



Microsoft Azure

Planning, Deploying, and
Managing the Cloud

—
Second Edition

—
Julian Soh
Marshall Copeland
Anthony Puca
Micheleen Harris

Apress®

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—Julian

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—Marshall

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Their unique insights into the various aspects of Microsoft's Azure solutions provides an eloquent summary of some very complex technologies. Special thanks to our conductor, Julian, who kept this train on track!

Working at Microsoft for almost ten years has exposed me to a slew of clients, their challenges, and some of the brightest and most passionate IT professionals I have ever met. Thank you to Pete Luongo and Javier Vasquez for the Specialist teams they've built. A talented pool of individuals who continuously keep me and each other on their toes. Thank you to my Account Teams: PJ Kemp, Matt Chong, Chris Peacock, Matt Holzmann, Wole Moses, Jay Bhalodia, David Axinn, Gunnar Pribadi, Kent Cunningham, Susie Adams, and Angela Altimont. This group keeps the customers' business needs and challenges in the foreground and reminds me of the value these things provide to the customers and public.

—Anthony

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—Micheleen

Table of Contents

About the Authors	xvii
About the Technical Reviewers	xix
Acknowledgments	xxi
Introduction	xxiii
Part I: Introducing Microsoft Azure	1
Chapter 1: Microsoft Azure and Cloud Computing	3
Where Is Microsoft Azure Today?	4
Azure Availability.....	5
Azure Compliance.....	7
Microsoft Azure Subscriptions	8
Azure Cost Management.....	10
Azure Resource Manager	12
Microsoft Azure Identity	13
Azure Security.....	15
Azure Sentinel	17
Previewing New Security Features	18
IaaS and PaaS Security.....	18
Summary.....	20
Chapter 2: Overview of Azure Infrastructure as a Service (IaaS) Services	21
Azure Virtual Machines	22
Azure Batch	26
Azure Service Fabric	26
Azure CycleCloud.....	27
Azure VMware Solutions.....	27

TABLE OF CONTENTS

- Azure Storage Services..... 28
 - Blob Storage..... 30
 - Hot Access Tier 30
 - Cool Access Tier 30
 - Archive Access Tier 30
 - Storage Explorer..... 31
 - Data Lake Storage Gen2..... 31
 - Managed Disks..... 32
 - Queue Storage..... 32
 - Azure Files..... 33
 - Data Box 33
 - Ephemeral OS Disks 34
- Azure Networking Services..... 34
 - Azure Virtual Network..... 35
 - Azure Application Gateway and Web Application Firewall..... 35
 - Azure DDoS Protection 36
 - ExpressRoute..... 37
 - Azure Firewall..... 37
 - Azure Front Door..... 38
 - Azure Internet Analyzer 38
 - Azure CDN 38
 - Azure Load Balancer..... 39
 - Traffic Manager 40
 - VPN Gateway 40
- Summary..... 40
- Chapter 3: Overview of Azure Platform as a Service..... 43**
 - Azure Web Apps 43
 - Azure Database Services 45
 - Azure DNS..... 46
 - Azure Traffic Manager 47

Content Delivery Network	49
Azure Batch.....	52
Azure Private Link	52
Summary.....	54
Chapter 4: Azure AppDev Services Overview	57
Azure Development and GitHub	58
Azure Infrastructure as Code	60
Azure App Service	62
Summary.....	66
Chapter 5: Ethical AI, Azure AI, and Machine Learning	67
Ethical AI	68
Science Fiction and Reality: A Social Convergence.....	68
What Is Ethical AI?.....	69
Microsoft AI Principles.....	70
Microsoft Cognitive Services	71
Object Recognition	71
Face AI.....	72
Speech Services.....	75
Machine Reading Comprehension.....	77
Machine Translation	77
Text Analytics: Sentiment	78
Bots	79
Azure Machine Learning	80
Azure Machine Learning.....	81
Machine Learning Studio (Classic).....	82
Azure Databricks.....	82
Use Cases for Azure Databricks.....	83
Azure Data Science Virtual Machines	83
Summary.....	84

- Part II: Planning and Adopting Azure 85**
- Chapter 6: Budgeting and Cloud Economics..... 87**
 - Understanding Cloud Economics: CapEx vs. OpEx..... 87
 - Using Assessment Tools..... 88
 - Forecasting and Other Cost-Saving Features 90
 - Autoscaling..... 93
 - Azure Hybrid Benefit..... 94
 - Reserved Instances 97
 - Azure Cost Management + Billing 98
 - Summary..... 100
- Chapter 7: Designing a Hybrid Datacenter 101**
 - Networking Considerations..... 102
 - PaaS Considerations 104
 - Azure Private Link..... 104
 - Azure Virtual Network Service Endpoints 105
 - Identity and Access Management..... 106
 - Security and Monitoring..... 109
 - Summary..... 113
- Chapter 8: Tools and Training to Up-Skill Existing IT Teams..... 115**
 - Available Training..... 115
 - Cloud Engineer Toolkit..... 120
 - Azure Storage Explorer 127
 - Azure Resource Manager (ARM) and HashiCorp Terraform 128
 - Version Control..... 130
 - Summary..... 133
- Part III: Using Azure for Infrastructure as a Service (IaaS) 135**
- Chapter 9: Implementing Azure Networking 137**
 - Internet Connectivity..... 138
 - Azure VPN..... 140

ExpressRoute	142
Layer 2 ExpressRoute	146
Layer 3 ExpressRoute	147
ExpressRoute Premium.....	149
ExpressRoute Direct.....	149
ExpressRoute Global Reach	150
Implementing ExpressRoute.....	151
Azure Virtual WAN	153
Implementing Network Security Groups	156
Implementing Security and Monitoring for networks	158
Network Watcher	159
Network Performance Monitor	160
Summary.....	163
Chapter 10: Virtual Machines	165
Creating and Managing Virtual Machines	165
Operating Systems (Windows, Linux)	167
Shared Image Gallery	168
Uploading Custom Images.....	170
Virtual Machine Disks.....	176
Image Builder	177
Monitoring the Health of Virtual Machines	178
Securing Virtual Machines.....	183
Troubleshooting	187
Improving VM Availability	188
Availability Zones.....	188
Availability Sets	189
Disaster Recovery.....	190
Azure Site Recovery	191
Summary.....	199

TABLE OF CONTENTS

- Chapter 11: Infrastructure as Code (IaC) 201**
 - Overview of IaC in Microsoft Azure 202
 - Infrastructure as Code Example..... 203
 - ARM Templates..... 205
 - HashiCorp Terraform on Azure..... 210
 - Deploy VNets with Code 219
 - Deploy VMs with Code 220
 - IaC Enhancement Considerations 222
 - Troubleshooting IaC 227
 - Azure Blueprints 227
 - Summary..... 229

- Part IV: Adopting Platform as a Service (PaaS) 231**

- Chapter 12: Azure Web Apps 233**
 - What Are Web Apps? 233
 - Hands-on: Deploying a Web App..... 234
 - Self-Guided Exercise 238
 - Content Management Systems on Web Apps 238
 - Using Azure Web Apps 241
 - Hands-on: Publishing to a Web App..... 242
 - Hands-on: Adding a Custom Domain to a Web App 242
 - Hands-on: Monitoring a Web App 245
 - Hands-on: Self-Guided Exercises 247
 - Summary..... 248

- Chapter 13: Network Platform as a Service 249**
 - Azure DDoS Protection..... 252
 - Web Application Firewall..... 254
 - Application Gateway 257
 - Load Balancers 258
 - Azure Front Door Service 260

Azure Firewall	267
Summary.....	269
Chapter 14: Azure Storage.....	271
The Difference Between Azure Storage and Azure Databases.....	271
Cloud Storage and Storage Accounts.....	271
Azure Blob Storage	272
Hands-on: Deploying Azure Blob Storage	274
Hands-on: Using Azure Blob Storage.....	278
Next Steps: Azure Blob Storage.....	281
Azure Data Lake Store (ADLS).....	281
Azure Tables.....	282
Anatomy of Azure Tables	283
Hands-on: Using Azure Tables	286
Next Steps: Azure Tables	287
Azure Files	288
Hands-on: Using Azure Files.....	288
Next Steps: Azure Files	289
Azure Queues.....	289
Hands-on: Using Azure Queues	290
Next Steps: Azure Queues	290
Summary.....	291
Part V: Azure Data Services and Big Data	293
Chapter 15: Azure Cognitive (COG) Services	295
Azure Cognitive Services	295
Quick Hands-on Introduction	298
Hands-on Exercise	300
Scenario	300
Final Product	301
Exercise.....	302

TABLE OF CONTENTS

- Other Real-World Uses..... 308
- Bots..... 308
- QnA Maker 309
- Hands-on Exercise Part 1: QnA Maker 310
- Hands-on Exercise Part 2: Deploying Bots to a Website 314
- Summary..... 323
- Chapter 16: Machine Learning and Deep Learning..... 325**
- Introduction to Machine Learning and Deep Learning..... 325
 - Data Discussion..... 329
 - Traditional ML..... 331
 - Neural Networks..... 333
 - Transfer Learning 335
- The Data Science Process 335
 - Prerequisites for Becoming a Successful Data Scientist 337
 - Overview of the Data Science Virtual Machine..... 338
 - A Jupyter Notebook Overview 339
 - Hands-on with the Data Science Virtual Machine 340
- Overview of Azure Machine Learning 345
 - Hands-on with Azure Machine Learning: Training a Model 347
 - Hands-on with Azure Machine Learning: Deploying a Model 354
 - Use Case: Image Classification with a Deep Neural Network and Azure Machine Learning..... 356
 - Hands-on with Azure Machine Learning and PyTorch 357
- IoT Devices and the Intelligent Edge..... 358
- Overview of Spark and Databricks..... 361
 - Auto ML with Azure Databricks and Azure Machine Learning..... 362
 - Hands-on with Azure Databricks and Auto ML 363
 - Use Case: Azure Databricks for Data Scientists 368
- Summary..... 368

Chapter 17: Azure Data Services	369
Data Trends	370
Data Types and Volume.....	370
Data Analysis Trends.....	371
Modern Data Roles	372
Data Platform as a Service	373
Azure Data Services.....	374
Azure SQL Database.....	375
Hands-on with Azure SQL Database.....	376
Azure SQL Managed Instance.....	384
Elastic Pools	385
Hands-on with Elastic Pools.....	386
Hands-on Tuning and Monitoring Azure SQL Databases	388
Next Steps: Self-Guided Assignment.....	398
Azure Cosmos DB.....	399
Use Cases for Azure Cosmos DB	399
Hands-on: Deploying Azure Cosmos DB	400
Hands-on: Using Azure Cosmos DB to Store Bot Conversation History	403
Summary.....	409
Part VI: Azure Services for Application Developers	411
Chapter 18: Migrating On-Premises Databases to Azure	413
Data Migration Assistant (DMA)	414
Hands-on: Setting up a Lab	414
Hands-on: Using the Data Migration Assistant for Assessment	415
Hands-on: Reading the Assessment Reports from the Data Migration Assistant.....	418
Hands-on: Azure Migrate	418
Hands-on: Uploading an Assessment Report to Azure Migrate	421
Hands-on: Migrate Database Using Data Migration Assistant.....	421

TABLE OF CONTENTS

- Azure Database Migration Service (DMS) 426
 - Hands-on: Deploying Azure Database Migration Service 427
 - Hands-on: Using Azure Database Migration Service 428
- Summary..... 432
- Chapter 19: Data Engineering and the Modern Data Estate 433**
 - Terminology 433
 - Data Estate 434
 - Modern Data Warehouse: ELT vs. ETL..... 434
 - Modern Storage and Big Data 435
 - Modern Data Platform Strategies 435
 - Azure Data Factory (ADF) 436
 - Hands-on: Installing Azure Data Factory 436
 - Hands-on: Exploring Azure Data Factory 437
 - Hands-on: Creating a Copy Data Pipeline 448
 - Saving Your Work..... 450
 - Hands-on: Multiple Activities in a Pipeline 451
 - Accessing On-Premises Data Sources..... 456
 - The Architecture of the Self-Hosted Integration Runtime..... 456
 - Installing and Configuring the Self-Hosted Integration Runtime 457
 - Summary..... 459
- Part VII: Intelligent Cloud, Machine Learning, and Artificial Intelligence 461**
 - Chapter 20: Developing and Deploying Azure-based Applications..... 463**
 - Introduction..... 463
 - Trends in Cloud-based Application Development..... 464
 - Platform as a Service (PaaS) 464
 - Slots on Azure Web Apps 465
 - Hands-on with Slots on Azure Web Apps..... 465

Containers.....	472
Containers in Azure	474
Hands-on with Docker Images and the Azure Container Registry.....	474
Hands-on with Azure Kubernetes Service (AKS)	478
Troubleshooting and Monitoring AKS	487
Hands-on Monitoring and Troubleshooting AKS	487
Summary.....	492
Chapter 21: Continuous Integration/Continuous Delivery with Azure DevOps	493
What Is Azure DevOps?	494
Why Azure DevOps	494
Predictability and Repeatability.....	495
Agile Deployment and Continuous Improvement.....	495
Planning, Collaboration, and Workflow	495
Provisioning Azure DevOps	496
Azure Repos	497
Hands-on with Azure Repos	498
Repository Operations	502
Hands-on with Azure Repos: Adding an Existing Project to Azure Repos.....	509
Azure Pipelines	511
Key Concepts.....	512
Hands-on with Azure Pipelines: CI/CD	513
Summary.....	518
Index.....	521

About the Authors



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About the Technical Reviewers



Kurtis Carlson is an independent consultant helping businesses migrate their mission-critical applications to Azure and apply governance across the organization’s portfolio of applications. He also helps developers and operations teams modernize applications and practices using Azure DevOps and infrastructure as code. His IT career includes working for San Francisco-based companies like Visa International and First Republic Bank, as well as local government agencies.

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ABOUT THE TECHNICAL REVIEWERS



Daren Child is a lifelong data professional with experience as a data architect in Fortune 100 companies, world financial organizations, and research organizations. Daren joined Microsoft as a government data architect in 2016. Since then, he has been involved in data transformation and aiding government organizations with developing a data culture. Daren is a fan of storage-based data access patterns and has taken on a personal initiative to revive enterprise data warehouses across US government organizations.

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Introduction

Since the launch of the first edition of this book in 2015, Microsoft Azure, and cloud computing in general, has come a long way. This second edition is completely rewritten and updated, with more than 70% of the book containing brand-new topics and trends. In the first edition, we focused on managing a data center in the cloud, as reflected by the subtitle we chose at that time. Since then, Microsoft Azure is more than just your data center in the cloud. It is where you adopt advanced technologies like artificial intelligence (AI), Internet of Things (IoT), and machine learning, and handle vast amounts of data to help make data-driven decisions. With the focus on these new capabilities in Microsoft Azure, this second edition is all about adopting the intelligent cloud.

There are many resources online and by other authors that focus on all the topics covered in this book. But we found that there is a lack of updated material that goes into more than just an introduction of all the main technologies in Microsoft Azure. Thus, we wanted a book that ambitiously strives to give readers a strong foundation in all the important aspects of Microsoft Azure. If you are new to Microsoft Azure and cloud computing in general, Parts I and II of this book should give you a solid overview of Azure's capabilities and the business and environmental trends, including planning and adopting strategies. For the more seasoned readers, Parts III through VII cover the different categories of Azure services (IaaS, PaaS, data, cloud-based software development, and AI/ML). Although we tried to build the hands-on exercises in such a way that they are interrelated throughout the book, you can read any part in any order and still gain the benefits of the content without getting lost.

Due to the rapidly changing nature of technology, we have also incorporated a GitHub repository that is dedicated to updating the hands-on exercises and provide more content than we were able to fit within the physical constraints of these pages. We hope that you benefit greatly from this book as much as we enjoyed working on it. We wish you all the best in your quest for knowledge and making a difference in technology.

PART I

Introducing Microsoft Azure

CHAPTER 1

Microsoft Azure and Cloud Computing

Cloud computing as a platform does not require a review; however, the hundreds of new services and updated changes to the Microsoft Azure public cloud can be a great investment for your business. Updated Azure core services and new business services are explained in this book to further your knowledge. This book was written for both technical and business readers to gain greater skills through our guidance.

This book is updated in its second edition. We know that reader commitment goes beyond the cover price; it is spent in the value of your time learning. You cannot afford to waste one hour, so we are dedicated to earning your commitment on every page and in every chapter by providing you the most timely and updated guidance on Microsoft Azure services. We provide guidance and information to help you understand the details and completed code in the book as well as additional examples on the public GitHub location.

Note All the code for the software-defined infrastructure (both Microsoft Azure ARM templates and HashiCorp Terraform) can be downloaded at <https://github.com/harris-soh-copeland-puca>.

In this chapter, you learn about many new features and best-in-cloud improvements that are integrated and deployed through various methods in the Azure platform. This chapter is written as a high-level introduction to updated features that have been greatly enhanced or are new to the platform. The other chapters provide in-depth information on topics, to provide guidance and configuration.

Where Is Microsoft Azure Today?

One of the challenges for technical readers may be having expertise in other cloud solutions and relating to Microsoft Azure terminology. You are first guided through Azure services and cloud products to identify a cloud service, and then in later chapters, we provide a deeper look at how to create, deploy, and manage that service. Azure services are continuously updated, and you need to understand the details to enable technologies to support your business and leverage updated Azure platform services. The market drives features that benefit business revenue, and cloud computing customers are requesting continuous innovation from Microsoft.

The Microsoft Azure additions have grown out of teams that expand beyond the Redmond campus to include global collaboration with businesses, customers, universities, and governments to expand Microsoft Azure services. The incorporated feedback provides a road map that, like software development, leverages a CI/CD (continuous integration/continuous deployment) pipeline. Azure services and resources change and adapt much more rapidly than traditional on-premises software deployment cycles.

The information provided is written with the intent to eliminate unnecessary acronyms. Some are unavoidable, and many are overused in online documentation. Depending on your business role, some acronyms are indispensable and are used in more than one workflow, and if you are skimming information, it can be confusing. For example, SDLC (software development life cycle) is used in Agile delivery conversations. If the topic also includes cybersecurity, then SDLC means *security development life cycle*.

Agile is a term used in software development conversations; it is not an acronym but a process for delivering software in a short schedule. Another example is continuous integration/continuous deployment (CICD or CI/CD). It is a term that is used in more than software delivery; for example, Azure documentation is updated on GitHub and delivered directly to websites.

Note This chapter provides an overview of many of the fundamental Azure features with additional chapters providing deep dives and guidance.

Azure Availability

Azure has an infrastructure that is geographically identified globally, regionally, and by zone. Azure regions are based on countries and broken into geographies. This is important because specific regions have failover availability and services that are available in a region. Not all services are available in all regions across the globe.

Azure regions are several datacenters deployed within a perimeter. They provide low network latency for communication within those regions and inside those datacenters. Many of the datacenters' physical buildings are aligned together as one location; they are described as a *datacenter campus* in some documentation. An entire datacenter can failover for another datacenter in the Azure region. Some of the Azure regions (in the United States, for example) are identified as Central US or East US in the Azure public cloud.

A Microsoft Azure region supports at least two physically separate locations that preserve data within a specific compliance boundary. *Geographies* allow customers to maintain data inside known locations by geographic boundaries. Geographic boundaries are connected using dedicated low-latency networks and include regions in the United States and around the globe, but it is more apparent when you look at geographic regions in Europe. For example, Azure regions in Europe include North Europe and West Europe, which support each other to provide high availability; likewise, North Germany and West Germany specifically maintain data inside Germany's borders.

Azure availability zones include at least two Azure regions, which are physically separated by hundreds of miles to support more than one location for high availability. The datacenter equipment includes redundant power, redundant cooling, and redundant network connectivity. High availability requires an architecture that considers both *infrastructure as a service* (IaaS) and *platform as a service* (PaaS). High availability does not include backup and recovery, which is included in the architecture for disaster recovery processes.

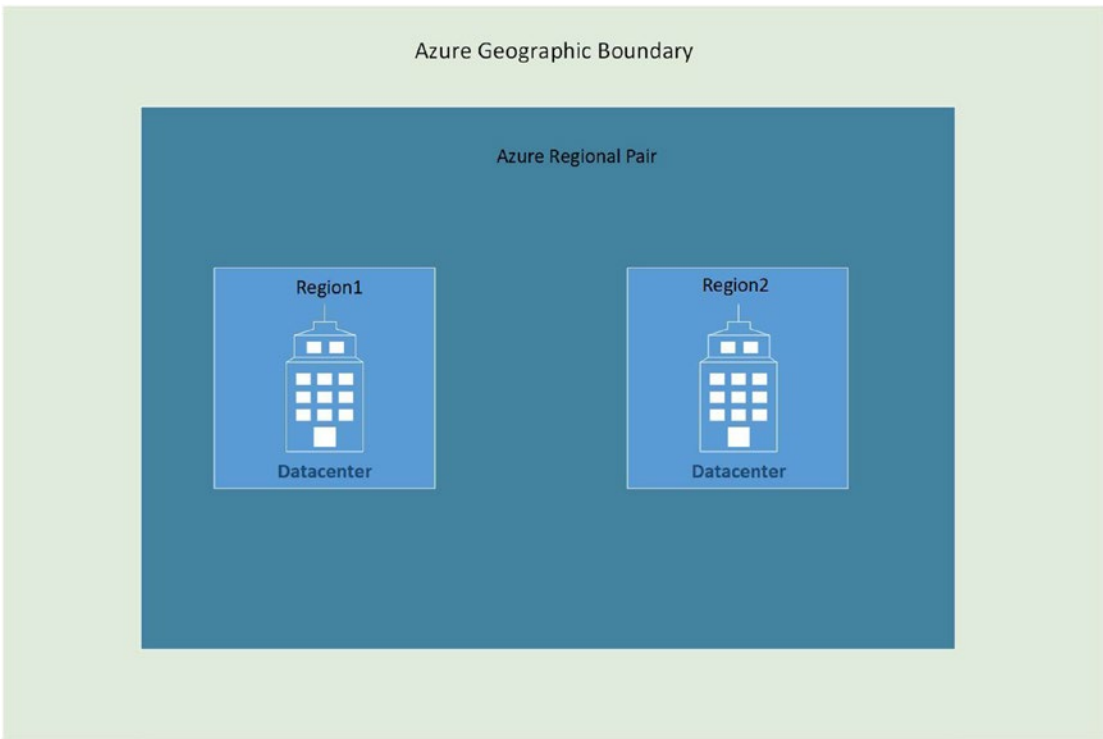


Figure 1-1. Azure geographic boundary with regional pairs

For the Azure Government cloud, we use USDOD central or USDODE. Other regions support both the US public cloud and the US Azure Government clouds. To learn more about the Azure regions across the United States, Europe, and Asia, go to <https://azure.microsoft.com/is-is/global-infrastructure/geographies/>.

Azure Government is significantly different from other cloud services providers because it specifically addresses technical and mandatory regulatory requirements, such as

- FedRAMP
- FISMA
- FBI Criminal Justice Information Systems (CJIS)

Often, these government-specific requirements make it difficult for cloud services providers to scale up. Also, special SLAs (service-level agreements) and compliance requirements can cause providers to be penalized for noncompliance. For example, the FBI CJIS requires that a cloud service provider’s personnel be background-checked and fingerprinted.

The Azure Government cloud was the first cloud to be consistent with the 13 areas defined in the CJIS security policy.

Note Standards apply to all customers using Azure cloud, Public or Government. Microsoft datacenter personnel are background-checked and fingerprinted, the same personnel are responsible for the service. Standards such as CJIS apply to all customers using Azure Government. Use the contact email cjis@microsoft.com for information on which services are currently available in specific states across the United States.

The Azure SLA for availability Each Microsoft Azure service has an SLA based on the region the service is available in. The most up-to-date SLA information is available at <https://azure.microsoft.com/en-us/support/legal/sla/>. The Azure SLA for availability zones offers 99.99% virtual machine (VM) uptime.

Azure Compliance

Azure maintains more than 90 compliance certifications, which include ones that specifically support regions and countries. These certifications are built to meet industry standards for IT and cloud-computing services. Azure's industry-recognized certifications are at <https://docs.microsoft.com/en-us/microsoft-365/compliance/offering-home?view=o365-worldwide>.



Figure 1-2. Azure compliance offerings

Certifications govern Azure's suitability for specific industry use, and they form the basis of customer trust. Third-party auditors, who are recognized by certification bodies, independently verify each certification. There is also a requirement for recertification and periodic audits to ensure compliance with all certifications.

Microsoft is a member of the advisory committee for many certification bodies, and it provides feedback and recommendations on proposed changes. Microsoft has visibility in many upcoming changes, which allows them to incorporate changes in the Azure platform in a timely manner.

Microsoft Azure Subscriptions

An Azure subscription is a large collection of services in your Azure account for identifying, controlling, and providing governance of those resources. Azure Active Directory is used in the provisioning of resources through ARM being able to use the role-based access control applied to specific resources. There are several ways to purchase an Azure subscription.

- Free trial
- Pay as you go
- Visual Studio MSDN (testing only)
- Microsoft resellers
- open license platform plus
- Microsoft enterprise account agreements

Azure role-based administration allows user and machine accounts access to resources in your Azure subscription; however, at a high level, there are administrative roles that are limited to the number of roles per subscription. Before we take a deeper dive into administration accounts, a few definitions need to be reviewed.

The term *Azure resource* designates an entity or an intelligent object that is managed by Azure. Simple examples are a virtual network (VNet), a storage account, or a virtual machine (VM). All three are Azure resources; they are not Azure services.

An *Azure service* is an automated deployment of a VM, VNet, or storage account.

An *Azure resource group* allows the grouping of resources that have the same life cycle and security requirements. Like individual services, a resource group can assign privileged access to multiple Azure roles.

Note One Azure account can have multiple Azure subscriptions associated with it.

An Azure subscription name is limited to a maximum of 64 characters, and the name cannot be changed. It is an important planning decision for administrative roles support for your Azure subscription.

Note Be aware the person who completes the Azure subscription sign up wizard is assigned the Global Administrator role.

It is important to realize that a Global Administrator and a Privileged Role Administrator can delegate administrator roles to other users in Azure AD. Table 1-1 provides key roles for Azure subscription users to consider for management and to support security needs, such as separation of duties.

Table 1-1. *Azure Account Roles, Limits, and Descriptions*

Admin Role	Limit	Description
Account Administrator	1/Azure account	Access to the Account Center
Service Administrator	1/Azure subscription	Access all subscriptions through the Azure management portal
Co-Administrator	Unlimited/Azure subscription	Cannot change permissions of Azure subscriptions
Global Administrator	1/Azure account	Read and modify every administrative setting in Azure AD

There is one Account Administrator per Azure subscription; this role authorizes and creates additional accounts for access to a subscription. This account allows you to change billing information and services administration. There is one Service Administrator account per Azure subscription, and it authorizes management access to the management portal for subscriptions. In a subscription, the Co-Administrator account is unlimited.