physical isolation with at least a 300-mile distance (when possible)
Some services have platform-provided replications
Data residency maintained for disaster recovery

Availability Zones

Availability Zones are present within Azure regions. These zones provide highly available protected areas to run applications and

data.

Microsoft Azure provides a high availability option for hosting applications across the entire Azure region. The availability zone protects applications and data within a region from data center-level failure. To ensure the 99.99% availability of the application, an application should be made available in multiple zones. If one of the zones goes down due to some reason, the other zone will be available for application. All the zones are in a single Azure region, and the application can deploy in multiple availability zones within the same region.

Availability Sets

Availability sets are the logical combination of VMs to provide the maximum availability of an application. No cost is required for availability sets. Azure gives us a 99.95% SLA for service within the availability set.

Azure App Service

In Microsoft Azure App Services are usually used to provide the hosting environment for web applications. Azure App Service manages various instances to handle the traffic and the load balancer spreads the incoming traffic request to all the available VM instances of the web application.

In Azure, the App Service plan defines the set of features and resources available to the instances. This service can configure the computing resources of the virtual machine, which include CPU, memory, storage, custom domain, scalability, traffic manager, and much more. It also describes the operating system (Windows or Linux) and the availability of the service in terms of backup.

Additionally, the Azure App Service plan defines:

Region
Number of VM Instances
Size of the Instance
Pricing Tier

Pricing Tier of an App Service Plan

Azure offers a series of App Service plan pricing tiers. Each tier consists of several well-defined features like CPU, storage, size, and scale. You can choose the tier according to your requirement and the cost that you need to pay for. The summarized picture of the App Service plan is listed in table 11-02.

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Table 11-02: Pricing Tiers of App Service Plan

Lab 11-02: Create a Website hosted in Azure

An organization has shifted its resources from on-premises to the cloud. The developer wants to create a new website for the organization by using the Azure service. How could this be possible?

Scenario: Using Azure App Service, the developer can host the website by following the given steps.

Log in to the Microsoft Azure portal and go to the portal menu. Before creating a website, we will first create a resource group in which the website will reside. Therefore, click on "Resource groups" from the portal home page.

Click on "+ Create".

Enter the configuration for the resource group. Inside the "Project details", select your subscription.

Write the unique name for the resource group.

Inside the "Resource details", select your nearest location from the given list.

Click on "Review + create".

Once the validation is passed, click on “Create”.

When the deployment is completed, the notification will appear. Click on “Go to resource group”.

The overview page of the new resource group will appear.

Now, go to the portal home page, and click on “Create a resource” for the website.

In the search bar of “Azure Marketplace”, search and opwn “WordPress”.

Click on “Create”.

On the configuration pane, write the app name.
Select your subscription.
Choose the recently created resource group.
Select “MySQL In App” as “Database Provider”.

Click on “App Service plan/Location”.

On the “New App Service Plan” dialog box, write the app service plan name.

Choose the nearest location.

Click on the “Pricing tier” option.

To change the pricing tier, select the “Dev / Test” category.
Scroll down and select the “F1” pricing tier.
Click on “Apply”.

After that, return to the “New App Service Plan” dialog box and click on “OK”.

After setting up the “App Service plan/Location”, click on “Create”.

A notification will appear as soon as the deployment is successful. Click on “Go to resource”.

The overview page of the website will appear containing all the configuration details.

Navigate to the given “URL”.

A new “WordPress” site will appear. Now you can select the language and click on “Continue” to add the content.

Not secure | ips-app.azurewebsites.net/wp-admin/i...
Incognito
English (United States)
Afrikaans
العربية
العربية المغربية
অসমীয়া
گۆڕی آزربایجان
Azərbaycan dili
Беларуская мова
Български
বাংলা
ཇོང্ཁ
Bosanski
Català
Cebuano
Čeština
Cymraeg
Dansk
Deutsch (Sie)
Deutsch (Österreich)
Deutsch (Schweiz, Du)
Deutsch (Schweiz)
Continue

Not secure | ips-app.azurewebsites.net/wp-admin/i... Incognito

Welcome

Welcome to the famous five-minute WordPress installation process! Just fill in the information below and you'll be on your way to using the most extendable and powerful personal publishing platform in the world.

Information needed

Please provide the following information. Don't worry, you can always change these settings later.

Site Title

Username

Usernames can have only alphanumeric characters, spaces, underscores, hyphens, periods, and the @ symbol.

Password

d3B!D9X0VQxp@W(slm

Mind Map

Figure 11-08: Mind Map

Practice Questions

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Chapter 12: Support

Introduction

Support plays an important role in the cloud environment. As we have learned, when we move to the cloud, at least some portion of infrastructure management moves to the cloud provider. When something goes wrong, it is important you get the help you need to keep your applications available. It is also important to understand what level of support is being provided for specific services, in particular services that may be in previewing and not published officially. We also know that there are always some changes that have been performed to upgrade features or new products coming for which you need an extensive support infrastructure for Azure and its users.

In this lesson, we will look at all the aspects related to Azure. We will cover some various support plans that you can purchase and benefit from, tickets to generate query, available support channels, knowledge center, Service Level Agreements and the release cycle for Azure services.

Plans

Microsoft offers numerous support plans for Azure customers in order to find right level of support for your organization. There are five different support plans available in Azure; Basic, Developer, Standard, Professional Direct, and Premier. Choosing the right plan is a balance between how much access you required for resources and how much money you are willing to spend.

EXAM The higher the support plans, the higher the amount you need to pay.

The things which are included in all support plans are:

24/7 Access: Around the clock access to billing and subscription support as Microsoft wants to make sure you can pay them
Online Self-Help: Includes Azure documentation and white papers that guides you through complex issues or scenarios
Forums: Support forums that offer a great way to ask questions to other Azure users about what they use and how they use it
Azure Advisor: Best practice recommendations for multiple Azure services from Azure Advisor
Service Health: Access to service health status of current issues and future planned maintenance on the Azure platform

These are included in all the support plans free of charge and coincidentally, these all are a part of Basic Support Plan, which is free as well.

Plans Inclusions- Paid Plans

The following table is shows features of various Azure paid plans. plans.
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Table 12-01: Azure Paid Plans

Apart from premier, these all support services can be used by signing up online. Your support service will start immediately.

Tickets

Azure enables you to create and manage support requests, also known as support tickets. A ticket is usually a number that uniquely identify your inquiry. All communication and details of your support request are recorded with a ticket number attached to them. So, a ticket is a single reference to the whole support request.

Submitting a Ticket

There are number of steps to submit a ticket.

You submit a ticket through the Azure portal after logging in.

2. Choose the support ticket type from the four support ticket types as shown in the figure below.

3. Fill in the details regarding the issue you are creating a ticket for.

4. Microsoft's support person will attend to your request within the specific time and according to your support plan.

plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan. plan.

Channels

Azure supports various channels that are free to everyone through which you get more help from Azure. The support channels are:

Azure Documentation: Azure documentation is a collection of thousands of articles written on Azure products and services. They are written by the Azure product managers, technical experts and the community contributes. These are constantly updated and they provide in-depth knowledge of products and services.
Forums: Forums attracts everyone from beginners to experts. On forums, people ask questions, some give answers, and some search for past knowledge.

https://azure.microsoft.com/en-au/support/community/

Social Media: Social media is an effective way to get direct support from Azure and the team behind every service. You can ask questions by searching experts on various social media platforms.

Knowledge Center

Knowledge center is the place of a common Azure knowledge. In knowledge center, you can find basic questions that are common for all those who are new to Azure, these questions are called Common questions. Azure knowledge center aims to answer those common questions.

In knowledge center, you are provided with the following guidelines:

No New Question: You cannot add a new question or add to an existing one.

Search: Search the knowledge center by category, product and free text. Azure knowledge center also give links to Azure documentation and more.

Complements to other Channel: You cannot find all the answers in knowledge center, so you can use the other support channels as well.

https://azure.microsoft.com/en-au/resources/knowledge-center/

Service Level Agreement

When you are using Azure Services, you need some form of guarantee that the service will be running stably. This is called Service Level Agreement, which helps to ensure the services you are subscribed for is available to you as mentioned in the agreement. It describes the Microsoft's commitment for uptime and connectivity.

It is like a contract between the service provide and client. It is an agreement on certain levels of service like how long the service will be available in case of any unavailability. If your service does not go up for the given time defined in the agreement, then you will be compensated by claiming it from the Microsoft.

Properties

Some properties of SLAs are:

Confidence: SLAs give confidence to customers by ensuring uptime and reliability of services.
Contract: SLAs ensure a contract between Microsoft and customers that states a commitment for uptime and connectivity.
Multiple SLAs: There are a lot of SLAs in Azure, generally one for each product. It automatically comes when you subscribe for the service.
Complex: Some SLAs are very complex as they have various levels depending on the number and variety of services, which region you use, and much more.
Mandatory: SLAs are given from Microsoft; if you have an Azure account, various service levels apply. No SLAs are associated with free products and services.

Service Life Cycle

Every product and the service in Azure has its lifecycle known as Service Lifecycle. Azure is an always-changing environment, and new services are always being introduced. Existing services also evolve over time and introduce new features. It is important to understand the service lifecycle in Azure, how you can keep up with changes, and how a service's lifecycle might impact your support and your SLA.

Gathering Customers Data

When the services are developed by the Microsoft for the Azure platform, it is necessary to ask questions to customers regarding the new features before adding. This act can save large investments if the services fail.

Stages

There are two main stages in Service Life Cycle:

1) **Preview:** Most of the Azure product will go through the preview phase before becoming fully available at the Azure platform. It is categorized into two forms: private preview and public preview.

a) *Private Preview:* It ensures that *specific* Azure customers have an Azure feature available for assessment. This is typically by invite only and issued directly by the product team responsible for the feature or service.

b) *Public Preview:* This ensures that all Azure customers have an Azure feature available for evaluation.

2) **General Availability:** In this, all the services are generally available to all the customers as normal service. These services have an SLA, support team and all other support that the services need. Azure technologies, which are reviewed and tested successfully will typically be made available as part of the generally available Azure-based product to customers. Before going fully global, generally, services are rolled out in few regions.

https://azure.microsoft.com/en-au/updates/

Demo: Using Preview Services

Go to the following preview portal link: Now here, you see a preview option is showing on top of the portal. It is different from the Azure portal, as it contains all the services and products that are in preview state.

If you go to the Virtual machine and search for “Bastion hosts”, you will see that option here.

preview.portal.azure.com/#home
Create a resource
Home
Dashboard
All services
FAVORITES
All resources
Resource groups
App Services
Function App
SQL databases
Azure Cosmos DB
Virtual machines
Load balancers
Storage accounts
App Services
Storage accounts
Azure Cosmos DB
Kubernetes services
Virtual machines

Note: Go into that service and create it if you want. From this preview portal, you can view of all the products that are currently not available on Azure portal.

Mind Map

Figure 12-01: Mind Map

Practice Questions

From the following options, which are the valid support channels in Azure?

Azure Call Support
Phone a Friend
Azure Documentation
Social Media

How will you submit a ticket in Azure?

Through the Azure Support Portal, which comes with any paid support plan.
Through the Azure Portal
Using the email address support@azure.com
Use the phone number for your region and support level

What is the response time for Severity B on the Professional Direct Support Plan?

1 hour
3 hour
2 hour
5 hour

What is the response time of Severity C cases in Standard Support Plan?

8 hour
3 hour
2 hour

5 hour

How many support plans are available in Azure?

2
3
4
5

From the following support plans, which one is free of costs and available with free account?

Standard
Basic
Developer
Premier

What questions and answers can the Azure Knowledge Center give you?

Architectural diagrams
A selection of the Azure documentation and articles found on TechNet
Common questions asked when first starting to use Azure
Over 100,000 user submitted questions and answers

In Azure Knowledge Center, users are able to submit new questions as well. True or false?

True
False

How do you sign up for a service level agreement with Azure?

Call the regional support number as provided in the Azure Portal to discuss the desired level of the agreement
In the Azure Portal, go to the service in question and click on the "Service Level Agreement" section
Fill out the form on the Microsoft Azure main support page
Service level agreements are included with every Azure service automatically

In private preview, the services will be available for evaluation to all customers. True or false?

True
False

There is no SLAs with the free products. True or false?

True
False

What is SLA?

A contract between user and Azure
A contract between user and free services
A contract between user and preview services
None of the above

From the following support plans, which support give < 15 minutes response time for critical business impact cases?

Standard
Basic
Developer
Premier

Which support plan has only technical support via email?

Standard
Professional Direct
Developer
Premier

Which support channel is a collection of thousands of articles written on Azure products and services?

Azure Documentation
Azure Call Support
Phone a Friend
Social Media

Answers

Chapter 01: Introduction to Azure

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Chapter 02: Compute

1. **Answer: C**

Explanation: Virtual machines are an IaaS offering, where you can manage the entire machine.

2. **Answer: B and C**

Explanation: Azure charges for Virtual Machines on hourly basis and the resources you used. In another way; if you use more CPUs and RAMs on your VMs, the more you pay per hour.

3. **Answer: D**

Explanation: Azure Container Instances is the simplest and fastest way to run an Azure container without having to manage any virtual machines and without having to follow a higher-level service.

4. **Answer: C**

Explanation: With respect to Azure, compute is a term that covers any services in Azure enabling computation in the cloud.

5. **Answer: A**

Explanation: Azure App Service is a fully managed Platform as a Service (PaaS), meaning servers, networks, storage and other fundamental infrastructures are all managed and controlled by Azure.

6. **Answer: D**

Explanation: Scale sets support up to 1,000 VM instances. If your own custom VM images are created and uploaded, the limit is 600 VM instances.

7. **Answer: A**

Explanation: API is an Application Programming Interface that host your data backend services and does not have graphical user

interface, i.e., no user interface, no front end.

8. **Answer: C**

Explanation: Containers are the preferred way for cloud applications to be packaged, deployed and managed.

9. **Answer: B**

Explanation: Kubernetes is an open-source container orchestration system for automating application deployment, management, and scaling.

10. **Answer: A, C, and D**

Explanation: Azure Kubernetes Service cluster architecture is based on Node, Node pools, Node selector, Pods.

11. **Answer: A**

Explanation: Azure Functions is the serverless computing service that is hosted on the public cloud of Microsoft Azure.

12. **Answer: C**

Explanation:

Easy to create and manage multiple VMs

It is important to maintain a consistent configuration across your environment when you have multiple VMs that operate your application. The VM size, disk configuration, and device configurations should be the same across all VMs for reliable performance of your application

All VM instances are created from the same base OS image and configuration in the scale set. This approach allows you to easily control hundreds of VMs without additional network management or configuration tasks

Scale sets allow the use of the Azure load balancer for basic layer-4 traffic distribution, and Azure Application Gateway for further advanced layer-7 traffic distribution and SSL termination.

13. **Answer: C**

Explanation: Azure Functions is a great solution for data processing, systems integration, internet-of-things (IoT) work, and simple APIs and microservices development.

Answer: C

Explanation: With respect to Azure, compute is a term that covers any services, enablinf computation in the cloud.

15. **Answer: B**

Explanation: Function Service belong to Serverless cloud service model.

Answer: C

Explanation: Azure virtual machine scale sets allow you to create and manage a pool of load balanced VMs that are identical. In response to a demand or a given schedule, the number of VM instances will automatically increase or decrease. Scale sets make your applications highly accessible and allow you to centrally manage, configure and upgrade a large number of VMs.

17. **Answer: C**

Explanation: Azure Functions is an easy way to run small pieces of code or "functions" in the cloud. A user can create and upload code with serverless, and then define the triggers or events to execute the code. Triggers may come from a wide variety of sources, including the application of another user or other cloud services, such as databases and events and hubs for notification.

Answer: B

Explanation: Azure App Service is a fully managed Platform as a Service (PaaS). This means servers, networks, storage and other fundamental infrastructures are all managed and controlled by Azure; you just have to focus on business values and logics.

Answer: A, D, E

Explanation: Azure provides three types of app services. Web Apps, Web Apps for Containers and API Apps all cover a specific use case. App Services can all run on Linux, but it is not a particular type of service. Event Grid is a separate service on Azure.

20. **Answer: C**

Explanation: Each virtual machine has its own virtual hardware, including CPUs, memory, hard drives, network interfaces, and other devices. On the physical computer, the virtual hardware is then mapped to the actual hardware, which saves costs by reducing the need for physical hardware systems along with the related maintenance costs, also the power and cooling demand.

Chapter 03: Networking

1. **Answer: A**

Explanation: Azure networking provides the connectivity between Azure resources and the on-premises network.

2. **Answer: C**

Explanation: Azure load balancer and application gateway are both able to distribute the traffic load among the service.

3. **Answer: A**

Explanation: CDN with Dynamic Site Acceleration (DSA) provides the web application update features to the customers. It enables the user to route the dynamic request through CDN without cache.

4. **Answer: D**

Explanation: Azure CDN places the replicas of data at the datacentre present closest to the user side. The datacentre present closest to the users is called edge nodes, which contain a cache of files that provides the edge of the internet to users.

5. **Answer: A**

Explanation: VPN gateway provides secure connectivity between Azure and on-premises network. A VPN gateway is made up of VNet gateway and virtual private network.

6. **Answer: A**

Explanation: It is considered as the most advanced load balancer that enables the balancing of web traffic to manage the web applications using an HTTP request. Because of its services, the gateway is called layer 7 load balancer within Microsoft Azure.

7. **Answer: B**

Explanation: CDN is able to provide information like image, dynamic changes of video or website content that is regularly changing. Users can experience good performance and access the resources more quickly.

8. **Answer: C**

Explanation: VPN gateway is useful for establishing the private connection between Azure resource and an on-premises environment, office, the cloud or other premises within the cloud in order to establish a private secure connection.

9. **Answer: A**

Explanation: The main purpose of creating a subnet is to make multiple networks within the same VNet. With multiple subnets, two or more VM is developed within the subnet. Such subnet is called gateway subnet and a virtual network gateway is used to connect these gateway subnets.

10. **Answer: C**

Explanation: Azure load balancer provides the load-balancing feature to the connected virtual machines within Microsoft Azure. It is responsible for managing the network traffic load and also enables the use of all VMs for processing.

11. **Answer: D**

Explanation: Azure portal is the console of Microsoft Azure, providing numerous features, services, and a way to create networks with multiple Azure resources and services. It gives GUI representation for the customer to use Azure services. It provides constant availability for using these services.

12. **Answer: A**

Explanation: Cloud networking enables cloud computing in order to develop network with low latency, better security and optimumized performance of devices.

13. **Answer: B**

Explanation: There are 3 possible connections for connecting the hybrid networks. These are:

Site-to-Site Connection
Point-to-Site Connection
Multi-Site Connection

Answer: D

Explanation: The data of a company is distributed in Azure and on-premises infrastructure for making it a hybrid solution. A specific type of VNet gateway called VPN gateway is used for providing the connection between the two. VPN gateway is responsible for creating encrypted communication within the hybrid cloud architecture.

15. **Answer: A**

Explanation: A simple VNet must consist of virtual machine (one or more than one), the internet resource and an on-premises network. VNet is able to provide secure connections using gateways.

16. **Answer: A**

Explanation: Content Delivery Network (CDN) provides networking services but it can lead toward the chance of network failure. CDN proves reliability to its end-users, but when it stops working due to some technical issues, the end-users are unable to get any information from the server-side.

17. **Answer: C**

Explanation: Azure load balancer delivers high availability and network performance to online applications. It distributes the traffic load to the virtual machine present in the network.

18. **Answer: B**

Explanation: The attributes of VNet while being created in the Azure portal, define a way to improve network performance and provide scalable service from the designed network. These attributes include address space, public IP address, location, and subnet.

19. **Answer: B**

Explanation: Using the Azure portal, a VNet should first be create, once the VNet has been deployed, the next step is to add a number of resources from the resource group to VNet present in Azure portal. The resources can be added as long as there is space available in address space and each resource should have a unique IP address.

20. **Answer: C**

Explanation: The load balancer belongs to layer 4. It has multiple virtual IP addresses to route TCP/UDP traffic. It is also responsible for providing the connection between the virtual network and on-premises. Whereas, application gateway is an advanced load balancer that provides gateway services to the application layer. It is responsible for routing traffic to specific applications like web apps. Application gateway secures application services using firewalls.

Chapter 04: Storage

1. **Answer: D**

Explanation:

Disk storage is a complete virtual hard drive to be accessed. The disk storage is created when you create a virtual machine.

2. **Answer: C**

Explanation:

In file types and sizes, Azure blob containers are the most flexible. Any type of file sizing up to 2GB can be stored in an Azure blob container.

3. **Answer: B**

Explanation:

Drive mapping is how operating systems, like Microsoft Windows, link a local drive to another device (such as File Server), via a network using a shared storage area. So the shared storage solution is File storage.

4. **Answer: B**

Explanation:

Archive storage is the cheapest form of blob storage to store data, which is very rarely used, like, device backups.

5. **Answer: B**

Explanation:

When creating a Storage Account, the name must be in between 3 to 24 characters in length and may only contain numbers and lowercase letters.

6. **Answer: A**

Explanation:

Every storage account on Azure must have a unique name, which is used by giving it a web address to identify it on the Internet. Access management of storage account is done via Azure Active Directory

7. **Answer: C**

Explanation:

You can use the file storage as an extension to your on-premises file system so that it never runs out of space and also prioritizes which data you keep on-site.

8. Answer: B and D

Explanation:

Azure offers four types of manage disk storage: Standard HDD, Standard SSD, Premium SSD, and Ultra Disk.

9. **Answer: B**

Explanation:

All storage accounts are encrypted for data at rest using SSE (Storage Service Encryption).

Answer: D

Explanation:

Append blobs are used for log data and can be up to 195GB in size. It is usually used for optimizing the append operation.

11. **Answer: B**

Explanation:

Hot tier - it is for frequently accessed data and is the most optimized. Access costs are lower (read-write) but storage costs are the highest.

12. **Answer: C**

Explanation:

Premium SSD is a super-fast and high performance storage for critical workloads. It is recommended for database installation in particular with low latency.

13. **Answer: C**

Explanation:

Data on your Azure Storage Account are durable, highly accessible, safe and scalable. The unique namespace means that every storage data has its webpage with its unique name. It is written in the format: "https://..core.windows.net.

14. **Answer: A**

Explanation:

A Storage Account is like an access point for Azure Storage. All of your Azure Storage Data Objects like blobs, files, queues, tables, and disks are on an Azure storage account. So first, you need to create a storage account then use any storage option.

15. **Answer: D**

Explanation:

Block blobs store text and binary data up to 4.7 TB. It is made up of blocks of data that can be managed individually. In one block blob, you can have 50,000 blocks.

Chapter 05: Databases

1. **Answer: B**

Explanation:

Cosmos DB is a NoSQL, globally distributed DB.

2. **Answer: B**

Explanation:

Latency is the time taken by the data to travel. The higher the latency, the longer the data takes time to reach the user.

3. **Answer: A**

Explanation:

With Cosmos DB, latency is limited to single-digit millisecond (0-9) to anywhere in the world.

4. **Answer: D**

Explanation:

With Azure SQL, you can easily migrate your on-premises SQL database to Azure SQL and get all its benefits, this is done without any code change and with a frictionless process.

5. **Answer: C**

Explanation:

With Azure SQL, you can store 100TB of data within a minute.

6. **Answer: A**

Explanation:

With Azure SQL, you can also take advantage of integrated Machine learning tools. Depending on the usage pattern, database optimization and performance improvement suggestions are given. With ML, you get the benefit of getting notified about any degradation or anything bad happening in your database.

7. **Answer: D**

Explanation:

Azure Server for MySQL was designed to provide high availability with 99.99% SLA and does not require additional setup, replica features, or costs to guarantee that your apps run as necessary.

8. **Answer: C**

Explanation:

Azure Database for MySQL is the database built-in by the community while Azure SQL is Microsoft's product. MySQL is an open-source project where anyone can contribute to the community.

9. **Answer: C**

Explanation:

Azure Database for MySQL is PaaS, which is managed by Microsoft.

10. **Answer: B**

Explanation:

PostgreSQL is the default database for MacOS.

Answer: D

Explanation:

It is the ability of a database to sort and indexing the data and be able to retrieve them. Databases are cheaper, safer, and have more efficient space than other data storage options.

Answer: A

Explanation:

Cosmos DB has a distributed database that is globally distributed and includes an extremely low latency, a number of collaborative software, and unlimited scaling in order to meet demand. Cosmos DB is not meant for cheap storage or data backup.

Answer: C

Explanation:

Database Migration Service on Azure has a range of destinations to which the data can be migrated. These include Azure SQL, Azure SQL Server, and Cosmos DB. Big data tools like Azure Data Lake or HDInsight are not currently supported.

Answer: A

Explanation:

It is deployed as a single server and as a Citus cluster. The Hyperscale (Citus) choice scale queries horizontally through multiple sharding tools and offers more scaled and productive applications.

Answer: C

Explanation:

For geometric data (GIS) the government mostly uses Postgres. PostGIS is the GIS extension that gives hundreds of functions to

process geometric data in multiple formats.

Answer: C

Explanation:

When large volumes of data that are not frequently used are needed to be stored, then search for a data warehouse or data lake. Transactional applications such as SQL, PostgreSQL, and CosmosDB are useful for data that are frequently accessed.

Answer: A

Explanation:

Azure Synapse is a data warehouse that blends the data warehouse, big data analytics, and data integration into a single unified service that provides end-to-end analytics at a cloud scale. It stores big data of size petabytes and runs queries on relational and non-relational data.

Chapter 06: Authentication and Authorization

1. **Answer: A**

Explanation: Identity services of Microsoft Azure are responsible for providing the platform to the users and ensures the validity of users for the application through the process of authentication, authorization and access management tool.

2. **Answer: B**

Explanation: Authentication is a way to verify the customer's or user's identity. Once authenticated, the user is allowed to access files, databases, emails, etc. This is called authorization.

3. **Answer: D**

Explanation: Identity service is responsible for access management, ensuring the restriction of access to service towards other or unauthorized users. It provides confidentiality, integrity, and availability.

4. **Answer: C**

Explanation: Authentication is the identification of the user through user ID and password. Other verification approaches are also used to authenticate Azure users.

5. **Answer: B**

Explanation: Identity service is the management tool that secures the identity of the user by first authenticating it. After authentication, authorization will be done to give the access right to Azure users.

6. **Answer: A**

Explanation: Multi-Factor Authentication provides the most advanced level of security and protection features to Azure users. MFA has the most efficient throughput protection using multiple authentication processes. MFA uses the principle of "something you know (user ID and password), something you have (app on mobile to receive the confirmation code) and something you are (biometric)".

7. **Answer: C**

Explanation: Authorization is a part of identity management that provides access rights to Azure users after the authentication process..

8. **Answer: A**

Explanation: Tenant is the first AAD instance after creating an Azure account. One user belongs to a single tenant only.

9. **Answer: C**

Explanation: Microsoft Active Directory (AD) provides directory services for physical access only. It is most commonly used in on-premises networks like offices, educational institutes, etc.

10. **Answer: D**

Explanation: Hybrid cloud architecture is the requirement for many organizations. Azure Active Directory (AAD) can help the user manage resources and services on both on-premises and Azure clouds.

Answer: B

Explanation: Multi-Factor Authentication (MFA) performs authentication of the user in multiple steps. The first step is to verify the user with user ID and password. The second step is to

send a code on the user phone for further verification. The third step is the biometric verification. This step is optional.

Answer: C

Explanation: Authorization is considered as a granular part of identity service that provides the rights to authenticated users to access particular data.

Answer: A

Explanation: Both Azure Active Directory (AAD) and Active Directory (AD) are directory services. Directory services are databases, which store information distributed across different locations. AAD is the main tool to manage services on Azure. Whereas, AD is the management tool for the on-premises network.

Answer: A

Explanation: Azure subscription is very important for both the end-user and Microsoft. Azure subscription allows the user to use Azure resources for cloud computing.

Answer: D

Explanation: Multi-Factor Authentication combines multiple authentication processes for the provision of an advanced level of

secure environment for accessing the data. Sometimes, biometric is taken to be the only authentication way to provide security.

Answer: B

Explanation: Access management provides user access to IT resources. Access management only allows a correct user (i.e., authorized user) to access the system applications for the sake of security.

Answer: C

Explanation: Azure Active Directory is the first service when a user creates an Azure account. Without AAD, Azure users are able to use Azure resources and services.

Answer: B

Explanation: Azure Active Directory is a very important tool in the Azure portal because it is also responsible for handling user's information and assigning access to other resources such as Cosmos DB, Virtual Machine, etc.

Answer: A

Explanation: Active Directory is designed for access to on-premises network resources and users. AD does not support the management of web-based services.

Answer: C

Explanation: Tenant is the first directory service when a new user creates an account in Azure. A user belongs to single-tenant and tenants may have multiple users. Sometimes, the user can be guests of other tenants.

Chapter 07: Azure Solutions

1. **Answer: A**

Explanation: A model is a set of rules of how to use the data provided. The model finds patterns based on the rules.

2. Answer: A, C, and D

Explanation: Azure Data Lake Analytics is an on-demand job analytics service that simplifies big data. Instead of hardware tuning, deploying, and configuring, you write queries to transform the data and abstract valuable insights. The analytics service can promptly handle jobs of any size by changing the dial to how much power you need. You pay for your job only when it is working, making it cost-effective.

Answer: C

Explanation: Logic Apps simplifies how you design and build flexible applications for application integration, data integration, system integration, Enterprise Application Integration (EAI), and Business-to-Business (B2B) communication, whether in the cloud, at the premises, or both.

Answer: D

Explanation: Azure DevOps offers developer tools to support teams in preparing projects, working on application creation, and designing and deploying software. Developers can use Azure DevOps Services or on-premises with Azure DevOps Server to

operate in the cloud. Azure DevOps provides integrated features that can be accessed via your web browser or client IDE.

Answer: B, E, & F

Explanation: There are currently 5 services in Azure DevOps:

Azure Boards- Provides a suite of Agile tools to help with planning and monitoring, code bugs, and issues using Kanban and Scrum processes.

Azure Pipelines- Provides services to develop and release continuous integration and distribution of your apps.

Azure Repos- Provides the source control of your code to Git repositories or Team Foundation Version Control (TFVC).

Azure Test Plans- Provides various tools for testing the software, including manual/exploratory testing and continuous testing.

Azure Artifacts: Allows teams to share public and private Maven, Npm, and NuGet packages and incorporate package sharing into your CI/CD pipelines.

Answer: C and E

Explanation: There are many Azure services for the Internet of Things. Two of them are IoT Hub and IoT Central. The others listed are not valid Azure services.

Answer: D

Explanation: Use Azure Search to find existing insights in your data. File relationships, geography connections, and much more.

Answer: B and C

Explanation: Azure HDInsight allows storing massive amounts of data easily, efficiently, and cost-effectively. The most popular open-source frameworks such as Hadoop, Spark, Hive, LLAP, Kafka, Storm, R, and more are available. With these frameworks, a wide range of scenarios such as Extracting, Transforming, and Loading (ETL), data warehousing, machine learning, and IoT can be enabled.

Answer: D

Explanation: Azure Event Grid lets you easily build applications with event-based architectures.

Answer: C and D

Explanation: Logic Apps are similar to Function Apps because they are kicked off by a trigger, but what happens after that is completely different. Unlike Function Apps, to create some efficient workflows with Logic Apps, you do not have to write code.

Answer: A, C and D

Explanation: Cognitive services bring AI within every developer's reach — without requiring expertise in machine learning. All it takes is an API call to embed the feature to see, hear, speak, search, understand, and accelerate decision-making into your apps.

Answer: C

Explanation: The Azure Machine Learning studio is the top-level tool for the machine learning service. It provides a centralized location for data scientists and developers to work with all the artifacts for developing, training, and deploying machine learning models.

Answer: C

Explanation: Machine Learning Services are:

End-to-End Service: The service to use AI and machine learning almost anywhere on Azure.

Tooling: The Machine Learning service is a collection of tools to help you build AI applications.

Automation: Azure automatically recognizes trends in your applications and creates models for you.

Answer: A, C and D

Explanation: Benefits of Serverless Model are:

No Infrastructure Management: Use fully managed infrastructure. Developers can avoid administrative tasks and concentrate on the core business logic. You simply deploy the code with a serverless platform, and it runs with great availability.

Dynamic Scalability: For serverless computing, the infrastructure can automatically scale up and down within seconds to match any workload requirements.

Faster Time to Market: Serverless applications reduce the dependencies of operations on each development cycle, increasing the agility of development teams to produce more features in less time.

More Efficient Use of Resources: Shifting to serverless technology allows companies to reduce TCO and resource reallocation to speed up the pace of innovation.

Answer: B and D

Explanation: DevTest Labs creates labs that consist of pre-configured based or templates for Azure Resource Manager. These have all the tools and applications you can use to create environments. With this, you can create environments in a couple of minutes instead of taking hours or days.

By using DevTest Labs, you can test the latest versions of your software when performing the following tasks:

Using interchangeable templates and artifacts to quickly provision Windows and Linux environments

Easily integrating the DevTest Labs delivery system for the provision of on-demand environments

Scaling up the load testing by providing multiple testing agents and building pre- provisioned training and demo environments

Answer: A

Explanation: Azure Logic Apps is a cloud service that helps you plan, automate, and orchestrate business processes, activities, and workflows when businesses or organizations need to integrate apps, data, and services.

Answer: B

Explanation: Azure Data Lake Analytics is an on-demand job analytics service that simplifying big data. Instead of hardware tuning, deploying, and configuring, you write queries to transform the data and abstract valuable insights.

Answer: D

Explanation: Azure Functions is the compute component of serverless services offered by Azure. This means that you can use Functions to write code without having to worry about deploying that code or creating VMs to run your code.

Answer: C

Explanation: Azure Databricks is an analytics platform based on Apache Spark, enhanced for the Microsoft Azure cloud services

platform.

Answer: D

Explanation: Businesses use the big data accumulated in their systems to improve operations, provide better customer service, create customized marketing campaigns based on specific customer preferences, and, ultimately, increase profitability.

Chapter 08: Security

1. **Answer: A**

Explanation: In the configuration of networks, network security is a very important part that protects access to files, directory, and information in a computer network against hacking and unauthorized changes in the network.

Answer: B

Explanation: There are four possible ways defined to make secure network connections. The Azure firewall defines a set of rule for the protection of resources. Distributed-Denial-of-Service (DDoS) protection services prevent the system from an excessive number of requests. Network Security Group (NSG) makes the security of network resources and Application Security Group (ASG) is used for the provision of application-level security.

Answer: C

Explanation: Azure firewall is a layer 7 protocol introduced by Microsoft. It defines a set of rules for the incoming and outgoing traffic in the network to make sure the security of resources in the network.

Answer: D

Explanation: To hide the key password, secrets, and other information from third-party Azure Key Vault is the best option for key storage. It allows the sharing of a secret with others without revealing the actual credential for security reasons. Azure Key Vault has hardware and software protection. Azure Key Vault uses Hardware Security Module (HSM) to stores passwords and secrets that no one can view.

Answer: C

Explanation: When the same number of requests are received by the webserver from many different sources and computers at once, then the webserver would suddenly stop working due to the multiple simultaneous requests. This type of attack on the service is called a Distributed-Denial-of-Service (DDoS) attack.

Answer: A

Explanation: Network Security Group (NSG) is required in the configuration of a Virtual Network (VNet) where different Virtual Machines (VM) within the subnet are connecting with each other. Network Security Group is capable of securing the traffic load across the network whereas Application Security Group (ASG) protects the application running on that particular VM or subnet in the network.

Answer: C

Explanation: Network Security Group (NSG) is required in the configuration of a Virtual Network (VNet) where different Virtual Machines (VM) within the subnet are connecting with each other. NSG uses Access Control List (ACL) rules to allow or deny the access of network traffic to subnet or VM.

Answer: B

Explanation: To provide secure and protected communication between the resources, services, and processes, a secure network connection should be required in the configuration of a network.

Answer: A

Explanation: Azure Key Vault is a useful service that hides the actual passwords and key from other parties. It secures the network by defining the access policy that allows secure access to secret and password.

Answer: D

Explanation: Azure Information Protection provides a way of protecting the sharing of resources. Azure Information Protection (AIP) enables the sharing of files, documents, and sensitive information more securely outside the organization.

Answer: C

Explanation: Advanced Threat Protection (ATP) is an advanced and secure option for providing the security of the links as compared to the standard one. It gives an extra layer of security and management of the users in order to make a more secure and protected system.

Answer: B

Explanation: Azure Key Vault stores secrets and passwords. It allows the sharing of passwords and secrets with others in a hidden form that nobody can view the actual secret.

Answer: A

Explanation: Azure Security Center is itself a portal that monitors the various security features of Azure. Security features include policy, compliance, networking, and subscription coverage and resource security hygiene. Security Center enables threat alerts as well.

Answer: D

Explanation: DDoS attack is the attack of excessive number requests at a time from different sources resulting in server failure or website failure. GitHub experienced the recent record break DDoS attack with 1.35 Tb traffic per second.

Answer: C

Explanation: Network Security Group (NSG) is acting as a resource firewall to prevent network resources from unwanted traffic loads. It defines rules called the Access Control List (ACL) to make the security of network resources as secure as possible.

Answer: B

Explanation: Application Security Group (ASG) is responsible for providing protection to an application that is currently running on a particular VM or subnet.

Answer: C

Explanation: Azure Security Center provides an overview of security features in Azure. It also provides its advantage towards a hybrid cloud infrastructure where data is present on both on-premises and cloud.

Answer: A

Explanation: Azure Information Protection (AIP) provides the protected sharing of email, file or sensitive data inside and outside an organization. It uses a label to sensitive information that protects the information from threats and other activities throughout the process.

Answer: A

Explanation: Azure Advanced Threat Protection service has a security alert timeline that contains a timeframe for the activities in the network. It also highlights and detects the issues in the network.

Answer: B

Explanation: Azure Key Vault is the limit access to secret and password. It defines access policy to make sure that who can access the secret.

Answer: C

Explanation: The data on Azure is encrypted and protected against anyone unauthorized reading it or making sense of it. In almost all cases attackers are after data.

Answer: A and B

Explanation: Strategy to slow the advance of an attack to get unauthorized access to information and layered approach that each layer provides protection. So if one layer is breached, a subsequent prevents further exposure.

Answer: A

Explanation: A famous DDoS attack was, as it is against the developer website GitHub in 2018, where attackers sent 127 million requests per second and that is huge. To protect against DDoS, Azure has the DDoS Protection service.

Answer: C

Explanation: Perimeter is the protection against DDoS attacks, volumetric attacks, protocol attacks, and so on. It uses DDoS protection to filter large-scale attacks before they can cause a denial of service for end-users.

Answer: D

Explanation: Network is the filter of traffic to and from Azure using virtual networks and applying security "standards.Limit" communication between resources.

Chapter 09: Privacy, Compliance, and Trust

1. **Answer: D**

Explanation:

First is Azure Government Cloud, if you are US government body or are contracted for one, then you can get access to Azure resources in Azure Government Cloud regions. It is a physically separated instance of Azure, dedicated to U.S. government workloads only.

2. **Answer: B**

Explanation:

Azure Policy is used to create policies in Azure. With Azure policy, you can manage and assign policies to the resources with multiple rules so that specific resource is complaint with your business standard and SLAs.

3. **Answer: C**

Explanation:

With the use of Azure Policy, you can define the company policy so it will enforce the resource to comply with this policy.

4. **Answer: A**

Explanation:

Trust Center is a shortcut of knowing all the things that Microsoft does to make sure that you do not loss trust in Azure and other services. With this, you have a link to learn about security, privacy, GDPR, location of your data, compliance and more.

5. **Answer: B**

Explanation:

Any company that wishes to interact with users located in the European Union must adhere to the many GDPR rules around privacy.

6. **Answer: C**

Explanation:

Azure Service Health informs you of incidents and planned maintenance related to Azure Service. This information can be used to take adequate measures to limit downtime. Data from any of your applications or third-party services cannot be received from Azure Service Health. It is Azure only.

7. **Answer: A**

Explanation:

With RBAC you can outline fine grained access management to the resources. You can define specific user access to an individual resource for example, what they can do with that specific resource and in which specific area of resource they have access to.

Answer: C

Explanation:

In order to monitor their activities and health, Azure Monitor can accept data from almost any application. You have a single dashboard for all the current measurements, or you can use the collaborative query language to dive into the archived data.

Answer: B and E

Explanation:

Locks are of two types: delete or read only. In delete lock type, you cannot delete the resource while in read only lock type, you

cannot make any changes to the resource.

Answer: B

Explanation:

The Trust Center can be used to find evidence of all the various compliance specifications Azure complies with. You can read audit reports on any part of Microsoft products, like Azure, through the Service Trust Portal.

Answer: B

Explanation:

Azure has physically separated datacenters located in China without any connection to the other regions of Azure. All data is stored in China at all times with Chinese regulations.

Answer: B

Explanation:

In RBAC, there are three main elements present: Security Principal, Scope and Role Definition.

Answer: D

Explanation:

Azure Blueprint is a template for creating Azure resources. Everything you need to deploy in the standard cloud environment

of Azure is mentioned in the blueprint.

Answer: C

Explanation:

In Azure, for Compliance, provides you the Azure Compliance Manager, because Azure knows about compliance and as it knows about your resources, so it can easily combines the tools and gives you a recommendation as per that.

Answer: D

Explanation:

Azure Information Protection is used for classifying, labelling and helping protect data based on its sensitivity.

Chapter 10: Pricing

1. **Answer: C**

   Explanation: A billing cycle on Azure is either 30 or 60 days.

2. **Answer: C**

   Explanation: Management groups may indicate the following:

Group Subscriptions: You can group your subscriptions to allow taking actions in bulk across subscriptions. This is very useful in organizations that deal with many subscriptions.
Organize: You can manage policies and compliance in multiple subscriptions at the same time.
Billing Logic: You can maintain the billing associated with the right budgets. You have the Nest management groups to indicate the hierarchy and their relationship.

Answer: D

A free account gives you free access to the most popular Azure services for 12 months.

Answer: B

Cost management allows you to create a budget for your Azure expenses, set up configurable notifications so you will know if you are hitting a budgeted limit, and evaluate your costs in detail.

Answer: A

By Azure Cost Management, you can download reports on spending and get recommendations on how to save on costs and analyze them.

Answer: C

The bandwidth slightly influences the pricing factor; the bandwidth your services are using incurs a cost as well.

Answer: B

Explanation: Any data transfer between the regions located in the same billing zone is free, this process is called Ingress.

Answer: A

Explanation: Any data transfer between two different billing zones is charged, this process is called Egress.

Answer: C

Explanation: The Azure price calculator will help you get an estimate of costs depending on the products that you plan to use, and where those products will be deployed, and so on.

Answer: D

Explanation: When you have applications on site that you want to migrate to Azure, and you want an estimate of how much you can save in Azure, the TCO calculator is the best choice.

Answer: C

Explanation: TCO report shows you how much you can save by moving your app to Azure over the next 5 years.

Answer: A, B, & C

Explanation: Three primary groups that are listed below need to be coordinated within the company to ensure you handle the costs effectively.

Finance: Person responsible for authorizing budget requests across the enterprise based on projections of cloud spending. To drive accountability, they pay the corresponding bill and assign the costs to different teams.

Managers: Business decision-makers in an organization needs to understand cloud spending to find the best outcomes for spending.

App Teams: Engineers manage cloud infrastructure on a daily basis, and create applications that meet the needs of the enterprise. These teams need flexibility in their defined budgets to deliver the most value.

Answer: A

Explanation: By Azure Cost Management, you can optimize your current resources to save money and monitor the charges of other cloud service providers such as Amazon Web Services.

Answer: A, B, and C

Explanation: In order to implement cost control effectively and reduce costs, you need to:

Be equipped with the right tools for performance
Be responsible for costs
Take appropriate action to reduce expenses

Answer: B

Explanation: Advisor makes recommendations for purchases in reserved instances. The recommendations are based on your virtual machine usage for the last 30 days. The recommendations can help you reduce your expenditure when you act upon them.

Answer: C

Explanation: The pricing structure of Microsoft Azure works on a subscription price that is tied to what you are using within the

Azure infrastructure. All resources in Azure requires a subscription; you cannot access any resources until you subscribe.

Answer: D

Explanation: Azure spending limits are the recommended means to manage your Azure subscription's total spending. When your usage leads to charges that exhaust your spending limit, the services you deployed will be disabled for the rest of that billing period. Manual monitoring of the spending of Azure services is ineffective.

Answer: D

Explanation: The Azure price calculator will help you get an estimate of costs depending on the products that you plan to use, as well as where those products will be deployed.

Answer: B and C

Explanation: Azure Cost Management is accessible from the Azure portal. You can get a detailed view of the current and future projected costs of all the resources that are within your area of accountability. Azure Cost Management is free of cost and is included with all Azure subscriptions.

Answer: A, D, and E

Explanation: The primary factors influencing costs are;

Resource Size - Different sizes of resources will have different pricing. A more powerful virtual machine will cost more than the less powerful one.

Resource Type - The choice of resource type has a big influence on price. This also makes sense as there is a very big difference in the number of hardware resources needed to run a virtual machine as compared to a machine learning service or big data analytics. There is also a big difference in the complexity of maintaining and running various Azure services.

Location - Azure has a global network of datacenters from US to Australia and from Norway to South Africa; they are all treated equally with slightly different pricing. Exchange rates, labor costs, etc. have an influence on the price.

The bandwidth your services are using incurs a cost as well.

Chapter 11: Core Azure Architectural Components

1. **Answer: B**

Explanation: It is an underlying service where the Azure resource deployment and management are done. It provides a management layer that lets you create, upgrade, and uninstall your Azure subscription tools. You use management features such as access control, locks, or tags to ensure that your resources are protected and organized after deployment.

2. **Answer: A**

Explanation: Resource Manager Template is a JavaScript Object Notation (JSON) file that defines the resources deployed in the resource group. It also defines the dependencies between the deployed resources. With this template, resources can be deployed in a consistent and repeatable way.

3. **Answer: C**

Explanation: With ARM templates, we can automate the deployments. ARM templates provide the automation and orchestration deployments through scripts and Azure services.

4. **Answer: A**

Explanation: Variables are where you define the specific values that can be used in the entire template. It is not necessary but you can use it to reduce the complexity in the template, as it makes your template simpler to maintain.

5. **Answer: B**

Explanation: "Custom Script Extension" through which you can download and run the script on your VMs helps configure, downloading applications, or for other setup or management tasks

after deployment. These scripts can either be stored in Git or Azure Storage. These scripts may be executed manually or in an automatic deployment. You can describe a resource that you will shortly need to be added in the template of your Resource Manager. It is the most useful and best technique for the continuous addition of resources. When you are done with the service principal (who has access), role definition (what can access), and scope (where they can access). You combine these three elements to grant access with a role assignment

6. **Answer: D**

Explanation: In Microsoft Azure, Azure App Service is a Platform as a Service (PaaS) used for hosting your code on Azure. Because of the PaaS service, there is no need to maintain the infrastructure like you would if you are managing the virtual machine. It enables you to build and host web applications and mobile back ends without manually maintaining an operating system or a web server.

7. **Answer: A**

Explanation The basic tier provides 10 GB storage of disk space and supports an unlimited number of applications with 32 bits and 64 bits. The pricing tier has 3 different sizes (B1, B2, and B3) for compute power, memory, and disk storage. It supports manual scaling of up to 3 dedicated instances only. This pricing tier is used for the dev/test application before production. It provides a guaranteed SLA of 99.95%.

8. **Answer: C**

Explanation: Azure Resource Manager Template is a simple template that contains: $schema, contentVersion, Parameters, variables, functions, resources, and outputs.

9. **Answer: D**

Explanation: There are two options available.

Standalone Template - You can deploy any resource by using a single standalone ARM template. With this option, the ARM template contains all the information required to deploy resources within a single file.

Template with Parameters File - The parameters file can be used to provide some flexibility towards consistent deployment. With this template, there is a separate command argument used to specify the parameters file.

Answer: B

Explanation: Azure App Service is a powerful tool for hosting web apps, mobile, and APIs. It also offers auto-scaling, high availability, and applications running in Windows and Linux environments. Azure App Service has several designs available for the development of an application.

11. **Answer: A**

Explanation: Azure Marketplace enables to development of applications by seeking help and by using tools available in Azure Marketplace.

12. **Answer: C**

Explanation: Availability Zones are present within Azure regions. These zones provide highly available protected areas to run applications and data.

Chapter 12: Support

1. **Answer: C and D**

Explanation:

In Azure, the supported channels used to interact with experts and professionals of Azure. These include: The Azure documentation, technical forums and official Azure social media accounts.

2. **Answer: B**

Explanation:

For support tickets, you can go through the "Support" section of the Azure Portal. There, you will have a choice of various tickets and you can choose the kind of support level you want.

3. **Answer: C**

Explanation:

The response time for Severity B cases in Professional Direct Support plan is <2 hours.

4. **Answer: A**

Explanation:

The response time of the severity C cases in Standard Support plan is <8 hours and it is also in Developer support plan.

5. **Answer: D**

Explanation:

There are five different support plans available in Azure; Basic, Developer, Standard, Professional Direct, and Premier.

6. **Answer: B**

Explanation:

Basic support plan is free of costs and given along with the Azure Free account.

7. **Answer: C**

Explanation:

Knowledge center is the place of a common Azure knowledge. In knowledge center, you can find basic questions that are common for all those who are new to Azure, these questions are called Common questions. Azure knowledge center aims to answer those common questions.

8. **Answer: B**

Explanation:

No New Question: You cannot add a new question or add to an existing one.

9. **Answer: D**

Explanation:

All Azure services are subject to Service Level Agreements. Each SLA includes subscription and support level.

10. **Answer: B**

Explanation:

Public preview: This ensures that all Azure customers have an Azure feature available for evaluation.

11. **Answer: A**

Explanation:

SLAs are given from Microsoft; if you have an Azure account, various service levels apply. No SLAs are associated with free products and services.

12. **Answer: A**

Explanation:

SLA describes the Microsoft's commitment for uptime and connectivity. It is like a contract between the service provider and client. It is an agreement on certain levels of service like how long the service will be available in case of any unavailability.

Answer: D

Explanation:

For high severity business impact cases, the response time is <15 minutes (with Azure Rapid Response or Azure Event Management).

Answer: C

Explanation:

Access to support engineers via email only during business hours is given in the developer support plan.

Answer: A

Explanation:

Azure documentation is a collection of thousands of articles written on Azure products and services. They are written by the Azure product manager, technical experts and the community contributes.

Acronyms

AAD Azure Active Directory

ACI Azure Container Instances

ACL Access Control List

AD Active Directory

ADC Application Delivery Controller

AES Advanced Encryption Standard

AI Artificial Intelligence

AIP Azure Information Protection

AKS Azure Kubernetes Service

API Application Program Interface

APU Accelerated Processing Unit

ARM Azure Resource Manger

ASG Application Security Group

AWS Amazon Web Service

AZ Availability Zone

Azure ATP Azure Advanced Threat Protection

B2B Business-to-Business

CapEx Capital Expenditure

CDN Content Delivery Network

CLI Command Line Interface

CPU Central Processing Unit

DB Database

DC/OS Distributed Cloud Operating System

DDoS Distributed Denial of Service

DevOps Development and Operations
DMS Database Migration Services
DNS Domain Name System
DoS Denial of Service

DR Disaster Recovery
DSA Dynamic Site Acceleration
EAI Enterprise Application Integration
ETL Extracting, Transforming, and Loading
EU European Union
FaaS Function as a Service
FIPS Federal Information Processing Standards
GCP Google Cloud Platform
GDPR General Data Protection Regulation
GPU Graphics Processing Unit
HA High Availability
HDD Hard Disk Drive
HDFS Hadoop Distributed File System
HSM Hardware Security Model
HTTP Hypertext Transfer Protocol
HTTPS Hypertext Transfer Protocol Secure
IaaS Infrastructure as a Service
IOPS Input/Output Operations per Second
IoT Internet-of-Things
IP Internet Protocol
ISO International Standardization Organization
IT Information Technology
JSON JavaScript Object Notation
KEDA Kubernetes-based Event Driven Autoscaling
MCU Micro-Controller Unit

MFA Multi-Factor Authentication

ML Machine Learning

MPLS Multiprotocol Label Switching

NIST National Institute of Standards and Technology

NSG Network Security Group

OpEx Operational Expenditure

OS Operating System

PaaS Platform as a Service

PCI Payment Card Industry

POP Point of Presence

RBAC Role Based Access Control

RCAs Root Cause Analyses

SaaS Software as a Service

SDKs Software Development Kits

SLA Service Level Agreement

SOC Standard Occupational Classification

SQL Structured Query Language

SSD Solid State Drive

SSE Storage Service Encryption

SSL Secure Sockets Layer

SSO Single Sign-On

TCO Total Cost of Ownership

TCP Transmission Control Protocol

TFS Team Foundation Server

TFVC Team Foundation Version Control

UIDs Unique Identifiers

URL Uniform Resource Locator

US United State

VM Virtual Machine

VMs Virtual Machines

VNet Virtual Network

VPN Virtual Private Network

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