

# From SQL to KQL via Azure Data Explorer



Data Saturday - Denmark

Thomas Hütter

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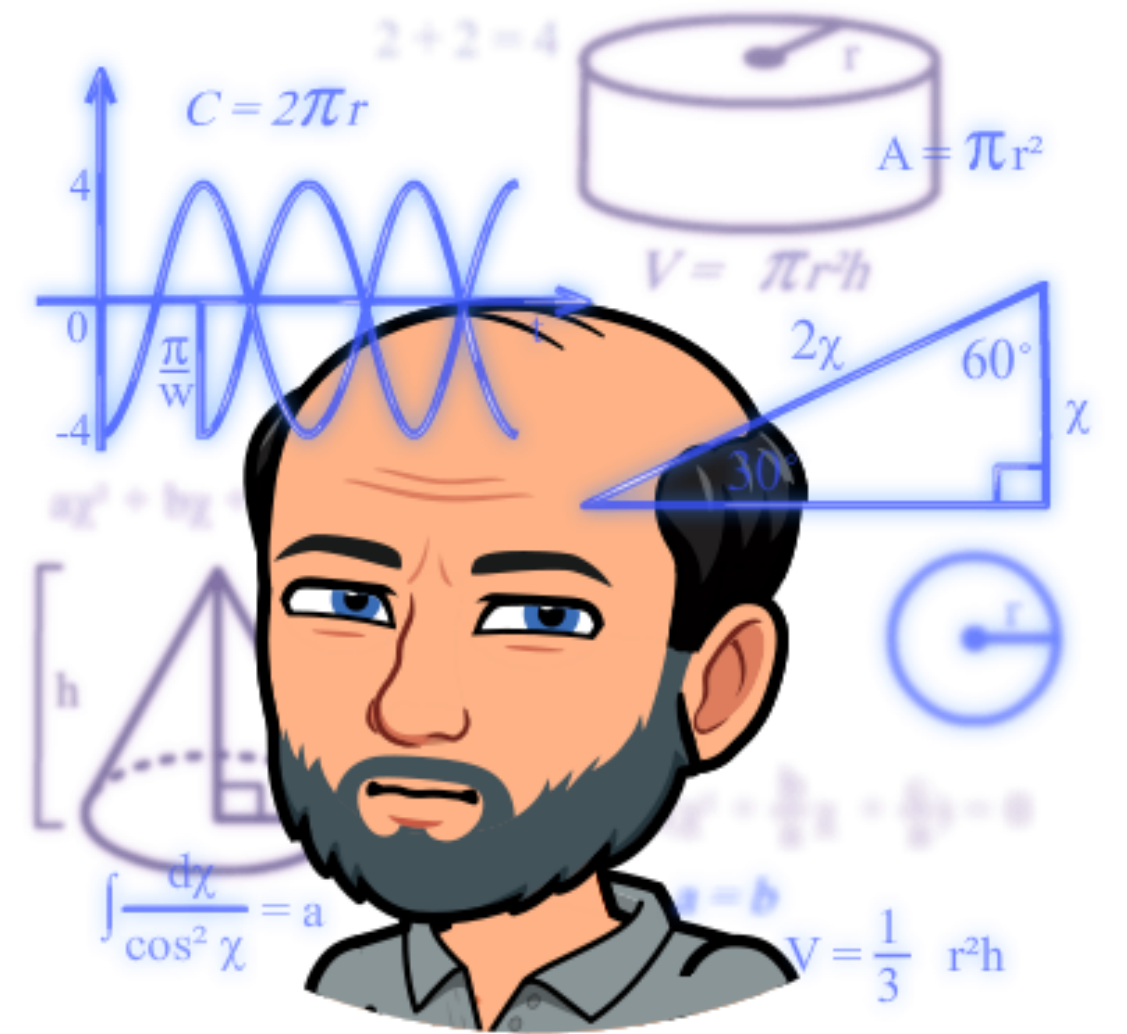
**SILVER**  
Solution



**BIWISSE**  
BUSINESS INTELLIGENCE



# From SQL to KQL via Azure Data Explorer



Thomas Hütter

Data Saturday Denmark  
Lyngby - 2025-02-08



# From SQL to KQL via Azure Data Explorer

Thomas Hütter, Diplom-Betriebswirt

- Developer for ERP apps, SQL scripts and BI stuff
- Worked at consultancies, ISVs, end user companies
- 1995: SQL Server, 2014: R, 2020: Power\*, 2024: Arduino
- Speaker at SQL / data / dev events around Europe



 @DerFredo <https://twitter.com/DerFredo>

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# Agenda

- Where we come from: SQL - Structured Query Language
- Starring: the `SELECT` statement
- Where we are going: KQL - Kusto Query Language
- Helping us along the way: ADX - Azure Data Explorer
- Hands-on examples: KQL in action
- Next level: visualizations, dashboards, time series
- Round-up, resources, learning

# Where we come from: SQL - Structured Query Language

- The Structured Query Language (SQL for short) is a set-based declarative, domain-specific, cross-platform 4GL language that was first released by IBM in 1974.
- Based upon relational algebra and tuple calculus  
(👉 Edgar F. Codd's relational model of data).
- It is mainly used for managing relational data in an RDBMS.
- Standardized by ISO and ANSI, latest version ISO/IEC 9075:2023 or SQL:2023, but all the vendors roll their own set of additions, extensions, omissions to the standard.
- The concept of NULL values enforces 3-valued logic.
- Whitespace is generally ignored, allowing to format for good readability.

# Where we come from: SQL - Structured Query Language

Lately, SQL has been divided into 4 sublanguages:

- **DCL - Data Control Language**  
GRANT, DENY, REVOKE
- **DDL - Data Definition Language**  
CREATE, DROP, ALTER, TRUNCATE
- **DML - Data Manipulating Language**  
INSERT, UPDATE, DELETE
- **DQL - Data Query Language**  
SELECT



# Starring: the `SELECT` statement

The `SELECT` statement and its clauses:

- 5. **SELECT** (8. **TOP** <n> | 6. **DISTINCT**) <columns>, <aggregates>
- 1. **FROM** <table1>  
(<jointype> **JOIN** <table2> **ON** <join\_condition> ...)
- 2. **WHERE** <constraint>
- 3. **GROUP BY** <column\_list>
- 4. **HAVING** <constraint\_on\_group>
- 7. **ORDER BY** <column\_list> (**ASC** | **DESC**)
- 8. **LIMIT** <n> / **OFFSET** <m>



# Starring: the SELECT statement

CONNECTIONS

SERVICES

localhost, <default> (sa)

Databases

System Databases

AdventureWorks2017

AdventureWorks2019

AdventureWorks2022

JsonDemo

Security

Server Objects

AWS

Azure

ADXFree (Thomas)

ADXDemo

Local

KQLDemo.sql - localh...22 (sa) ×

KQLDemo.kql - disconnected

Users > Thomas > Sessions > 14 From SQL to KQL via ADX > 202309\_SQLKonferenz > KQLDemo.sql

Run

Cancel

Disconnect

Change

Database: AdventureWorks2022

Estimated Plan

Enable Actual Plan

Parse

Enable SQLCMD

To Notebook

1

-- ©2023 Thomas Hütter, this script is provided as-is for demo and educational use only,

2

-- without warranty of any kind for any other purposes, so run at your own risk!

3

4

USE AdventureWorks2022;

5

6

SELECT @@VERSION;

7

8

SELECT TOP 10 \*

9

FROM [Sales].[SalesOrderHeader];

10

11

SELECT TOP 10 SalesOrderNumber, CustomerID, TerritoryID, TotalDue

12

FROM [Sales].[SalesOrderHeader];

13

14

SELECT TOP 10 Head.SalesOrderNumber, Cust.CustomerID, Pers.FirstName, COALESCE(Pers.MiddleName, '') AS MiddleName, Pers.LastName, Head.TotalDue

15

FROM [Sales].[SalesOrderHeader] Head

16

JOIN [Sales].[Customer] Cust ON Cust.CustomerID = Head.CustomerID

17

JOIN [Person].[Person] Pers ON Pers.BusinessEntityID = Cust.PersonID;

18

Results

Messages

	SalesOrderNumber	CustomerID	TerritoryID	TotalDue
1	S043659	29825	5	23153,2339
2	S043660	29672	5	1457,3288
3	S043661	29734	6	36865,8012
4	S043662	29994	6	32474,9324
5	S043663	29565	4	472,3108
6	S043664	29898	1	27510,4109
7	S043665	29580	1	16158,6961
8	S043666	30052	4	5694,8564
9	S043667	29974	3	6876,3649
10	S043668	29614	6	40487,7233

Ln 11, Col 1 (98 selected)

Spaces: 4

UTF-8

LF

SQL

10 rows

Choose SQL Language

00:00:00

localhost : AdventureWorks2022

# Where we are going: KQL - Kusto Query Language

- Kusto\* Query Language (KQL) is  
„... the query language used by Azure Data Explorer, Real-Time Analytics in Microsoft Fabric, Log Analytics in Azure Monitor, Microsoft Sentinel, Microsoft 365 Defender, Azure Resource Graph, and Resource Manager, among other Microsoft products. Querying data using KQL lets you gain insights about your IT, business, and security from large data sets you collect, in near real-time.“
- A Kusto query is  
a read-only request to the query engine to process data, stated in plain-text, which will be evaluated top-down and can consist of one or more statements, separated by a semicolon (;).
- A query statement can be  
a tabular expression, a „let“ statement or a „set“ statement; statements are separated by a pipe (|).
- A management / control command  
is used to retrieve/modify metadata or objects, ingest or export data etc...;  
always starts with a period (.); result may be piped as input to a query.

\*: Why „Kusto“? Think of Jacques Cousteau diving the oceans to find hidden treasures 🤔

# Where we are going: KQL - Kusto Query Language

- A tabular expression  
is usually composed of a tabular data source (often a table reference or a table literal), tabular data operators such as filters or projections, optional rendering operators; each step connected by a pipe (|), expecting tabular input and providing tabular output (except graphic renderers).
- A rendering statement  
is used to render the result into a graphical output - generate a visualization ( usually the last statement in a query ).
- A „let“ statement  
defines a named variable that can hold a scalar or tabular value, a function or a virtual table.
- A „set“ statement  
sets an option value, valid for the scope of the query.

# Helping us along the way: ADX - Azure Data Explorer

- Azure Data Explorer (ADX ) is  
„... a fully managed, high-performance, big data analytics platform that makes it easy to analyze high volumes of data in near real time. The Azure Data Explorer toolbox gives you an end-to-end solution for data ingestion, query, visualization, and management.“
- ADX allows for advanced analytics, including versatile data visualization, using a user-friendly (i.e. easy to read, understand and learn) query language.
- Probably is „The most powerful Azure service you’ve never heard of“ (Patrick LeBlanc)
- Can be tried without costs by using the ADX „free cluster“ option.
- Alternatives: Kusto.Explorer (Windows app),  
Kusto extension for Azure Data Studio (which is being deprecated)



# Helping us along the way: ADX - Azure Data Explorer

Azure Data Explorer

Home

Data

Query

Dashboards

My cluster

DemoCluster.Hanau2023

KQLDemo.kql

2

Run

Recall

KQL tools

DemoCluster/Hanau2023

Pin to dashboard

Open

Copy

Export

Filter...

DemoCluster

Hanau2023

help

ContosoSales

FindMyPartner

SampleIoTData

SampleLogs

SampleMetrics

Samples

SecurityLogs

Trender

```
1 // ©2023 Thomas Hütter, this script is provided as-is for demo and educational use only,
2 // without warranty of any kind for any other purposes, so run at your own risk!
3 // Connection DemoCluster, database Hanau2023
4
5 SalesHeader
6 | take 10;
7
8 SalesHeader
9 | project SalesOrderNumber, CustomerID, TerritoryID, TotalDue
10 | take 10;
11
12 SalesHeader
13 | join kind=inner Customer on $left.CustomerID == $right.CustomerID
14 | join kind=inner Person on $left.PersonID == $right.BusinessEntityID
15 | project SalesOrderNumber, CustomerID, FirstName, MiddleName, LastName, TotalDue
16 | take 10;
17
18 SalesHeader
19 | join kind=inner Customer on $left.CustomerID == $right.CustomerID
20 | join kind=inner Person on $left.PersonID == $right.BusinessEntityID
21 | join kind=inner Territory on $left.TerritoryID == $right.TerritoryID
22 | project SalesOrderNumber, CustomerID, FirstName, MiddleName, LastName, Country=CountryRegionCode, Territory=Name, TotalDue
23 | where Country == 'DE';
24
25 SalesHeader
26 | join kind=inner Customer on $left.CustomerID == $right.CustomerID
27 | join kind=inner Person on $left.PersonID == $right.BusinessEntityID
28 | join kind=inner Territory on $left.TerritoryID == $right.TerritoryID
29 | join kind=inner ShipmentMethod on $left.ShipMethodID == $right.ShipMethodID
30 | summarize OrderCount = count(), TotalWorth = sum(TotalDue) by Country=CountryRegionCode, Territory=Name, ShipBy=Name1;
```

Table 1

Add visual

Stats

Search

UTC

Done (0.116 s)

10 records

Columns

	SalesOrderNumber	CustomerID	TerritoryID	TotalDue
>	SO43659	29,825	5	23,153.2339
>	SO43660	29,672	5	1,457.3288
>	SO43661	29,734	6	36,865.8012
>	SO43662	29,994	6	32,474.9324
>	SO43663	29,565	4	472.3108
>	SO43664	29,898	1	27,510.4109
>	SO43665	29,580	1	16,158.6961
>	SO43666	30,052	4	5,694.8564
>	SO43667	29,974	3	6,876.3649
>	SO43668	29,614	6	40,487.7233

# ADX - Alternative 1: Kusto.Explorer

HomeFileConnectionsViewToolsMonitoringManagementHelp

Query

Query and Results To Clipboard

Result To Clipboard

Query To Clipboard

New Tab

Share

Area Chart

Stacked Area Chart

Anomaly Chart

Scatter Chart

Column Chart

Time Chart

Pie Chart

Pivot Chart

Bar Chart

Line Chart

Time Ladder

Time Pivot

Visualizations

Full View Mode

Hide Empty Columns

Collapse Singular Columns

Explore Column Values

Increase Font

Decrease Font

View

Keyboard Shortcuts

Report Issue

Help

Connections

3 [Connections]

2 [DemoCluster.Hanau2023]

1 [DemoCluster.Hanau2023]

[DemoCluster.Hanau2023]

cluster('kvc[redacted]heurope.kusto.windows.net').datab[redacted]

Unlocked

1 SalesHeader

2 | take 10;

Name

Details

[Type for filtering]

Connections

C:\Users\vm\AppData

DemoCluster

https://kvc[redacted]

Hanau2023

Customer

Person

Product

SalesDetail

SalesHea...

Shipment...

Terr2

Territory

SalesOrderID	RevisionNumber	OrderDate	DueDate	ShipDate	Status	OnlineOrderFlag	SalesOrderNumber	PurchaseOrderNumber	AccountNumber	CustomerID	Si
43659	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43659	PO522145787	10-4020-000676	29825	
43660	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43660	PO18850127500	10-4020-000117	29672	
43661	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43661	PO18473189620	10-4020-000442	29734	
43662	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43662	PO18444174044	10-4020-000227	29994	
43663	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43663	PO18009186470	10-4020-000510	29565	
43664	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43664	PO16617121983	10-4020-000397	29898	
43665	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43665	PO16588191572	10-4020-000146	29580	
43666	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43666	PO16008173883	10-4020-000511	30052	
43667	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43667	PO15428132599	10-4020-000646	29974	
43668	8	2011-05-31 00:00:00.0000000	2011-06-12 00:00:00.0000000	2011-06-07 00:00:00.0000000	5	0	SO43668	PO14732180295	10-4020-000514	29614	

Record 1 of 10

Done (00:00.359): 10 records

SUM: 43.659

Results

Query Summary

QueryCompletionInformation

Issues: (0)

https://kvc[redacted]heurope.kusto.windows.net/Hanau2023

UTC: 2023-08-31 09:51:47



# ADX - Alternative 2: Kusto extension for Azure Data Studio

CONNECTIONS

SERVERS

localhost, <default> (sa)

AWS

Azure

ADXFree (Thomas)

ADXDemo

Hanau2023

Customer

Person

Product

SalesDetail

SalesHeader

ShipmentMethod

Terr2

Territory

Local

KQLDemo.sql - disconnected

KQLDemo.kql - https...ft.com)

ADXDemo:Hanau2023

Users > Thomas > Sessions > 14 From SQL to KQL via ADX > 202309\_SQLKonferenz > KQLDemo.kql

Run

Cancel

Disconnect

Change

Database: Hanau2023

30

31 SalesHeader

32 | project SalesOrderID, RevisionNumber, OrderDate, DueDate, ShipDate, Status, OnlineOrderFlag, SalesOrderNumber, PurchaseOrderNumber, AccountNumber, CustomerID, SalesPersonID, TerritoryID, BillToAddressID

33 | take int(10)

34

35 SalesHeader

36 | take 10;

37

38 SalesHeader

39 | project SalesOrderNumber, CustomerID, TerritoryID, TotalDue

40 | take 10;

41

42 explain

43 SELECT TOP 10 Head.SalesOrderNumber, Cust.CustomerID, Pers.FirstName, COALESCE(Pers.MiddleName, '') AS MiddleName, Pers.LastName, Head.TotalDue

44 FROM [SalesHeader] Head

45 JOIN [Customer] Cust ON Cust.CustomerID = Head.CustomerID

46 JOIN [Person] Pers ON Pers.BusinessEntityID = Cust.PersonID;

47

48

Results

Messages

	SalesOrderID	RevisionNumber	OrderDate	DueDate	ShipDate	Status	OnlineOrderFlag	SalesOrderNumber	PurchaseOrderNumber	AccountNumber
1	43659	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043659	P0522145787	10-4020-000676
2	43660	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043660	P018850127500	10-4020-000117
3	43661	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043661	P018473189620	10-4020-000442
4	43662	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043662	P018444174044	10-4020-000227
5	43663	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043663	P018009186470	10-4020-000510
6	43664	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043664	P016617121983	10-4020-000397
7	43665	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043665	P016588191572	10-4020-000146
8	43666	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043666	P016008173883	10-4020-000511
9	43667	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043667	P015428132599	10-4020-000646
10	43668	8	2011-05-31 00:00:00	2011-06-12 00:00:00	2011-06-07 00:00:00	5	0	S043668	P014732180295	10-4020-000514

0 0 0

Ln 35, Col 1 (22 selected) Spaces: 4 UTF-8 with BOM LF Kusto 10 rows Choose SQL Language 00:00:00 https://kvc

europe.kusto.windows.net : Hanau2023

# Hands-on examples: KQL in action

- Understands a limited subset of T-SQL
- „Explain“ function translates SQL to KQL ( also limited 😞 )
- Observe special behavior:
  - default sort order: descending
  - default equality check: case-sensitive ( case-insensitive with `=~` )
  - `union` allows for differing table schemas
  - `search` works on *all* columns in a table ( default case-*insensitive* )
  - `ago` allows for dynamic time intervals
  - ...



## Next level: visualizations, dashboards, time series

- Visualizations? Yes, easy, just add a `render` clause at the end of your query 😊.
- Several types of visualization possible, including maps ( geospatial clustering ).
- Then „Pin to dashboard“ does exactly that.
- Dashboards can be filtered, even dynamically.
- Dashboards can be exported and shared with others in your org ( tenant ).
- Built-in time series analysis capabilities
- Graphical analysis, anomaly detection, decomposition, forecasting

# Resources:

- KQL overview: <https://learn.microsoft.com/en-us/azure/data-explorer/kusto/query/>
- SQL to Kusto cheat sheet: <https://learn.microsoft.com/en-us/azure/data-explorer/kusto/query/sqlcheatsheet>
- Azure Data Explorer: <https://learn.microsoft.com/en-us/azure/data-explorer/data-explorer-overview>
- ADX free cluster: <https://dataexplorer.azure.com/freecluster>
- Visualization overview: <https://learn.microsoft.com/en-us/azure/data-explorer/viz-overview>,  
dashboards: <https://learn.microsoft.com/en-us/azure/data-explorer/azure-data-explorer-dashboards>
- Microsoft learning paths: <https://learn.microsoft.com/en-us/training/paths/kusto-query-language/>,  
<https://learn.microsoft.com/en-us/training/paths/data-analysis-data-explorer-kusto-query-language/>,  
<https://learn.microsoft.com/en-us/training/paths/analyze-monitoring-data-with-kql/>
- ADX-in-a-day: <https://github.com/Azure/ADX-in-a-Day>

---

Session ‘Kusto: Diving For Insights in the Data Ocean’

by Abhinav Jayanty and Thomas Sykes - today at 14:30 in this room

# From SQL to KQL via Azure Data Explorer

Thank you for your time and interest & keep in touch:

 X @DerFredo <https://twitter.com/DerFredo>

 [de.linkedin.com/in/derfredo](https://de.linkedin.com/in/derfredo)

 <https://bsky.app/profile/derfredo.bsky.social>

This file and the demo scripts can be found at:

<https://bit.ly/DerFredoLyngby2025>

