

# Designing a Geo-replication Strategy

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# Module Overview



Handling disaster recovery and failover in the popular Azure PaaS services

Enable multiple Azure regions for an existing Azure Web App and Azure SQL database

Use Azure Front Door and configure endpoints which support regional failover



# Failure Mode Analysis for Azure Applications

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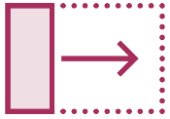


# Failure Mode Analysis (FMA)

Process for building resiliency into a system, by identifying possible failure points in the system



# General Process to Conduct an FMA



Identify all of the components in the system



For each component, identify potential failures that could occur



Rate each failure mode according to its overall risk



For each failure mode, determine how the application will respond and recover



# App Service App Shut Down

## Expected shutdown

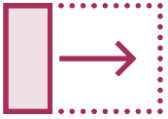
The app was unloaded  
because it was idle

## Unexpected shutdown

The app crashed



# Recovery and Diagnostics



If the application was unloaded while idle, it is automatically restarted on the next request



To prevent the application from being unloaded while idle, enable the Always On setting



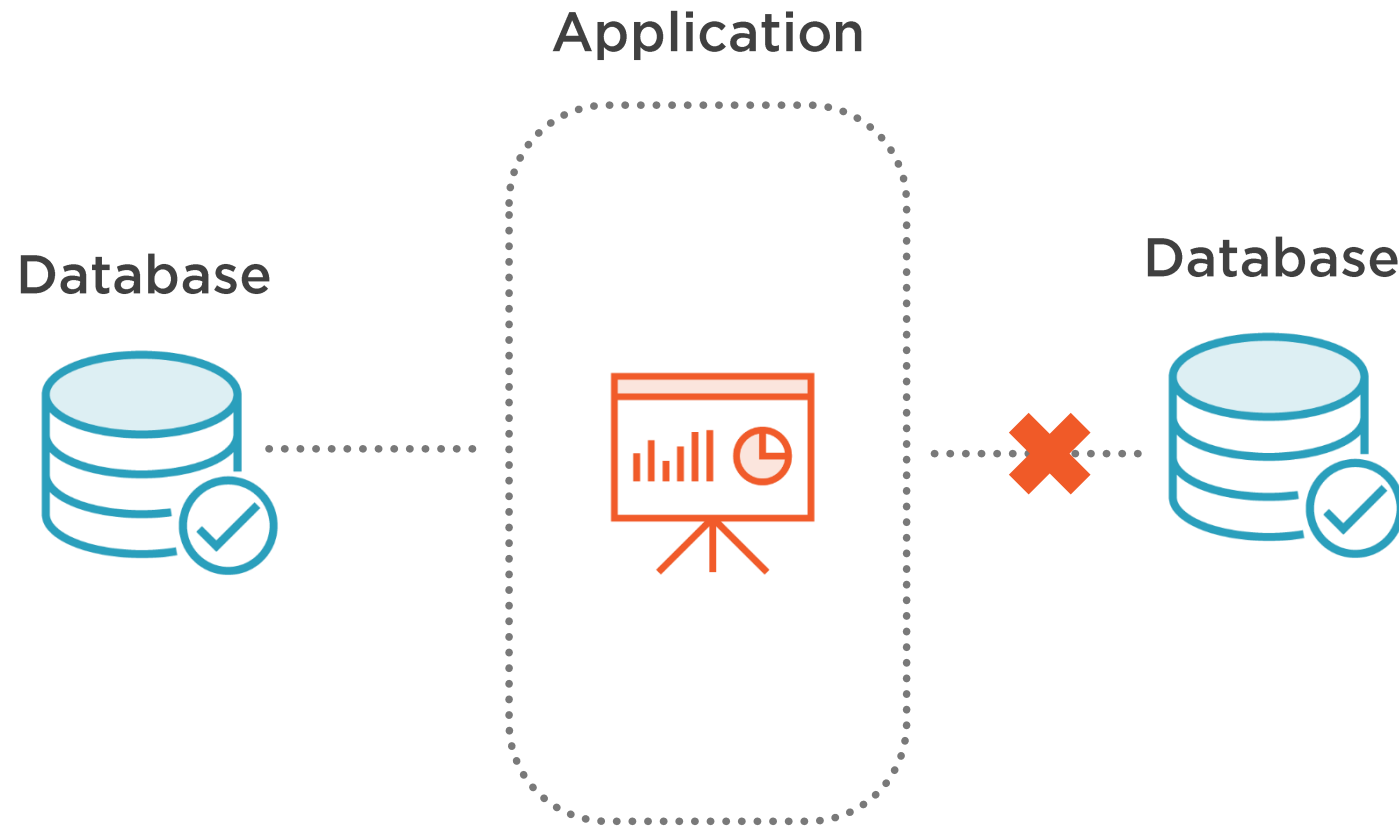
If the app crashes or an App Service VM becomes unavailable, App Service automatically restarts the app



Enable diagnostics logging for web apps in Azure App Service

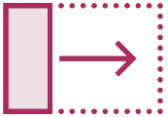


# Broken Connection to the SQL Database





# Recovery and Diagnostics



The database must be configured for active geo-replication



For queries, read from a secondary replica

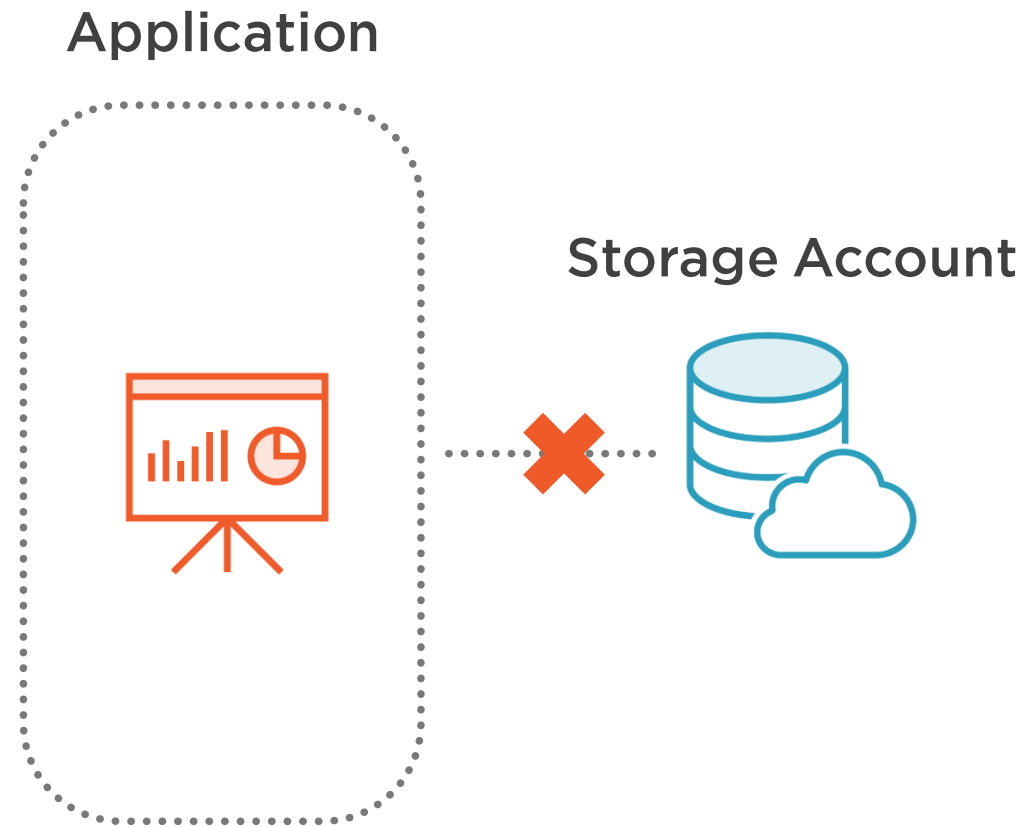


Catch `System.InvalidOperationException` errors in the source code

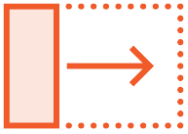


Catch `System.Data.SqlClient.SqlException` in the source code

# Cannot Write to the Storage Account



# Recovery and Diagnostics



Retry the operation, to recover from transient failures. The retry policy in the Storage Account SDK handles it automatically



If N retry attempts fail, perform a graceful fallback - store the data in a local cache



Use storage metrics



# Azure Cosmos DB Data Read/Write Failure

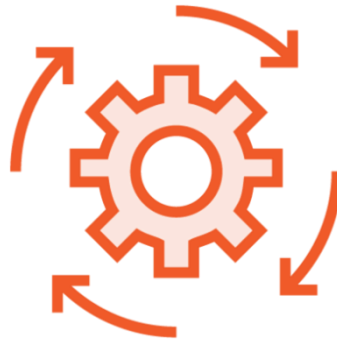
Catch:

- `System.Net.Http.HttpRequestException`
- `Microsoft.Azure.Documents.DocumentClientException`



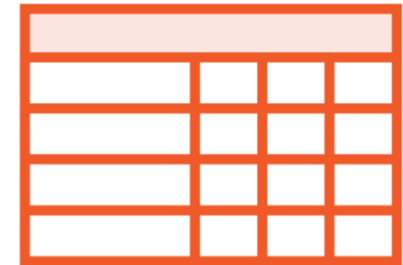
## Replicate

Replicate the Cosmos DB database across two or more regions



## Retry

The SDK automatically retries failed attempts



## Check

When Cosmos DB throttles the client, it returns an HTTP 429 error

# Azure Cosmos DB Data Read/Write Failure

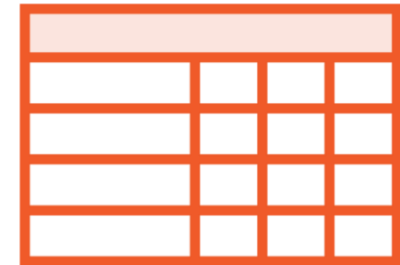
Catch:

- `System.Net.Http.HttpRequestException`
- `Microsoft.Azure.Documents.DocumentClientException`



## Queue

Persist the document to a backup queue, and process the queue later



## Log

Log all errors on the client side

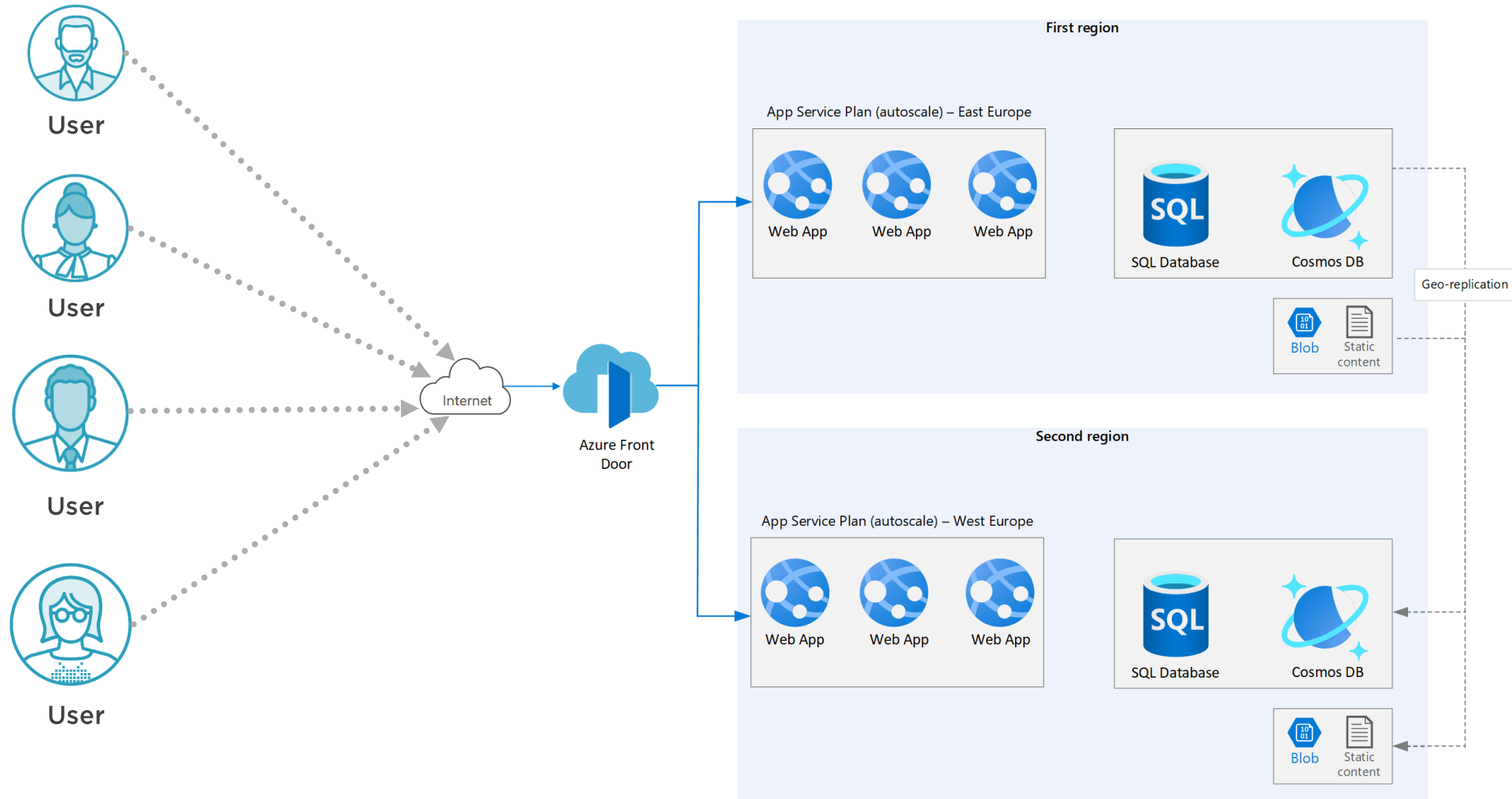


# Web Application in Multiple Azure Regions for High Availability

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# Multiple Azure Regions for High Availability



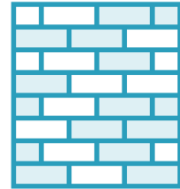
# Architecture

**The application is deployed to each region:**

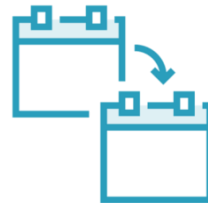
- During normal operations, network traffic is routed to the primary region
- If the primary region becomes unavailable, traffic is routed to the secondary region



**Primary and secondary regions**



**Azure Front Door**



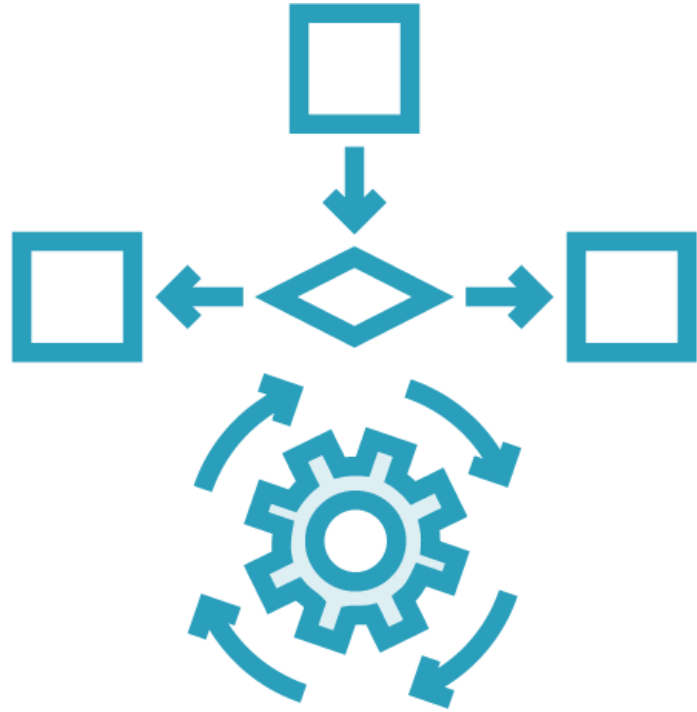
**Geo-replication**



If a regional outage affects the primary region, Azure Front Door can be used to fail over to the secondary region



# Architecture Recommendations



## Regional pairing

Choose regions from the **same regional pair** (like East Europe and West Europe)

# Architecture Recommendations



## Azure Front Door

Use **priority routing**. With this setting, Front Door sends all requests to the primary region unless the endpoint for that region becomes unreachable



# Architecture Recommendations



Use Active  
Geo-Replication for  
SQL Database

Fail over to a secondary database  
if your primary database fails or  
needs to be taken offline



# Architecture Recommendations

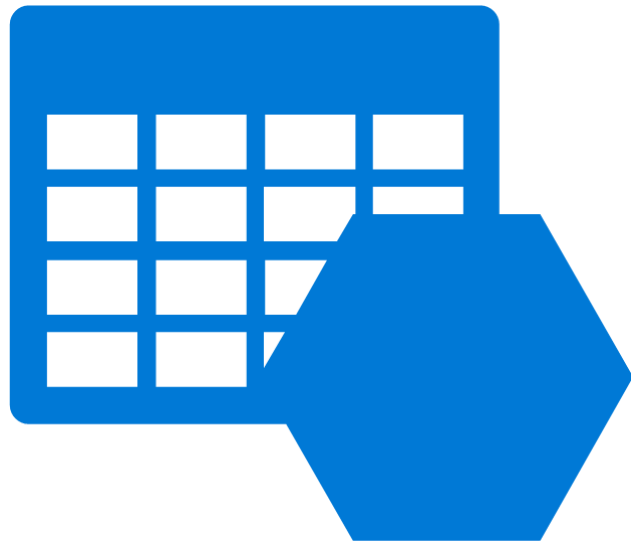


## Use Geo-Replication for Azure Cosmos DB

Cosmos DB supports geo-replication across regions with multi-master (multiple write regions)



# Architecture Recommendations



## Read-Access Geo-Redundant Azure Storage

With read-access geo-redundant storage, the data is replicated to a secondary region



# Demo



## Use Azure Web App in the multiple regions

- Use the Azure portal to create Azure Web App in the multiple Azure regions
- Create an Azure Front Door and configure endpoints which support regional failover



# Summary



**Failure Mode Analysis for Azure Applications**

**Web Application in Multiple Azure Regions for High Availability**

**Create and configure an Azure Front Door service in the Azure portal**





# Thank you!

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