

AZ-203: Developing Solutions on Microsoft Azure

STUDY RESOURCES

Register and prepare for Exam

<https://aka.ms/az-203>

Exam Objectives

<https://aka.ms/az-203/objectives>

Microsoft Certification Dashboard

<https://www.microsoft.com/en-us/learning/dashboard.aspx>

Mike Stevens

Microsoft Azure Technical Trainer

[linkedin.com/in/mikestevens](https://www.linkedin.com/in/mikestevens)

Last Updated: 17 January 2020

Page 1

Table of Contents

Learning Resources.....	6
Develop Azure Infrastructure as a Service compute solution (10-15%).....	7
Implement solutions that use virtual machines (VM)	7
Provision VMs.....	8
Create ARM templates	9
Configure Azure Disk Encryption for VMs.....	9
Implement batch jobs by using Azure Batch Services.....	10
Manage batch jobs by using Batch Service API References.....	11
Run a batch job by using Azure CLI, Azure portal, and other tools	11
Write code to run an Azure Batch Services batch job.....	12
Create containerized solutions.....	12
Create an Azure Managed Kubernetes Service (AKS) cluster	13
Create container images for solutions.....	14
Publish an image to the Azure Container Registry	15
Run containers by using Azure Container Instance or AKS.....	16
Develop Azure Platform as a Service compute solution (20-25%).....	17
Create Azure App Service Web Apps.....	17
Create an Azure App Service Web App	18
Create an Azure App Service background task by using WebJobs.....	19
Enable diagnostics logging	20
Create an Azure Web App for containers	21
Monitor service health by using Azure Monitor.....	21
Create Azure App Service mobile apps.....	23
Add push notifications for mobile apps.....	23
Enable offline sync for mobile app	24
Implement a remote instrumentation strategy for mobile devices	25
Create Azure App Service API apps.....	25
Create an Azure App Service API app	26
Create documentation for the API by using open source and other tools	26
Implement Azure functions	27
Implement input and output bindings for a function	28
Implement function triggers by using data operations, timers, and webhooks	29

Implement Azure Durable Functions.....	29
Create Azure Function apps by using Visual Studio	31
Implement Python Azure functions	32
Develop for Azure storage (15-20%)	33
Develop solutions that use storage tables	33
Design and implement policies for tables	34
Query table storage by using code	34
Implement partitioning schemes	35
Develop solutions that use Cosmos DB storage	35
Create, read, update, and delete data by using appropriate APIs.....	36
Implement partitioning schemes	38
Set the appropriate consistency level for operations	39
Develop solutions that use a relational database	40
Provision and configure relational databases	41
Configure elastic pools for Azure SQL Database	42
Create, read, update, and delete data tables by using code	43
Provision and configure Azure SQL Database serverless instances	45
Provision and configure Azure SQL and Azure PostgreSQL Hyperscale instances	45
Develop solutions that use blob storage	47
Move items in Blob storage between storage accounts or containers	48
Set and retrieve properties and metadata	49
Implement blob leasing	50
Implement data archiving and retention	50
Implement Geo Zone Redundant storage	51
Implement Azure security (10-15%).....	52
Implement authentication	52
Implement authentication by using certificates, forms-based authentication, or tokens.....	53
Implement multi-factor or Windows authentication by using Azure AD	53
Implement OAuth2 authentication	54
Implement Managed identities/Service Principal authentication.....	55
Implement Microsoft identity platform	57
Implement access control	59
Implement CBAC (Claims-Based Access Control) authorization	59
Implement RBAC (Role-Based Access Control) authorization.....	59

Create shared access signatures	60
Implement secure data solutions.....	61
Encrypt and decrypt data at rest and in transit	61
Create, read, update, and delete keys, secrets, and certificates by using the KeyVault API	62
Monitor, troubleshoot, and optimize solutions (10-15%)	65
Develop code to support scalability of apps and services.....	65
Implement autoscaling rules and patterns (schedule, operational/system metrics, singleton applications)	65
Implement code that handles transient faults	66
Implement AKS scaling strategies	67
Integrate caching and content delivery within solutions.....	68
Store and retrieve data in Azure Redis cache	69
Develop code to implement CDN's in solutions	70
Invalidate cache content (CDN or Redis)	71
Instrument solutions to support monitoring and logging	72
Configure instrumentation in an app or service by using Application Insights	72
Analyze and troubleshoot solutions by using Azure Monitor	73
Implement Application Insights Web Test and Alerts	74
Connect to and consume Azure and third-party services (20-25%)	76
Microsoft Azure Logic Apps	76
Creating Logic Apps.....	76
Creating custom connectors for Logic Apps.....	77
Creating a custom template for Logic Apps.....	78
Working with Azure Search	78
Creating an Azure Search Index.....	79
Indexing and querying documents	80
Full-text search in Azure Search.....	80
Azure API Management.....	81
Azure API Management.....	81
Securing APIs.....	82
Defining API policies	82
Develop event-based solutions.....	83
Azure Event Grid.....	83
Azure Event Hubs.....	85

Azure Notification Hubs.....	86
Develop message-based solutions	87
Azure Service Bus	87
Azure Queue storage.....	88
Microsoft Graph.....	89
Azure Relay.....	91

Learning Resources

Get started with 12 months of free services

Scroll down to full listing of "Always Free" service offerings

<https://azure.microsoft.com/en-us/free/>



Microsoft Learn – Azure Learning Paths

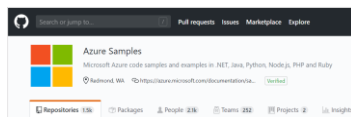
<https://microsoft.com/learn>



Pluralsight Azure courses

<https://azure.com/pluralsight>

<https://www.pluralsight.com/paths/developing-solutions-for-microsoft-azure-az-203>



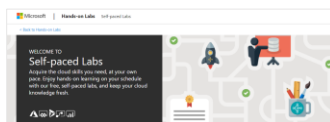
Azure-Samples on GitHub

<http://github.com/azure-samples>



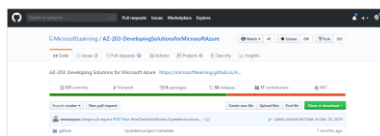
measureup Practice Exam (Paid)

<https://aka.ms/az-203/measureup>



Microsoft Self-paced Labs

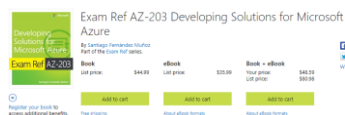
<https://www.microsoft.com/hands-on-labs/self-paced-labs>



AZ-203 Instructor Led Training (ILT) Lab Materials

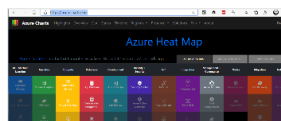
MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure

<https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/>



Exam Ref AZ-203 Developing Solutions for Microsoft Azure (Print, e-Book)

<https://aka.ms/az-203/book>



Azure Heat Map

<https://azurecharts.com/>

Mike Stevens

Microsoft Azure Technical Trainer

[linkedin.com/in/mikestevens](https://www.linkedin.com/in/mikestevens)

Last Updated: 17 January 2020

Page 6

Develop Azure Infrastructure as a Service compute solution (10-15%)

Lab: Deploying compute workloads by using images and containers (AZ-203 ILT, Module 1)

https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_01_lab_ak.md

Implement solutions that use virtual machines (VM)

References

Virtual Machines Documentation

<https://docs.microsoft.com/en-us/azure/virtual-machines/>

Linux virtual machines in Azure

<https://docs.microsoft.com/en-us/azure/virtual-machines/linux/>

Windows virtual machines in Azure

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/>

Frequently asked questions about Azure IaaS VM disks and managed and unmanaged premium disks

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/faq-for-disks>

Windows Virtual Machines Pricing

<https://azure.microsoft.com/en-us/pricing/details/virtual-machines/windows/>

Enabling Cloud for All Compute Needs: Azure's Compute Portfolio (pdf, signup required)

<https://azure.microsoft.com/en-us/resources/idc-enabling-cloud-for-all-compute-needs/>

Hands-on

Azure Virtual Machine PowerShell samples

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/powershell-samples>

Learning

Introduction to Azure virtual machines (MSLearn, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-azure-virtual-machines/>

Core Cloud Services - Azure compute options (MSLearn, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-azure-compute/>

Microsoft Azure Administrator (Pluralsight, video)

<https://www.pluralsight.com/role-iq/microsoft-azure-administrator?aid=7010a000001xDURAA2>

Provision VMs

References

Hands-on

Tutorial: Create and Manage Windows VMs with Azure PowerShell

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/tutorial-manage-vm>

Quickstart: Create a Linux virtual machine with the Azure CLI

<https://docs.microsoft.com/en-us/azure/virtual-machines/linux/quick-create-cli>

Create a Linux virtual machine that uses SSH authentication with the REST API

<https://docs.microsoft.com/en-us/azure/virtual-machines/linux/create-vm-rest-api>

Tutorial: Create and deploy highly available virtual machines with Azure PowerShell

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/tutorial-availability-sets>

Virtual Machines (REST API)

<https://docs.microsoft.com/en-us/rest/api/compute/virtualmachines>

Learning

Create a Windows virtual machine in Azure (MSLearn, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/create-windows-virtual-machine-in-azure/>

Manage virtual machines with the Azure CLI (MSLearn, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/manage-virtual-machines-with-azure-cli/>

Create a Linux virtual machine in Azure (MSLearn, ~1.5 hr)

<https://docs.microsoft.com/en-us/learn/modules/create-linux-virtual-machine-in-azure/>

Configure the network for your virtual machines (MSLearn, ~1.5 hrs)

<https://docs.microsoft.com/en-us/learn/modules/configure-network-for-azure-virtual-machines/>

Deploy Azure virtual machines from VHD templates (MSLearn, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/deploy-vm-from-vhd-templates/>

Choose the right disk storage for your virtual machine workload (MSLearn, ~25 min)

<https://docs.microsoft.com/en-us/learn/modules/choose-the-right-disk-storage-for-vm-workload/>

Keep your virtual machines updated (MSLearn, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/keep-your-virtual-machines-updated/>

Add and size disks in Azure virtual machines (MSLearn, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/add-and-size-disks-in-azure-virtual-machines/>

Protect your virtual machines by using Azure Backup (MSLearn, ~35 min)

<https://docs.microsoft.com/en-us/learn/modules/protect-virtual-machines-with-azure-backup/>

Protect your virtual machine settings with Azure Automation State Configuration (MSLearn, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/protect-vm-settings-with-dsc/>

Provisioning Microsoft Azure Virtual Machines (Pluralsight, ~3 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-virtual-machines-provisioning/table-of-contents>

Create ARM templates

References

Azure Resource Manager documentation

<https://docs.microsoft.com/en-us/azure/azure-resource-manager/>

Azure Resource Manager overview

<https://docs.microsoft.com/en-us/azure/azure-resource-manager/management/overview>

Azure Resource Manager templates overview

<https://docs.microsoft.com/en-us/azure/azure-resource-manager/templates/overview>

Hands-on

Learning

Build Azure Resource Manager templates (MSLearn, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/build-azure-vm-templates/>

Deploying Multiple Virtual Machines in Microsoft Azure (Pluralsight, ~1 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-deploying-multiple-virtual-machines/table-of-contents>

Configure Azure Disk Encryption for VMs

References

Azure Disk Encryption for Windows VMs

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/disk-encryption-overview>

Azure Disk Encryption for virtual machines and virtual machine scale sets

<https://docs.microsoft.com/en-us/azure/security/fundamentals/azure-disk-encryption-vmss-vmss>

Azure Disk Encryption scenarios on Windows VMs

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/disk-encryption-windows>

Hands-on

Azure Disk Encryption sample scripts

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/disk-encryption-sample-scripts>

Quickstart: Create and encrypt a Windows virtual machine in Azure with PowerShell

<https://docs.microsoft.com/en-us/azure/virtual-machines/windows/disk-encryption-powershell-quickstart>

Learning

Secure your Azure virtual machine disks (MSLearn, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/secure-your-azure-virtual-machine-disks/>

Implement batch jobs by using Azure Batch Services

References

What is Azure Batch?

<https://docs.microsoft.com/en-us/azure/batch/batch-technical-overview>

Azure Batch documentation

<https://docs.microsoft.com/en-us/azure/batch/>

High Performance Computing (HPC) on Azure (see Example Workloads)

<https://docs.microsoft.com/en-us/azure/architecture/topics/high-performance-computing>

Hands-on

Quickstart: Run your first Batch job in the Azure portal

<https://docs.microsoft.com/en-us/azure/batch/quick-create-portal>

Azure/batch-shipyard (GitHub, use Docker containers with Azure Batch)

<https://github.com/Azure/batch-shipyard>

Learning

Fire safety engineering firm ignites simulation speeds with Azure Batch (Case Study)

<https://customers.microsoft.com/en-us/story/holmes-group-professional-services-azure>

Microsoft Azure Batch: Getting Started (Pluralsight, video)

<https://www.pluralsight.com/courses/microsoft-azure-batch-getting-started>

Mike Stevens

Microsoft Azure Technical Trainer

linkedin.com/in/mikestevens

Last Updated: 17 January 2020

Page 10

3D video rendering on Azure (Azure Batch, Example Solution Architecture)

<https://docs.microsoft.com/en-us/azure/architecture/example-scenario/infrastructure/video-rendering>

Manage batch jobs by using Batch Service API References

Overview of Batch APIs and tools

<https://docs.microsoft.com/en-us/azure/batch/batch-apis-tools>

Batch Management APIs

<https://docs.microsoft.com/en-us/azure/batch/batch-apis-tools#batch-management-apis>

Hands-on

Azure-Samples/azure-batch-samples (GitHub)

<https://github.com/Azure-Samples/azure-batch-samples>

Learning

Microsoft Azure Batch: Getting Started (Pluralsight, ~2.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-batch-getting-started/table-of-contents>

Run a batch job by using Azure CLI, Azure portal, and other tools

References

Run tasks concurrently to maximize usage of Batch compute nodes

<https://docs.microsoft.com/en-us/azure/batch/batch-parallel-node-tasks>

Use a managed image to create a pool of virtual machines

<https://docs.microsoft.com/en-us/azure/batch/batch-custom-images>

Batch Analytics

<https://docs.microsoft.com/en-us/azure/batch/batch-analytics>

Batch metrics, alerts, and logs for diagnostic evaluation and monitoring

<https://docs.microsoft.com/en-us/azure/batch/batch-diagnostics>

Hands-on

Quickstart: Run your first Batch job in the Azure portal

<https://docs.microsoft.com/en-us/azure/batch/quick-create-portal>

Quickstart: Run your first Batch job with the Azure CLI

<https://docs.microsoft.com/en-us/azure/batch/quick-create-cli>

Batch Explorer (Windows, OSX, Linux) **formerly "BatchLabs"*

<https://azure.github.io/BatchExplorer/>

Learning

Run parallel tasks in Azure Batch with the Azure CLI (MSLearn, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/run-parallel-tasks-in-azure-batch-with-the-azure-cli/>

Write code to run an Azure Batch Services batch job

References

Develop large-scale parallel compute solutions with Batch

<https://docs.microsoft.com/en-us/azure/batch/batch-api-basics>

Use multi-instance tasks to run Message Passing Interface (MPI) applications in Batch

<https://docs.microsoft.com/en-us/azure/batch/batch-mpi>

Microsoft.Azure.Batch Namespace (SDK)

<https://docs.microsoft.com/en-us/dotnet/api/microsoft.azure.batch?redirectedfrom=MSDN&view=azure-dotnet>

Hands-on

Azure-Samples/azure-batch-samples (GitHub)

<https://github.com/Azure-Samples/azure-batch-samples>

Tutorial: Run a parallel workload with Azure Batch using the .NET API

<https://docs.microsoft.com/en-us/azure/batch/tutorial-parallel-dotnet>

Use Azure Pipelines to build and deploy HPC solutions

<https://docs.microsoft.com/en-us/azure/batch/batch-ci-cd>

Learning

Create containerized solutions

References

What is a Container? (Docker)

<https://www.docker.com/resources/what-container>

Kubernetes (K8s)

<https://kubernetes.io/>

Kubernetes - Concepts

<https://kubernetes.io/docs/concepts/>

Azure Container Services – Case Studies

https://customers.microsoft.com/en-us/search?sq=%22Azure%20Container%20Service%22&ff=language%26%3EEnglish&p=0&so=story_publish_date%20desc

Hands-on

Play with Docker Classroom

<https://training.play-with-docker.com/>

Kubernetes – Tutorials

<https://kubernetes.io/docs/tutorials/>

Learning

Introduction to Docker containers (MSLearn, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-docker-containers/>

Administer containers in Azure (MSLearn Learning Patch, 6 modules, ~4.25 hr)

<https://docs.microsoft.com/en-us/learn/paths/administer-containers-in-azure/>

Docker and Kubernetes: The Complete Guide (Udemy course, ~20 hrs, PAID)

<https://www.udemy.com/course/docker-and-kubernetes-the-complete-guide/>

Getting Started with Docker (Pluralsight video, PAID)

<https://www.pluralsight.com/courses/docker-getting-started>

Docker Deep Dive (Pluralsight video, PAID)

<https://www.pluralsight.com/courses/docker-deep-dive-update>

Microsoft Azure Developer: Deploying and Managing Containers (Pluralsight, ~4 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-containers-deploying-managing/table-of-contents>

Create an Azure Managed Kubernetes Service (AKS) cluster

References

Azure Kubernetes Service (AKS)

<https://docs.microsoft.com/en-us/azure/aks/intro-kubernetes>

Mike Stevens

Microsoft Azure Technical Trainer

linkedin.com/in/mikestevens

Last Updated: 17 January 2020

Page 13

Kubernetes core concepts for Azure Kubernetes Service (AKS)

<https://docs.microsoft.com/en-us/azure/aks/concepts-clusters-workloads>

az aks create (CLI)

<https://docs.microsoft.com/en-us/cli/azure/aks?toc=https%3A%2F%2Fdocs.microsoft.com%2Fen-us%2Fazure%2Faks%2FTOC.json&bc=https%3A%2F%2Fdocs.microsoft.com%2Fen-us%2Fazure%2Fbread%2Ftoc.json&view=azure-cli-latest#az-aks-create>

Hands-on

Quickstart: Deploy an Azure Kubernetes Service (AKS) cluster using the Azure portal

<https://docs.microsoft.com/en-us/azure/aks/kubernetes-walkthrough-portal>

Quickstart: Deploy an Azure Kubernetes Service cluster using the Azure CLI

<https://docs.microsoft.com/en-us/azure/aks/kubernetes-walkthrough>

Quickstart: Deploy an Azure Kubernetes Service (AKS) cluster using an Azure Resource Manager template

<https://docs.microsoft.com/en-us/azure/aks/kubernetes-walkthrough-rm-template>

Learning

50 days from zero to hero with Kubernetes (Learning Path)

https://azure.microsoft.com/mediahandler/files/resourcefiles/kubernetes-learning-path/Kubernetes%20Learning%20Path_Version%202.0.pdf

Azure Kubernetes Basics (YouTube, >18 videos)

https://www.youtube.com/playlist?list=PLLasX02E8BPCrIhFrc_ZiINhbRkYMKdPT

Kubernetes: Up and Running, Second Edition (e-book, register to download)

<https://azure.microsoft.com/en-us/resources/kubernetes-up-and-running/>

Introduction to Azure Kubernetes Service (MSLearn, ~25 min)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-azure-kubernetes-service/>

Create container images for solutions

References

docker create

<https://docs.docker.com/engine/reference/commandline/create/>

Introduction to Azure App Service on Linux (WebApp for Containers)

<https://docs.microsoft.com/en-us/azure/app-service/containers/app-service-linux-intro>

Hands-on

Tutorial: Create a container image for deployment to Azure Container Instances

<https://docs.microsoft.com/en-us/azure/container-instances/container-instances-tutorial-prepare-app>

Create a multi-container (preview) app using a Docker Compose configuration

<https://docs.microsoft.com/en-us/azure/app-service/containers/quickstart-multi-container>

Learning

Build a containerized web application with Docker (MSLearn, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-containers/>

Deploy and run a containerized web app with Azure App Service (MSLearn, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/deploy-run-container-app-service/>

Publish an image to the Azure Container Registry

References

Introduction to private Docker container registries in Azure

<https://docs.microsoft.com/en-us/azure/container-registry/container-registry-intro>

Hands-on

Push your first image to a private Docker container registry using the Docker CLI

<https://docs.microsoft.com/en-us/azure/container-registry/container-registry-get-started-docker-cli>

Tutorial: Build and deploy container images in the cloud with Azure Container Registry Tasks

<https://docs.microsoft.com/en-us/azure/container-registry/container-registry-tutorial-quick-task>

Quickstart: Create a private container registry using the Azure portal

<https://docs.microsoft.com/en-us/azure/container-registry/container-registry-get-started-portal>

Quickstart: Deploy a container instance in Azure using the Azure CLI

<https://docs.microsoft.com/en-us/azure/container-instances/container-instances-quickstart>

ACR Tasks samples (YAML, Dockerfiles)

<https://docs.microsoft.com/en-us/azure/container-registry/container-registry-tasks-samples>

Learning

Build and store container images with Azure Container Registry (MSLearn, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/build-and-store-container-images/>

Run containers by using Azure Container Instance or AKS

References

Helm (Package Manager for Kubernetes)

<https://v2.helm.sh/>

Hands-on

The Azure Kubernetes Workshop

<https://aksworkshop.io/>

Quickstart: Develop on Azure Kubernetes Service (AKS) with Draft

<https://docs.microsoft.com/en-us/azure/aks/kubernetes-draft>

Learning

Microsoft Azure Developer: Deploying and Managing Containers (Pluralsight video, PAID)

<https://app.pluralsight.com/player?course=microsoft-azure-containers-deploying-managing>

Develop Azure Platform as a Service compute solution (20-25%)

Lab: Building a web application on Azure Platform-as-a-Service offerings (AZ-203 ILT, Module 2)

https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_02_lab_ak.md

Create Azure App Service Web Apps

References

App Service Overview

<https://docs.microsoft.com/en-us/azure/app-service/overview>

Building Real World Cloud Apps with Azure

<https://docs.microsoft.com/en-us/aspnet/aspnet/overview/developing-apps-with-windows-azure/building-real-world-cloud-apps-with-windows-azure/>

Azure App Service Blog

<https://azure.github.io/AppService/>

Continuous deployment to Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/deploy-continuous-deployment>

projectkudu/Kudu (GitHub)

Kudu is the engine behind git deployments in Azure Web Sites. It can also run outside of Azure.

<https://github.com/projectkudu/kudu/wiki>

Hands-on

Azure-Samples (GitHub) – Web App

<https://github.com/Azure-Samples?q=web+app>

Microsoft-Web/WebCampTrainingKit (GitHub)

<https://github.com/Microsoft-Web/WebCampTrainingKit>

Azure Resource Manager templates for App Service

<https://docs.microsoft.com/en-us/azure/app-service/samples-resource-manager-templates>

Learning

Architect modern applications in Azure (MS Learn, Learning Path, ~6.5 hr)

<https://docs.microsoft.com/en-us/learn/paths/architect-modern-apps/>

Build applications with Azure DevOps (MS Learn, Learning Path, ~8 hr)
<https://docs.microsoft.com/en-us/learn/paths/build-applications-with-azure-devops/>

Azure App Service (YouTube Channel)
<https://www.youtube.com/channel/UCsPBgKDTzROY5-bslUnBbIQ>

Getting Started with Azure App Service: Web Apps (edX)
<https://www.edx.org/course/getting-started-with-azure-app-service-web-apps>

Implementing Web and Mobile Services on Microsoft Azure (Pluralsight, ~4 hr)
<https://app.pluralsight.com/library/courses/microsoft-azure-implementing-web-mobile-services-update/table-of-contents>

Create an Azure App Service Web App

References

App Service Documentation
<https://docs.microsoft.com/en-us/azure/app-service/>

Manage an App Service plan in Azure
<https://docs.microsoft.com/en-us/azure/app-service/app-service-plan-manage>

Azure App Service plan overview
<https://docs.microsoft.com/en-us/azure/app-service/overview-hosting-plans>

Introduction to the App Service Environments
<https://docs.microsoft.com/en-us/azure/app-service/environment/intro>

E-commerce website running in secured App Service Environment (sample architecture)
<https://docs.microsoft.com/en-us/azure/architecture/solution-ideas/articles/ecommerce-website-running-in-secured-ase>

Create a web app in an App Service Environment v1
<https://docs.microsoft.com/en-us/azure/app-service/environment/app-service-web-how-to-create-a-web-app-in-an-ase>

Hands-on

Create a Web App
<https://azure.microsoft.com/en-us/get-started/web-app/>

Create a static HTML web app in Azure
<https://docs.microsoft.com/en-us/azure/app-service/app-service-web-get-started-html>

Create an ASP.NET Framework web app in Azure

<https://docs.microsoft.com/en-us/azure/app-service/app-service-web-get-started-dotnet-framework>

Create an ASP.NET Core web app in Azure

<https://docs.microsoft.com/en-us/azure/app-service/app-service-web-get-started-dotnet>

Tutorial: Build an ASP.NET Core and SQL Database app in Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/app-service-web-tutorial-dotnetcore-sqldb>

Create a Node.js web app in Azure

<https://docs.microsoft.com/en-us/azure/app-service/app-service-web-get-started-nodejs>

CLI samples for Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/samples-cli>

Deploy your app to Azure App Service with a ZIP or WAR file

<https://docs.microsoft.com/en-us/azure/app-service/deploy-zip>

Azure App Service (REST API)

<https://docs.microsoft.com/en-us/rest/api/appservice/>

Learning

Host a web application with Azure App service (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/host-a-web-app-with-azure-app-service/>

Publish a web app to Azure with Visual Studio (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/publish-azure-web-app-with-visual-studio/>

Deploy a website to Azure with Azure App Service (MS Learn, Learning Path, ~4.5 hr)

<https://docs.microsoft.com/en-us/learn/paths/deploy-a-website-with-azure-app-service/>

Create and publish an Express.js web application with Azure App Service and Visual Studio Code (MS Learn, Module, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/publish-express-node-app-service-vscode/>

Create an Azure App Service background task by using WebJobs

References

Run background tasks with WebJobs in Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/webjobs-create>

Get started with the Azure WebJobs SDK for event-driven background processing

<https://docs.microsoft.com/en-us/azure/app-service/webjobs-sdk-get-started>

Compare Azure Functions and WebJobs

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-compare-logic-apps-ms-flow-webjobs#compare-functions-and-webjobs>

Hands-on

Azure/azure-webjobs-sdk (GitHub)

<https://github.com/Azure/azure-webjobs-sdk/tree/dev/sample/SampleHost>

microsoftgraph/webjobs-webhooks-sample (GitHub)

<https://github.com/microsoftgraph/webjobs-webhooks-sample>

Azure Web Jobs SDK

<https://github.com/Azure/azure-webjobs-sdk/wiki>

Learning

Run a background task in an App Service Web App with WebJobs (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/run-web-app-background-task-with-webjobs/>

Microsoft Azure Developer: Web Jobs (Pluralsight, ~1 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-web-jobs/table-of-contents>

Azure WebJobs (Videos)

<https://azure.microsoft.com/en-us/resources/videos/playlists/webjobs/>

Azure Serverless Computing Cookbook, Second Edition (e-book)

<https://azure.microsoft.com/en-us/resources/azure-serverless-computing-cookbook/>

Enable diagnostics logging

References

Azure App Service diagnostics overview

<https://docs.microsoft.com/en-us/azure/app-service/overview-diagnostics>

ASP.NET Core Logging with Azure App Service and Serilog

<https://devblogs.microsoft.com/aspnet/asp-net-core-logging/>

System.Diagnostics.Trace Application Logging Log Stream on Azure App Service Function App (Blog)

<https://docs.microsoft.com/en-us/archive/blogs/benjaminperkins/system-diagnostics-trace-application-logging-log-stream-on-azure-app-service-function-app>

Hands-on

How to view the event logs of your Azure App Service (Blog)

<https://docs.microsoft.com/en-us/archive/blogs/benjaminperkins/how-to-view-the-event-logs-of-your-azure-app-service>

Learning

Capture Web Application Logs with App Service Diagnostics Logging (MS Learn, Module, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/capture-application-logs-app-service/>

Create an Azure Web App for containers

References

Azure Web Apps for Containers

<https://azure.microsoft.com/en-us/services/app-service/containers/>

App Service on Linux Documentation

<https://docs.microsoft.com/en-us/azure/app-service/containers/>

Hands-on

Create an ASP.NET Core app in a Docker container from Docker Hub using Azure CLI

<https://docs.microsoft.com/en-us/azure/app-service/scripts/cli-linux-docker-aspnetcore?toc=%2fcli%2fazure%2ftoc.json>

Learning

Deploy and run a containerized web app with Azure App Service (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/deploy-run-container-app-service/>

Monitor service health by using Azure Monitor

References

What is Azure Monitor?

<https://docs.microsoft.com/en-us/azure/azure-monitor/overview>

Azure Monitor documentation

<https://docs.microsoft.com/en-us/azure/azure-monitor/>

Monitoring solutions in Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/insights/solutions>

Sources of monitoring data for Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/data-sources>

What is Application Insights?

<https://docs.microsoft.com/en-us/azure/azure-monitor/app/app-insights-overview>

Monitor Azure Functions

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-monitoring>

Hands-on

Start monitoring your website

<https://docs.microsoft.com/en-us/azure/azure-monitor/app/website-monitoring>

Start Monitoring Your ASP.NET Core Web Application

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/dotnetcore-quick-start>

Find and diagnose run-time exceptions with Azure Application Insights

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/tutorial-runtime-exceptions>

Find and diagnose performance issues with Azure Application Insights

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/tutorial-performance>

Monitor and alert on application health with Azure Application Insights

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/tutorial-alert>

Use Azure Application Insights to understand how customers are using your application

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/tutorial-users>

Create custom KPI dashboards using Azure Application Insights

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/tutorial-app-dashboards>

Learning

Instrument server-side web application code with Application Insights (MS Learn, Module, ~)

<https://docs.microsoft.com/en-us/learn/modules/instrument-web-app-code-with-application-insights/>

Capture and view page load times in your Azure web app with Application Insights (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/capture-page-load-times-application-insights/>

Create Azure App Service mobile apps

References

About Mobile Apps in Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-value-prop>

(Visual Studio App Center - <https://docs.microsoft.com/en-us/appcenter>)

Mobile Apps Documentation

<https://docs.microsoft.com/en-us/azure/app-service-mobile/>

Hands-on

Create an Android app

<https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-android-get-started>

Create an iOS app

<https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-ios-get-started>

Azure/azure-mobile-apps (GitHub)

<https://github.com/Azure/azure-mobile-apps>

Learning

App Center and the Future of Azure Mobile Apps | Xamarin Developer Summit (YouTube)

<https://www.youtube.com/watch?v=USQmInspKf0>

Add push notifications for mobile apps

References

What is Azure Notification Hubs?

<https://docs.microsoft.com/en-in/azure/notification-hubs/notification-hubs-push-notification-overview>

Enterprise push architectural guidance

<https://docs.microsoft.com/en-us/azure/notification-hubs/notification-hubs-enterprise-push-notification-architecture>

Hands-on

Azure Notification Hubs Samples

<https://docs.microsoft.com/en-in/azure/notification-hubs/samples>

Azure/azure-mobile-apps-quickstarts (GitHub)

<https://github.com/Azure/azure-mobile-apps-quickstarts>

Send cross-platform notifications to users with Notification Hubs

<https://docs.microsoft.com/en-in/azure/notification-hubs/notification-hubs-aspnet-cross-platform-notification>

Add push notifications to your Android app

<https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-android-get-started-push>

Add Push Notifications to your iOS App

<https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-ios-get-started-push>

Securely push notifications from Azure Notification Hubs

<https://docs.microsoft.com/en-us/azure/notification-hubs/notification-hubs-aspnet-backend-windows-dotnet-wns-secure-push-notification>

Azure/azure-notificationhubs-samples (GitHub)

<https://github.com/Azure/azure-notificationhubs-samples>

Learning

Using Azure Notification Hubs in an Android Application (C9, Video, ~20 min)

<https://channel9.msdn.com/Shows/Azure-Friday/Using-Azure-Notification-Hubs-in-an-Android-Application>

Enable offline sync for mobile app

References

Offline Data Sync in Azure Mobile Apps

<https://docs.microsoft.com/en-in/azure/app-service-mobile/app-service-mobile-offline-data-sync>

Hands-on

Enable offline syncing with iOS mobile apps

<https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-ios-get-started-offline-data>

Enable offline sync for your Android mobile app

<https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-android-get-started-offline-data>

microsoft/XamarinAzure_ShoppingDemoApp (GitHub)

https://github.com/Microsoft/XamarinAzure_ShoppingDemoApp/wiki/Offline-Data-Sync

Learning

Offline data sync overview (Lynda/LinkedIn Learning, Video, ~2 min)

<https://www.lynda.com/Azure-tutorials/Offline-data-sync-overview/584488/664055-4.html>

Implement a remote instrumentation strategy for mobile devices

References

Monitor apps in Azure App Service

<https://docs.microsoft.com/en-in/azure/app-service/web-sites-monitor>

Start analyzing your mobile app with App Center and Application Insights

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/mobile-center-quickstart>

Enable diagnostics logging for apps in Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/troubleshoot-diagnostic-logs>

Troubleshoot an app in Azure App Service using Visual Studio

<https://docs.microsoft.com/en-us/azure/app-service/troubleshoot-dotnet-visual-studio?toc=%2fazure%2fapp-service-mobile%2ftoc.json>

(Use TeamViewer to remotely administer Intune devices - <https://docs.microsoft.com/en-us/intune/remote-actions/teamviewer-support>)

Hands-on

Start analyzing your mobile app with App Center and Application Insights

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/mobile-center-quickstart>

Tutorial: Configure devices connected to your monitoring solution

<https://docs.microsoft.com/en-us/azure/iot-accelerators/iot-accelerators-remote-monitoring-manage>

Learning

Create Azure App Service API apps

References

Hands-on

Create a new Azure API Management service instance

<https://docs.microsoft.com/en-us/azure/api-management/get-started-create-service-instance>

Learning

Create an Azure App Service API app

References

Hands-on

Import and publish your first API

<https://docs.microsoft.com/en-us/azure/api-management/import-and-publish>

Tutorial: Host a RESTful API with CORS in Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/app-service-web-tutorial-rest-api>

Azure-Samples/dotnet-core-api (GitHub)

<https://github.com/Azure-Samples/dotnet-core-api>

Learning

Create documentation for the API by using open source and other tools

References

Announcing the preview of OpenAPI Specification v3 support in Azure API Management

<https://azure.microsoft.com/en-us/blog/announcing-the-preview-of-openapi-specification-v3-support-in-azure-api-management/>

OpenAPI Initiative

<https://www.openapis.org/>

Swagger (OpenAPI) documentation

<https://swagger.io/docs/>

Hands-on

microsoft/OpenAPI.NET (GitHub)

<https://github.com/Microsoft/OpenAPI.NET>

Azure/oav (GitHub, "OpenAPI Validator")

<https://github.com/Azure/oav>

Azure/azure-openapi-validator (GitHub, "OpenAPI Validator")

<https://github.com/Azure/azure-openapi-validator>

Import an OpenAPI specification (APIM)

<https://docs.microsoft.com/en-us/azure/api-management/import-api-from-oas>

Azure-Samples/app-service-api-dotnet-swashbuckle-swaggerresponse (GitHub)
<https://github.com/Azure-Samples/app-service-api-dotnet-swashbuckle-swaggerresponse>

Learning

Implement Azure functions

References

An introduction to Azure Functions
<https://docs.microsoft.com/en-us/azure/azure-functions/functions-overview>

Azure Functions scale and hosting
<https://docs.microsoft.com/en-us/azure/azure-functions/functions-scale#consumption-plan>

Azure Functions Premium plan
<https://docs.microsoft.com/en-us/azure/azure-functions/functions-premium-plan>

Compare Functions and WebJobs
<https://docs.microsoft.com/en-us/azure/azure-functions/functions-compare-logic-apps-ms-flow-webjobs#compare-functions-and-webjobs>

Deployment technologies in Azure Functions
<https://docs.microsoft.com/en-us/azure/azure-functions/functions-deployment-technologies>

Azure Functions developers guide
<https://docs.microsoft.com/en-us/azure/azure-functions/functions-reference>

Serverless Microservices reference architecture (GitHub, .zip)
<https://docs.microsoft.com/en-us/samples/azure-samples/serverless-microservices-reference-architecture/serverless-microservices-reference-architecture/>

Choose the right integration and automation services in Azure
<https://docs.microsoft.com/en-us/azure/azure-functions/functions-compare-logic-apps-ms-flow-webjobs>

Hands-on

Azure serverless community library
<https://www.serverlesslibrary.net/>

Azure Functions on Linux custom image tutorial sample project
<https://docs.microsoft.com/en-us/samples/azure-samples/functions-linux-custom-image/azure-functions-on-linux-custom-image-tutorial-sample-project/>

Learning

Create serverless logic with Azure Functions (MS Learn, Module, ~35 min)

<https://docs.microsoft.com/en-us/learn/modules/create-serverless-logic-with-azure-functions/>

Microsoft Azure Developer: Create Serverless Functions (Pluralsight, ~2.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-serverless-functions-create/table-of-contents>

Azure Functions (YouTube channel)

<https://www.youtube.com/c/AzureFunctions>

Implement input and output bindings for a function

References

Azure Functions triggers and bindings concepts

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-triggers-bindings>

Register Azure Functions binding extensions

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-bindings-register>

Azure Functions trigger and binding example

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-bindings-example>

Azure Functions reliable event processing

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-reliable-event-processing>

Hands-on

Create your first function in the Azure portal

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-create-first-azure-function>

Chain Azure Functions together using input and output bindings (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/chain-azure-functions-data-using-bindings/>

Learning

Implement function triggers by using data operations, timers, and webhooks

References

HTTP and webhooks

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-bindings-http-webhook?tabs=csharp#trigger>

Hands-on

Create a function triggered by Azure Cosmos DB

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-create-cosmos-db-triggered-function>

Create a function triggered by Azure Blob storage

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-create-storage-blob-triggered-function>

Create a function triggered by Azure Queue storage

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-create-storage-queue-triggered-function>

Create a function in Azure that is triggered by a timer

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-create-scheduled-function>

Azure-Samples – “functions” (GitHub)

<https://github.com/Azure-Samples?q=functions>

Learning

Execute an Azure Function with triggers (MS Learn, Module, ~1.5 hr)

<https://docs.microsoft.com/en-us/learn/modules/execute-azure-function-with-triggers/>

Monitor GitHub events by using a webhook with Azure Functions (MS Learn, Module, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/monitor-github-events-with-a-function-triggered-by-a-webhook/>

Implement Azure Durable Functions

References

What are Durable Functions?

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-overview?tabs=csharp>

Azure Durable Functions documentation

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/>

Durable Functions types and features

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-types-features-overview>

Eternal orchestrations in Durable Functions (Azure Functions)

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-eternal-orchestrations>

Developer's guide to durable entities in .NET

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-dotnet-entities>

How to run Durable Functions as WebJobs

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-webjobs-sdk>

Durable Functions billing

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-billing>

Hands-on

Retrieve opened issue count on GitHub with Azure Durable Functions (.NET)

<https://docs.microsoft.com/en-us/samples/azure-samples/durablefunctions-apiscraping-dotnet/retrieve-opened-issue-count-on-github-with-azure-durable-functions/>

Diagnostics in Durable Functions in Azure

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-diagnostics>

Function chaining in Durable Functions - Hello sequence sample

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-sequence>

Fan-out/fan-in scenario in Durable Functions - Cloud backup example

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-cloud-backup>

Monitor scenario in Durable Functions - Weather watcher sample

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-monitor>

Human interaction in Durable Functions - Phone verification sample

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-phone-verification>

Durable Functions publishing to Azure Event Grid (preview)

<https://docs.microsoft.com/en-us/azure/azure-functions/durable/durable-functions-event-publishing>

Learning

Create a long-running serverless workflow with Durable Functions (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/create-long-running-serverless-workflow-with-durable-functions/>

Break through the serverless barriers with Durable Functions (2018 build, Video, ~20 min)

<https://channel9.msdn.com/Events/dotnetConf/NET-Conf-2019/B206>

Create Azure Function apps by using Visual Studio

References

Develop Azure Functions using Visual Studio

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-develop-vs>

Develop Azure Functions by using Visual Studio Code

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-develop-vs-code?tabs=csharp>

Code and test Azure Functions locally

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-develop-local>

Hands-on

Create your first function using Visual Studio

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-create-your-first-function-visual-studio>

Complementary Code pattern sample - .NET/C# *cloud* workspace

<https://docs.microsoft.com/en-us/samples/azure-samples/iot-edge-complementary-code/complementary-code-pattern-sample---netc-cloud-workspace/>

Create an OpenAPI definition for a serverless API using Azure API Management

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-openapi-definition>

Learning

Develop, test, and publish Azure Functions by using Azure Functions Core Tools (MS Learn, Module, ~20 min)

<https://docs.microsoft.com/en-us/learn/modules/develop-test-deploy-azure-functions-with-core-tools/>

Develop, test, and deploy an Azure Function with Visual Studio (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/develop-test-deploy-azure-functions-with-visual-studio/>

Expose multiple Azure Function apps as a consistent API by using Azure API Management (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/build-serverless-api-with-functions-api-management/>

Implement Python Azure functions

References

Announcing the general availability of Python support in Azure Functions

<https://azure.microsoft.com/en-us/blog/announcing-the-general-availability-of-python-support-in-azure-functions/>

Hands-on

Tutorial: Create and deploy serverless Azure Functions in Python with Visual Studio Code

<https://docs.microsoft.com/en-us/azure/python/tutorial-vs-code-serverless-python-01>

Learning

Introduction to Python (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-python/>

Develop for Azure storage (15-20%)

Lab: Constructing a polyglot data solution (AZ-203 ILT, Module 3)

[https://github.com/MicrosoftLearning/AZ-203-](https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_03_lab.md)

[DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_03_lab.md](https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_03_lab.md)

Develop solutions that use storage tables

References

Introduction to Azure Storage

<https://docs.microsoft.com/en-us/azure/storage/common/storage-introduction>

Storage APIs, libraries, and tools

<https://docs.microsoft.com/en-us/azure/storage/common/storage-introduction#storage-apis-libraries-and-tools>

Azure Table storage overview

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-storage-overview>

Table service concepts

<https://docs.microsoft.com/en-us/rest/api/storageservices/table-service-concepts>

Table Service REST API

<https://docs.microsoft.com/en-us/rest/api/storageservices/table-service-rest-api>

Hands-on

Introduction to Azure Cosmos DB: Table API

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-introduction>

Azure Cosmos DB Table .NET API: Download and release notes

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-sdk-dotnet>

Learning

Architect storage infrastructure in Azure (MS Learn, Learning Path, ~4.5 hrs)

<https://docs.microsoft.com/en-us/learn/paths/architect-storage-infrastructure/>

Core Cloud Services - Azure data storage options (MS Learn, Module, ~25 min)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-data-in-azure/>

Choose a data storage approach in Azure (MS Learn, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/choose-storage-approach-in-azure/>

Create an Azure Storage account (MS Learn, Module, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/create-azure-storage-account/>

Microsoft Azure Developer: Implementing Table Storage (Pluralsight, ~1.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-table-storage-implementing/table-of-contents>

Design and implement policies for tables

References

Azure Table storage table design guide: Scalable and performant tables

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-storage-design-guide>

Security recommendations for Blob storage

<https://docs.microsoft.com/en-us/azure/storage/blobs/security-recommendations>

Grant limited access to Azure Storage resources using shared access signatures (SAS)

<https://docs.microsoft.com/en-us/azure/storage/common/storage-sas-overview>

Hands-on

Learning

Query table storage by using code

References

Developing with Azure Cosmos DB Table API and Azure Table storage

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-support>

Querying tables and entities (REST)

<https://docs.microsoft.com/en-us/rest/api/storageservices/querying-tables-and-entities>

Hands-on

Get started with Azure Cosmos DB Table API and Azure Table storage using the .NET SDK

<https://docs.microsoft.com/en-us/azure/cosmos-db/tutorial-develop-table-dotnet>

Getting Started with Azure Table Storage in .NET (Azure-Samples) [GitHub Archive]

<https://github.com/Azure-Samples/storage-table-dotnet-getting-started>

Learning

Store and Access NoSQL Data with Azure Cosmos DB and the Table API (MS Learn, Module ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/store-access-data-cosmos-table-api/>

Implement partitioning schemes

References

Azure Table storage table design guide: Scalable and performant tables

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-storage-design-guide>

Design a scalable partitioning strategy for Azure Table storage

<https://docs.microsoft.com/en-us/rest/api/storageservices/designing-a-scalable-partitioning-strategy-for-azure-table-storage>

Partitioning Azure table storage

<https://docs.microsoft.com/en-us/azure/architecture/best-practices/data-partitioning-strategies#partitioning-azure-table-storage>

Design for Query ("read heavy")

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-storage-design-guide#design-for-querying>

Design for Modification ("write heavy")

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-storage-design-guide#design-for-data-modification>

Scalability and performance targets for standard storage accounts

<https://docs.microsoft.com/en-us/azure/storage/common/scalability-targets-standard-account>

Hands-on

Azure Storage Explorer (Windows, MacOS, Linux)

<https://azure.microsoft.com/en-us/features/storage-explorer/>

Use the Azure storage emulator for development and testing

<https://docs.microsoft.com/en-us/azure/storage/common/storage-use-emulator>

Learning

Develop solutions that use Cosmos DB storage

References

Welcome to Azure Cosmos DB

<https://docs.microsoft.com/en-us/azure/cosmos-db/introduction>

Mike Stevens

Microsoft Azure Technical Trainer

linkedin.com/in/mikestevens

Last Updated: 17 January 2020

Page 35

Azure Cosmos DB documentation

<https://docs.microsoft.com/en-us/azure/cosmos-db/>

A technical overview of Azure Cosmos DB

<https://azure.microsoft.com/en-us/blog/a-technical-overview-of-azure-cosmos-db/>

Understanding the differences between NoSQL and relational databases

<https://docs.microsoft.com/en-us/azure/cosmos-db/relational-nosql>

Azure Cosmos DB as a key value store – cost overview

<https://docs.microsoft.com/en-us/azure/cosmos-db/key-value-store-cost>

Hands-on

Azure Cosmos DB – Visual Studio Code

<https://marketplace.visualstudio.com/items?itemName=ms-azuretools.vscode-cosmosdb>

<https://github.com/microsoft/vscode-cosmosdb>

Azure Cosmos DB Workshop (includes labs)

<https://cosmosdb.github.io/labs/>

<https://github.com/CosmosDB/labs>

Use the Azure Cosmos Emulator for local development and testing

<https://docs.microsoft.com/en-us/azure/cosmos-db/local-emulator>

Estimate RU/s using the Azure Cosmos DB capacity planner

<https://docs.microsoft.com/en-us/azure/cosmos-db/estimate-ru-with-capacity-planner>

Learning

Learning Azure Cosmos DB (Pluralsight, ~6 hr)

<https://app.pluralsight.com/library/courses/azure-cosmos-db/table-of-contents>

Azure Cosmos DB (YouTube channel)

https://www.youtube.com/channel/UC9OJ32CzooNJNoP6_ilfxRw

The TLA+ Video Course

<https://aka.ms/tla>

Create, read, update, and delete data by using appropriate APIs

References

Work with databases, containers, and items in Azure Cosmos DB

<https://docs.microsoft.com/en-us/azure/cosmos-db/databases-containers-items>

Mike Stevens

Microsoft Azure Technical Trainer

[linkedin.com/in/mikestevens](https://www.linkedin.com/in/mikestevens)

Last Updated: 17 January 2020

Page 36

Indexing in Azure Cosmos DB – Overview

<https://docs.microsoft.com/en-us/azure/cosmos-db/index-overview>

SQL (Core) API

<https://docs.microsoft.com/azure/cosmos-db/sql-api-introduction>

SQL Syntax

<https://docs.microsoft.com/azure/cosmos-db/sql-api-sql-query-reference>

JavaScript in the SQL API

<https://docs.microsoft.com/azure/cosmos-db/programming>

.NET SDK

<https://docs.microsoft.com/azure/cosmos-db/tutorial-develop-sql-api-dotnet>

Java Async SDK

<https://docs.microsoft.com/en-us/azure/cosmos-db/sql-api-sdk-async-java>

Introduction to the Azure Cosmos DB Cassandra API

<https://docs.microsoft.com/en-us/azure/cosmos-db/cassandra-introduction>

Azure Cosmos DB's API for MongoDB

<https://docs.microsoft.com/en-us/azure/cosmos-db/mongodb-introduction>

Introduction to Azure Cosmos DB: Gremlin API

<https://docs.microsoft.com/en-us/azure/cosmos-db/graph-introduction>

Introduction to Azure Cosmos DB: Table API

<https://docs.microsoft.com/en-us/azure/cosmos-db/table-introduction>

Introduction to the Azure Cosmos DB etcd API (preview)

<https://docs.microsoft.com/en-us/azure/cosmos-db/etcd-api-introduction>

Hands-on

Lab: Visualizing Real-Time Data Analysis with Cosmos DB Change Feed

Azure-Samples/azure-cosmos-db-change-feed-dotnet-retail-sample

<https://github.com/Azure-Samples/azure-cosmos-db-change-feed-dotnet-retail-sample>

<https://www.youtube.com/watch?v=AYOiMkxIz0>

Azure-Samples/cosmos-dotnet-getting-started

<https://github.com/Azure-Samples/cosmos-dotnet-getting-started>

Azure-Samples/azure-cosmos-db-change-feed-dotnet-retail-sample

<https://github.com/Azure-Samples/azure-cosmos-db-change-feed-dotnet-retail-sample>

How to write stored procedures, triggers, and user-defined functions in Azure Cosmos DB
<https://docs.microsoft.com/en-us/azure/cosmos-db/how-to-write-stored-procedures-triggers-udfs>

Learning

Choose the appropriate API for Azure Cosmos DB storage (MS Learn, Module, ~40 min)
<https://docs.microsoft.com/en-us/learn/modules/choose-api-for-cosmos-db/>

Insert and query data in your Azure Cosmos DB database (MS Learn, Module, ~1 hr)
<https://docs.microsoft.com/en-us/learn/modules/access-data-with-cosmos-db-and-sql-api/>

Build a .NET Core app for Azure Cosmos DB in Visual Studio Code (MS Learn, Module, ~55 min)
<https://docs.microsoft.com/en-us/learn/modules/build-cosmos-db-app-with-vscode/>

Build a Node.js app for Azure Cosmos DB in Visual Studio Code (MS Learn, Module, ~1 hr)
<https://docs.microsoft.com/en-us/learn/modules/build-node-cosmos-app-vscode/>

Store and access graph data in Azure Cosmos DB with the Graph API (MS Learn, Module, ~40 min)
<https://docs.microsoft.com/en-us/learn/modules/store-access-data-cosmos-graph-api/>

Introduction to open source database migration to Azure Cosmos DB (MS Learn, Module, ~25 min)
<https://docs.microsoft.com/en-us/learn/modules/introduction-open-source-database-migration-azure-cosmos-db/>

Migrate Cassandra workloads to Cosmos DB (MS Learn, Module, ~20 min)
<https://docs.microsoft.com/en-us/learn/modules/migrate-cassandra-workloads-cosmos-db/>

Work with NoSQL data in Azure Cosmos DB (MS Learn, Learning Path, ~6 hr)
<https://docs.microsoft.com/en-us/learn/paths/work-with-nosql-data-in-azure-cosmos-db/>

Implement partitioning schemes

References

Partitioning in Azure Cosmos DB
<https://docs.microsoft.com/en-us/azure/cosmos-db/partitioning-overview>

Partitioning and horizontal scaling in Azure Cosmos DB
<https://docs.microsoft.com/en-us/azure/cosmos-db/partition-data>

Create a synthetic partition key
<https://docs.microsoft.com/en-us/azure/cosmos-db/synthetic-partition-keys>

Hands-on

Microsoft Azure | Partition Key Advisor

<https://partitionkeyadvisor.azurewebsites.net/>

Azure Cosmos DB Partition Key Advisor [VIDEO]

<https://www.youtube.com/watch?v=9v6WbCOzPiM>

Learning

Create an Azure Cosmos DB database built to scale (MS Learn, Module, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/create-cosmos-db-for-scale/>

Optimize the performance of Azure Cosmos DB by using partitioning and indexing strategies (MS Learn, Module, ~1.25 hr)

<https://docs.microsoft.com/en-us/learn/modules/monitor-and-scale-cosmos-db/>

Azure Cosmos DB partitioning design patterns – Part 1

<https://azure.microsoft.com/en-us/blog/azure-cosmos-db-partitioning-design-patterns-part-1/>

Set the appropriate consistency level for operations

References

Consistency levels in Azure Cosmos DB

<https://docs.microsoft.com/en-us/azure/cosmos-db/consistency-levels>

Consistency, availability, and performance tradeoffs

<https://docs.microsoft.com/en-us/azure/cosmos-db/consistency-levels-tradeoffs>

Choose the right consistency level

<https://docs.microsoft.com/en-us/azure/cosmos-db/consistency-levels-choosing>

Global data distribution with Azure Cosmos DB – overview

<https://docs.microsoft.com/en-us/azure/cosmos-db/distribute-data-globally>

Global data distribution with Azure Cosmos DB - under the hood

<https://docs.microsoft.com/en-us/azure/cosmos-db/global-dist-under-the-hood>

Performance and scale testing with Azure Cosmos DB

<https://docs.microsoft.com/en-us/azure/cosmos-db/performance-testing>

Hands-on

Learning

Distribute your data globally with Azure Cosmos DB (MS Learn, Module, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/distribute-data-globally-with-cosmos-db/>

Azure Cosmos DB - Tunable Consistency Models (YouTube, ~17 min)

<https://www.youtube.com/watch?v=-4FsGysVD14>

Develop solutions that use a relational database

References

What is the Azure SQL Database service?

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-technical-overview>

Azure SQL Database documentation

<https://docs.microsoft.com/en-us/azure/sql-database/>

Azure SQL Database Features

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-features>

SQL tools overview

<https://docs.microsoft.com/en-us/sql/tools/overview-sql-tools?view=sql-server-ver15>

Migrate your relational databases to Azure

<https://docs.microsoft.com/en-us/dotnet/architecture/modernize-with-azure-containers/migrate-your-relational-databases-to-azure>

Hands-on

Azure/azure-sql-database-samples

<https://github.com/Azure/azure-sql-database-samples>

dotnet-architecture/eShopModernizing (GitHub)

<https://github.com/dotnet-architecture/eShopModernizing>

SQL Server (mssql) – Visual Studio Code

<https://marketplace.visualstudio.com/items?itemName=ms-mssql.mssql>

Build an app using SQL Server (c#, java, node, php, python, ruby, Go)

<https://www.microsoft.com/en-us/sql-server/developer-get-started>

Download and install Azure Data Studio

<https://docs.microsoft.com/en-us/sql/azure-data-studio/download-azure-data-studio?view=sql-server-ver15>

Download SQL Server Management Studio (SSMS)

<https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-ver15>

Learning

Azure for the Data Engineer (MS Learn, Learning Path, ~2 hr)

<https://docs.microsoft.com/en-us/learn/paths/azure-for-the-data-engineer/>

Microsoft Azure Developer: Managing Azure SQL Database (Pluralsight, ~2 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-sql-database-managing/table-of-contents>

Provision and configure relational databases

References

Choose the right deployment option in Azure SQL

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-paas-vs-sql-server-iaas>

Azure Database Migration Service documentation

<https://docs.microsoft.com/en-us/azure/dms/>

Services and tools available for data migration scenarios

<https://docs.microsoft.com/en-us/azure/dms/dms-tools-matrix>

az sql – Azure SQL CLI documentation

<https://docs.microsoft.com/en-us/cli/azure/sql?view=azure-cli-latest>

Hands-on

How to use Azure SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-howto>

Getting started with single databases in Azure SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-single-database-quickstart-guide>

Getting started with Azure SQL Database managed instance

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-managed-instance-quickstart-guide>

Azure CLI samples for Azure SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-cli-samples?tabs=single-database>

Tutorial: Design a relational database in a single database within Azure SQL Database C# and ADO.NET
<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-design-first-database-csharp>

How to Set up the Adventureworks Sample Data on Microsoft Azure SQL Database in a Couple of Minutes
<https://social.technet.microsoft.com/wiki/contents/articles/25957.how-to-set-up-the-adventureworks-sample-data-on-microsoft-azure-sql-database-in-a-couple-of-minutes.aspx>

Quickstart: Import a BACPAC file to a database in Azure SQL Database
<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-import?tabs=azure-powershell>

Export an Azure SQL database to a BACPAC file
<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-export>

Microsoft Data Migration Assistant v5.0 (DMA)
<https://www.microsoft.com/en-us/download/details.aspx?id=53595>

Learning

Provision an Azure SQL database to store application data (MS Learn, Module, ~50 min)
<https://docs.microsoft.com/en-us/learn/modules/provision-azure-sql-db/>

Back up and restore your Azure SQL database (MS Learn, Module, ~40 min)
<https://docs.microsoft.com/en-us/learn/modules/backup-restore-azure-sql/>

Store data in Azure *MS Learn, Learning Path, ~4 hr)
<https://docs.microsoft.com/en-us/learn/paths/store-data-in-azure/>

Professional Azure SQL Database Administration (e-book)
<https://azure.microsoft.com/en-us/resources/professional-azure-sql-database-administration/>

Configure elastic pools for Azure SQL Database

References

Manage elastic pools in Azure SQL Database
<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-elastic-pool-manage>

Elastic pools help you manage and scale multiple Azure SQL databases
<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-elastic-pool>

Azure SQL Elastic Pools – Customer Case Studies
<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-elastic-pool#customer-case-studies>

Hands-on

Use PowerShell to monitor and scale an elastic pool in Azure SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/scripts/sql-database-monitor-and-scale-pool-powershell>

Introduction to a multitenant SaaS app that uses the database-per-tenant pattern with SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/saas-dbpertenant-wingtip-app-overview>

Learning

Scale multiple Azure SQL Databases with SQL elastic pools (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/scale-sql-databases-elastic-pools/>

Azure SQL Database Elastic Pools and Elastic Jobs (Cp, Video, ~24 min)

<https://channel9.msdn.com/Shows/Data-Exposed/Azure-SQL-Database-Elastic-Pools>

Create, read, update, and delete data tables by using code

References

Connection modules for Microsoft SQL databases

<https://docs.microsoft.com/en-us/sql/connect/sql-connection-libraries?view=sql-server-ver15>

Entity Framework Core

<https://docs.microsoft.com/en-us/ef/core/>

Querying Data (EF Core)

<https://docs.microsoft.com/en-us/ef/core/querying/>

Azure SQL REST API - Operations - List

<https://docs.microsoft.com/en-us/rest/api/sql/operations/list>

Transact-SQL Reference (Database Engine)

<https://docs.microsoft.com/en-us/sql/t-sql/language-reference?view=sql-server-ver15>

Hands-on

Quickstart: Use the Azure portal's SQL query editor to connect and query data

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-connect-query-portal>

Quickstart: Use Visual Studio Code to connect and query an Azure SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-connect-query-vscode>

How to use a single database in Azure SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-howto-single-database>

Query the database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-single-database-get-started?tabs=azure-portal#query-the-database>

Quickstart: Use .NET and C# in Visual Studio to connect to and query an Azure SQL database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-connect-query-dotnet-visual-studio>

Quickstart: Use .NET Core (C#) to query an Azure SQL database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-connect-query-dotnet-core>

Build an ASP.NET Core and SQL Database app in Azure App Service on Linux

<https://docs.microsoft.com/en-us/azure/app-service/containers/tutorial-dotnetcore-sqlldb-app>

Azure-Samples/dotnet-sqlldb-tutorial (see above for walkthru)

<https://github.com/Azure-Samples/dotnet-sqlldb-tutorial>

Azure SQL Database REST API

<https://docs.microsoft.com/en-us/rest/api/sql/>

Public data sets for testing and prototyping

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-public-data-sets>

Tutorial: Deploy your ASP.NET app and Azure SQL Database code by using Azure DevOps Projects

<https://docs.microsoft.com/en-us/azure/devops-project/azure-devops-project-sql-database>

Learning

Develop and configure an ASP.NET application that queries an Azure SQL database (MS Learn, Module, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/develop-app-that-queries-azure-sql/>

Work with relational data in Azure *MS Learn, Learning Path, ~4 hr)

<https://docs.microsoft.com/en-us/learn/paths/work-with-relational-data-in-azure/>

Getting Started with Entity Framework Core (C9, 5 videos, ~31 min total)

https://channel9.msdn.com/Series/Entity-Framework-Core-101/?WT.mc_id=EducationalEF-c9-niner

How to connect to Azure SQL Database from Azure Data Studio (C9, Video, ~3 min)

<https://channel9.msdn.com/Shows/Data-Exposed/How-to-connect-to-Azure-SQL-Database-from-Azure-Data-Studio>

Provision and configure Azure SQL Database serverless instances

References

Azure SQL Database serverless

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-serverless>

Azure SQL Database serverless – scenarios

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-serverless#scenarios>

Hands-on

How to migrate your SQLite database to Azure SQL Database Serverless

<https://docs.microsoft.com/en-us/azure/sql-database/tutorial-sqlite-db-to-azure-sql-serverless-offline>

Learning

Azure SQL Database Serverless (YouTube, ~12 min)

<https://www.youtube.com/watch?v=2ykwUOfEPoU>

Azure SQL Database serverless: Providing autoscaling and optimized price-performance | BRK2011 (YouTube, ~40 min)

https://www.youtube.com/watch?v=4qsHoX_n4SI

How to switch an existing Azure SQL Database from Provisioned Compute to Serverless (C9, Video, ~2 min)

<https://channel9.msdn.com/Shows/Data-Exposed/How-to-switch-an-existing-Azure-SQL-Database-from-Provisioned-Compute-to-Serverless>

Provision and configure Azure SQL and Azure PostgreSQL Hyperscale instances

References

Azure SQL Hyperscale service tier

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-service-tier-hyperscale>

Azure SQL Database Hyperscale FAQ

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-service-tier-hyperscale-faq>

Introducing Hyperscale (Citus) on Azure Database for PostgreSQL

<https://www.citusdata.com/blog/2019/05/06/introducing-hyperscale-citus-on-azure-database-for-postgres/>

Azure Database for PostgreSQL - Hyperscale (Citus)

<https://docs.microsoft.com/en-us/azure/postgresql/overview#azure-database-for-postgresql---hyperscale-citus>

Nodes in Azure Database for PostgreSQL – Hyperscale (Citus)

<https://docs.microsoft.com/en-us/azure/postgresql/concepts-hyperscale-nodes>

Distributed data in Azure Database for PostgreSQL – Hyperscale (Citus)

<https://docs.microsoft.com/en-us/azure/postgresql/concepts-hyperscale-distributed-data>

Choose distribution columns in Azure Database for PostgreSQL – Hyperscale (Citus)

<https://docs.microsoft.com/en-us/azure/postgresql/concepts-hyperscale-choose-distribution-column>

Hands-on

Quickstart: Create an Azure Database for PostgreSQL - Hyperscale (Citus) in the Azure portal

<https://docs.microsoft.com/en-us/azure/postgresql/quickstart-create-hyperscale-portal>

Tutorial: design a multi-tenant database by using Azure Database for PostgreSQL – Hyperscale (Citus)

<https://docs.microsoft.com/en-us/azure/postgresql/tutorial-design-database-hyperscale-multi-tenant>

Tutorial: Design a real-time analytics dashboard by using Azure Database for PostgreSQL – Hyperscale (Citus)

<https://docs.microsoft.com/en-us/azure/postgresql/tutorial-design-database-hyperscale-realtime>

citusdata/citus (GitHub)

<https://github.com/citusdata/citus>

Learning

What is Azure SQL Database Hyperscale? (YouTube, ~17 min)

<https://www.youtube.com/watch?v=Z9AFnKI7sfl>

Azure SQL Database Hyperscale (YouTube, ~12 min)

https://www.youtube.com/watch?v=rI_Mt0IHzi0

Create an Azure Database for PostgreSQL server (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/create-azure-db-for-postgresql-server/>

Unleash analytics on operational data with Hyperscale (Citus) on Azure Database for PostgreSQL (YouTube, ~4 min)

<https://www.youtube.com/watch?v=-cbT64D9Kfk>

Develop solutions that use blob storage

References

Storage account overview

<https://docs.microsoft.com/en-us/azure/storage/common/storage-account-overview?toc=%2fazure%2fstorage%2fblobs%2ftoc.json>

What is Azure Blob storage?

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blobs-overview>

Introduction to Azure Blob storage

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blobs-introduction>

Understanding block blobs, append blobs, and page blobs

<https://docs.microsoft.com/en-us/rest/api/storageservices/understanding-block-blobs--append-blobs--and-page-blobs>

Blob service REST API

<https://docs.microsoft.com/en-us/rest/api/storageservices/blob-service-rest-api>

az storage – Azure Storage CLI documentation

<https://docs.microsoft.com/en-us/cli/azure/storage?view=azure-cli-latest>

Azure.Storage – Azure Storage PowerShell documentation

<https://docs.microsoft.com/en-us/powershell/module/azure.storage/?view=azurermps-6.13.0>

Azure Storage .NET

<https://docs.microsoft.com/en-us/dotnet/api/overview/azure/storage/client?view=azure-dotnet>

Hands-on

Azure Blob code samples

<https://docs.microsoft.com/en-us/samples/browse/?products=azure&term=blob>

Quickstart: Use Azure Storage Explorer to create a blob

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-quickstart-blobs-storage-explorer>

Azure-Samples/storage-blob-dotnet-getting-started (GitHub)

<https://github.com/Azure-Samples/storage-blob-dotnet-getting-started/blob/master/BlobStorage/Advanced.cs#L1144>

Quickstart: Azure Blob storage client library v12 for .NET

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-quickstart-blobs-dotnet>

Tutorial: Upload image data in the cloud with Azure Storage

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-upload-process-images?tabs=dotnet>

Tutorial: Optimize storage application performance and scalability

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-scalable-app-create-vm>

Azure Storage samples using .NET

<https://docs.microsoft.com/en-us/azure/storage/common/storage-samples-dotnet?toc=%2fazure%2fstorage%2fblobs%2ftoc.json>

Microsoft.Azure.Storage.Common – NuGet

<https://www.nuget.org/packages/Microsoft.Azure.Storage.Common/>

Host a static website in Azure Storage

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-static-website-how-to?tabs=azure-portal>

Learning

Connect an app to Azure Storage (MS Learn, Module, ~1.25 hr)

<https://docs.microsoft.com/en-us/learn/modules/connect-an-app-to-azure-storage/>

Store application data with Azure Blob storage (MS Learn, Module, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/store-app-data-with-azure-blob-storage/>

Leverage Azure Blob Storage to build storage intensive cloud native applications (C9, Video, 1.25 hr)

<https://channel9.msdn.com/events/Build/2018/BRK3313>

Azure Blob Storage: Scalable, efficient storage for PBs of unstructured data (C9, Video, ~1.25 hr)

<https://channel9.msdn.com/events/Ignite/Microsoft-Ignite-Orlando-2017/BRK2256>

Microsoft Azure Developer: Implementing Blob Storage (Pluralsight, ~4 hrs)

<https://app.pluralsight.com/library/courses/microsoft-azure-blob-storage-implementing/table-of-contents>

Creating and Configuring Microsoft Azure Storage Accounts (Pluralsight, ~3.75 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-creating-configuring-storage-accounts/table-of-contents>

Move items in Blob storage between storage accounts or containers

References

Migrate blobs across storage accounts using AzCopy on Windows

<https://docs.microsoft.com/en-us/azure/storage/scripts/storage-common-transfer-between-storage-accounts>

Get started with AzCopy (Windows, MacOS, Linux)

<https://docs.microsoft.com/en-us/azure/storage/common/storage-use-azcopy-v10>

Frequently asked questions about Azure Storage migration

<https://docs.microsoft.com/en-us/azure/storage/common/storage-migration-faq>

Hands-on

Tutorial: Migrate on-premises data to cloud storage with AzCopy

<https://docs.microsoft.com/en-us/azure/storage/common/storage-use-azcopy-migrate-on-premises-data?toc=%2Fazure%2Fstorage%2Fblobs%2Ftoc.json&tabs=windows>

Learning

Copy and move blobs from one container or storage account to another from the command line and in code (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/copy-blobs-from-command-line-and-code/>

Core Cloud Services - Set up CORS for your website and storage assets (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/set-up-cors-website-storage/>

Set and retrieve properties and metadata

References

Naming and Referencing Containers, Blobs, and Metadata

<https://docs.microsoft.com/en-us/rest/api/storageservices/naming-and-referencing-containers--blobs--and-metadata>

Manage container properties and metadata with .NET

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-container-properties-metadata>

Setting and retrieving properties and metadata for Blob service resources

<https://docs.microsoft.com/en-us/rest/api/storageservices/setting-and-retrieving-properties-and-metadata-for-blob-resources>

Get Container Properties (REST API)

<https://docs.microsoft.com/en-us/rest/api/storageservices/get-container-properties>

Get Container Metadata (REST API)

<https://docs.microsoft.com/en-us/rest/api/storageservices/get-container-metadata>

Set Container Metadata (REST API)

<https://docs.microsoft.com/en-us/rest/api/storageservices/set-container-metadata>

Azure.Storage.Blobs Namespace .NET

<https://docs.microsoft.com/en-us/dotnet/api/azure.storage.blobs?view=azure-dotnet>

Hands-on

Azure-Samples/storage-blob-dotnet-getting-started (GitHub, Advanced.cs)

<https://github.com/Azure-Samples/storage-blob-dotnet-getting-started>

Learning

Organize Azure storage blobs with properties and metadata (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/organize-blobs-properties-metadata/>

Implement blob leasing

References

az storage blob lease – CLI documentation

<https://docs.microsoft.com/en-us/cli/azure/storage/blob/lease?view=azure-cli-latest>

Lease Blob (REST API)

<https://docs.microsoft.com/en-us/rest/api/storageservices/lease-blob>

Hands-on

Learning

Support concurrency in Blob storage apps with ETags and blob leases (MS Learn, Module, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/support-concurrency-blob-storage/>

Microsoft Azure Fundamentals: Storage and Data: (16) How Do I: Lease a Blob to Update It (C9,Video, ~5 min)

<https://channel9.msdn.com/Series/Microsoft-Azure-Fundamentals-Storage-and-Data/16>

Implement data archiving and retention

References

Azure Blob storage: hot, cool, and archive access tiers

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-storage-tiers?tabs=azure-portal>

Rehydrate blob data from the archive tier

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-rehydration?tabs=azure-portal>

Azure Storage Access Tiers - FAQ

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-storage-tiers?tabs=azure-portal#faq>

Manage the Azure Blob storage lifecycle

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-lifecycle-management-concepts?tabs=azure-portal>

Store business-critical blob data with immutable storage

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-immutable-storage>

Hands-on

Learning

Optimize storage performance and costs using Blob storage tiers (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/optimize-archive-costs-blob-storage/>

Implement Geo Zone Redundant storage

References

Azure Storage redundancy

<https://docs.microsoft.com/en-us/azure/storage/common/storage-redundancy?toc=%2fazure%2fstorage%2fblobs%2ftoc.json>

Build highly available applications with zone-redundant storage (ZRS)

<https://docs.microsoft.com/en-us/azure/storage/common/storage-redundancy-zrs>

Build highly available Azure Storage applications with geo-zone-redundant storage (GZRS) (preview)

<https://docs.microsoft.com/en-us/azure/storage/common/storage-redundancy-gzrs?toc=%2fazure%2fstorage%2fblobs%2ftoc.json>

Business continuity and disaster recovery (BCDR): Azure Paired Regions (Cross-region activities, Storage)

<https://docs.microsoft.com/en-us/azure/best-practices-availability-paired-regions#cross-region-activities>

Storage account overview

<https://docs.microsoft.com/en-us/azure/storage/common/storage-account-overview>

Hands-on

Learning

Implement Azure security (10-15%)

Lab: Access resource secrets securely across services (AZ-203 ILT, Module 4)

https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_04_lab_ak.md

Manage security operations in Azure (MS Learn, Learning Path, ~7 hr)

<https://docs.microsoft.com/en-us/learn/paths/manage-security-operations/>

Design for security in Azure (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/design-for-security-in-azure/>

Secure your cloud applications in Azure (MS Learn, Learning Path, ~6 hr)

<https://docs.microsoft.com/en-us/learn/paths/secure-your-cloud-apps/>

Secure and isolate access to Azure resources by using network security groups and service endpoints (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/secure-and-isolate-with-nsg-and-service-endpoints/>

Implement authentication

References

Authentication basics

<https://docs.microsoft.com/en-us/azure/active-directory/develop/authentication-scenarios>

What methods are available for authentication?

<https://docs.microsoft.com/en-us/azure/active-directory/authentication/overview-authentication>

What is Azure Active Directory?

<https://docs.microsoft.com/en-us/azure/active-directory/fundamentals/active-directory-what-is>

Azure Active Directory documentation

<https://docs.microsoft.com/en-us/azure/active-directory/>

Authentication and authorization in Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/overview-authentication-authorization>

Application and service principal objects in Azure Active Directory

<https://docs.microsoft.com/en-us/azure/active-directory/develop/app-objects-and-service-principals>

How and why applications are added to Azure AD

<https://docs.microsoft.com/en-us/azure/active-directory/develop/active-directory-how-applications-are-added>

Tenancy in Azure Active Directory

<https://docs.microsoft.com/en-us/azure/active-directory/develop/single-and-multi-tenant-apps>

Azure Active Directory Graph API

<https://docs.microsoft.com/en-us/azure/active-directory/develop/active-directory-graph-api>

Hands-on

Learning

Getting Started with Microsoft Identity (MNS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/getting-started-identity/>

Implement Microsoft identity – Associate (MS Learn, Learning Path, ~3 hr)

<https://docs.microsoft.com/en-us/learn/paths/m365-identity-associate/>

Managing Microsoft Azure Active Directory (Pluralsight, ~3 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-managing-active-directory/table-of-contents>

Azure Authentication Fundamentals (YouTube, >6 videos)

<https://www.youtube.com/user/windowsazure/search?query=%22Authentication+fundamentals%3A%22>

Implement authentication by using certificates, forms-based authentication, or tokens

References

Get started with certificate-based authentication in Azure Active Directory

<https://docs.microsoft.com/en-us/azure/active-directory/authentication/active-directory-certificate-based-authentication-get-started>

Hands-on

Learning

Implement multi-factor or Windows authentication by using Azure AD

References

How it works: Azure Multi-Factor Authentication

<https://docs.microsoft.com/en-us/azure/active-directory/authentication/concept-mfa-howitworks>

Configure Azure Multi-Factor Authentication Server for IIS web apps

<https://docs.microsoft.com/en-us/azure/active-directory/authentication/howto-mfaserver-iis>

When to use an Azure Multi-Factor Authentication Provider

<https://docs.microsoft.com/en-us/azure/active-directory/authentication/concept-mfa-authprovider>

Hands-on

Tutorial: Complete an Azure Multi-Factor Authentication pilot roll out

<https://docs.microsoft.com/en-us/azure/active-directory/authentication/tutorial-mfa-applications>

Azure Active Directory – code samples

<https://docs.microsoft.com/en-us/samples/browse/?products=azure&term=aad>

Tutorial: Authenticate and authorize users end-to-end in Azure App Service

<https://docs.microsoft.com/en-us/azure/app-service/app-service-web-tutorial-auth-aad>

Learning

Secure Azure Active Directory users with Multi-Factor Authentication (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/secure-aad-users-with-mfa/index>

Implement OAuth2 authentication

References

OAuth 2.0 and OpenID Connect protocols on the Microsoft identity platform

<https://docs.microsoft.com/en-us/azure/active-directory/develop/active-directory-v2-protocols>

The OAuth 2.0 Authorization Framework

<https://tools.ietf.org/html/rfc6749>

OpenID Connect 1.0 (simple identity layer on top of the OAuth 2.0 protocol)

https://openid.net/specs/openid-connect-core-1_0.html

An Illustrated Guide to OAuth and OpenID Connect (Okta)

<https://developer.okta.com/blog/2019/10/21/illustrated-guide-to-oauth-and-oidc>

7 Ways an OAuth Access Token is like a Hotel Key Card (Okta)

<https://developer.okta.com/blog/2019/06/05/seven-ways-an-oauth-access-token-is-like-a-hotel-key-card>

What is the OAuth 2.0 Bearer Token exactly?

<https://stackoverflow.com/questions/25838183/what-is-the-oauth-2-0-bearer-token-exactly>

Hands-on

Azure-Samples/active-directory-dotnet-webapp-webapi-oauth2-useridentity (GitHub)

<https://github.com/Azure-Samples/active-directory-dotnet-webapp-webapi-oauth2-useridentity>

Azure-Samples/active-directory-dotnet-webapp-webapi-oauth2-appidentity (GitHub)

<https://github.com/Azure-Samples/active-directory-dotnet-webapp-webapi-oauth2-appidentity>

Azure-Samples/active-directory-aspnetcore-webapp-openidconnect-v2 (GitHub)

<https://github.com/Azure-Samples/active-directory-aspnetcore-webapp-openidconnect-v2>

Calling a web API in a web app using Azure AD and OpenID Connect

<https://docs.microsoft.com/en-us/samples/azure-samples/active-directory-dotnet-webapp-webapi-openidconnect/active-directory-dotnet-webapp-webapi-openidconnect/>

Tutorial: Create an Azure Active Directory B2C tenant

<https://aka.ms/az-203/security/B2C>

Learning

How to Call the Azure REST APIs with Postman In No Time Flat (Jon Gallant)

<https://blog.jongallant.com/2017/11/azure-rest-apis-postman/>

<https://www.youtube.com/watch?v=TCuEKpsB-MQ>

Secure your application by using OpenID Connect and Azure AD (MS Learn, Module, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/secure-app-with-oidc-and-azure-ad/index>

Implement Managed identities/Service Principal authentication

References

What is managed identities for Azure resources?

<https://docs.microsoft.com/en-us/azure/active-directory/managed-identities-azure-resources/overview>

How does the managed identities for Azure resources work?

<https://docs.microsoft.com/en-us/azure/active-directory/managed-identities-azure-resources/overview#how-does-the-managed-identities-for-azure-resources-work>

Services that support managed identities for Azure resources

<https://docs.microsoft.com/en-us/azure/active-directory/managed-identities-azure-resources/services-support-managed-identities>

Hands-on

Use a Windows VM system-assigned managed identity to access Resource Manager

<https://docs.microsoft.com/en-us/azure/active-directory/managed-identities-azure-resources/tutorial-windows-vm-access-arm>

Assign a managed identity access to a resource using Azure CLI

<https://docs.microsoft.com/en-us/azure/active-directory/managed-identities-azure-resources/howto-assign-access-cli>

View the service principal of a managed identity in the Azure portal

<https://docs.microsoft.com/en-us/azure/active-directory/managed-identities-azure-resources/how-to-view-managed-identity-service-principal-portal>

Create, list or delete a user-assigned managed identity using REST API calls

<https://docs.microsoft.com/en-us/azure/active-directory/managed-identities-azure-resources/how-to-manage-ua-identity-rest>

Authenticate a managed identity with Azure Active Directory to access Azure Service Bus resources

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-managed-service-identity?context=azure/active-directory/managed-identities-azure-resources/context/msi-context>

How to use managed identities for App Service and Azure Functions

<https://docs.microsoft.com/en-us/azure/app-service/overview-managed-identity?tabs=dotnet>

Managed identities for Azure resources with Event Hubs

<https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-managed-service-identity?context=azure/active-directory/managed-identities-azure-resources/context/msi-context>

Preview - Use managed identities in Azure Kubernetes Service

<https://docs.microsoft.com/en-us/azure/aks/use-managed-identity>

How to use managed identities with Azure Container Instances

<https://docs.microsoft.com/en-us/azure/container-instances/container-instances-managed-identity?context=azure/active-directory/managed-identities-azure-resources/context/msi-context>

Azure-Samples/app-service-msi-keyvault-dotnet (GitHub)

<https://github.com/Azure-Samples/app-service-msi-keyvault-dotnet>

Azure-Samples/app-service-managed-identity-key-vault-csharp (GitHub)

<https://github.com/Azure-Samples/app-service-managed-identity-key-vault-csharp>

Azure-Samples/app-service-msi-servicebus-dotnet (GitHub)

<https://github.com/Azure-Samples/app-service-msi-servicebus-dotnet>

Learning

Azure AD Managed Service Identity | Azure Friday (YouTube, ~12 min)

<https://www.youtube.com/watch?v=bBi1bll2928>

Implementing Managed Identities for Microsoft Azure Resources (Pluralsight, ~1.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-resources-managed-identities-implementing/table-of-contents>

Implement Microsoft identity platform

References

Microsoft identity platform (formerly Azure Active Directory for developers)

<https://docs.microsoft.com/en-us/azure/active-directory/develop/>

Evolution of Microsoft identity platform

<https://docs.microsoft.com/en-us/azure/active-directory/develop/about-microsoft-identity-platform>

Microsoft identity platform best practices and recommendations

<https://docs.microsoft.com/en-us/azure/active-directory/develop/identity-platform-integration-checklist>

(Azure Active Directory for developers (v1.0) overview -

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v1-overview>)

Microsoft identity platform (v2.0) overview

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-overview>

Supported account types

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-supported-account-types>

Microsoft identity platform and OpenID Connect protocol

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-protocols-oidc>

Overview of Microsoft Authentication Library (MSAL)

<https://docs.microsoft.com/en-us/azure/active-directory/develop/msal-overview>

Application types for Microsoft identity platform

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-app-types>

MSAL - JSON Web Token (JWT)

<https://docs.microsoft.com/en-us/azure/active-directory/develop/active-directory-v2-protocols#tokens>
<https://tools.ietf.org/html/rfc7519>

Authentication flows and application scenarios

<https://docs.microsoft.com/en-us/azure/active-directory/develop/authentication-flows-app-scenarios>

Microsoft identity platform and Implicit grant flow

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-oauth2-implicit-grant-flow>

Microsoft identity platform and OAuth 2.0 authorization code flow

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-oauth2-auth-code-flow>

Permissions and consent in the Microsoft identity platform endpoint

<https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-permissions-and-consent>

Hands-on

Quickstart: Add sign-in to Microsoft to an ASP.NET web app

<https://aka.ms/az-203/security/quickstart>

Microsoft identity platform code samples (v2.0 endpoint)

<https://docs.microsoft.com/en-us/azure/active-directory/develop/sample-v2-code>

microsoftgraph/msgraph-community-samples (GitHub)

<https://github.com/microsoftgraph/msgraph-community-samples>

Microsoft.Azure.ActiveDirectory.GraphClient – NuGet

<https://www.nuget.org/packages/Microsoft.Azure.ActiveDirectory.GraphClient>

Microsoft identity platform authentication libraries

<https://docs.microsoft.com/en-us/azure/active-directory/develop/reference-v2-libraries>

Azure-Samples/active-directory-b2c-javascript-msal-singlepageapp (GitHub)

<https://github.com/Azure-Samples/active-directory-b2c-javascript-msal-singlepageapp>

MSAL code samples

<https://docs.microsoft.com/en-us/samples/browse/?products=azure&term=msal>

Build an app with admin restricted scopes using the Microsoft identity platform endpoint

<https://docs.microsoft.com/en-us/samples/azure-samples/active-directory-dotnet-admin-restricted-scopes-v2/active-directory-dotnet-admin-restricted-scopes-v2/>

Sign in users and call the Microsoft Graph API from a JavaScript single-page application (SPA)

<https://docs.microsoft.com/en-us/azure/active-directory/develop/tutorial-v2-javascript-spa>

Learning

Application types in Microsoft identity (MS Learn, Module, ~50 min)

<https://docs.microsoft.com/en-us/learn/modules/identity-application-types/>

Microsoft Azure Authentication Scenarios for Developers (Pluralsight, ~3 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-authentication-scenarios-developers/table-of-contents>

Microsoft identity platform: Developer Blog

<https://developer.microsoft.com/en-us/identity/blogs/>

Implement access control

References

Hands-on

Learning

Manage identity and access in Azure (MS Learn, Learning Path, ~4 hr)

<https://docs.microsoft.com/en-us/learn/paths/manage-identity-and-access/>

Implement CBAC (Claims-Based Access Control) authorization

References

Hands-on

Learning

Implement RBAC (Role-Based Access Control) authorization

References

What is role-based access control (RBAC) for Azure resources?

<https://docs.microsoft.com/en-us/azure/role-based-access-control/overview>

RBAC for Azure resources documentation

<https://docs.microsoft.com/en-us/azure/role-based-access-control/>

Built-in roles for Azure resources

<https://docs.microsoft.com/en-us/azure/role-based-access-control/built-in-roles>

Add or remove role assignments using Azure RBAC and the Azure portal

<https://docs.microsoft.com/en-us/azure/role-based-access-control/role-assignments-portal>

Understand role definitions for Azure resources

<https://docs.microsoft.com/en-us/azure/role-based-access-control/role-definitions>

List role assignments using Azure RBAC and the REST API

<https://docs.microsoft.com/en-us/azure/role-based-access-control/role-assignments-list-rest>

Azure Resource Manager resource provider operations

<https://docs.microsoft.com/en-us/azure/role-based-access-control/resource-provider-operations>

Custom roles for Azure resources

<https://docs.microsoft.com/en-us/azure/role-based-access-control/custom-roles>

Microsoft.Authorization roleAssignments template reference

<https://docs.microsoft.com/en-us/azure/templates/Microsoft.Authorization/2018-09-01-preview/roleAssignments>

Microsoft.Authorization roleDefinitions template reference

<https://docs.microsoft.com/en-us/azure/templates/Microsoft.Authorization/2018-01-01-preview/roleDefinitions>

Hands-on

Learning

Create shared access signatures

References

Grant limited access to Azure Storage resources using shared access signatures (SAS)

<https://docs.microsoft.com/en-us/azure/storage/common/storage-sas-overview>

Define a stored access policy

<https://docs.microsoft.com/en-us/rest/api/storageservices/define-stored-access-policy>

Delegate access with a shared access signature

<https://docs.microsoft.com/en-us/rest/api/storageservices/delegate-access-with-shared-access-signature>

Hands-on

Getting Started with Shared Access Signatures (SAS)

<https://docs.microsoft.com/en-us/samples/azure-samples/storage-dotnet-sas-getting-started/storage-dotnet-sas-getting-started/>

Create a service SAS for a container or blob with .NET

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-service-sas-create-dotnet>

Service SAS examples

<https://docs.microsoft.com/en-us/rest/api/storageservices/service-sas-examples>

Learning

Create security baselines (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/create-security-baselines/>

Implement secure data solutions

References

Azure data security and encryption best practices

<https://docs.microsoft.com/en-us/azure/security/fundamentals/data-encryption-best-practices>

Securing PaaS deployments

<https://docs.microsoft.com/en-us/azure/security/fundamentals/paas-deployments>

Best practices for securing PaaS web and mobile applications using Azure Storage

<https://docs.microsoft.com/en-us/azure/security/fundamentals/paas-applications-using-storage>

Hands-on

Learning

Secure your Azure SQL Database (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/secure-your-azure-sql-database/>

Configure security policies to manage data (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/configure-security-policies-to-manage-data/>

Azure security white papers

<https://azure.microsoft.com/en-us/resources/whitepapers/search/?term=security&type=WhitePaperResource>

Encrypt and decrypt data at rest and in transit

References

Azure Data Encryption-at-Rest

<https://docs.microsoft.com/en-us/azure/security/fundamentals/encryption-atrest>

Azure database security overview

<https://docs.microsoft.com/en-us/azure/security/fundamentals/database-security-overview>

Hands-on

Learning

Introduction to securing data at rest on Azure (MS Learn, Module, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/secure-data-at-rest/>

Encrypt network traffic end to end with Azure Application Gateway (MS Learn, Module, ~1.25 hr)

<https://docs.microsoft.com/en-us/learn/modules/end-to-end-encryption-with-app-gateway/>

Create, read, update, and delete keys, secrets, and certificates by using the KeyVault API

References

What is Azure Key Vault?

<https://docs.microsoft.com/en-us/azure/key-vault/key-vault-overview>

Azure Key Vault documentation

<https://docs.microsoft.com/en-us/azure/key-vault/>

Azure Key Vault basic concepts

<https://docs.microsoft.com/en-us/azure/key-vault/basic-concepts>

Best practices to use Key Vault

<https://docs.microsoft.com/en-us/azure/key-vault/key-vault-best-practices>

Azure Key Vault Developer's Guide

<https://docs.microsoft.com/en-us/azure/key-vault/key-vault-developers-guide>

Security recommendations for Azure Key Vault

<https://docs.microsoft.com/en-us/azure/key-vault/security-recommendations>

Service-to-service authentication to Azure Key Vault using .NET

<https://docs.microsoft.com/en-us/azure/key-vault/service-to-service-authentication>

Authentication, requests and responses

<https://docs.microsoft.com/en-us/azure/key-vault/authentication-requests-and-responses>

About keys, secrets, and certificates

<https://docs.microsoft.com/en-us/azure/key-vault/about-keys-secrets-and-certificates>

az keyvault – Azure KeyVault CLI

<https://docs.microsoft.com/en-us/cli/azure/keyvault?view=azure-cli-latest>

Azure Key Vault REST API reference

<https://docs.microsoft.com/en-us/rest/api/keyvault/>

Best practices to use Key Vault

<https://docs.microsoft.com/en-us/azure/key-vault/key-vault-best-practices>

Hands-on

Quickstart: Set and retrieve a secret from Azure Key Vault using Azure CLI

<https://docs.microsoft.com/en-us/azure/key-vault/quick-create-cli>

Quickstart: Azure Key Vault client library for .NET (SDK v4)

<https://docs.microsoft.com/en-us/azure/key-vault/quick-create-net>

Provide Key Vault authentication with a managed identity

<https://docs.microsoft.com/en-us/azure/key-vault/managed-identity>

Use Key Vault from App Service with Managed Service Identity (dotnet core)

<https://docs.microsoft.com/en-us/samples/azure-samples/app-service-msi-keyvault-dotnet/keyvault-msi-appservice-sample/>

Access your secrets in code (ASP.NET Core)

<https://docs.microsoft.com/en-us/azure/key-vault/vs-key-vault-add-connected-service#access-your-secrets-in-code-aspnet-core>

Azure Key Vault Configuration Provider in ASP.NET Core

<https://docs.microsoft.com/en-us/aspnet/core/security/key-vault-configuration?view=aspnetcore-3.1>

Add Key Vault to your web application by using Visual Studio Connected Services

<https://docs.microsoft.com/en-us/azure/key-vault/vs-key-vault-add-connected-service>

Azure Key Vault task – DevOps Pipeline

<https://docs.microsoft.com/en-us/azure/devops/pipelines/tasks/deploy/azure-key-vault?view=azure-devops>
<https://github.com/Microsoft/azure-pipelines-tasks>

Azure.Security.KeyVault.Secrets – NuGet

<https://www.nuget.org/packages/Azure.Security.KeyVault.Secrets/>

Azure.Security.KeyVault.Secrets Namespace .NET

<https://docs.microsoft.com/en-us/dotnet/api/azure.security.keyvault.secrets?view=azure-dotnet>

Azure/azure-sdk-for-net (GitHub)

<https://github.com/Azure/azure-sdk-for-net/tree/master/sdk/keyvault>

Learning

Configure and manage secrets in Azure Key Vault (MS Learn, Module, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/configure-and-manage-azure-key-vault/>

Manage secrets in your server apps with Azure Key Vault (MS Learn, Module, ~45 min)
<https://docs.microsoft.com/en-us/learn/modules/manage-secrets-with-azure-key-vault/>

Monitor, troubleshoot, and optimize solutions (10-15%)

Lab: Monitoring services deployed to Azure (AZ-203 ILT, Module 5)

[https://github.com/MicrosoftLearning/AZ-203-](https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_05_lab_ak.md)

[DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_05_lab_ak.md](https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_05_lab_ak.md)

Develop code to support scalability of apps and services

References

Performance and Scalability patterns

<https://docs.microsoft.com/en-us/azure/architecture/patterns/category/performance-scalability>

Azure Application Architecture Guide

<https://docs.microsoft.com/en-us/azure/architecture/guide/>

Scalable Web Apps

<https://docs.microsoft.com/en-us/azure/architecture/solution-ideas/articles/scalable-web-apps>

Improve scalability in an Azure web application – sample architecture

<https://docs.microsoft.com/en-us/azure/architecture/reference-architectures/app-service-web-app/scalable-web-app>

Hands-on

Learning

The Developer's Guide to Azure (e-book)

<https://azure.microsoft.com/en-us/campaigns/developer-guide/>

Cloud Design Patterns

<https://docs.microsoft.com/en-us/azure/architecture/patterns/>

Implement autoscaling rules and patterns (schedule, operational/system metrics, singleton applications)

References

Autoscaling

<https://docs.microsoft.com/en-us/azure/architecture/best-practices/auto-scaling>

Overview of autoscale in Microsoft Azure Virtual Machines, Cloud Services, and Web Apps

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/autoscale-overview>

Best practices for Autoscale

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/autoscale-best-practices>

Overview of common autoscale patterns

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/autoscale-common-scale-patterns>

Troubleshooting Azure autoscale

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/autoscale-troubleshoot>

Singleton pattern

https://en.wikipedia.org/wiki/Singleton_pattern

Hands-on

Smart scaling for Azure Scale Set with Azure Functions

<https://docs.microsoft.com/en-us/samples/azure-samples/azure-scale-set-smart-downscale/smart-scaling-for-azure-scale-set-with-azure-functions/>

Start Monitoring Your ASP.NET Core Web Application

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/dotnetcore-quick-start>

Azure-Samples/monitor-dotnet-autoscale-based-on-performance (GitHub)

<https://github.com/Azure-Samples/monitor-dotnet-autoscale-based-on-performance>

<https://docs.microsoft.com/en-us/azure/azure-monitor/learn/tutorial-autoscale-performance-schedule>

Learning

Dynamically meet changing web app performance requirements with autoscale rules (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/app-service-autoscale-rules/>

Scale an App Service web app to efficiently meet demand with App Service scale up and scale out (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/azure/architecture/solution-ideas/articles/scalable-web-apps>

Microsoft Azure Developer: Developing for Autoscaling (Pluralsight, ~1.74 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-autoscaling-developing/table-of-contents>

Implement code that handles transient faults

References

Transient fault handling

<https://docs.microsoft.com/en-us/azure/architecture/best-practices/transient-faults>

Retry pattern

<https://docs.microsoft.com/en-us/azure/architecture/patterns/retry>

Retry guidance for Azure services

<https://docs.microsoft.com/en-us/azure/architecture/best-practices/retry-service-specific>

General REST and retry guidelines

<https://docs.microsoft.com/en-us/azure/architecture/best-practices/retry-service-specific#general-rest-and-retry-guidelines>

Troubleshooting transient connection errors to SQL Database

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-connectivity-issues>

Circuit Breaker pattern

<https://docs.microsoft.com/en-us/azure/architecture/patterns/circuit-breaker#example>

Compensating Transaction pattern

<https://docs.microsoft.com/en-us/azure/architecture/patterns/compensating-transaction>

Idempotency Patterns

<https://blog.jonathanoliver.com/idempotency-patterns/>

Hands-on

Transient Fault Handling (Building Real-World Cloud Apps with Azure)

<https://docs.microsoft.com/en-us/aspnet/aspnet/overview/developing-apps-with-windows-azure/building-real-world-cloud-apps-with-windows-azure/transient-fault-handling>

App-vNext/Polly (GitHub) - .NET resilience and transient-fault-handling library

<https://github.com/App-vNext/Polly>

<http://www.thepollyproject.org>

Learning

Designing for Resiliency: Retry Policies (YouTube, ~6 min)

<https://www.youtube.com/watch?v=orCSIJye6Ek>

Implement AKS scaling strategies

References

Kubernetes core concepts for Azure Kubernetes Service (AKS)

<https://docs.microsoft.com/en-us/azure/aks/concepts-clusters-workloads>

Scale the node count in an Azure Kubernetes Service (AKS) cluster

<https://docs.microsoft.com/en-us/azure/aks/scale-cluster>

Mike Stevens

Microsoft Azure Technical Trainer

[linkedin.com/in/mikestevens](https://www.linkedin.com/in/mikestevens)

Last Updated: 17 January 2020

Page 67

Scaling options for applications in Azure Kubernetes Service (AKS)

<https://docs.microsoft.com/en-us/azure/aks/concepts-scale>

Automatically scale a cluster to meet application demands on Azure Kubernetes Service (AKS)

<https://docs.microsoft.com/en-us/azure/aks/cluster-autoscaler>

Horizontal Pod Autoscaler – Kubernetes

<https://kubernetes.io/docs/tasks/run-application/horizontal-pod-autoscale/>

kubernetes/autoscaler (GitHub)

<https://github.com/kubernetes/autoscaler/tree/master/cluster-autoscaler>

Hands-on

Tutorial: Scale applications in Azure Kubernetes Service (AKS)

<https://docs.microsoft.com/en-us/azure/aks/tutorial-kubernetes-scale>

Azure-Samples/virtual-node-autoscale (GitHub) – AKS virtual node scale out

<https://github.com/Azure-Samples/virtual-node-autoscale>

Learning

Azure Kubernetes Service (AKS) videos

<https://azure.microsoft.com/en-us/resources/videos/index/?services=container-service&sort=newest>

Autoscaling with virtual node and Azure Kubernetes Service (AKS) – (YouTube, ~7 min)

<https://www.youtube.com/watch?v=vZp71F3xDNc>

Integrate caching and content delivery within solutions

References

Caching

<https://docs.microsoft.com/en-us/azure/architecture/best-practices/caching?toc=%2Fazure%2Fredis-cache%2Ftoc.json>

Documentation - redis

<https://redis.io/documentation>

<https://github.com/antirez/redis-doc>

Azure CDN Coverage by Metro

<https://docs.microsoft.com/en-us/azure/cdn/cdn-pop-locations>

Hands-on

How to Scale Azure Cache for Redis

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-how-to-scale>

Learning

Create a Content Delivery Network for your Website with Azure CDN and Blob Services (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/create-cdn-static-resources-blob-storage/>

Store and retrieve data in Azure Redis cache

References

Azure Cache for Redis description

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-overview>

Azure Cache for Redis Documentation

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/>

Introduction to Redis

<https://redis.io/topics/introduction>

Best practices for Azure Cache for Redis

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-best-practices>

ASP.NET Session State Provider for Azure Cache for Redis

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-aspnet-session-state-provider>

ASP.NET Output Cache Provider for Azure Cache for Redis

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-aspnet-output-cache-provider>

Hands-on

Quickstart: Use Azure Cache for Redis with a .NET Core app

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-dotnet-core-quickstart>

Quickstart: Use Azure Cache for Redis with Node.js

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-nodejs-get-started>

https://github.com/NodeRedis/node_redis

Tutorial: Create a cache-aside leaderboard on ASP.NET

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-web-app-cache-aside-leaderboard>

Learning

Work with mutable and partial data in Azure Cache for Redis (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/work-with-mutable-and-partial-data-in-a-redis-cache/>

Optimize your web applications by caching read-only data with Redis (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/optimize-your-web-apps-with-redis/>

Microsoft Azure Developer: Implementing Azure Cache (Pluralsight, ~1 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-cache-implementing/table-of-contents>

Develop code to implement CDN's in solutions

References

Azure CDN Documentation

<https://docs.microsoft.com/en-us/azure/cdn/>

What is a content delivery network on Azure?

<https://docs.microsoft.com/en-us/azure/cdn/cdn-overview>

Compare Azure CDN product features

<https://docs.microsoft.com/en-us/azure/cdn/cdn-features>

Get started with Azure CDN development

<https://docs.microsoft.com/en-us/azure/cdn/cdn-app-dev-net>

Hands-on

Getting started on managing CDN in C#

<https://docs.microsoft.com/en-us/samples/azure-samples/cdn-dotnet-manage-cdn/getting-started-on-managing-cdn-in-c/>

Uploading and CDN-preloading static content with Azure Functions

<https://docs.microsoft.com/en-us/samples/azure-samples/functions-java-push-static-contents-to-cdn/functions-java-push-static-contents-to-cdn/>

Azure-Samples/azure-cdn-samples (GitHub)

<https://github.com/Azure-Samples/azure-cdn-samples>

Azure-Samples/cdn-dotnet-manage-cdn (GitHub)

<https://github.com/Azure-Samples/cdn-dotnet-manage-cdn>

Monitor the health of Azure CDN resources

<https://docs.microsoft.com/en-us/azure/cdn/cdn-resource-health>

Azure CDN libraries for .NET

<https://docs.microsoft.com/en-us/dotnet/api/overview/azure/cdn?view=azure-dotnet>

Learning

Microsoft Azure Developer: Implementing CDNs for Storage (Pluralsight, ~1.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-storage-cdns-implementing/table-of-contents>

Azure CDN (YouTube, ~16 min)

<https://www.youtube.com/watch?v=ssTsfndE8Jk>

Azure CDN videos

<https://azure.microsoft.com/en-us/resources/videos/index/?services=cdn>

Invalidate cache content (CDN or Redis)

References

How caching works (CDN)

<https://docs.microsoft.com/en-us/azure/cdn/cdn-how-caching-works>

Control Azure CDN caching behavior with caching rules

<https://docs.microsoft.com/en-us/azure/cdn/cdn-caching-rules>

Standard rules engine reference for Azure CDN

<https://docs.microsoft.com/en-us/azure/cdn/cdn-standard-rules-engine-reference>

Purge an Azure CDN endpoint

<https://docs.microsoft.com/en-us/azure/cdn/cdn-purge-endpoint>

Pre-load assets on an Azure CDN endpoint

<https://docs.microsoft.com/en-us/azure/cdn/cdn-preload-endpoint>

Hands-on

Azure Cache for Redis samples

<https://docs.microsoft.com/en-us/azure/azure-cache-for-redis/cache-redis-samples>

Learning

Azure Redis Cache Best Practices (Video, ~7 min)

<https://azure.microsoft.com/en-us/resources/videos/azure-redis-cache-best-practices/>

Instrument solutions to support monitoring and logging

References

Hands-on

Learning

Capture feedback and monitoring data to continuously improve your software (MS Learn, Learning Path, ~1.75 hr)

<https://docs.microsoft.com/en-us/learn/paths/capture-feedback-monitoring/>

Microsoft Azure Developer: Monitoring Performance (Pluralsight, ~1.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-performance-monitoring/table-of-contents>

Configure instrumentation in an app or service by using Application Insights

References

Overview of Insights in Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/insights/insights-overview>

What is Application Insights?

<https://docs.microsoft.com/en-us/azure/azure-monitor/app/app-insights-overview>

Hands-on

Learning

Instrument server-side web application code with Application Insights (MS Learn, Module, ~30 min)

<https://docs.microsoft.com/en-us/learn/modules/instrument-web-app-code-with-application-insights/>

Capture and view page load times in your Azure web app with Application Insights (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/capture-page-load-times-application-insights/>

Analyzing your applications with Application Insights (YouTube, ~25 min)

<https://www.youtube.com/watch?v=pqZF8LjBh68>

Analyze and troubleshoot solutions by using Azure Monitor

References

Azure Monitor documentation

<https://docs.microsoft.com/en-us/azure/azure-monitor/>

Metrics in Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/data-platform-metrics>

Logs in Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/data-platform-logs>

Kusto / Azure Data Explore

<https://kusto.azurewebsites.net/docs/>

Overview of alerts in Microsoft Azure

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/alerts-overview>

Visualizing data from Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/visualizations>

Continuous monitoring with Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/continuous-monitoring>

Azure Monitor partner integrations

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/partners>

Hands-on

Getting started with Azure Metrics Explorer

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/metrics-getting-started>

Get started with Log Analytics in Azure Monitor

<https://docs.microsoft.com/en-us/azure/azure-monitor/log-query/get-started-portal>

Azure Monitoring REST API walkthrough

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/rest-api-walkthrough>

Retrieve Azure Monitor metrics with .NET

<https://docs.microsoft.com/en-us/samples/azure-samples/monitor-dotnet-metrics-api/monitor-dotnet-metrics-api/>

Azure Monitor CLI quick start samples

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/cli-samples>

Manage Log Analytics workspace using Azure Resource Manager templates

<https://docs.microsoft.com/en-us/azure/azure-monitor/platform/template-workspace-configuration>

Learning

Monitor cloud resources (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/cmu-monitor-cloud-resources/>

Apply and monitor infrastructure standards with Azure Policy (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-governance/>

Monitor, diagnose, and troubleshoot your Azure storage (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/monitor-diagnose-and-troubleshoot-azure-storage/>

Azure Monitor videos

<https://azure.microsoft.com/en-us/resources/videos/index/?services=monitor>

Instrument Application with Azure Monitor Application Insights (Pluralsight, ~45 min)

<https://app.pluralsight.com/library/courses/microsoft-azure-application-insights-web-application-instrument/table-of-contents>

Implement Application Insights Web Test and Alerts

References

Monitor the availability of any website

<https://docs.microsoft.com/en-us/azure/azure-monitor/app/monitor-web-app-availability>

Multi-step web tests

<https://docs.microsoft.com/en-us/azure/azure-monitor/app/availability-multistep>

UI test with Selenium

<https://docs.microsoft.com/en-us/azure/devops/pipelines/test/continuous-test-selenium?view=azure-devops>

Availability alerts

<https://docs.microsoft.com/en-us/azure/azure-monitor/app/availability-alerts>

Set Alerts in Application Insights

<https://docs.microsoft.com/en-us/azure/azure-monitor/app/alerts>

Creating an Application Insights Web Test and Alert Programmatically

<https://azure.microsoft.com/en-us/blog/creating-a-web-test-alert-programmatically-with-application-insights/>

Azure Application Insights REST API

<https://dev.applicationinsights.io/>

<https://dev.applicationinsights.io/apiexplorer/metrics>

Hands-on

Azure-Samples/application-insights-react-demo (GitHub)

<https://github.com/Azure-Samples/application-insights-react-demo>

Application Insights REST API - Quickstart

<https://dev.applicationinsights.io/quickstart>

Learning

Azure Monitor action groups

<https://azure.microsoft.com/en-us/resources/videos/azure-friday-azure-monitor-action-groups/>

Connect to and consume Azure and third-party services (20-25%)

Lab: Creating a multi-tier solution by using services in Azure (AZ-203 ILT, Module 6)

https://github.com/MicrosoftLearning/AZ-203-DevelopingSolutionsforMicrosoftAzure/blob/master/Instructions/Labs/AZ-203_06_lab_ak.md

Microsoft Azure Logic Apps

References

Overview - What is Azure Logic Apps?

<https://docs.microsoft.com/en-us/azure/logic-apps/logic-apps-overview>

Introducing Azure Logic Apps (C9, Video, ~2 min)

<https://channel9.msdn.com/Blogs/Azure/Introducing-Azure-Logic-Apps>

What are Microsoft Flow, Logic Apps, Functions, and WebJobs?

<https://docs.microsoft.com/en-us/azure/azure-functions/functions-compare-logic-apps-ms-flow-webjobs>

Common scenarios, examples, tutorials, and walkthroughs for Azure Logic Apps

<https://docs.microsoft.com/en-us/azure/logic-apps/logic-apps-examples-and-scenarios>

Hands-on

Learning

Connect your services together (MS Learn, Learning Path, ~3.5 hr)

<https://docs.microsoft.com/en-us/learn/paths/connect-your-services-together/>

Creating Logic Apps

References

Azure Logic Apps – Code & API free integration + New SAP connector (Microsoft Mechanics, Video, ~15 min)

<https://www.youtube.com/watch?v=Z3qaBQS0w20>

Visual Studio Code extension for Azure Logic Apps

<https://marketplace.visualstudio.com/items?itemName=ms-azuretools.vscode-logicapps>

Hands-on

Quickstart: Create your first workflow by using Azure Logic Apps - Azure portal

<https://docs.microsoft.com/en-us/azure/logic-apps/quickstart-create-first-logic-app-workflow>

Quickstart: Create automated tasks, processes, and workflows with Azure Logic Apps - Visual Studio
<https://docs.microsoft.com/en-us/azure/logic-apps/quickstart-create-logic-apps-with-visual-studio>

Data operation code samples for Azure Logic Apps
<https://docs.microsoft.com/en-us/azure/logic-apps/logic-apps-data-operations-code-samples>

Learning

Introduction to Azure Logic Apps (MSLearn, ~28 min)
<https://docs.microsoft.com/en-us/learn/modules/intro-to-logic-apps/>

Route and process data automatically using Logic Apps (MSLearn, ~56 min)
<https://docs.microsoft.com/en-us/learn/modules/route-and-process-data-logic-apps>

Build automated workflows to integrate data and apps with Azure Logic Apps (MSLearn, ~2 hr 49 min)
<https://docs.microsoft.com/en-us/learn/paths/build-workflows-with-logic-apps>

Microsoft Azure Developer: Creating Enterprise Logic Apps (Pluralsight, ~2.25 hr)
<https://app.pluralsight.com/library/courses/microsoft-azure-enterprise-logic-app-creating/table-of-contents>

Creating custom connectors for Logic Apps

References

Connectors
<https://docs.microsoft.com/en-us/connectors>

Connectors for Azure Logic Apps
<https://docs.microsoft.com/en-us/azure/connectors/apis-list>

Create a custom connector in Azure Logic Apps
<https://docs.microsoft.com/en-us/connectors/custom-connectors/create-logic-apps-connector>

Hands-on

Custom Connectors
<https://docs.microsoft.com/en-us/connectors/custom-connectors/#tutorial>
<https://docs.microsoft.com/en-us/connectors/custom-connectors/#advanced-tutorials>

Create a custom connector from an OpenAPI definition
<https://docs.microsoft.com/en-us/connectors/custom-connectors/define-openapi-definition>

Create a custom connector from a Postman collection
<https://docs.microsoft.com/en-us/connectors/custom-connectors/define-postman-collection>

Use a webhook as a trigger for Azure Logic Apps and Power Automate

<https://docs.microsoft.com/en-us/connectors/custom-connectors/create-webhook-trigger>

Learning

Call an API from a Logic Apps workflow using a custom connector (MSLearn, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/logic-apps-and-custom-connectors>

Creating a custom template for Logic Apps

References

Azure Resource Manager (ARM) Templates for LogicApps

<https://azure.microsoft.com/en-us/resources/templates/?resourceType=Microsoft.Logic>

Hands-on

Run timer jobs that execute on a schedule using Logic Apps (Deployable Template)

<https://azure.microsoft.com/en-us/resources/templates/301-logicapps-jobscheduler>

Learning

Create and deploy Logic Apps using Azure Resource Manager templates (MSLearn, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/create-deploy-logic-apps-using-arm-templates>

Working with Azure Search

References

What is Azure Cognitive Search?

<https://docs.microsoft.com/en-us/azure/search/search-what-is-azure-search>

Deployment strategies and best practices for optimizing performance on Azure Cognitive Search

<https://docs.microsoft.com/en-us/azure/search/search-performance-optimization>

Azure Cognitive Search Service REST

<https://docs.microsoft.com/en-us/rest/api/searchservice/>

Hands-on

Quickstart: Create an Azure Cognitive Search service in the portal

<https://docs.microsoft.com/en-us/azure/search/search-create-service-portal>

Azure Cognitive Search Sample Data

<https://docs.microsoft.com/en-us/samples/azure-samples/azure-search-sample-data/azure-search-sample-data/>

Getting Started with Azure Search using .NET

<https://docs.microsoft.com/en-us/samples/azure-samples/search-dotnet-getting-started/getting-started-with-azure-search-using-net/>

Azure Cognitive Search Quickstart in REST – Postman

<https://docs.microsoft.com/en-us/samples/azure-samples/azure-search-postman-samples/rest-api-quickstart/>

Azure Search .NET - Jobs Website Sample

<https://docs.microsoft.com/en-us/samples/azure-samples/search-dotnet-asp-net-mvc-jobs/search-dotnet-asp-net-mvc-jobs/>

Learning

Introduction to Azure Cognitive Search (MS Learn, ~53 min)

<https://docs.microsoft.com/en-us/learn/modules/intro-to-azure-search/>

Microsoft Azure Developer: Enabling Search of Textual Content (Pluralsight, ~1.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-textual-content-search-enabling/table-of-contents>

Azure Cognitive Search videos

<https://azure.microsoft.com/en-us/resources/videos/index/?services=search>

Creating an Azure Search Index

References

Create a basic index in Azure Cognitive Search

<https://docs.microsoft.com/en-us/azure/search/search-what-is-an-index>

How to use Azure Cognitive Search from a .NET Application

<https://docs.microsoft.com/en-us/azure/search/search-howto-dotnet-sdk>

Indexers in Azure Cognitive Search

<https://docs.microsoft.com/en-us/azure/search/search-indexer-overview>

Introduction to AI in Azure Cognitive Search

<https://docs.microsoft.com/en-us/azure/search/cognitive-search-concept-intro>

What is incremental indexing in Azure Cognitive Search?

<https://docs.microsoft.com/en-us/azure/search/cognitive-search-incremental-indexing-conceptual>

Hands-on

Tutorial: Import Azure SQL database in C# using Azure Cognitive Search indexers

<https://docs.microsoft.com/en-us/azure/search/search-indexer-tutorial>

Learning

Cognitive Search - Azure Search with AI | Azure Friday (YouTube, ~15 min)

<https://www.youtube.com/watch?v=6kw8SHwpx9c>

Indexing and querying documents

References

How full text search works in Azure Cognitive Search

<https://docs.microsoft.com/en-us/azure/search/search-lucene-query-architecture>

Hands-on

C# tutorial: Create your first app - Azure Cognitive Search

<https://docs.microsoft.com/en-us/azure/search/tutorial-csharp-create-first-app>

Learning

Full-text search in Azure Search

References

Hands-on

Azure-Samples/search-dotnet-asp-net-mvc-jobs (GitHub)

<https://github.com/Azure-Samples/search-dotnet-asp-net-mvc-jobs>

Azure-Samples/cognitive-services-node-sdk-samples (GitHub)

<https://github.com/Azure-Samples/cognitive-services-node-sdk-samples>

Learning

How full text search works in Azure Cognitive Search (~16 min)

<https://docs.microsoft.com/en-us/azure/search/search-lucene-query-architecture>

Azure API Management

Azure API Management

References

About API Management

<https://docs.microsoft.com/en-us/azure/api-management/api-management-key-concepts>

API Management Blog

<https://azure.microsoft.com/en-us/blog/topics/api-management-2/>

Add an API manually

<https://docs.microsoft.com/en-us/azure/api-management/add-api-manually>

Import an OpenAPI specification

<https://docs.microsoft.com/en-us/azure/api-management/import-api-from-oas>

Azure API Management (REST API)

<https://docs.microsoft.com/en-us/rest/api/apimanagement/>

API Design (white paper, pdf)

https://azure.microsoft.com/mediahandler/files/resourcefiles/api-design/Azure_API-Design_Guide_eBook.pdf

APIs and microservices (white paper, pdf)

https://azure.microsoft.com/mediahandler/files/resourcefiles/apis-microservices-ebook/Azure_API-Microservices_eBook.pdf

Hands-on

Import and publish your first API (Tutorial)

<https://docs.microsoft.com/en-us/azure/api-management/import-and-publish>

Learning

Architect API integration in Azure (MSLearn, Learning Path, ~3 hrs)

<https://docs.microsoft.com/en-us/learn/paths/architect-api-integration/>

Expose multiple Azure Function apps as a consistent API by using Azure API Management (MS Learn, Module, ~40 min)

<https://docs.microsoft.com/en-us/learn/modules/build-serverless-api-with-functions-api-management/>

Microsoft Azure Developer: Enabling Search of Textual Content (Pluralsight, ~1.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-textual-content-search-enabling/table-of-contents>

Securing APIs

References

Subscriptions in Azure API Management (~2 min)

<https://docs.microsoft.com/en-us/azure/api-management/api-management-subscriptions>

How to secure APIs using client certificate authentication in API Management (~2 min)

<https://docs.microsoft.com/en-us/azure/api-management/api-management-howto-mutual-certificates-for-clients>

Hands-on

Learning

Protect your APIs on Azure API Management (MS Learn, Module, ~43 min)

<https://docs.microsoft.com/en-us/learn/modules/protect-apis-on-api-management/>

Azure API Management: Driving Digital Transformation in Today's API Economy (e-book)

<https://azure.microsoft.com/en-us/resources/azure-api-management-driving-digital-transformation-in-todays-api-economy/>

Defining API policies

References

About API Management

<https://docs.microsoft.com/en-us/azure/api-management/api-management-key-concepts>

Policies in Azure API Management

<https://docs.microsoft.com/en-us/azure/api-management/api-management-howto-policies>

How to set or edit Azure API Management policies

<https://docs.microsoft.com/en-us/azure/api-management/set-edit-policies>

API Management policy samples

<https://docs.microsoft.com/en-us/azure/api-management/policy-samples>

API Management advanced policies

<https://docs.microsoft.com/en-us/azure/api-management/api-management-advanced-policies#choose>

API Management cross domain policies

<https://docs.microsoft.com/en-us/azure/api-management/api-management-cross-domain-policies>

Hands-on

Learning

Develop event-based solutions

References

Choose between Azure messaging services - Event Grid, Event Hubs, and Service Bus

https://docs.microsoft.com/en-us/azure/event-grid/compare-messaging-services?WT.mc_id=ondotnet-c9-cxa

Hands-on

Learning

Choose a messaging model in Azure to loosely connect your services (MS Learn, Module, ~45 min)

<https://docs.microsoft.com/en-us/learn/modules/choose-a-messaging-model-in-azure-to-connect-your-services/>

Architect message brokering and serverless applications in Azure (MS Learn, Learning Path, ~5 hr)

<https://docs.microsoft.com/en-us/learn/paths/architect-messaging-serverless/>

Azure Event Grid

References

What is Azure Event Grid?

<https://docs.microsoft.com/en-us/azure/event-grid/overview>

Azure Event Grid documentation

<https://docs.microsoft.com/en-us/azure/event-grid/>

Choose between Azure messaging services - Event Grid, Event Hubs, and Service Bus

<https://docs.microsoft.com/en-us/azure/event-grid/compare-messaging-services>

Azure Event Grid event schema

<https://docs.microsoft.com/en-us/azure/event-grid/event-schema>

Monitor Event Grid message delivery

<https://docs.microsoft.com/en-us/azure/event-grid/monitor-event-delivery>

Hands-on

Quickstart: Route Blob storage events to web endpoint with the Azure portal
<https://docs.microsoft.com/en-us/azure/event-grid/blob-event-quickstart-portal>

Quickstart: Route custom events to an Azure Function with Event Grid
<https://docs.microsoft.com/en-us/azure/event-grid/custom-event-to-function>

Quickstart: Route custom events to Azure Queue storage with Azure CLI and Event Grid
<https://docs.microsoft.com/en-us/azure/event-grid/custom-event-to-queue-storage>

Event Grid Relay listener
<https://docs.microsoft.com/en-us/samples/azure-samples/event-grid-relay-listener/event-grid-relay-listener/>

Azure Event Grid Viewer
<https://docs.microsoft.com/en-us/samples/azure-samples/azure-event-grid-viewer/azure-event-grid-viewer/>
(<https://madeofstrings.com/2018/03/14/azure-event-grid-viewer-with-asp-net-core-and-signalr/>)

Microsoft Azure Event Grid Publish/Consume Samples for C#
<https://docs.microsoft.com/en-us/samples/azure-samples/event-grid-dotnet-publish-consume-events/event-grid-dotnet-publish-consume-events/>

Microsoft Azure Event Grid Publish/Consume Samples for Node.js
<https://docs.microsoft.com/en-us/samples/azure-samples/event-grid-node-publish-consume-events/event-grid-node-publish-consume-events/>

Image Upload Resize
<https://docs.microsoft.com/en-us/samples/azure-samples/function-image-upload-resize/function-image-upload-resize/>

Tutorial: Stream big data into a data warehouse
<https://docs.microsoft.com/en-us/azure/event-grid/event-grid-event-hubs-integration>

Tutorial: Route custom events to Azure Relay Hybrid Connections with Azure CLI and Event Grid
<https://docs.microsoft.com/en-us/azure/event-grid/custom-event-to-hybrid-connection>

Learning

An overview of Azure Event Grid (YouTube, ~6 min)
<https://www.youtube.com/watch?v=p8ia7J4Y7tl>

Azure Event Grid videos
<https://azure.microsoft.com/en-us/resources/videos/index/?services=event-grid&sort=newest>

Azure Event Hubs

References

Azure Event Hubs — A big data streaming platform and event ingestion service

<https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-about>

Features and terminology in Azure Event Hubs

<https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-features>

AMQP 1.0 in Azure Service Bus and Event Hubs protocol guide

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-amqp-protocol-guide>

Hands-on

.NET Programming guide for Azure Event Hubs

<https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-programming-guide>

Git repositories with samples for Azure Event Hubs

<https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-samples>

Send events to or receive events from Azure Event Hubs using .NET Core

https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-dotnet-standard-getstarted-send?WT.mc_id=ondotnet-c9-cxa

Tutorial: Visualize data anomalies in real-time events sent to Azure Event Hubs

<https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-tutorial-visualize-anomalies>

Azure/azure-event-hubs (GitHub)

<https://github.com/Azure/azure-event-hubs>

Microsoft.Azure.EventHubs - NuGet

<https://www.nuget.org/packages/Microsoft.Azure.EventHubs/>

Learning

Enable reliable messaging for Big Data applications using Azure Event Hubs (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/enable-reliable-messaging-for-big-data-apps-using-event-hubs/>

Messaging with Azure Event Hubs (YouTube, ~27 min)

<https://www.youtube.com/watch?v=DDDjFQSQyF4>

Understanding the Event Processor Host in Azure Event Hubs (YouTube, ~15 min)

<https://www.youtube.com/watch?v=kU7c-uzT8yY>

Azure Event Hubs videos

<https://azure.microsoft.com/en-us/resources/videos/index/?services=event-hubs>

Azure Notification Hubs

References

What is Azure Notification Hubs?

<https://docs.microsoft.com/en-us/azure/notification-hubs/notification-hubs-push-notification-overview>

Enterprise push architectural guidance

<https://docs.microsoft.com/en-us/azure/notification-hubs/notification-hubs-enterprise-push-notification-architecture>

Azure Notification Hubs Documentation

<https://docs.microsoft.com/en-us/azure/notification-hubs/>

Push notifications with Azure Notification Hubs: Frequently asked questions

<https://docs.microsoft.com/en-us/azure/notification-hubs/notification-hubs-push-notification-faq>

Microsoft.Azure.NotificationHubs Namespace - .NET

<https://docs.microsoft.com/en-us/dotnet/api/microsoft.azure.notificationhubs?view=azure-dotnet>

Hands-on

Create an Azure notification hub in the Azure portal

<https://docs.microsoft.com/en-us/azure/notification-hubs/create-notification-hub-portal>

Send cross-platform notifications to users with Notification Hubs

<https://docs.microsoft.com/en-us/azure/notification-hubs/notification-hubs-aspnet-cross-platform-notification>

Azure Notification Hubs libraries for .NET

<https://docs.microsoft.com/en-us/dotnet/api/overview/azure/notification-hubs?view=azure-dotnet>

Azure Notification Hubs Samples

<https://docs.microsoft.com/en-us/azure/notification-hubs/samples>

Learning

Mike Stevens

Microsoft Azure Technical Trainer

[linkedin.com/in/mikestevens](https://www.linkedin.com/in/mikestevens)

Last Updated: 17 January 2020

Page 86

Develop message-based solutions

References

Messaging patterns

<https://docs.microsoft.com/en-us/azure/architecture/patterns/category/messaging>

Choose between Azure messaging services - Event Grid, Event Hubs, and Service Bus

https://docs.microsoft.com/en-us/azure/event-grid/compare-messaging-services?WT.mc_id=ondotnet-c9-cxa

Hands-on

Learning

Microsoft Azure Developer: Enterprise Messaging and Eventing (Pluralsight, ~2.5 hr)

<https://app.pluralsight.com/library/courses/microsoft-azure-enterprise-messaging-eventing/table-of-contents>

Azure Service Bus

References

What is Azure Service Bus?

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-messaging-overview>

Choose between Azure messaging services - Event Grid, Event Hubs, and Service Bus

<https://docs.microsoft.com/en-us/azure/event-grid/compare-messaging-services>

Storage queues and Service Bus queues - compared and contrasted

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-azure-and-service-bus-queues-compared-contrasted>

Best Practices for performance improvements using Service Bus Messaging

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-performance-improvements>

Azure Service Bus REST API

<https://docs.microsoft.com/en-us/rest/api/servicebus/>

Hands-on

Service Bus messaging samples

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-samples>

Quickstart: Use Azure portal to create a Service Bus queue

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-quickstart-portal>

Get started with Service Bus queues (.NET)

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-dotnet-get-started-with-queues>

Quickstart: Use the Azure portal to create a Service Bus topic and subscriptions to the topic

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-quickstart-topics-subscriptions-portal>

Get started with Service Bus topics (.NET)

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-dotnet-how-to-use-topics-subscriptions>

Tutorial: Update inventory using CLI and topics/subscriptions

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/service-bus-tutorial-topics-subscriptions-cli>

Azure-Samples/app-service-msi-servicebus-dotnet (GitHub)

<https://github.com/Azure-Samples/app-service-msi-servicebus-dotnet>

Azure/azure-service-bus (GitHub)

<https://github.com/Azure/azure-service-bus>

Learning

Implement message-based communication workflows with Azure Service Bus (MS Learn, Module, ~55 min)

<https://docs.microsoft.com/en-us/learn/modules/implement-message-workflows-with-service-bus/>

Azure Service Bus Core Features (YouTube, ~16 min)

<https://www.youtube.com/watch?v=cdSSA5L-Ndw>

Azure Service Bus from the ground up (YouTube, ~25 min)

<https://www.youtube.com/watch?v=FRzMPqViuwY>

Azure Service Bus and the .NET Standard SDK (YouTube, ~35 min)

<https://www.youtube.com/watch?v=QvtQ8p7aJKo>

Azure Queue storage

References

What are Azure queues?

<https://docs.microsoft.com/en-us/azure/storage/queues/storage-queues-introduction>

Azure Queue storage documentation

<https://docs.microsoft.com/en-us/azure/storage/queues/>

Queue service concepts

<https://docs.microsoft.com/en-us/rest/api/storageservices/Queue-Service-Concepts>

Queue service REST API

<https://docs.microsoft.com/en-us/rest/api/storageservices/queue-service-rest-api>

Azure Storage APIs for .NET

<https://docs.microsoft.com/en-us/dotnet/api/overview/azure/storage>

Hands-on

Quickstart: Create a queue and add a message with the Azure portal

<https://docs.microsoft.com/en-us/azure/storage/queues/storage-quickstart-queues-portal>

Getting Started with Azure Queue Service in .NET

<https://docs.microsoft.com/en-us/samples/azure-samples/storage-queue-dotnet-getting-started/storage-queue-dotnet-getting-started/>

Connect to Azure Storage accounts from Azure Logic Apps

<https://docs.microsoft.com/en-us/samples/azure-samples/azure-logic-apps-deployment-samples/connect-to-azure-storage-accounts-from-azure-logic-apps/>

Azure Storage Queue client library samples for JavaScript

<https://docs.microsoft.com/en-us/samples/azure/azure-sdk-for-js/storage-queue-javascript/>

Azure Storage samples using .NET

<https://docs.microsoft.com/en-us/azure/storage/common/storage-samples-dotnet?toc=%2fazure%2fstorage%2fqueues%2ftoc.json>

Learning

Azure Storage Queue Message Management (YouTube, ~6 min)

<https://www.youtube.com/watch?v=ksryHC9sIOM>

Azure Storage for Serverless .NET Apps in Minutes (YouTube, ~9 min)

<https://www.youtube.com/watch?v=QNwZdfx4sp8>

Microsoft Graph

References

Microsoft Graph

<https://developer.microsoft.com/en-us/graph/>

Overview of Microsoft Graph

<https://docs.microsoft.com/en-us/graph/overview?view=graph-rest-1.0>

Best practices for working with Microsoft Graph

<https://docs.microsoft.com/en-us/graph/best-practices-concept?view=graph-rest-1.0>

Microsoft Graph Resources

<https://developer.microsoft.com/en-us/graph/gallery/?filterBy=Samples,SDKs>

Microsoft Graph SDKs overview

<https://docs.microsoft.com/en-us/graph/sdks/sdks-overview?view=graph-rest-1.0>

msgraph-sdk-design (Requirements and design documents for Microsoft Graph SDKs)

<https://microsoftgraph.github.io/msgraph-sdk-design/>

Microsoft Graph Toolkit

<https://docs.microsoft.com/en-us/graph/toolkit/overview?context=graph%2Fapi%2F1.0&view=graph-rest-1.0>

Microsoft Graph REST API v1.0 reference

<https://docs.microsoft.com/en-us/graph/api/overview?view=graph-rest-1.0>

Hands-on

Microsoft Graph Explorer v1.0, beta)

<https://developer.microsoft.com/en-us/graph/graph-explorer>

microsoftgraph/aspnet-snippets-sample (GitHub)

<https://github.com/microsoftgraph/aspnet-snippets-sample>

Azure-Samples/active-directory-dotnet-graphapi-console (GitHub)

<https://github.com/Azure-Samples/active-directory-dotnet-graphapi-console>

microsoftgraph/microsoft-graph-explorer-api (GitHub)

<https://github.com/microsoftgraph/microsoft-graph-explorer-api>

OfficeDev/Timesheet (GitHub)

<https://github.com/OfficeDev/Timesheet>

Microsoft Graph ASP.NET Webhooks

<https://docs.microsoft.com/en-us/samples/microsoftgraph/aspnet-webhooks-rest-sample/microsoft-graph-aspnet-webhooks/>

Microsoft Graph Sentiment Analysis Bot

<https://docs.microsoft.com/en-us/samples/microsoftgraph/nodejs-sentiment-bot-sample/microsoft-graph-sentiment-analysis-bot/>

Learning

Build apps with Microsoft Graph – Associate (MS Learn, Learning Path, ~5.5 hr)

<https://docs.microsoft.com/en-us/learn/paths/m365-msgraph-associate/>

Access User Data from Microsoft Graph (MS Learn, Module, ~1.25 hr)

<https://docs.microsoft.com/en-us/learn/modules/msgraph-access-user-data/>

Optimize network traffic with Microsoft Graph (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/optimize-network-traffic/>

Build ASP.NET MVC web applications with the Microsoft Graph .NET SDK (MS Learn, Module, ~1 hr)

<https://docs.microsoft.com/en-us/learn/modules/msgraph-build-aspnetmvc-apps/>

Microsoft Graph (YouTube, ~24 min)

<https://www.youtube.com/watch?v=3RzdHookpbs>

Getting Started with Microsoft Graph and .NET SDKs (YouTube, ~7 min)

<https://www.youtube.com/watch?v=hDnsd2nJf88>

Exploring the Microsoft Graph SDK (YouTube, ~28 min)

<https://www.youtube.com/watch?v=1ytDvWdOMpl>

Azure Relay

References

What is Azure Relay?

<https://docs.microsoft.com/en-us/azure/service-bus-relay/relay-what-is-it>

Azure Relay documentation

<https://docs.microsoft.com/en-us/azure/service-bus-relay/>

Azure Relay Hybrid Connections protocol

<https://docs.microsoft.com/en-us/azure/service-bus-relay/relay-hybrid-connections-protocol>

Microsoft.Azure.Relay Namespace

<https://docs.microsoft.com/en-us/dotnet/api/microsoft.azure.relay?view=azure-dotnet>

Hands-on

Get started with Relay Hybrid Connections WebSockets in .NET

<https://docs.microsoft.com/en-us/azure/service-bus-relay/relay-hybrid-connections-dotnet-get-started>

Get started with Relay Hybrid Connections HTTP requests in .NET

<https://docs.microsoft.com/en-us/azure/service-bus-relay/relay-hybrid-connections-http-requests-dotnet-get-started>

Azure/azure-relay (GitHub)

<https://github.com/Azure/azure-relay/tree/master/samples>

Expose an on-premises WCF service to a web application in the cloud by using Azure Relay

<https://docs.microsoft.com/en-us/azure/service-bus-relay/service-bus-dotnet-hybrid-app-using-service-bus-relay>

Learning