Nowa składnia zapytań SQL w BigQuery

Pipe Query Syntax

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Agenda

- What is BigQuery
- SQL
- Pipe Query Syntax
- Demos

What is BigQuery?

BigQuery

- Modern, AI-era data platform
- Managed data warehouse / data lakehouse
  - Cloud native
  - Enterprise-grade
  - Distributed
  - Exabyte scale
- Fully serverless from ground up
  - No infrastructure to manage
- Batch and streaming processing
  - Continuous queries
- Supports AI natively
  - Generative AI, pretrained models
  - Agents
  - Machine learning
  - Time series
  - Augmented analytics

BigQuery

- Efficient columnar storage (Capacitor) for native tables
- Supports popular formats
  - Iceberg, Delta Lake
  - Parquet, ORC, AVRO, (ND)JSON, CSV
- SQL at the core - GoogleSQL - very rich in features
- 2 pricing models
  - On-demand
  - Capacity-based
- Cross-cloud (BigQuery Omni)
- SDKs and clients for many programming languages
- Rich integrations
- Scheduling
- Notebooks
- ... and more

What is BigQuery good for?

Do use it for:

- Storing lots of structured data natively
- Data warehouses, data lakes
- Fully-structured data (tables, views, datasets)
- Semi-structured data (JSON),
- Unstructured data
  - Through lakes or object tables from storage
- Denormalized data model
- Analytical queries (on large amounts of data)
- Queries for reporting
- Streaming and batch loads
- CDC, ELT, ETL
- AI tasks (data understanding, exploration, agents, image analysis, document analysis, embeddings generation, vector search)
  - Consider other products for specialized AI needs

Don't use it for:

- OLTP workload
- High-frequency or high volume single-row queries
- Ultra low latency data access (sub-millisecond)
- Primary storage for unstructured data
  - Not in native tables
- Lots of joins in queries
- Normalized data model
- Real-time compute-heavy stream processing engine
- Use Cloud Dataflow for that
- Drop-in replacement for PostgreSQL, MySQL, SQL Server, SQLite etc.
  - BigQuery has SQL but it's not a RDBMS
- Scaffolding for a spreadsheet-based BI solutions

SQL
Structured Query Language

SQL

- De facto standard *) query language
  - Works in hundreds of engines / products
- Declarative: emphasizes what needs to be returned
  - Not how to fetch and process rows of data
  - Hides complexity of data storage, retrieval, manipulation and modification
- Set-based operations
- Astonishing amount of features
- Innovating at high speed
- Best for > 95% *) data processing tasks
- Handles big data with ease
- Works great with AI
- Not going anywhere

SQL syntax

```
SELECT a, b, SUM(c) AS s,
  RANK() OVER (ORDER BY d) AS r
FROM t
INNER JOIN u USING (id)
WHERE b < 100
GROUP BY a, b
HAVING SUM(c) > 10
QUALIFY r <= 3
ORDER BY a, b
LIMIT 10
```

SQL

- Arbitrary and rigid syntax
- Quite difficult to learn
- Queries are not linearly readable
  - Inside-out flow, starting with tables or subqueries in the middle
- Distant side effects
  - e.g. aggregates and GROUP BY
  - Window functions
- Redundant clauses (e.g. WHERE, HAVING, QUALIFY, PREWHERE)
- Many operations need subqueries
- Verbose and repetitive
  - List the same columns in SELECT, GROUP BY, ORDER BY, and in subqueries
- Difficult to implement autocompletion

SQL syntax	Semantic evaluation order

`SELECT a, b, SUM(c) AS s,`
`  RANK() OVER (ORDER BY d) AS r`
`FROM t`
`INNER JOIN u USING (id)`
`WHERE b < 100`
`GROUP BY a, b`
`HAVING SUM(c) > 10`
`QUALIFY r <= 3`
`ORDER BY a, b`
`LIMIT 10`
	from
	join
	filter
	aggregate
	filter
	sort
	window
	filter
	limit
	project

Pipeline processing

Pipeline features

- Sequential transformations
- Improved readability
- Modularity and reusability

Shell languages - the originators

Specialized query languages

- KQL, SPL

Functional languages

- OCaml, R, F#, Elixir, Haskell

Method chaining (fluent syntax)

- JavaScript, Python, Ruby, Java, C#, Scala, Rust
- Python data frames
- C++20 (std::views)

(bash)

```bash
curl -s https://static.nbp.pl/.../archiwum_tab_a_2025.csv  \
  | grep ^2025     \  # filter data
  | cut -d";" -f3  \  # transform (extract 'USD' field)
  | sed 's/,/./'   \  # transform (change decimal point)
  | sort -n -r     \  # sort data
  | head -n 1         # get the required item
```

(JavaScript)

```javascript
const highestUsdRate = csvFile
  .split(/\r?\n/)
  .filter(line => line.startsWith('2025'))
  .map(line => line.split(';')[2])
  .map(rateString => rateString.replace(',', '.'))
  .map(rateString => parseFloat(rateString))
  .sort((a, b) => b - a)
  .shift();  // or [0]

  // (I know it's not optimal 🙂)
```

But... we cannot fix SQL...
... can we?

SQL Has Problems. We Can Fix Them: Pipe Syntax In SQL

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Google, Inc.

Shannon Bales
Google, Inc.

Matthew Brown
Google, Inc.

Jean-Daniel Browne
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https://research.google/pubs/sql-has-problems-we-can-fix-them-pipe-syntax-in-sql/

Pipe Query Syntax in BigQuery

Pipe |> Query |> Syntax

What is it

- Extension to GoogleSQL
- Does not replace SQL - extends it
- Very straightforward, easy to learn
- Blends with traditional syntax
- Natural operator order
- Sequential execution
- Improves readability
- Iterative query development
- Enables easier optimization
- Doesn't deprecate any GoogleSQL feature

SQL syntax	Pipe query syntax

`SELECT a, b, SUM(c) AS s,`
`  RANK() OVER (ORDER BY d) AS r`
`FROM t`
`JOIN u USING (id)`
`WHERE b < 100`
`GROUP BY a, b`
`HAVING SUM(c) > 0`
`ORDER BY a, b`
`LIMIT 10`
	`FROM t`
	`|> JOIN u USING (id)`
	`|> WHERE b < 100`
	`|> AGGREGATE SUM(c) AS s`
	`  GROUP BY a, b`
	`|> WHERE s > 0`
	`|> ORDER BY a, b`
	`|> LIMIT 10`
	`|> SELECT a, b, s,`
	`  RANK() OVER (ORDER BY d) AS r`

Pipe |> Query |> Syntax

Key characteristics

- Simple syntax: pipe symbol, operator name, arguments:

```
|> operator_name argument_list
```

- Pipe operators can be added to the end of any valid query
- Pipe operators can be applied in any order, any number of times
- Pipe syntax works anywhere standard syntax is supported: queries, views, table-valued functions etc.

- The simplest query:

```
FROM data_source;
```

```
|> SELECT
|> EXTEND
|> SET
|> DROP
|> RENAME
|> AS

|> WHERE
|> ORDER BY
|> LIMIT

|> AGGREGATE

|> JOIN
|> UNION
|> INTERSECT
|> EXCEPT

|> WITH

|> PIVOT
|> UNPIVOT
|> CALL
|> TABLESAMPLE
```

Pipe |> Query |> Syntax

Pipe operator semantics

- Each pipe operator performs a self-contained operation
- A pipe operator consumes the input rowset passed to it through the pipe symbol `|>` and produces a new rowset as output
  - Semantically, not physically
- A pipe operator can reference only columns available in its immediate input rowset(s)
  - Columns from earlier operators in the same query aren't visible (semantically)

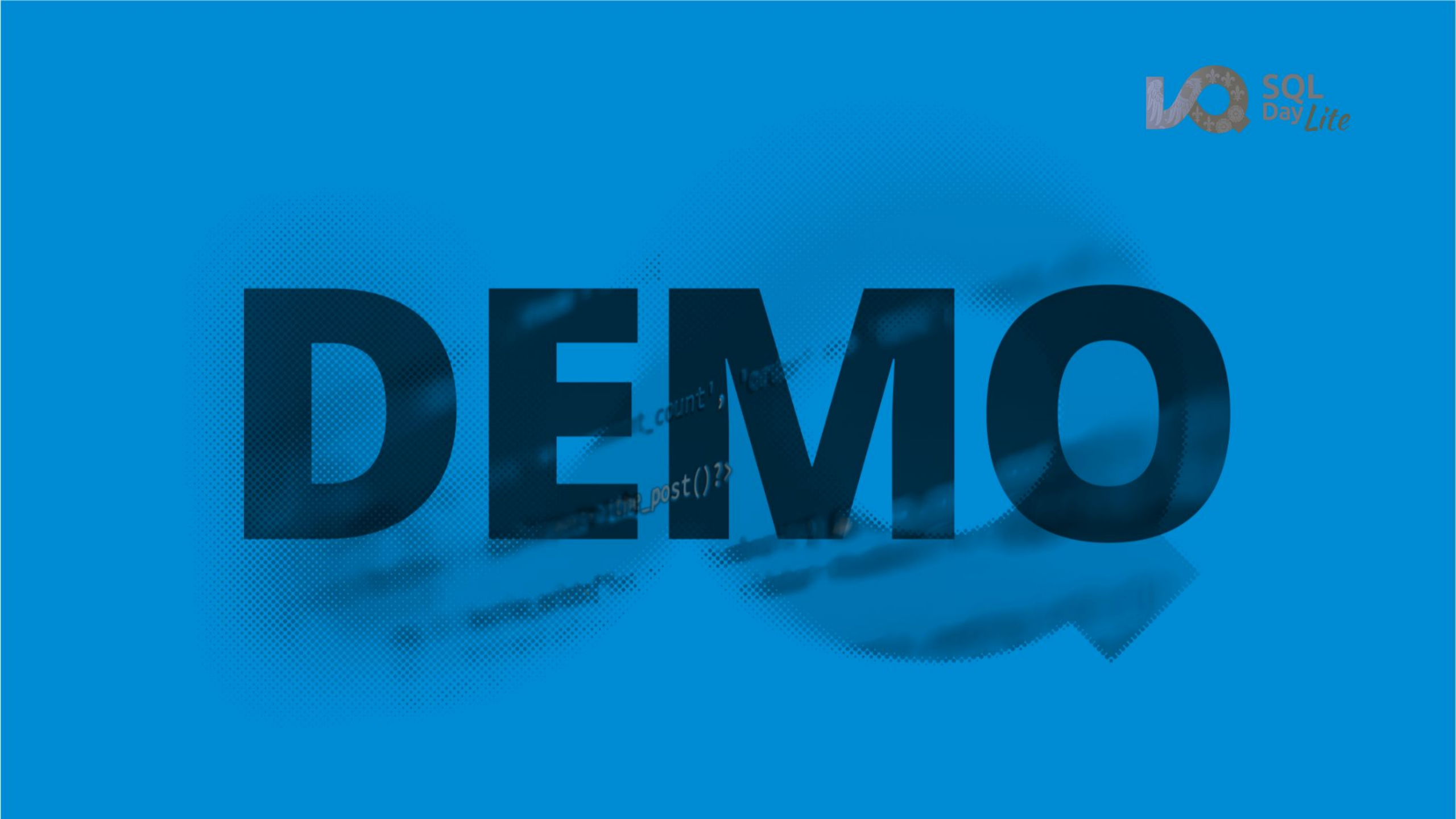
```
|> SELECT
|> EXTEND
|> SET
|> DROP
|> RENAME
|> AS

|> WHERE
|> ORDER BY
|> LIMIT

|> AGGREGATE

|> JOIN
|> UNION
|> INTERSECT
|> EXCEPT

|> WITH

|> PIVOT
|> UNPIVOT
|> CALL
|> TABLESAMPLE
```

Who's it for? Everyone!

- **SQL beginners**
  - Very easy to learn
- **SQL experts**
  - Same operators and similar syntax, better structure
  - Much more productive
- **SQL dislikers**
  - Fixes many difficult or annoying parts that confuse users or cause resistance

Who's it for? Everyone!

- **No migrations, nothing to lose**
  - Existing queries all still work
  - New syntax can be introduced incrementally
  - No translations needed
- **Fully supported by Google**
  - GA in BigQuery as of April 2025
- **Market is starting to adopt it**
  - Apache Spark SQL
  - Databricks SQL
  - DuckDB (partial, through extension)
  - Some products have open FRs about it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```
FROM `me`
|> THANK YOU
```