Microsoft

Explore the Azure Cosmos DB with .NET Core 2.0

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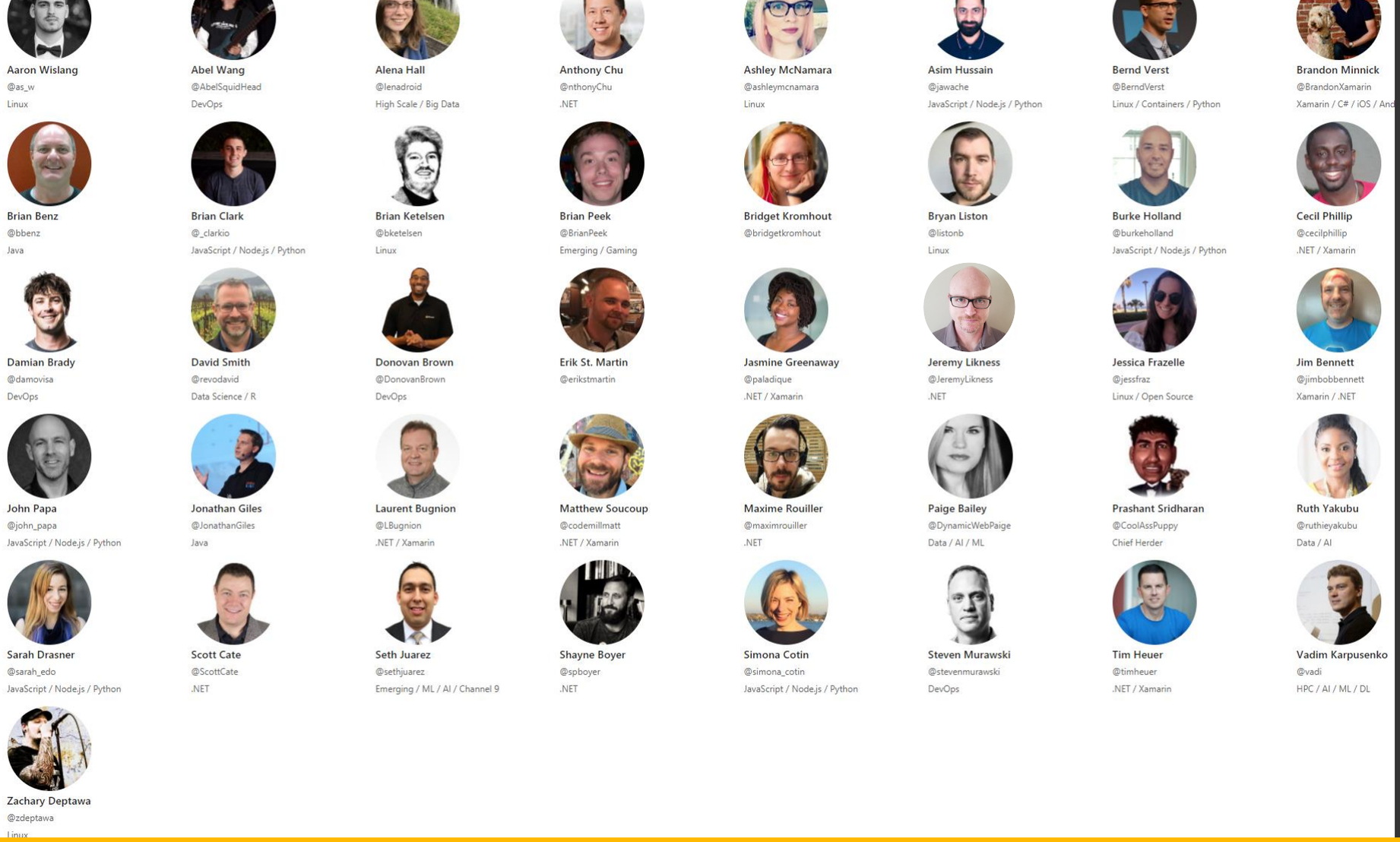


https://aka.ms/advocates

@azureAdvocates

https://aka.ms/cosmos-docs

Today's journey …

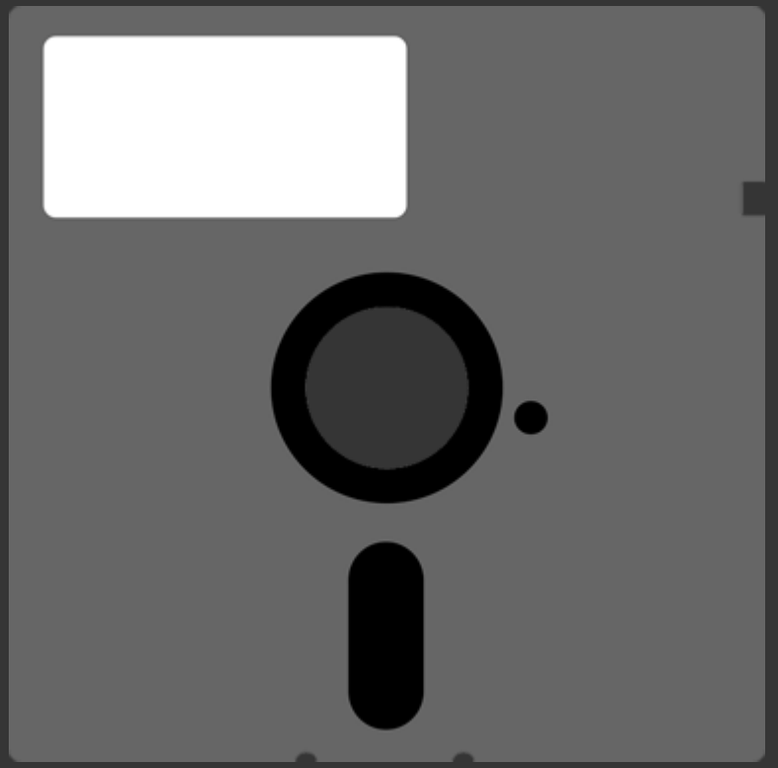
- The SQL legacy
- A different way: NoSQL
- Introducing Azure Cosmos DB
- Demos
- Conclusion

"We are a way for the cosmos to know itself."

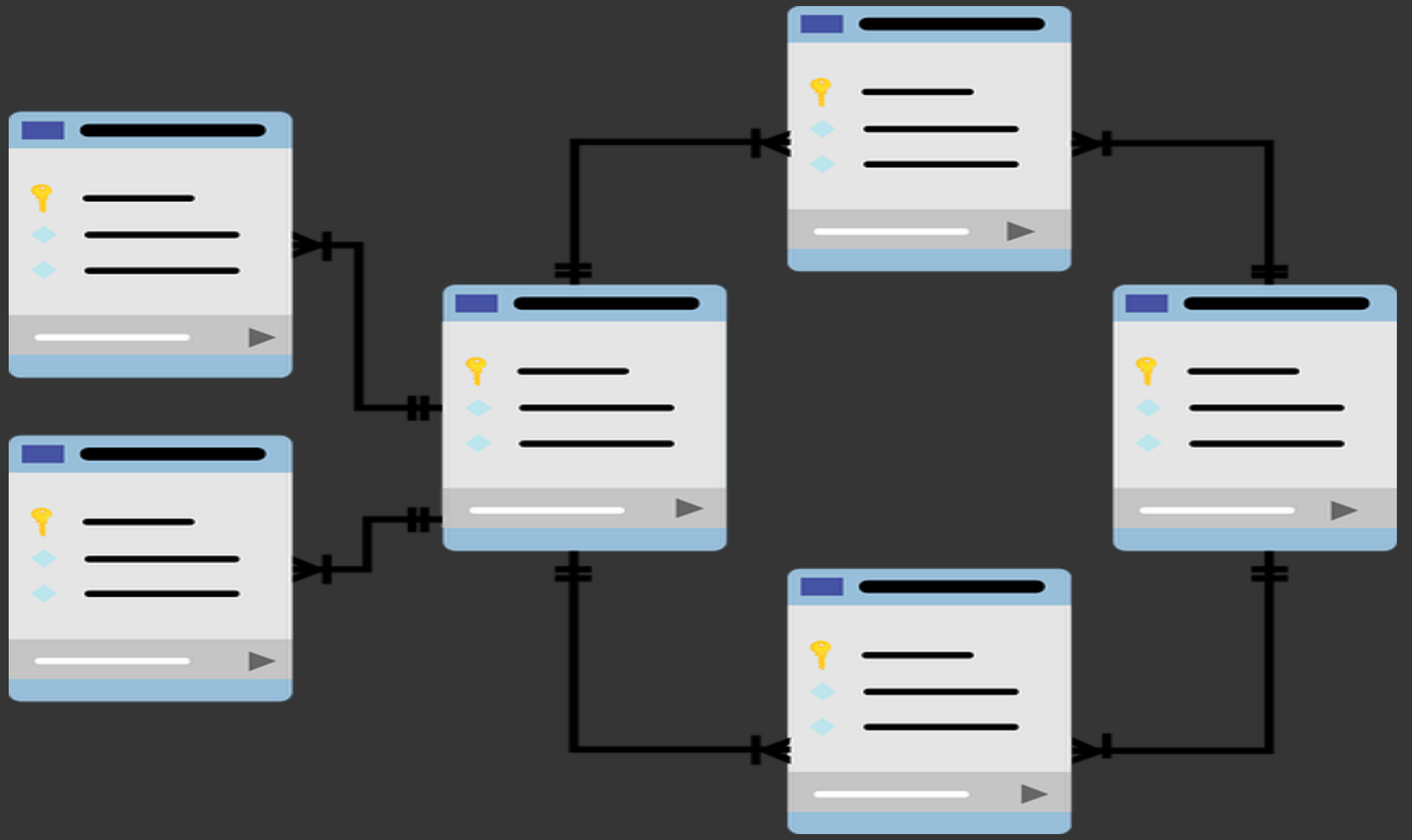
-Carl Sagan

"But this is how we've always done it."

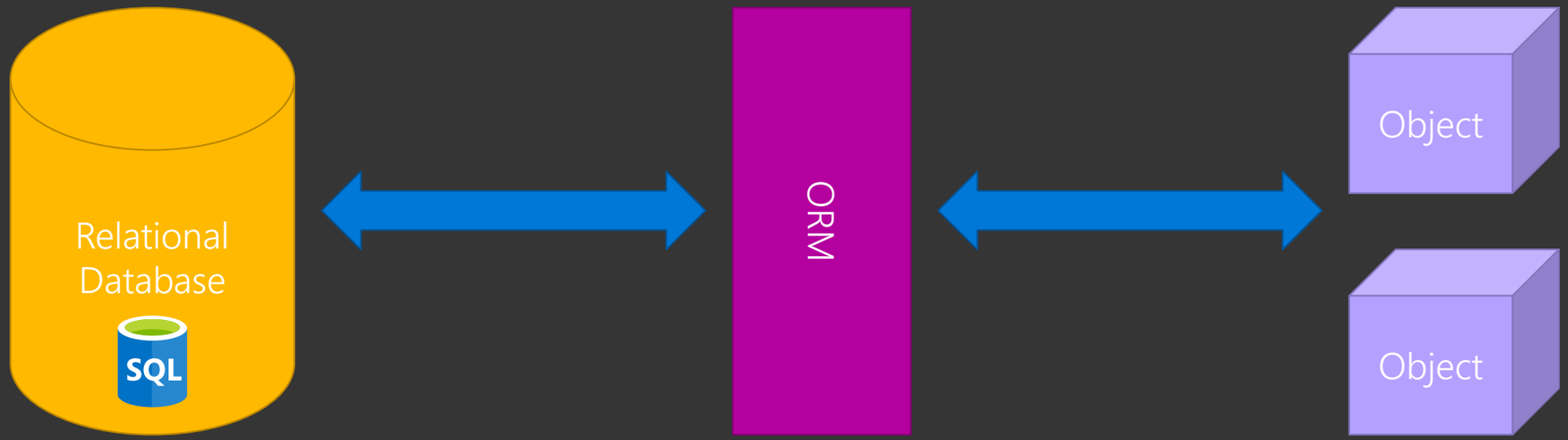
-Developer



```
    **** COMMODORE 64 BASIC V2 ****

 64K RAM SYSTEM  38911 BASIC BYTES FREE

READY.
10 OPEN 15,8,15
20 OPEN 1,8,2,"COSMOSDB,L,"+CHR$(50)
30 PRINT #15,"P"+CHR$(98)+CHR$(10)+CHR$(
0)+CHR$(1)
40 PRINT #1,"HOW WE ROLLED IN THE 80S"
50 CLOSE 1
```


SQL

Disconnect: Relational vs. Domain



Introducing Not Only SQL: NoSQL

Key/Value

Column

Document

Graph

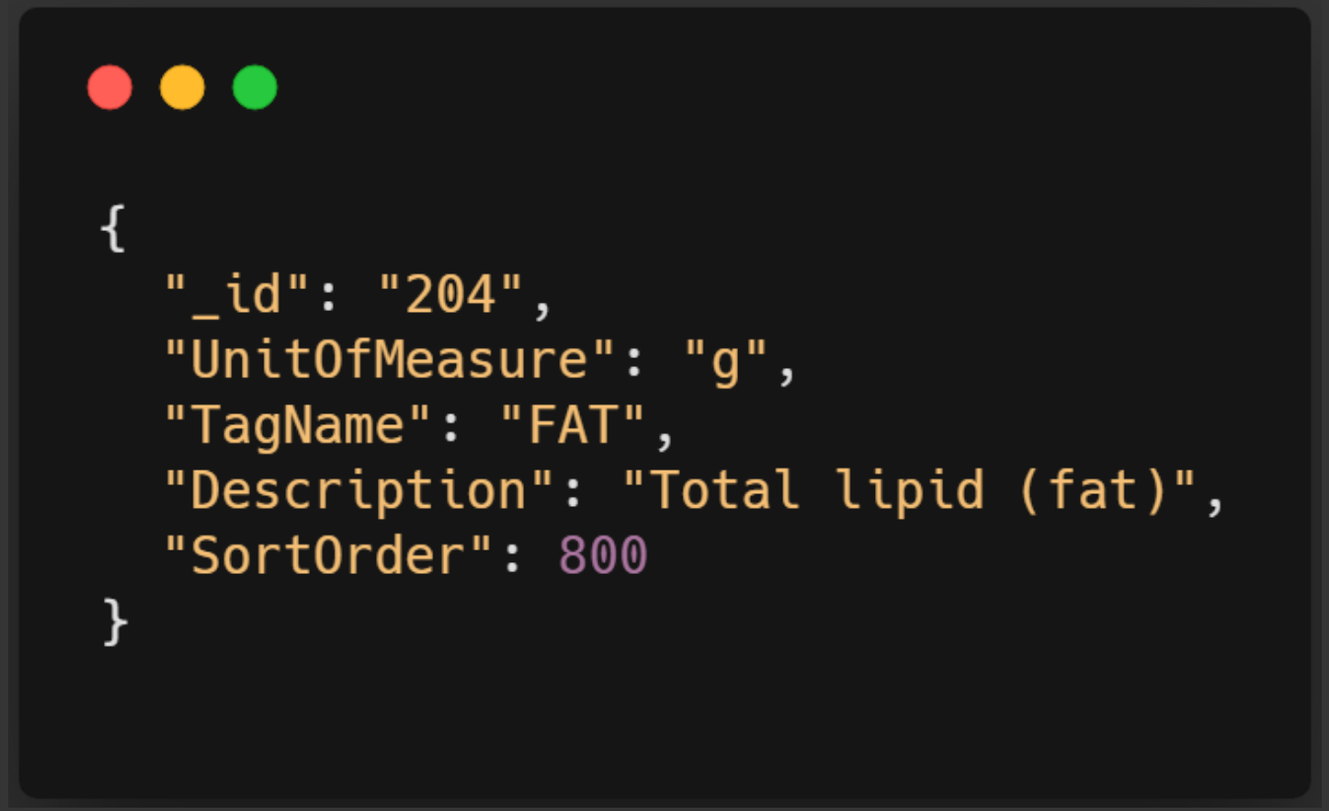
Key/Value

Key	Value		
Key1	$3.05		
Key2		9/22/1974	
Key3	$4.99		Profile1.jpg

Column

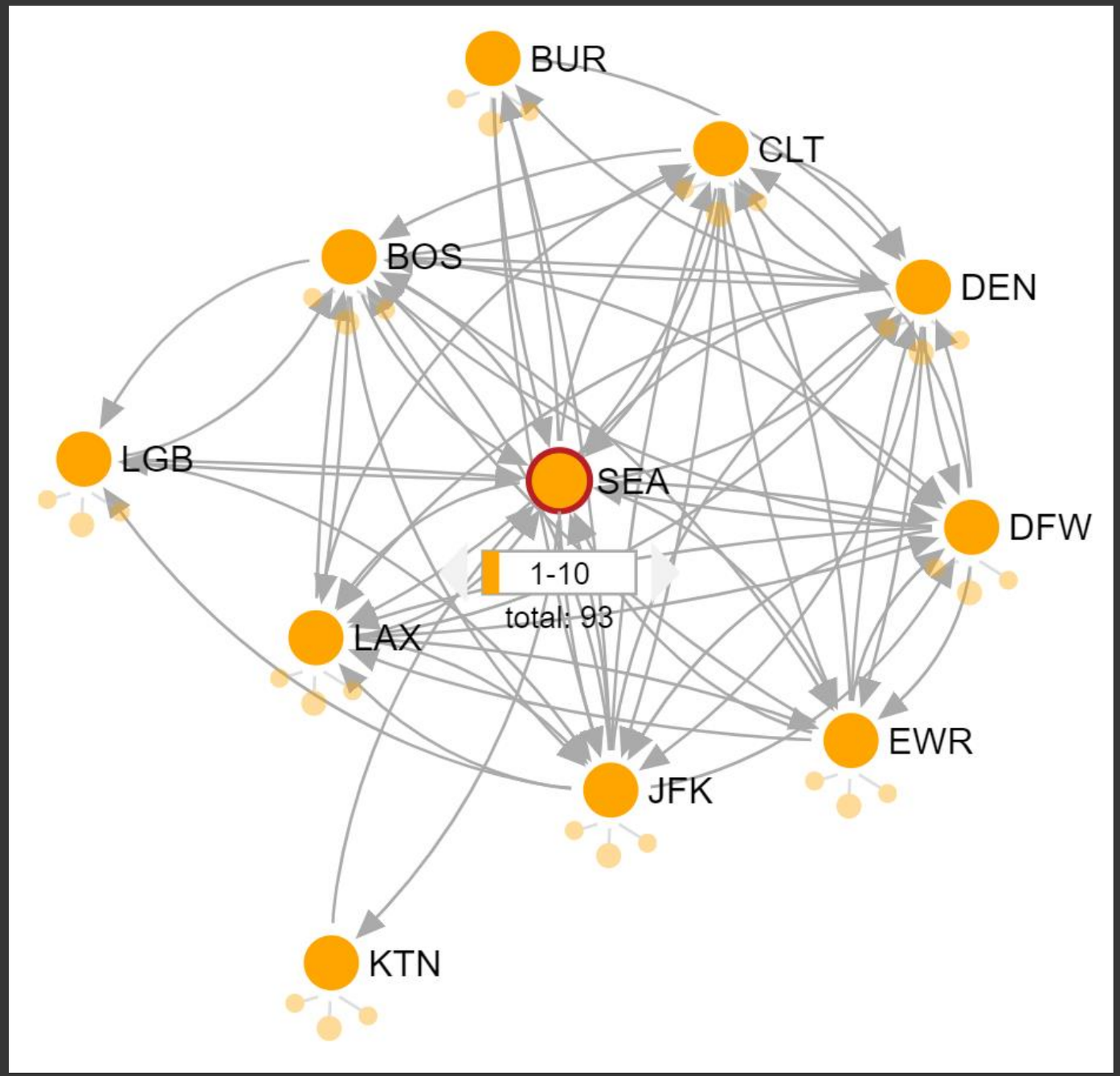
```
[
  { "id": 1, "name": "Jeremy Likness", "twitter": "@JeremyLikness" },
  { "id": 2, "name": "Scott Cate", "twitter": "@ScottCate", "isManager": true }
]

{
  "isManager" : { "2": true },
  "name": { "1": "Jeremy Likness", "2": "Scott Cate" },
  "twitter": { "1": "@JeremyLikness", "2": "Scott Cate" }
}
```

Document



```
{
  "_id": "204",
  "UnitOfMeasure": "g",
  "TagName": "FAT",
  "Description": "Total lipid (fat)",
  "SortOrder": 800
}
```

Graph



Advantages

Independent	Flexible Schema	Indexing Support
Easy Manipulation	JSON Ready	Fast
Large Datasets	Version Proof	ORM Free

Azure Cosmos DB Handles all of your NoSQL Needs

- Column: Cassandra API
- Document: SQL API, MongoDB API
- Graph: Gremlin API
- Key/Value: Table API

Demo: Create Azure Cosmos DB

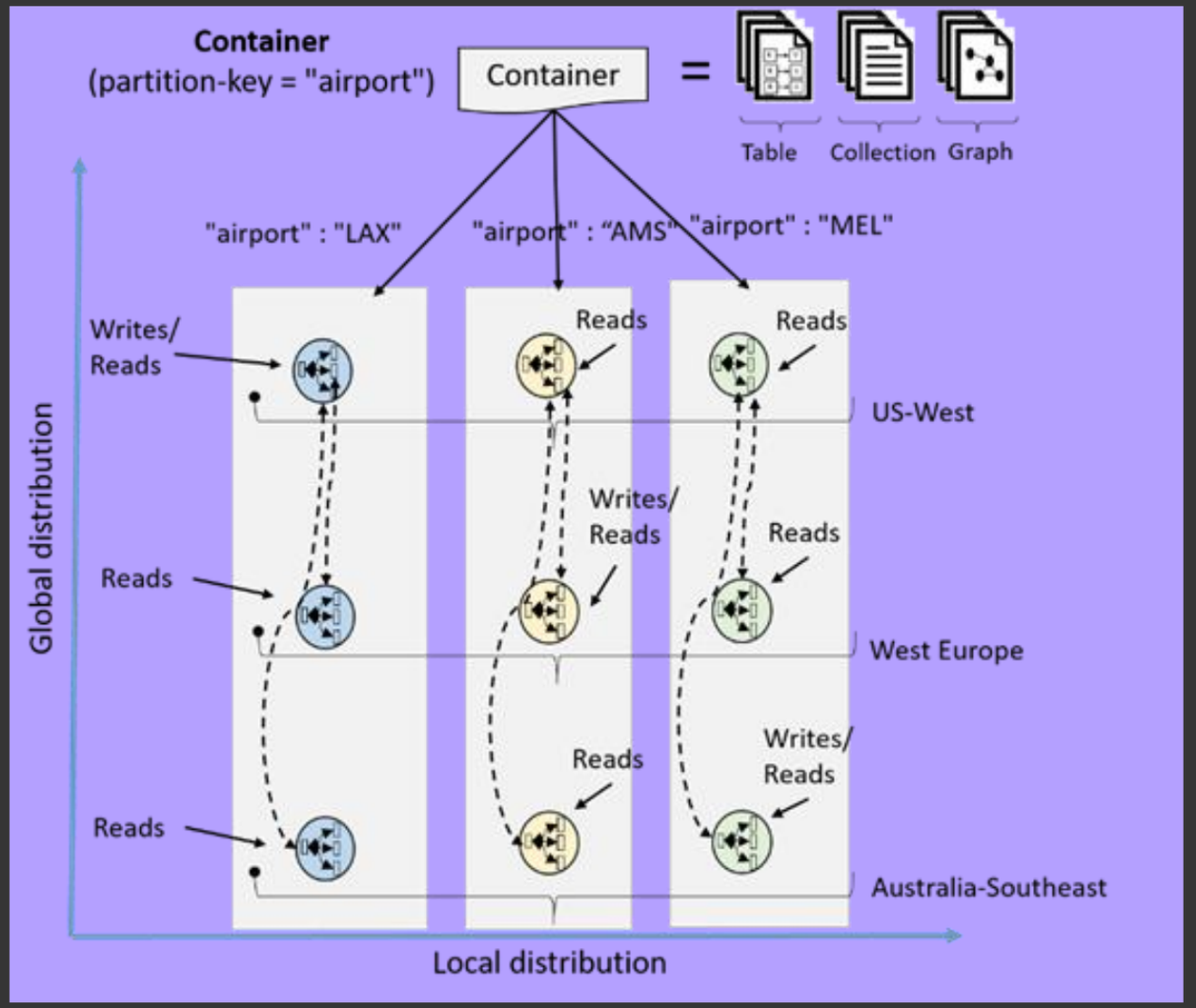
Introducing Serverless NoSQL with Azure Cosmos DB.

Turnkey Global Distribution

Learn more:

⇨ https://jlik.me/ckw

Turnkey Global Distribution



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Turnkey Global Distribution

Elastic scale out of storage and throughput

No single-machine bottleneck

Server-side partition management

GB to PB Storage, selectable throughput

Automatic document expiration

Pay by the hour, customize throughput cost

Support for requests per second or minute

Turnkey Global Distribution

Elastic scale out of storage and throughput

Guaranteed 99th percentile low latency

	Strong	Bounded Staleness	Session	Prefix	Eventual
Indexed Writes (1 KB)	<10ms + 2RTT	<10ms	<10ms	<10ms	<10ms
Reads (1 KB)	<10ms	<10ms	<10ms	<10ms	<10ms

Turnkey Global Distribution

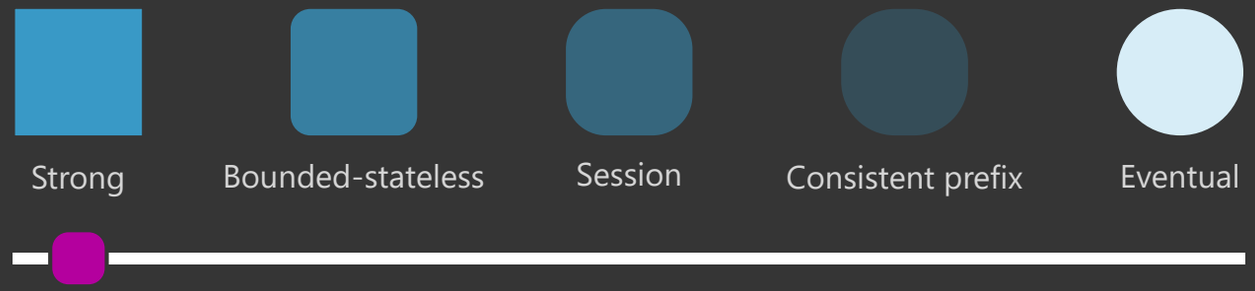
Elastic scale out of storage and throughput

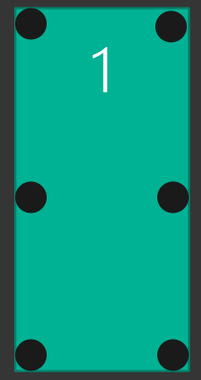
Guaranteed 99th percentile low latency

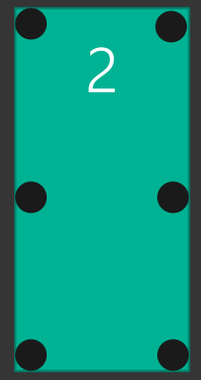
Five well-defined consistency models

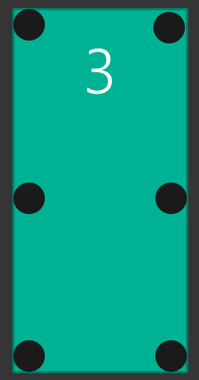
Learn more:

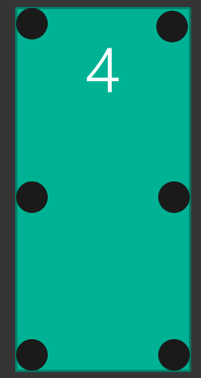
⇨ https://jlik.me/ckx











A	-	B
0	–	0
1	–	0
1	–	1
2	–	1
2	–	2
3	–	2

Learn more:

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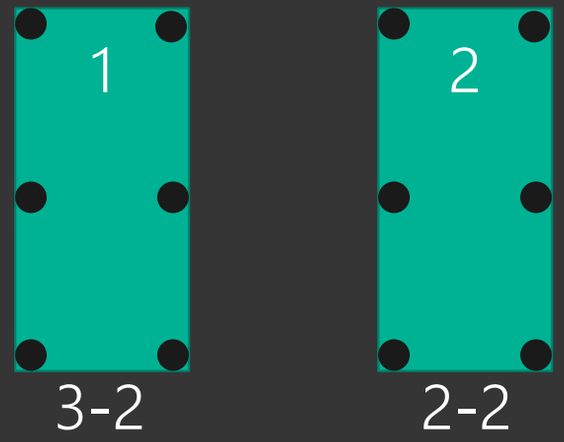

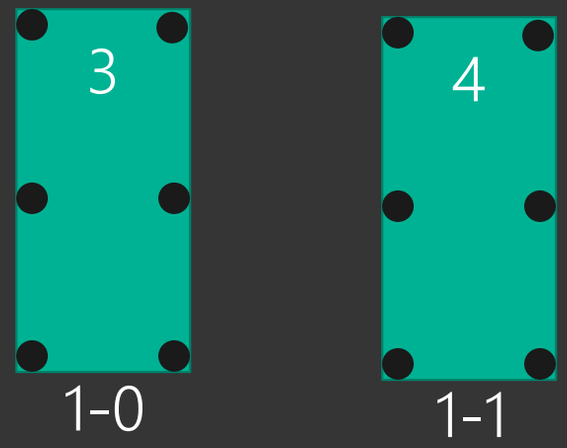


```
Write 1:A +1
Write 1:B +1
Write 2:A +1
Write 1:A +1
…
```

Learn more:

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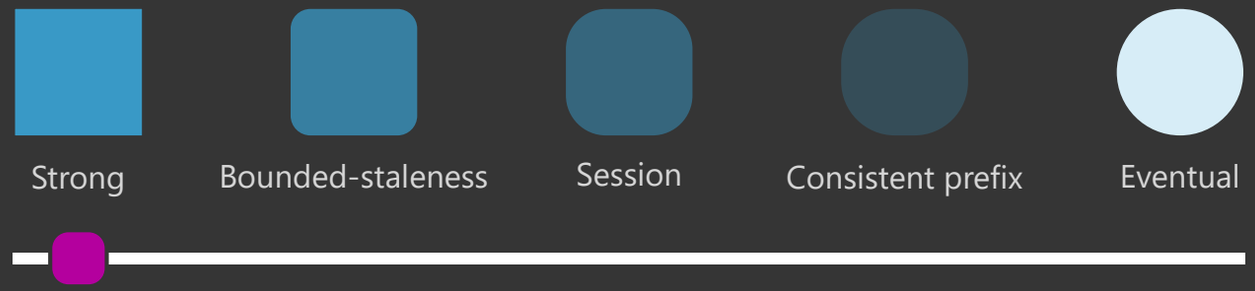
Turnkey Global Distribution

Elastic scale out of storage and throughput

Guaranteed 99th percentile low latency

Five well-defined consistency models

- Guaranteed latest version of reads
- Highest consistency
- Lowest performance
- Lowest availability
- 2x cost of Session -> Eventual



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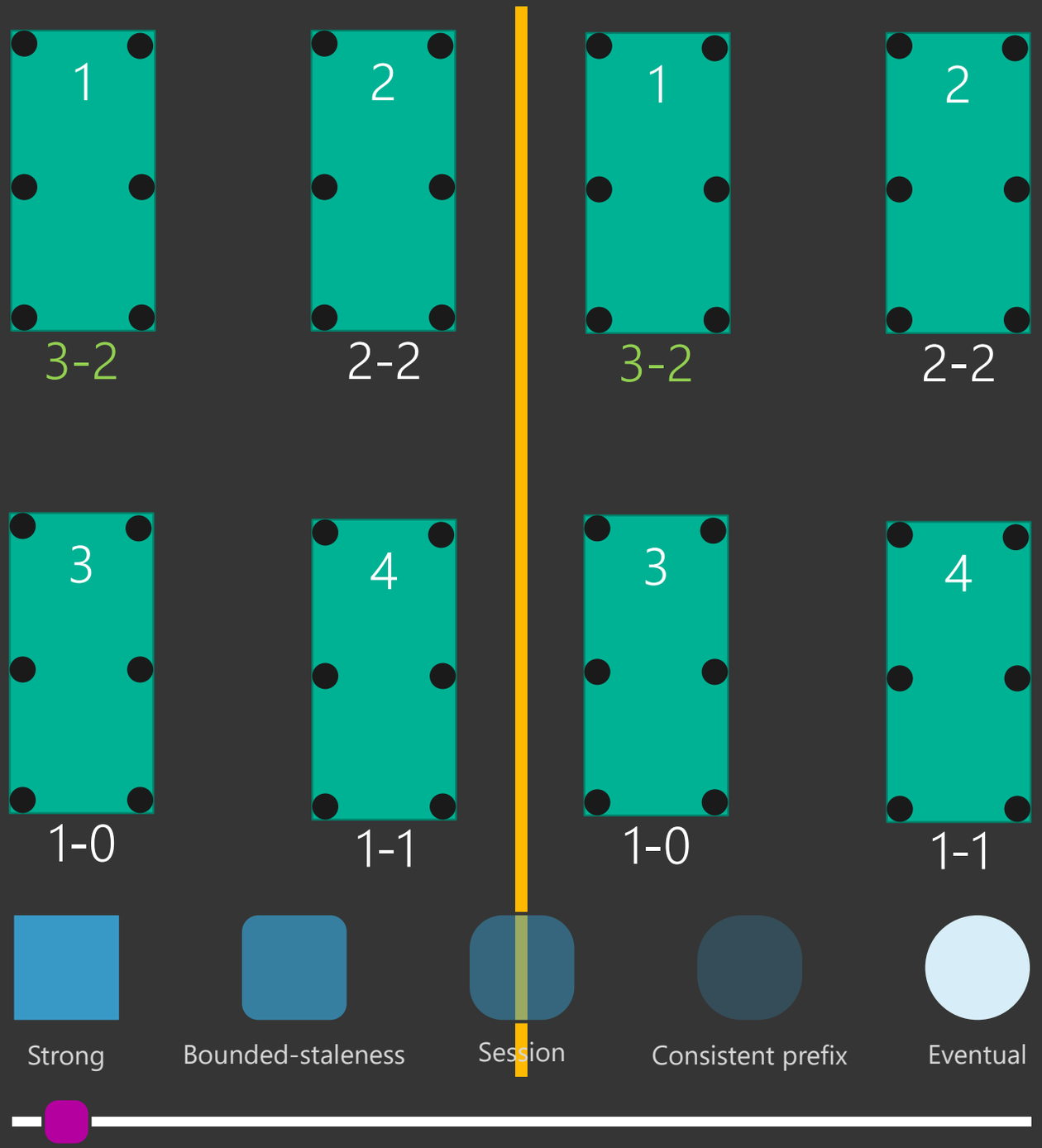


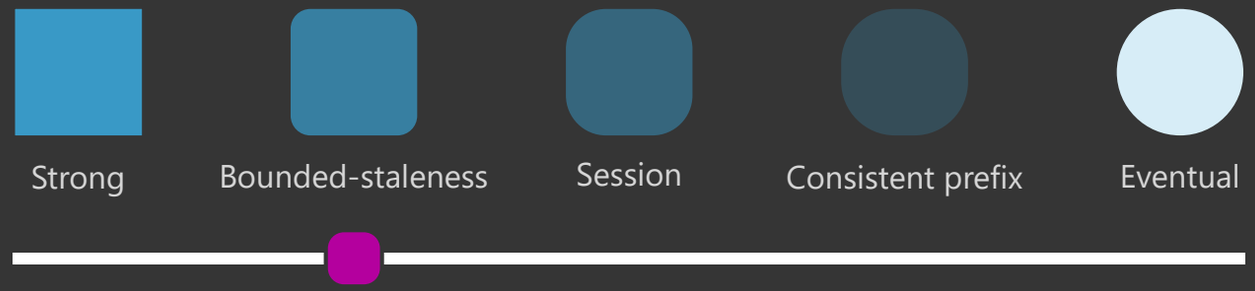
Turnkey Global Distribution

Elastic scale out of storage and throughput

Guaranteed 99th percentile low latency

Five well-defined consistency models

- Consistent within a time frame (i.e. 5 minutes old)
- Better performance
- Low availability
- 2x cost of Session -> Eventual



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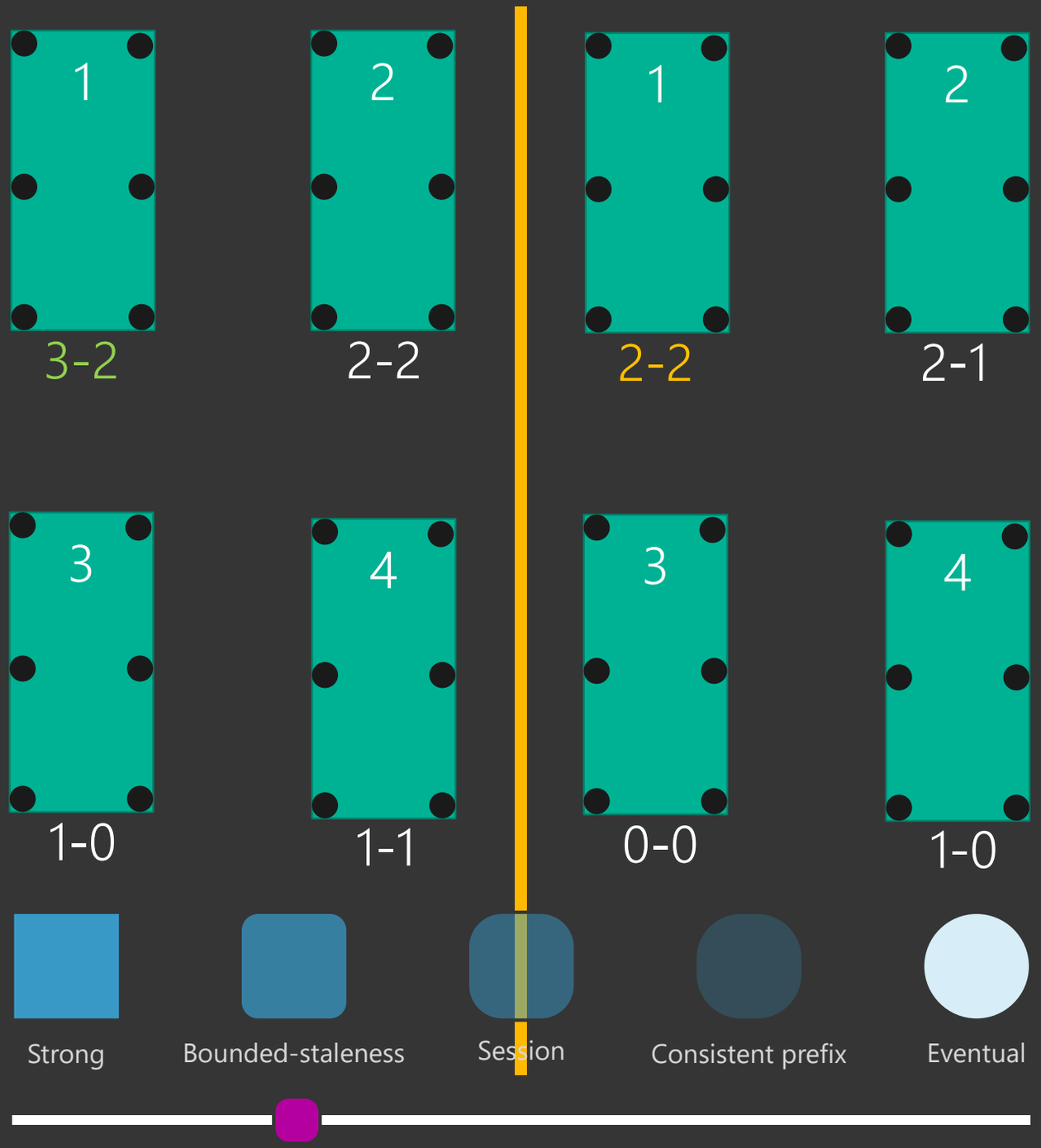


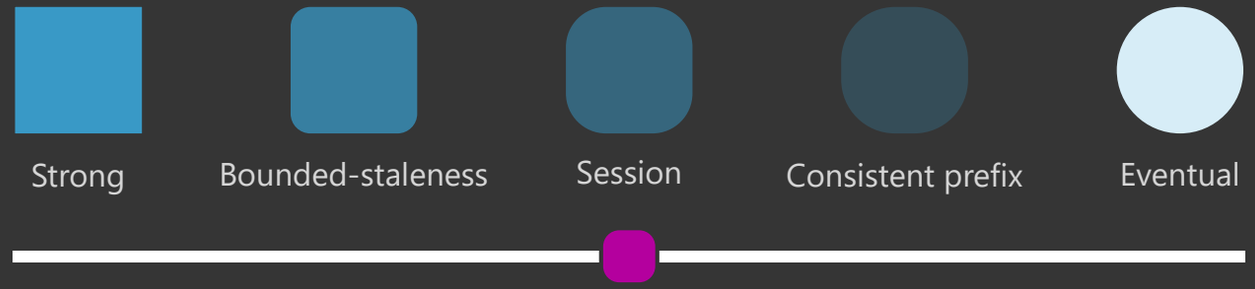
Turnkey Global Distribution

Elastic scale out of storage and throughput

Guaranteed 99th percentile low latency

Five well-defined consistency models

- Consistent for the session
- Always read own writes
- Other data ordered but not guaranteed current
- Good performance
- Good availability



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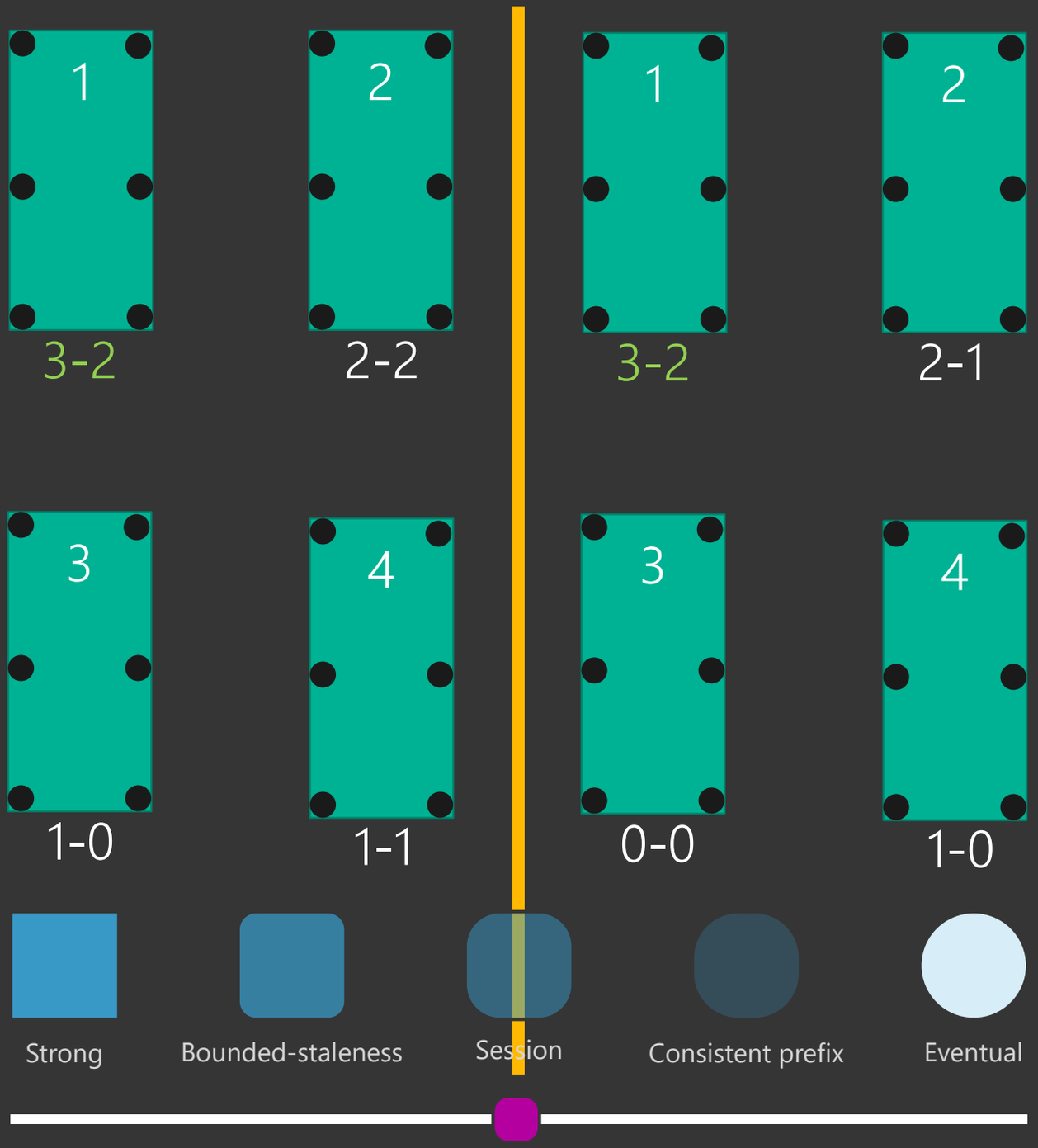


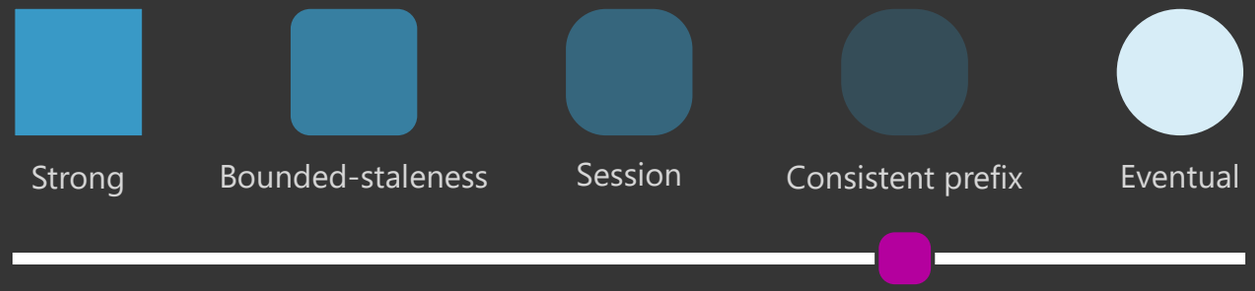
Turnkey Global Distribution

Elastic scale out of storage and throughput

Guaranteed 99th percentile low latency

Five well-defined consistency models

- Read is consistent to a point in time
- No guarantee how current
- Good performance
- Excellent availability



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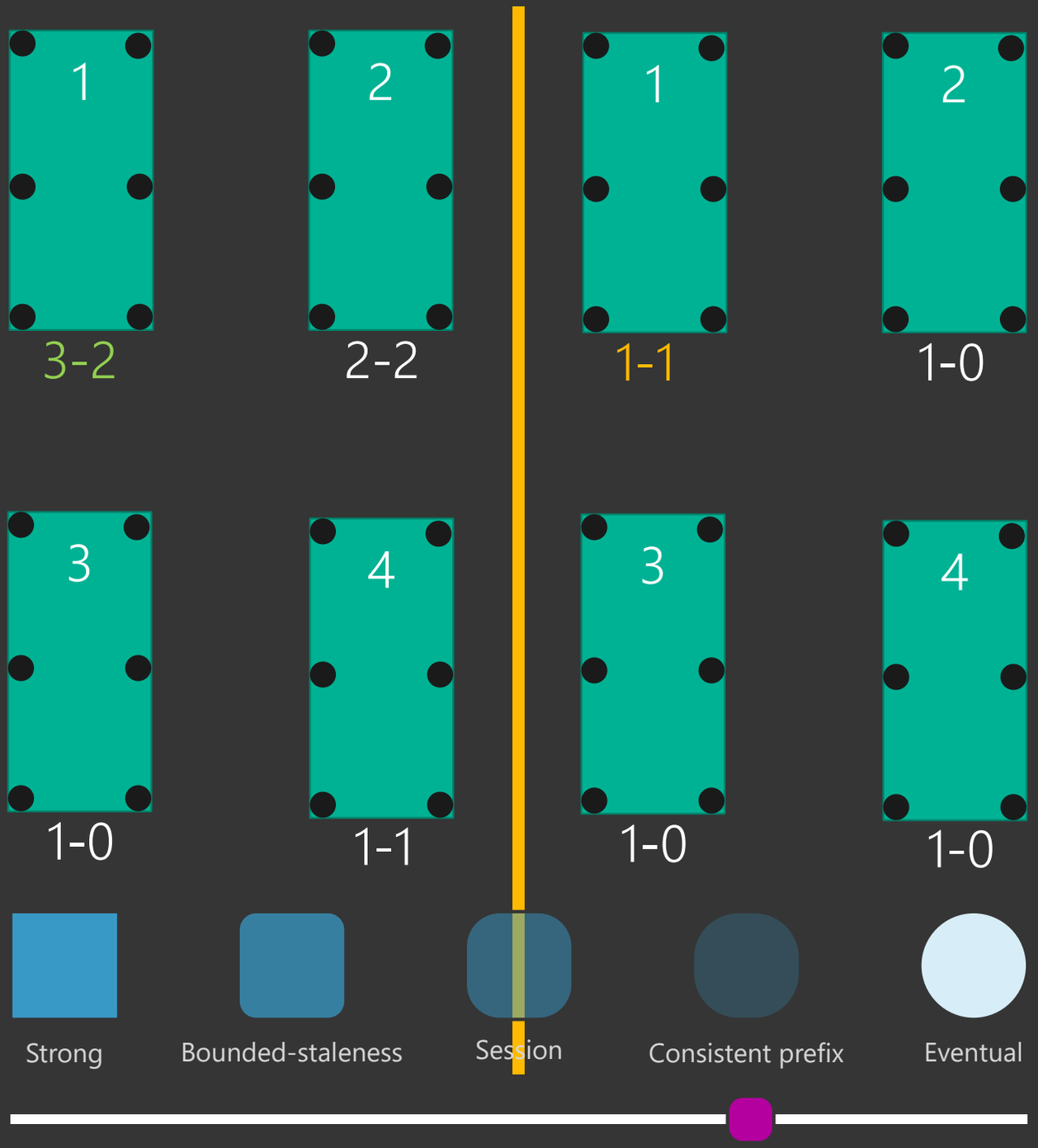


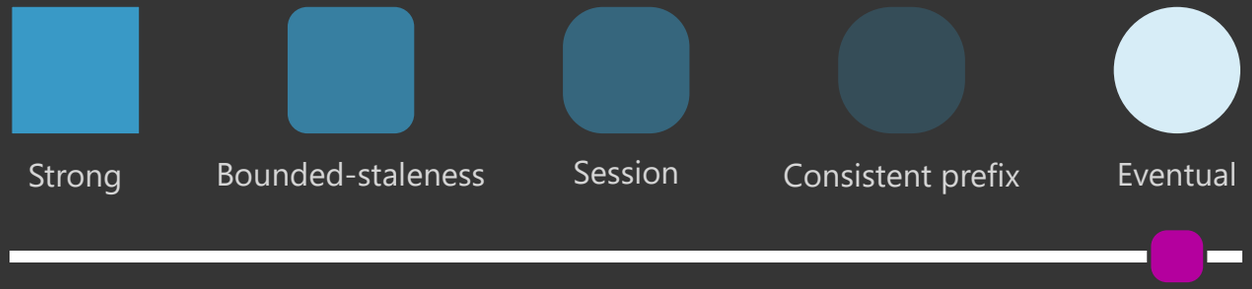
Turnkey Global Distribution

Elastic scale out of storage and throughput

Guaranteed 99th percentile low latency

Five well-defined consistency models

- No guaranteed ordering/freshness of data
- Eventually “catches up”
- Highest performance
- Highest availability



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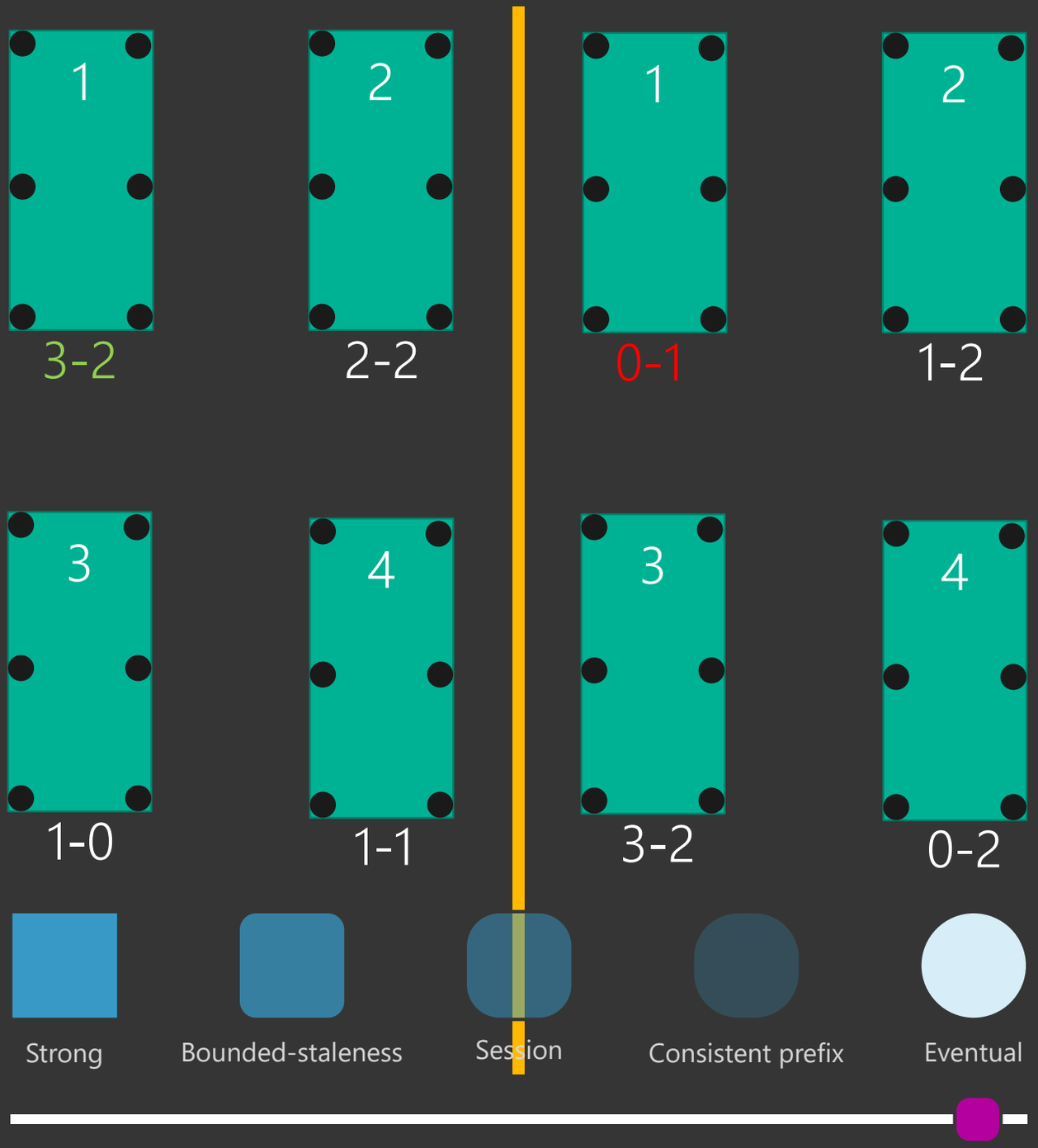


Demo: Consistency Levels

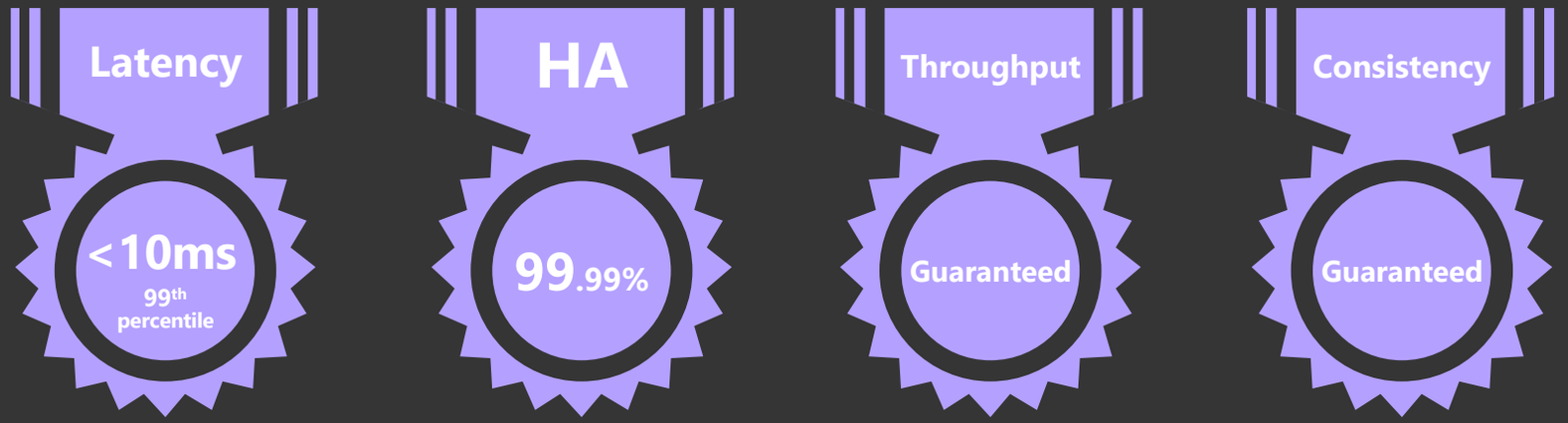
Turnkey Global Distribution

Elastic scale out of storage and throughput

Guaranteed 99th percentile low latency

Five well-defined consistency models

Comprehensive SLAs



1 RU = Read 1 KB Item with 10 Unique Properties

https://jlik.me/ckv

Item Size	Reads/second	Writes/second	Request units
1 KB	500	100	1,000 RU
1 KB	500	500	3,000 RU
4 KB	500	100	1,350 RU
4 KB	500	500	4,150 RU
64 KB	500	100	9,800 RU
64 KB	500	500	29,000 RU

Why Cosmos DB?

Automated backups	Automatic failover	ACID inside partition	Change feed	Encryption (rest & transit)
Geo-fencing	Geospatial data	LINQ	Local emulator	ODBC
Recycle bin (30 days)	Security (ISO 27001, EUMC, HIPAA)	Serverless bindings	Sprocs, triggers, UDFs	

Table API

Got Interfaces?

SQL API

mongoDB.

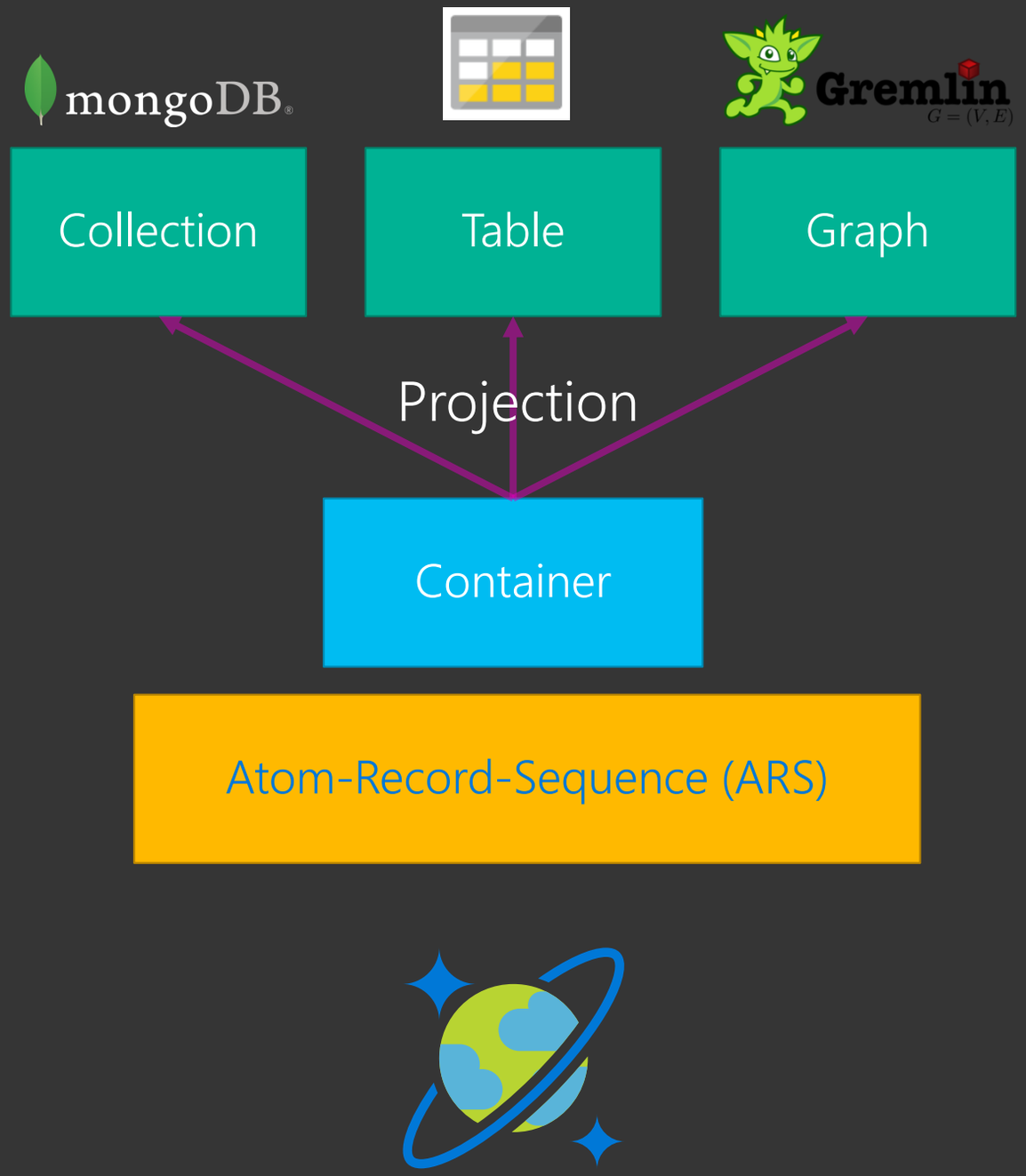
- Atoms – primitive types
- Records – structs
- Sequences – arrays of atoms, records, or other sequences

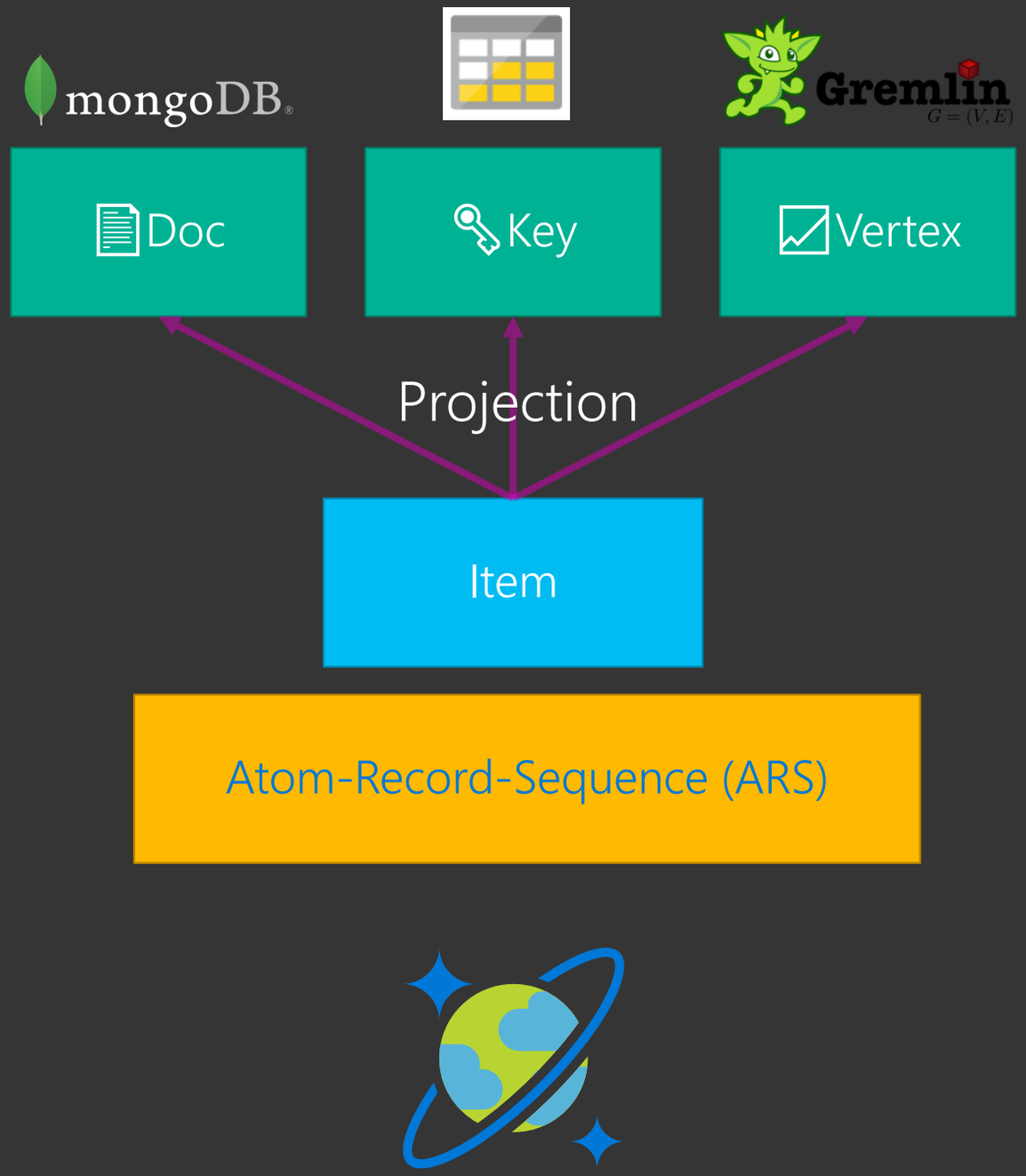
Atom-Record-Sequence (ARS)

Projection is used to map ARS to the API

Container

Atom-Record-Sequence (ARS)


mongoDB.
Gremlin
$G = (V, E)$
Collection
Table
Graph
Projection
Container
Atom-Record-Sequence (ARS)

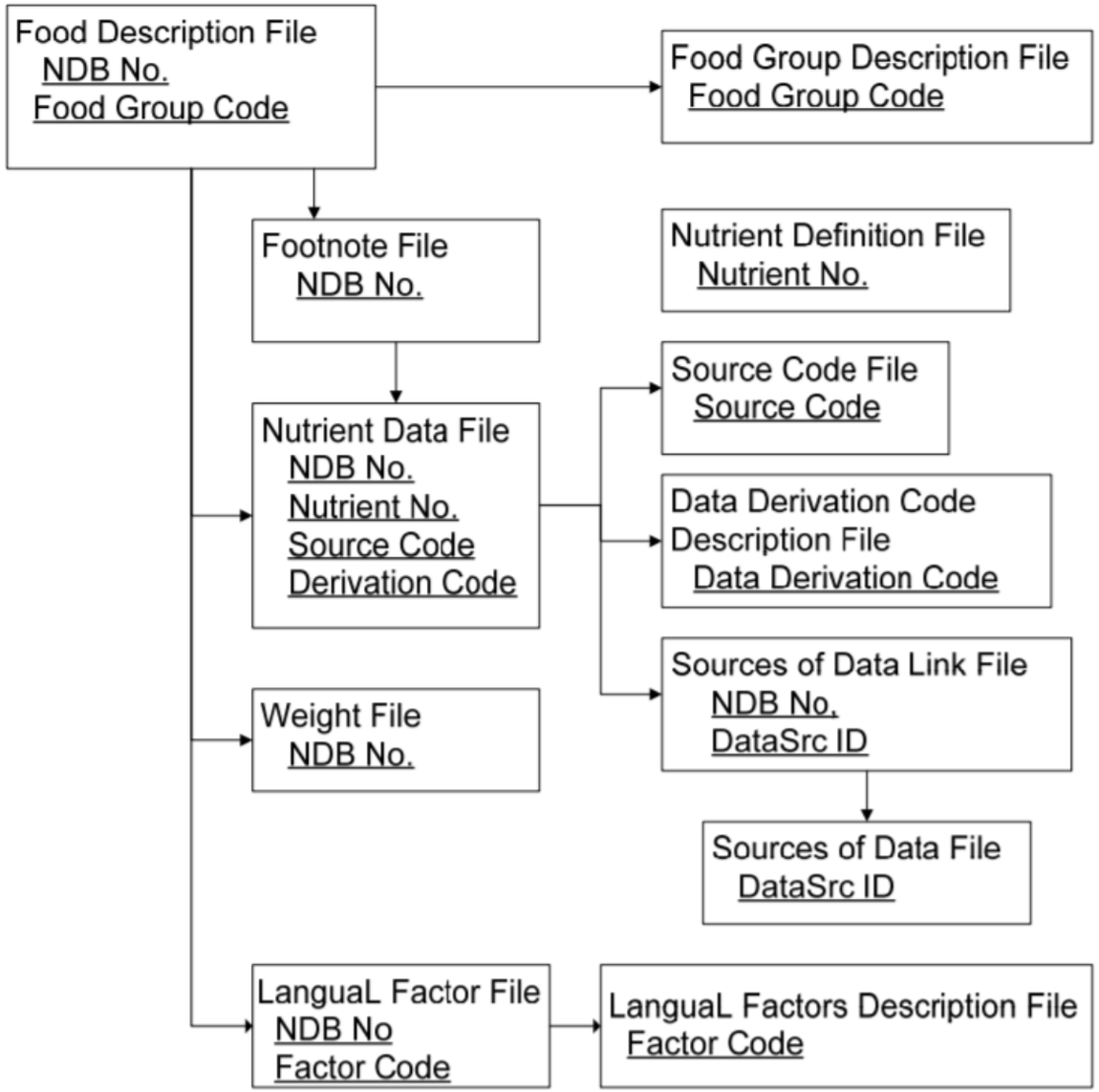

mongoDB.
Gremlin
$G = (V, E)$
Doc
Key
Vertex
Projection
Item
Atom-Record-Sequence (ARS)

mongoDB®

USDA Database

mongoDB.

Figure 1. Relationships among files in the USDA National Nutrient Database for Standard Reference *



* Underlined items denote key fields.

Source: https://www.ars.usda.gov/ARSUserFiles/80400525/Data/SR/SR28/sr28_doc.pdf

mongoDB.

Food Groups

Nutrient Definitions

Food Items
Nutrient Data
Weights

- This could be implemented as a single collection with a type identifier

mongoDB.

```
{
  "foodId": 1,
  "nutrients": [
    {"name": "protein", "abbr": "pro"},
    {"name": "carbohydrate", "abbr": "carb"}
  ]
}
```

mongoDB.

```
{
  "foodId": 1,
  "nutrients": {
    "pro": {"name": "protein"},
    "carb": {"name": "carbohydrate"}
  }
}
```

mongoDB®

DEMO

Table API

Got Interfaces?

SQL API

mongoDB.

Flights


```
[
  {"label":"airport",
    "id":"MAG",
    "latitude":[{"_value":-5.20707988739,"id":"2e0bfd38-95a3-4bbc-bac1-0e346fe9d3cc"}],
    "longitude":[{"_value":145.789001465,"id":"58087297-6041-4d4b-ab4b-c938d310e3f6"}]
  },
  {"label":"flight",
    "distance":229918.897192623,
    "id":"090cc119-b1aa-4f1f-96e5-545728191471",
    "_sink":"ADL",
    "_sinkLabel":"airport",
    "_vertexId":"WYA",
    "_vertexLabel":"airport",
    "_isEdge":true
  }
]
```

Table API

Got Interfaces?

SQL API

mongoDB.

Table API

SQL API

Link Shortener

Table API

Got Interfaces?

SQL API

mongoDB.

Cassandra API

- Public preview
- Details here: https://aka.ms/cassandra-api

```
// Connect to cassandra cluster  (Cassandra API on Azure Cosmos DB supports only TLSv1.2)
var options = new Cassandra.SSLOptions(SslProtocols.Tls12, true, ValidateServerCertificate);
options.SetHostNameResolver((ipAddress) => CassandraContactPoint);
Cluster cluster = Cluster.Builder().WithCredentials(UserName, Password).WithPort(CassandraPort)
  .AddContactPoint(CassandraContactPoint).WithSSL(options).Build();
ISession session = cluster.Connect();
```

In Conclusion …

- NoSQL: a different approach
- Azure Cosmos DB: one engine to rule them all … but multiple APIs to bind them
- Scale, speed, and security – all turnkey, all serverless
- .NET-ready

Microsoft

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USDA
https://github.com/JeremyLikness/explore-cosmos-db

Flights
https://github.com/anthonychu/cosmosdb-gremlin-flights

Link Shortener
https://github.com/JeremyLikness/jlik.me

Link Shortener Simplified
https://github.com/JeremyLikness/ShortLink

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Performance tips: https://aka.ms/cosmos-perf