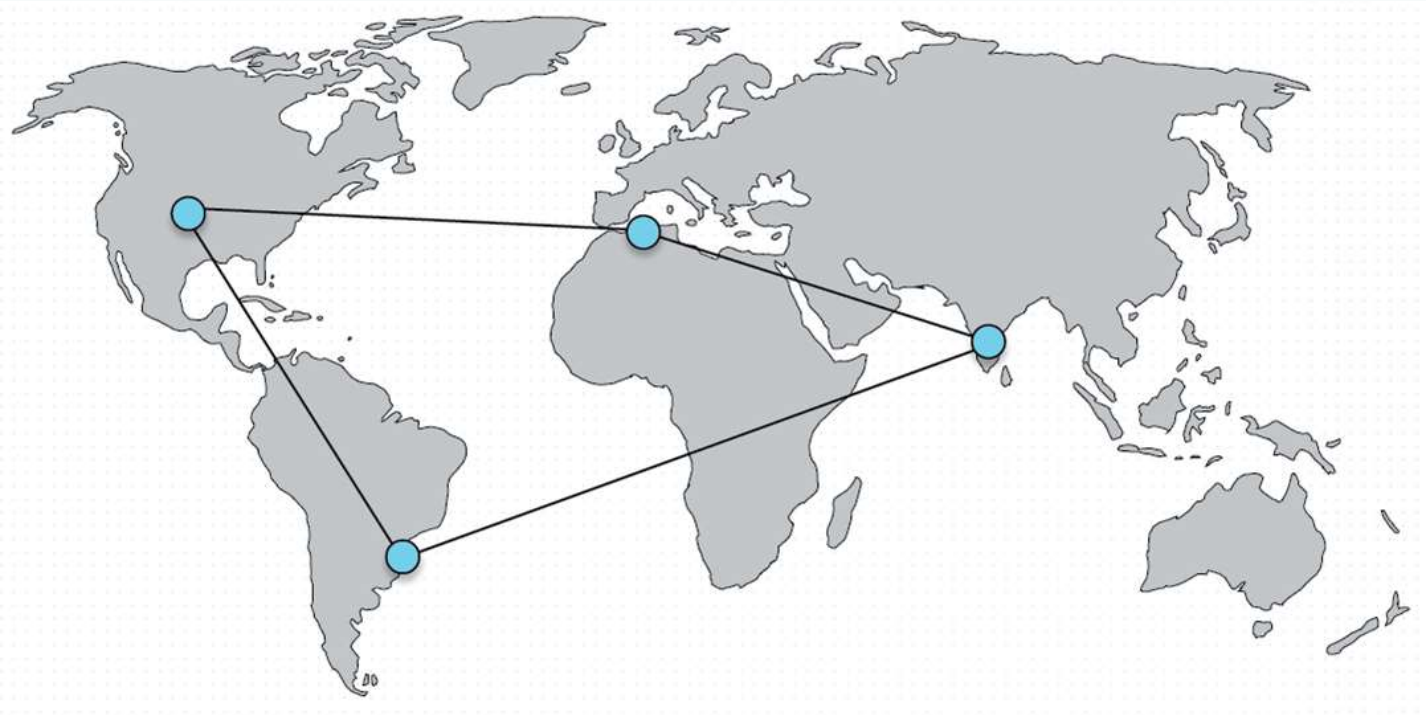
Azure Cosmos DB Concepts

Global Distribution

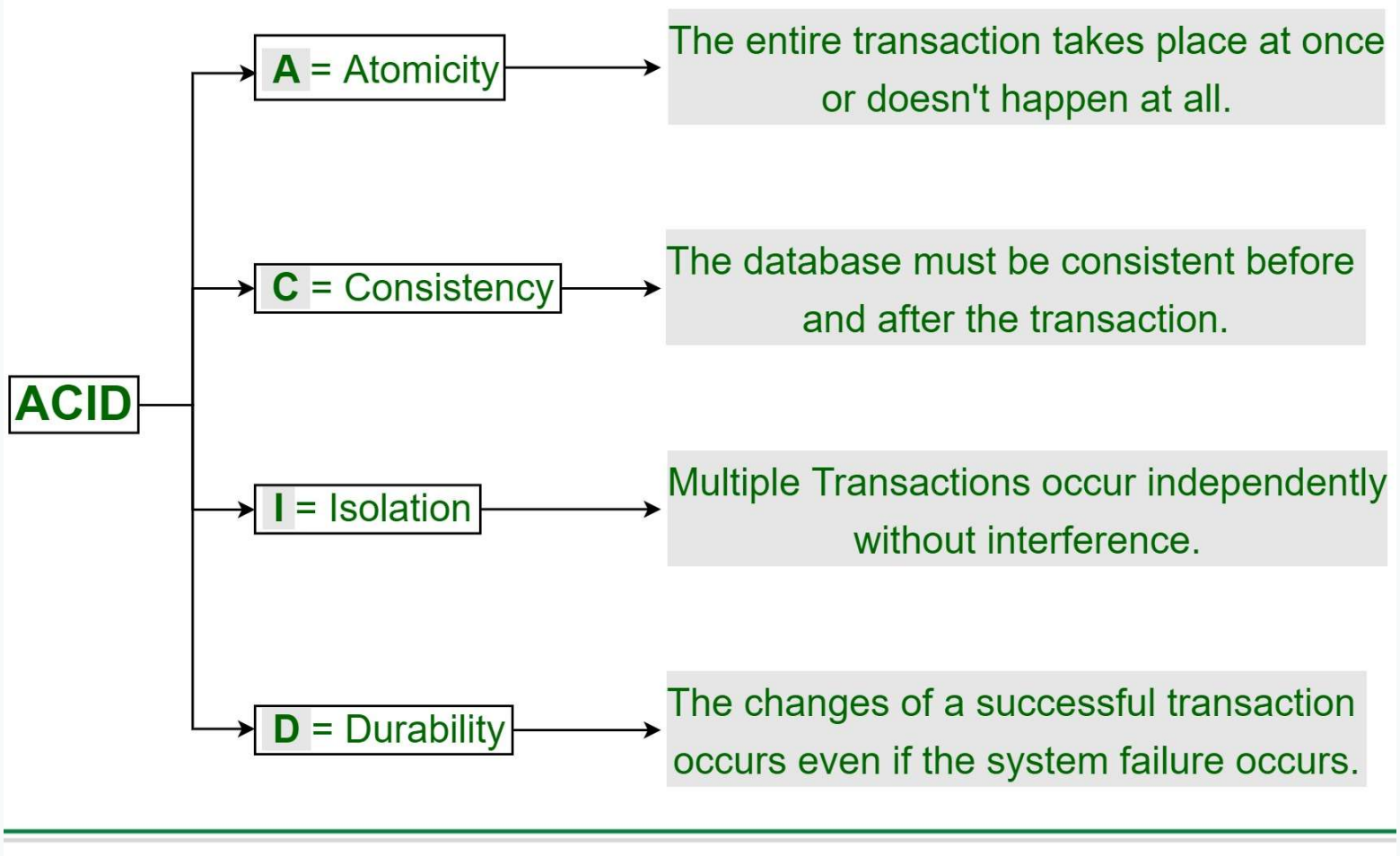
- Microsoft Azure is available globally in over 30 regions
- Global distribution is a comparable concept to what replication is for relational databases
- Don’t need complex configurations



Write and Read Regions

- When the database was first created, it was based on only one region
- This default configuration defines the first (and only) region where a database accepts read and write operations.
- When you distribute the database to more regions, the new regions automatically become read regions

ACID Properties



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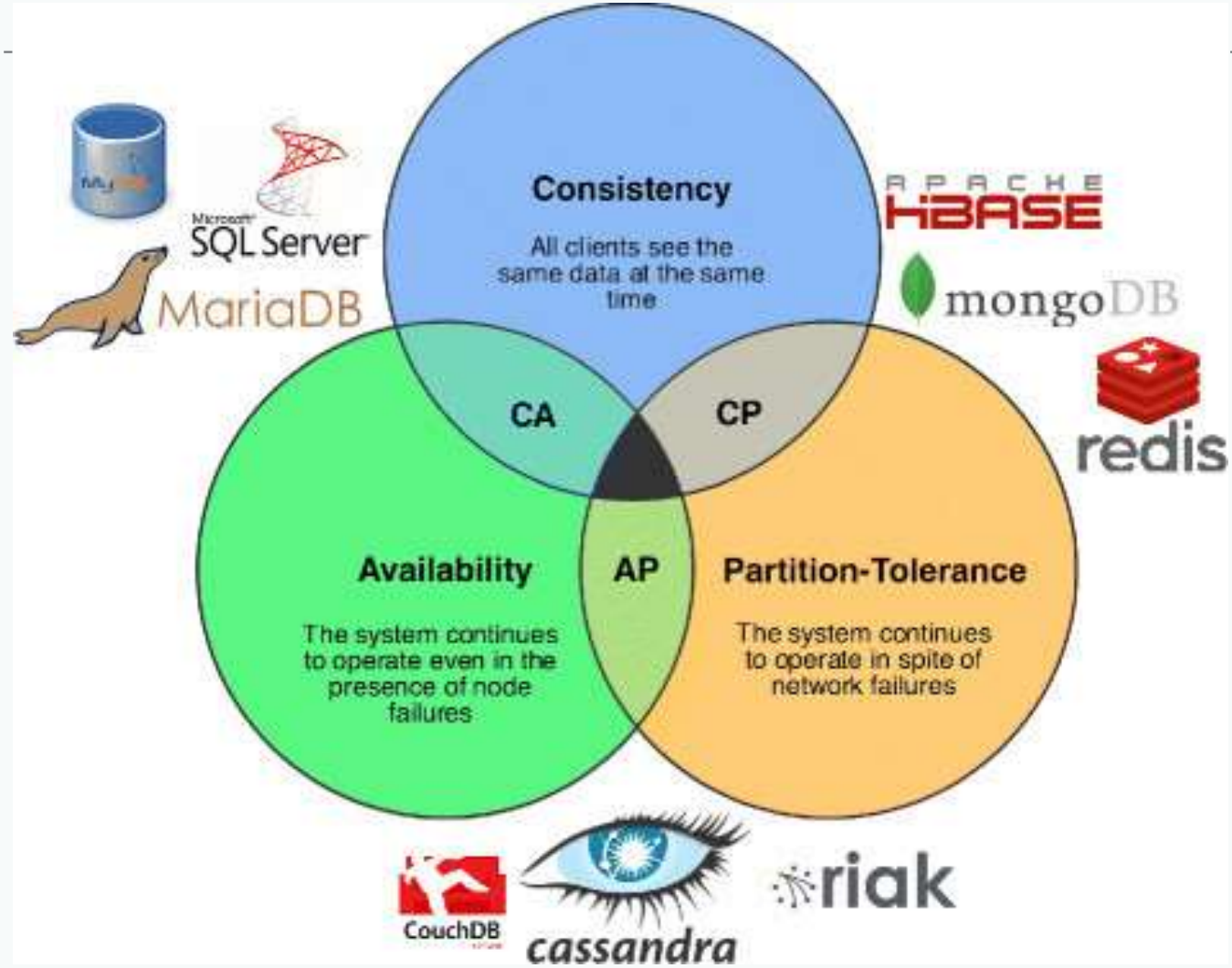
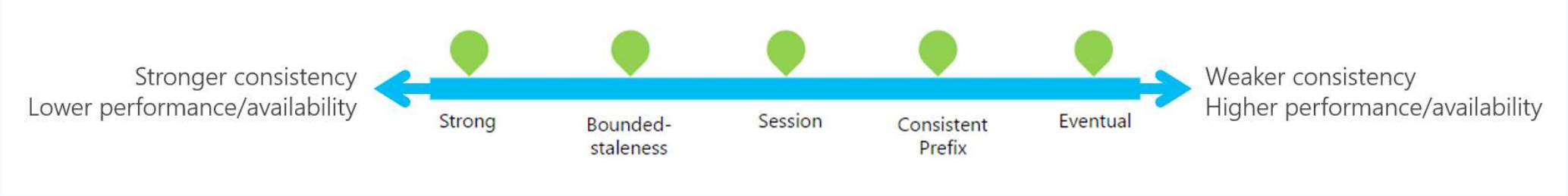
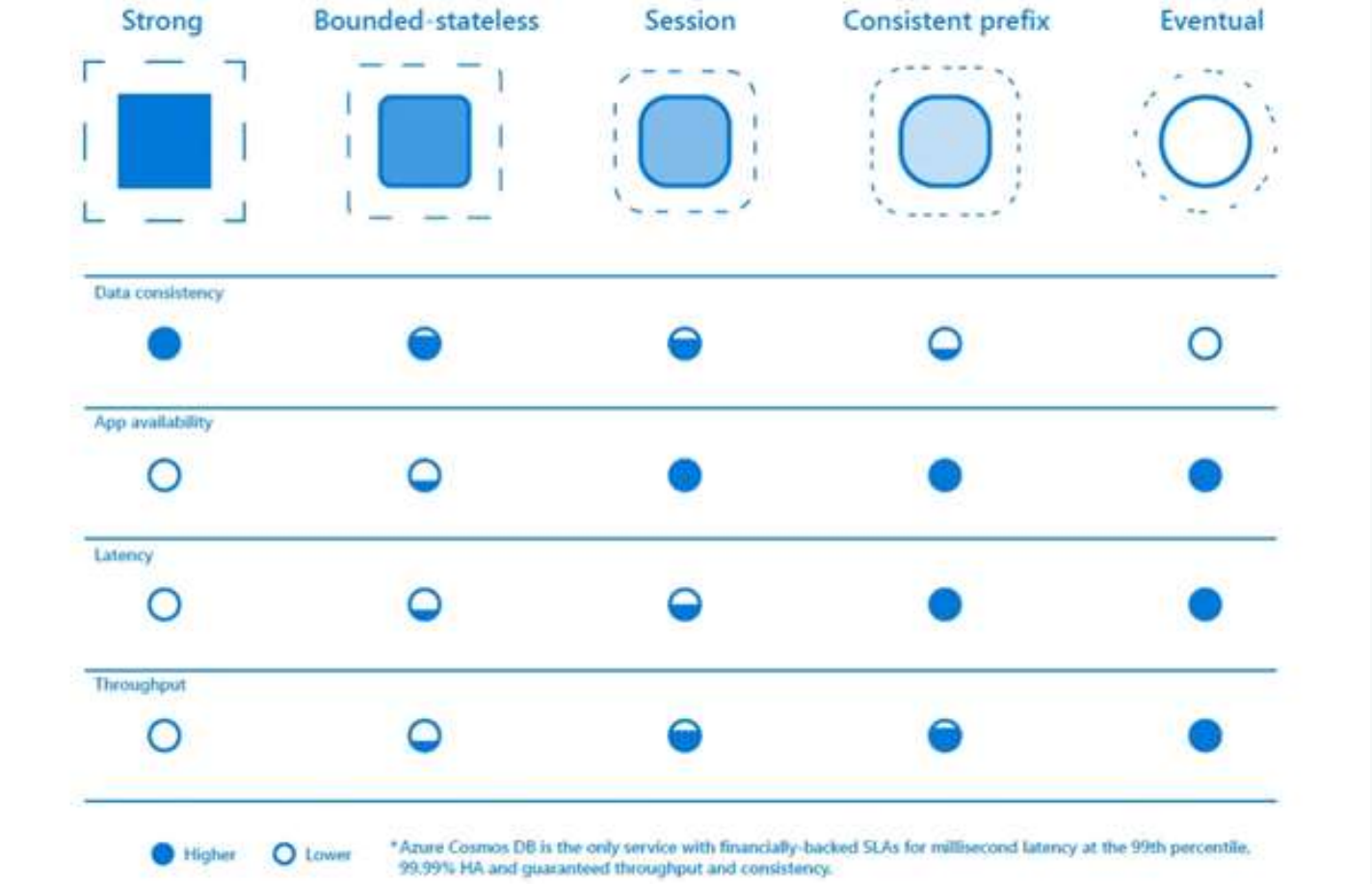

Consistency
All clients see the same data at the same time
Availability
The system continues to operate even in the presence of node failures
Partition-Tolerance
The system continues to operate in spite of network failures
CA
CP
AP
SQL Server
MariaDB
APACHE HBASE
mongoDB
redis
CouchDB
cassandra
riak

Consistency Models

- Consistency defines the rules under which distributed data is available to users.
- Azure Cosmos DB implements five different consistency models



Consistency Models

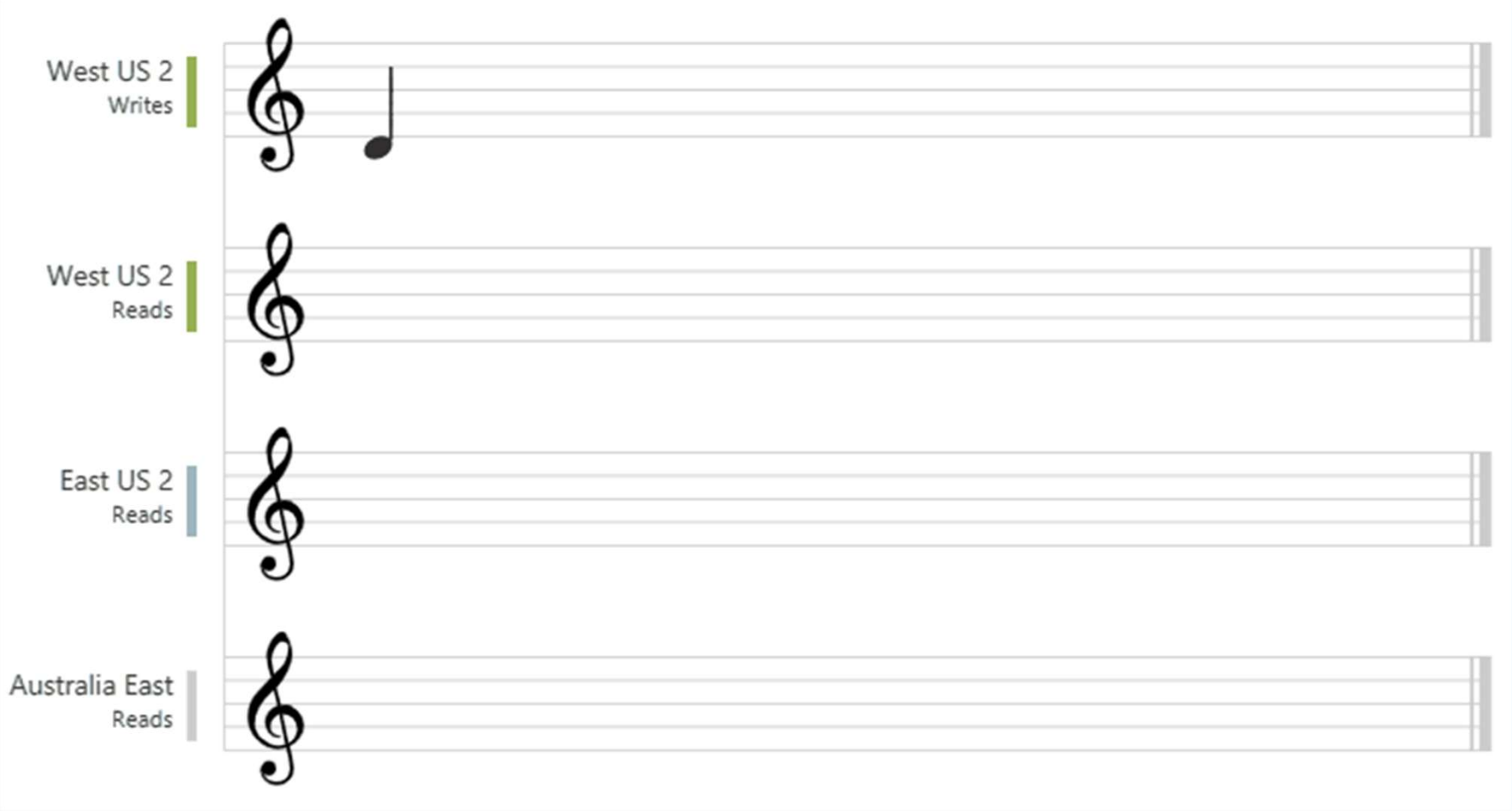


Scope of Consistency

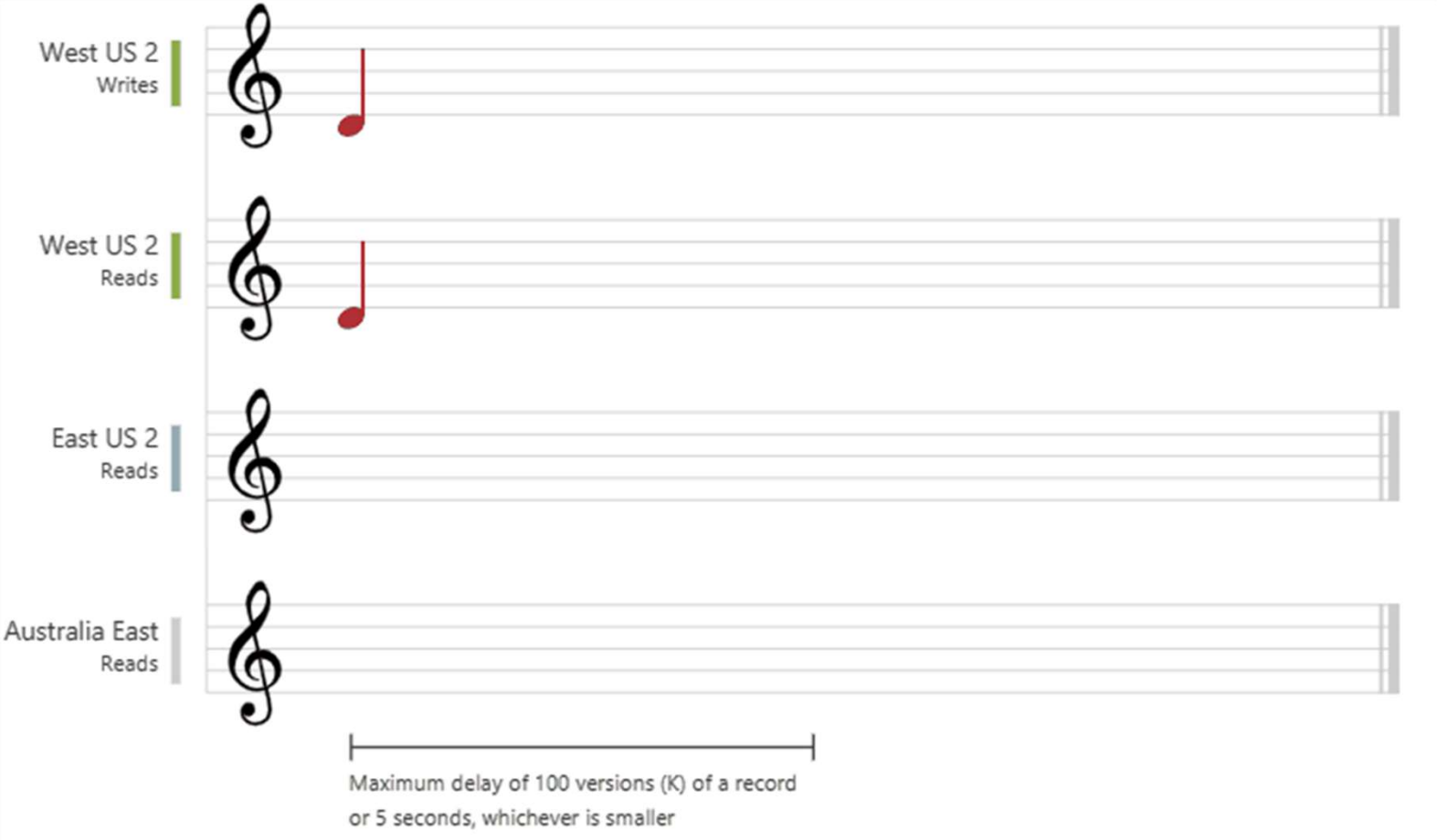
- The granularity of consistency is scoped to a single user request.
- A write request may correspond to an insert, replace, update, or delete Transaction
- As with writes, a read/query transaction is also scoped to a single user request.

Strong Consistency Model

Eventual Consistency Model

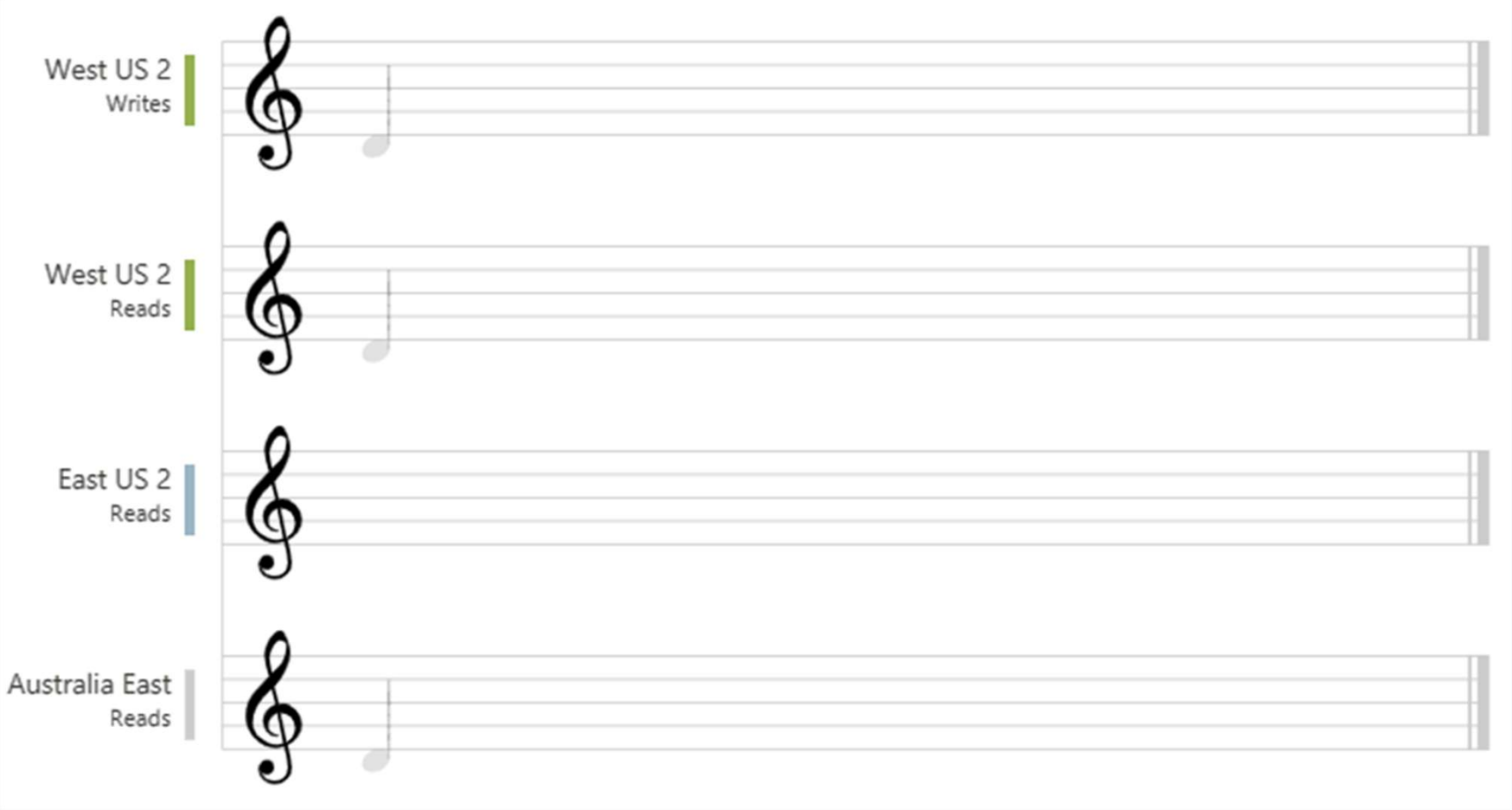


Bounded Staleness Consistency Model



Session Consistency Model

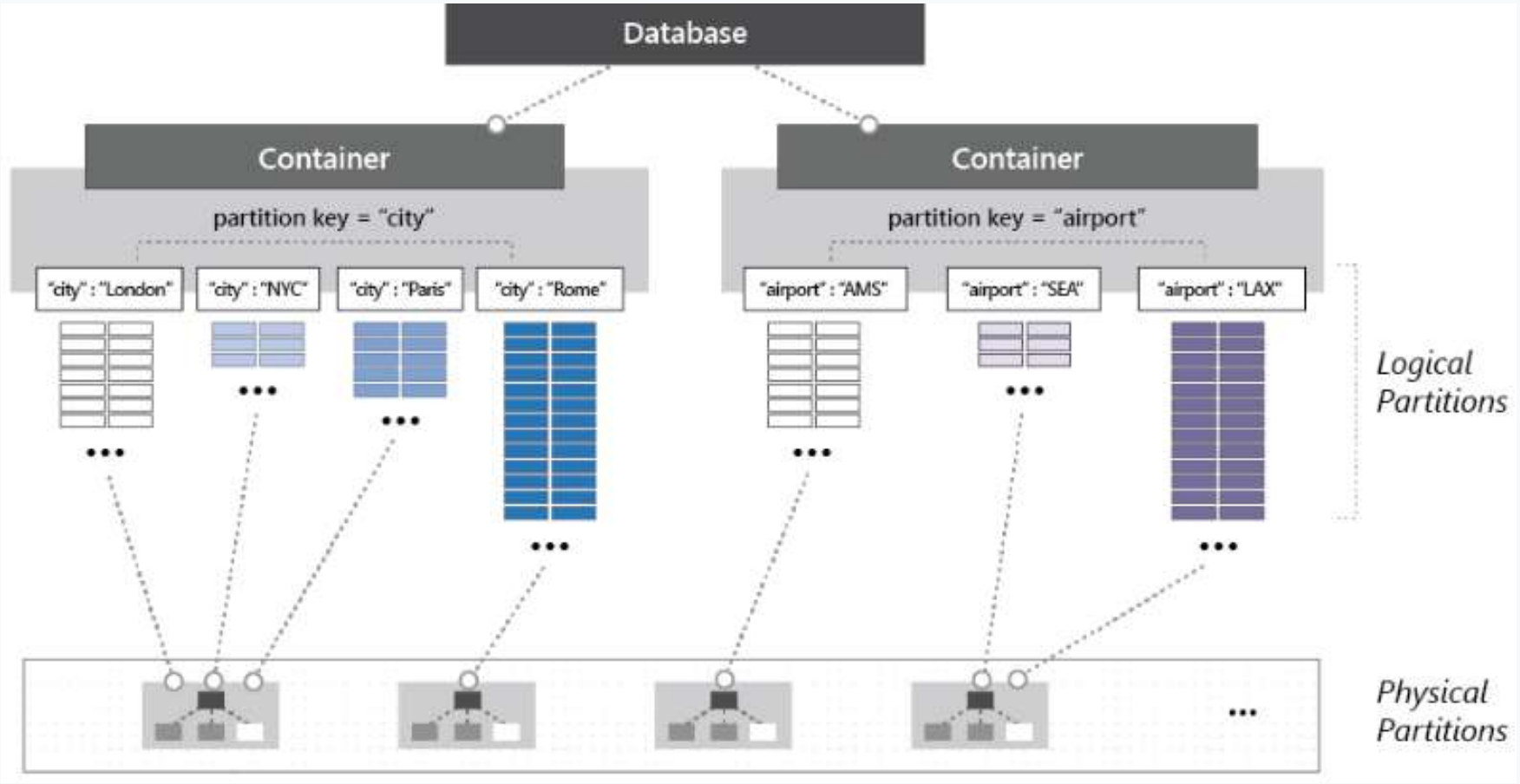
Consistent Prefix Consistency Model



Consistency for Queries

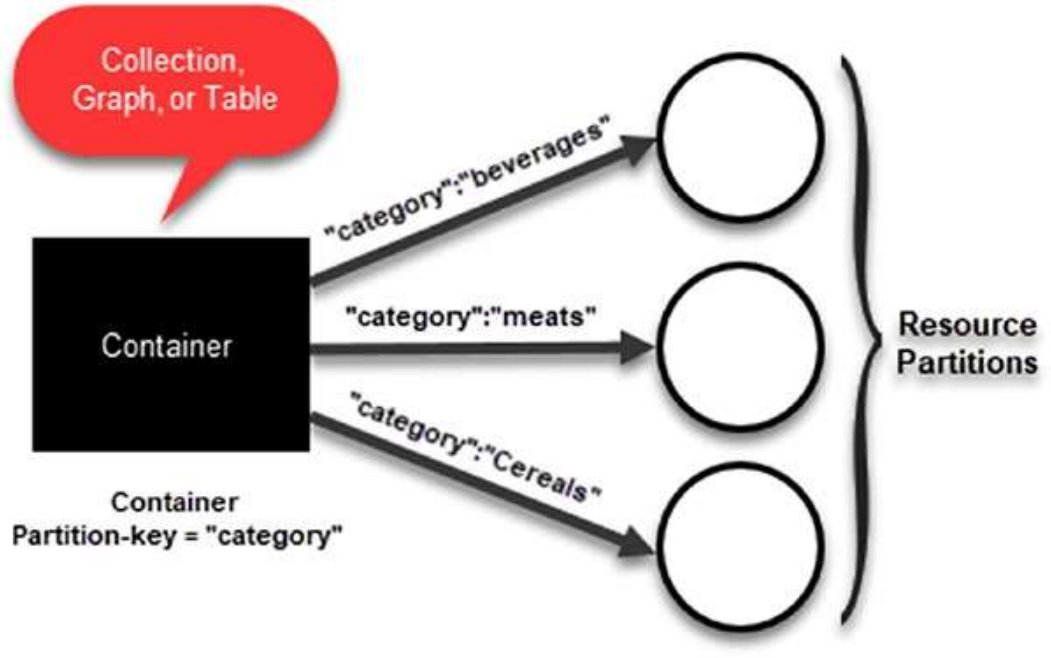
- By default, any user-defined resource would have the same consistency level for queries as was defined for reads
- This is possible because indexes are updated synchronously
- You can also change the index update strategy to be lazy
  - This will boost the performance of writes
- When changing to lazy, regardless of the read consistency level, queries will have a consistency level of eventual

Understanding Partitioning



What Are Containers?

- Containers are logical resources that group together one or more physical partitions.
- Don’t have any restrictions in terms of amount of storage or throughput

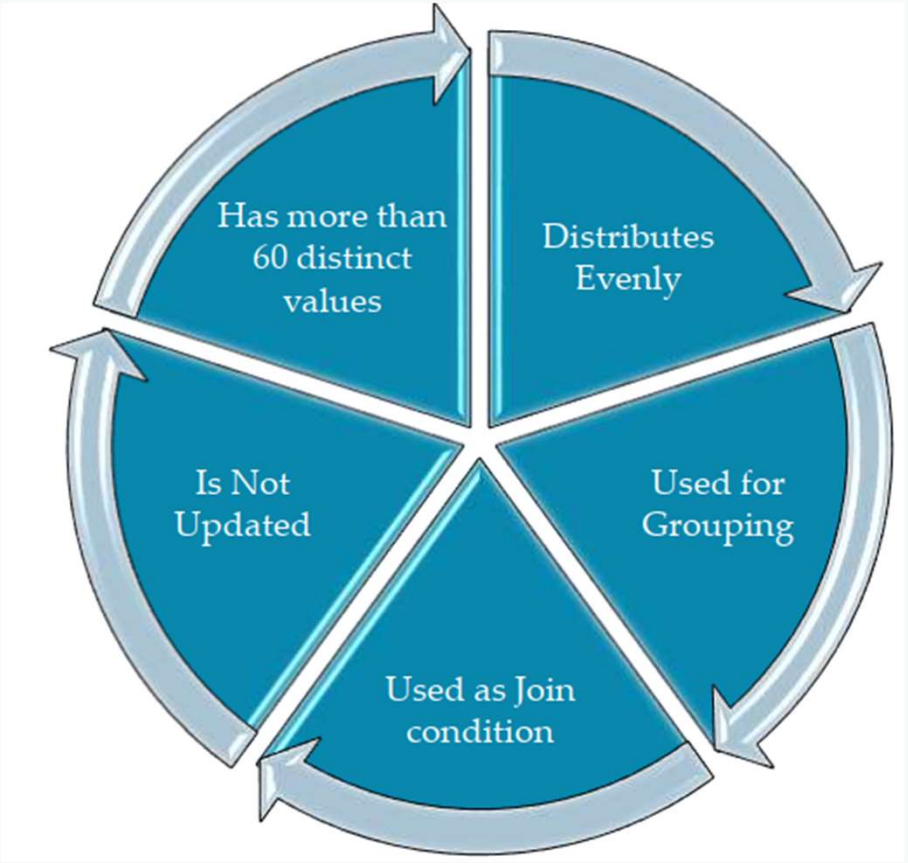


How Does Partitioning Work?

- Need to define a partition key and a row key for each item in your container.
- These key combinations uniquely identify the item
- The partition key determines the logical partition for your data
- Choosing the right partition key is crucial

Designing for Partitioning

- There are two key considerations when choosing the partition key



Understanding Throughput

- Azure Cosmos DB has predictable performance
- This is achieved by provisioning a specific amount of request units (RU) per second
- This amount is what is called throughput.
- This means that you will be billed by how much reserved throughput you have as opposed to how much you actually use

Specifying Request Unit Capacity

- When defining a new collection, you need to configure the specific number of request units per second you want reserved for the container.
- The reserved throughput can be between 400 and 10,000 request units per second.
- Based on this number, Azure Cosmos DB allocates physical partitions to host the collection and it will manage the data across partitions as it grows.

Estimating Throughput

- Refer:
  - https://azure.microsoft.com/en-gb/products/cosmos-db/

Implementing Security

- Encryption at Rest
- Firewall Support
- Securing Access to Data

Supported APIs

- Azure Cosmos DB supports several APIs for resource and data management
- Several software development kits (SDKs)
- At its core is the REST API, which provides a foundation for all actions
- There are also other APIs such as
  - DocumentDB
  - Mongo DB
  - Apache Cassandra
  - Table
  - Graph

Azure Cosmos DB REST API

- The REST API interacts with Azure Cosmos DB using the HTTP protocol.

Resources	Base URI
Database	{base}/dbs/{db}
User	{base}/dbs/{db}/users/{user}
Permission	{base}/dbs/{db}/users/{user}/permissions/{perm}
Collection	{base}/dbs/{db}/colls/{coll}
Stored Procedure	{base}/dbs/{db}/colls/{coll}/sprocs/{sproc}
Trigger	{base}/dbs/{db}/colls/{coll}/triggers/{trigger}
UDF	{base}/dbs/{db}/colls/{coll}/udfs/{udf}
Document	{base}/dbs/{db}/colls/{coll}/docs/{doc}
Attachment	{base}/dbs/{db}/colls/{coll}/docs/{doc}/attachments/{attch}
Offer	{base}/offers/{offer}

DocumentDB API

- The DocumentDB API is built on top of the REST API and is implemented in several languages and platforms including .NET, Java, NodeJS, JavaScript, and Python via their respective SDKs.

  - var dbUrl = "https://productcatalog.documents.azure.com/dbs";
  - var authKey = "the primary or secondary key for the account";
  - client = new DocumentClient(new Uri(dbUrl),authKey);
  - await client.CreateDatabaseAsync(new Database { Id = "Products" });

MongoDB API

- With the MongoDB API, you can leverage your knowledge of MongoDB
- In most cases, an existing MongoDB application would work without any code changes.

```
var host = "host string shown in the Azure portal";
var dbName = "ProductCatalog";
var username = "jose";
var password = "p@sswOrd";
MongoClientSettings settings = new MongoClientSettings();
settings.Server = new MongoServerAddress(host, 10255);
settings.UseSsl = true;
settings.SslSettings = new SslSettings();
settings.SslSettings.EnabledSslProtocols = SslProtocols.Tls12;

MongoIdentity identity =
                    new MongoInternalIdentity(dbName, userName);
MongoIdentityEvidence evidence = new PasswordEvidence(password);

settings.Credentials = new List<MongoCredential>()
    {
        new MongoCredential("SCRAM-SHA-1", identity, evidence)
    };

MongoClient client = new MongoClient(settings);
```

Graph API

- Graphs are very useful to understand a wide range of datasets in different fields such as science and business

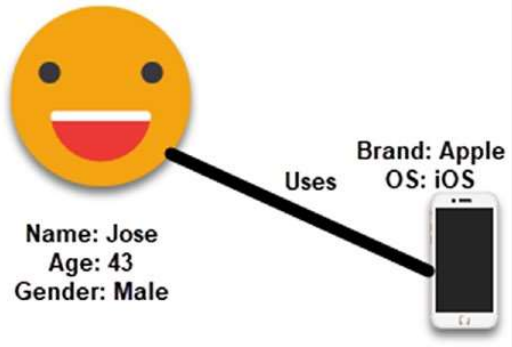


Table API

- An Azure Cosmos DB account implementing the Table API provides the same functionality as Azure Table storage
- With the benefits of scalability and throughput from Cosmos DB.

```
CloudStorageAccount storageAccount =
                    CloudStorageAccount.Parse(connectionString);
CloudTableClient tableClient =
                        storageAccount.CreateCloudTableClient();
CloudTable table = tableClient.GetTableReference("products");
table.CreateIfNotExists();
ProductEntity item = new ProductEntity()
                            {
                                 PartitionKey =
                                        Guid.NewGuid().ToString(),
                                 RowKey = Guid.NewGuid().ToString(),
                                 Name = $"Oranges",
                                 Origin = "Florida"
                            };
TableOperation insertOperation = TableOperation.Insert(item);
table.Execute(insertOperation);
```

Thank You