

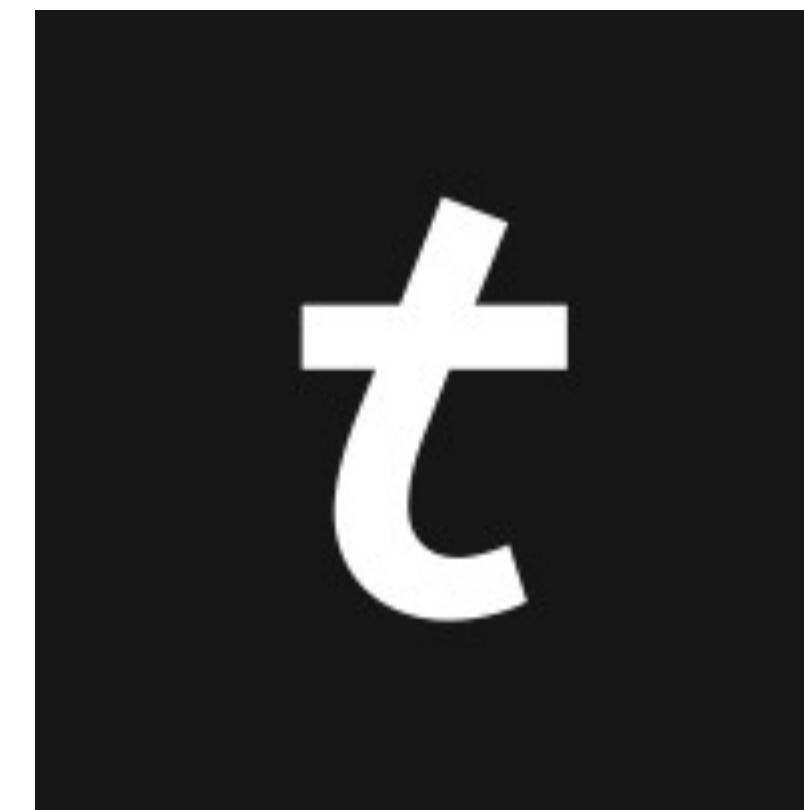
From SQL to KQL via Azure Data Explorer



Data Saturday - Denmark

Thomas Hütter

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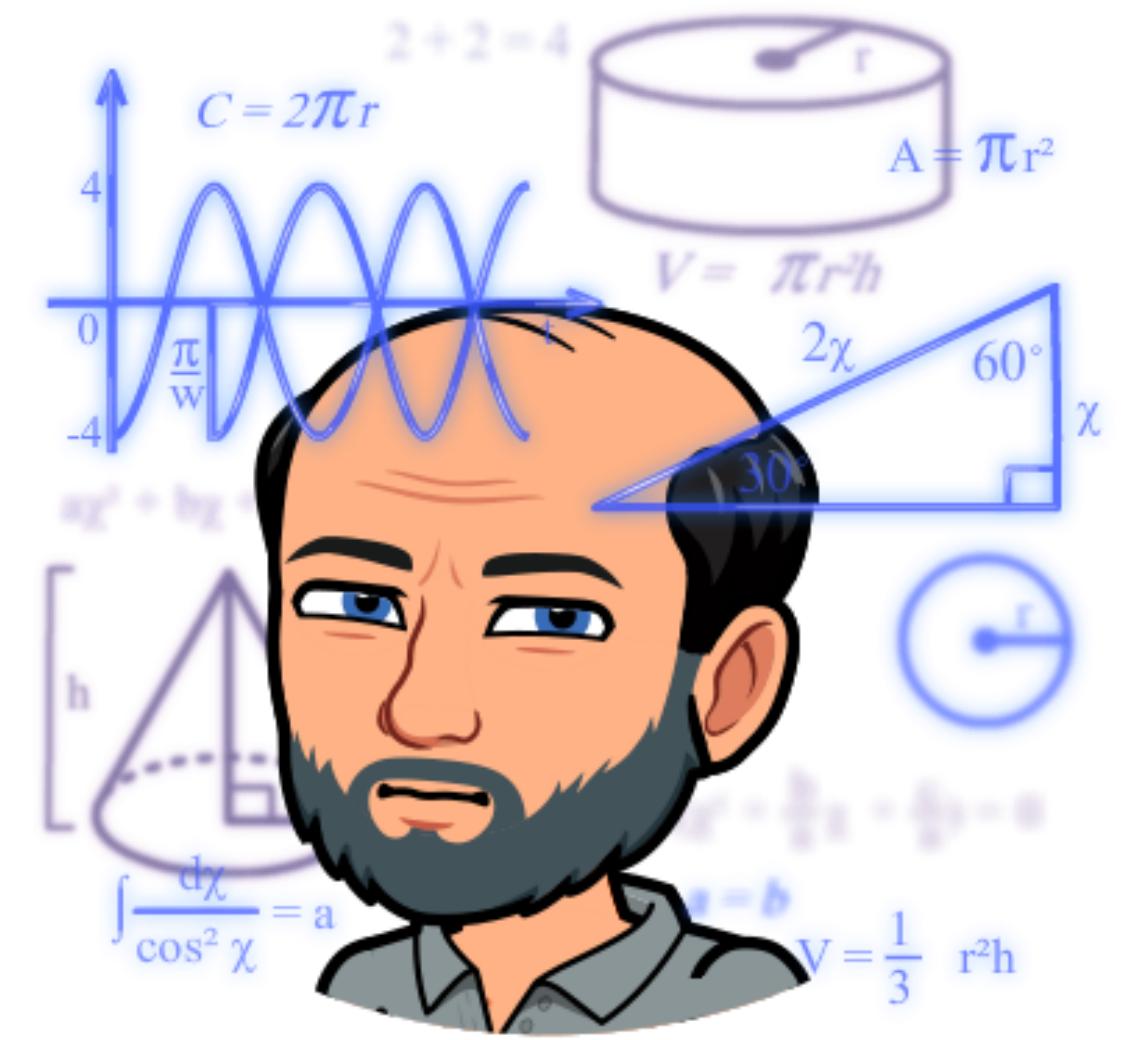
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From SQL to KQL via Azure Data Explorer



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



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sqlbits

{ } NDC
Conferences



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 it's 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

KQLDemo.sql - localhost.AdventureWorks2022 (sa)

Connections

Servers

- localhost, <default> (sa)
 - Databases
 - System Databases
 - AdventureWorks2017
 - AdventureWorks2019
 - AdventureWorks2022**
 - JsonDemo
 - Security
 - Server Objects
 - AWS
- Azure
 - ADXFree (Thomas)
 - ADXDemo
- Local

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;
```

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

The screenshot shows the Azure Data Explorer interface. The left sidebar has navigation links: Home, Data, Query (which is selected), Dashboards, and My cluster. The main area has a top bar with 'DemoCluster.Hanau2023' and 'KQLDemo.kql'. Below it is a toolbar with 'Run', 'Recall', 'KQL tools', and a dropdown for 'DemoCluster/Hanau2023'. To the right are buttons for 'Pin to dashboard', 'Open', 'Copy', and 'Export'. The central part displays a Kusto Query Language (KQL) script:

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

Below the query is a table titled 'Table 1' with 10 records. The columns are SalesOrderNumber, CustomerID, TerritoryID, and TotalDue. The data is as follows:

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

Kusto Explorer [v1.0.3.1284]

Home File Connections View Tools Monitoring Management Help

Query New Tab Tabs Share

Visualizations

Connections

Name Details

[Type for filtering]

Connections C:\Users\vm\AppData\Roaming\Kusto\Connections

DemoCluster https://kvcs... Hanau2023

SalesHeader

take 10;

cluster('kvc... heurope.kusto.windows.net').database

Unlocked

SalesOrderID RevisionNumber OrderDate DueDate ShipDate Status OnlineOrderFlag SalesOrderNumber PurchaseOrderNumber AccountNumber CustomerID S...

SalesOrderID	RevisionNumber	OrderDate	DueDate	ShipDate	Status	OnlineOrderFlag	SalesOrderNumber	PurchaseOrderNumber	AccountNumber	CustomerID	S...
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	

Done (00:00:359): 10 records SUM: 43.659

Results Query Summary QueryCompletionInformation Issues: (0)

https://kvcs... heurope.kusto.windows.net/Hanau2023 UTC: 2023-08-31 09:51:47

ADX - Alternative 2: Kusto extension for Azure Data Studio

The screenshot shows the Azure Data Studio interface with the following details:

- Connections:** KQLDemo.sql - disconnected, KQLDemo.kql - https://ft.com, ADXDemo:Hanau2023.
- Servers:** localhost, <default> (sa), AWS, Azure (selected), ADXFree (Thomas), ADXDemo, Hanau2023.
- Database:** Hanau2023.
- Query:** A Kusto query (KQL) is being run against the Hanau2023 database. The query retrieves SalesHeader data and joins it with Customer and Person tables to include FirstName, MiddleName, and LastName. It then filters for SalesOrderNumber starting with 'S04' and orders by SalesOrderID.
- Results:** The query results are displayed in a table with columns: SalesOrderID, RevisionNumber, OrderDate, DueDate, ShipDate, Status, OnlineOrderFlag, SalesOrderNumber, PurchaseOrderNumber, AccountNumber, CustomerID, SalesPersonID, TerritoryID, BillToAddressID, FirstName, MiddleName, LastName, TotalDue, and BusinessEntityID.

	SalesOrderID	RevisionNumber	OrderDate	DueDate	ShipDate	Status	OnlineOrderFlag	SalesOrderNumber	PurchaseOrderNumber	AccountNumber	CustomerID	SalesPersonID	TerritoryID	BillToAddressID	FirstName	MiddleName	LastName	TotalDue	BusinessEntityID
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									
1...	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									

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:

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-  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>

