



CH-CH-CH-CHANGES:

**TRACING
CHANGES**

**IN AZURE
COSMOS DB**



David Bowie - Changes

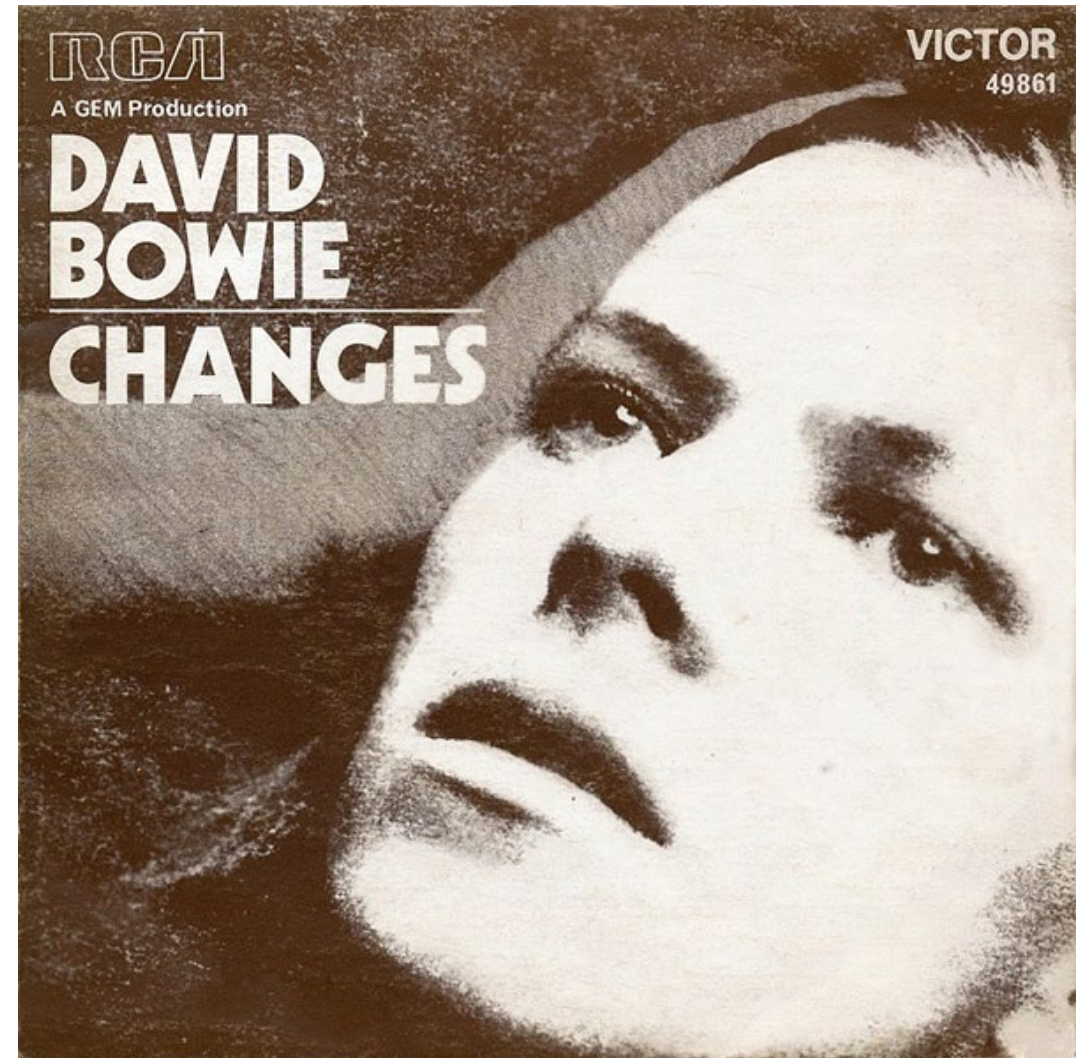
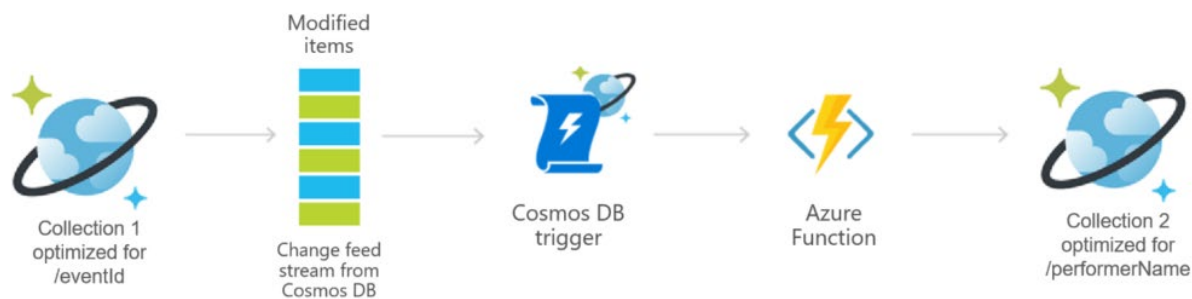
Ch-ch-ch-changes: Tracing Changes in Azure Cosmos DB

Time may change me

But I can't trace time

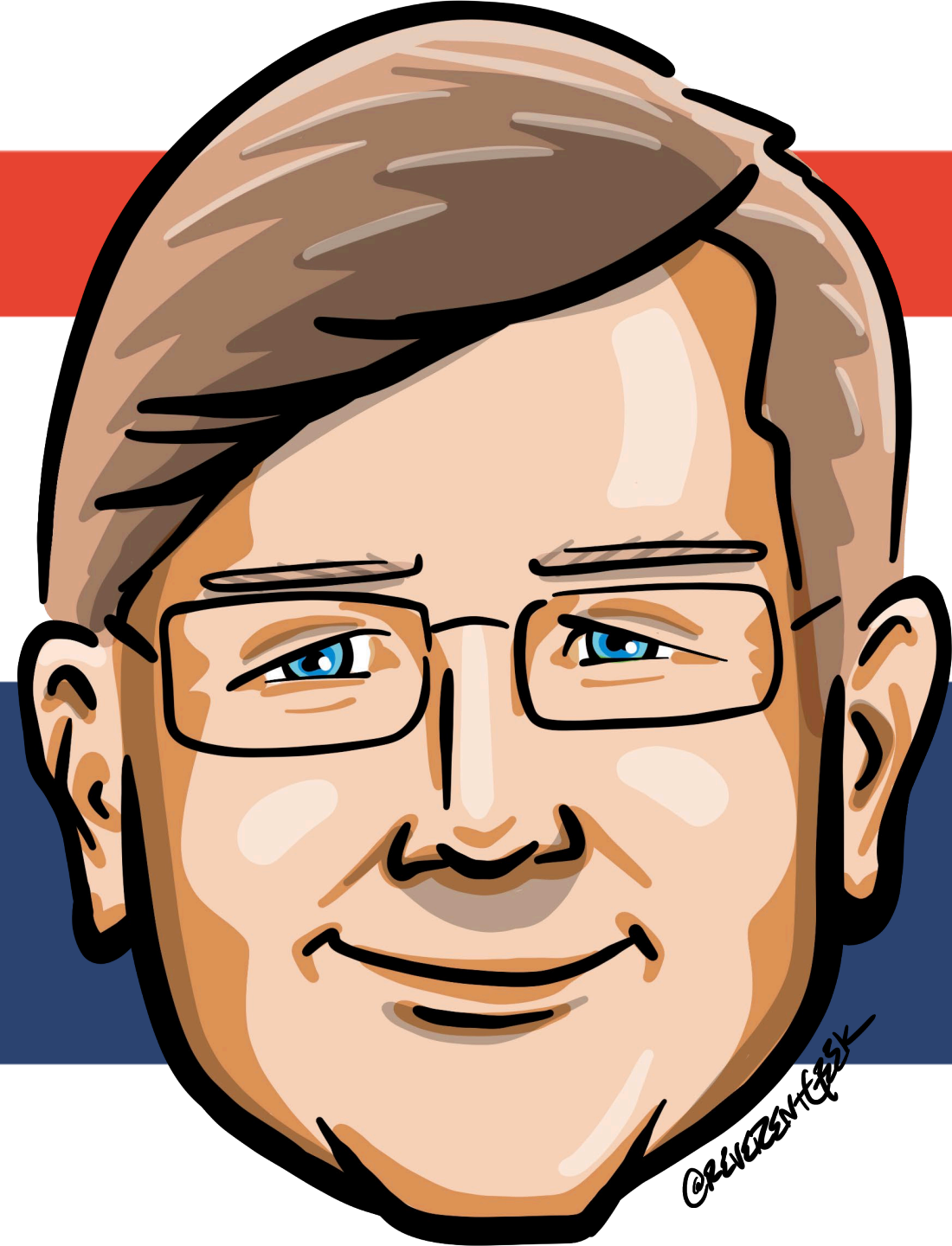
I said that time may change me

But I can't trace time



Who is Chad Green

Director of Architecture
Louisville, KY



What is Cosmos DB

Ch-ch-ch-changes: Tracing Changes in Azure Cosmos DB



A globally distributed,
massively scalable, multi-
model database service

Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Turnkey global distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Turnkey global distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Elastic scale out of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Elastic scale out of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Guaranteed low latency at the 99th percentile

Elastic scale out
of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Guaranteed low latency at the 99th percentile

Elastic scale out
of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Five well-defined consistency models

Guaranteed low latency
at the 99th percentile

Elastic scale out
of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Five well-defined consistency models

Guaranteed low latency
at the 99th percentile

Elastic scale out
of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Comprehensive SLAs

Guaranteed low latency
at the 99th percentile

Five well-defined
consistency models

Elastic scale out
of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Comprehensive SLAs

Guaranteed low latency
at the 99th percentile

Five well-defined
consistency models

Elastic scale out
of storage & throughput

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Battle Tested



Guaranteed low latency
at the 99th percentile

Elastic scale out
of storage & throughput

Five well-defined
consistency models

Comprehensive
SLAS

Turnkey global
distribution



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Battle Tested



SAFEWAY



Rolls-Royce

ExxonMobil



Guaranteed low latency
at the 99th percentile

Elastic scale out
of storage & throughput

Five well-defined
consistency models

Turnkey global
distribution

Comprehensive
SLAS



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service

Ubiquitous Regional Presence



Turnkey global
distributed

Comprehensive
SLAS

Azure Cosmos DB

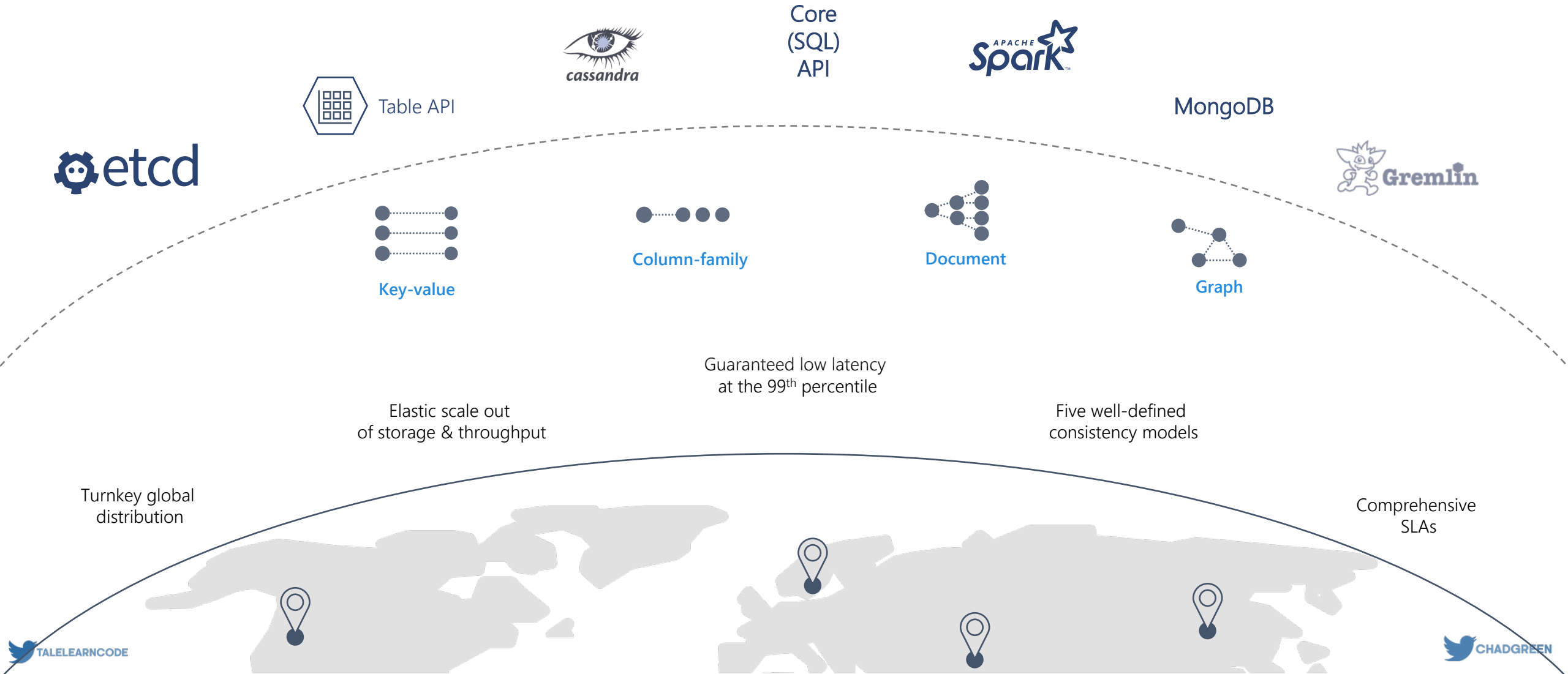
A globally distributed, massively scalable, multi-model database service

Secure by default and enterprise ready



Azure Cosmos DB

A globally distributed, massively scalable, multi-model database service



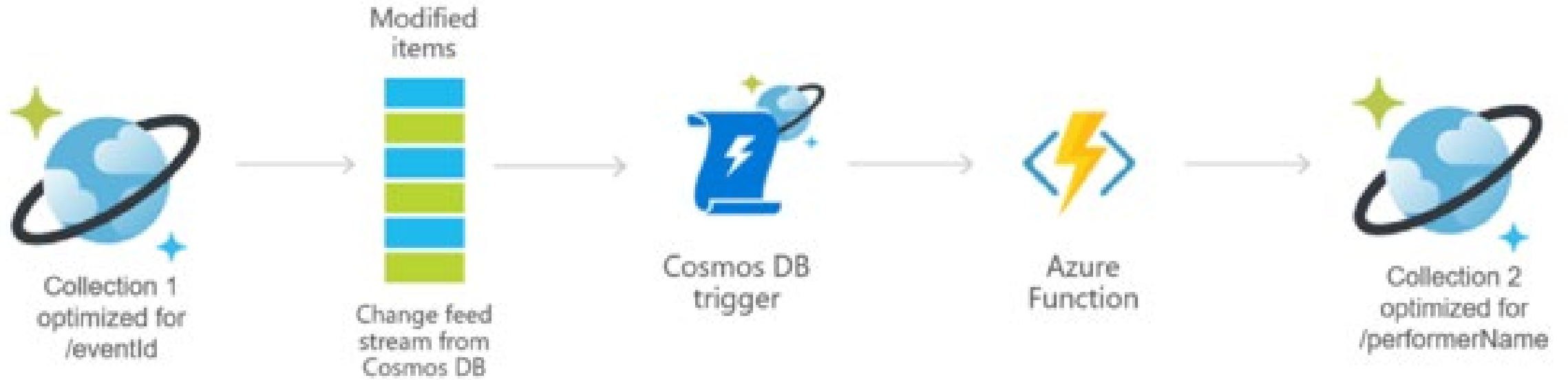
Change Feed

Ch-ch-ch-changes: Tracing
Changes in Azure Cosmos DB



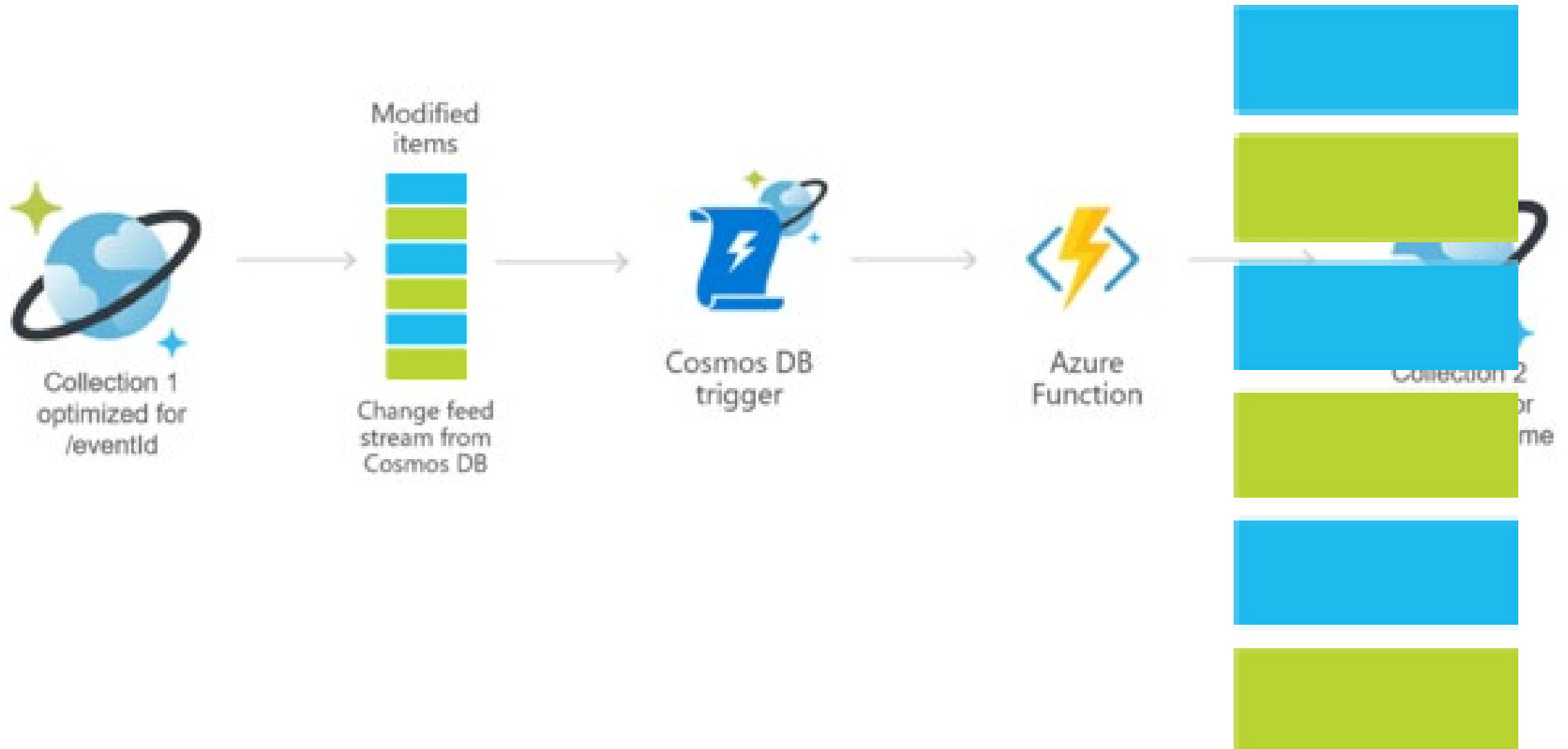
Overview

Change Feed

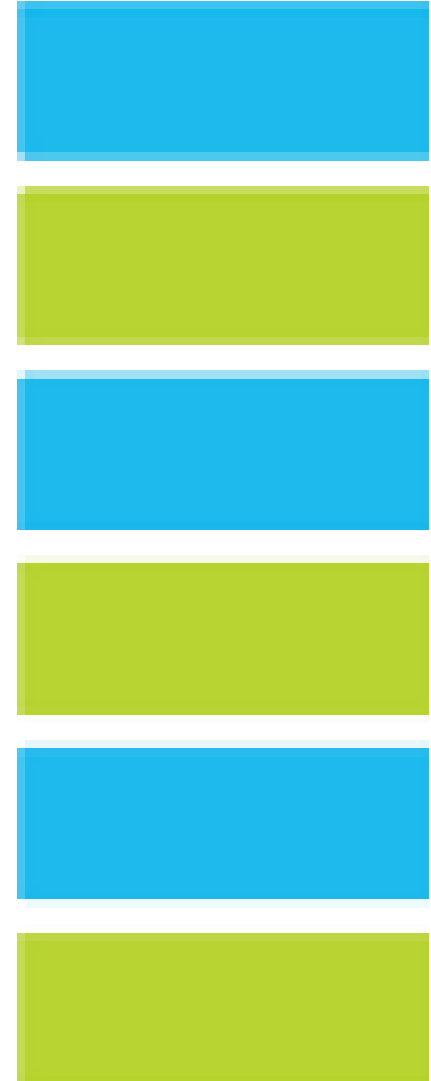


Overview

Change Feed



Unsung Hero of Azure Cosmos DB



**Enabled by
default**

Overview

Change Feed

Enabled by default

Enabled by
default

Overview

Change Feed

Enabled by default

**Includes insert
and update
operations**

Overview

Change Feed

Enabled by default

Includes insert and update
operations

**Includes insert
and update
operations**

Overview

Change Feed

Enabled by default

Includes insert and update
operations

**Each change
appears exactly
once**

Overview

Change Feed

Enabled by default

Includes insert and update
operations

Each change appears
exactly once

**Each change
appears exactly
once**

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

**Clients manage
checkpointing
logic**

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

**Clients manage
checkpointing
logic**

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

Sorted by order of modification

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

Sorted by order of modification

Sorted by order of modification

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

**No guaranteed
order logical
partitions**

Sorted by order of modification

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

**No guaranteed
order logical
partitions**

Sorted by order of modification

No guaranteed order logical partitions

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

**Synchronized
from any point-
in-time**

Sorted by order of modification

No guaranteed order
logical partitions

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

**Synchronized
from any point-
in-time**

Sorted by order of modification

No guaranteed order logical partitions

Synchronized from any point-in-time

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

**Changes available
in parallel for
logical partitions**

Sorted by order of modification

No guaranteed order logical partitions

Synchronized from any point-in-time

Overview

Change Feed

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

**Changes available
in parallel for
logical partitions**

Sorted by order of modification

No guaranteed order logical partitions

Synchronized from any point-in-time

Changes available in parallel for logical partitions

Enabled by default

Includes insert and update operations

Each change appears exactly once

Clients manage checkpointing logic

Applications can request multiple change feeds

Sorted by order of modification

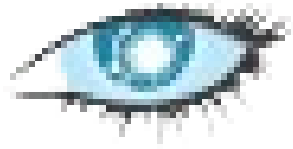
No guaranteed order logical partitions

Synchronized from any point-in-time

Changes available in parallel for logical partitions

Supported APIs and Client SDKs

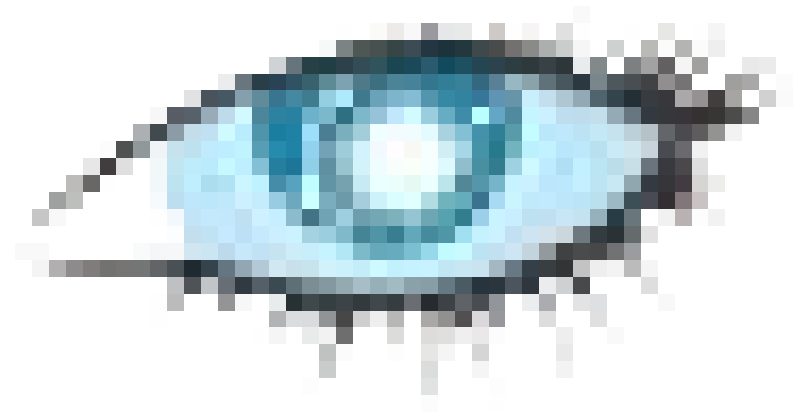
Change Feed



Supported APIs and Client SDKs

Change Feed

{LEAF}



Current Limitations

Change Feed

**Intermediate
Updates**

Current Limitations

Change Feed

**Intermediate
Updates**

Current Limitations

Change Feed

Intermediate
Updates

Guaranteed
Order

Current Limitations

Change Feed

Intermediate
Updates

Guaranteed
Order

Current Limitations

Change Feed

Intermediate
Updates

Deletes

Guaranteed
Order

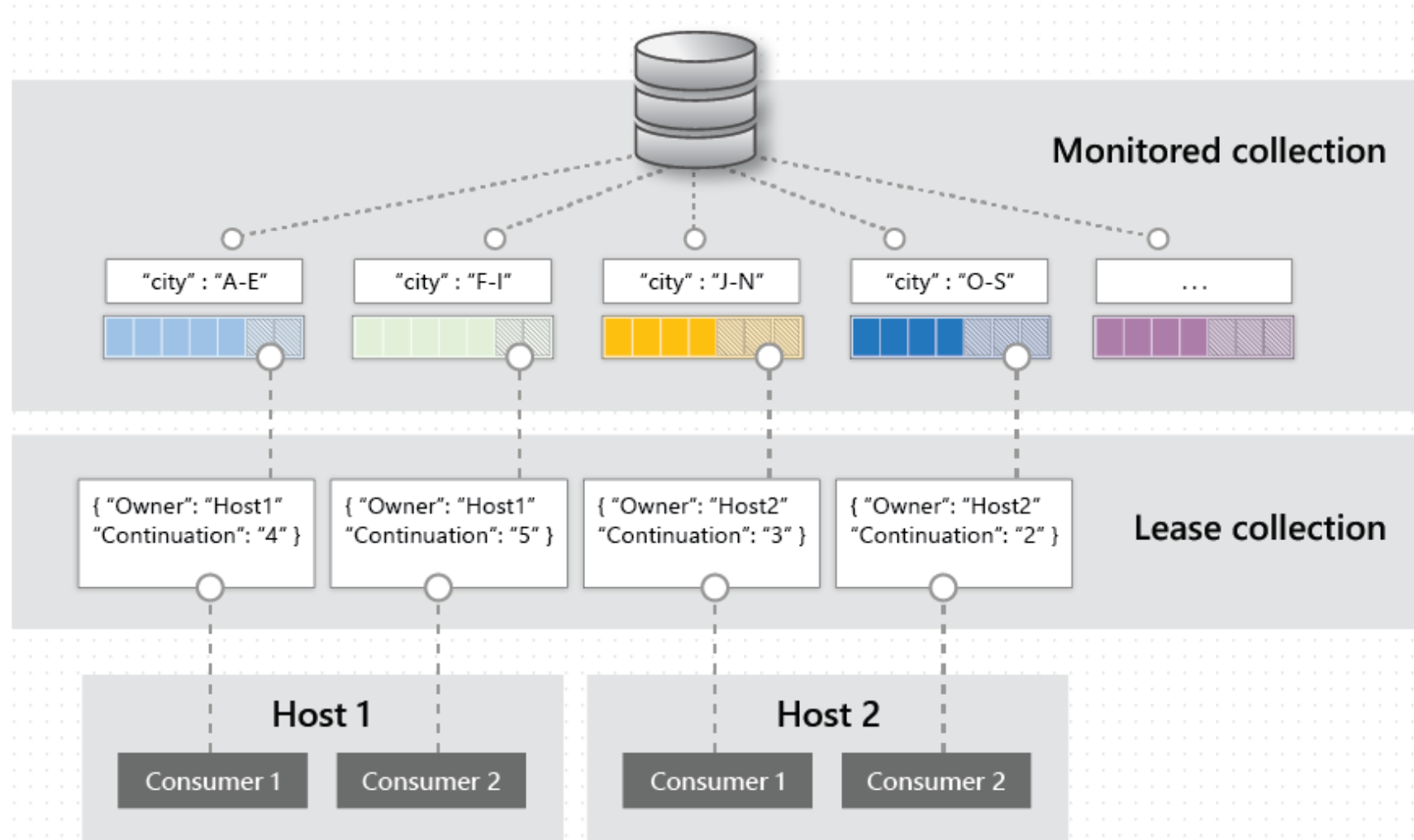
Change Feed Processor

Ch-ch-ch-changes: Tracing
Changes in Azure Cosmos DB



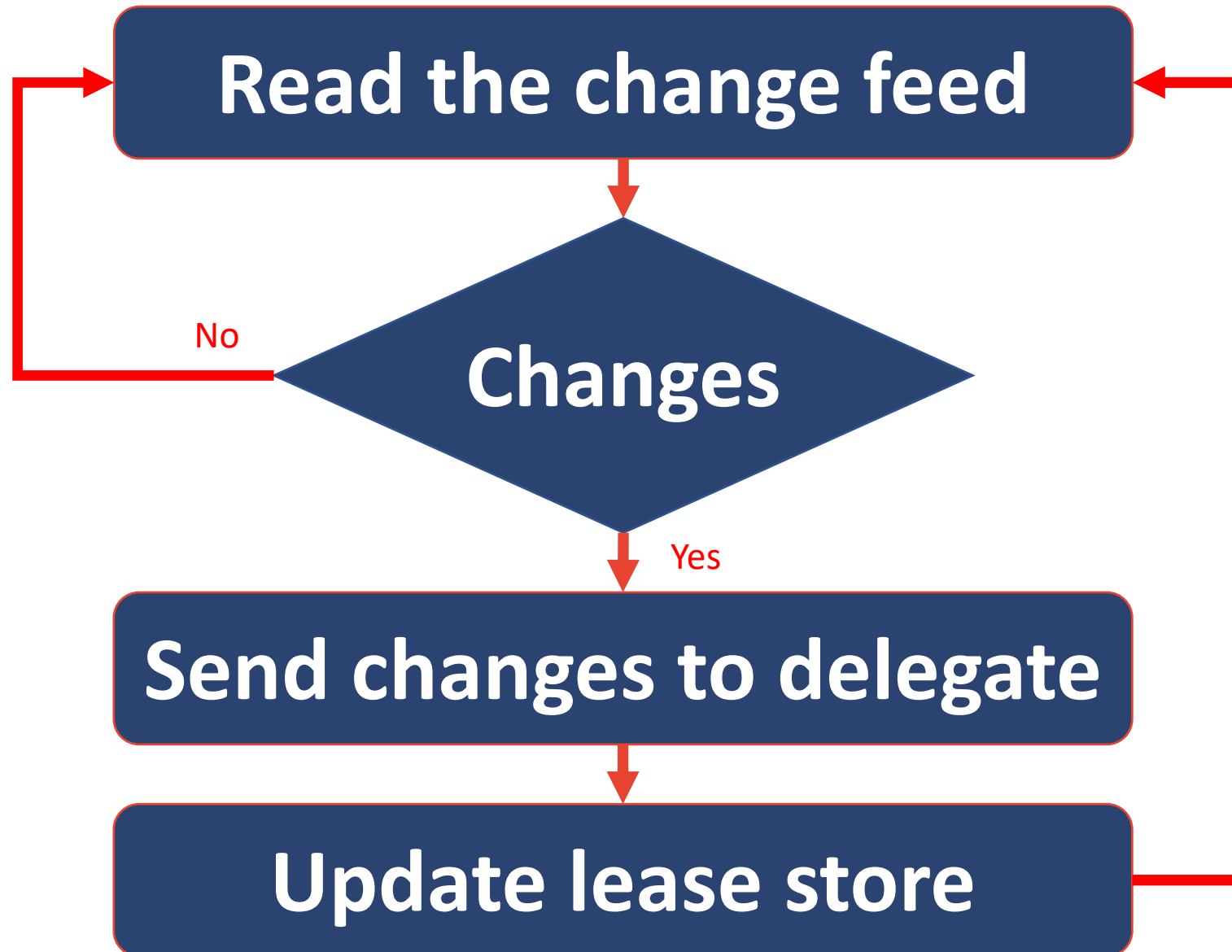
Change Feed Processor Components

Reading the Change Feed



Processing Life Cycle

Reading the Change Feed



Hosting the Change Feed Processor

Reading the Change Feed

Azure WebJob

**Azure Virtual
Machine**

**Azure Kubernetes
Service**

**ASP.NET Hosted
Service**

Serverless Event-Based Architectures

Ch-ch-ch-changes: Tracing
Changes in Azure Cosmos DB



Azure Functions

Serverless Event-Based Architectures



Azure Functions

Serverless Event-Based Architectures

Serverless

Language Choice

Pay-Per-Use

BYOD

Security

Integration

Flexible Dev

Stateful

Open-Source

What can you do with Azure Functions?

Serverless Event-Based Architectures

HTTP

Timer

Blob storage

Queue storage

Event Grid

Event Hub

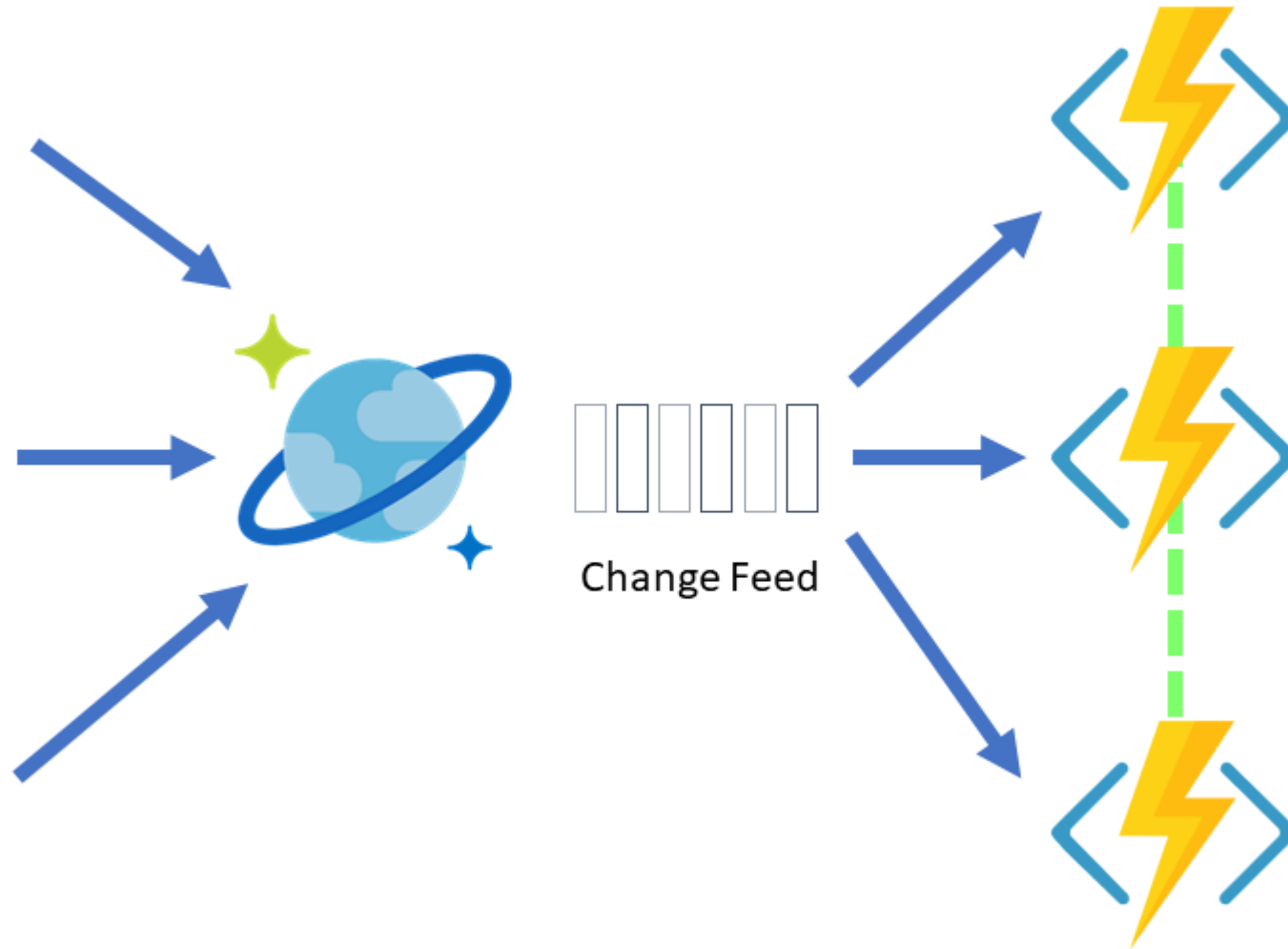
Service Bus Queue

Service Bus Topic

Cosmos DB

Azure Cosmos DB and Azure Functions

Serverless Event-Based Architectures



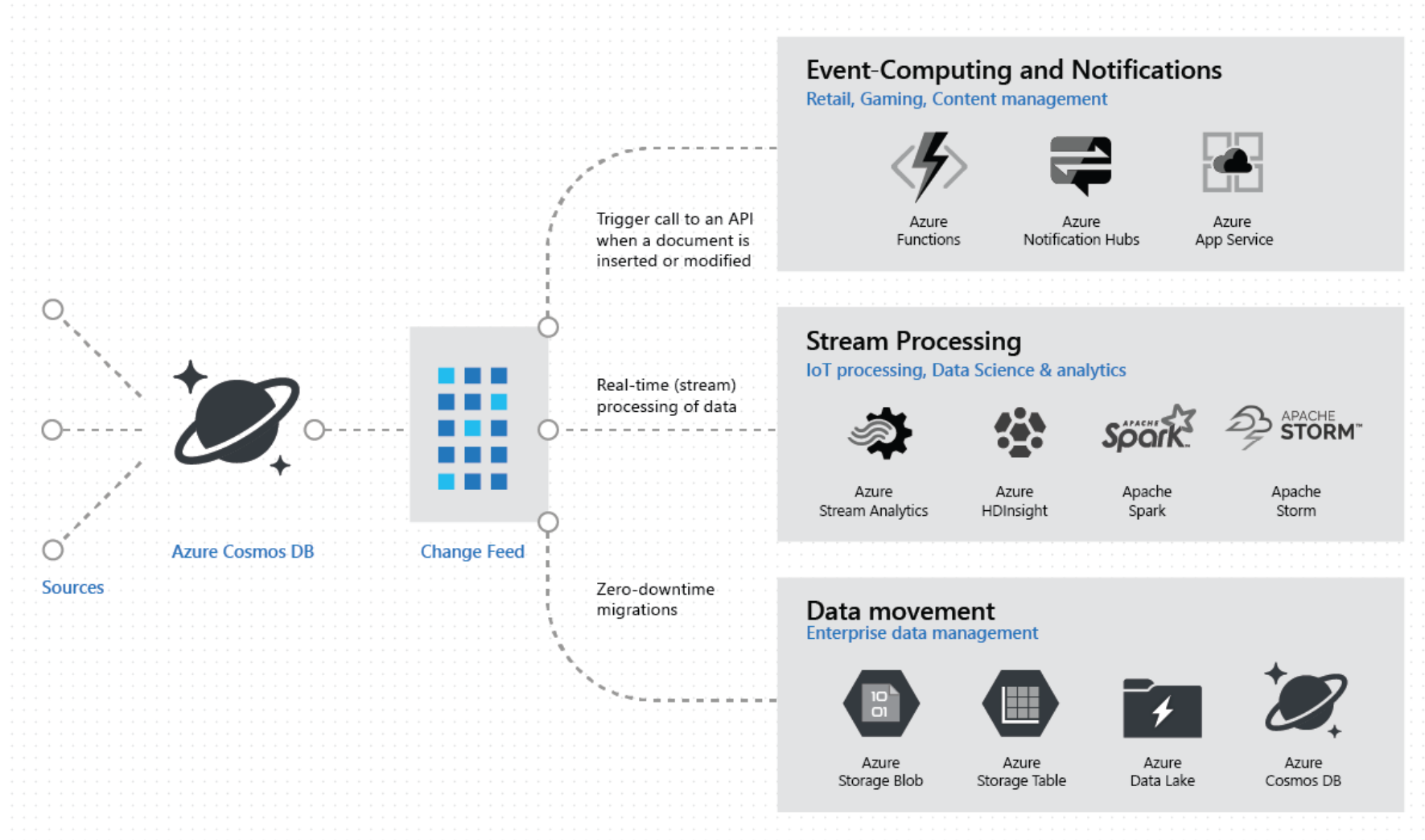
Change Feed Design Patterns

Ch-ch-ch-changes: Tracing
Changes in Azure Cosmos DB



Common Uses of the Change Feed

Change Feed Design Patterns



Common Uses of the Change Feed

Change Feed Design Patterns

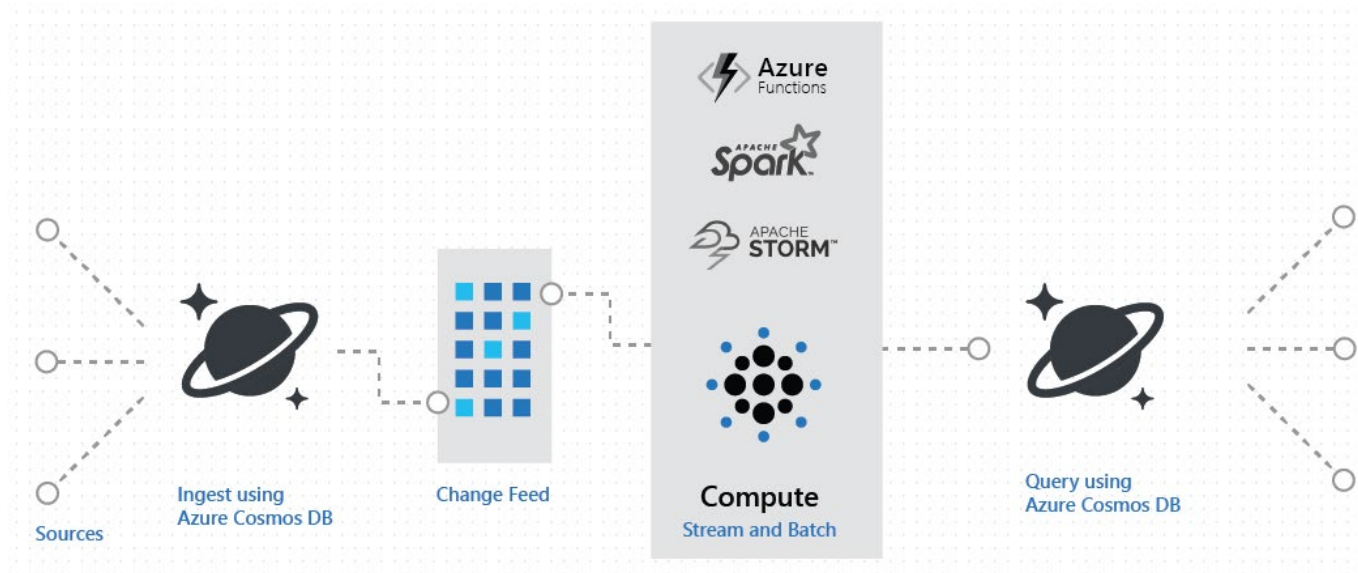
**Event Computing
and Notifications**

Common Uses of the Change Feed

Change Feed Design Patterns

**Event Computing
and Notifications**

**Real-Time Stream
Processing**



Common Uses of the Change Feed

Change Feed Design Patterns

**Event Computing
and Notifications**

**Real-Time Stream
Processing**

Data Movement

Common Uses of the Change Feed

Change Feed Design Patterns

**Event Computing
and Notifications**

**Real-Time Stream
Processing**

Data Movement

Event Sourcing

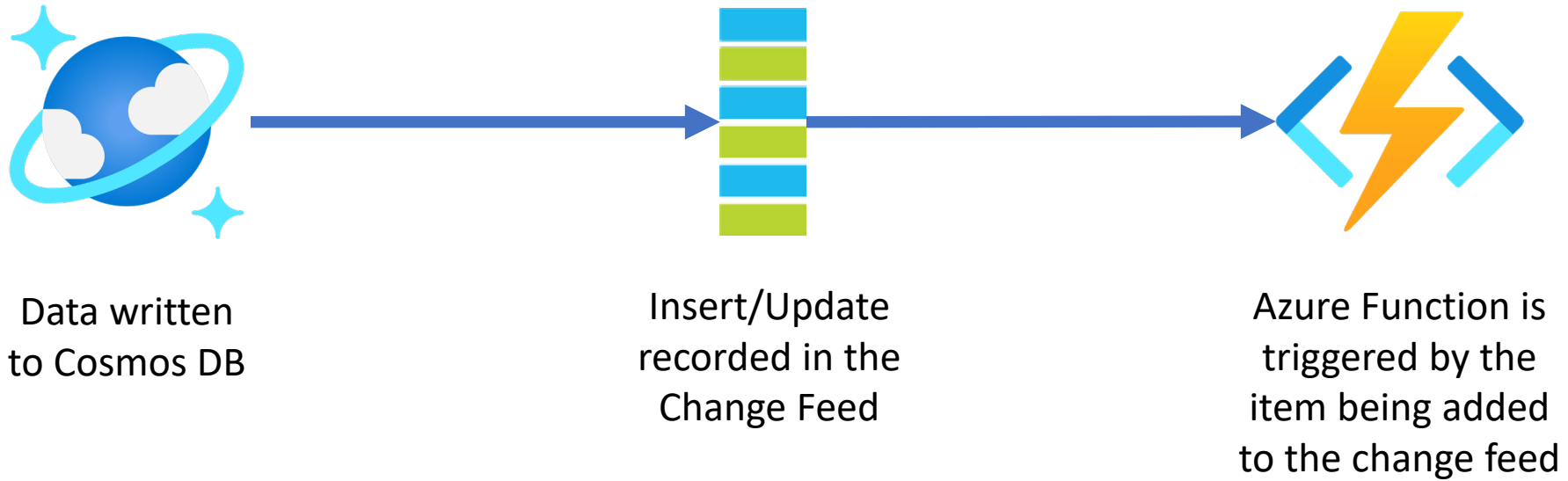
Demos

Ch-ch-ch-changes: Tracing
Changes in Azure Cosmos DB



Basic Change Feed Demo

Change Feed Demos

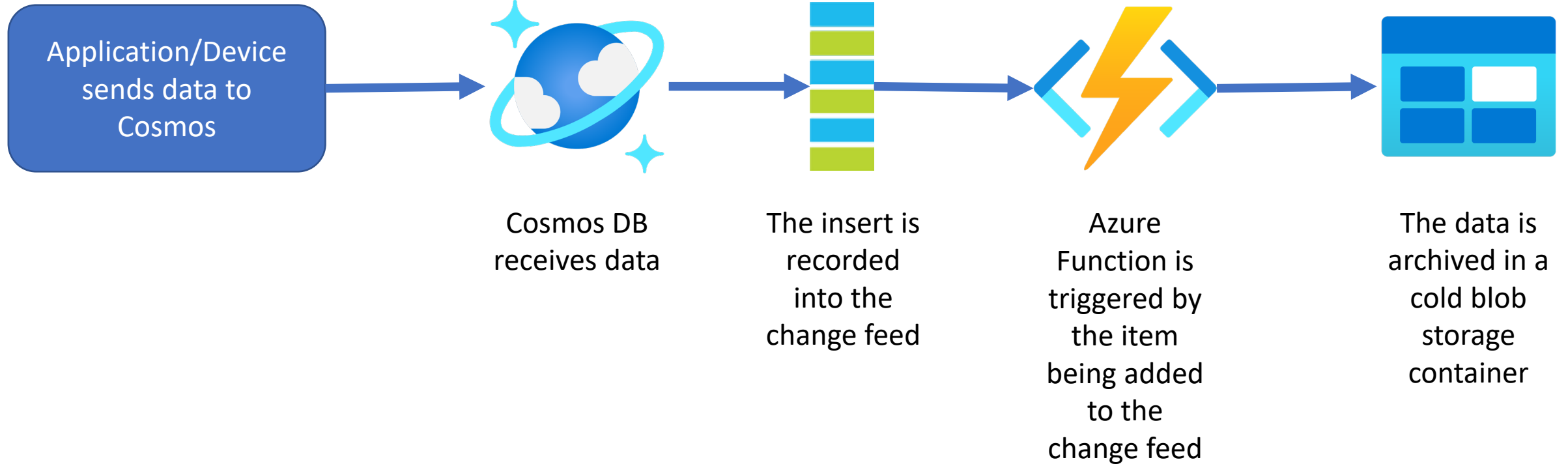


Scenario

- Practice test application
- Data is useful for active queries within 30 days (2,592,000 seconds)
- Need to keep archive for historical, compliance reasons
- Demo will process 428k records over 24-hour period
- Real data that has been autonomized

Data Archival

Change Feed Demos

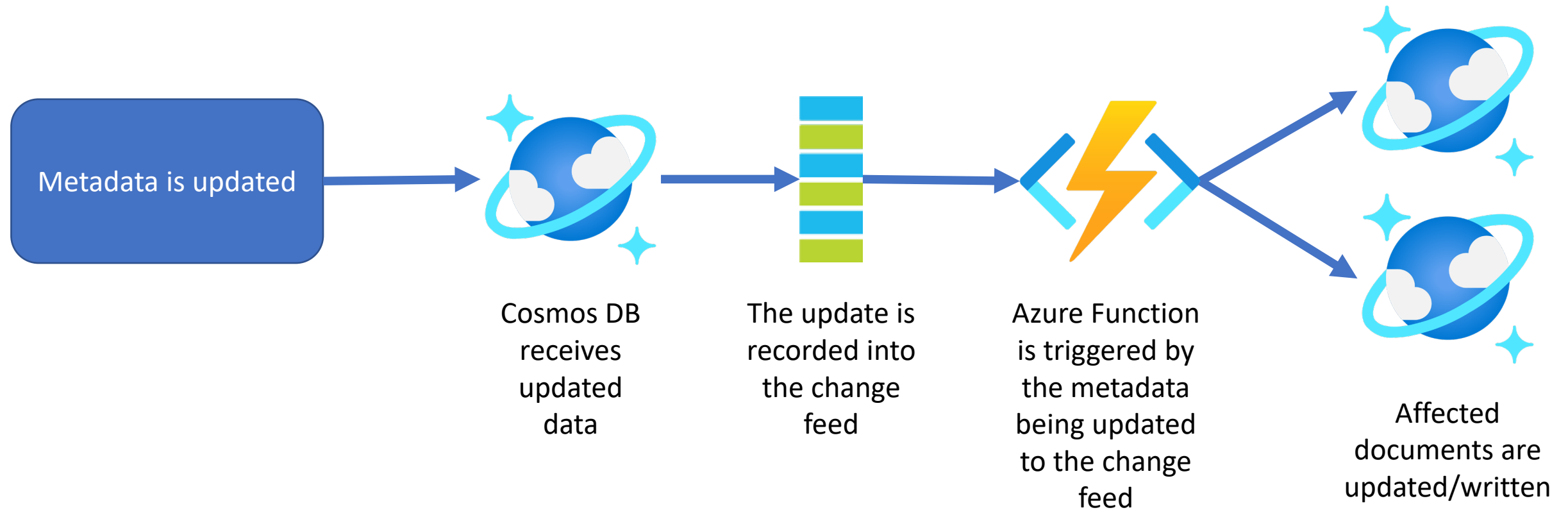


Scenario

- Shindig Manager
- Manages presentations for different shindigs (events)
- Metadata maintained in its own container
- Need way to update denormalized data in shindig (event) partitions

Denormalization

Change Feed Demos

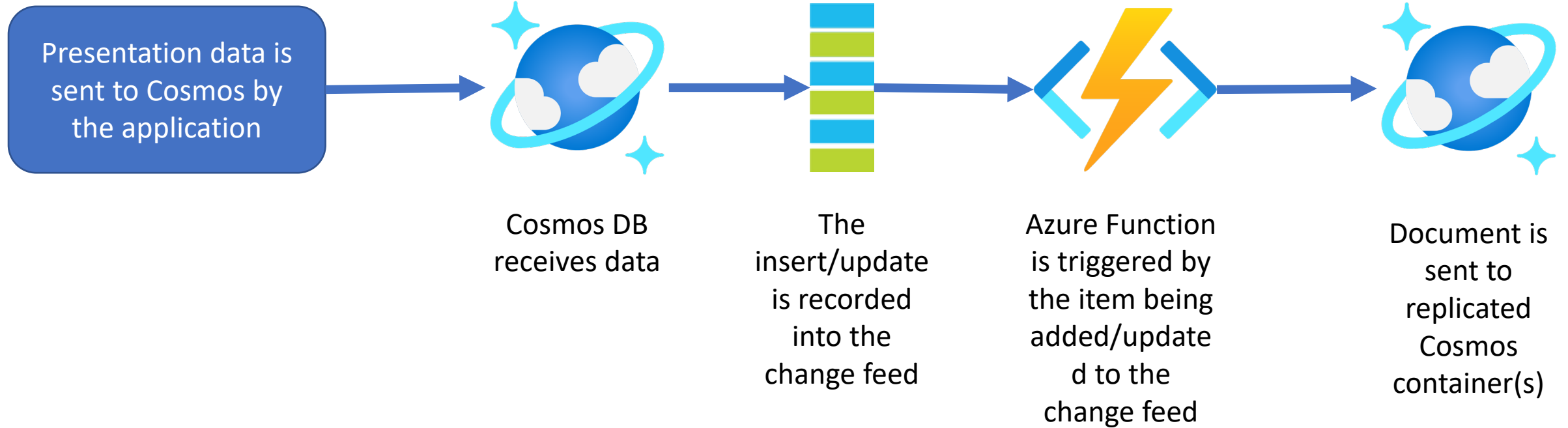


Scenario

- Shindig Manager
- Manages presentations for different shindigs (events)
- Presentations partitioned by shindig
- Want to improve query performance when searching across tags (original partitioning would require cross-partition querying)

Replicating Containers

Change Feed Demos

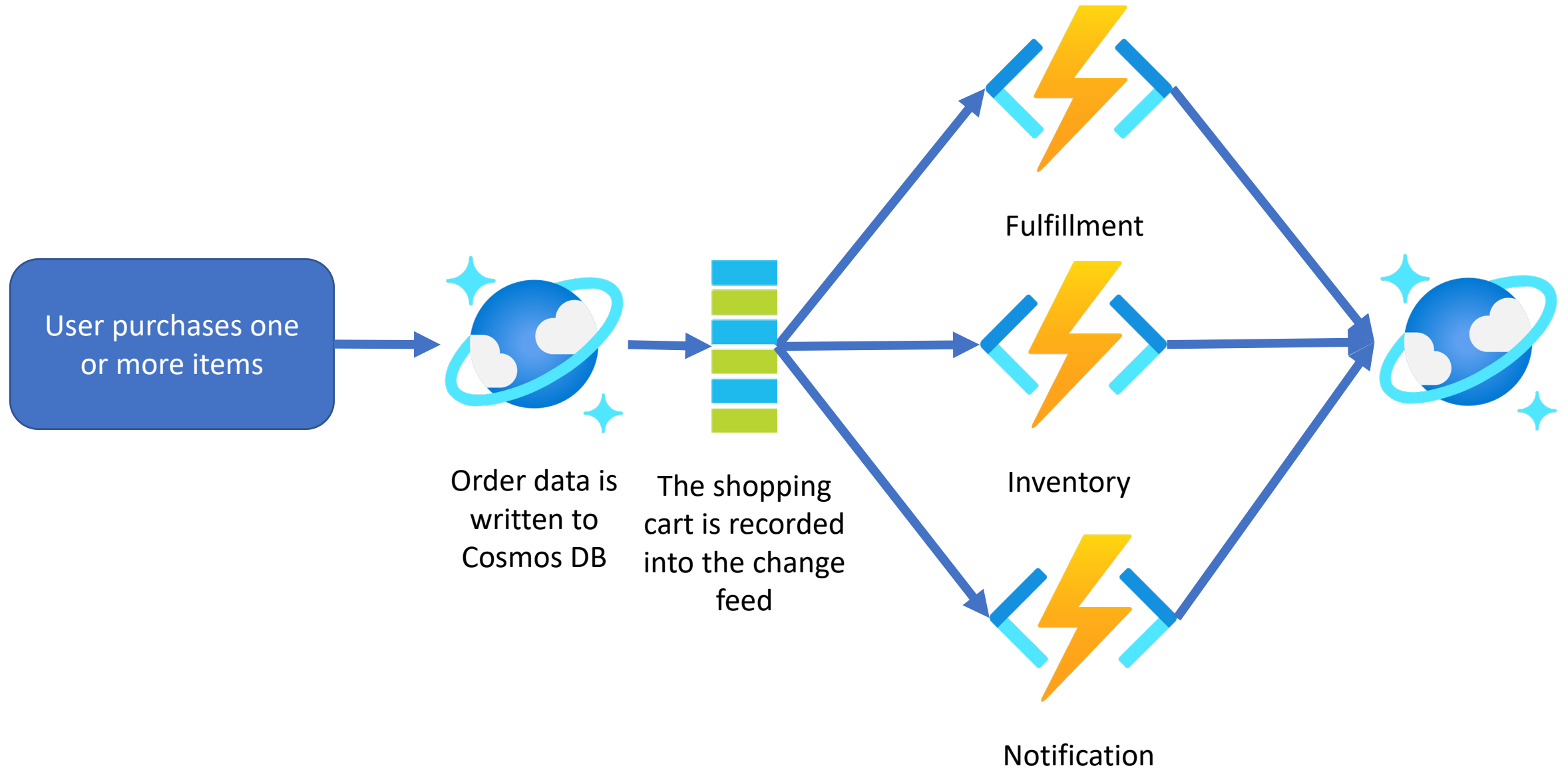


Scenario

- Shopping cart implementation – Lego store
- Implementing an event-driven architecture to allow for asynchronous processing of an order
- Note: functions are only simulating doing actions

Triggering Event-Driven Architecture

Change Feed Demos



Wrap-Up

Ch-ch-ch-changes: Tracing
Changes in Azure Cosmos



Wrap-Up

Ch-ch-ch-changes: Tracing Changes in Azure Cosmos DB

- Azure Cosmos DB

Wrap-Up

Ch-ch-ch-changes: Tracing Changes in Azure Cosmos DB

- Azure Cosmos DB
- Change feed is the unsung hero of Cosmos DB

Wrap-Up

Ch-ch-ch-changes: Tracing Changes in Azure Cosmos DB

- Azure Cosmos DB
- Change feed is the unsung hero of Cosmos DB
- Supported APIs and client SDKs

Wrap-Up

Ch-ch-ch-changes: Tracing Changes in Azure Cosmos DB

- Azure Cosmos DB
- Change feed is the unsung hero of Cosmos DB
- Supported APIs and client SDKs
- Current limitations
 - Intermediate Updates
 - Guaranteed Order
 - Deletes

- Azure Cosmos DB
- Change feed is the unsung hero of Cosmos DB
- Supported APIs and client SDKs
- Current limitations
 - Intermediate Updates
 - Guaranteed Order
 - Deletes
- Three processes for reading the change feed

- Azure Cosmos DB
- Change feed is the unsung hero of Cosmos DB
- Supported APIs and client SDKs
- Current limitations
 - Intermediate Updates
 - Guaranteed Order
 - Deletes
- Three processes for reading the change feed
- Common patterns

- Azure Cosmos DB
- Change feed is the unsung hero of Cosmos DB
- Supported APIs and client SDKs
- Current limitations
 - Intermediate Updates
 - Guaranteed Order
 - Deletes
- Three processes for reading the change feed
- Common patterns
- Demos

Thank You!

✉ chadgreen@chadgreen.com

💬 TaleLearnCode

🌐 ChadGreen.com

🐦 ChadGreen & TaleLearnCode

🌐 ChadwickEGreen

