

# Developing Solutions for Microsoft Azure AZ-204

## Exam Guide

### Preface:

The screenshot shows the dashboard interface of the online practice resources. At the top, there is a dark header bar with the text "Practice Resources" and a bell icon. To the right of the bell icon is a button labeled "SHARE FEEDBACK". Below the header, the word "DASHBOARD" is centered. In the center of the dashboard, there is a large card for the book "Developing Solutions for Microsoft Azure AZ-204 Exam Guide", which is described as "A comprehensive guide to success in the AZ-204 exam". Below this card are four expandable sections: "Mock Exams", "Chapter Review Questions", "Flashcards", and "Exam Tips". At the bottom left of the dashboard, there is a link "BACK TO THE BOOK" next to the book's cover image and its title.

Figure 0.1 – Dashboard interface of the online practice resources

## Chapter 1: Azure and Cloud Fundamentals

The screenshot shows the 'DASHBOARD' section of the online practice resources. At the top, there's a header with 'Practice Resources' and a 'SHARE FEEDBACK' button. Below the header, the title 'Developing Solutions for Microsoft Azure AZ-204 Exam Guide' is displayed, along with a subtitle 'A comprehensive guide to success in the AZ-204 exam'. There are four expandable sections: 'Mock Exams', 'Chapter Review Questions', 'Flashcards', and 'Exam Tips'. At the bottom left, a link 'BACK TO THE BOOK' is visible, followed by the book cover and title 'Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition' by Paul Ivey, Alex Ivanov.

Figure 1.1 – Dashboard interface of the online practice resources

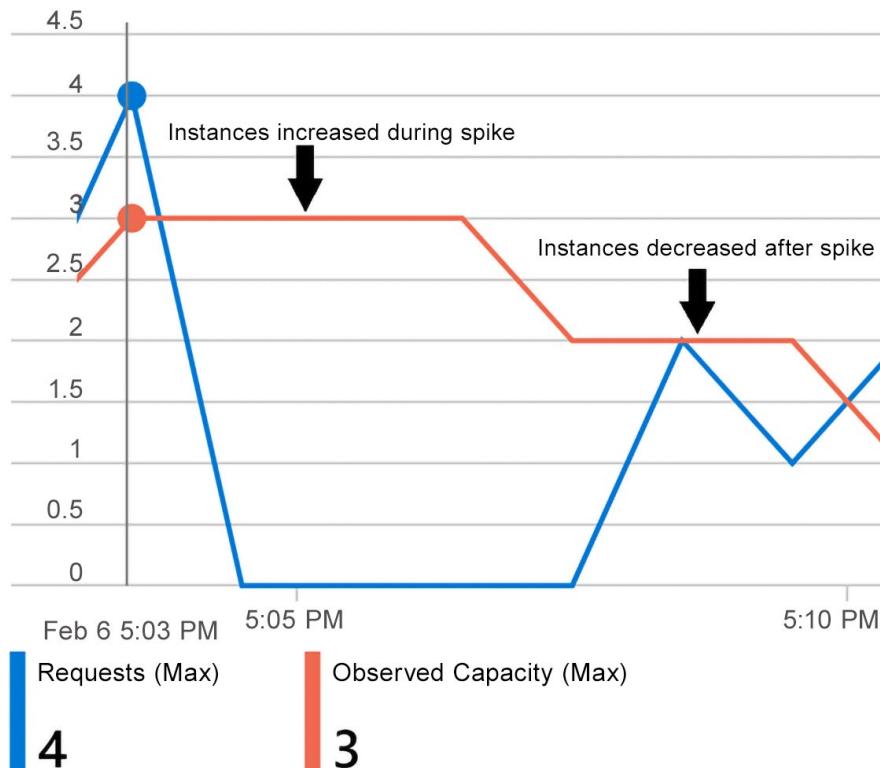


Figure 1.2: Automatically scaled instances during and after a spike in requests

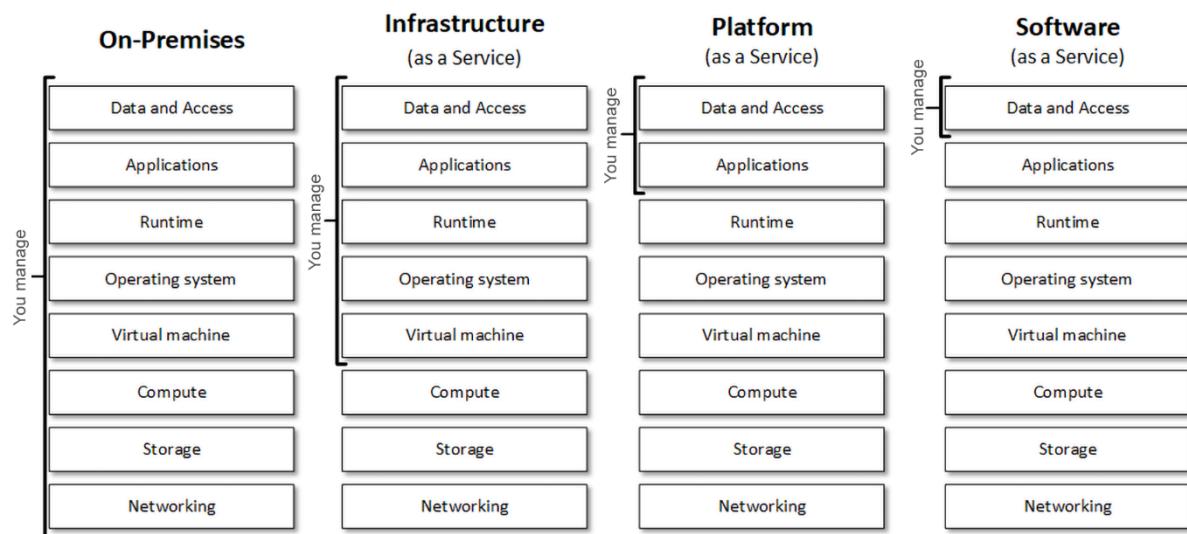


Figure 1.3: Illustration of the different cloud service models and management responsibility in comparison to on-premises

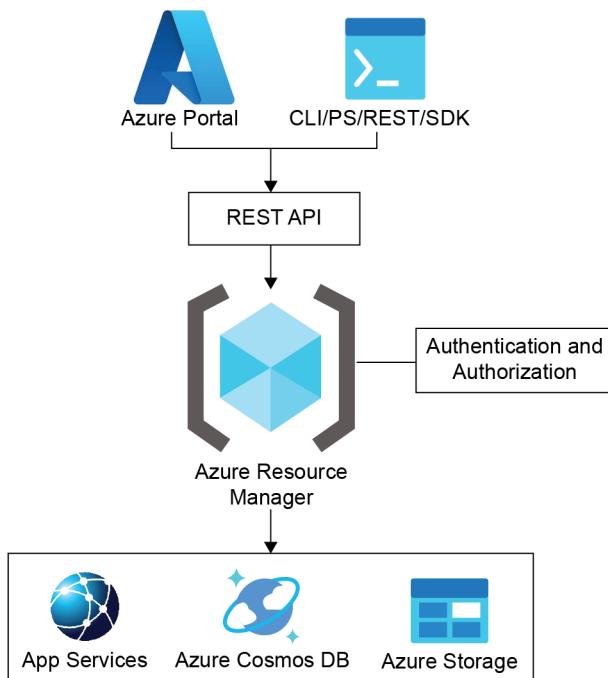


Figure 1.4: Illustration of the role ARM plays in handling Azure requests

## Deployment details

| Resource  | Type                      |
|---|---------------------------|
| <input checked="" type="checkbox"/> az204chapter1       | Microsoft.Web/sites       |
| <input checked="" type="checkbox"/> az204appserviceplan | Microsoft.Web/serverfarms |

Figure 1.5: Resource providers and resource types in the Azure portal

The screenshot shows the 'Practice Resources' interface. At the top, there's a dark header with the 'Practice Resources' logo, a bell icon for notifications, and a 'SHARE FEEDBACK' button. Below the header, the navigation path is 'DASHBOARD > CHAPTER 1'. The main content area has a title 'Azure and Cloud Fundamentals' and a 'Summary' section. The summary text discusses the chapter's content, mentioning cloud computing benefits, Azure Active Directory, Microsoft Entra ID, regions, availability groups, and ARM. It also notes the transition to Azure App Service web apps in the next chapter. To the right, a 'Chapter Review Questions' sidebar is visible, featuring the book title 'The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition by Paul Ivey, Alex Ivanov', a 'Select Quiz' button, and a 'Quiz 1' section with a 'SHOW QUIZ DETAILS' link and a 'START' button.

Figure 1.7 – Chapter Review Questions for Chapter 1

## Chapter 2: Implementing Azure App Service Web Apps

The screenshot shows the 'App Service plans' section in the Azure portal. At the top left is a blue cloud icon with a gear and slider. To its right is the text 'App Service plans'. Further right is a blue star icon. Below the title are two buttons: a blue '+' icon labeled 'Create' and a blue eye icon labeled 'View'. The background is white with some light gray horizontal lines.

### Description

App Service plans represent the collection of physical resources used to host your apps, like location, scale, size and SKU

Figure 2.1: The Azure portal description of App Service plans

### App Service Plan details

Name \*

 MY-WINDOWS-ASP

Operating System \*

 Linux  Windows

Region \*

West Europe

Figure 2.2: App Service plan details within the Azure portal

Hardware view  Feature view

| Name                                 | ACU/vCPU ↑         | vCPU | Memory (GB) | Remote Storage (GB) | Scale (instance) |
|--------------------------------------|--------------------|------|-------------|---------------------|------------------|
| ▼ Popular options                    |                    |      |             |                     |                  |
| <input type="checkbox"/> Free F1     | 60 minutes/day...  | N/A  | 1           | 1                   | N/A              |
| <input type="checkbox"/> Shared D1   | 240 minutes/day... | N/A  | 1           | 1                   | N/A              |
| <input type="checkbox"/> Basic B1    | 100                | 1    | 1.75        | 10                  | 3                |
| <input type="checkbox"/> Standard S1 | 100                | 1    | 1.75        | 50                  | 10               |

Figure 2.3: App Service plan hardware view

## Select App Service Pricing Plan

Hardware view  Feature view

| Name                                 | Custom domain | Auto Scale | Daily backups | Staging slots |
|--------------------------------------|---------------|------------|---------------|---------------|
| ▼ Popular options                    |               |            |               |               |
| <input type="checkbox"/> Free F1     | -             | N/A        | N/A           | N/A           |
| <input type="checkbox"/> Shared D1   | -             | N/A        | N/A           | N/A           |
| <input type="checkbox"/> Basic B1    | ✓             | Manual     | N/A           | N/A           |
| <input type="checkbox"/> Standard S1 | ✓             | Rules      | 10            | 5             |

Figure 2.4: App Service plan feature view

## Select App Service Pricing Plan

Hardware view  Feature view

| Name  | Custom domain | Auto Scale | Daily backups | Staging slots |
|---|---------------|------------|---------------|---------------|
| > Popular options                               |               |            |               |               |
| > Dev/Test (For less demanding workloads)       |               |            |               |               |
| ▼ Production (For most production workloads)    |               |            |               |               |
| <input checked="" type="checkbox"/> Standard S1 | ✓             | Rules      | 10            | 5             |

Figure 2.5: Standard S1 production tier App Service plan feature view

### Pricing Tier

App Service plan pricing tier determines the location, features, cost and compute resources associated with your app.  
[Learn more ↗](#)

Pricing plan

Standard S1 (100 total ACU, 1.75 GB memory, 1 vCPU)

[Explore pricing plans](#)



### Zone redundancy

An App Service plan can be deployed as a zone redundant service in the regions that support it. This is a deployment time only decision. You can't make an App Service plan zone redundant after it has been deployed [Learn more ↗](#)

Zone redundancy

**Enabled:** Your App Service plan and the apps in it will be zone redundant. The minimum App Service plan instance count will be three.

**Disabled:** Your App Service Plan and the apps in it will not be zone redundant. The minimum App Service plan instance count will be one.

Figure 2.6: Pricing tier SKU code and zone redundancy options



## Your web app is running and waiting for your content

Your web app is live, but we don't have your content yet. If you've already deployed, it could take up to 5 minutes for your content to show up, so come back soon.

Figure 2.7: Web app starter page content

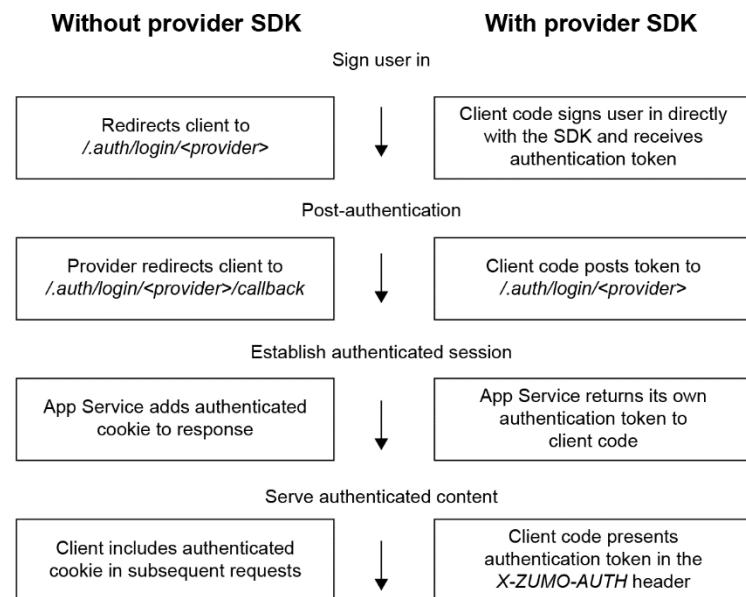


Figure 2.8: Authentication flow steps

## App registration

An app registration associates your identity provider with your app. Enter the app registration information here, or go to your provider to create a new one. [Learn more](#)

App registration type \*

- Create new app registration
- Pick an existing app registration in this directory
- Provide the details of an existing app registration

Name \* ⓘ

Supported account types \*

- Current tenant - Single tenant
- Any Azure AD directory - Multi-tenant
- Any Azure AD directory & personal Microsoft accounts
- Personal Microsoft accounts only

[Help me choose...](#)

Figure 2.9: Default App Service app registration settings

## App Service authentication settings

Requiring authentication ensures that requests to your app include information about the caller, but your app may still need to make additional authorization decisions to control access. If unauthenticated requests are allowed, any client can call the app and your code will need to handle both authentication and authorization. [Learn more](#)

Restrict access \*

- Require authentication
- Allow unauthenticated access

Unauthenticated requests \*

- HTTP 302 Found redirect: recommended for websites
- HTTP 401 Unauthorized: recommended for APIs
- HTTP 403 Forbidden
- HTTP 404 Not found

Redirect to

 ⓘ

Token store ⓘ



Figure 2.10: App Service authentication settings

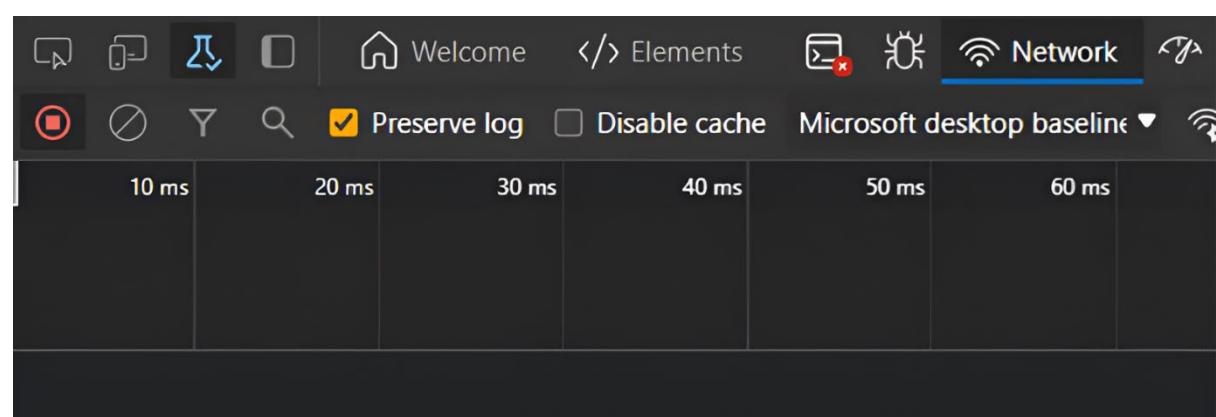


Figure 2.11: In-browser developer tools Network tab

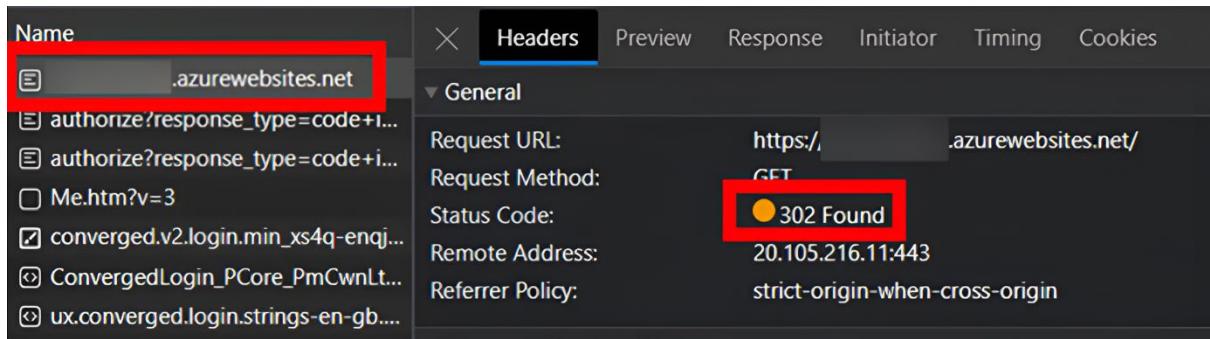


Figure 2.12: In-browser developer tools showing a 302 Found status code

|                            |   |
|----------------------------|---|
| App Service authentication | Enabled   |
| Restrict access            | Require authentication                                |
| Unauthenticated requests   | Return HTTP 302 Found (Redirect to identity provider) |
| Redirect to                | Microsoft   |
| Token store                | Enabled   |

Figure 2.13: Authentication settings summary showing the 302 Found configuration

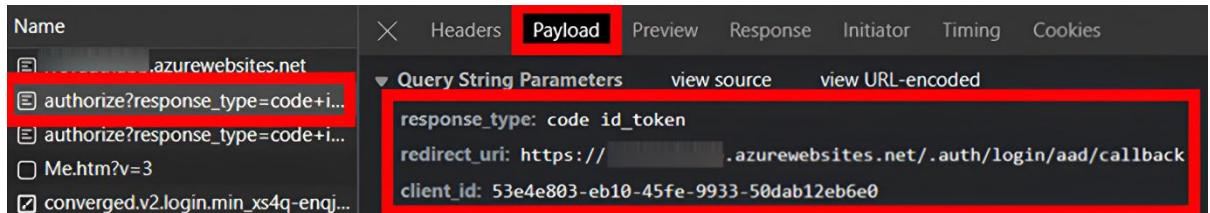


Figure 2.14: In-browser developer tools showing the redirect URI and client ID

# Permissions requested

This application is not published by Microsoft.

This app would like to:

- ✓ View your basic profile
- ✓ Maintain access to data you have given it access to
- Consent on behalf of your organisation

Accepting these permissions means that you allow this app to use your data as specified in their Terms of Service and Privacy Statement. You can change these permissions at <https://myapps.microsoft.com>. [Show details](#)

Does this app look suspicious? [Report it here](#)

[Cancel](#) [Accept](#)

Figure 2.15: Permissions requested by the app registration

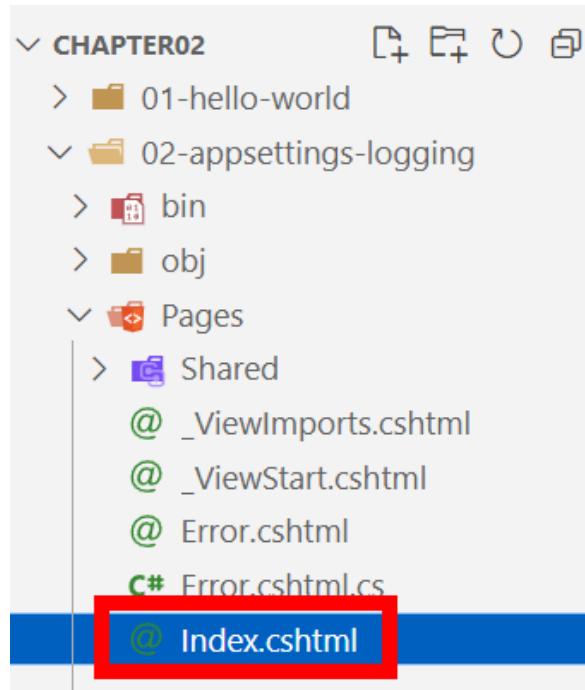


Figure 2.16: The Index.cshtml file within VS Code

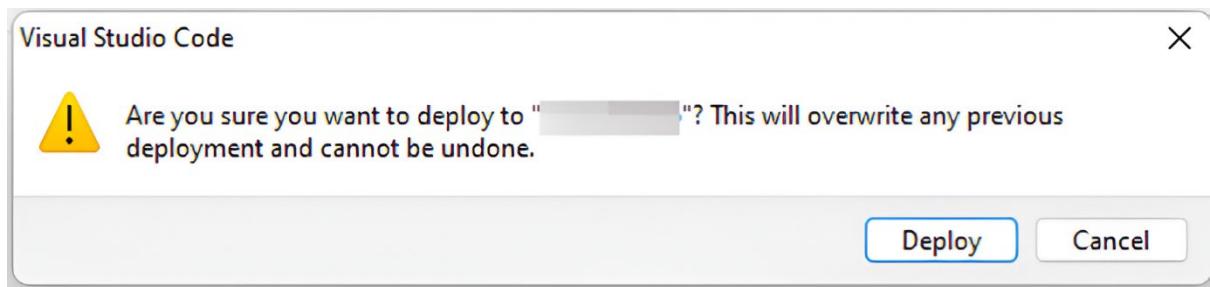


Figure 2.17: App Service deployment confirmation window

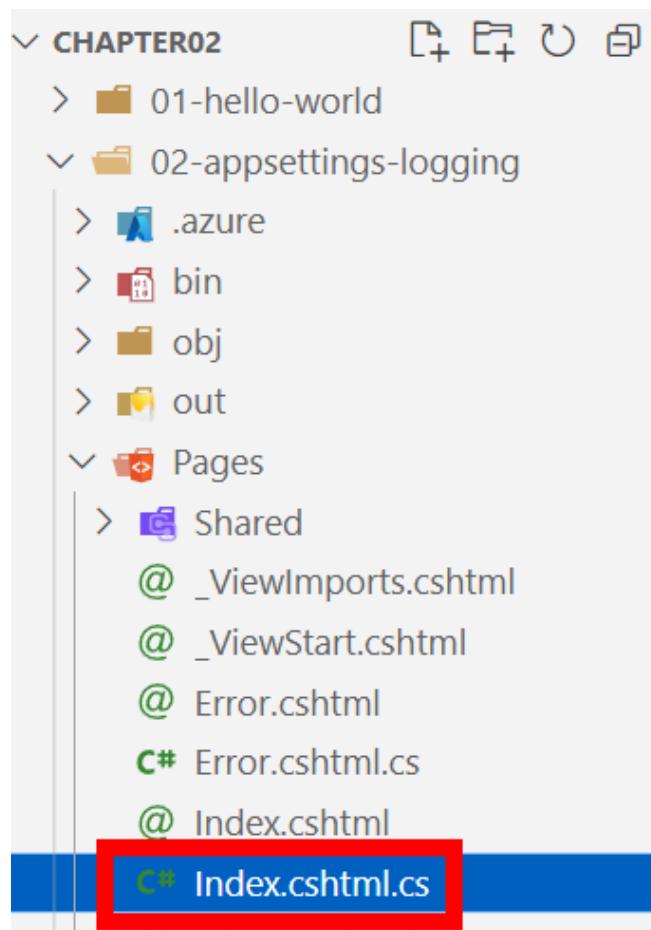


Figure 2.18: The Index.cshtml.cs file within VS Code

```
> dotnet run
[info]: Microsoft.Hosting.Lifetime[14]
  Now listening on: http://localhost:5000
[info]: Microsoft.Hosting.Lifetime[14]
  Now listening on: https://localhost:5001
[info]: Microsoft.Hosting.Lifetime[0]
  Application started. Press Ctrl+C to shut
[info]: Microsoft.Hosting.Lifetime[0]
  Hosting environment: Production
[info]: Microsoft.Hosting.Lifetime[0]
  Content root path: [REDACTED]
[info]: 02 appsettings.logging.Pages.IndexModel[0]
  Hello, Packt! I'm logging for the AZ-204!
```

Figure 2.19: Terminal output showing information logging from the web app

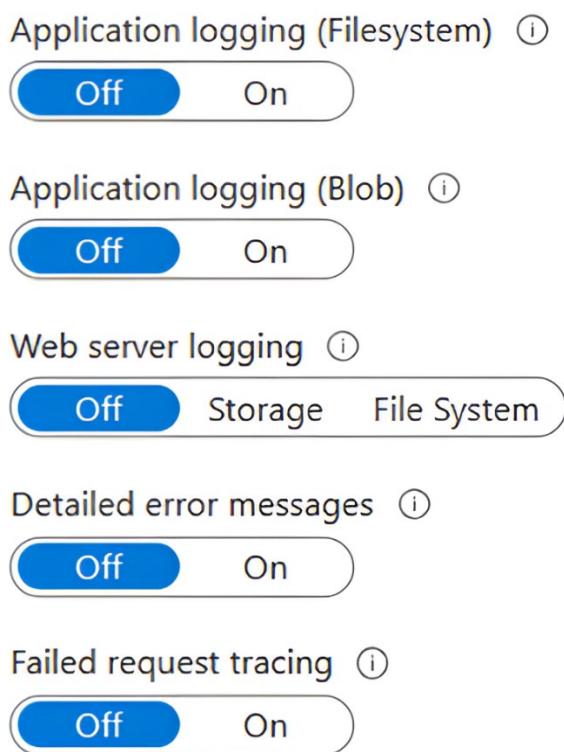


Figure 2.20: App Service logging options for a Windows App Service

Scale out method

- Manual  
Maintain a constant instance count for your application
- Automatic (preview)  
Platform managed scale up and down based on traffic  
Automatic scaling requires a Premium v2 or Premium v3 App Service Plan.  
Upgrade your App Service Plan to enable this feature.
- Rules Based  
User defined rules to scale on a schedule or based on any app metric

[See recommended pricing plan](#)

⚠ Rule based scaling will be ignored if Automatic scaling is enabled. [Manage rules based scaling](#)

Figure 2.21: Options to configure rule-based scaling

## Criteria

| Metric namespace *  | Metric name    |                  |                                     |
|---------------------|----------------|------------------|-------------------------------------|
| Standard metrics    | CPU Percentage |                  |                                     |
| 1 minute time grain |                |                  |                                     |
| Dimension Name      | Operator       | Dimension Values | Add                                 |
| Instance            | =              | All values       | <span style="color: blue;">+</span> |

If you select multiple values for a dimension, autoscale will aggregate the metric across the selected values, not evaluate the metric for each values individually.



Enable metric divide by instance count (i)

|  |  |
|--|--|
| Operator *   | Metric threshold to trigger scale action * <span style="color: blue;">(i)</span> |
| Greater than   | 20 <span style="color: green;">✓</span>  |
| Duration (minutes) * <span style="color: blue;">(i)</span> | Time grain (minutes) <span style="color: blue;">(i)</span>                       |
| 10   | 1  |

Figure 2.22: Custom metric condition visual

# Original slot: Staging.

# Current slot: Production.

Figure 2.23: Text showing that the previous staging app is now the production app

The screenshot shows a dark-themed web application interface. At the top, there's a navigation bar with the 'Practice Resources' logo, a bell icon for notifications, and a 'SHARE FEEDBACK' button. Below the navigation, the path 'DASHBOARD > CHAPTER 2' is visible. The main content area has a title 'Implementing Containerized Solutions' and a 'Summary' section. The summary text discusses the chapter's content, including Azure App Service fundamentals, authentication, authorization, networking, configuration, and deployment slots. It also mentions the next chapter on containerized solutions. To the right, a 'Chapter Review Questions' sidebar is shown, featuring the text 'The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition by Paul Ivey, Alex Ivanov'. Below this, a 'Select Quiz' section lists 'Quiz 1' with a 'SHOW QUIZ DETAILS' link and an orange 'START' button.

Figure 2.25 – Chapter Review Questions for Chapter 2

## Chapter 3: Implementing Containerized Solutions

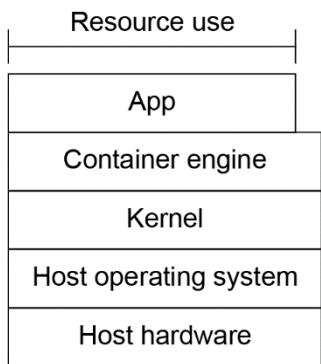


Figure 3.1: Diagram showing the components required when running a web app on a VM

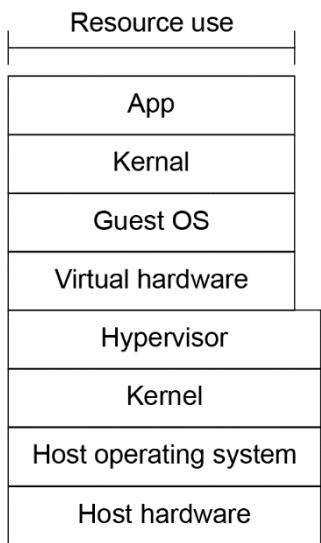


Figure 3.2: Diagram showing the components required when running a web app in a container

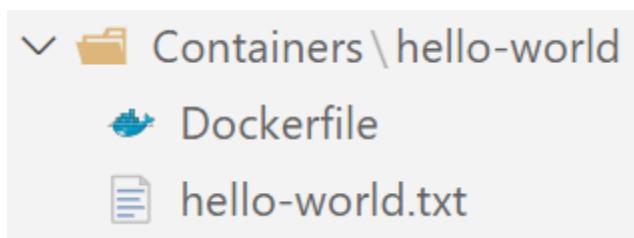


Figure 3.3: The Dockerfile and the text file in the same new directory

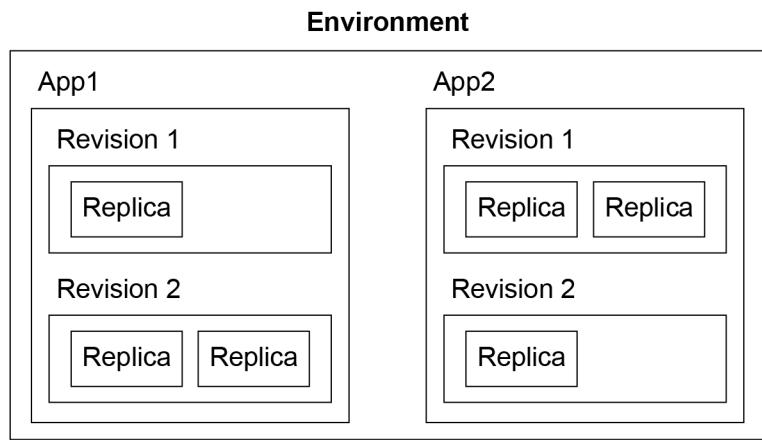


Figure 3.4: Container Apps hierarchy

```
demoapp Home
```

```
[{"date":"2023-07-14","temperatureC":-11,"temperatureF":13,"summary":"Hot"}, {"date":"2023-07-15","temperatureC":44,"tem  
16","temperatureC":45,"temperatureF":112,"summary":"Cool"}, {"date":"2023-07-17","temperatureC":31,"temperat  
18","temperatureC":-10,"temperatureF":15,"summary":"Bracing"}]
```

Figure 3.5: Example output from demoapp when demoapi is also running

| > docker images |        |              |               |       |
|-----------------|--------|--------------|---------------|-------|
| REPOSITORY      | TAG    | IMAGE ID     | CREATED       | SIZE  |
| demo-api        | latest | bdcca4bf945a | 4 minutes ago | 216MB |
| demo-app        | latest | 9e44532c0d9b | 8 hours ago   | 220MB |

Figure 3.6: Both the demo-api and demo-app images created from Docker Compose

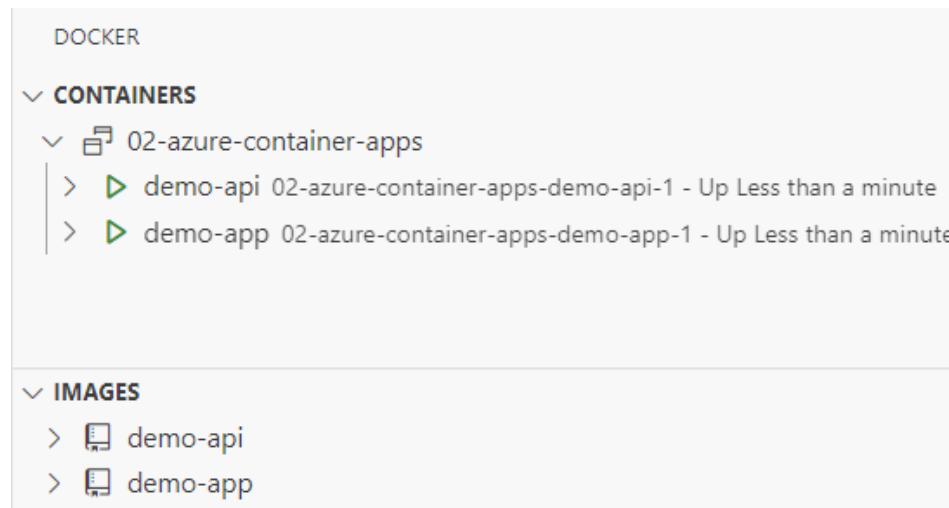


Figure 3.7: Example view of the Docker VS Code extension

## Add scale rule

### Scale rule details

Rule name \*

Type \* ⓘ  HTTP scaling  HTTP scaling  Azure queue  Custom

Concurrent requests \*

Figure 3.8: Scale rule options

| Scale                                 | Replicas |                        |
|---------------------------------------|----------|------------------------|
| <input type="text"/> Search           |          |                        |
| Replica name ↑                        | Ready ↑  | Running status         |
| demo-app--helloworld-79f9b944d8-krjnk | 1/1      | <span>✓</span> Running |

Figure 3.9: Example replica running

## Edit a container

X

Basics    **Health probes**    Volume mounts

---

^ Liveness probes

▼ Readiness probes

Enable readiness probes

Transport \* ⓘ

Path \* ⓘ

Port \* ⓘ

Initial delay seconds ⓘ

Period seconds ⓘ

Figure 3.10: Corrected health probe

### Environment variables

+ Add

| Name    | Source              | Value     | Delete |
|---------|---------------------|-----------|--------|
| API_URL | Reference a se... ▾ | api-url ▾ |        |

Figure 3.11: Environment variable referencing a secret



## Implementing Azure App Service Web Apps

### Summary

This chapter was all about containers—building container images and running containers from those images. With the fundamentals of containers covered, you looked at how ACR can help with the storage and maintenance of container images, followed by running containers within ACI. One of the newest editions to Azure in the containers space, and the newest edition to the AZ-204 exam, is ACA. The core features and functionality of ACA were covered, as well as the hierarchy, some nice automation making use of Docker Compose, ingress settings, health probes, and secret use. Having microservices that can be independently built, deployed, and scaled can be extremely valuable in modern applications, and ACA can be a great service to empower this pattern.

The next chapter introduces Azure Functions and what it does, as well as how it compares to other services. Scaling and hosting options will also be covered. Then, you'll explore developing Azure Functions, triggers, and bindings.

### Chapter Review Questions

The Developing Solutions for Microsoft Azure AZ-204 Exam Guide – Second Edition by Paul Ivey, Alex Ivanov

#### Select Quiz

Quiz 1

[SHOW QUIZ DETAILS ▾](#)

START

Figure 3.13 – Chapter Review Questions for Chapter 1

## Chapter 4: Implementing Azure Functions

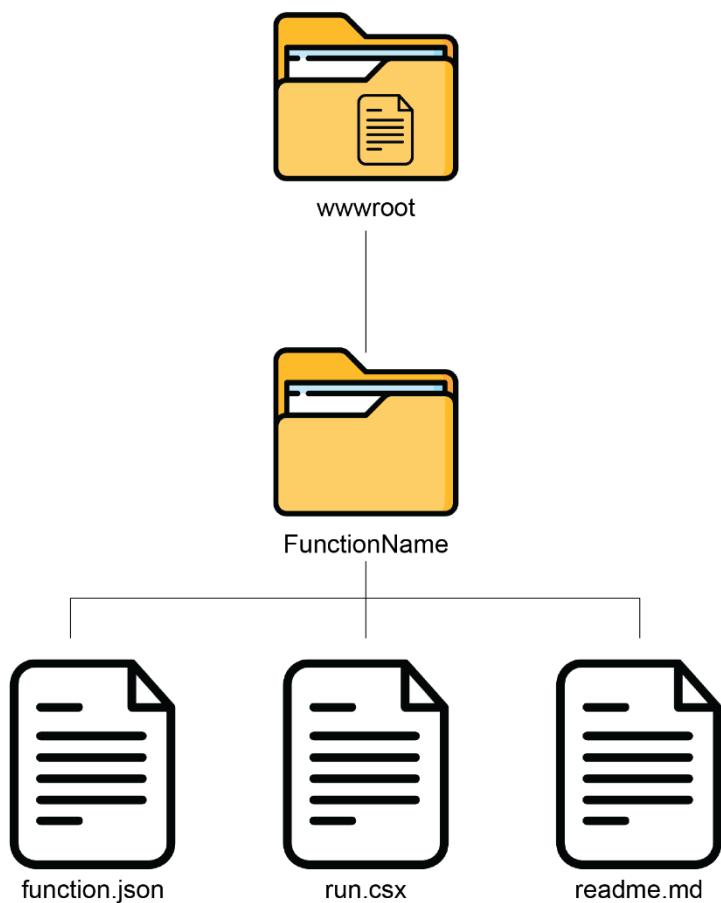


Figure 4.1: An example folder structure of a function app

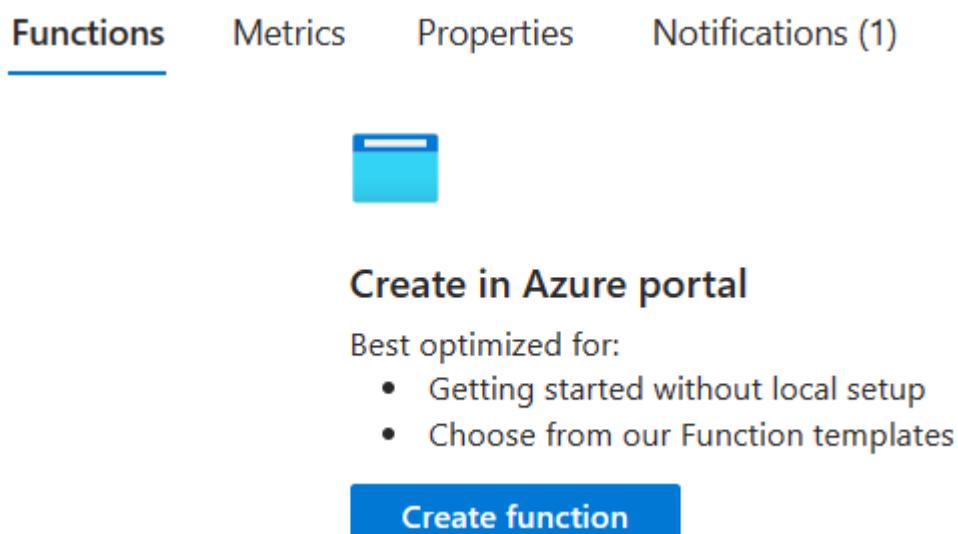


Figure 4.2: Screenshot showing the Create function button

## Template details

We need more information to create the Azure Queue Storage trigger function. [Learn more](#)

New Function \*

Queue name \* ⓘ

Storage account connection \* ⓘ

[New](#)

---

[Create](#) [Cancel](#)

Figure 4.3: Screenshot showing the template details for the Azure Queue Storage trigger

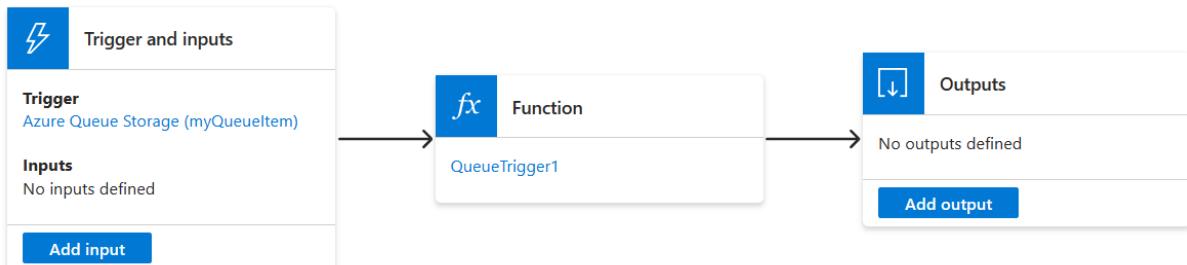


Figure 4.4: A visual representation of function integrations

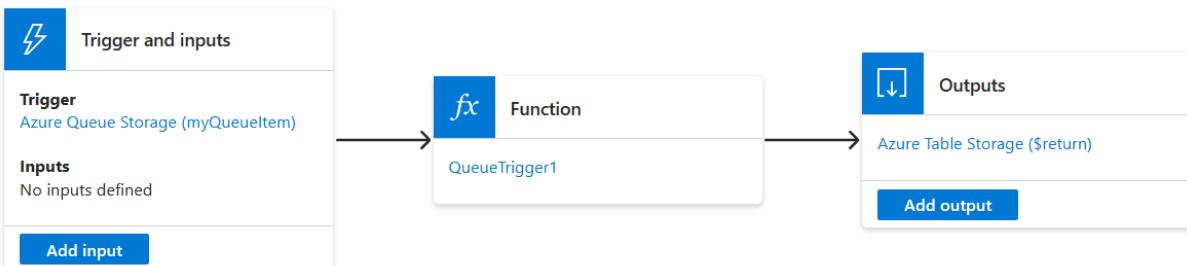


Figure 4.5: A visual representation of function integrations including the output binding

| PartitionKey | RowKey                  | Timestamp                 | Message       |
|--------------|-------------------------|---------------------------|---------------|
| Messages     | 601402b3-54aa-4d9c-8... | 2022-04-12T20:40:42.55... | Hello, World! |

Figure 4.6: A new row created in Azure Table Storage using the function test run

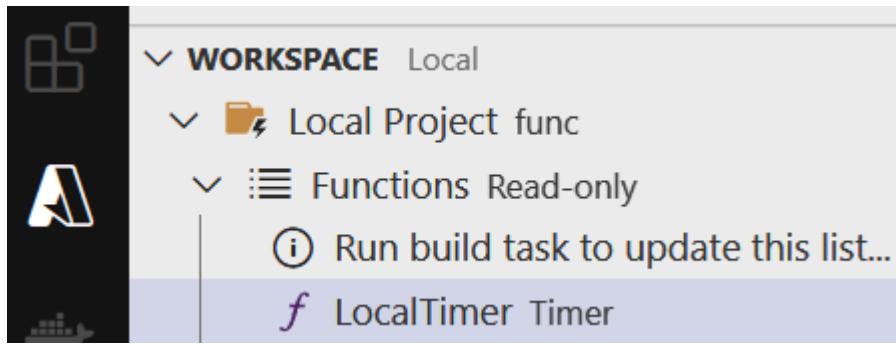


Figure 4.7: The local functions list within VS Code

A screenshot of the 'Practice Resources' website. At the top, there's a navigation bar with 'Practice Resources' (containing a logo), a bell icon, and a 'SHARE FEEDBACK' button. Below the bar, 'DASHBOARD &gt; CHAPTER 4' is shown. The main content area has a title 'Implementing Azure Functions' and a 'Summary' section. The summary text discusses the chapter's content, mentioning Azure Functions, hosting options, scaling, triggers, bindings, development locally in VS Code, and deployment to a function app. It also预告了下一章将介绍 Cosmos DB。On the right, there's a 'Chapter Review Questions' section. It includes a note about the 'The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition' by Paul Ivey and Alex Ivanov. It features a 'Select Quiz' dropdown, 'Quiz 1' (with a 'SHOW QUIZ DETAILS' link), and a 'START' button.

Figure 4.9 – Chapter Review Questions for Chapter 4

## Chapter 5: Developing Solutions that Use Cosmos DB Storage

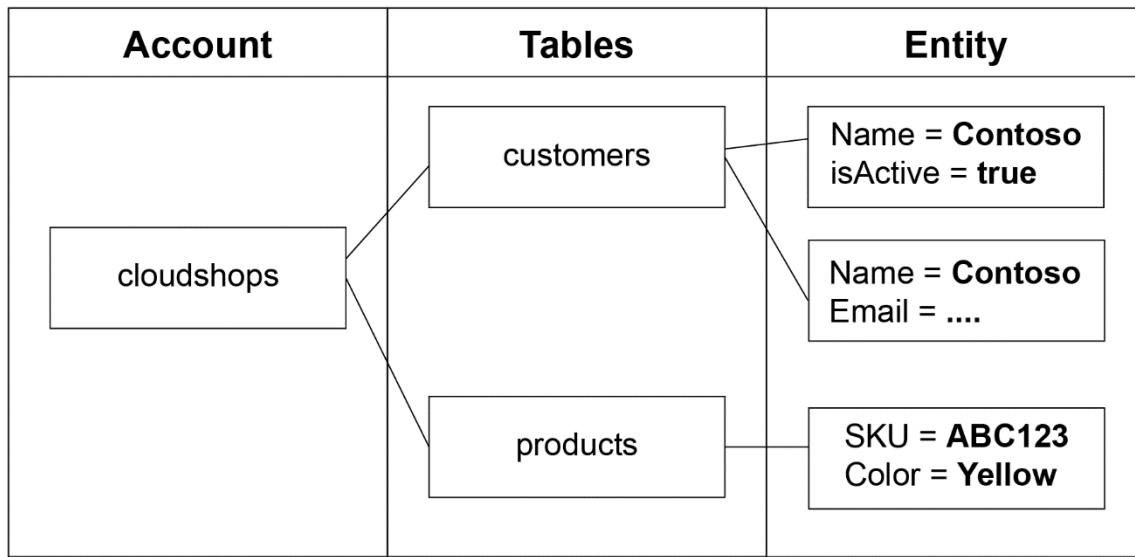


Figure 5.1: An illustration of the Azure Table storage account structure

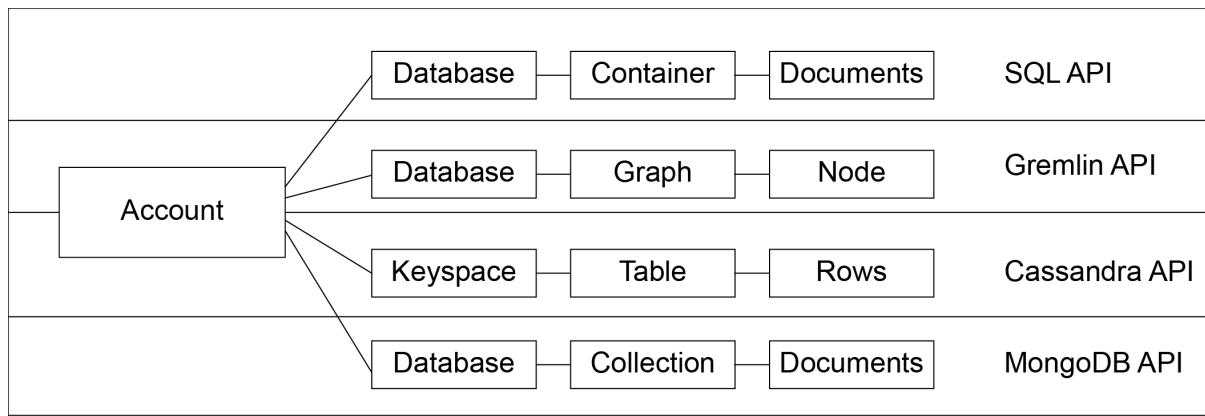


Figure 5.2: The structure of the Cosmos DB account

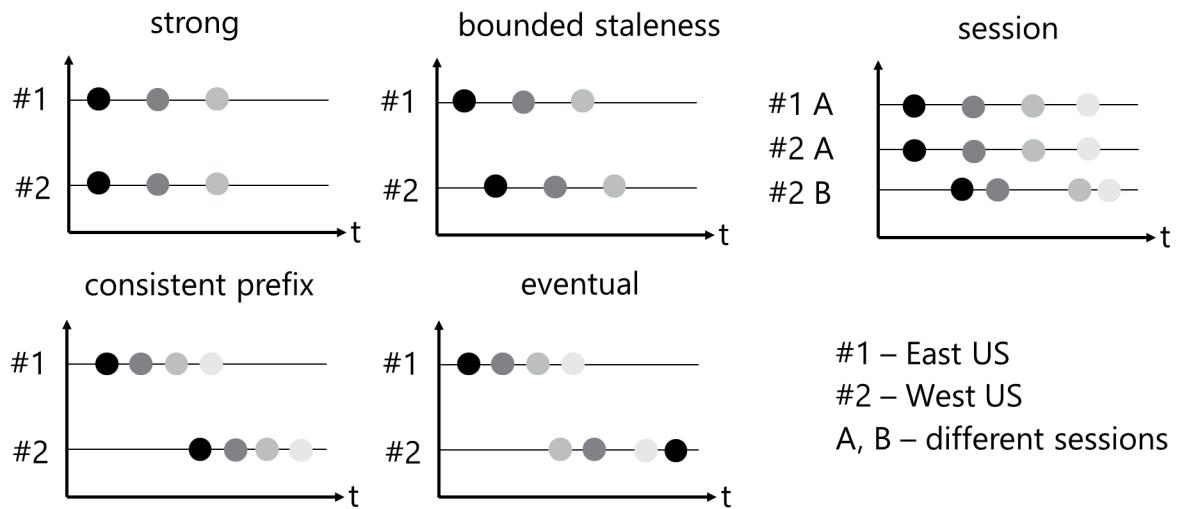


Figure 5.3: Processing transactions for a globally distributed Cosmos DB account with two instances

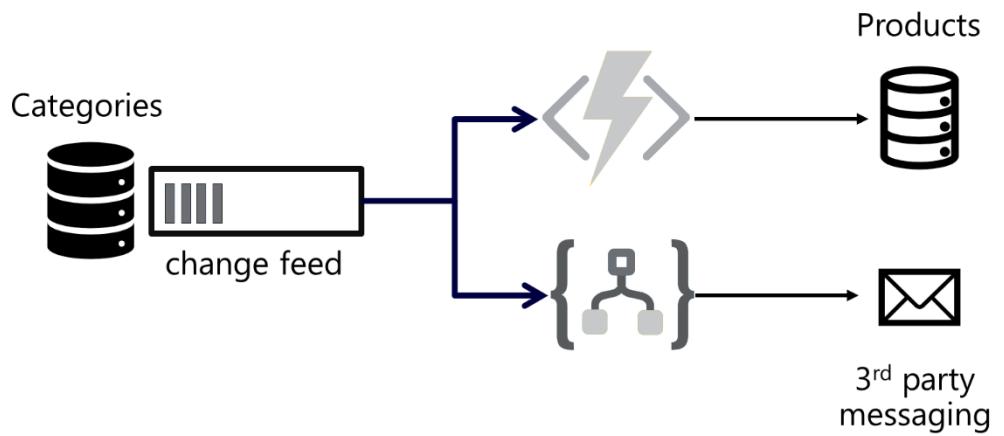


Figure 5.4: Processing change feed items to another Cosmos DB container by Azure Functions and logic app



## Developing Solutions That Use Cosmos DB

### Summary

In this chapter, you learned about Cosmos DB, which is the best NoSQL service available in Azure. Azure Cosmos DB provides a convenient way to store JSON documents with indexing and querying capabilities through a RESTful interface.

Cosmos DB is a unique service available for provisioned and serverless throughput with autoscale settings. The horizontal and vertical scaling will let your solution adjust performance to fit the needs of the application and save costs. From a cost-saving perspective, Azure Cosmos DB provides a free tier, with one instance deployed per subscription with provisioned throughput. Meanwhile, throughput can significantly affect the total cost, and developers can monitor current use and optimize queries by decreasing throughput consumption, which is measured in RUs.

Cosmos DB supports several APIs to simplify *lift-and-shift* scenarios for customers moving from the IaaS to the PaaS model. Cosmos DB can be provisioned with Cassandra, the Gremlin API, and the API for MongoDB. Meanwhile, the Azure Table API allows developers to migrate to Cosmos DB from the storage account and leverage a managed scalability model. The SQL API provides the best experience for developers using their SQL skills to query indexed documents. The SQL API also supports stored procedures, triggers, and functions developed on powerful JavaScript.

High availability is another benefit of Cosmos DB. An SLA of up to 99.999% can be reached out of the box by the Cosmos DB service, provisioned in regions chosen by customers. It is also possible to build more than one instance of the database and allow multi-writes. Five different consistency levels will control updates on multi-instance databases and let you choose between the level of consistency and throughput.

This chapter has familiarized you with the NoSQL services provided by Azure, including Azure Table storage and Azure Cosmos DB. You have learned about the main use case scenarios with Azure Table storage and Cosmos DB. By now, you should know how to configure Azure NoSQL services, how to get connected from code, how to protect data, and how to avoid data loss. If you are going to take the AZ-204 exam, it's important to understand the principles of the NoSQL solution and its implementation in Azure.

In *Chapter 6, Developing Solutions that Use Azure Blob Storage*, we will continue to discuss data storage technology and look at the PaaS Azure Blob storage designed for persisting files. You will learn how to upload, download, search through metadata, and protect blobs in an Azure storage account.

## Chapter Review Questions

The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition by Paul Ivey, Alex Ivanov

### Select Quiz

Quiz 1

[SHOW QUIZ DETAILS](#) ▾

START

Figure 5.6 – Chapter Review Questions for Chapter 5

## Chapter 6: Developing Solutions That Use Azure Blob Storage

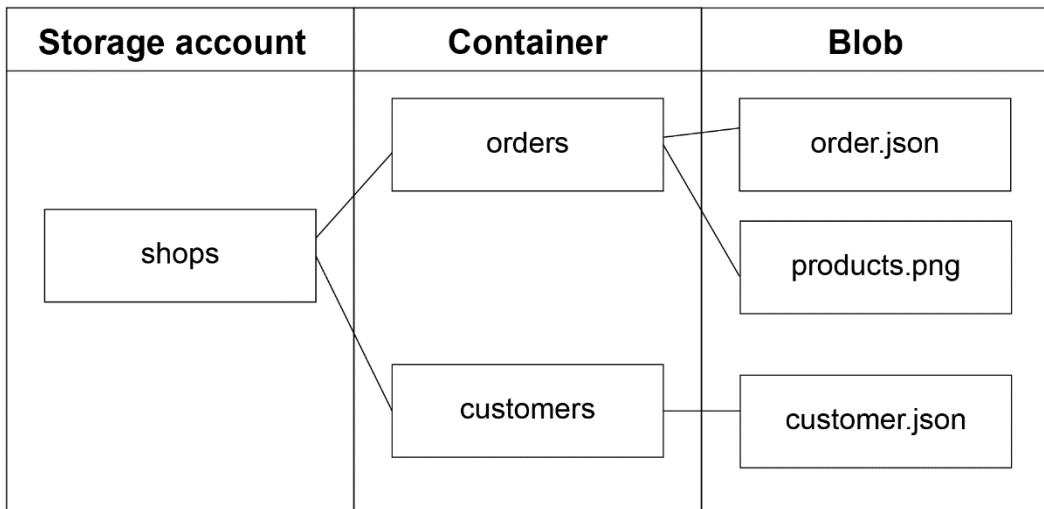


Figure 6.1 – The Azure storage account structure

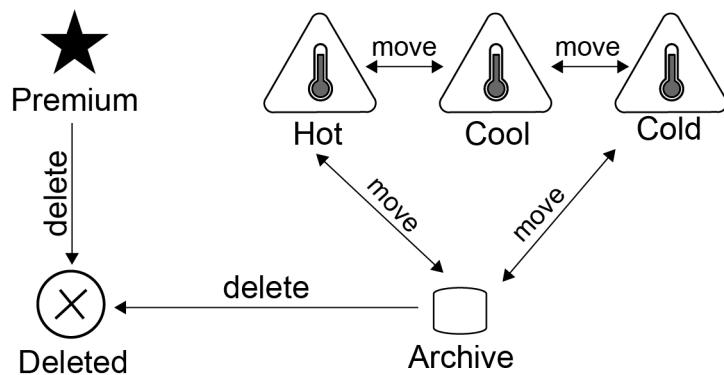


Figure 6.2 – File migration between tiers with the lifecycle management policy



## Developing Solutions That Use Azure Blob Storage

### Summary

In this chapter, you explored the Azure Blob Storage service and learned how to configure the service properly to achieve the required security level and optimal performance and costs. Now that you are familiar with the provisioning process and blob manipulation operations, you can leverage Azure Blob Storage from code and persist your files in an Azure storage account to build a robust and reliable cloud solution.

Azure Storage is one of the most frequently used services for Azure deployments. It is provisioned as part of many solutions and is used for storing files, including binary and semi-structured data. It supports a RESTful interface and can even host static websites or work as content storage for dynamic websites. A storage account can be provisioned with a *Standard* or *Premium* pricing tier with *Hot*, *Cool*, *Cold*, and *Archive* access tiers for files. Migration between tiers is managed by lifecycle policies. From a security standpoint, an Azure storage account allows public and private access to blobs and containers and encrypts its content and communication.

For development projects, access to storage accounts configured with connection strings and managed by an SDK exists for Python, C#, Node.js, and Java. Storage accounts can persist data and metadata with files and allow you to search through indexed tags to quickly find the exact blobs you need.

Overall, Azure Blob Storage provides affordable and reliable storage for files in the cloud with up to a 99.99% [service-level agreement \(SLA\)](#). Geo-redundant storage can protect your application from data availability loss by providing read access to copies of files in paired data centers.

In *Chapter 7, Implementing User Authentication and Authorization*, you will learn about implementing Azure security to better secure your solution in Azure and integrating with Microsoft Entra ID to leverage strong authentication and authorization protocols.

## Chapter Review Questions

The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition by Paul Ivey, Alex Ivanov

### Select Quiz

Quiz 1

[SHOW QUIZ DETAILS](#) ▾

[START](#)

Figure 6.4 – Chapter Review Questions for Chapter 6

## Chapter 7: Implementing User Authentication and Authorization

| API / Permissions name | Type      | Description                   | Admin consent required |
|------------------------|-----------|-------------------------------|------------------------|
| ▽ Microsoft Graph (1)  |           |                               |                        |
| User.Read              | Delegated | Sign in and read user profile | No                     |

Figure 7.1 — User.Read delegated permission within the app registration

### **This application is not published by Microsoft.**

This app would like to:

- ✓ View your basic profile
- ✓ Maintain access to data you have given it access to
- Consent on behalf of your organisation

Figure 7.2 – User.Read permissions requested

### **This application is not published by Microsoft.**

This app would like to:

- ✓ View your basic profile
- ✓ Read your calendars
- ✓ Maintain access to data you have given it access to
- Consent on behalf of your organisation

Figure 7.3 – Additional Calendars.Read permission requested

| Permission   | Admin consent required |
|--|------------------------|
| Calendars (1) <ul style="list-style-type: none"><li>Calendars.Read ⓘ<br/>Read user calendars</li></ul> | No                     |

Figure 7.4 – Calendars.Read Graph permission selected in the app registration

## This application is not published by Microsoft.

This app would like to:

- ✓ Sign in and read user profile
- ✓ Read user calendars

Figure 7.5 – Admin consent permissions prompt

## You cannot access this right now

Your sign-in was successful, but does not meet the criteria to access this resource. For example, you might be signing in from a browser, app or location that is restricted by your admin.

[Sign out and sign in with a different account](#)

[More details](#)

Figure 7.6 – Conditional access denying access to the application

| Flow                                    | Description  |
|---|--|
| Authorization code                      | Obtains tokens and accesses web APIs on the user's behalf.   |
| Client credentials                      | Accesses web APIs using the application's identity with no user interaction.   |
| Device code                             | Sends users in to a device without a browser, from another device that has a browser, and accesses web APIs on their behalf. |
| Implicit grant                          | Used by browser-based applications to sign in and access web APIs on behalf of the user.                                     |
| Integrated Windows authentication (IWA) | Acquires a token silently when accessed from an AAD-joined device without user interaction.                                  |
| On-Behalf-Of (OBO)                      | Accesses a downstream web API from an upstream web API on a user's behalf, sending their identity and delegated permissions. |
| Username/password                       | Sends the user in by directly handling their password. This is NOT recommended.  |

Figure 7.7 – Some of the authentication flows provided by the MSAL

The screenshot shows a dark-themed web page for 'Practice Resources'. At the top, there's a navigation bar with a bell icon and a 'SHARE FEEDBACK' button. Below the header, the breadcrumb navigation shows 'DASHBOARD > CHAPTER 7'. The main content area is titled 'Implementing User Authentication and Authorization' and includes a 'Summary' section. The summary text discusses the chapter's focus on tools and features for building applications with authentication and authorization, mentioning app registrations, service principals, permission types, and conditional access. It also notes the use of the Microsoft Authentication Library and Graph Explorer, and the creation of an app that uses tokens to query Microsoft Graph. The final topic of the chapter involved SASs providing access to storage accounts via stored access policies. The right side of the screen features a 'Chapter Review Questions' sidebar. This sidebar includes the title 'Chapter Review Questions', the subtitle 'The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition by Paul Ivey, Alex Ivanov', a 'Select Quiz' section, and a 'Quiz 1' section with a 'SHOW QUIZ DETAILS' link and a 'START' button.

Figure 7.9 – Chapter Review Questions for Chapter 7

## Chapter 8: Implementing Secure Azure Solutions

1 Permissions      2 Review + save

| Key permissions                                | Secret permissions                          | Certificate permissions                        |
|--|---|--|
| Key Management Operations                      | Secret Management Operations                | Certificate Management Operations              |
| <input checked="" type="checkbox"/> Select all | <input type="checkbox"/> Select all         | <input checked="" type="checkbox"/> Select all |
| <input checked="" type="checkbox"/> Get        | <input checked="" type="checkbox"/> Get     | <input checked="" type="checkbox"/> Get        |
| <input checked="" type="checkbox"/> List       | <input type="checkbox"/> List               | <input checked="" type="checkbox"/> List       |
| <input checked="" type="checkbox"/> Update     | <input checked="" type="checkbox"/> Set     | <input checked="" type="checkbox"/> Update     |
| <input checked="" type="checkbox"/> Create     | <input checked="" type="checkbox"/> Delete  | <input checked="" type="checkbox"/> Create     |
| <input checked="" type="checkbox"/> Import     | <input checked="" type="checkbox"/> Recover | <input checked="" type="checkbox"/> Import     |
| <input checked="" type="checkbox"/> Delete     | <input checked="" type="checkbox"/> Backup  | <input checked="" type="checkbox"/> Delete     |
| <input checked="" type="checkbox"/> Recover    | <input checked="" type="checkbox"/> Restore | <input checked="" type="checkbox"/> Recover    |

Figure 8.1: Key Vault access policy with List in the Secret Permissions removed

**⚠️** The operation "List" is not enabled in this key vault's access policy.

| Name   | Type |
|--|------|
| You are unauthorized to view these contents. |      |

Figure 8.2 — Unauthorized message with List secrets permission removed

## Permission model

Grant data plane access by using a [Azure RBAC](#) or [Key Vault access policy](#)

- Azure role-based access control (recommended) ⓘ
- Vault access policy ⓘ

[Go to access control\(IAM\)](#)

## Resource access

**⚠** WARNING: You are changing the permission model. This may immediately change users and services that are allowed to access this key vault. You may proceed if this key vault is new, not used in production workloads, or if you are undoing a previous change. Otherwise it's strongly recommended that you perform this action in the beginning of your own planned maintenance event, during which you can test the new configuration and undo if necessary.

Figure 8.3 — Permission model changes warning

## Functions

HttpTrigger1: [GET] <http://localhost:7071/api/HttpTrigger1>

Figure 8.4: GET URL shown in the VS Code terminal output

## Source

---

**i** Key vault Reference

Figure 8.5: Application setting source showing as a Key Vault reference

## Source

---

**✗** Key vault Reference

Figure 8.6: Key vault reference error on an application setting

## Identity

### System assigned managed identity

## Status

✖ MSINotEnabled

Figure 8.7: Key vault reference application setting error status

| Identity | System assigned managed identity |
|----------|----------------------------------|
|          |                                  |
| Status   | Resolved                         |
|          |                                  |

Figure 8.8: Key vault reference application setting resolved status

| Key ↑↓                      | Value                   | Label       |
|-----------------------------|-------------------------|-------------|
| ✓ Chapter8:DemoApp:Greeting | Hello, World!           | (No label)  |
|                             | Hello from Development! | Development |
|                             | Hello from Production!  | Production  |

Figure 8.9: New key-value pairs listed in App Configuration with both labels

\_04\_app\_configuration\_labels   Home   Privacy

## Message: Hello from Development!

Figure 8.10: Website showing the message from App Configuration

| <input type="checkbox"/> Name ↑↓     | Label ↑↓    | Enabled ↑↓                          | Feature filter(s) ↑↓ |
|--------------------------------------|-------------|-------------------------------------|----------------------|
| <input type="checkbox"/> demofeature | Development | <input checked="" type="checkbox"/> | None                 |

Figure 8.11: Example disabled feature flag with the Development label and no filters

The screenshot shows a dark-themed user interface for 'Practice Resources'. At the top, there's a navigation bar with 'Practice Resources' logo, a bell icon, and a 'SHARE FEEDBACK' button. Below the navigation, the path 'DASHBOARD > CHAPTER 8' is visible. The main content area has a title 'Implementing Secure Azure Solutions' and a 'Summary' section. The summary text discusses the chapter's content on Azure Key Vault, managed identities, Azure App Configuration, and feature management. To the right, a dark sidebar titled 'Chapter Review Questions' lists 'Quiz 1' and a 'START' button. Above the sidebar, it says 'The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition by Paul Ivey, Alex Ivanov'.

Figure 8.13 – Chapter Review Questions for Chapter 8

## Chapter 9: Integrating Caching and Content Delivery within Solutions

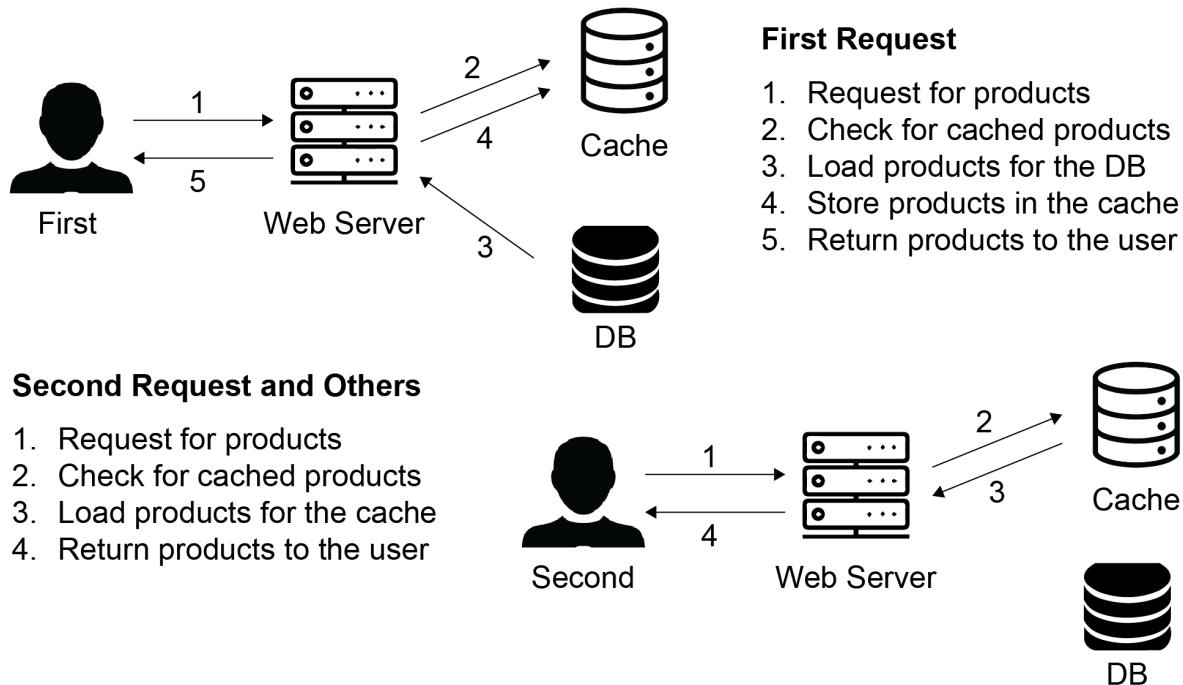


Figure 9.1: Implementation of the cache-aside pattern with Azure Cache for Redis

### ASP.NET Core Session State Provider for Azure Cache for Redis

Your Session ID: 8b595968-f4d6-9a5c-96f5-e0c528814303

Session Msg: Azure Rocks

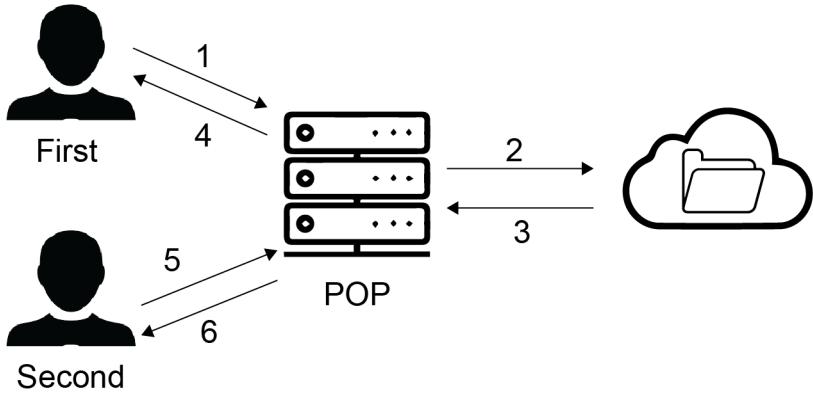
Session ID: 8b595968-f4d6-9a5c-96f5-e0c528814303

Session Msg Set Time: 7/7/2022 11:22:38 PM

Set Session Value:

**Set**

Figure 9.2: The page loaded session value, Azure Rocks, from the session stored in Azure Cache



### First Request:

1. File requested
2. File does not exist on the POP type and the request is sent to the server
3. File provided and cached on POP
4. File returned to the user

### Second Request and Others:

1. File requested
2. Cached copy of file returned to the user

Figure 9.3: Implementation of the cache-aside pattern with CDN

**Practice Resources**

DASHBOARD > CHAPTER 9

**Implementing Caching for Solutions**

**Summary**

In this chapter, you have learned about caching with Azure Cache for Redis and Azure CDN. Both caching services can be successfully used for the cache-aside pattern to implement caching for static and dynamic content and configured with a custom expiration time to avoid inconsistency with the source of the data. Azure Cache for Redis is a platform service available in Azure with a large scale of different price tiers. It supports multiple data types such as strings, integers, lists, sets, and hashes to store strings, binaries, and object fields. It should be used as temporary storage and the application should not rely on the cache data.

Azure CDN is designed for caching static data such as images, videos, and documents. The CDN can also help to speed up the loading of static content such as media, CSS, and JavaScript files. CDN works as a proxy server for your customers and helps them cache files very close to their location. The CDN network supports a variety of locations to store files, including Microsoft, Verizon, and Akamai data centers. Configuration settings will help you set up different caching policies for files in the path, specific extensions, and depending on the region/country of requests.

By provisioning and configuring Azure CDN and Azure Cache resources, you gain the experience required for the exam. Now, you can leverage caching technology in your web-based solution and recommend the appropriate size and configuration depending on the requirements of exam questions.

In the next chapter, you will learn about monitoring technologies and tools that help you minimize downtime, proactively diagnose possible performance bottlenecks, and prevent crashes. Let's move on to the next chapter.

**Chapter Review Questions**

The Developing Solutions for Microsoft Azure AZ-204 Exam Guide - Second Edition by Paul Ivey, Alex Ivanov

**Select Quiz**

Quiz 1 [SHOW QUIZ DETAILS](#) ▾ [START](#)

Figure 9.5 – Chapter Review Questions for Chapter 9

## Chapter 10: Monitoring and Troubleshooting Solutions by Using Application Insights

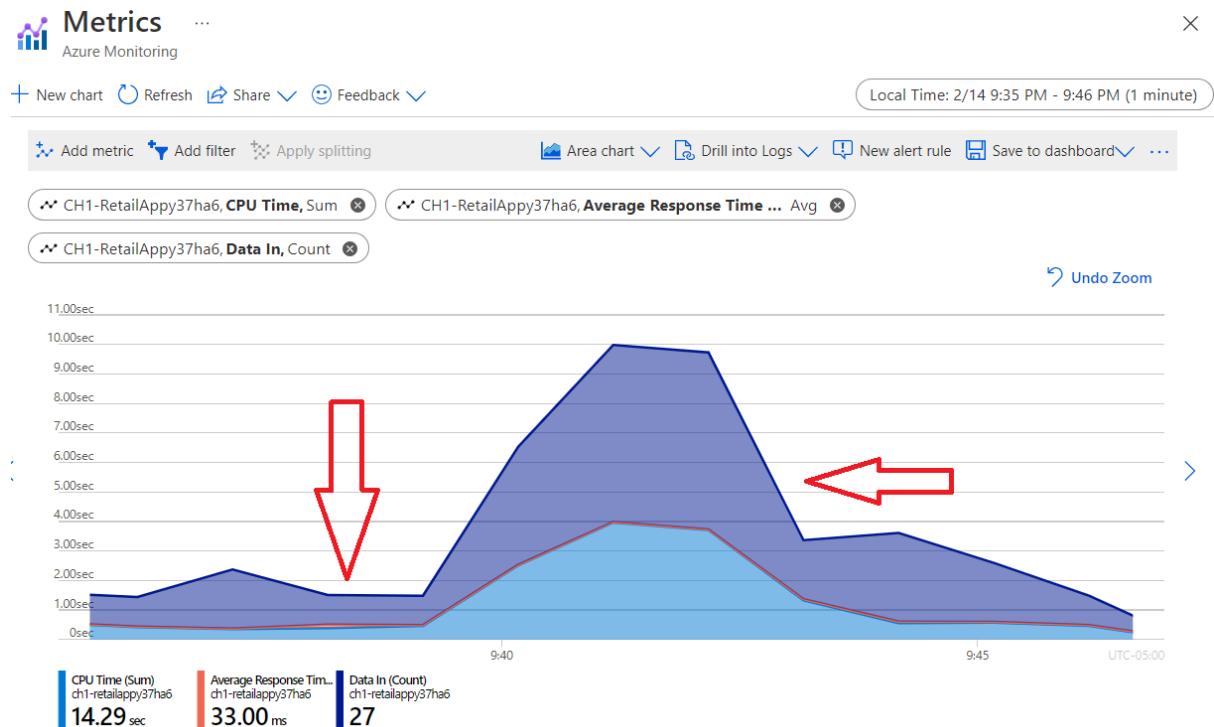


Figure 10.1: Azure Monitor metrics demonstrating the CPU spike issue

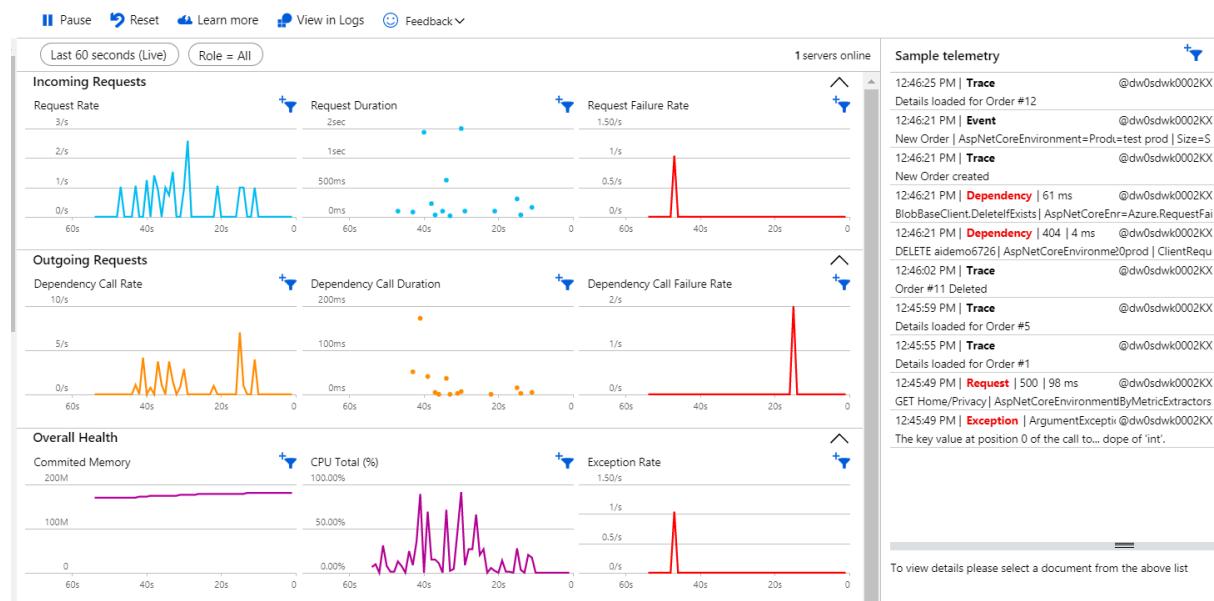


Figure 10.2: Live metrics dashboard for the web application deployed previously

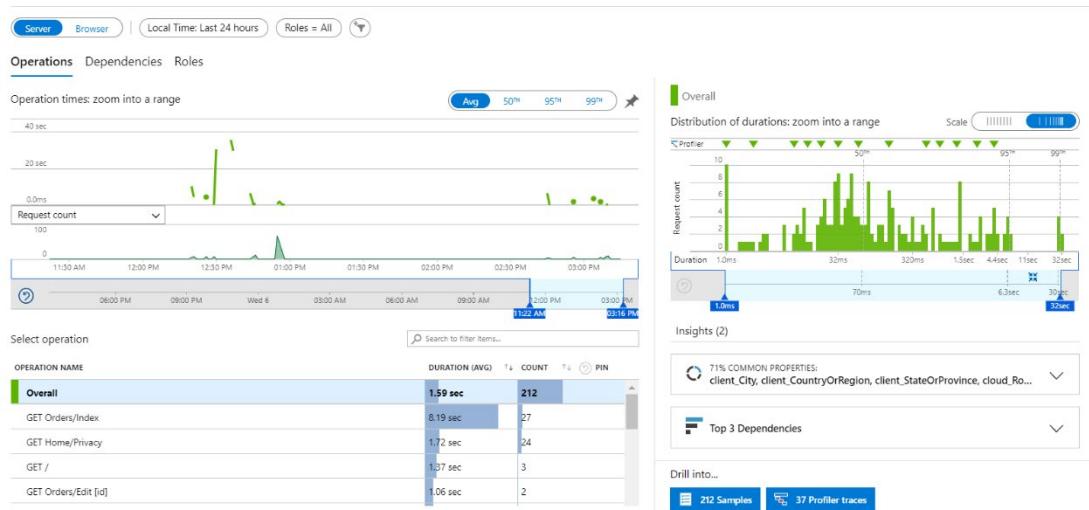


Figure 10.3: Performance chart with page performance details

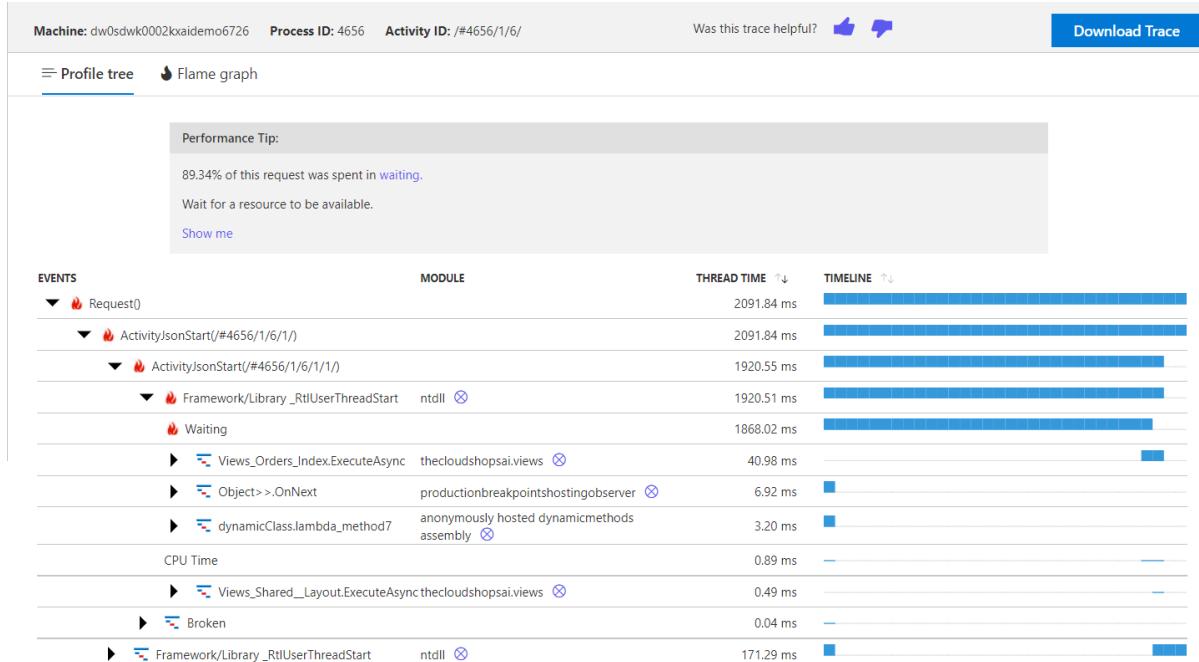


Figure 10.4: Profile of the loading orders call

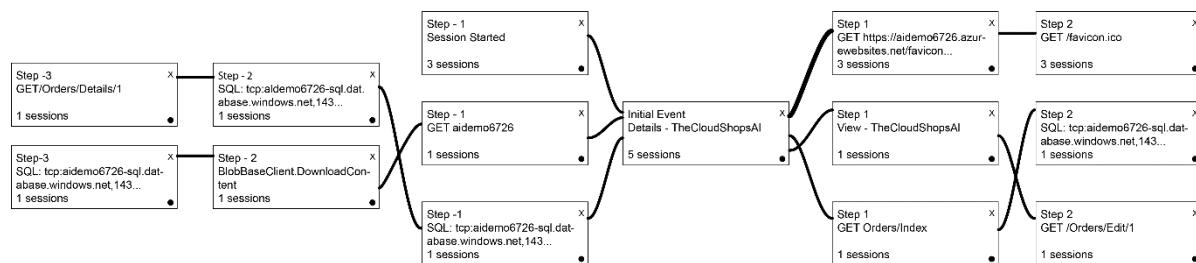


Figure 10.5: User flow chart for the Details page views

Search results Learn more Copy link Feedback Try preview

### End-to-end transaction

Operation ID: fe8f208d8b921948b133a656da22f11b

| EVENT  | RES. | DURATION |  |
|--|------|----------|--|
| aidemo6726 GET Home/Privacy                    | 500  | 22.0 ms  |  |
| aidemo6726-sql aidemo6726-db                   |      | 694.9 µs |  |
| <b>EXCEPTION System.NullReferenceException</b> |      |          |  |

Custom Properties

AspNetCoreEnvironment Production

Call Stack

```
System.NullReferenceException:
    at TheCloudShopsAI.Controllers.HomeController.Privacy (TheCloudS...
    at lambda_method88 (Anonymously Hosted DynamicMethods Assembly, ...
    at Microsoft.Extensions.Internal.ObjectMethodExecutor.Execute (M...
    at Microsoft.AspNetCore.Mvc.Infrastructure.ActionMethodExecutor+<...
    at Microsoft.AspNetCore.Mvc.Infrastructure.ControllerActionInvoker...
    at System.Runtime.ExceptionServices.ExceptionDispatchInfo.Throw ...
    at System.Runtime.CompilerServices.TaskAwaiter.ThrowForNonSuccess...
    at System.Runtime.CompilerServices.TaskAwaiter.HandleOnSuccessA...
    at Microsoft.AspNetCore.Mvc.Infrastructure.ControllerActionInvoker...
    at System.Runtime.ExceptionServices.ExceptionDispatchInfo.Throw ...
    at Microsoft.AspNetCore.Mvc.Infrastructure.ControllerActionInvoker...
    at Microsoft.AspNetCore.Mvc.Infrastructure.ControllerActionInvoker...
    at Microsoft.AspNetCore.Mvc.Infrastructure.ControllerActionInvoker...
```

Figure 10.6: Troubleshooting a NullReference exception collected by Application Insights

Add Classic test Add Standard (preview) test Refresh View in Logs SLA Report Copy link Troubleshoot Feedback

Local Time: Last 7 days

### Availability

Line Scatter Plot

Overall

Availability results

| COUNT            |
|------------------|
| Successful 2.02k |

Select availability test

AVAILABILITY TEST

| Overall        | 100.00% | 100.00% | 1.19 sec |
|----------------|---------|---------|----------|
| Ping My WEB    | 100.00% | 100.00% | 1.19 sec |
| France Central | 100.00% | 100.00% | 1.22 sec |
| UK South       | 100.00% | 100.00% | 1.20 sec |
| West US        | 100.00% | 100.00% | 1.16 sec |

Figure 10.7: Application Insights availability test results

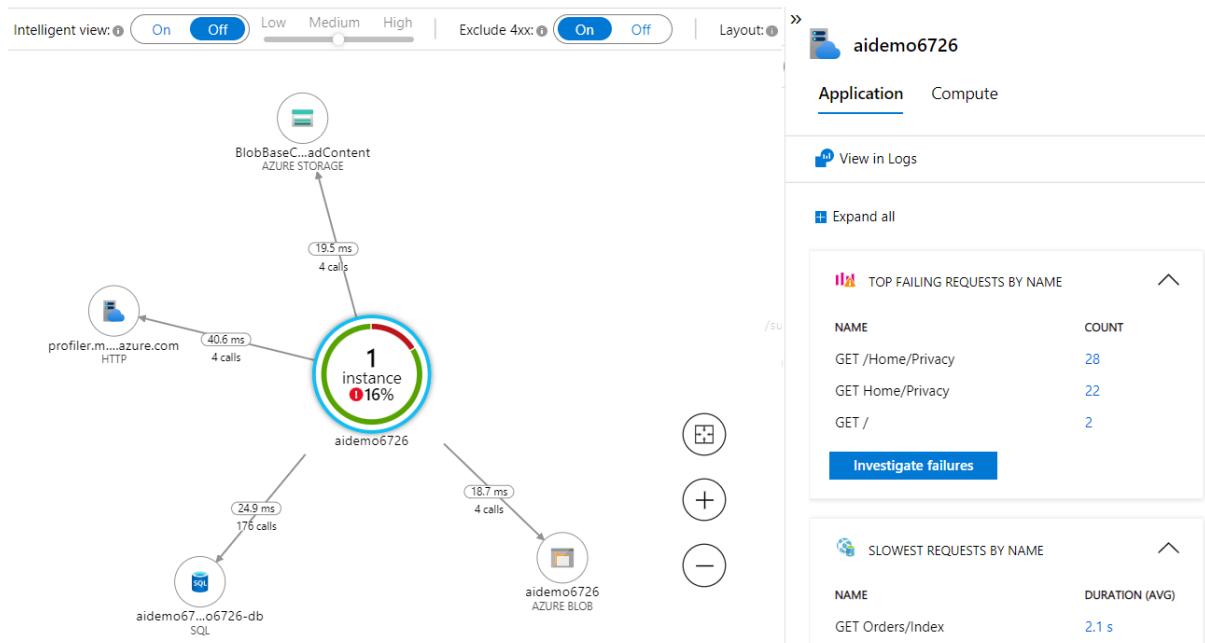


Figure 10.8: Application map for the deployed application



Figure 10.9: Transaction search output

The screenshot shows the Application Insights query interface. At the top, there's a header with a lightbulb icon, the scope name "aidemo22462-ai", a "Select scope" dropdown, a "Run" button, a time range selector set to "Last 24 hours", and "Save" and "Share" buttons. Below the header, there's a navigation bar with tabs for "Tables", "Queries", "Functions", and more. A search bar and a filter button are also present. On the left, a sidebar titled "Application Insights" lists various data types: availabilityResults, browserTimings, customEvents, customMetrics, dependencies, exceptions (which is highlighted with a red box), pageViews, performanceCounters, and requests. The main area is titled "Queries History".

Figure 10.10: Application Insights query interface with tables

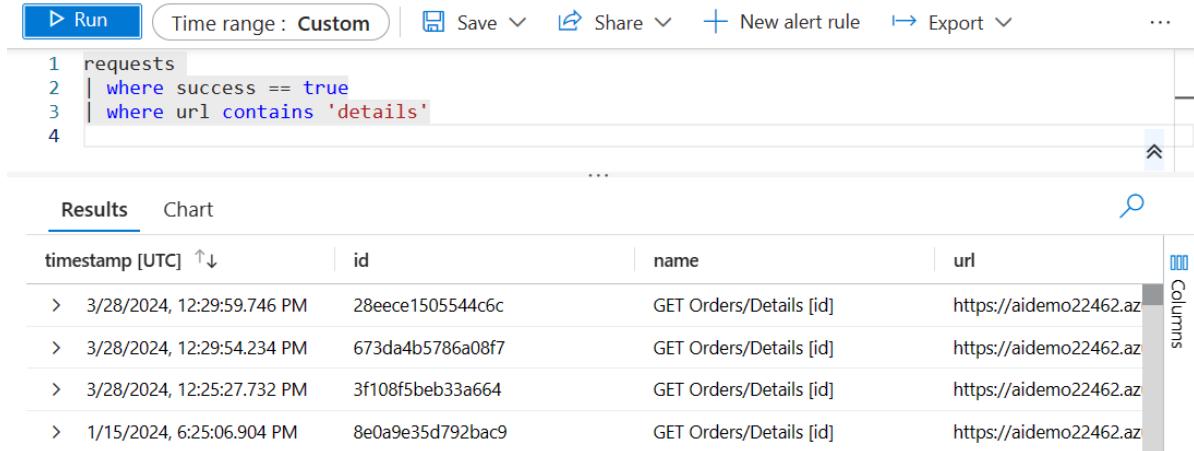
The screenshot shows the Application Insights query interface with a "Custom" time range. The query entered is:

```
1 requests  
2 | where success == false
```

The results section displays a table of failed requests:

| timestamp [UTC]            | id               | name             | url                                 |
|----------------------------|------------------|------------------|-------------------------------------|
| 3/28/2024, 2:26:04.002 PM  | 57a4a38058c2b3c9 | GET Home/Privacy | https://aidemo22462.azurewebsite... |
| 3/28/2024, 2:19:04.162 PM  | a1ca5511773f8ac1 | GET Home/Privacy | https://aidemo22462.azurewebsite... |
| 3/28/2024, 1:30:29.022 PM  | 1e7a172a905c7f8a | GET Home/Privacy | https://aidemo22462.azurewebsite... |
| 3/28/2024, 12:29:45.989 PM | 7b32a72960de2417 | GET Home/Privacy | https://aidemo22462.azurewebsite... |
| 3/28/2024, 12:25:36.460 PM | 57c881bfbdac16db | GET Home/Privacy | https://aidemo22462.azurewebsite... |

Figure 10.11: Application Insights failed requests query



A screenshot of the Application Insights Kusto Query Editor. The query is:

```

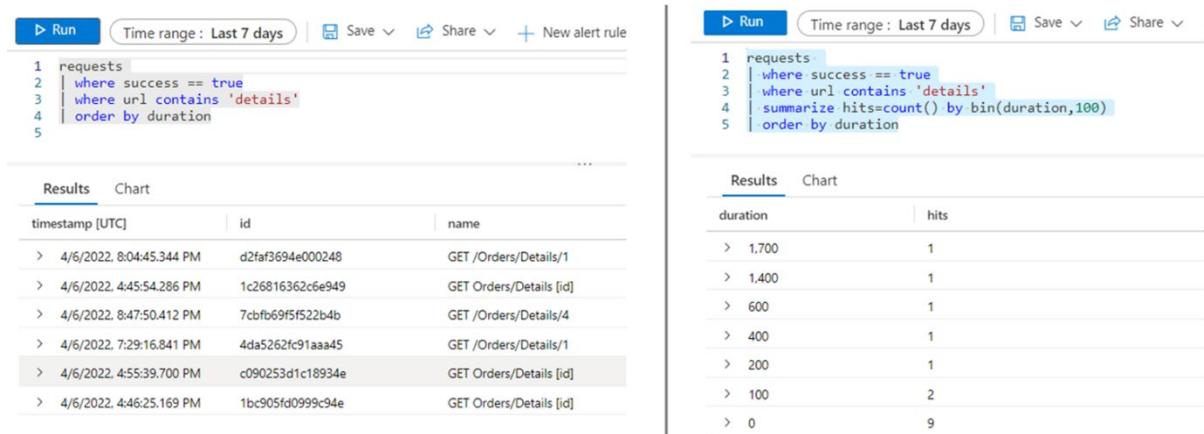
1 requests
2 | where success == true
3 | where url contains 'details'
4

```

The results table shows four successful requests to the 'details' page:

| timestamp [UTC]              | id               | name                    | url                    |
|------------------------------|------------------|-------------------------|------------------------|
| > 3/28/2024, 12:29:59.746 PM | 28eece1505544c6c | GET Orders/Details [id] | https://aidemo22462.az |
| > 3/28/2024, 12:29:54.234 PM | 673da4b5786a08f7 | GET Orders/Details [id] | https://aidemo22462.az |
| > 3/28/2024, 12:25:27.732 PM | 3f108f5beb33a664 | GET Orders/Details [id] | https://aidemo22462.az |
| > 1/15/2024, 6:25:06.904 PM  | 8e0a9e35d792bac9 | GET Orders/Details [id] | https://aidemo22462.az |

Figure 10.12: Application Insights successful requests to Details page



This figure shows two Kusto queries running side-by-side.

Left Query:

```

1 requests
2 | where success == true
3 | where url contains 'details'
4 | order by duration
5

```

Right Query:

```

1 requests
2 | where success == true
3 | where url contains 'details'
4 | summarize hits=count() by bin(duration,100)
5 | order by duration

```

Both queries return results for requests to the 'details' page over the last 7 days.

Figure 10.13: Executing KQL queries on the requests table



Figure 10.14: KQL query execution with exception rate chart

The screenshot shows the 'Workbooks | Gallery' section of the Azure Application Insights interface. On the left, a sidebar titled 'Monitoring' contains links for Alerts, Metrics, Diagnostic settings, Logs, and Workbooks. The 'Workbooks' link is highlighted with a red box. The main area displays several template cards:

- Default Template**: A report with text and query sections.
- Empty**: A completely empty workbook.
- Downtime & Outages**: Under Availability (1).
- Failure Analysis** and **New Failures Analysis**: Under Failure (2).

At the top, there are navigation links for 'Search', 'New', 'Refresh', 'Feedback', 'Help', 'Community Git repo', and 'Browse across galleries'. Filter options include 'Subscription : All', 'Resource Group : All', and 'Reset filters'.

Figure 10.15: Workbooks section with gallery templates

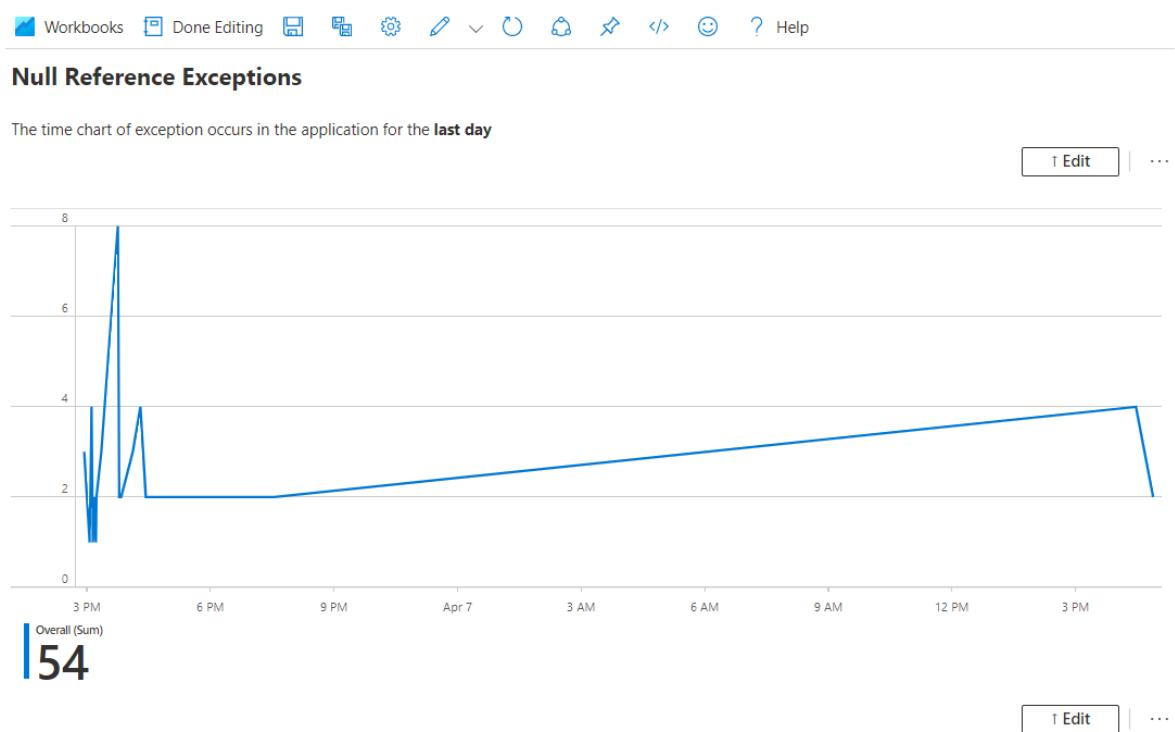


Figure 10.16: Azure workbook created with Markdown and query items



## Monitoring and Troubleshooting Solutions by Using Application Insights

### Summary

In this chapter, you have learned about a variety of monitoring tools in Azure. You played around with Azure Monitor and were able to retrieve performance counters for your application, such as request rate, CPU usage, and failed requests. You learned about different options for persisting and analyzing logs by using Azure Blob Storage and Log Analytics workspaces. You also learned about Application Insights – the most powerful tool for monitoring and troubleshooting applications running on Azure platforms or on-premises. You got familiar with a variety of useful charts provided by Application Insights to monitor and detect bottlenecks in performance, investigate crashes, and collect dependency metrics of the solution's components. You also learned how to instrument the code to collect custom metrics and custom events, and handled exceptions. You were introduced to essential skills of root cause analysis by using custom KQL queries and custom charts. You learned about various ways of representing collected metrics and logs, including Azure workbooks and Azure dashboards. You were also made aware of availability tests and Azure alerts as the best ways to be informed of an application outage. All of these skills and knowledge will be verified through exam questions and will also help you successfully monitor and troubleshoot enterprise applications running on the Azure platform.

In the next chapter, we will continue our journey through Azure platform services and learn about the implementation, hosting, and protection of mid-tier web API services with API management resources.

### Chapter Review Questions

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#### Select Quiz

Quiz 1

[SHOW QUIZ DETAILS](#) ▾

START

Figure 10.18 – Chapter Review Questions for Chapter 10

## Chapter 11: Implementing API Management

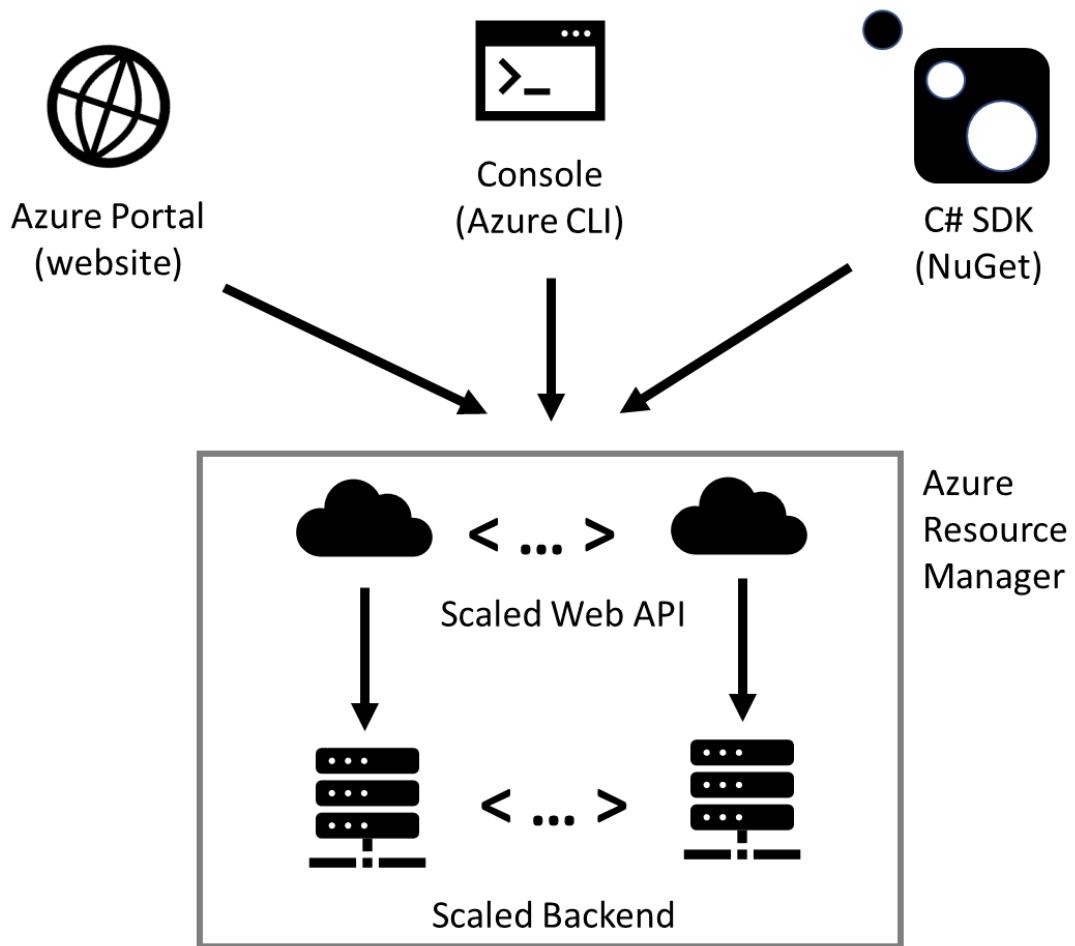


Figure 11.1: ARM service architectural design

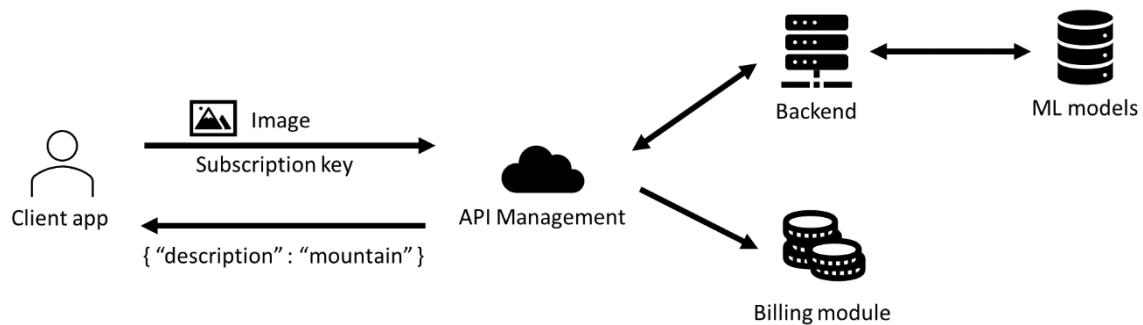


Figure 11.2: Azure Cognitive Services architecture

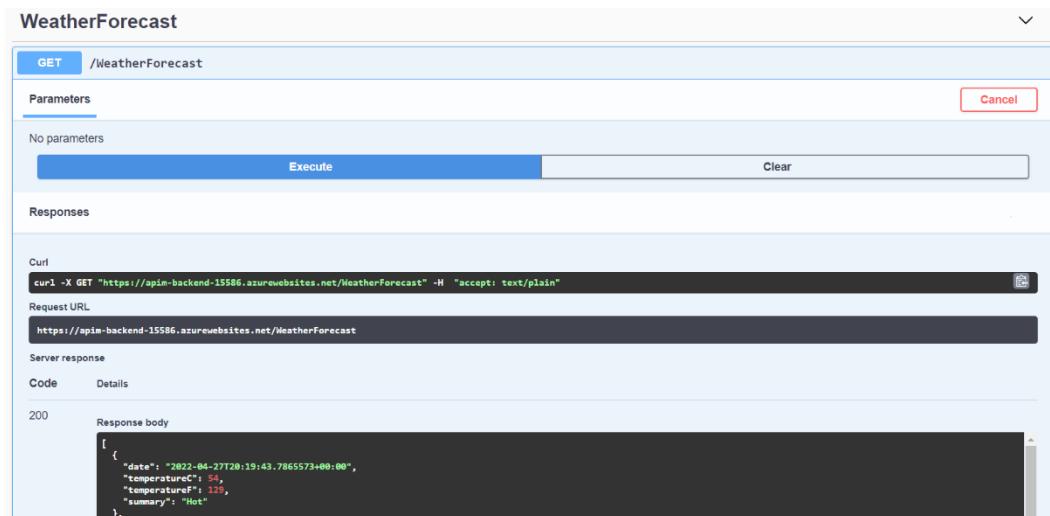


Figure 11.3: Swagger interface with the weather forecast operation executed

The screenshot shows the Azure API Management Test blade for the color-api. At the top, there are tabs for "Design", "Settings", "Test" (which is selected), "Revisions (1)", and "Change log". On the left, there's a sidebar with search and filter options, and a "Group by tag" checkbox. The main area shows a list of operations under "color-api > Get random color > Console".

- HTTP request**: Shows a GET request to "https://apim-18243.azure-api.net/color-api/colors/random" with "Host: apim-18243.azure-api.net".
- HTTP response**: Shows a 200 OK response with the following headers and payload:
 

Message Trace Generate definition

```
HTTP/1.1 200 OK
cache-control: private
content-encoding: gzip
content-type: application/json; charset=utf-8
date: Wed, 10 Apr 2024 18:45:37 GMT
transfer-encoding: chunked
vary: Accept-Encoding,Origin
```

```
{
  "id": 1,
  "name": "blue",
  "data": null
}
```

Figure 11.4: Testing a connected API and observing the output

Design   Settings   Test   Revisions   Change log

Search operations  
 Filter by tags  
 Group by tag

color-api > ApiRandomColorGet > Console

HTTP request

```
GET https://apim-6323.azure-api.net/color-api/api/RandomColor HTTP/1.1
Host: apim-6323.azure-api.net
Ocp-Apim-Subscription-Key: *****
Ocp-Apim-Trace: true
```

HTTP response

Message   Trace   [Generate definition](#)

Jump to: Inbound   Backend   Outbound   On error

Inbound  
(58.158 ms)

```
api-inspector (48.541 ms)
{
    "request": {
        "method": "GET",
        "url": "https://apim-6323.azure-api.net/color-api/api/RandomColor",
        "headers": [
            {
                "name": "Cache-Control",
                "value": "no-cache, no-store"
            }
        ]
    }
}
```

Figure 11.5: Trace output for the operation of retrieving random color from color-api

```
<policies>
    <inbound>
        <!-- this part will be executed before the global policy applied -->
        <base />
        <!-- this part will be executed after the global policy applied -->
    </inbound>
    <backend>
        <!-- global policy execution excluded -->
    </backend>
    <outbound>
        <base />
    </outbound>
    <on-error>
        <base />
    </on-error>
</policies>
```

Figure 11.6: Default operation policy with references to the base policy



## Implementing API Management

### Summary

APIM is an important platform for enterprise customers who expose web API services to public consumers. APIM is provisioned in Azure and a variety of backend services are deployed as IaaS, PaaS, or even on-premises. APIM is also an orchestrator service that implements the management of backend requests, can combine several requests in one, caches the output, and throttles requests from consumers. The support of modern authentication algorithms allows the service to securely protect the backend and manage networking integration.

APIM exposes the developer portal, which helps API customers integrate, test, and monitor the consumption of the service. The variety of pricing tiers allows for deploying affordable instances and using consumption-based serverless instances for low-load scenarios. The APIM service is the perfect choice for companies that make money from selling historical data, forecasts, machine learning services, and many other services that communicate through public networks. Subscription and product configuration will allow companies to track the usage of and generate billing for clients who call APIM.

In the next chapter, you will learn about event processing and an event-based solution that is also built on top of web APIs and is designed for big data ingestion, flow management, and IoT device streaming.

### Chapter Review Questions

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#### Select Quiz

Quiz 1

[SHOW QUIZ DETAILS](#) ▾

START

Figure 11.8 – Chapter Review Questions for Chapter 11

## Chapter 12: Developing Event-Based Solutions

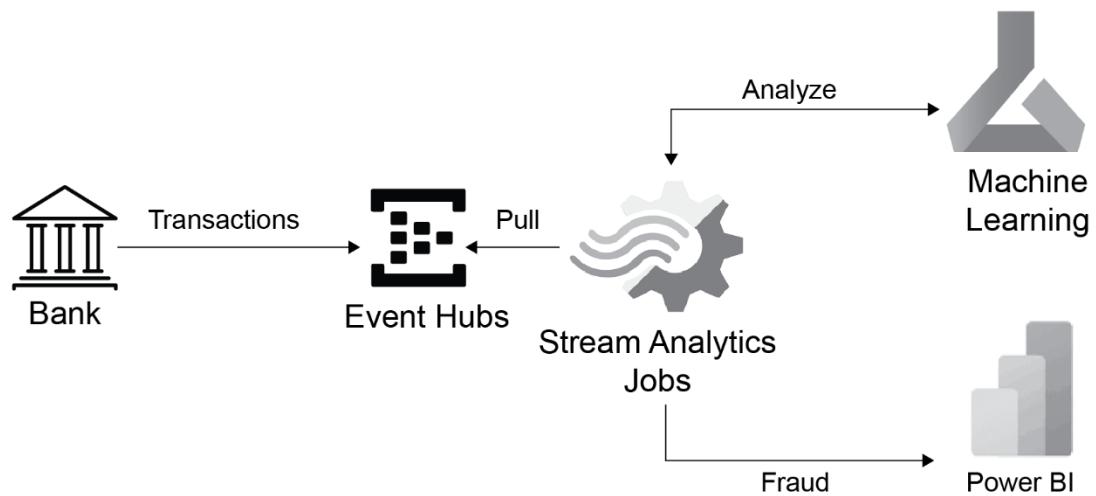


Figure 12.1: Detecting fraud transactions with Event Hubs

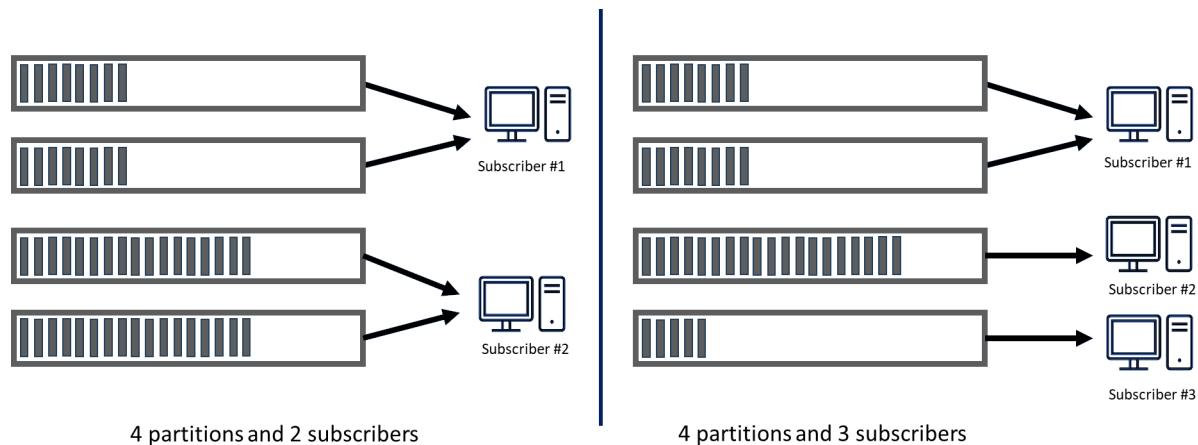


Figure 12.2: A partition load balancing algorithm in Event Hubs

A screenshot of the Azure portal showing a blob named 'eventhub20999/eventhub20999/3/2022/05/30/21/00/22.avro'. The interface includes standard file operations like Save, Discard, Download, Refresh, and Delete. Below the file name, there are tabs for Overview, Versions, Snapshots, Edit (which is selected), and Generate SAS. A warning message states: 'The file 'eventhub20999/eventhub20999/3/2022/05/30/21/00/22.avro' may not render correctly as it contains an unrecognized extension.' The 'Edit' tab displays the raw Avro data:

```
1 Obj@null.avro.codec@null@avro.schema@{"type":"record","name":"EventData","namespace":"Microsoft
2 21312(5/30/2022 9:04:16 PM)&x-opt-enqueued-time@null@Event #2@null
3 21368(5/30/2022 9:04:16 PM)&x-opt-enqueued-time@null@Event #6@null
```

Figure 12.3: Captured events from the Avro file opened from the Azure portal

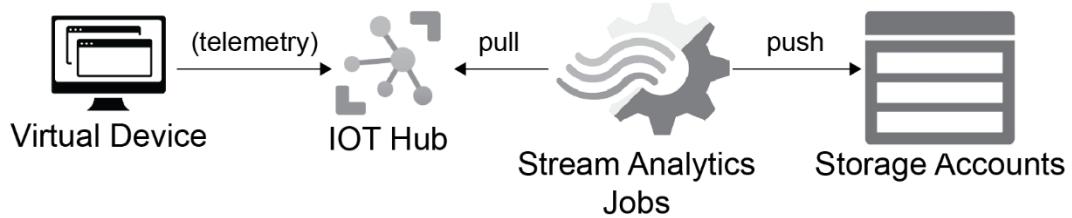


Figure 12.4: Processing an event stream with IoT Hub and a Stream Analytics job

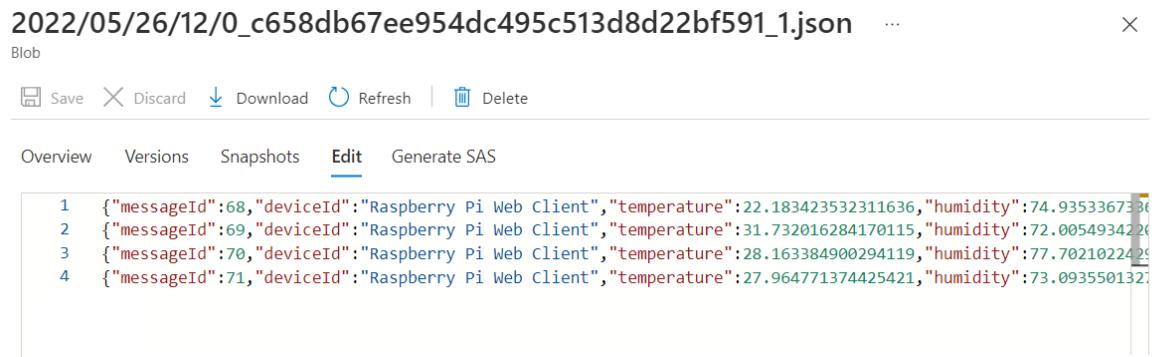


Figure 12.5: The collected telemetry data from the virtual device in Azure Blob Storage

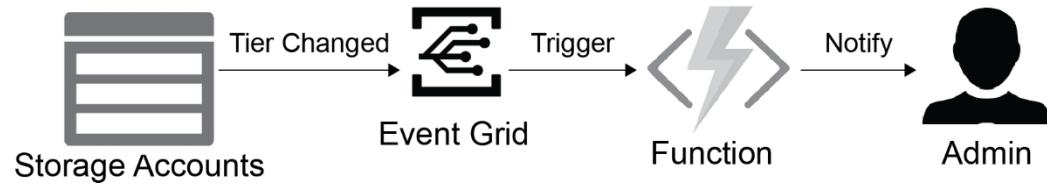


Figure 12.6: Monitoring changes in Azure Storage with Event Grid and an Azure function

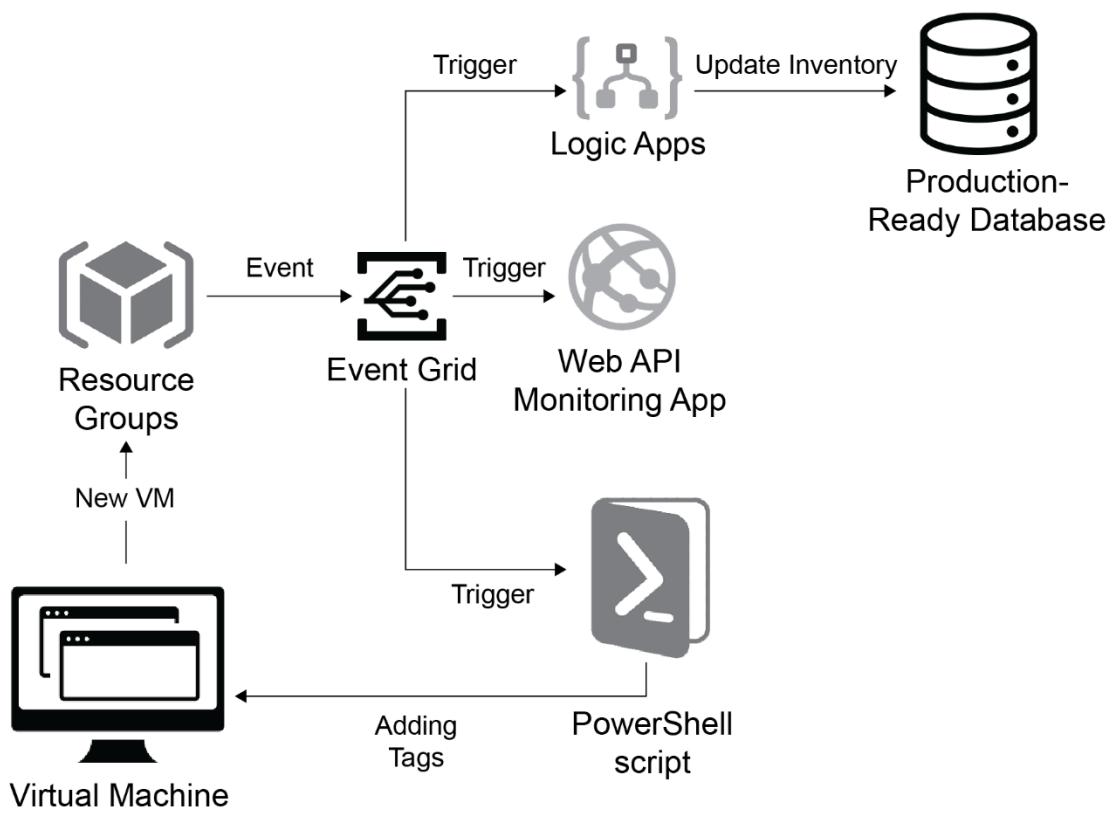


Figure 12.7: Resource group change monitoring with Event Grid

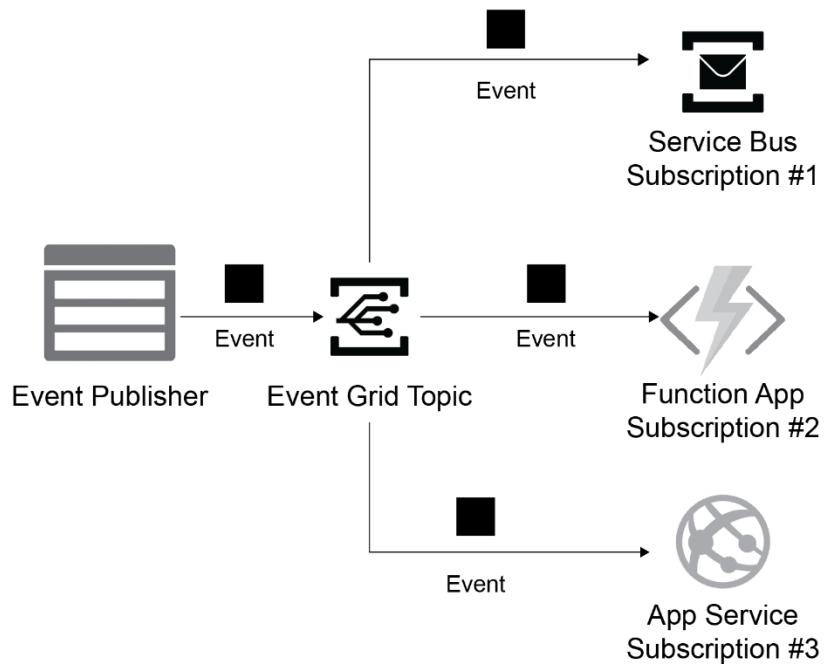


Figure 12.8: Topic functionality – event processing from publisher to handlers

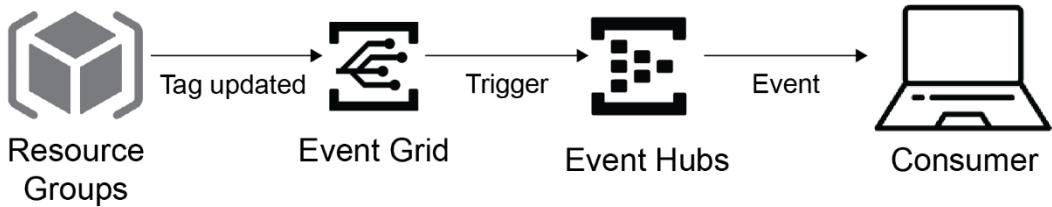


Figure 12.9: Resource group change processing with Event Grid

## Azure Event Grid Viewer

| Event Type        | Subject             |
|-------------------|---------------------|
| Example.EventType | ExampleEventSubject |

```
{
  "id": "1f68cb0e-34d2-4895-a381-09315c2fab92",
  "subject": "ExampleEventSubject",
  "data": "This is the event data",
  "eventType": "Example.EventType",
  "dataVersion": "1.0",
  "metadataVersion": "1",
  "eventTime": "2024-03-18T20:52:29.1299196Z",
  "topic": "/subscriptions/88567e9b-b727-467c-a328-91743855cc1d/resourceGroups/EventGridDemo-RG/providers/Microsoft.EventGrid/topics/custom-events-web"
}
```

Figure 12.10: A custom event received from a console application

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### Developing Event-Based Solutions

Summary

Event-based technology plays a significant role in the data processing solutions hosted in Azure. The solutions based on event processing provide high-scale and high-availability services that are maintained in Azure with minimum administrative effort. Event-based services will help you implement asynchronous programming models and reactive programming models. Event-based services are commonly used for big data ingestion, telemetry stream processing, reactive programming, and mobile platform notifications.

Communication with the services and receiving events are implemented in custom applications based on SDKs and involve a variety of other Azure services, such as Azure Functions, storage accounts, and the Azure App Service platform. Plug-and-play integration is the biggest advantage of using event-based technology services in Azure. By completing this chapter, you can now select the appropriate service based on your requirements and leverage it to process events in an enterprise solution for your company.

In the next chapter, you will learn about the differences between message and event processing and will be able to maximize outcomes from the message-based services in Azure, such as Azure Queue Storage and Azure Service Bus.

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Figure 12.12 – Chapter Review Questions for Chapter 12

## Chapter 13: Developing Message-Based Solutions

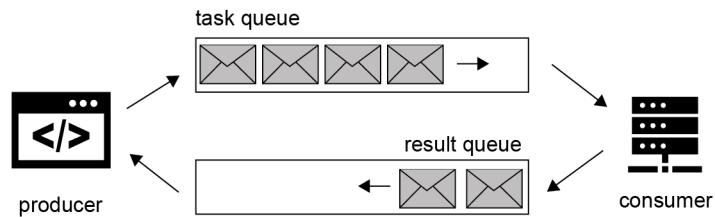


Figure 13.1: Two-way communication with a message broker

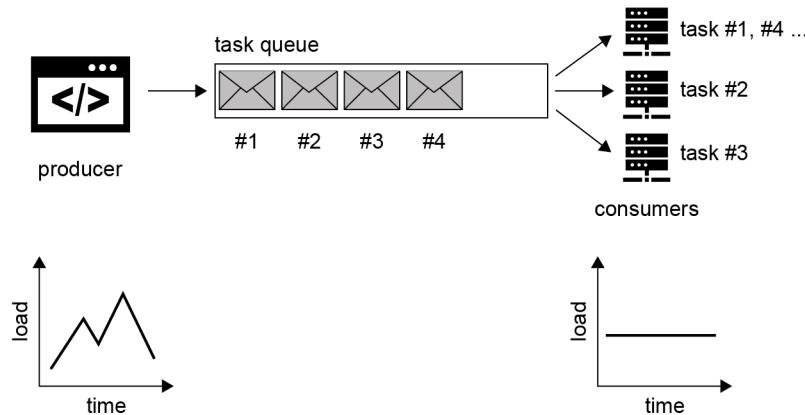


Figure 13.2: Load balancing and scaling consumers

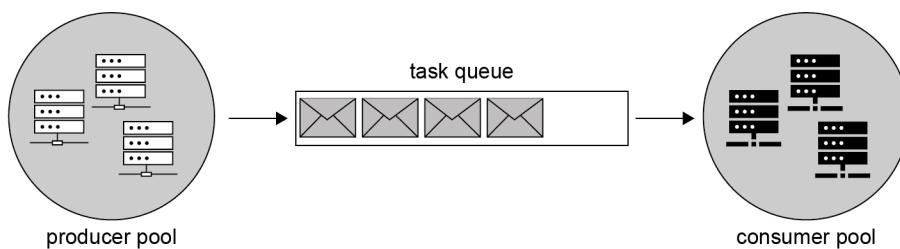


Figure 13.3: Distributing the load between producers and consumers

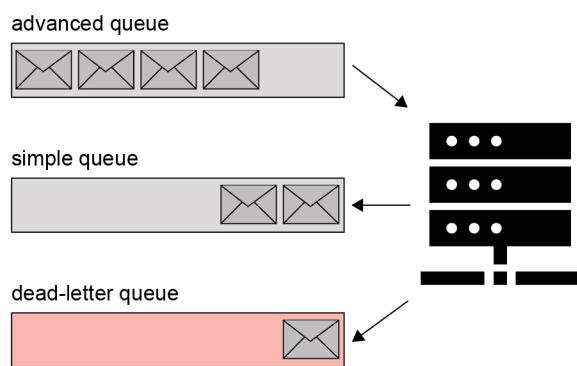


Figure 13.4: A schema of transactional support and a DLQ

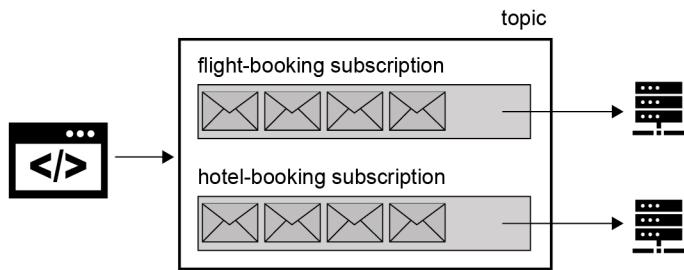


Figure 13.5: A diagram demonstrating working with topics

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### Developing Message-Based Solutions

#### Summary

Message-based services hosted in Azure implement the asynchronous messaging and competing consumers patterns, which help to communicate between services in cloud-to-cloud and cloud-to-on-premises scenarios. Messages always guarantee that the delivery and sequence of delivery are not changed. Message processing supports batches and transactions but is not ideal for high-performance loads. Meanwhile, message queue publishers and subscribers can be horizontally scaled to process messages at a higher speed.

Azure Queue Storage was introduced in this chapter. It enables you to save costs if your application does not need to leverage enterprise features. Furthermore, Azure Service Bus offers a reliable, scalable, and adjustable service that provides you with enterprise-grade capabilities for a reasonable price. You learned the details about each of the services and learned how to communicate with both services using code. Now, in the exam, you can recommend the best service to meet the requirements of a given case study and leverage the best service for your company.

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Figure 13.7 – Chapter Review Questions for Chapter 13

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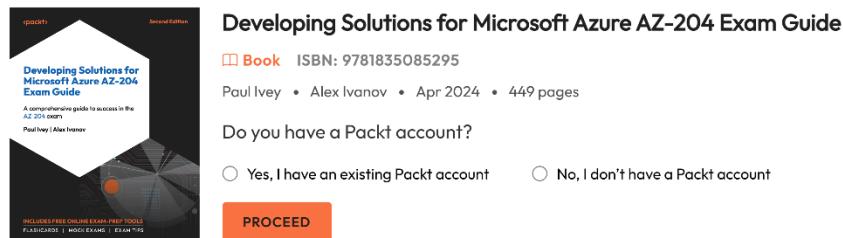


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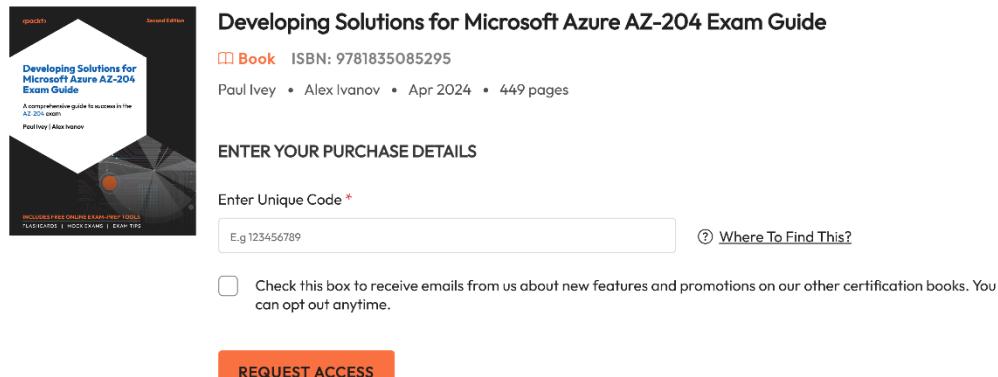


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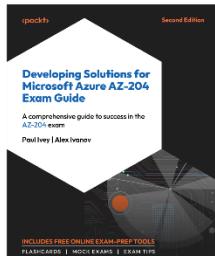
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