o Verify that the documents are successfully added and visible in the Data Explorer.

4. **Query Data in Cosmos DB:**

   o Use SQL-like queries in the Data Explorer to retrieve data:

     ▪ Retrieve all documents: SELECT * FROM c

     ▪ Retrieve specific documents: SELECT * FROM c WHERE c.category = 'Electronics'

   o Observe how the partition key affects query results.

5. **Configure and Test Consistency Levels:**

   o Review the available consistency levels in the Cosmos DB account: Eventual, Session, Consistent Prefix, Bounded Staleness, Strong.

   o Set the account-level consistency to "Session."

   o Perform a query or data operation and observe the impact on performance and latency.

6. **Enable Global Distribution and Test Replication:**

   o Enable multi-region replication by adding at least one additional region to the Cosmos DB account.

   o Insert new data into the primary region and verify that it replicates to the secondary region.

   o Perform a manual failover and verify that the secondary region becomes the primary.

   o Test data consistency and latency after failover.

☰   Microsoft Azure   ⌕ Search resources, services, and docs (G+/)   🌀 Copilot   ⬚ ⏻ ⚙ ⑦ ⚑   StanislavKostenich@dm...   DEFAULT DIRECTORY

⇄ Switch to PowerShell   ↻ Restart   ⊕ Manage files ∨   ⧉ New session   ✎ Editor   ⬓ Web preview   ⚙ Settings ∨   ⑦ Help ∨   — ⬜ ✕

```
    "createdBy": null,
    "createdByType": null,
    "lastModifiedAt": null,
    "lastModifiedBy": null,
    "lastModifiedByType": null
  },
  "tags": {
    "defaultExperience": "Core (SQL)",
    "hidden-cosmos-mmspecial": ""
  },
  "type": "Microsoft.DocumentDB/databaseAccounts",
  "virtualNetworkRules": [],
  "writeLocations": [
    {
      "documentEndpoint": "https://devcosmosdbaccount20250125-eastus.documents.azure.com:443/",
      "failoverPriority": 0,
      "id": "devcosmosdbaccount20250125-eastus",
      "isZoneRedundant": false,
      "locationName": "East US",
      "provisioningState": "Succeeded"
    },
    {
      "documentEndpoint": "https://devcosmosdbaccount20250125-westus3.documents.azure.com:443/",
      "failoverPriority": 1,
      "id": "devcosmosdbaccount20250125-westus3",
      "isZoneRedundant": false,
      "locationName": "West US 3",
      "provisioningState": "Succeeded"
    }
  ]
}
```

🌐Adding Secondary Region: eastus...
△ Performing Manual Failover to Secondary Region...
🔄Verifying Data Consistency Post-Failover...
✅Data consistency verified after failover: {'id': '1', 'name': 'Replication Test', 'region': 'primary', '_rid': 'O+QBANB8JhUBAAAAAAAAAA==', '_self':
'dbs/O+QBAA==/colls/O+QBANB8JhU=/docs/O+QBANB8JhUBAAAAAAAAAA==/', '_etag': '"fd01c895-0000-0100-0000-679964ce0000"', '_attachments': 'attachments/', '
_ts': 1738106062}
🎉Azure Cosmos DB global distribution, replication, and failover testing completed!
stanislav [~]$ ▯

⇄ Switch to PowerShell   ↻ Restart   ⟳ Manage files ∨   ⬚ New session   ✎ Editor   ⬀ Web preview   ⚙ Settings ∨   ⑦ Help ∨   — ⧉ ✕

```
stanislav [ ~ ]$ ./cosmosdb_global_distribution.sh
WARNING: [Warning] This output may compromise security by showing secrets. Learn more at: https://go.microsoft.com/fwlink/?linkid=2258669

[notice] A new release of pip is available: 23.0.1 -> 24.3.1
[notice] To update, run: pip install --upgrade pip
📍Cosmos DB Endpoint: https://devcosmosdbaccount20250125.documents.azure.com:443/
🚀Starting Cosmos DB Global Distribution Setup...
✅Inserted test data into primary region.
✅Data replicated: {'id': '1', 'name': 'Replication Test', 'region': 'primary', '_rid': '9iFeANWKwXGBhB4AAAAAAA==', '_self': 'dbs/9iFeAA==/colls/9iFe
ANWKwXE=/docs/9iFeANWKwXGBhB4AAAAAAA==/', '_etag': '"00003513-0000-0600-0000-679550130000"', '_attachments': 'attachments/', '_ts': 1737838611}
🔄Enabling multi-region replication...
{
  "analyticalStorageConfiguration": {
    "schemaType": "WellDefined"
  },
  "apiProperties": null,
  "backupPolicy": {
    "migrationState": null,
    "periodicModeProperties": {
      "backupIntervalInMinutes": 240,
      "backupRetentionIntervalInHours": 8,
      "backupStorageRedundancy": "Geo"
    },
    "type": "Periodic"
  },
  "capabilities": [],
  "capacity": null,
  "connectorOffer": null,
  "consistencyPolicy": {
    "defaultConsistencyLevel": "Session",
    "maxIntervalInSeconds": 5,
    "maxStalenessPrefix": 100
  },
  "cors": [],
  "createMode": null,
  "customerManagedKeyStatus": null,
  "databaseAccountOfferType": "Standard",
  "defaultIdentity": "FirstPartyIdentity",
  "disableKeyBasedMetadataWriteAccess": false,
  "disableLocalAuth": false,
```

```
43    # Insert test data
44    test_data = {"id": "1", "name": "Replication Test", "region": "primary"}
45    container.upsert_item(test_data)
46    print("✅ Inserted test data into primary region.")
47
48    # Verify replication by reading data
49    retrieved_item = container.read_item(item="1", partition_key="1")
50    if retrieved_item:
51        print(f"✅ Data replicated: {retrieved_item}")
52
53    EOF
54
55    echo "🔄 Enabling multi-region replication..."
56    az cosmosdb update --name $COSMOS_ACCOUNT --resource-group $RESOURCE_GROUP --enable-multiple-write-locations true
57
58    echo "🌍 Adding Secondary Region: $SECONDARY_REGION..."
59    az cosmosdb failover-priority-change --name $COSMOS_ACCOUNT --resource-group $RESOURCE_GROUP --failover-policies "$PRIMARY_REGION=0" "$SECONDARY_R
60
61    # Wait for replication to take effect
62    sleep 60
63
64    echo "⚠️ Performing Manual Failover to Secondary Region..."
65    az cosmosdb failover-priority-change --name $COSMOS_ACCOUNT --resource-group $RESOURCE_GROUP --failover-policies "$SECONDARY_REGION=0" "$PRIMARY_R
66
67    # Wait for failover to take effect
68    sleep 60
69
70    echo "🔄 Verifying Data Consistency Post-Failover..."
71    python3 <<EOF
72    from azure.cosmos import CosmosClient
73
74    # Reconnect after failover
75    client = CosmosClient(ENDPOINT, KEY)
76    container = client.get_database_client(DATABASE_NAME).get_container_client(CONTAINER_NAME)
77
78    retrieved_item = container.read_item(item="1", partition_key="1")
79    if retrieved_item:
80        print(f"✅ Data consistency verified after failover: {retrieved_item}")
81    else:
82        print("❌ Data verification failed!")
83    EOF
84
```

untitled

Line 82, Column 1   Tab Size: 4   Python

```bash
#!/bin/bash

# Define variables
RESOURCE_GROUP="StanislavKostenich"
COSMOS_ACCOUNT="devcosmosdbaccount20250125"
DATABASE_NAME="Items"
CONTAINER_NAME="Items"
PRIMARY_REGION="westus3"
SECONDARY_REGION="westcentralus"

# Fetch Cosmos DB Account details
COSMOS_ENDPOINT=$(az cosmosdb show --name $COSMOS_ACCOUNT --resource-group $RESOURCE_GROUP --query "documentEndpoint" -o tsv)
COSMOS_KEY=$(az cosmosdb keys list --name $COSMOS_ACCOUNT --resource-group $RESOURCE_GROUP --query "primaryMasterKey" -o tsv)

# Install required dependencies if not already installed
pip install azure-cosmos --quiet

echo "🎯 Cosmos DB Endpoint: $COSMOS_ENDPOINT"
echo "🚀 Starting Cosmos DB Global Distribution Setup..."

# Python script for inserting, verifying replication, and failover testing
python3 <<EOF
from azure.cosmos import CosmosClient, PartitionKey

# Cosmos DB credentials
ENDPOINT = "$COSMOS_ENDPOINT"
KEY = "$COSMOS_KEY"
DATABASE_NAME = "$DATABASE_NAME"
CONTAINER_NAME = "$CONTAINER_NAME"

# Initialize Cosmos Client
client = CosmosClient(ENDPOINT, KEY)

# Create (or Get) Database
database = client.create_database_if_not_exists(DATABASE_NAME)

# Create (or Get) Container
container = database.create_container_if_not_exists(
    id=CONTAINER_NAME,
    partition_key=PartitionKey(path="/id")
)
```

Microsoft Azure

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Dashboard > Microsoft.Azure.CosmosDB-20250125173401 | Overview > devcosmosdbaccount20250125

devcosmosdbaccount20250125 | Data Explorer ☆ ⋯

Azure Cosmos DB account

🔍 Search

- 🏠 Overview
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- ∨ Settings
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  - 🟢 Replicate data globally
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  - ⟨⟩ Networking
  - 🟢 CORS
  - 🔷 Dedicated Gateway
  - 🔑 Keys
  - 🔵 Advisor Recommendations

🔶 Enable Azure Synapse Link

⚙️ 📱 🙂

+ **New Container** ∨

⌂ Home

Home ✕

Welcome to Azure Cosmos DB

Globally distributed, multi-model database service for any scale

⚡ **Launch quick start**	🔷 **New Container**	🔌 **Connect**
Launch a quick start tutorial to get started with sample data	Create a new container for storage and throughput	Prefer using your own choice of tooling? Find the connection string you need to connect

Recents

📄 Items
Container

📄 todolist

Top 3 things you need to know

Advanced Modeling Patterns ↗
Learn advanced strategies to optimize your database.

Learning Resources

Data Explorer keyboard shortcuts ↗
Learn keyboard shortcuts to navigate Data Explorer.

🔄 0 ⊘ 0 ⓘ 1

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  - Metrics

+ New Container ⌄

- Home
- ⌄ devtodolist
  - > todolist
- ⌄ Items
  - ⌄ Items
    - Items
    - Scale & Settings
    - > Stored Procedures
    - > User Defined Functions
    - > Triggers

▷ Execute Query   Save Query   Download Query   View ⌄

| Home | Items.Items | Items.Query 1 | Items.Scale & ... | **Items.Quer...** × |

```
1   SELECT * FROM c WHERE c.category = 'Electronics1'
```

Results   Query Stats

1 - 1

```
[
    {
        "id": "1",
        "name": "Smartphone1",
        "category": "Electronics1",
        "price": 699,
        "_rid": "xnwIAJXch6YBAAAAAAAAAA==",
        "_self": "dbs/xnwIAA==/colls/xnwIAJXch6Y=/docs/xnwIAJXch6YBAAAAAAAAAA==/",
        "_etag": "\"49009f2f-0000-4d00-0000-67951c840000\"",
        "_attachments": "attachments/",
        "_ts": 1737825412
    }
]
```

0   1   6   Successfully fetched 1 item for container Items

Dashboard > Microsoft.Azure.CosmosDB-20250125173401 | Overview > devcosmosdbaccount20250125

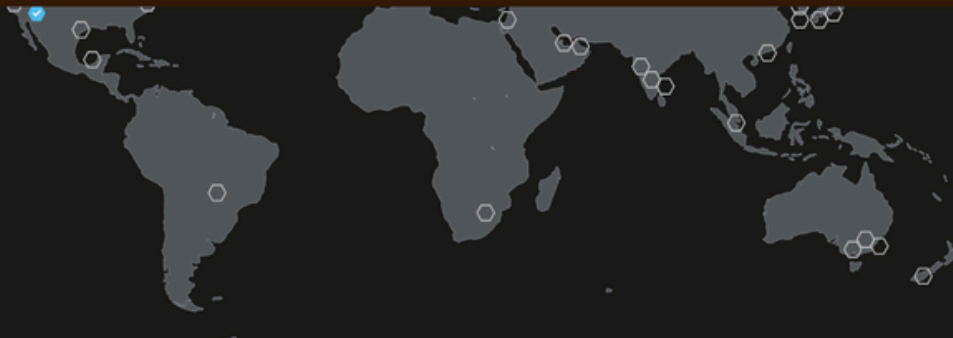🌐 **devcosmosdbaccount20250125 | Replicate data globally** ☆ ⋯ ✕
Azure Cosmos DB account

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  - 🖥️ Dedicated Gateway
  - 🔑 Keys
  - 🌐 Advisor Recommendations

🖫 Save ⟲ Discard ⇄ Manual failover 🗒 Service-Managed Failover ⧒ **Feedback**

⚠️ When you add a region to your account, you will be billed for the additional RU/s and storage copied to the region. Click here to learn more. →

Configure regions
Multi-region writes ⓘ
(Disable   Enable)

Configure the regions for reads, writes and availability zone (supported in selected regions and can only be configured when a new region is added).

Write region	Availability zone
West US 3	

Read regions	Availability zone	Action
West Central US		

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devcosmosdbaccount20250125 | Data Explorer ☆ ⋯

Azure Cosmos DB account

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  - Alerts
  - Metrics

New Item | Update | Discard | Delete | Upload Item

+ New Container

Home | **Items.Items** ✕

SELECT * FROM c | Edit Filter

Home

devtodolist

> todolist

Items

> Items

Items

Scale & Settings

> Stored Procedures

> User Defined Functions

> Triggers

	id ⋯	/c ⋯ ɟotyʃ ⋯ roni
☐	1	
☑	2	

Load more

```
 1  {
 2      "id": "2",
 3      "name": "Smartphone2",
 4      "category": "Electronics2",
 5      "price": 699,
 6      "_rid": "xnwIAJXch6YCAAAAAAAAAA==",
 7      "_self": "dbs/xnwIAA==/colls/xnwIAJXch6Y=/docs/xnwIAJXch6YCAAAA
 8      "_etag": "\"4900a02f-0000-4d00-0000-67951c950000\"",
 9      "_attachments": "attachments/",
10      "_ts": 1737825429
11  }
```

○ 0 ○ 0 ① 4

Dashboard > Microsoft.Azure.CosmosDB-20250125173401 | Overview > devcosmosdbaccount20250125

📦 **devcosmosdbaccount20250125 | Data Explorer** ☆ ⋯   ✕
   Azure Cosmos DB account

🔍 Search   ◌ ≪

🏠 Overview   ⬡ Enable Azure Synapse Link   **New Container**   ✕

📋 Activity log   ⟲ ‹   Items
                                   + New Container ⌄   Home   ✕
🔑 Access control (IAM)   ☐ Share throughput across containers ⓘ
                                   🏠 Home
🏷 Tags   Welcome to Az
                                   ⌄ 🗒 devtodolist   *** Container id** ⓘ
🔧 Diagnose and solve problems
                                      › 🗒 todolist   Globally distributed, multi-mo   Items
⊘ Cost Management
                                                                                                                                 * Partition key ⓘ
⚡ Quick start
                                                        ⚡ Launch quick   New   /categoty
🗄 Data Explorer   start   Cont
                                                                                                                                  /Electronics   🗑
🔀 Mirroring in Fabric (Preview)   Launch a quick   Create
                                                             start tutorial to get contai   Add hierarchical partition key
› Settings   started with   storag
                                                             sample data   throu   ⓘ This feature allows you to partition your data with up to three
› Integrations   levels of keys for better data distribution. Requires .NET V3, Java V4
                                                                                                                                 SDK, or preview JavaScript V3 SDK. Learn more
⌄ Containers
                                                                                                                                 * Container throughput (400 - unlimited RU/s) ⓘ
   📁 Browse   Recents   Top 3 things yo
                                                                                                                                 ○ Autoscale   ● Manual
   📈 Scale   🗒 todolist   Advanced Modeling
                                                          Container   Learn advanced str   Estimate your required RU/s with capacity calculator.
   ⚙ Settings   database.
                                                                                                                                 Container Required RU/s ⓘ
⌄ Monitoring
                                                                                                                                 400   *
   💡 Insights
                                                                                                                                 Estimated cost (USD) ⓘ: **$0.032 hourly / $0.77 daily / $23.36**
   📊 Alerts   **monthly** (1 region, 400RU/s, $0.00008/RU)

   📉 Metrics   ◌ 0   ◌ 0   ◌ 0   ^

Dashboard > Microsoft.Azure.CosmosDB-20250125173401 | Overview > devcosmosdbaccount20250125

devcosmosdbaccount20250125 | Data Explorer ☆ ⋯
Azure Cosmos DB account

New Container ∨

Execute Query | Save Query | Download Query | View ∨

Home | todolist.Items | **todolist.Qu...** ✕

```
1  SELECT * FROM c
```

Results | Query Stats

🏠 Home
∨ 🗇 devtodolist
  ∨ 🗋 todolist
    Items
    Scale & Settings
    > Stored Procedures
    > User Defined Functions
    > Triggers

1 - 3

```
[
    {
        "id": "1",
        "name": "Smartphone",
        "category": "Electronics",
        "price": 699,
        "_rid": "9cVKAIUlX7EBAAAAAAAAAA==",
        "_self": "dbs/9cVKAA==/colls/9cVKAIUlX7E=/docs/9cVKAIUlX7EBAAAAAAAAAA==/",
        "_etag": "\"0000df44-0000-4d00-0000-679516360000\"",
        "_attachments": "attachments/",
        "_ts": 1737823798
    },
    {
        "id": "2",
        "name": "Smartphone2",
        "category": "Electronics",
        "price": 699,
        "_rid": "9cVKAIUlX7ECAAAAAAAAAA==",
        "_self": "dbs/9cVKAA==/colls/9cVKAIUlX7E=/docs/9cVKAIUlX7ECAAAAAAAAAA==/",
        "_etag": "\"0000e044-0000-4d00-0000-679516590000\"",
        "_attachments": "attachments/",
        "_ts": 1737823833
```

○ 0   ○ 1   ○ 4

Dashboard > Microsoft.Azure.CosmosDB-20250125173401 | Overview > devcosmosdbaccount20250125

devcosmosdbaccount20250125 | Data Explorer ☆ ⋯
Azure Cosmos DB account

New Item   Update   Discard   Delete   Upload Item

+ New Container ⌄

Home   **todolist.Ite...** ×

SELECT * FROM c   Edit Filter

⌂ Home

∨ 🗄 devtodolist

   ∨ 🗋 todolist

     Items

     Scale & Settings

     › Stored Procedures

     › User Defined Functions

     › Triggers

☑	id ⋯	/categoty ⋯
☐	1	
☐	2	
☑	3	

```
1   {
2       "id": "3",
3       "name": "Smartphone3",
4       "category": "Electronics",
5       "price": 699,
6       "_rid": "9cVKAIUlX7EDAAAAAAAAAA==",
7       "_self": "dbs/9cVKAA==/colls/9cVKAIUlX7E=/docs/9cVKAIUlX7EDAAAAAAAA
8       "_etag": "\"0000e144-0000-4d00-0000-6795166d0000\"",
9       "_attachments": "attachments/",
10      "_ts": 1737823853
11  }
```

Load more

🔃 0   ⊘ 0   ① 3   Successfully created new item for container todolist

Dashboard > Microsoft.Azure.CosmosDB-20250125173401 | Overview > devcosmosdbaccount20250125

devcosmosdbaccount20250125 | Data Explorer ☆ ⋯

Azure Cosmos DB account

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  - 🔑 Keys
  - 🔵 Advisor Recommendations

⚡ Enable Azure Synapse Link

+ New Container ⌄

🏠 Home

Home ✕

Welcome to Az

Globally distributed, multi-mo

⚡ **Launch quick start**

Launch a quick start tutorial to get started with sample data

New Cont

Create contai storag throu

Recents

Top 3 things yo

Advanced Modeling
Learn advanced str
database.

○ 0 ⊘ 0 ① 0

New Container ✕

* Database id ①

◉ Create new ○ Use existing

devtodolist

☐ Share throughput across containers ①

* Container id ①

todolist

* Partition key ①

/categoty

Add hierarchical partition key

* Container throughput (400 - unlimited RU/s) ①

○ Autoscale ◉ Manual

Estimate your required RU/s with capacity calculator.

Container Required RU/s ①

400   *

Estimated cost (USD) ①: **$0.032 hourly / $0.77 daily / $23.36 monthly** (1 region, 400RU/s, $0.00008/RU)

Unique keys ①

Dashboard > Azure Cosmos DB >

Create Azure Cosmos DB Account - Azure Cosmos DB for NoSQL   ···   ✕

✓ Validation Success

Subscription	Azure subscription 1
Resource Group	StanislavKostenich
Location	West US 3
Account Name	(new) devcosmosdbaccount20250125
API	Azure Cosmos DB for NoSQL
Capacity mode	Provisioned throughput
Geo-Redundancy	Disable
Multi-region Writes	Disable
Availability Zones	Disable

Backup Policy

Backup policy	Periodic
Backup storage redundancy	Geo-redundant backup storage

Encryption

Data Encryption	Service Managed

Networking

Connectivity method	All networks
Minimum TLS Protocol	TLS 1.2

Create   Previous   Next   Download a template for automation   Feedback

Dashboard > Azure Cosmos DB >

Create Azure Cosmos DB Account - Azure Cosmos DB for NoSQL ···

 ✕

Subscription *   Azure subscription 1   ⌄

   └── Resource Group *   StanislavKostenich   ⌄

          Create new

Instance Details

Account Name *   devcosmosdbaccount20250125   ✓

Configure availability zone settings for your account. You cannot change these settings once the account is created.

Availability Zones ⓘ   ◯ Enable   ⦿ Disable

Location * ⓘ   (US) West US 3   ⌄

          Available locations are determined by your subscription's access and availability zone support (if that is enabled). If you don't see or cannot select your desired location, please open a support request for region access.
Click here for more details on how to create a region access request

Capacity mode ⓘ   ⦿ Provisioned throughput   ◯ Serverless
          Learn more about capacity mode

With Azure Cosmos DB free tier, you will get the first 1000 RU/s and 25 GB of storage for free in an account. You can enable free tier on up to one account per subscription. Estimated $64/month discount per account.

The subscription you have selected already has an account with free tier enabled.

Apply Free Tier Discount   ◯ Apply   ⦿ Do Not Apply

Limit total account throughput   ☐ Limit the total amount of throughput that can be provisioned on this account

Review + create   Previous   Next: Global distribution   ⚐ Feedback

Practical Task 10: Getting Started with Cosmos DB

Set up and explore Cosmos DB by creating a database, managing data, querying, and testing key features like consistency and global distribution.

Requirements:

1. **Create a Cosmos DB Account:**

   o Create a new Cosmos DB account in the Azure portal using the Core (SQL) API.

   o Select a region for the account and use the default settings.

   o Review key features like throughput, consistency levels, and global distribution.

   o Note down the primary and secondary keys for the account.

2. **Set Up a Database and Container:**

   o Create a database named "SampleDB" in the Cosmos DB account.

   o Add a container named "Items" with the partition key set to /category.

   o Use the default throughput settings for the database and container.

3. **Insert Data Using Data Explorer:**

   o Open the Data Explorer in the Azure portal.

   o Insert at least three sample JSON documents into the "Items" container. Example:

   ```
   {
     "id": "1",
     "name": "Smartphone",
     "category": "Electronics",
   ```