Raiders of the Lost ADX

Starring

Koen Verbeek as Indiana Jones

&

Johan Ludvig Brattås as Henry Jones

Thank you, partners

KOHERA

element 61
experience & expertise

lytix

bmatix
Act informed

inetum
realdolmen
Positive digital flow

datasense

MICROPOLE
BELUX

LACO

AKABI

Cloubis

datashift

EpicData.

Sparkle

Tabular Editor

solarwinds

u2u

Adapt
and
Enable

MONIN
Database Managed Services

proximus NXT
tech. bizz. people.

tillit data
shapers

ORDINA
Ahead of change

Agenda

- What exactly is Azure Data Explorer?
- A brief introduction to KQL
- Data Explorer – the hidden treasure of Azure analytic tools?
- Data Explorer in an IoT scenario
- Data Explorer with Synapse Link

contact

Koen Verbeeck

@Ko_Ver

@koen@dataplatform.social

SQLkover.com

Microsoft® MVP Most Valuable Professional

MSSQLTips.com

Adapt and Enable

contact

Johan Ludvig Brattås

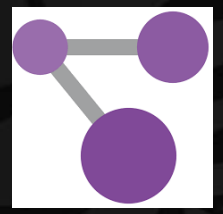
@intoleranse

@SqlClause.online

Microsoft® Most Valuable Professional

What exactly is Azure Data Explorer?

Azure Data Explorer




Azure Data Explorer

- Columnar
  - very good compression
- Append-Only
- Elastic scale
- Low latency ingestion (200 Mb/s per node)
- Fully managed
  - indexed by default

Azure Data Explorer

- Developed by Microsoft engineers in Israel to handle Azure's need for fast log and telemetry analytics
- Released as Application Insights in 2016
- Data Explorer went GA 2019

Azure Timeseries Insights facing the new Data Explorer

Azure Data Explorer

- RDBMS-like with databases, schemas & tables
- Powerful time series database
- Zero constraints
- Can be queried with SQL
- Better yet – the native language

No, Kusto – not Cousteau!

Intro to KQL

Kusto Query Language

name of the table = SELECT *

checkin_id	created_at	beer_name	beer_type	beer_ibu	beer_abv	flavors
600295668	2018-05-19 21:46:34.0000	Watou Tripel	Belgian Tripel	19	7.5	[{"flavor":"smooth"}]
600957579	2018-05-20 20:24:34.0000	Troubadour Magma	IPA - Belgian	45	9	[{"flavor":"hoppy"}]
600980213	2018-05-20 20:57:02.0000	Duvel	Belgian Strong Golden Ale	33	8.5	
601039251	2018-05-20 22:14:53.0000	Chouffe Soleil	Belgian Blonde	20	6	[{"flavor":"light"}]
601066988	2018-05-20 22:51:54.0000	Duvel	Belgian Strong Golden Ale	33	8.5	[{"flavor":"strong"}]
601849915	2018-05-23 19:11:38.0000	Orval	Pale Ale - Belgian	36	6.2	[{"flavor":"fruity"}]
601858859	2018-05-23 19:48:47.0000	Tripel Karmeliet	Belgian Tripel	16	8.4	[{"flavor":"strong"}]
601883612	2018-05-23 21:17:50.0000	Leffe Blonde / Blond	Belgian Blonde	20	6.6	[{"flavor":"light"}]
606238565	2018-06-02 15:17:25.0000	Maes Pils	Pilsner - Other	15	5.2	[{"flavor":"light"}]

filtering

```
13  // filtering
14  BeerCheckins
15  | where brewery_country == "Norway"
16
```

Table 1 | Stats

checkin_id	created_at	beer_name	beer_type
919498731	2020-07-18 23:31:19.0000	Nitro Hot Chocolate ...	Stout - Imperial / Double...
1088786720	2021-10-16 22:07:42.0000	Møykjeddingi	IPA - Farmhouse
1089148830	2021-10-17 15:38:25.0000	Gølse Singelkveik Kve...	Traditional Ale
1091170649	2021-10-23 18:27:02.0000	STAFANGR New Engl...	IPA - New England / Hazy
1167989760	2022-06-11 18:49:26.0000	Solitude	IPA - New England / Hazy
1216484786	2022-10-30 15:47:30.0000	Å VESTLAND, VESTLA...	Pale Ale - American
1216489681	2022-10-30 16:06:10.0000	LEFT BEHIND - TRIPL...	IPA - Imperial / Double N...

```
18  BeerCheckins
19  |  search todecimal(score) > 4.5
20  | project created_at, beer_name, beer_type, score
```

Table 1 | Stats

created_at	beer_name	beer_type	score
2018-05-20 20:57:02.0000	Duvel	Belgian Strong Golden Ale	5
2018-05-20 22:51:54.0000	Duvel	Belgian Strong Golden Ale	5
2018-05-23 19:48:47.0000	Tripel Karmeliet	Belgian Tripel	5
2018-06-29 12:24:47.0000	Duvel	Belgian Strong Golden Ale	5
2018-07-06 20:00:39.0000	Duvel Tripel Hop Citra	Belgian Strong Golden Ale	5
2018-07-08 15:44:51.0000	Duvel Tripel Hop Citra (2018)	Belgian Strong Golden Ale	5
2018-07-15 20:18:49.0000	Vedett Extra Ordinary IPA	IPA - Belgian	4.75

```
13  // searching
14  BeerCheckins
15  | search "Belgium"
16  | project created_at, beer_name, beer_type, venue_country, brewery_country
17
```

Table 1 | Stats

created_at	beer_name	beer_type	venue_country	brewery_country
2018-05-19 21:46:34.0000	Watou Tripel	Belgian Tripel		Belgium
2018-05-20 20:24:34.0000	Troubadour Magma	IPA - Belgian	Belgium	Belgium
2018-05-20 20:57:02.0000	Duvel	Belgian Strong Golden Ale	Belgium	Belgium
2018-05-20 22:14:53.0000	Chouffe Soleil	Belgian Blonde	Belgium	Belgium
2018-05-20 22:51:54.0000	Duvel	Belgian Strong Golden Ale	Belgium	Belgium
2018-05-23 19:11:38.0000	Orval	Pale Ale - Belgian	Belgium	Belgium
2018-05-23 19:48:47.0000	Tripel Karmeliet	Belgian Tripel	Belgium	Belgium
2018-05-23 21:17:50.0000	Leffe Blonde / Blond	Belgian Blonde	Belgium	Belgium
2018-06-02 15:17:25.0000	Maes Pils	Pilsner - Other		Belgium

aggregation, sampling, ordering

```
4   // row count
5   BeerCheckins
6   | count
7
```

Table 1 | Stats

Count
1,078

```
13  // group by
14  BeerCheckins
15  | summarize count() by bin(todatetime(created_at),30d)
16
```

Table 1 | Stats

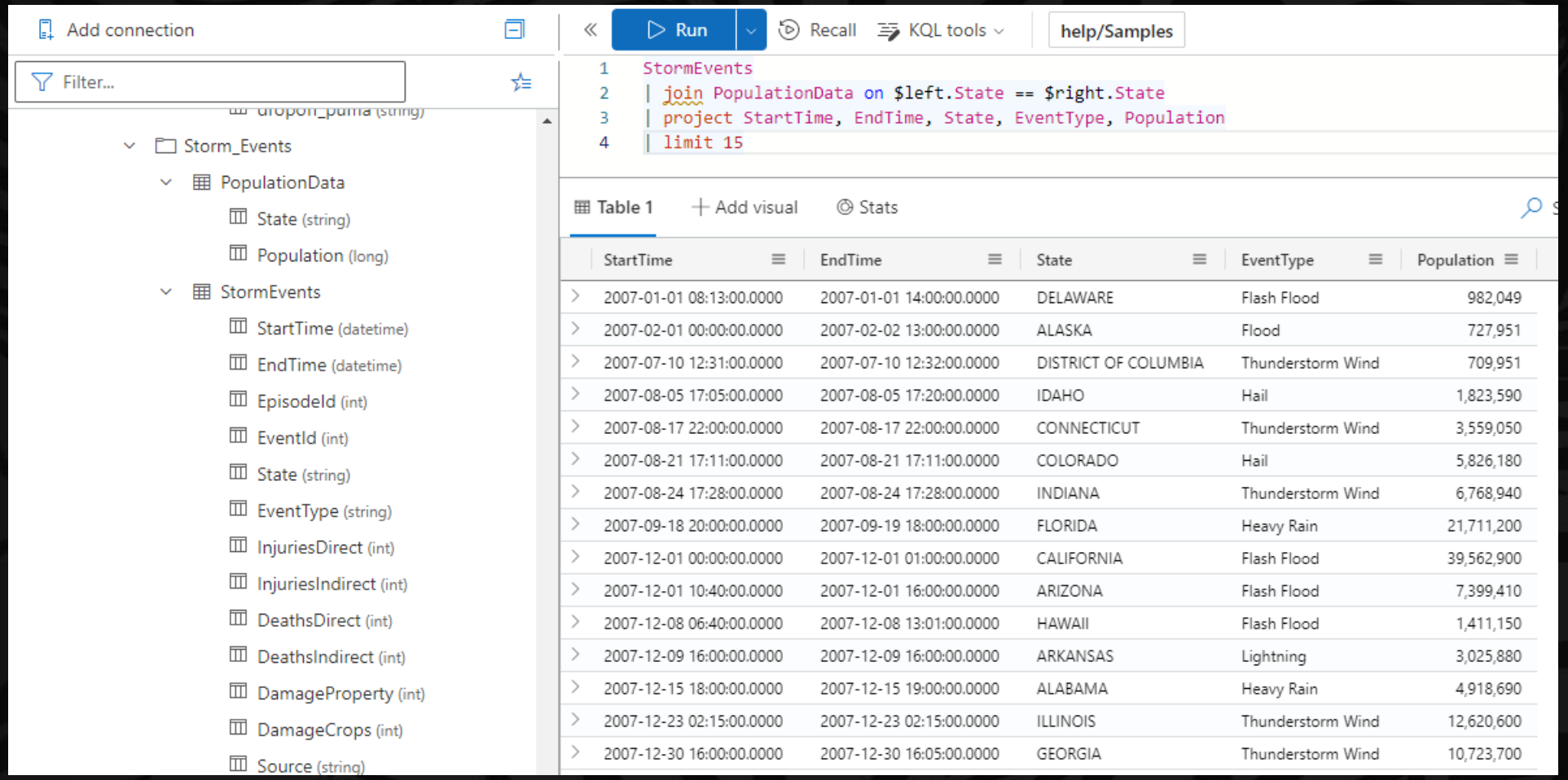
created_at	count_
2018-05-17 00:00:00.0000	14
2018-06-16 00:00:00.0000	14
2018-07-16 00:00:00.0000	22
2018-08-15 00:00:00.0000	16
2018-09-14 00:00:00.0000	19
2018-10-14 00:00:00.0000	18

```
8   // sampling
9   BeerCheckins
10  | order by created_at desc
11  | take 10
12
```

Table 1 | Stats

checkin_id	created_at	beer_name	beer_type	beer_ibu
1218337235	2022-11-05 22:09:59.0000	India Pale Ale Mosa...	IPA - American	0
1218240683	2022-11-05 20:33:14.0000	Zinne des Flandres	Pale Ale - Belgian	0
1218186931	2022-11-05 19:34:50.0000	Noire du Midi	Porter - Other	0
1217651189	2022-11-04 19:11:24.0000	Hercule Stout	Stout - Imperial / Double	44
1217577843	2022-11-04 15:38:45.0000	Monasterium Kloos...	Spiced / Herbed Beer	0
1217165844	2022-11-02 19:23:04.0000	Victoria	Belgian Strong Golden Ale	33
1216549442	2022-10-30 18:42:35.0000	HertenHaas	Belgian Tripel	35
1216503709	2022-10-30 16:52:17.0000	Trappist Westvleter...	Belgian Quadrupel	38
1216489681	2022-10-30 16:06:10.0000	LEFT BEHIND - TRIP...	IPA - Imperial / Double N...	0
1216484786	2022-10-30 15:47:30.0000	Å VESTLAND, VEST...	Pale Ale - American	28

joins



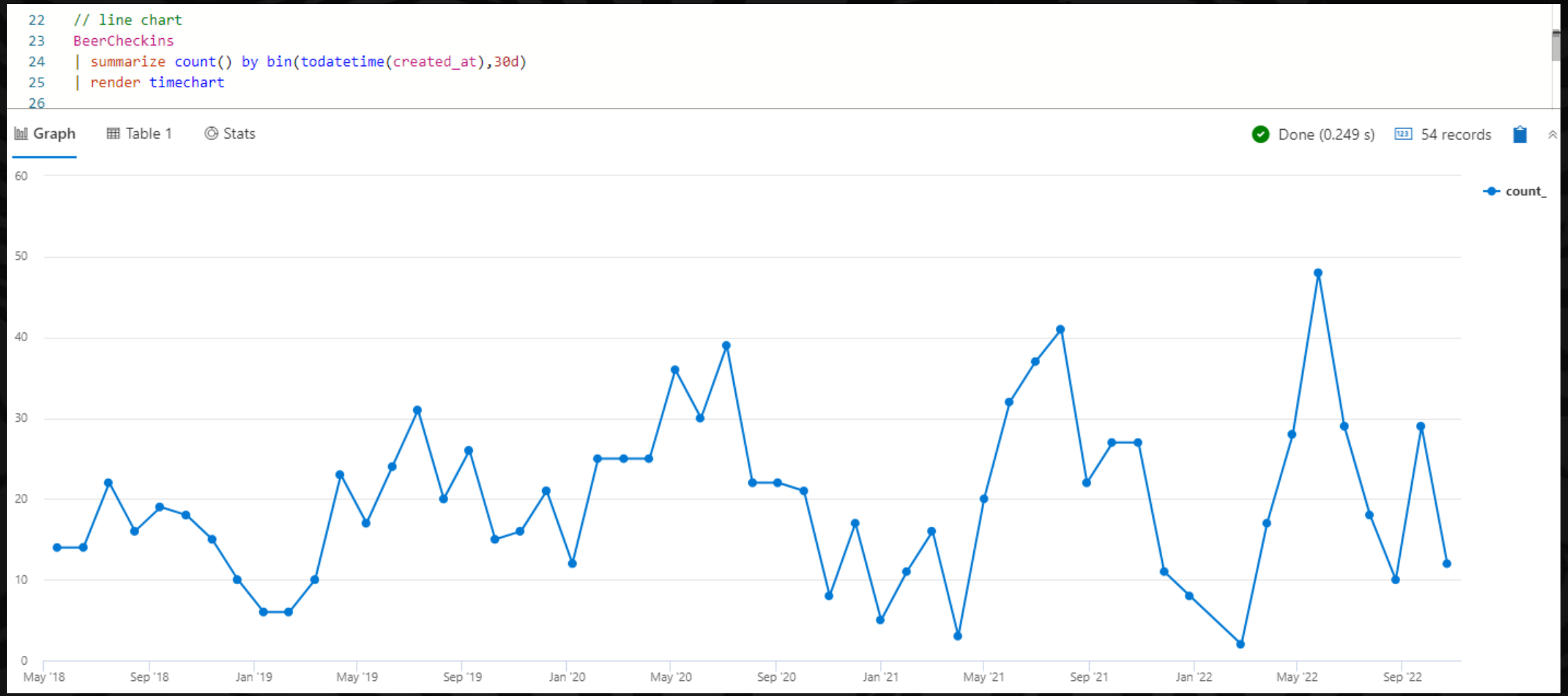
StartTime	EndTime	State	EventType	Population
2007-01-01 08:13:00.0000	2007-01-01 14:00:00.0000	DELAWARE	Flash Flood	982,049
2007-02-01 00:00:00.0000	2007-02-02 13:00:00.0000	ALASKA	Flood	727,951
2007-07-10 12:31:00.0000	2007-07-10 12:32:00.0000	DISTRICT OF COLUMBIA	Thunderstorm Wind	709,951
2007-08-05 17:05:00.0000	2007-08-05 17:20:00.0000	IDAHO	Hail	1,823,590
2007-08-17 22:00:00.0000	2007-08-17 22:00:00.0000	CONNECTICUT	Thunderstorm Wind	3,559,050
2007-08-21 17:11:00.0000	2007-08-21 17:11:00.0000	COLORADO	Hail	5,826,180
2007-08-24 17:28:00.0000	2007-08-24 17:28:00.0000	INDIANA	Thunderstorm Wind	6,768,940
2007-09-18 20:00:00.0000	2007-09-19 18:00:00.0000	FLORIDA	Heavy Rain	21,711,200
2007-12-01 00:00:00.0000	2007-12-01 01:00:00.0000	CALIFORNIA	Flash Flood	39,562,900
2007-12-01 10:40:00.0000	2007-12-01 16:00:00.0000	ARIZONA	Flash Flood	7,399,410
2007-12-08 06:40:00.0000	2007-12-08 13:01:00.0000	HAWAII	Flash Flood	1,411,150
2007-12-09 16:00:00.0000	2007-12-09 16:00:00.0000	ARKANSAS	Lightning	3,025,880
2007-12-15 18:00:00.0000	2007-12-15 19:00:00.0000	ALABAMA	Heavy Rain	4,918,690
2007-12-23 02:15:00.0000	2007-12-23 02:15:00.0000	ILLINOIS	Thunderstorm Wind	12,620,600
2007-12-30 16:00:00.0000	2007-12-30 16:05:00.0000	GEORGIA	Thunderstorm Wind	10,723,700

joins

- different join types
  - innerunique (default) → only first match is included (like the SSIS lookup component)
  - inner
  - leftouter, rightouter
  - fullouter
  - leftanti, rightanti
  - leftsemi, rightsemi

plotting

```
22  // line chart
23  BeerCheckins
24  | summarize count() by bin(todatetime(created_at),30d)
25  | render timechart
26
```



time series

```
37  BeerCheckins
38  | make-series events=count() default=0 on created_at step 1d
```

Table 1 | Stats | Search | Done (0.349 s) | 1 records

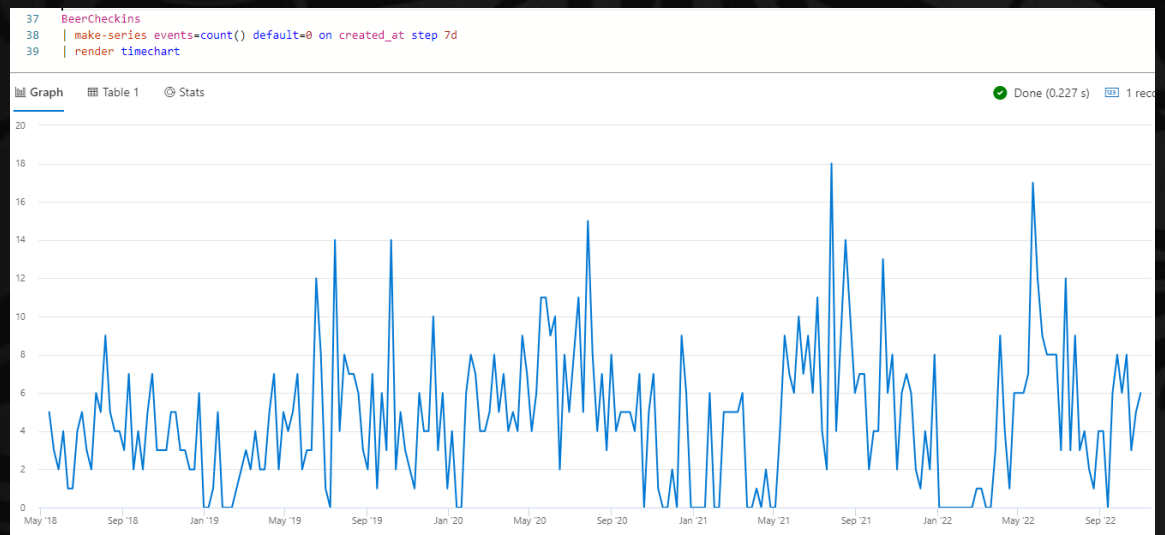
events	created_at
[1,4,0,0,3,0,0,0,0,0,0,0,0,0,2,0,0,0,0,0,1,2,1,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,2,0,2,0,0,1,0,1,0,3,0,0,0,0,0,1,2,0,0,0,0,1,1,...	["2018-05-19T00:00:00.0000000Z","2018-05-20T00:00:00.0000000Z","2018-05-21T00:00:00.0000000Z","2018-05-22T00:00:00.0000000Z",...

```
37  BeerCheckins
38  | make-series events=count() default=0 on created_at step 7d
39  | project series_stats(events)
```

Table 1 | Stats | Search | Done (0.604 s) | 1 records

series_stats_events_min	series_stats_events_min_idx	series_stats_events_max	series_stats_events_max_idx	series_stats_events_avg	series_stats_events_stdev	series_stats_events_variance
0	33	18	167	4.6068376068376065	3.5205278207401527	12.39411613660541

```
37  BeerCheckins
38  | make-series events=count() default=0 on created_at step 7d
39  | render timechart
```



time series

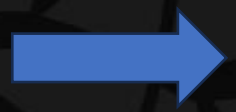
- you can also
  - calculate moving averages
  - apply linear regression
  - detect patterns
  - forecast
  - …

expand JSON

```
34  BeerCheckins
35  | project checkin_id, flavors
```

Table 1 | Stats

checkin_id	flavors
1216549442	[{"flavor":"belgiany"},{"flavor":"sweet"},{"flavor":"hoppy"}]
1214306625	[{"flavor":"floral"},{"flavor":"strong"},{"flavor":"spiced"}]
1210260383	[{"flavor":"dry"},{"flavor":"sour"},{"flavor":"tart"}]
1210205708	[{"flavor":"sweet"},{"flavor":"strong"},{"flavor":"smooth"}]
1209867243	[{"flavor":"soft"},{"flavor":"light"},{"flavor":"dry"}]
1206767994	[{"flavor":"herbal"},{"flavor":"strong"}]
1205300638	[{"flavor":"fruity"},{"flavor":"dry"},{"flavor":"sour"}]
1203891699	[{"flavor":"sweet"},{"flavor":"strong"}]
1198657148	[{"flavor":"clean"},{"flavor":"light"},{"flavor":"smooth"}]
1193418465	[{"flavor":"malty"},{"flavor":"ginger"},{"flavor":"spiced"}]
1190374989	



```
27  // expand
28  BeerCheckins
29  | project checkin_id, flavors
30  | mv-expand flavors
31  | extend flavor = tostring(flavors.flavor)
32  | project-away flavors
```

Table 1 | Stats

checkin_id	flavor
1216549442	belgiany
1216549442	sweet
1216549442	hoppy
1214306625	floral
1214306625	strong
1214306625	spiced
1210260383	dry
1210260383	sour
1210260383	tart

Kusto is too hard?

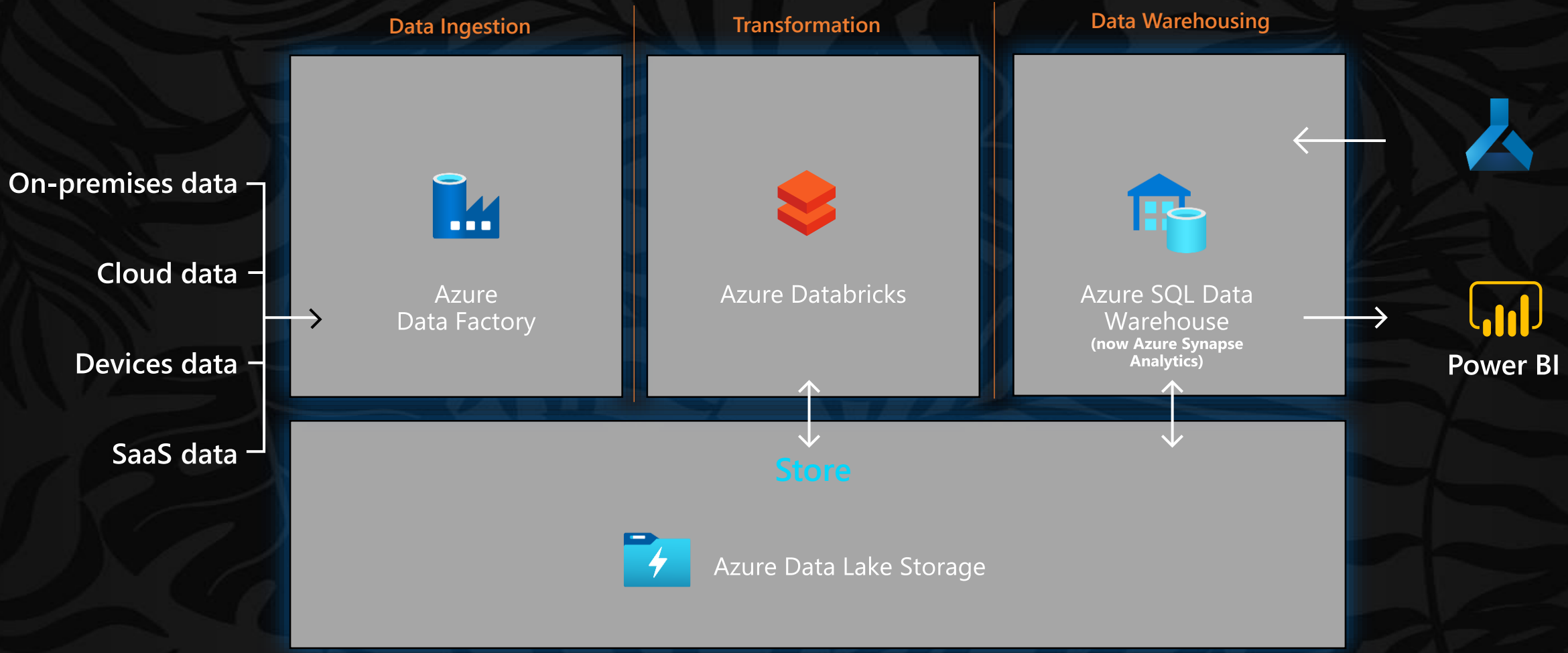
```
1  EXPLAIN
2  SELECT
3      beer_type
4      ,count(checkin_id) AS nbrBeers
5  FROM BeerCheckins
6  WHERE brewery_country like 'bel%'
7  GROUP BY beer_type
```

Table 1 | Stats | Search

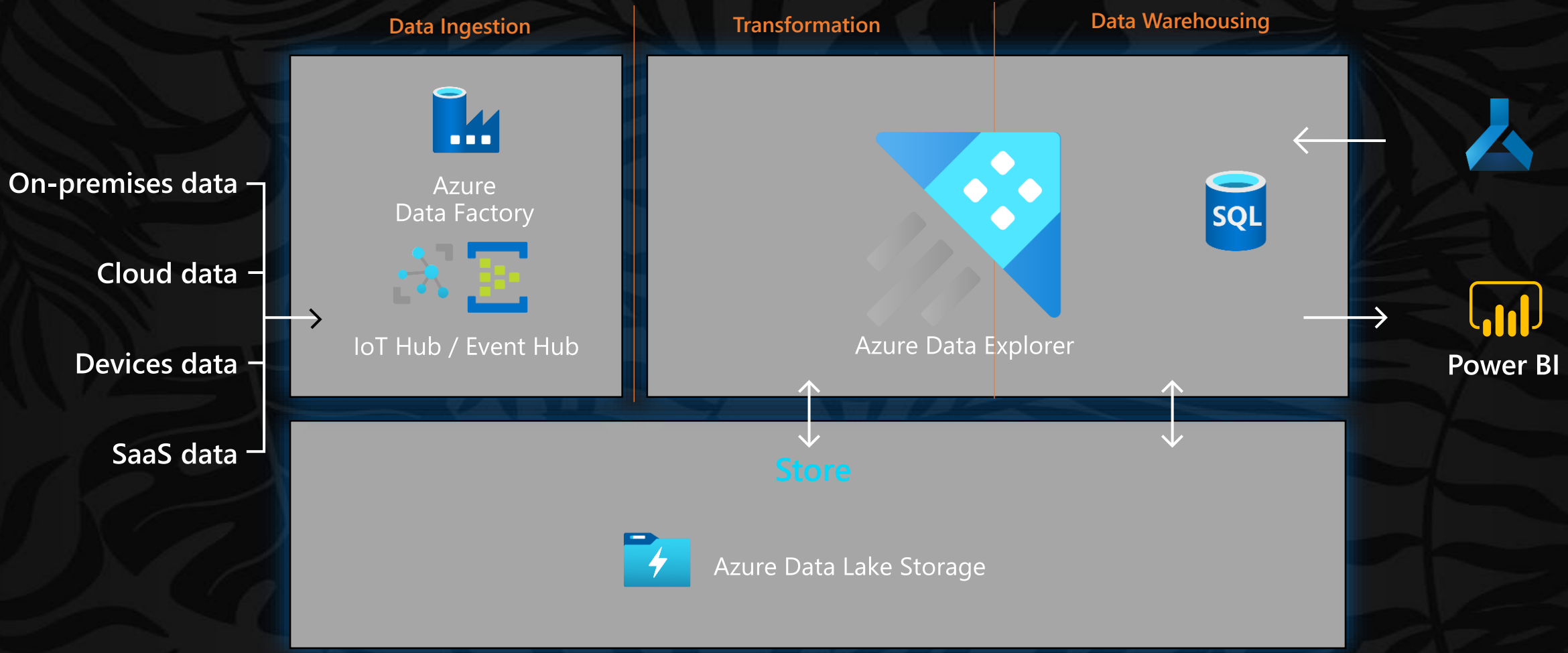
Query
BeerCheckins | where (brewery_country startswith "bel") | summarize nbrBeers=toint(countif(notnull(checkin_id))) by beer

Data Explorer – the hidden treasure of Azure analytic tools?

Typical data platform in Azure

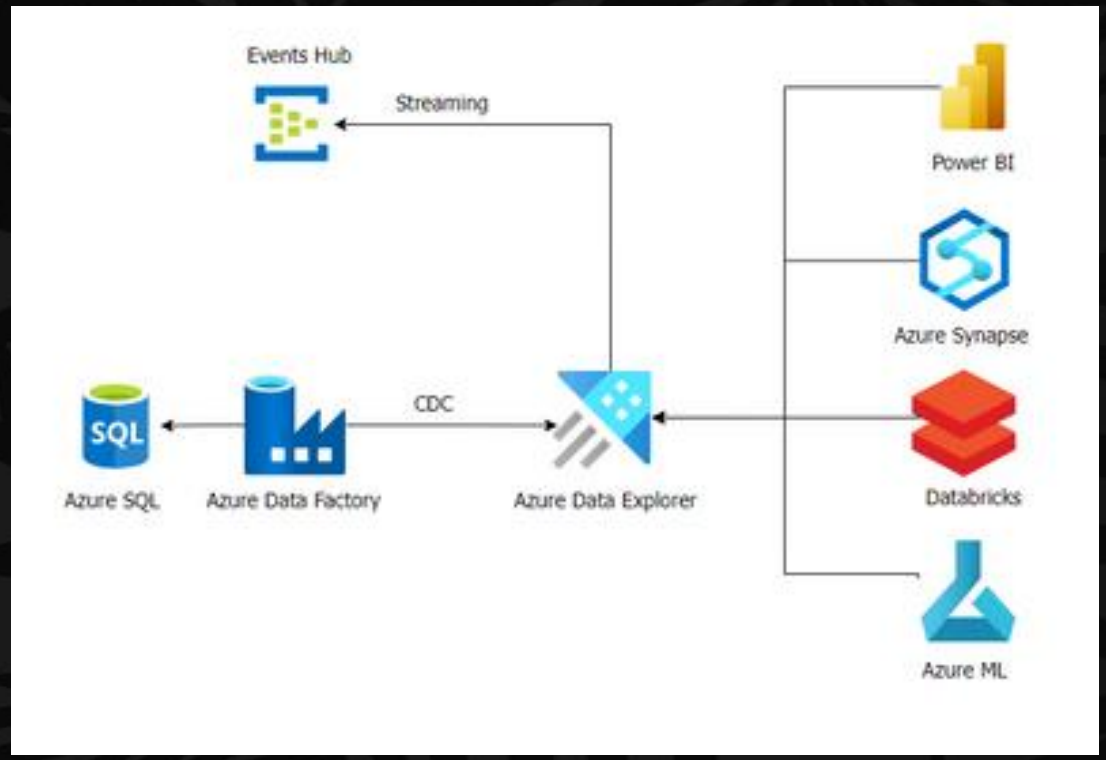


Azure Data Explorer



The benefits of Data Explorer

- Auto-ingest from event hubs
- Receive CDC & batch from Data Factory
- Continuous Export
- External Tables
- Materialized views
- Policies and retention to mimic SQL DB



DEMO

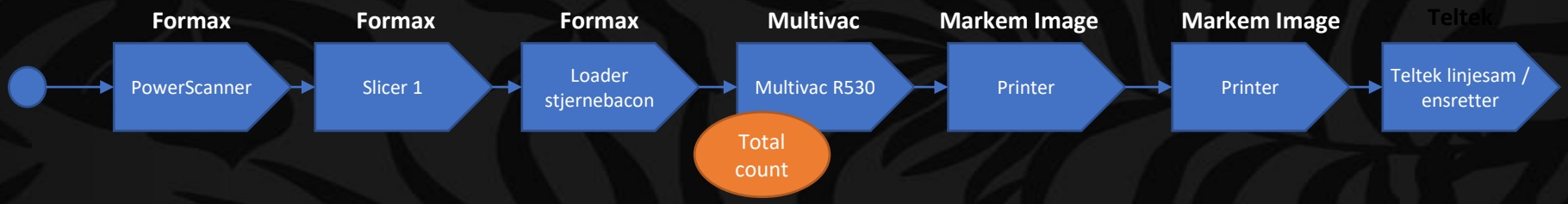
See, Indy – this is why…

Azure Data Explorer in an IoT scenario

Overall Equipment Efficiency

OEE identifies the percentage of manufacturing time that is truly productive.
100% is theoretical potential – if no failures, no breaks, no downtime

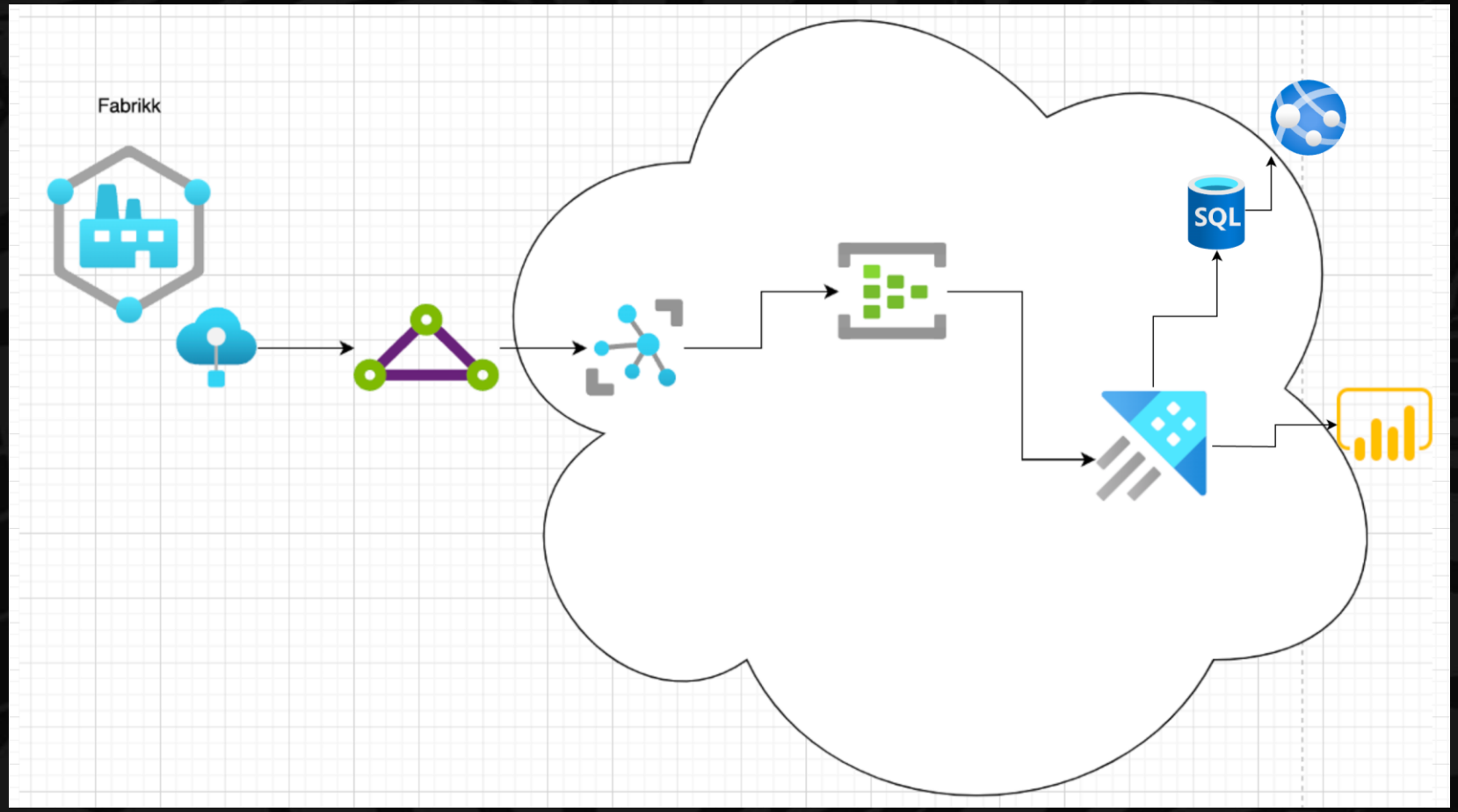




Solution

- Counter connected
- Simple counter – 1,2,3,4…
- Stop if same number repeated
- > 1 minute defined as stop
- Query collating timeseries, identifying stops – however…
- Customer demand for export every 2 minutes to webapp
- What if stop lasts longer?

Overall Equipment Efficiency

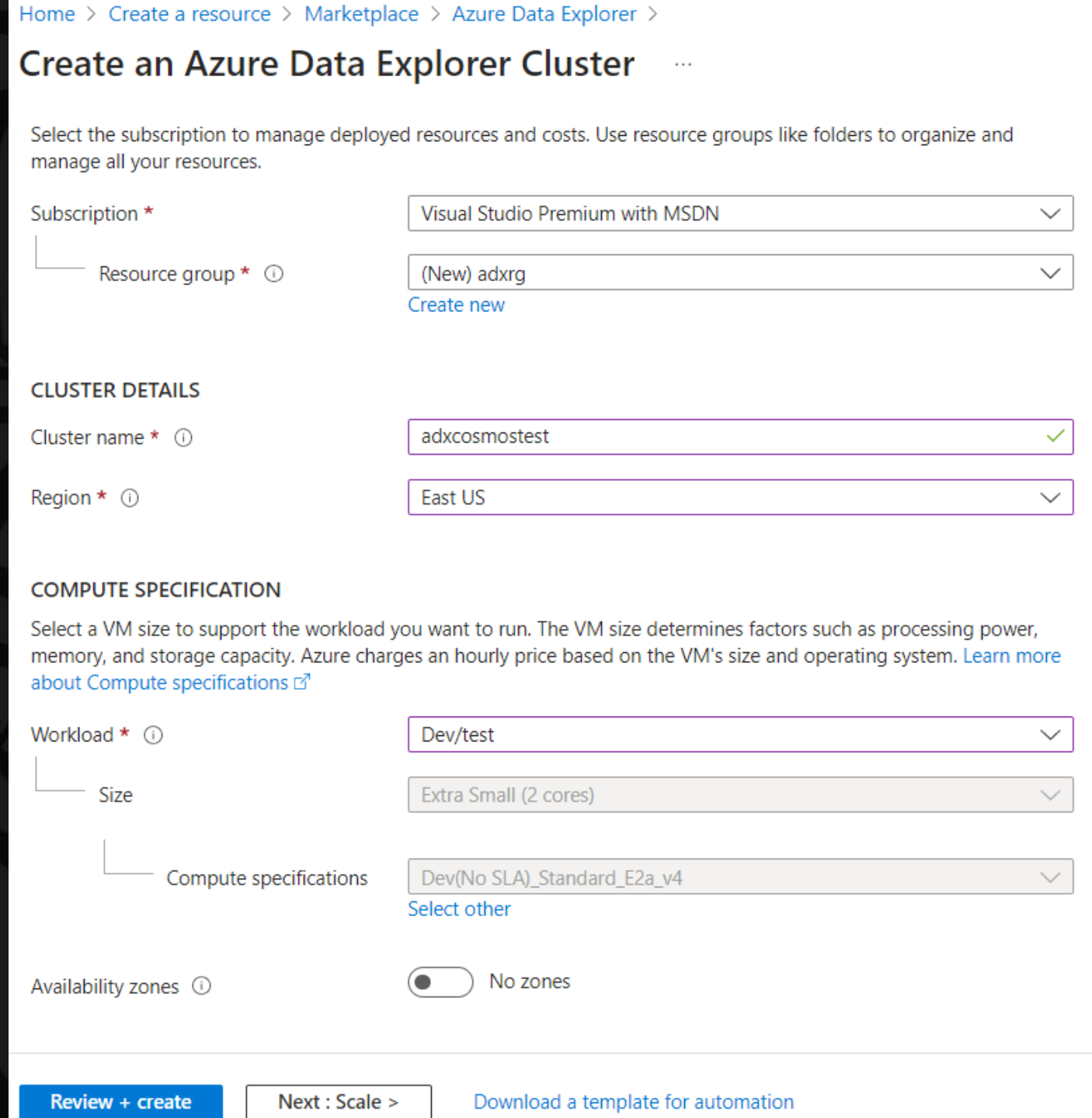


Azure Synapse Link from Azure Cosmos DB to ADX

(spoiler: it has nothing to do with Synapse)

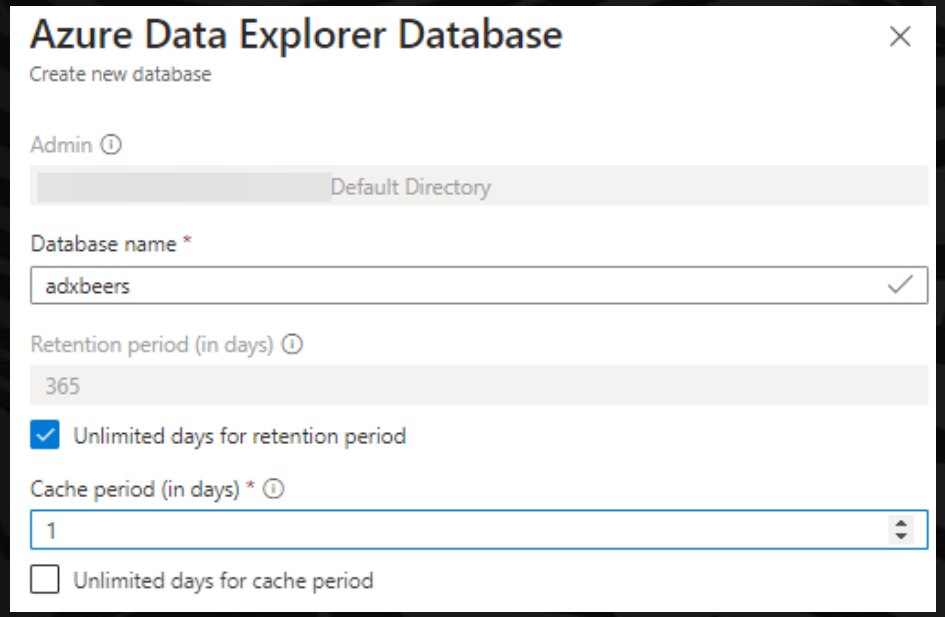
Synapse Link

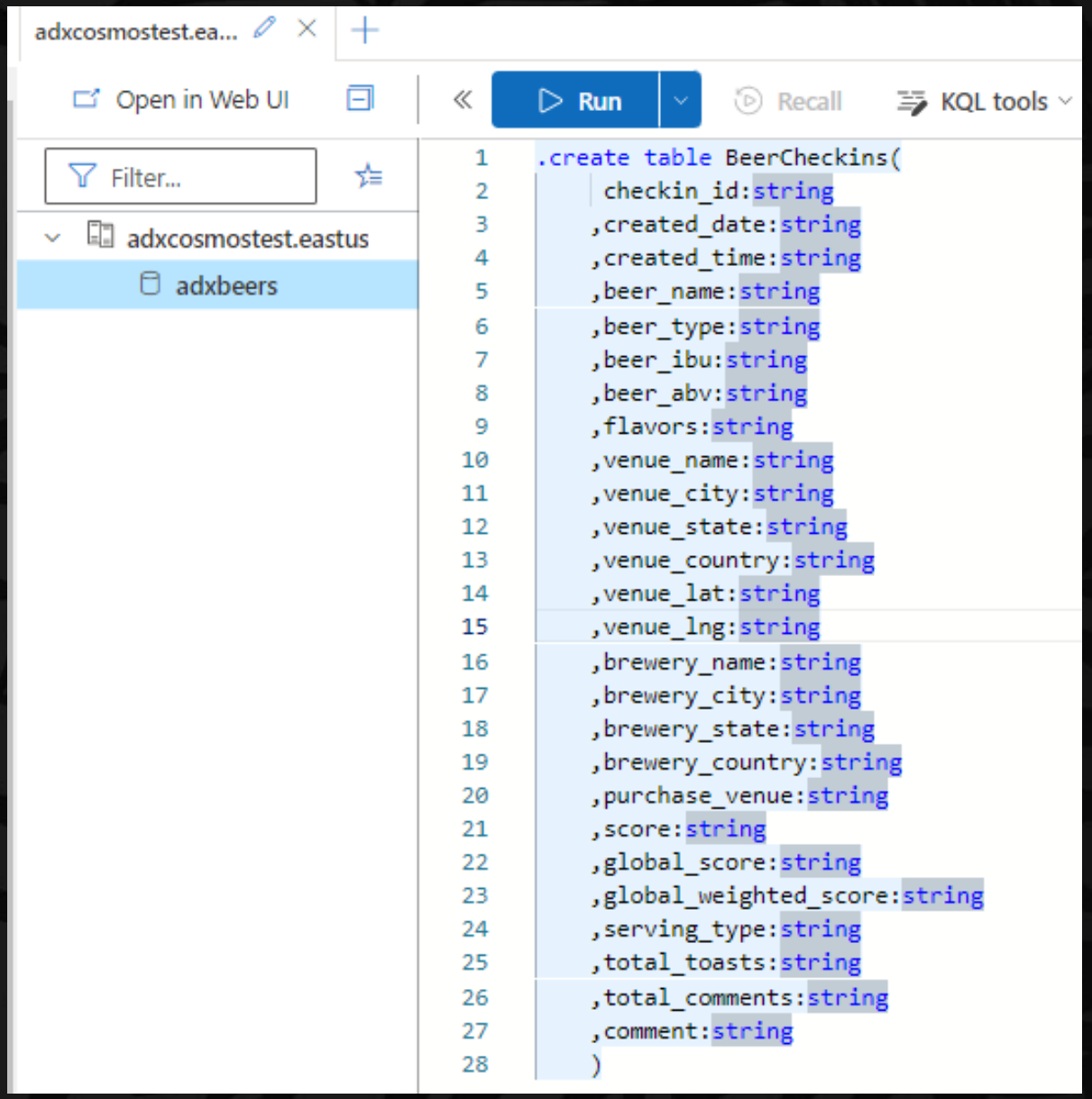
Create a cluster & database



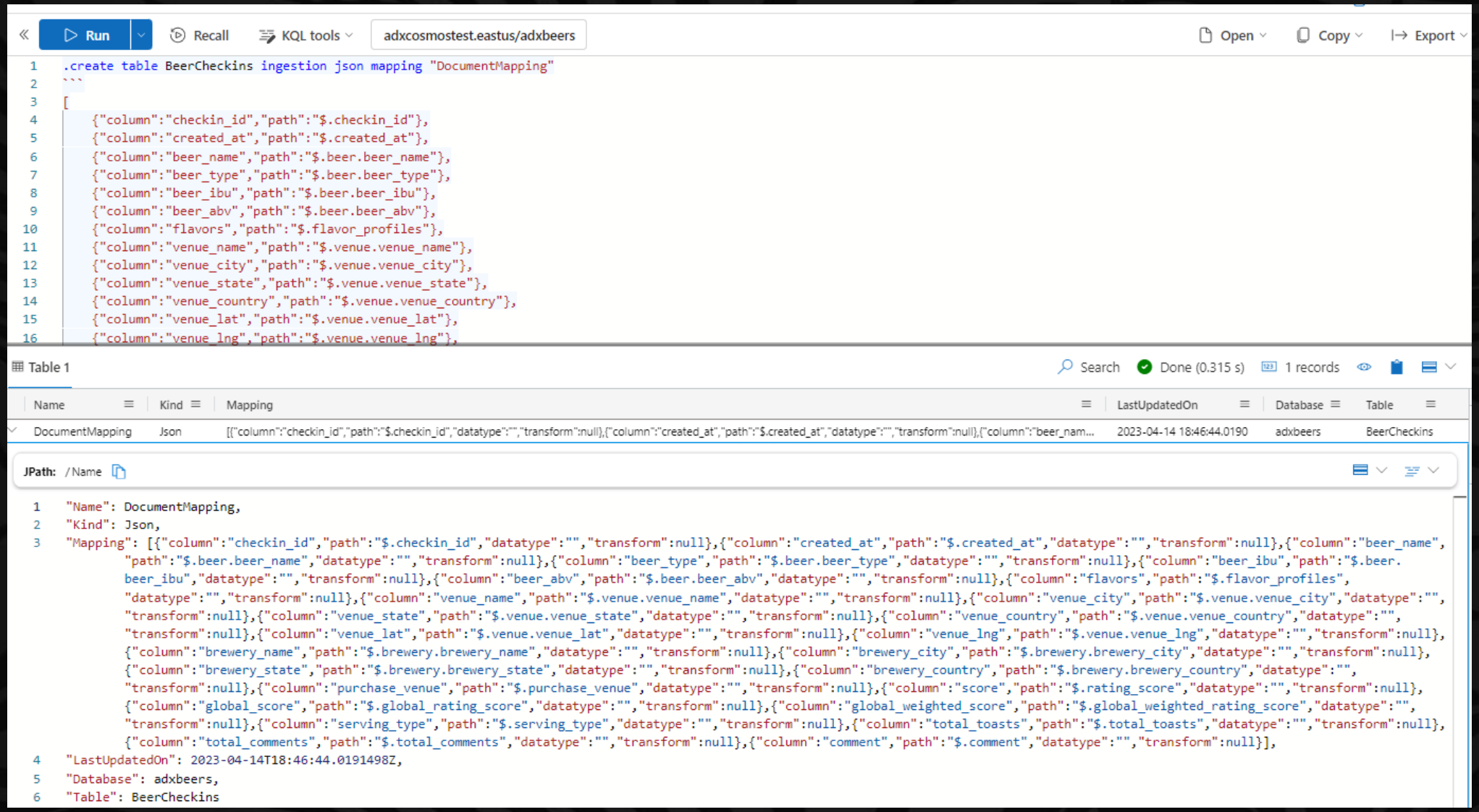
Waiting for the ADX cluster to start…

Synapse Link

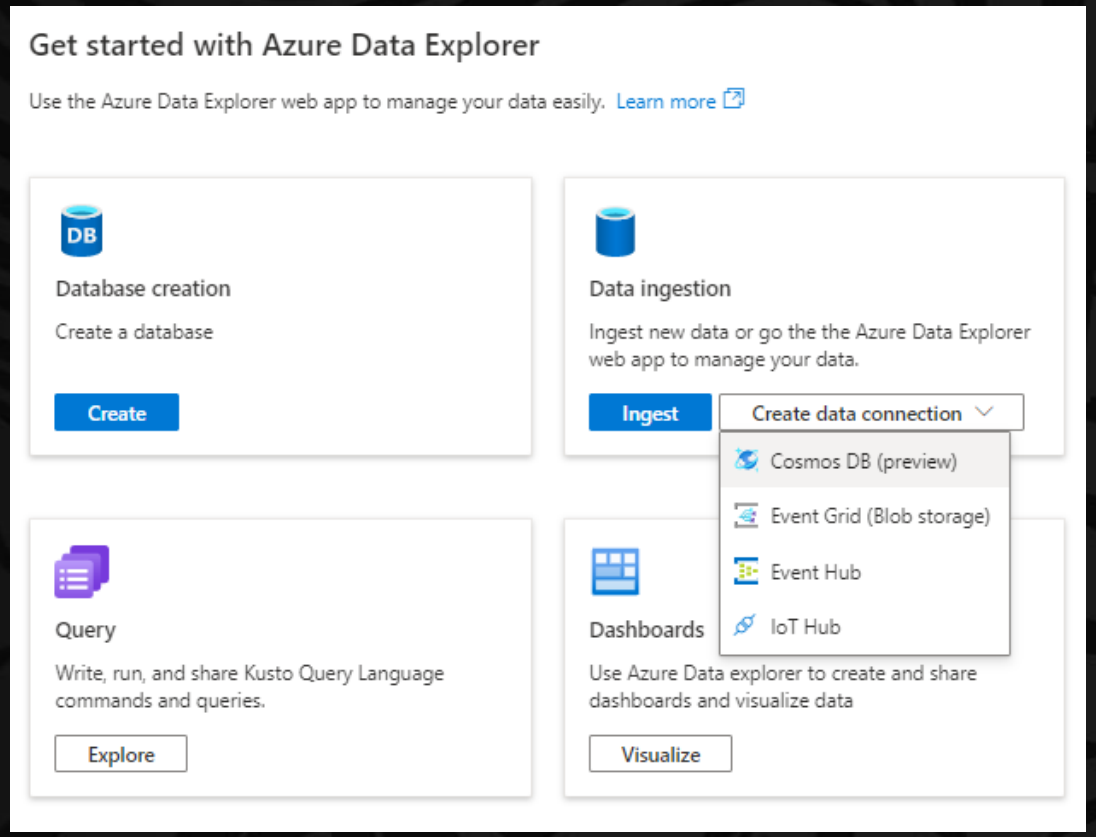


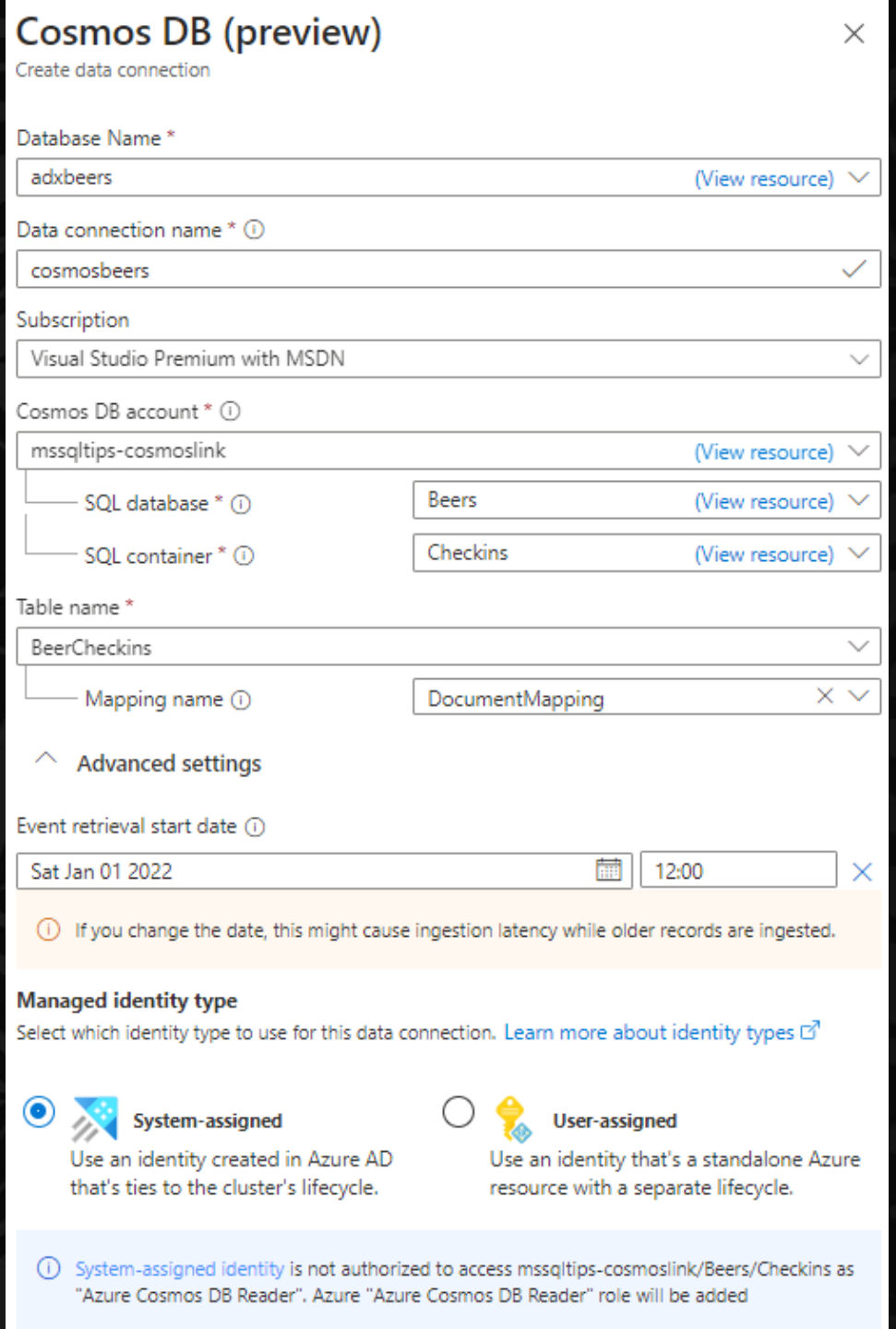


Synapse Link



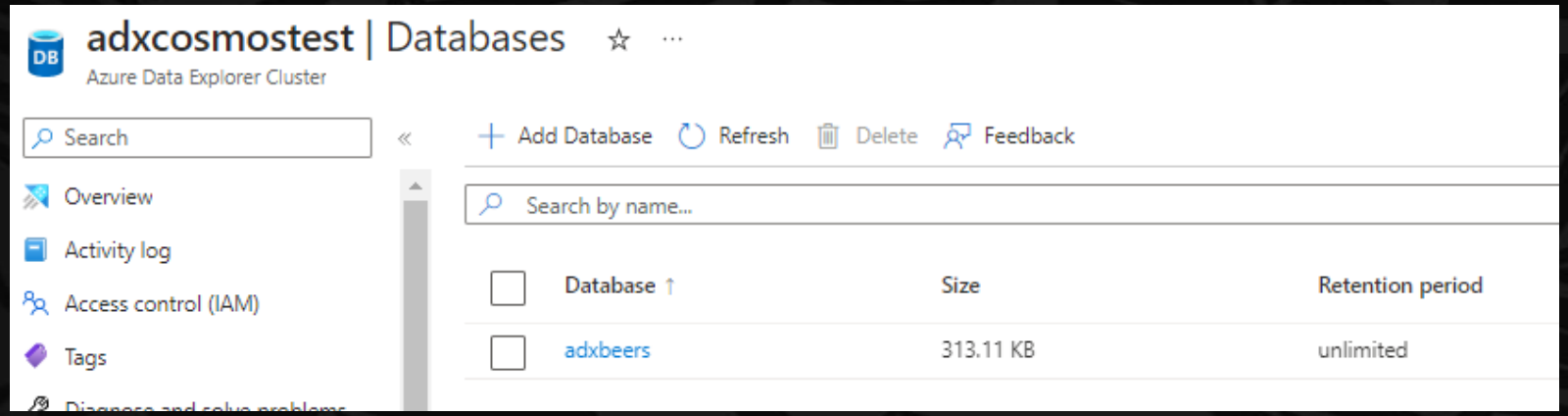
Synapse Link





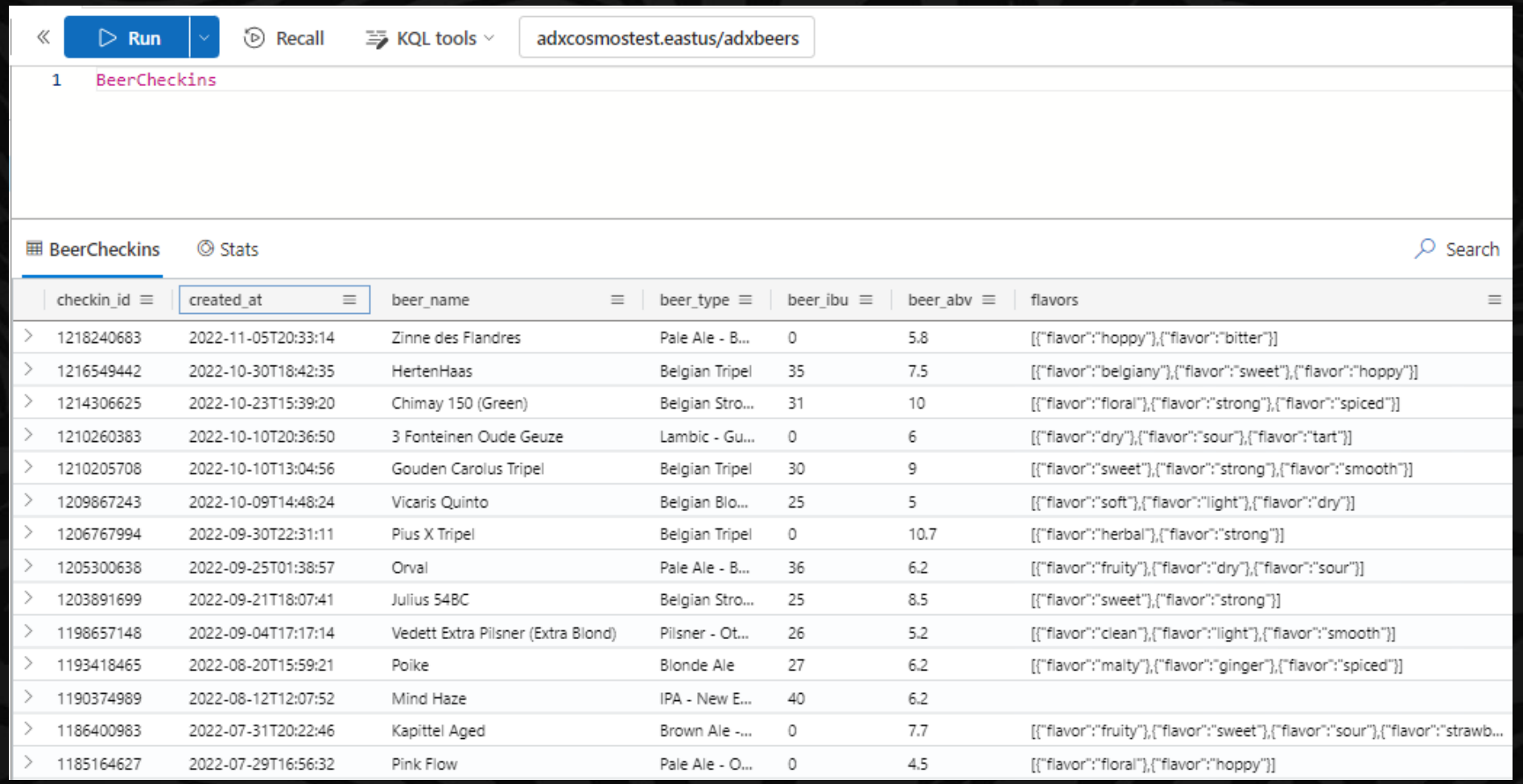
Synapse Link

data will be imported from the specified start date using Azure Cosmos DB change feed



when it’s imported, you can query it with KQL

profit!

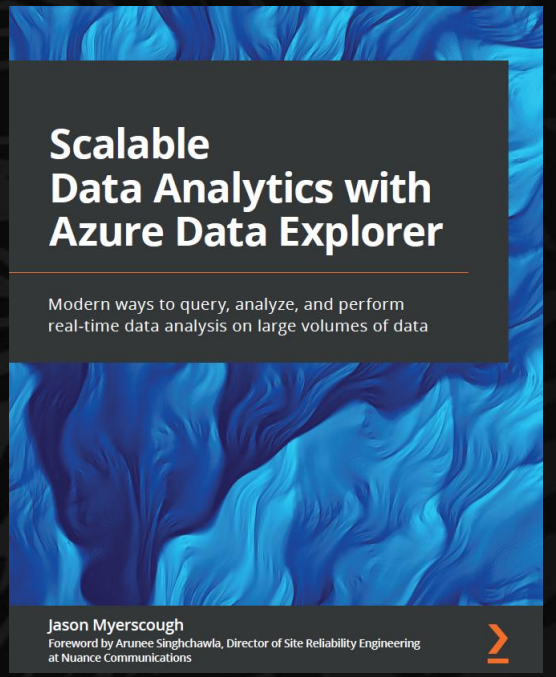


checkin_id	created_at	beer_name	beer_type	beer_ibu	beer_abv	flavors
1218240683	2022-11-05T20:33:14	Zinne des Flandres	Pale Ale - B...	0	5.8	[{"flavor":"hoppy"},{"flavor":"bitter"}]
1216549442	2022-10-30T18:42:35	HertenHaas	Belgian Tripel	35	7.5	[{"flavor":"belgiany"},{"flavor":"sweet"},{"flavor":"hoppy"}]
1214306625	2022-10-23T15:39:20	Chimay 150 (Green)	Belgian Stro...	31	10	[{"flavor":"floral"},{"flavor":"strong"},{"flavor":"spiced"}]
1210260383	2022-10-10T20:36:50	3 Fonteinen Oude Geuze	Lambic - Gu...	0	6	[{"flavor":"dry"},{"flavor":"sour"},{"flavor":"tart"}]
1210205708	2022-10-10T13:04:56	Gouden Carolus Tripel	Belgian Tripel	30	9	[{"flavor":"sweet"},{"flavor":"strong"},{"flavor":"smooth"}]
1209867243	2022-10-09T14:48:24	Vicaris Quinto	Belgian Blo...	25	5	[{"flavor":"soft"},{"flavor":"light"},{"flavor":"dry"}]
1206767994	2022-09-30T22:31:11	Pius X Tripel	Belgian Tripel	0	10.7	[{"flavor":"herbal"},{"flavor":"strong"}]
1205300638	2022-09-25T01:38:57	Orval	Pale Ale - B...	36	6.2	[{"flavor":"fruity"},{"flavor":"dry"},{"flavor":"sour"}]
1203891699	2022-09-21T18:07:41	Julius 54BC	Belgian Stro...	25	8.5	[{"flavor":"sweet"},{"flavor":"strong"}]
1198657148	2022-09-04T17:17:14	Vedett Extra Pilsner (Extra Blond)	Pilsner - Ot...	26	5.2	[{"flavor":"clean"},{"flavor":"light"},{"flavor":"smooth"}]
1193418465	2022-08-20T15:59:21	Poike	Blonde Ale	27	6.2	[{"flavor":"malty"},{"flavor":"ginger"},{"flavor":"spiced"}]
1190374989	2022-08-12T12:07:52	Mind Haze	IPA - New E...	40	6.2	
1186400983	2022-07-31T20:22:46	Kapittel Aged	Brown Ale -...	0	7.7	[{"flavor":"fruity"},{"flavor":"sweet"},{"flavor":"sour"},{"flavor":"strawb...
1185164627	2022-07-29T16:56:32	Pink Flow	Pale Ale - O...	0	4.5	[{"flavor":"floral"},{"flavor":"hoppy"}]

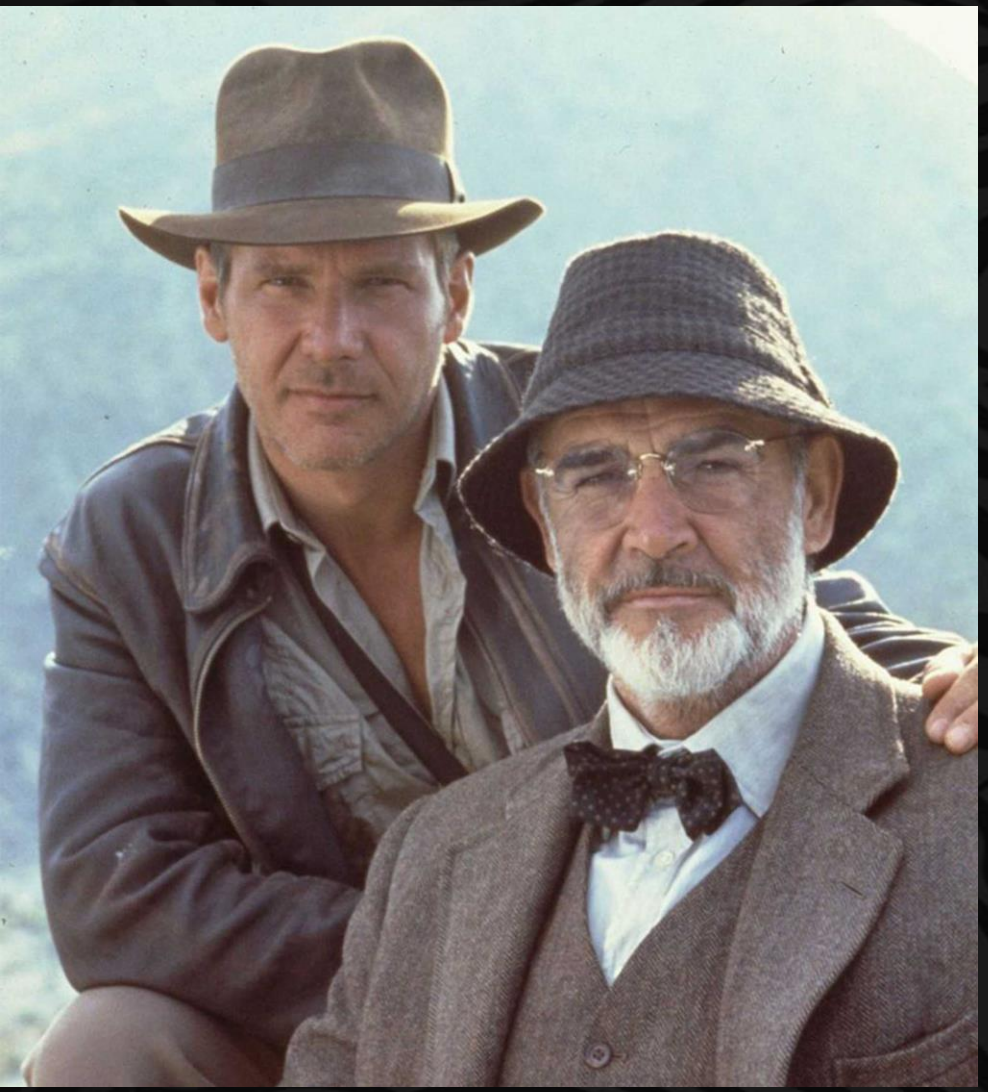
SUCCESS!

Resources

- ADX in a day – GitHub
- Kusto Detective Agency
- The Most Powerful Azure Service You've Never Heard Of – SQLBits
- Get started with Real-Time Analytics in Microsoft Fabric – Microsoft Learn
- Start for free with ADX
- Building a Data Lakehouse using Azure Data Explorer



Thank you for coming!



https://bit.ly/dMC2023_SessionFeedback