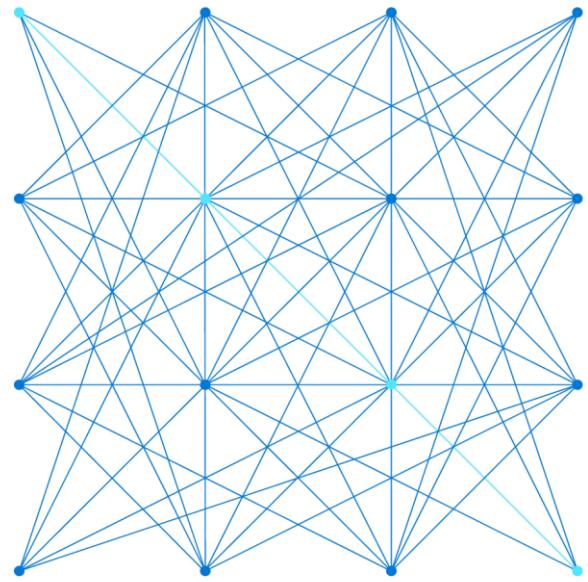


# Cloud Computing Workshop

Microsoft Azure



1

## Tissana Tanaklang

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- Master of Science Program in Software Engineering King Mongkut's University of Technology Thonburi
- Bachelor of Science Program in Computer Science Naresuan University
- Microsoft Certified Trainer (MCT)
- Microsoft Certified Solutions Associate (MCSA) - Web Application Development
- Microsoft Certified Azure Fundamentals

2

## About this course

- This course provides foundational level knowledge on cloud concepts; core Azure services; security, privacy, compliance, and trust; and Azure Machine Learning - No-Code with Designer
- The audience for this course is just beginning to learn about cloud computing and how Microsoft Azure provides that service.
- There are no prerequisites for the course, but students with an IT background will find the concepts easier to understand.



3

## Course Agenda

- 01 – Azure Cloud Concepts Pricing and Support
- 02 – Core Azure Services
- 03 – Security, Privacy, Compliance, and Trust
- 04 – Azure Machine Learning : No-Code with Designer



4

## Azure Learning Path

Level	Category	Code	Course	Role
Beginner (Fundamentals)	-	AZ-900	Microsoft Azure Fundamentals	IT Professional and Non-IT Professional (All)
	Data	DP-900	Microsoft Azure Data Fundamentals	Data Engineer, Database Administrator
	AI	AI-900	Microsoft Azure AI Fundamentals	AI Engineer, Data Scientist, Developer, Solutions Architect
Intermediate (Associate)	DevOps	AZ-104	Microsoft Azure Administrator	Administrator, DevOps Engineer
		AZ-204	Developing solutions for Microsoft Azure	Developer, DevOps Engineer
	Security	AZ-500	Microsoft Azure Security Technologies	Security Engineer
		DP-300	Administering Relational Databases on Microsoft Azure	Database Administrator
	Data	DP-200	Implementing an Azure Data Solution	Data Engineer
		DP-201	Designing an Azure Data Solution	Data Scientist
		DP-100	Designing and Implementing a Data Science Solution on Azure	Data Scientist
Advance (Expert)	AI	AI-100	Designing and Implementing an Azure AI Solution	AI Engineer
	DevOps	AZ-400	Designing and Implementing Microsoft DevOps solutions	DevOps Engineer
	Solutions	AZ-303	Microsoft Azure Architect Technologies	Solutions Architect
Specialty	Architect	AZ-304	Microsoft Azure Architect Design	Solutions Architect
	Data	DA-100	Analyzing Data with Power BI	Data Analyst
	-	AZ-220	Microsoft Azure IoT Developer	Developer



5

## Certification areas (AZ-900)

Study areas	Weights
Understanding cloud concepts	15-20%
Understanding core Azure services	30-35%
Understand security, privacy, compliance, and trust	25-30%
Understand Azure pricing and support	25-30%

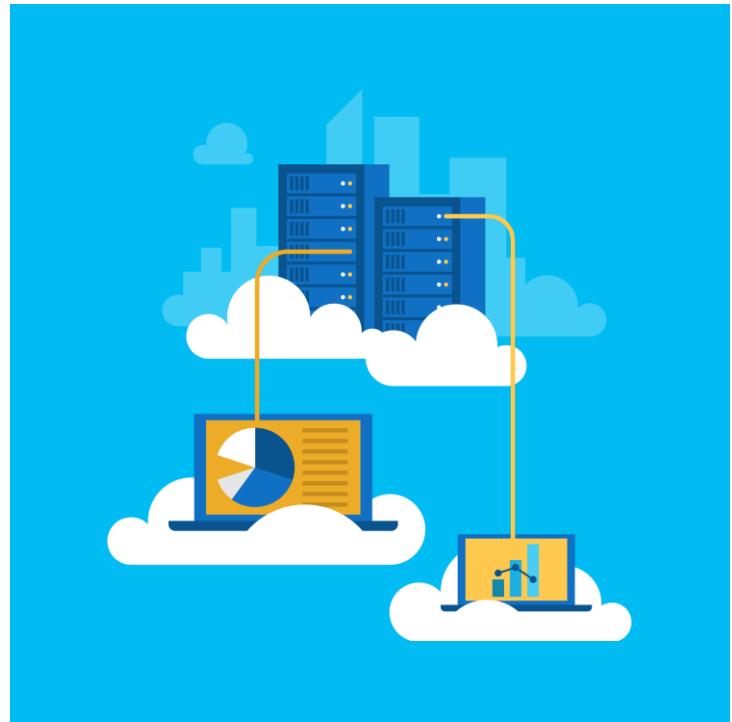
- This course maps directly to the exam AZ-900 Microsoft Azure Fundamentals.
- Percentages indicate the relative weight of each area on the exam.
- The higher the percentage, the more questions you are likely to see in that area.



6

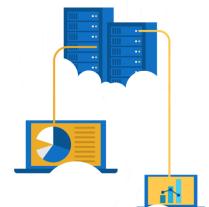


## Module 01 : Azure Cloud Concepts



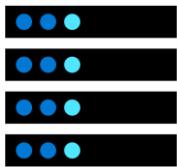
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## Discuss why cloud services?



8

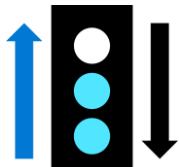
## Define cloud computing



Compute



Storage



Networking



Analytics



Cloud providers include  
Microsoft, Amazon, and Google

9

## Try This Exercise

1. Open a browser.
2. Enter the URL [portal.azure.com](https://portal.azure.com)
3. Take a few minutes and look at the site.
4. Can you find:
  1. where to create a resource like a Virtual Machine?
  2. how to launch your Dashboard to see what resources you have?
  3. where Microsoft Learn training site is linked right into Azure to help you learn?
5. Close your browser.



10

## Explore key cloud concepts

High availability	Fault tolerance
Scalability	Elasticity
Global reach	Customer latency capabilities
Agility	Predictive cost considerations
Disaster recovery	Security



11

## Discuss economies of scale

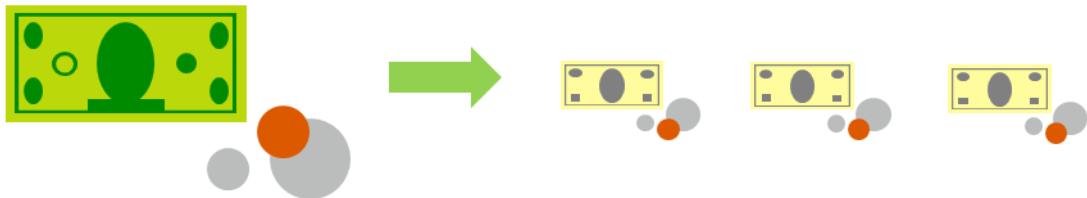
*Economies of scale* – Cloud providers can reduce costs and gain efficiency when operating at a large scale.



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12

## Compare CapEx vs. OpEx



### Capital Expenditure (CapEx)

- High upfront cost, value of investment reduces over time.

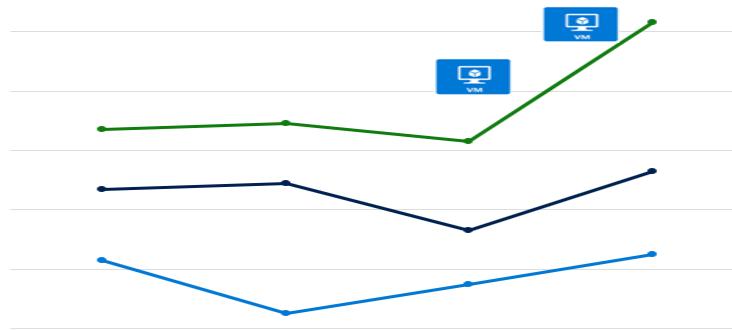
### Operational Expenditure (OpEx)

- Spend on services or products as needed.
- No upfront cost, pay-as-you use.



13

## Define consumption-based model



**Consumption-based model = Pay only for the resources you use**



14

## Module: Distinguish types of cloud models



15

### public cloud



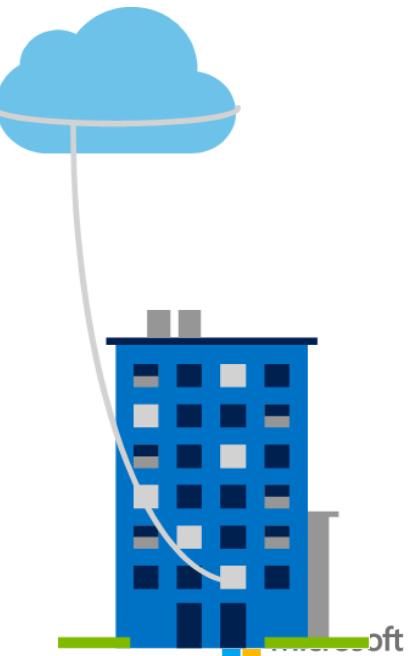
- Owned by cloud services or *hosting* provider.
- Provides resources and services to multiple organizations and users.
- Accessed via secure network connection (typically over the internet).



16

## private cloud

- Organizations create a cloud environment in their datacenter.
- Organizations responsible for operating the services they provide.



17

## hybrid cloud



Combines *Public* and *Private* clouds to allow applications to run in the most appropriate location.



18

## Compare cloud models

### Public cloud:

- No capital expenditures to scale up.
- Applications can be quickly provisioned and deprovisioned.
- Organizations pay only for what they use.

### Private cloud:

- Organizations have complete control over resources.
- Organizations have complete control over security.

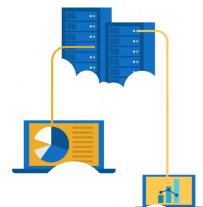
### Hybrid cloud:

- Most flexibility.
- Organizations determine where to run their applications.
- Organizations control security, compliance, or legal requirements.



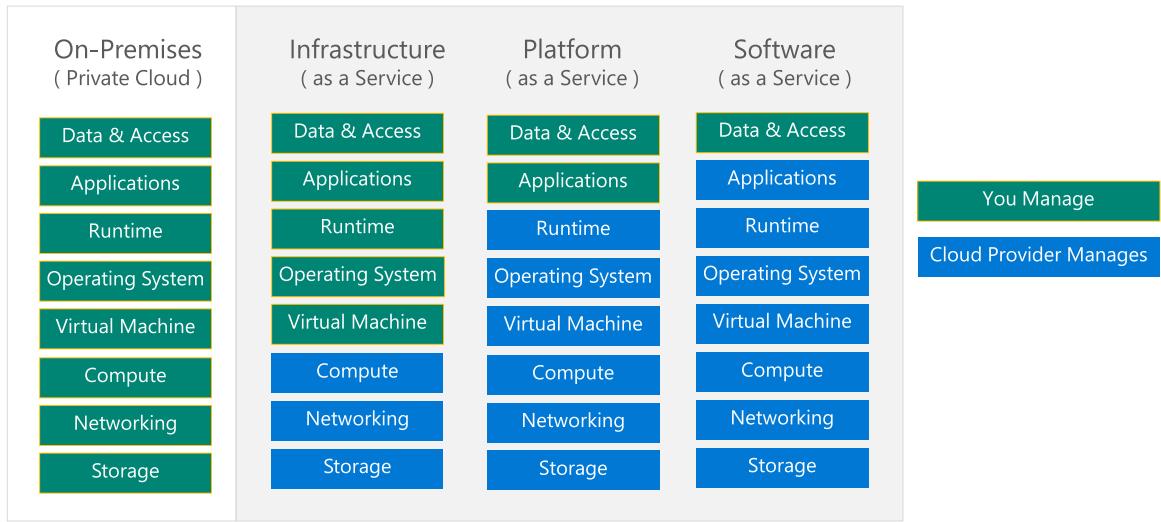
19

## Explore types of cloud services



20

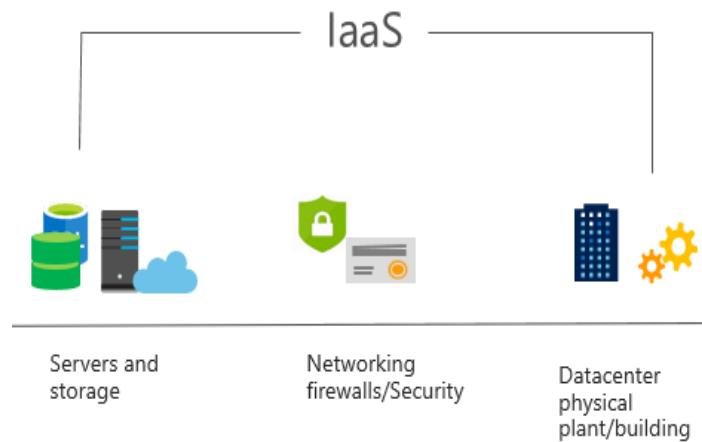
## Discuss shared responsibility model



21

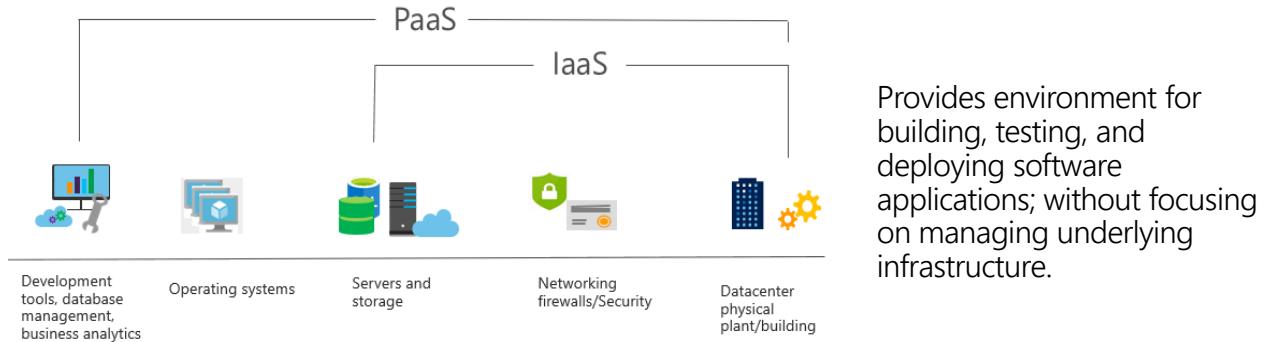
## Define Infrastructure as a Service (IaaS)

Build pay-as-you-go IT infrastructure by renting servers, virtual machines, storage, networks, and operating systems from a cloud provider.



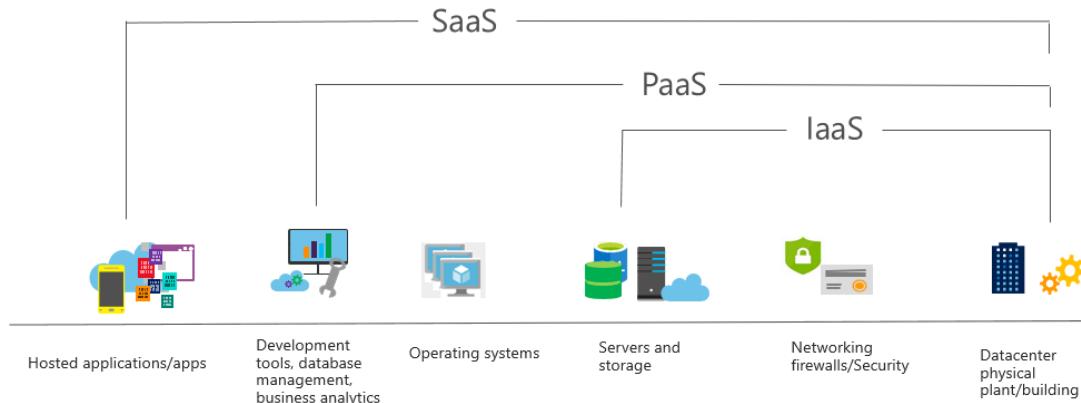
22

## Define Platform as a Service (PaaS)



23

## Define Software as a Service (SaaS)



Users connect to and use cloud-based apps over the internet: for example, Microsoft Office 365, email, and calendars.



24

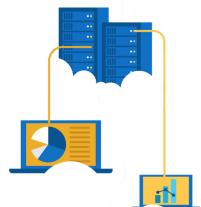
## Compare cloud services

IaaS	PaaS	SaaS
<ul style="list-style-type: none"><li>The most flexible cloud service.</li><li>You configure and manage the hardware for your application.</li></ul>	<ul style="list-style-type: none"><li>Focus on application development.</li><li>Platform management is handled by the cloud provider.</li></ul>	<ul style="list-style-type: none"><li>Pay-as-you-go pricing model.</li><li>Users pay for the software they use on a subscription model.</li></ul>



25

## Azure subscriptions



26

## Define Azure subscriptions



An Azure subscription provides you with authenticated and authorized access to Azure accounts.

Subscriptions can provide billing and access control boundaries.

An account can have one subscription or multiple subscriptions.



27

## Explore Subscription offers

- Free (next slide)
- Pay-as-you-go
- Enterprise Agreement
- Student

An account can have one subscription or multiple subscriptions.

SELECT AN OFFER

**Pay-As-You-Go Dev/Test**  
 This offer is for teams of active Visual Studio subscribers to run dev/test workloads on Microsoft Azure, providing discounted rates on Windows virtual machines and access to exclusive images in the Azure Gallery.  
[Learn more](#)

**Visual Studio Enterprise: BizSpark**  
 Enjoy monthly credits and lower rates.  
 Use MSDN software at no additional charge.  
[Learn more](#)

**Visual Studio Professional**  
 Enjoy monthly credits and lower rates.  
 Use MSDN software for development and test at no additional charge.  
[Learn more](#)



28

## Discuss Azure free account

### What do I get?

With your Azure free account, you get all of this—and you won't be charged until you choose to upgrade.

<b>12 months</b>	+	<b>\$200 credit</b>	+	<b>Always free</b>
of popular free services		to explore any Azure service for 30 days		25+ services

**Provides 12 months of our most popular services, a \$200 credit to explore any Azure service for 30 days, and over 25 services are free.**

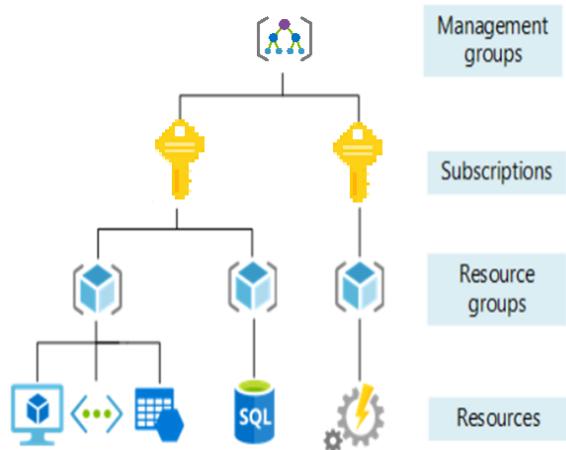
**At the end of the trial you can upgrade to pay-as-you-go pricing.**



29

## Explore Management Groups

- Management groups can include multiple Azure subscriptions.
- Subscriptions inherit conditions applied to the management group.
- 10,000 management groups can be supported in a single directory.
- A management group tree can support up to six levels of depth.



30

## Planning and managing costs



31

### Purchasing Azure products and services



Enterprise



Resellers



Partners



Personal

Three main customer types on which the available purchasing options for Azure products and services are contingent are:

**Enterprise**

**Web direct**

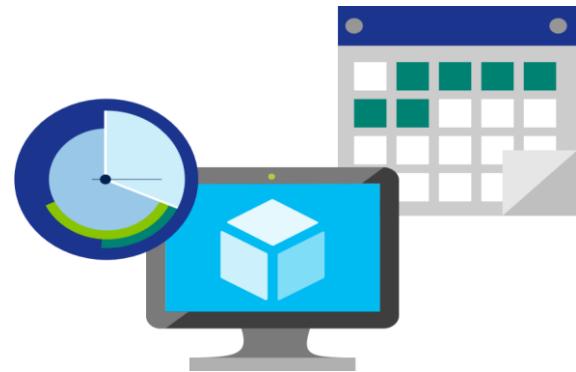
**Cloud solution providers (CSPs)**

Personal accounts can also purchase Azure products and services.



32

## Explore Factors affecting costs



There are three primary factors affecting costs:

Resource Type	Services	Location
Costs are resource-specific, so the usage that a meter tracks and the number of meters associated with a resource depend on the resource type.	Azure usage rates and billing periods can differ between Enterprise, Web Direct, and CSP customers.	The Azure infrastructure is globally distributed, and usage costs might vary between locations that offer Azure products, services, and resources.

ft

33

## Identify Zones for Billing Purposes

*Bandwidth* - data moving in and out of Azure datacenters. Some inbound data transfers are free, such as data going into Azure datacenters. For outbound data transfers—such as data going out of Azure datacenters—pricing is based on Zones.



Zone 1	West US, East US, West Europe, and others.
Zone 2	Australia Central, Japan West, Central India, and others.
Zone 3	Brazil South only.
DE Zone 1	Includes Germany Central and Germany Northeast.



34

## Explore Pricing calculator

Provides a detailed *estimate* of the costs associated with your infrastructure configuration.

Your Estimate

Virtual Machines    1 D2 v3 (2 vCPU(s), 8 GB RAM) x 730 Hours;    \$188.57

**Virtual Machines**

REGION: West US    OPERATING SYSTEM: Windows    TYPE: (OS Only)

TIER: Standard

INSTANCE: D2 v3: 2 vCPU(s), 8 GB RAM, 50 GB Temporary storage, \$0.209/hour

Clone    Delete

More info

- [Pricing details](#)
- [Product details](#)
- [Documentation](#)

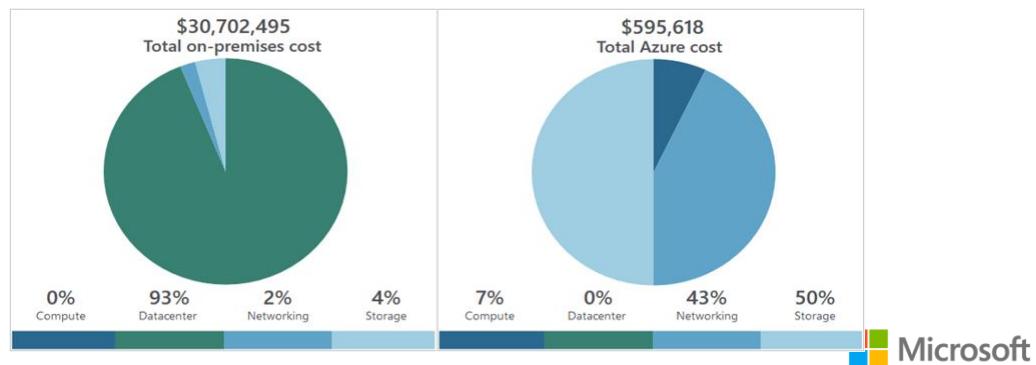
Microsoft

35

## Explore Total cost of ownership calculator

A tool to estimate cost savings you can realize by migrating to Azure.  
A report compares the costs of on-premises infrastructures with the costs of using Azure products and services in the cloud.

<https://azure.microsoft.com/en-us/pricing/tco/calculator/>



36

<https://azure.microsoft.com/en-us/pricing/tco/calculator/>

**Total Cost of Ownership (TCO) Calculator**  
Estimate the cost savings you can realize by migrating your workloads to Azure

1 Define your workloads    2 Adjust assumptions    3 View report

**Define your workloads**  
Enter the details of your on-premises workloads. This information will be used to understand your current TCO and recommended services in Azure.

**Servers**  
Enter the details of your on-premises server infrastructure. After adding a workload, select the workload type and enter the remaining details.

Workload 1

Workload	Environment	Operating system	Servers	Procs per server	Core(s) per proc
Windows/Linux Server	Physical Servers	Windows	1 (1 - 9999)	1 (1 - 4)	1 (1 - 8)
RAM (GB)	Optimize by	GPU	Windows Server 2008/2008 R2		
1 (1 - 448)	CPU	None			

+ Add server workload

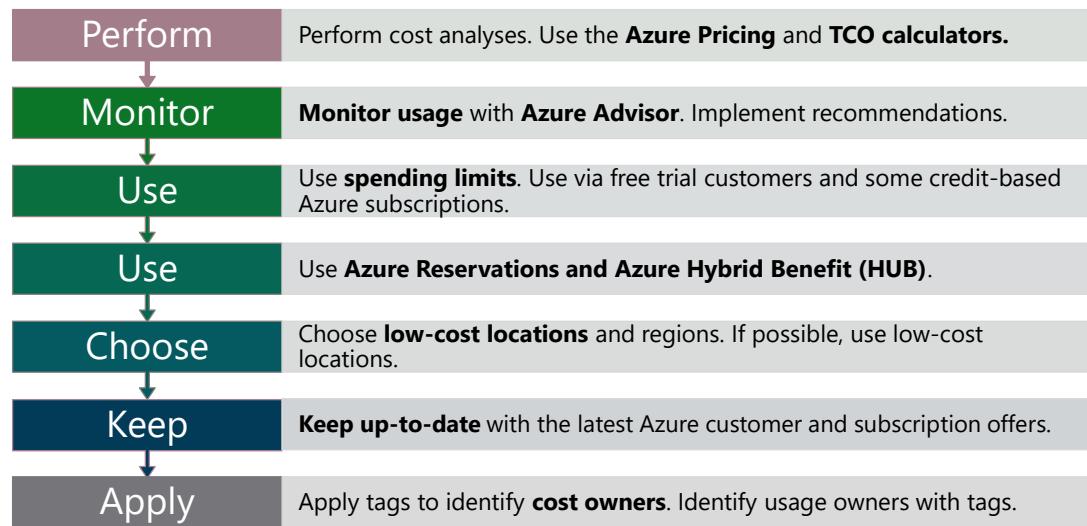
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**Databases**

Enter the details of your on-premises database infrastructure. After adding a database, enter the details of your on-premises database infrastructure in the Source section. In the Destination section, select the Azure service you would like to use.

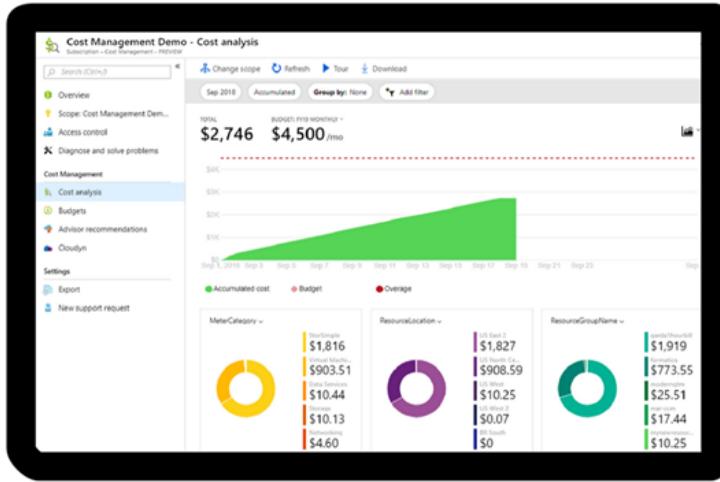
37

## Explore Minimizing costs



38

## Define Azure Cost Management

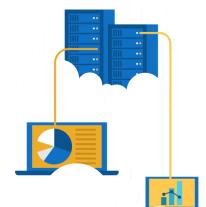


- Reporting
- Data enrichment
- Budgets
- Alerting
- Recommendations



39

## Azure support options



40

## Explore Support plan options

**Every Azure subscription includes free access to billing and subscription support, Azure products and services documentation, online self-help documentation, white papers, and community support forums.**

	Basic	Developer	Standard	Professional Direct
Scope	Available to all Microsoft Azure accounts	Trial and non-production environments	Production workload environments	Business-critical dependence
Technical Support		Business hours access to Support Engineers via email	24x7 access to Support Engineers via email and phone	24x7 access to Support Engineers via email and phone



41

## Explore Alternative support channels

	Microsoft Developer Network (MSDN) Azure Forums
	Stack Overflow
	Microsoft Azure general feedback
	Server Fault
	@AzureSupport



42

## Explore Knowledge Center

A searchable database that contains support questions and answers from a community of Azure experts, developers, customers, and users.

**Knowledge Center**  
Get answers to common questions.

Search  Filter by product

Questions matching "virtual machines"

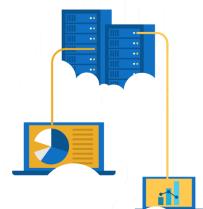
<b>About the features in Azure Backup</b> <a href="#">Learn More</a> <a href="#">Learn more &gt;</a>	<b>Are data transfers over the VPN connection charged separately?</b> Data transfers over the VPN connections to your on-premises sites or the internet in general are charged separately at the regular data transfer rate. <a href="#">Learn more &gt;</a>
<b>Am I billed separately for local disk storage?</b> No. All new virtual machines have an operating system disk and a local disk (or "resource disk"). We don't charge for local disk storage. The operating system disk is charged at the regular rate for disks. See all virtual machines config... <a href="#">Learn more &gt;</a>	<b>Are there additional diagnostics for Azure VM reboot issues?</b> <a href="#">Learn More</a> <a href="#">Learn more &gt;</a>

<https://azure.microsoft.com/en-us/resources/knowledge-center/>



43

## Azure Service Level Agreements (SLAs)



44

## Define Service Level Agreements (SLAs)

SLAs document the specific terms that define Azure performance standards.

- SLAs define Microsoft's commitment to an Azure service or product.
- Individual SLAs are available for each Azure product and service.
- SLAs also define what happens if a service or product fails to meet the designated availability commitments.



45

## Explore SLAs for Azure products and services

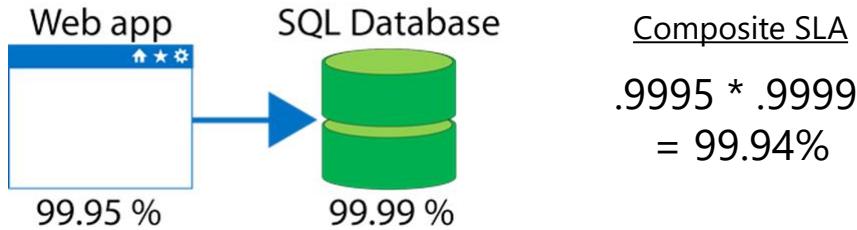
- Performance targets are expressed as uptime and connectivity guarantees.
- Performance-targets range from 99.9% (three nines) to 99.99% (four nines).
- If a service fails to meet the guarantees, a percentage of the monthly service fees can be credited to you.



46

## Define Composite SLAs

If the App Service has a 99.95% SLA, and the Azure SQL Database has a 99.99% SLA, what is the composite SLA for your application?



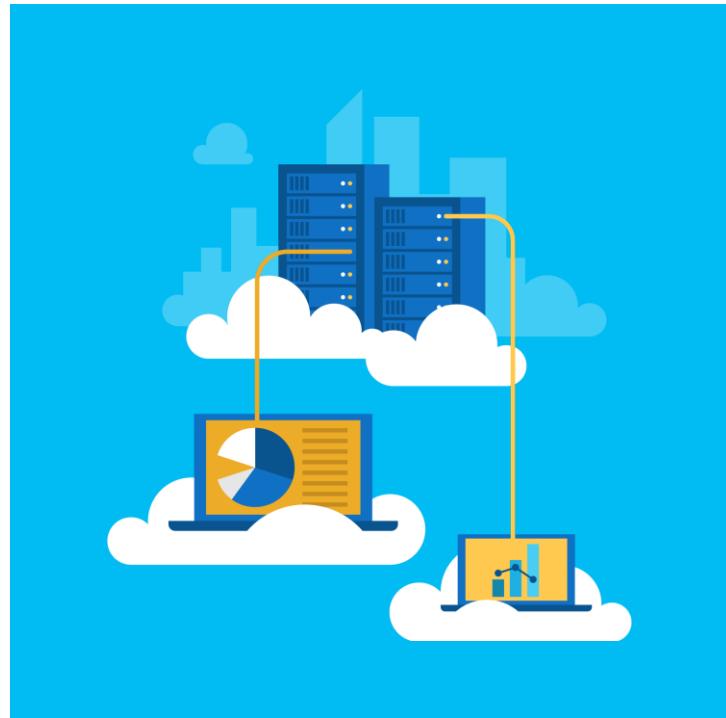
- Notice the composite SLA is lower than the individual SLAs.
- Improve the SLA by creating independent fallback paths.



47



## Module 02 : Core Azure Services



48

## Explore Core Azure architectural components



49

### Examine Regions

- Provides flexibility and scale.
- Preserves data residency.
- Select regions close to your users.



Worldwide there are 50+ regions  
representing 140 countries



50

## Explore Region Pairs

Region
North Central US
East US
West US 2
US East 2
Canada Central
North Europe
UK West
Germany Central
South East Asia
East China
Japan East
Australia Southeast
India South
Brazil South (Primary)



Region
South Central US
West US
West Central US
Central US
Canada East
West Europe
UK South
Germany Northeast
East Asia
North China
Japan West
Australia East
India Central
South Central US

- Each Azure region is paired with another region.
- In an outage, recovery of one region is prioritized out of every pair.
- Azure system updates are rolled out to paired regions sequentially (not at the same time).



51

## Define Azure Geographies

- Discrete markets that preserve data residency and compliance boundaries.
- Allow customers with specific data-residency and compliance needs to keep their data and applications in close proximity.



52

# Determine Availability Options

VM SLA 99.9% with Premium Storage	VM SLA 99.95%	VM SLA 99.99%	MULTI-REGION DISASTER RECOVERY

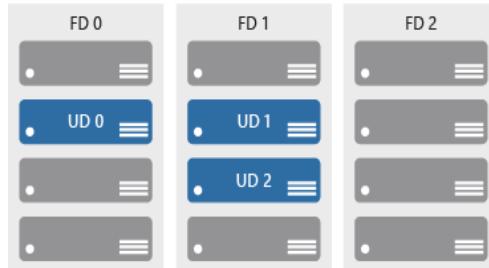
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SINGLE VM Easier lift and shift	AVAILABILITY SETS Protecting against failures within datacenters	AVAILABILITY ZONES Protection from entire datacenter failures	REGION PAIRS Regional protection within Data Residency Boundaries
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53

## Define Availability sets

Keep applications online during maintenance or hardware failure.



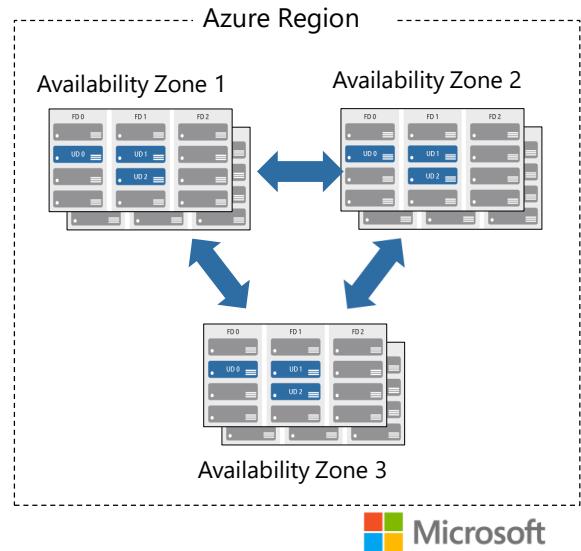
- **Update domains (UD):** Scheduled maintenance, performance or security updates are sequenced through update domains.
- **Fault domains (FD):** Provide a physical separation of workloads across different hardware in a datacenter.



54

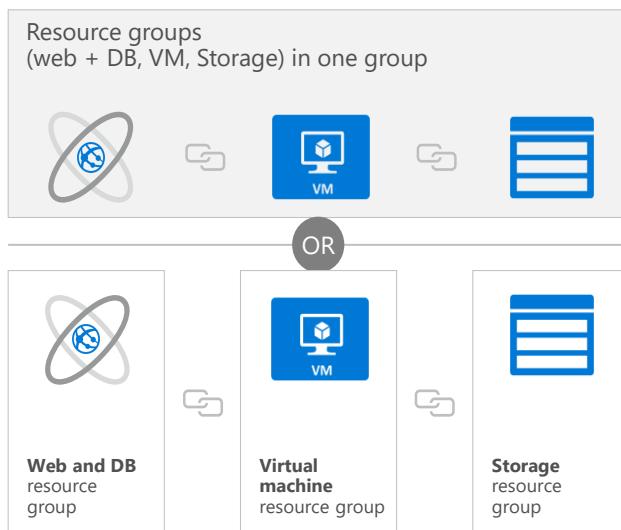
## Define Availability zones

- Physically separate locations within an Azure region.
- Includes one or more datacenters, equipped with independent power, cooling, and networking.
- If one availability zone goes down, the other continues working.



55

## Explore Resource groups



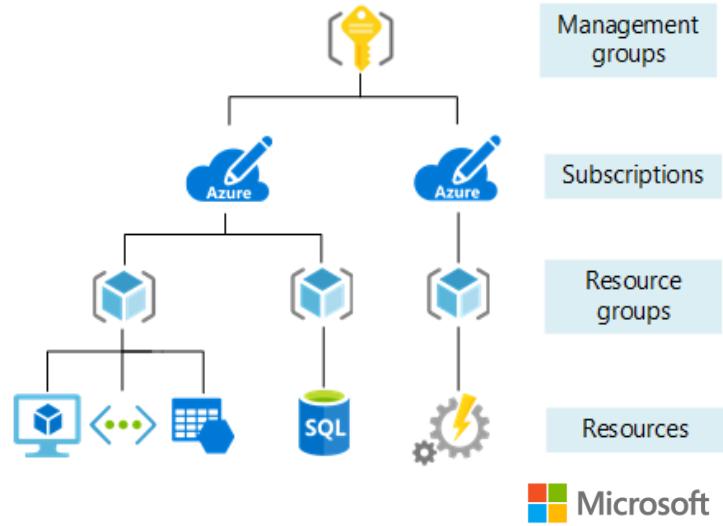
Containers for multiple resources that share the same life cycle.



56

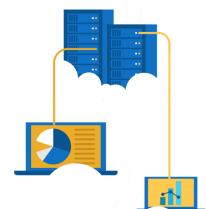
## Explore Azure Resource Manager

Provide a management layer that enables you to create, update, delete, and control access to resources in your Azure subscription.



57

## Define Core Azure services and products



58

## Define Azure compute

- On-demand computing resources such as disks, processors, memory, networking, and operating systems.
- Makes resources available in minutes or seconds.

Everything	COMPUTE (28)	
General	Virtual machines	
Compute	Virtual machine scale sets	
Networking	Function App	
Storage	App Services	
Web	Kubernetes services	
Mobile	Availability sets	
Containers	Disks	
Databases		
Analytics		



59

## Explore Azure compute services



**Azure VMs** use Infrastructure as a Service (IaaS) to provide computing power in the cloud.



**VM scale sets** are designed for automatic scaling of identical VMs.



**App services** is a Platform as a Service (PaaS) offering to build, deploy, and scale enterprise-grade web, mobile, and API apps.



**Functions** perform compute actions based on an event.



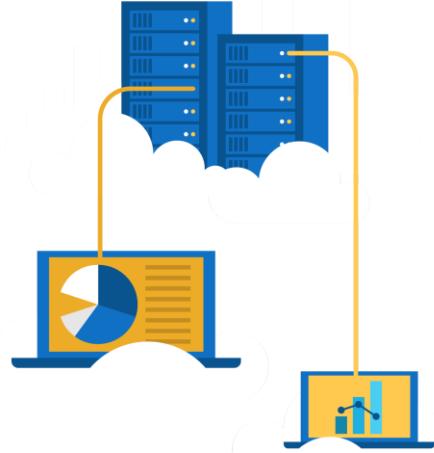
60



## Walkthrough – Create a Virtual Machine

Create a virtual machine in the Azure Portal, connect to the virtual machine, install the web server role and test.

1. Create the virtual machine.
2. Connect to the virtual machine.
3. Install the web server role and test.



61

## Define Container services

*Containers* are a virtualization environment where you do not manage an operating system.

-  • Azure Container Instances: A PaaS offering that allows you to upload your containers, which it then will run for you.
-  • Azure Kubernetes Service: A container orchestrator service for managing large numbers of containers.



62

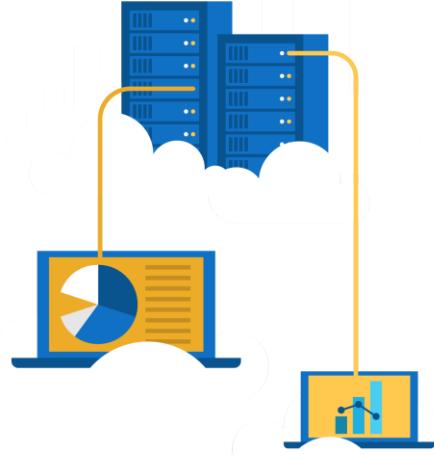


## Walkthrough – Deploy Azure Container Instances

Using the Azure Portal create, configure, and deploy a Docker container to an Azure Container Instance.

The container will deploy a Hello HTML page.

1. Create a container instance.
2. Deploy the container and test.



63

## Explore Azure network services

	<b>Azure Virtual Network</b> provides secure communication between Azure resources.
	<b>Azure Load Balancer</b> automatically scales to create highly-available access to applications or resources.
	<b>VPN Gateway</b> is a platform managed scalable and highly available application delivery controller.
	<b>Azure Application Gateway</b> provides for the management of traffic to web applications.
	<b>Content Delivery Network</b> provides a distributed network of servers that efficiently deliver web content in their local region.



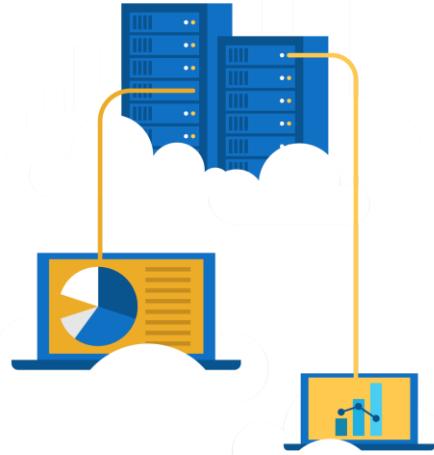
64



## Walkthrough – Create a virtual network

Create a virtual network with two virtual machines and then test connection between the machines.

1. Create a virtual network.
2. Create two virtual machines.
3. Test the connection.



65

## Define Azure data categories

	Schema	Data relationships	Examples
<b>Structured data</b>	Adheres to a schema, with the same data fields or properties.	Storable in relational database tables, with rows and columns.	Sensor data and financial data.
<b>Semi-structured data</b>	Has an ad hoc schema with less organized fields and properties.	Non-relational or NoSQL data, not storable in tables, rows and column.	Books, blogs, JSON, HTML documents.
<b>Unstructured data</b>	Has no designated schema or data structure.	Non-relational or blob data, with no restrictions on the kinds of data blobs contain.	PDFs, JPGs, videos.



66

## Explore Azure storage services

IaaS	PaaS			
Disks	Files	Containers	Tables	Queues
				

**Built on a unified distributed storage system**  
Durability, Encryption at rest, Strongly consistent replication, fault tolerance, auto load-balancing

Azure

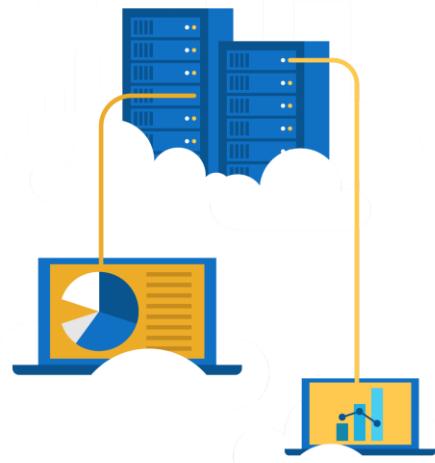
67



## Walkthrough – Create Blob storage

Create a storage account with a blob storage container. Work with blob files.

1. Create a storage account.
2. Work with blob storage.
3. Monitor the storage account.



68

## Explore Azure database services

	<b>Azure Cosmos DB</b> is a globally-distributed database service.
	<b>Azure SQL Database</b> is a relational database as a service (DaaS).
	<b>Azure Database Migration</b> is a fully-managed service designed to enable seamless migrations from multiple database sources to.



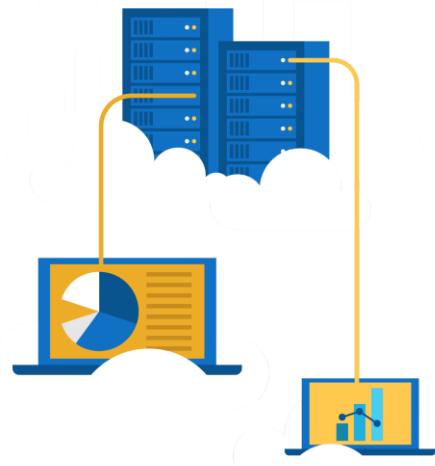
69



## Walkthrough – Create a SQL database

Create a SQL database in Azure and then query the data in that database.

1. Create the database.
2. Query the database.



70

## Explore Azure Marketplace

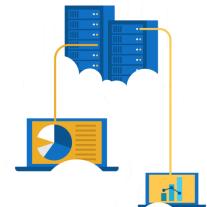


- Connects end users with Microsoft partners, Independent Software Vendors (ISVs), and start-ups that offer solutions and services for Azure.
- Includes close to 10,000 product listings.



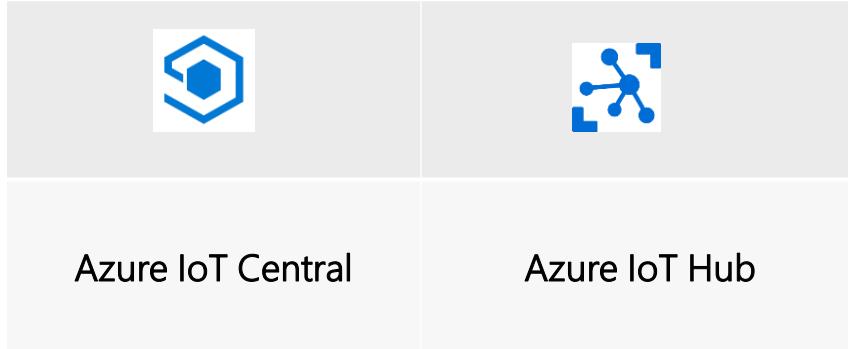
71

## Identify Azure solutions



72

## Define Internet of Things



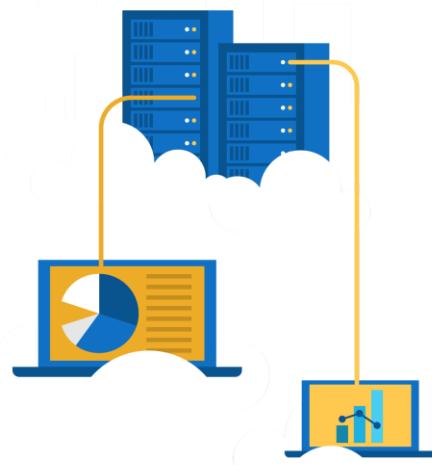
73



## Walkthrough – Implement the Azure IoT Hub

Create an Azure IoT Hub in Azure Portal and configure the hub to authenticate a connection to an IoT device using the Raspberry Pi device simulator.

1. Create an IoT Hub.
2. Add an IoT device.
3. Test the device using the **Raspberry Pi Simulator**.



74

## Explore Big data and analytics

		
<b>Azure SQL Data Warehouse</b> A cloud-based Enterprise Data Warehouse.	<b>Azure HDInsight</b> A fully-managed, open-source analytics service for enterprises.	<b>Azure Data Lake Analytics</b> An on-demand analytics job service that simplifies big data.

Microsoft

75

## Explore Artificial Intelligence

<b>Azure Machine Learning service</b> provides a cloud-based environment used to develop, train, test, deploy, manage, and track machine learning models.	
<b>Azure Machine Learning Studio</b> is a collaborative, drag-and-drop visual workspace where you can build, test, and deploy machine learning solutions without needing to write code.	

Microsoft

76

## Define Serverless computing

	<b>Azure Functions</b> is code running your service and not the underlying platform or infrastructure. Creates infrastructure based on an event.
	<b>Azure Logic Apps</b> is a cloud service that helps you automate and orchestrate tasks, business processes, and workflows when you need to integrate apps, data, systems, and services.
	<b>Azure Event Grid</b> is a fully-managed, intelligent event routing service that uses a publish-subscribe model for uniform event consumption.



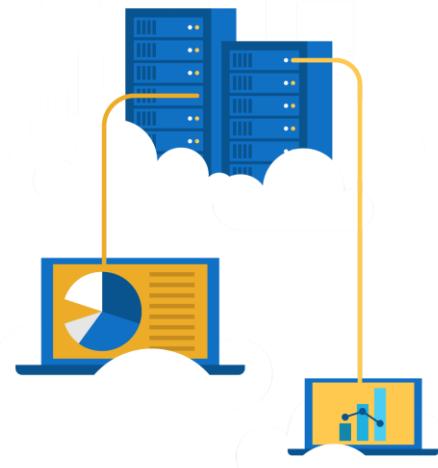
77



## Walkthrough – Implement Azure Functions

Create a Function app with a Webhook to provide a Hello message with your name.

1. Create a Function app.
2. Create a HTTP triggered event function and test.



78

## Explore DevOps

	
<p><b>Azure DevOps services</b> provides development collaboration tools including pipelines, Git repositories, Kanban boards, and extensive automated and cloud-based load testing.</p>	<p><b>Azure DevTest Labs</b> allows you to quickly create environments in Azure while minimizing waste and controlling cost.</p>

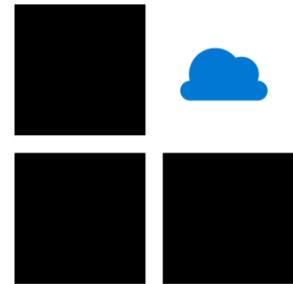


79

## Explore Azure App Service

**Quickly and easily build web and mobile apps for any platform or device.** Azure App Service enables you to build and host web apps, mobile back ends, and RESTful APIs in the programming language of your choice without managing infrastructure.

- Multiple languages and frameworks.
- Global scale with high availability.
- Security and compliance.
- Visual Studio integration.



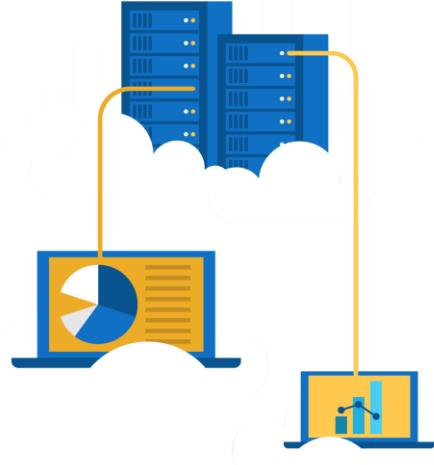
80



## Walkthrough – Create a Web App

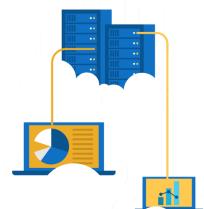
Create a new web app by using a Docker image stored in Azure Container Registry.

1. Create a Web App using a Docker image.
2. Test the Web App..



81

## Differentiate Azure management tools



82

## Explore Azure management tools

	Azure portal
	Azure PowerShell and Azure Command-Line Interface (CLI)
	Azure Cloud Shell
	Azure mobile app
	Azure REST API



83

## Review Azure Advisor



Analyzes your deployed Azure resources and recommends ways to improve availability, security, performance, and costs.



84



## Walkthrough – Create a VM with an ARM Template

Use the Azure QuickStart gallery to deploy a template that creates a virtual machine.

1. Explore the gallery and deploy a template.
2. Verify your virtual machine deployment.



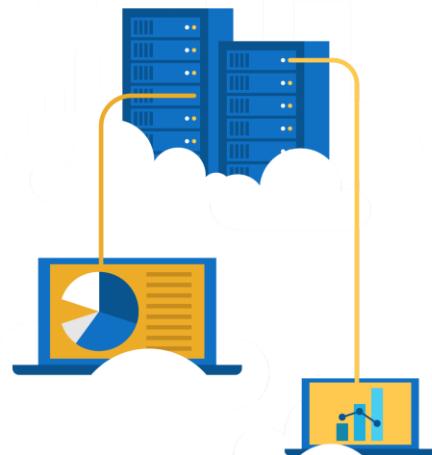
85



## Walkthrough – Create a VM with PowerShell

Install PowerShell locally, create a resource group and virtual machine, access and use the Cloud Shell, and review Azure Advisor recommendations.

1. Configure PowerShell locally.
2. Use PowerShell to create a resource group and virtual machine.
3. Execute PowerShell commands in the Cloud Shell.
4. Review Azure Advisor Recommendations.



86



## Walkthrough – Create a VM with the Azure CLI

Install the Azure CLI locally, create a resource group and virtual machine, use the Cloud Shell, and review Azure Advisor recommendations.

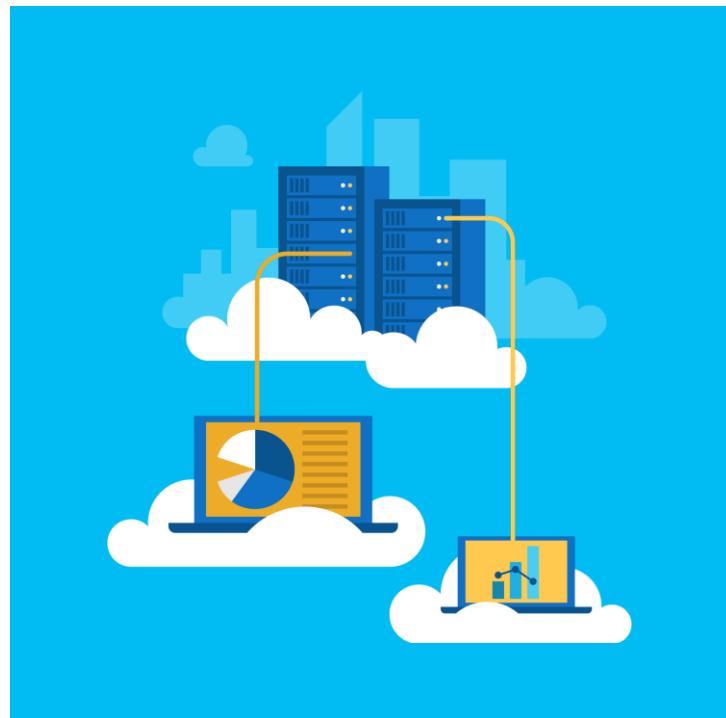
1. Install the CLI locally.
2. Use the CLI to create a resource group and virtual machine.
3. Execute commands in the Cloud Shell.
4. Review Azure Advisor Recommendations.



87



## Module 03 : Examine Microsoft Azure Security, privacy, compliance, and trust



88

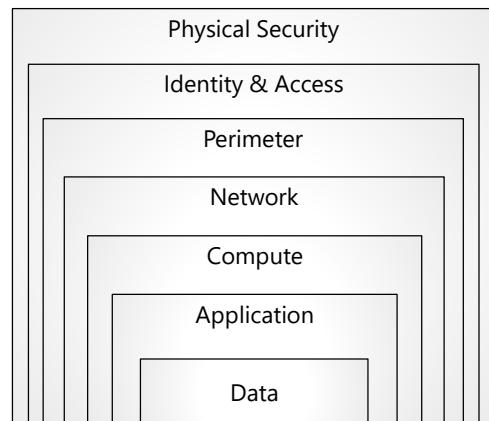
## Securing network connectivity



89

## Explore Defense in depth

**A layered approach to securing computer systems.**  
**Provides multiple levels of protection.**  
**Attacks against one layer are isolated from subsequent layers.**



90

## Define Shared security

Migrating from customer-controlled to cloud-based datacenters shifts the responsibility for security. Security becomes a shared concern between cloud providers and customers.

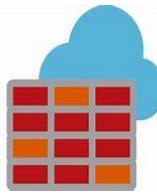
Responsibility	On-Premises	IaaS	PaaS	SaaS
Data governance and Rights Management	Customer	Customer	Customer	Customer
Client endpoints	Customer	Customer	Customer	Customer
Account and access management	Customer	Customer	Customer	Customer
Identity and directory infrastructure	Customer	Customer	Microsoft/ Customer	Microsoft/ Customer
Application	Customer	Customer	Microsoft/ Customer	Microsoft
Network controls	Customer	Customer	Microsoft/ Customer	Microsoft
Operating system	Customer	Customer	Microsoft	Microsoft
Physical hosts	Customer	Microsoft	Microsoft	Microsoft
Physical network	Customer	Microsoft	Microsoft	Microsoft
Physical datacenter	Customer	Microsoft	Microsoft	Microsoft



91

## Explore Azure Firewall

Stateful, managed, Firewall as a Service (FaaS) that grants / denies server access based on originating IP address, to protect network resources.



- ✓ Azure Application Gateway also provides a firewall, Web Application Firewall (WAF). WAF provides centralized, inbound protection for your web applications.



92

## Explore Azure Distributed Denial of Service (DDoS) protection



- **What is a DDoS attack?**
- **What does DDoS Protection do?**
  - Sanitizes unwanted network traffic, before it impacts service availability.
  - Basic service tier is automatically enabled in Azure.
  - Standard service tier adds mitigation capabilities, tuned to protect Azure Virtual Network resources.



93

## Define Network Security Groups (NSGs)

Filters network traffic to, and from, Azure resources on Azure Virtual Networks.



- Set inbound and outbound rules to filter by source and destination IP address, port, and protocol.
- Override default rules with new, higher priority, rules.



94

## Define Application Security Groups (ASGs)



ASGs - provide for the grouping of servers with similar port filtering requirements, and group together servers with similar functions, such as web servers.

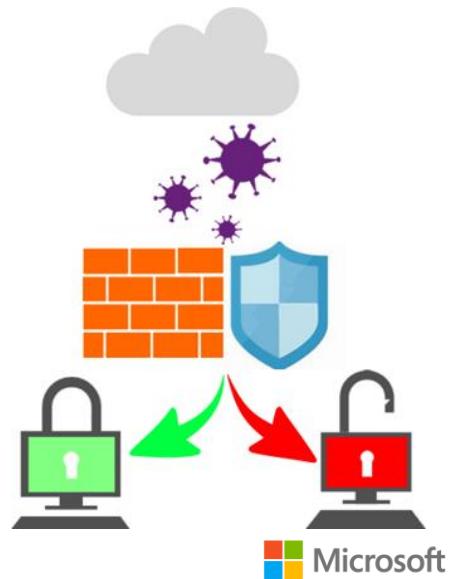


95

## Choose Azure network security solutions

Azure supports combined network security solutions:

- NSGs with Azure Firewall
- Web Application Firewall (WAF) with Azure Firewall.
- **Perimeter layer** protects your networks' boundaries with Azure DDoS Protection and Azure Firewall.
- **Networking layer** only permits traffic to pass between networked resources with Network Security Group (NSG) inbound and outbound rules.



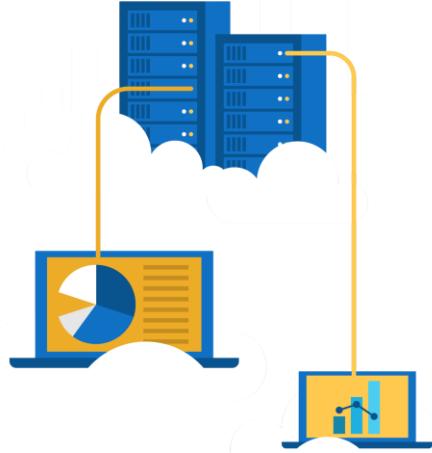
96



## Walkthrough – Secure network traffic

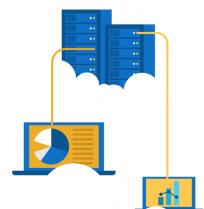
Create and configure inbound and outbound security port rules.

1. Deploy a custom template to create a virtual machine.
2. Create a network security group.
3. Create an inbound security port rule to allow RDP.
4. Configure an outbound security port rule to deny Internet access.



97

## Core Azure identity services



98

## Compare Authentication and authorization

Two concepts are fundamental to understanding identity and access.

Authentication



Authorization



99

## Explore Azure Active Directory (AD)

Microsoft Azure's cloud-based identity and access management service.

- Authentication (employees sign-in to access resources).
- Single sign-on (SSO).
- Application management.
- Business to Business (B2B).
- Business to Customer (B2C) identity services.
- Device management.



100

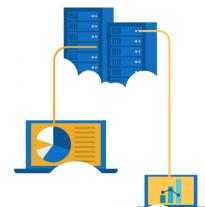
## Explore Azure Multi-Factor Authentication

Provides additional security for your identities by requiring two or more elements for full authentication.



101

## Security tools and features



102

## Explore Azure Security Center

A monitoring service that provides threat protection across all your Azure, and on-premises, services.

- Security recommendations
- Monitors security settings
- Automatically applies your security policies



103

## Walkthrough: Azure Security Center usage scenarios

You can use Security Center in the *Detect*, *Assess*, and *Diagnose* stages of an incident response.



104

## Explore Azure Key Vault



Stores application secrets in a centralized cloud location, to securely control access permissions, and access logging.

- Secrets management.
- Key management.
- Certificate management.
- Storing secrets backed by hardware security modules (HSMs).



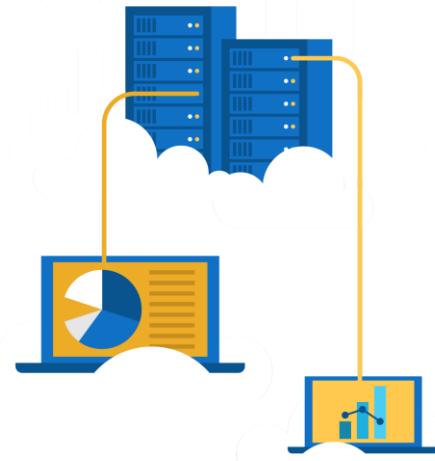
105



## Walkthrough – Implement Azure Key Vault

Create an Azure Key vault and then create a password secret within the key vault.

1. Create an Azure key vault.
2. Add a secret to the Azure key vault.

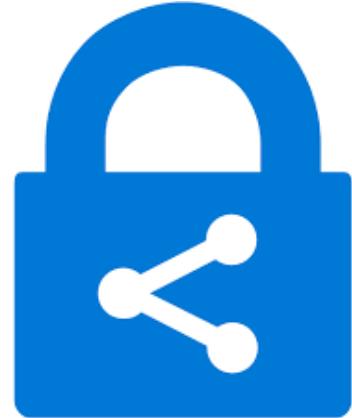


106

## Define Azure Information Protection (AIP)

**Classifies and protects documents, and emails, by applying labels.**

- Automatically using rules and conditions defined by administrators.
- Manually, by users.
- By combining automatic and manual methods, guided by recommendations.



107

## Define Azure Advanced Threat Protection (Azure ATP)

**Cloud-based security solution for identifying, detecting, and investigating advanced threats, compromised identities, and malicious insider actions.**



- Dedicated **portal** for monitoring and responding to suspicious activity.
- **Sensors** installed directly onto your domain controllers.
- **Cloud service** runs on Azure infrastructure.



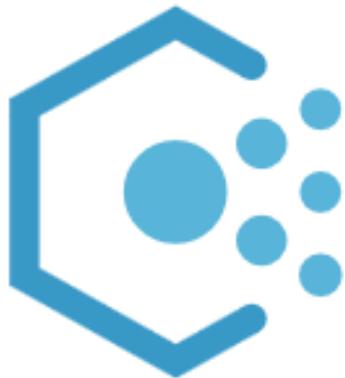
108

## Azure Governance methodologies



109

### Define Azure Policy



Azure Policy is a service to create, assign, and manage policies. These policies enforce different rules and effects over your resources, so those resources stay compliant with your corporate standards and service-level agreements (SLAs).



110

## Implementing Azure Policy

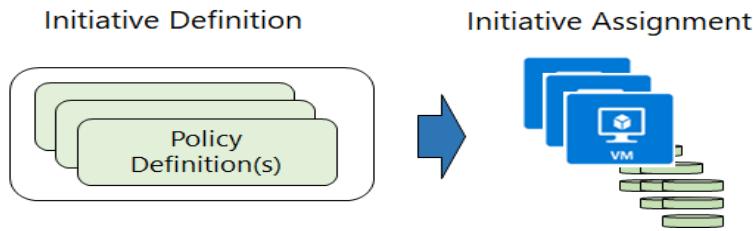


A policy definition expresses what to evaluate and what action to take.  
Implement your policy definition by assigning it to a group of resources.  
Review the results. Results are either compliant or non-compliant.



111

## Define Policy Initiatives



### Policy Initiatives work with Azure Policies

- **Initiative definitions** group multiple policy definitions into a single unit, to track compliance at a higher scope. For example, one initiative can monitor all your Azure Security Center recommendations.
- **Initiative assignments** are assigned to a specific scope and reduce the need to make an initiative definition for each scope.



112

## Walkthrough - Create an Azure Policy

Create an Azure Policy to restrict deployment of Azure resources to a specific location.

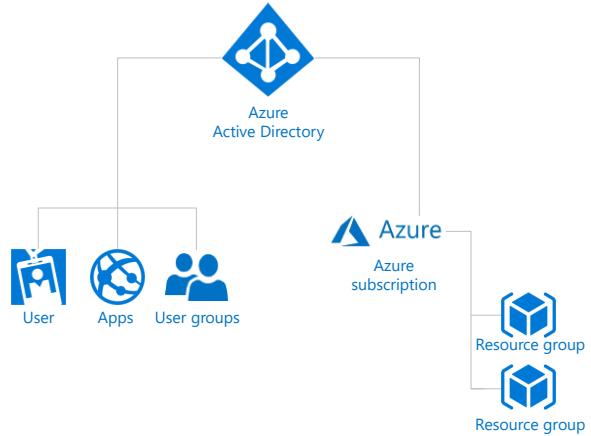
1. Create a policy assignment.
2. Test the allowed location policy.
3. Delete the policy assignment.



113

## Explore Role-based access control (RBAC)

- Fine-grained access management
- Segregate duties within your team and grant only the amount of access to users that they need to perform their jobs.
- Enables allowing or disallowing access to the Azure portal, and controlling access to resources.



114



## Walkthrough – Manage access with RBAC

Assign roles and view activity logs.

1. View and assign roles.
2. View the activity log and remove a role assignment.



115

## Define Resource locks

Lock Types	Read	Update	Delete
CanNotDelete	Yes	Yes	No
ReadOnly	Yes	No	No

- Protect your Azure resources from accidental deletion or modification.
- Manage locks at subscription, resource group, or individual resource levels within Azure Portal.



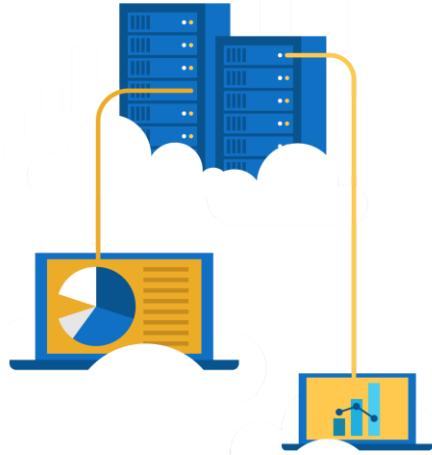
116



## Walkthrough – Manage Resource Locks

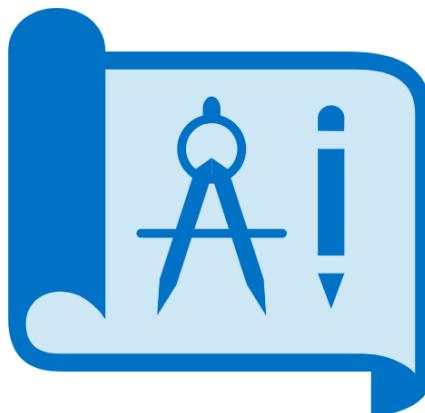
Create a resource group, add a lock to the resource group and test deletion, test deleting a resource in the resource group, and remove the resource lock.

1. Create a resource group.
2. Add a resource lock to prevent deletion of a resource group.
3. Test deleting a member of the resource group.
4. Remove the resource lock.



117

## Explore Azure Blueprints



Create reusable environment definitions that can recreate your Azure resources, like VMs, and apply your policies instantly.



118

## Define Subscription Governance

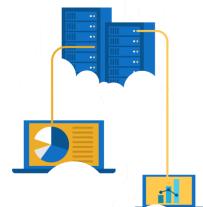
There are mainly three aspects to consider in relation to creating and managing subscriptions.

<b>Billing</b>	Reports and chargeback can be generated per subscriptions
<b>Access Control</b>	A subscription is a deployment boundary for Azure resources and can set up role-based access control.
<b>Subscription Limits</b>	Subscriptions are also bound to some hard limitations. If there is a need to go over those limits, then additional subscriptions may be needed. If you hit a hard limit, there is no flexibility.



119

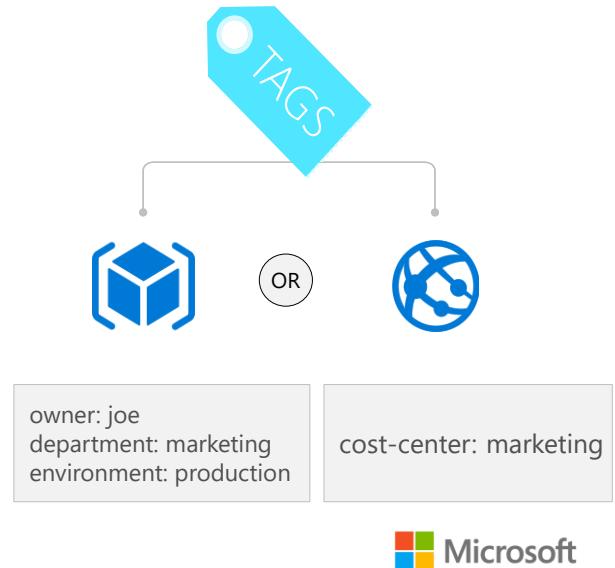
## Monitoring and reporting in Azure



120

## Explore Tags

- Provides metadata for your Azure resources.
- Logically organizes resources into a taxonomy.
- Consists of a name-value pair.
- Very useful for rolling up billing information.



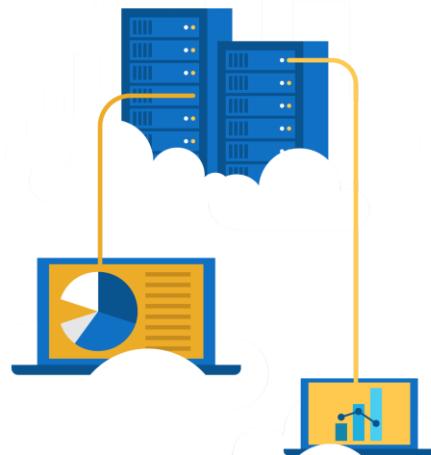
121



## Walkthrough – Implement resource tagging

Create a policy assignment that requires tagging, create a storage account and test the tagging, view resources with a specified tag, and remove the tagging policy.

1. Create a policy assignment to require tagging.
2. Create a storage account to test required tagging.
3. View all resources with a specific tag.
4. Delete the policy assignment.



122

## Explore Azure Monitor

Collect, analyse, and act on telemetry from cloud and on-premises environments, to maximize your applications' availability and performance.



123

## Explore Azure Service Health



Evaluate the impact of Azure service issues with personalized guidance and support, notifications, and issue resolution updates.

Azure Status

Service Health

Azure Resource Health



124

## Monitor applications and services

Integrate Azure Monitor with other Azure services to improve your data monitoring capabilities and gain better insights into your operations.

Analyze	Use variants of Azure Monitor for resources (containers, virtual machines, etc.), with Azure Application Insights for applications.
Respond	Azure Alerts can respond proactively to critical conditions identified in your monitor data and use Auto-scale with Azure Monitor Metrics.
Visualize	Use Azure Monitor data to create interactive visualizations, charts, and tables with Power BI.
Integrate	Integrate Azure Monitor with other systems to build customized solutions to suit your needs and requirements.

125

## Privacy, compliance, and data protection standards



126

## Explore Compliance Terms and Requirements

Microsoft provides the most comprehensive set of compliance offerings (including certifications and attestations) of any cloud service provider. Some compliance offerings include.

<b>CJIS</b> (Criminal Justice Information Services )	<b>HIPAA</b> (Health Insurance Portability and Accountability Act)
<b>CSA STAR Certification</b>	<b>ISO/IEC 27018</b>
<b>General Data Protection Regulation (GDPR)</b>	<b>National Institute of Standards and Technology (NIST)</b>



127

## Identify Microsoft privacy statement

Provides openness and honesty about how Microsoft handles the user data collected from its products and services.

The Microsoft privacy statement explains:

- What data Microsoft processes.
- How Microsoft processes it.
- What purposes the data is used for.



128

## Explore Trust Center

Learn about security, privacy, compliance, policies, features, and practices across Microsoft's cloud products.

The Trust Center website provides :



- In-depth, expert information.
- Curated lists of recommended resources, arranged by topic.
- Role-specific information for business managers, administrators, engineers, risk assessors, privacy officers, and legal teams.



129

## Explore Service Trust Portal (STP)

A Trust Center companion website for compliance-related publications about Microsoft cloud services. Hosts the Compliance Manager service.

Use STP to access :

- Audit reports across Microsoft cloud services.
- Guides to using Microsoft cloud services for regulatory compliance.
- Publications about trust, and how Microsoft cloud services protect your data.



130

## Explore Compliance Manager

**Workflow-based, risk assessment tool in Trust Portal that supports your organization's regulatory compliance activities.**

Compliance Manager features :

- Assign, track, and verify your compliance and assessment-related activities.
- Provides a score by evaluating your compliance status.
- Stores and manages your compliance-related artifacts in a secure digital repository.



131



## Walkthrough – Explore the Trust Center

Access the Trust Center, Service Trust Portal (STP), and Compliance Manager.

1. Access the Trust Center.
2. Access the Service Trust Portal.
3. Access the Compliance Manager.

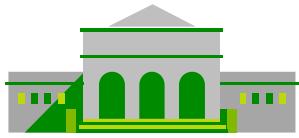


132

## Identify Azure Government services

**Meets the security and compliance needs of US federal agencies, state and local governments, and their solution providers.**

Azure Government :



- Separate instance of Azure.
- Physically isolated from non-US government deployments.
- Accessible only to screened, authorized personnel.

Examples of compliant standards : FedRAMP, NIST 800.171 (DIB), ITAR, IRS 1075, DoD L2, L4 & L5, and CJIS.



133

## Identify Azure China 21Vianet

**China's first foreign public cloud service provider, in compliance with government regulations.**

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Azure China 21Vianet features:

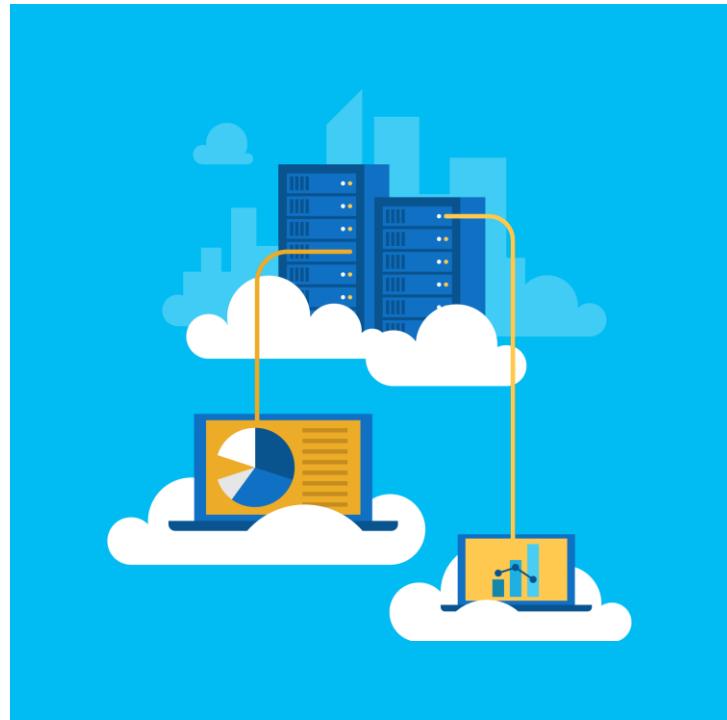
- Physically separated instance of Azure cloud services, located in China.
- Operated by 21Vianet (Azure China 21Vianet).



134



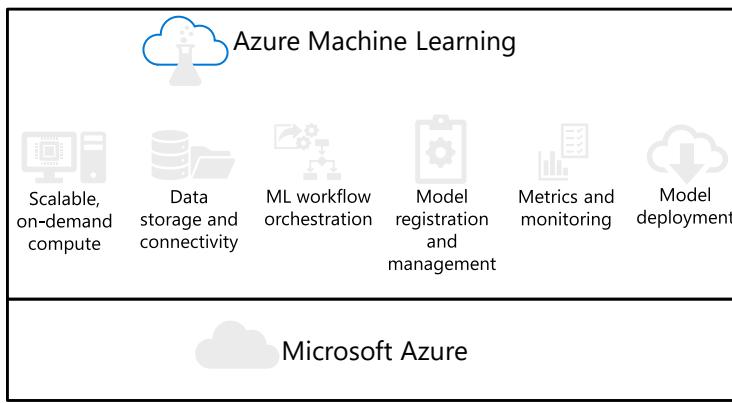
## Module 04 : Azure Machine Learning : No- Code with Designer



135

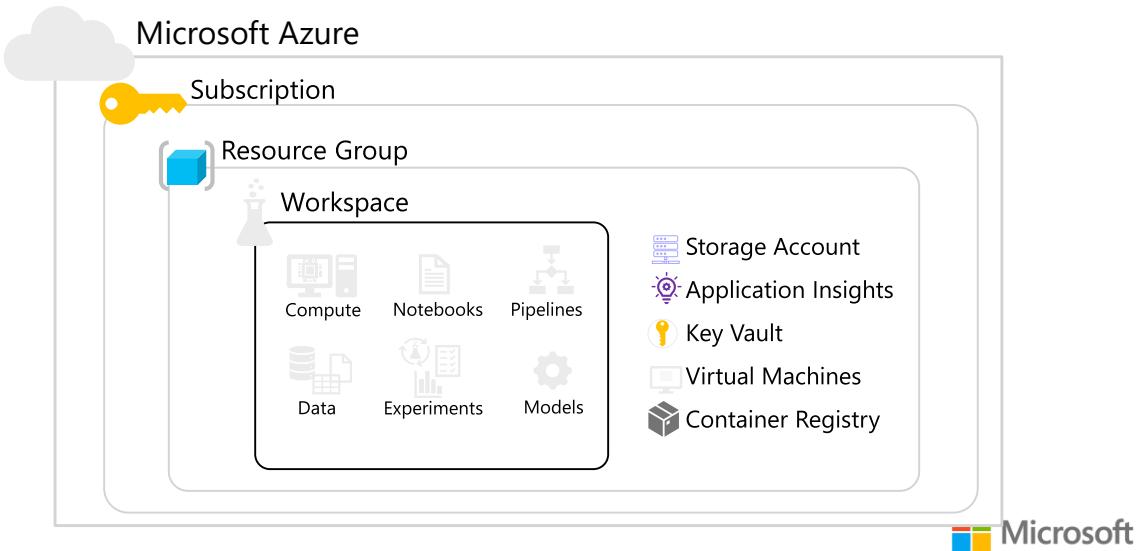
## What is Azure Machine Learning?

A platform for operating machine learning workloads in the cloud



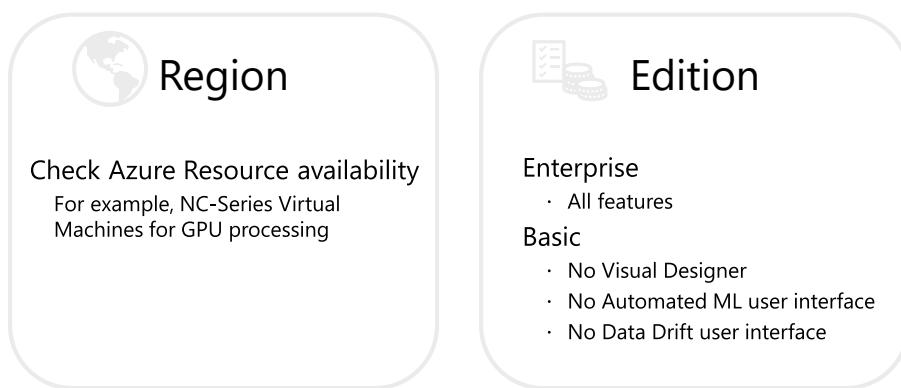
136

## Azure Machine Learning Workspaces



137

## Considerations for Creating a Workspace



138

## Azure Machine Learning studio

**Manage compute and data**

**Run experiments**

**View metrics**

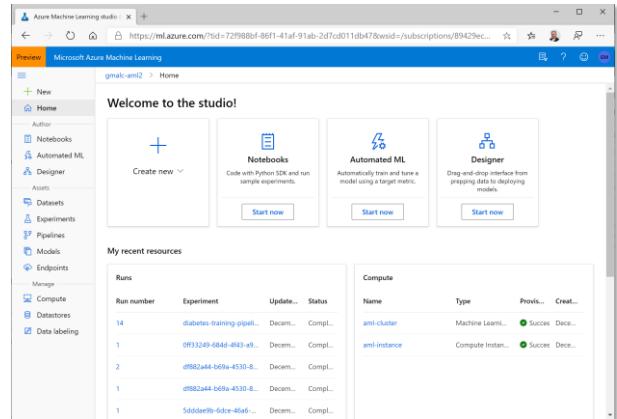
**Manage and deploy models**

**Manage endpoints**

**Use graphical modeling tools:**

*Designer* - "no-code" model development

*Automated Machine Learning* - find the best model for your data



139

## The Azure Machine Learning SDK for Python

**Code-based configuration for machine learning assets:**

**Automate repeatable asset creation**

**Ensure consistency across development, test, and production environments**

**Incorporate machine learning asset configuration into DevOps**

```
pip install azureml-sdk
```

```
from azureml.core import Workspace

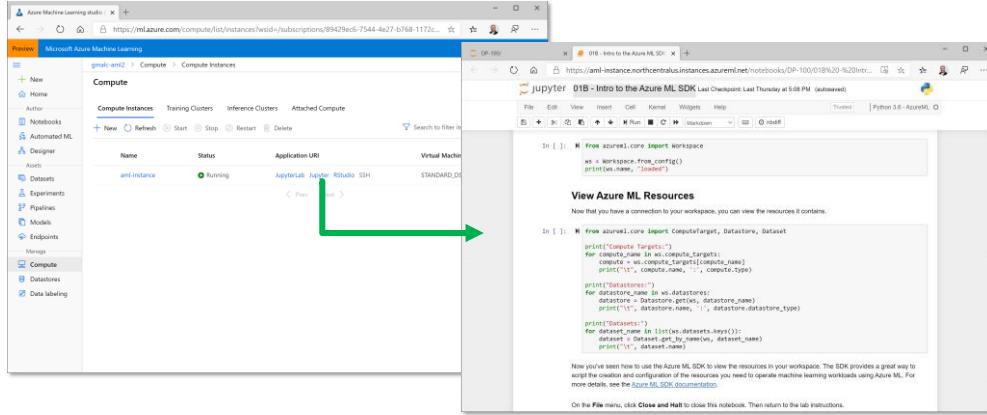
ws = Workspace.from_config()
for compute_name in ws.compute_targets:
    compute = ws.compute_targets[compute_name]
    print(compute.name, ":", compute.type)
```



140

## Compute Instances

Jupyter Notebook and JupyterLab servers in your workspace  
Choose the compute specifications you need



141

## Walkthrough :

### Creating an Azure Machine Learning Workspace

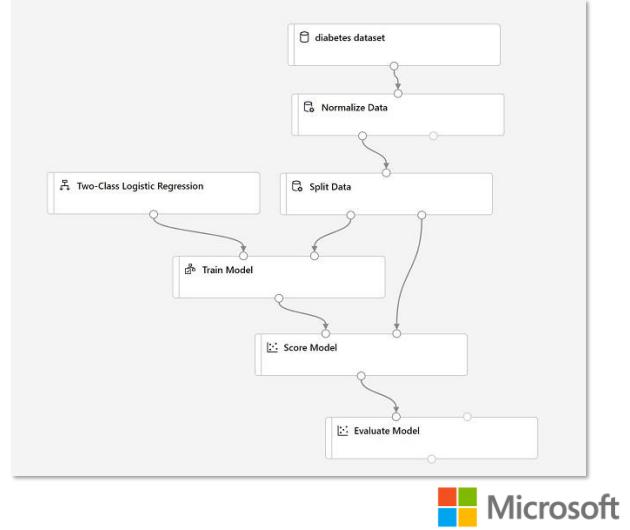


142

## What is Azure Machine Learning Designer?

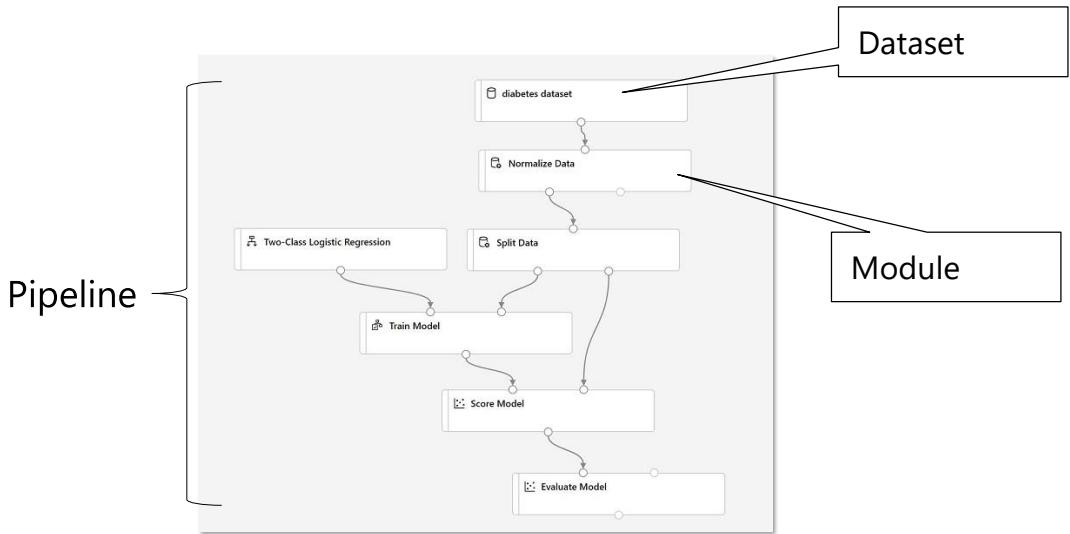
### Drag-and-Drop Interface for:

Preparing data and training models  
Publishing models as services



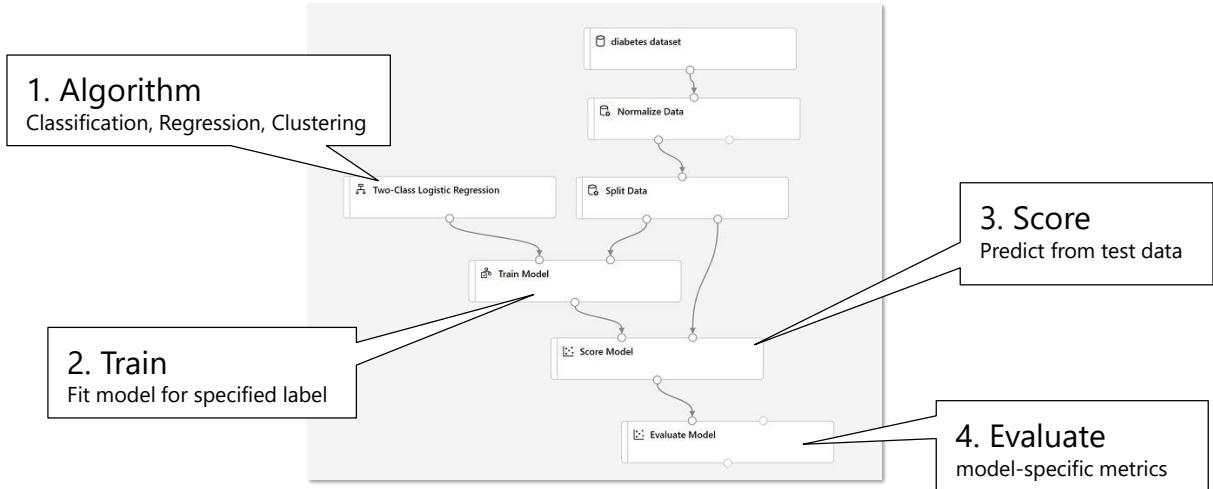
143

## Designer Pipelines and Modules



144

## Training, Scoring, and Evaluating Models



145

## Custom Code Modules

Apply SQL Transformation	Use a SQL statement to process up to three input tables
Execute Python Script	Implement a custom Python function to process up to two dataframes
Create Python Model	Implement a custom Python model in place of a built-in algorithm
Execute R Script	Implement a custom R function to process up to two dataframes



146

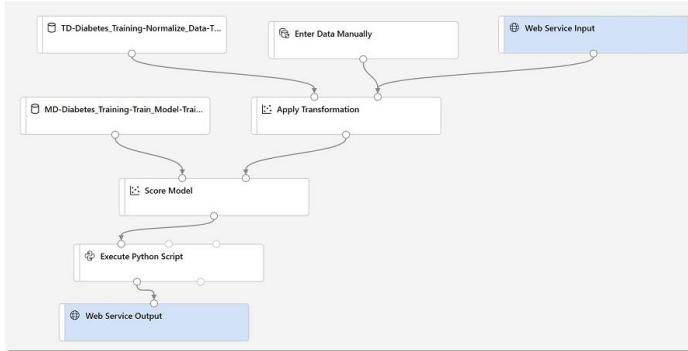
## Walkthrough :

### Creating a Training Pipeline with the Azure ML Designer



147

## What is an Inference Pipeline?



**A data flow defining a web service for using the trained model**

A **Web Service Input** defines the input data schema

Transformations based on training data are encapsulated in datasets

The trained model is encapsulated in a dataset

A **Web Service Output** defines the output data schema

You may want to modify the pipeline before deploying its as a web service



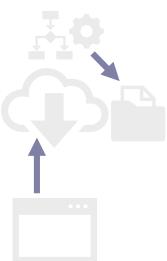
148

## Publishing a Service Endpoint



### Deploy a Real-Time Pipeline:

Requires Azure Kubernetes Services Inference Compute  
Submit new data to HTTP endpoint for immediate results



### Publish a Batch Pipeline

Requires Azure Machine Learning Training Compute  
Initiate pipeline experiment run through HTTP endpoint  
Results saved in run output



149

## Consuming a Service Endpoint

**View endpoints in Azure Machine Learning studio**  
**Use starter code to build client applications**

```
data = {"Inputs": {"input0": [{"feature1": "123", "feature2": "99", }, ], },
        "GlobalParameters": {}}
body = str.encode(json.dumps(data))

url = 'http://10.0.0.1:80/api/v1/service/diabetes_predictor/score'
api_key = 'a1234567890x'
headers = {'Content-Type': 'application/json',
           'Authorization': ('Bearer ' + api_key)}

req = urllib.request.Request(url, body, headers)
response = urllib.request.urlopen(req)
result = response.read()
```



150

Walkthrough :

Deploying a Service with the Azure ML Designer



151

# Complete the Course



152