T-SQL Window Function Performance

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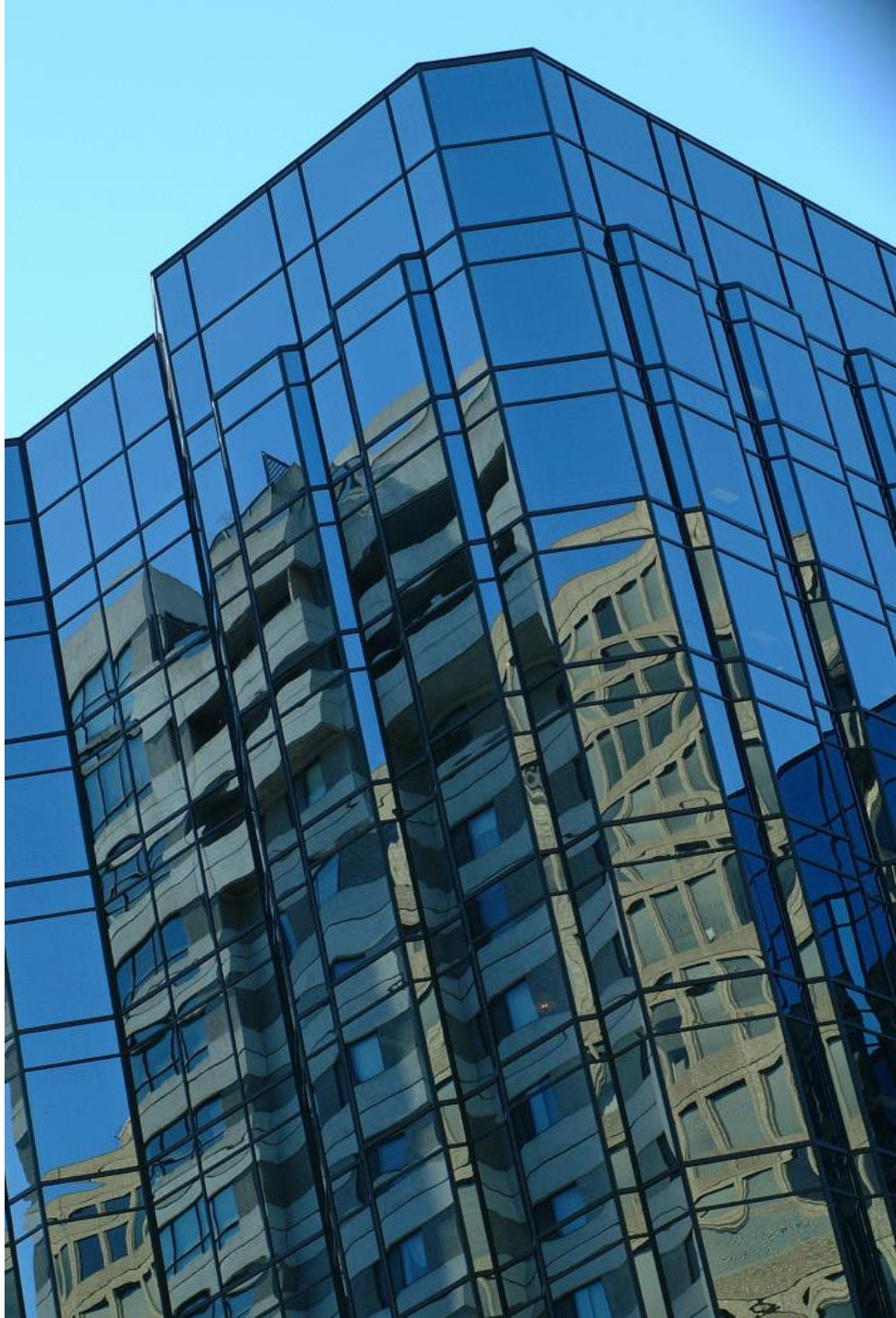
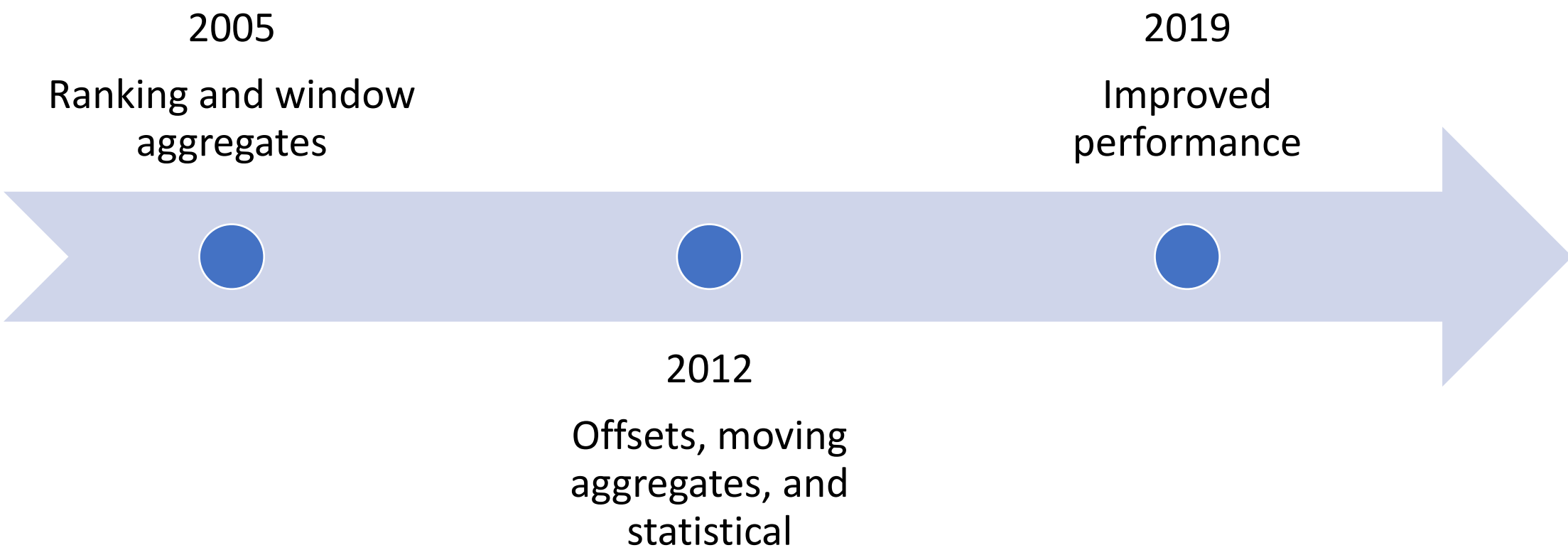
What are Window Functions?

- Nothing to do with the Windows OS
- Standard functionality added to T-SQL
- Functions that operate on a set or “window” or rows
- Will always see an OVER clause
- Always found in SELECT or ORDER BY
- Makes queries easier to write



History of Window Functions

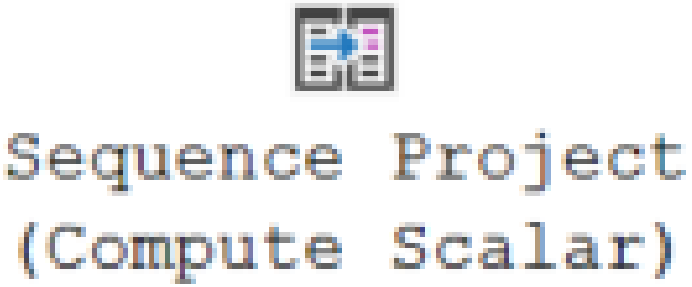


The OVER Clause

- PARTITION BY
  - Calculations don’t cross a boundary
  - Always supported
- ORDER BY
  - Required for some functions
  - How the rows line up
- Frame
  - Required for some functions
  - Very granular windows

Execution Plan Operators: Good

Adding a calculated column



Rows are partitioned or ordered

Execution Plan Operators: Watch out!

Sorting – from PARTITION BY and ORDER BY

Sort

Worktables

Window Spool

Table Spool
(Lazy Spool)

Plus a new operator

What have we done so far?

Type	Initial Performance
Ranking	OK
Window Aggregate	Poor
Moving Aggregates	Poor
LAG and LEAD	OK
FIRST_VALUE and LAST_VALUE	Poor
Statistical	Poor

The POC Index (from Itzik Ben-Gan)

Filtered columns +
Partition columns +
Order by columns +
Covering columns

Can sometimes eliminate sort, but at least will be covering

Helps all types of window function queries

What have we done so far?

Type	Initial Performance	POC Index
Ranking	OK	Good!
Window Aggregate	Poor	Slight improvement
Moving Aggregates	Poor	Slight improvement
LAG and LEAD	OK	Good!
FIRST_VALUE and LAST_VALUE	Poor	Slight improvement
Statistical	Poor	Slight improvement

Framing

Further defines the frame

Each row can have its own window

Moving aggregates

FIRST_VALUE

LAST_VALUE

Term	Meaning
ROWS	Positional operator used to define the frame
RANGE	Logical operator used to define the frame The DEFAULT operator
UNBOUNDED PRECEDING	The first row of the partition
UNBOUNDED FOLLOWING	The last row of the partition
CURRENT ROW	The row where the window function is being performed

ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW

The partition consists of row 1

ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW

The partition consists of rows 1 and 2

ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW

The partition consists of rows 1 to 3

ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW

The partition consists of rows 1 to 4

ROWS BETWEEN UNBOUNDED FOLLOWING AND CURRENT ROW

The partition consists of rows 1 to 15

ROWS BETWEEN UNBOUNDED FOLLOWING AND CURRENT ROW

The partition consists of rows 2 to 15

ROWS BETWEEN UNBOUNDED FOLLOWING AND CURRENT ROW

The partition consists of rows 3 to 15

ROWS BETWEEN UNBOUNDED FOLLOWING AND CURRENT ROW

The partition consists of rows 4 to 15

ROWS BETWEEN 2 PRECEDING AND CURRENT ROW

The partition consists of row 1

ROWS BETWEEN 2 PRECEDING AND CURRENT ROW

The partition consists of rows 1 and 2

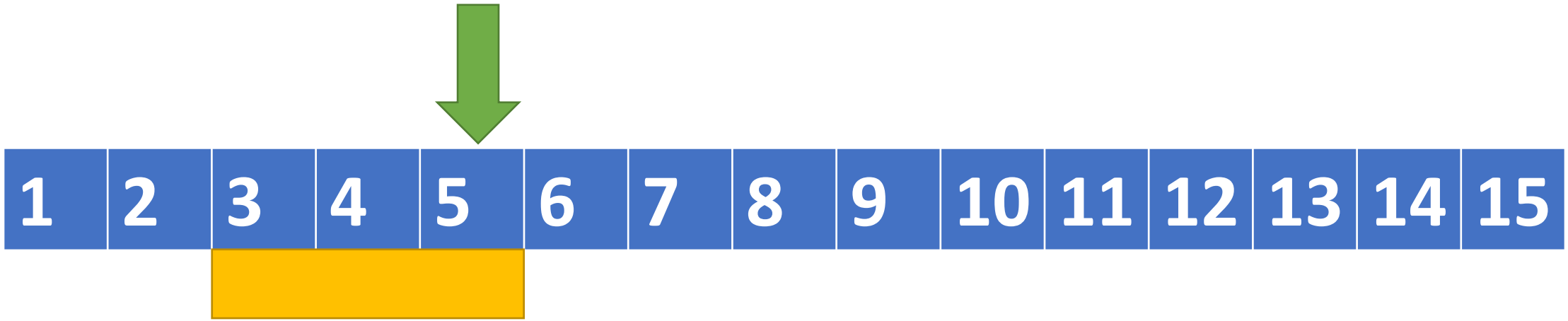
ROWS BETWEEN 2 PRECEDING AND CURRENT ROW

The partition consists of rows 1 to 3

ROWS BETWEEN 2 PRECEDING AND CURRENT ROW

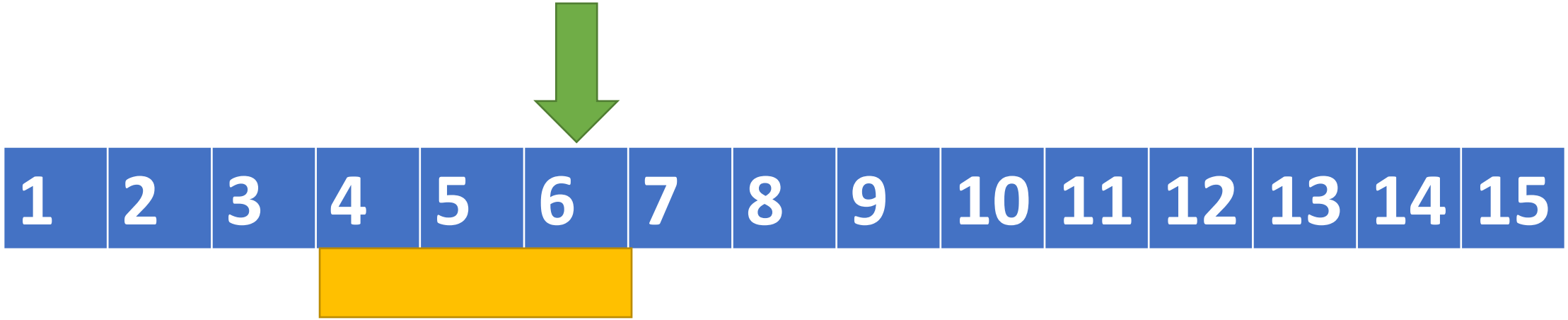
The partition consists of rows 2 to 4

ROWS BETWEEN 2 PRECEDING AND CURRENT ROW



The partition consists of rows 3 to 5

ROWS BETWEEN 2 PRECEDING AND CURRENT ROW



The partition consists of rows 4 to 6

What have we done so far?

Type	Initial Performance	POC Index	Frame
Ranking	OK	Good!	N/A
Window Aggregate	Poor	Slight improvement	N/A
Moving Aggregates	Poor	Slight improvement	Good!
LAG and LEAD	OK	Good!	N/A
FIRST_VALUE and LAST_VALUE	Poor	Slight improvement	Good!
Statistical	Poor	Slight improvement	N/A

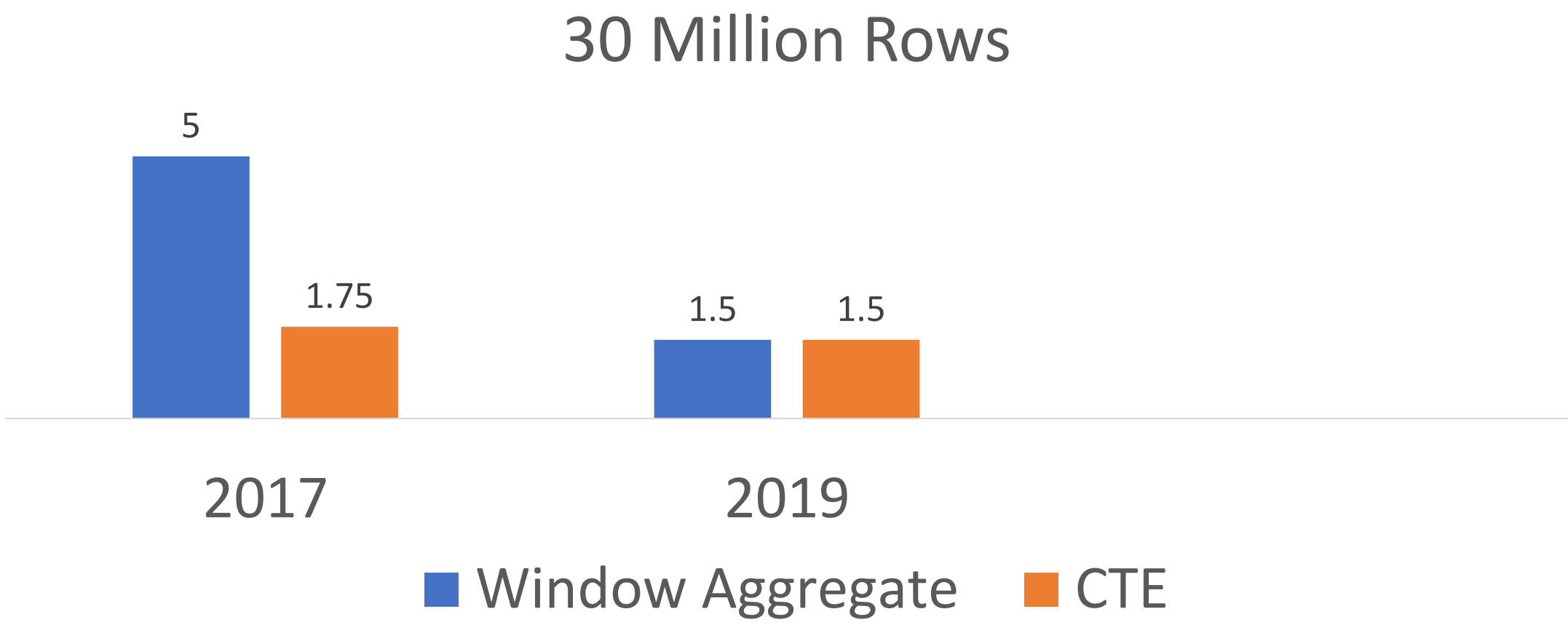
2019: Batch Mode on Rowstore

- Introduced with Columnstore
- Improves window aggregates and statistical functions
- Kicks in ~100K rows
- Can sometimes skip frame

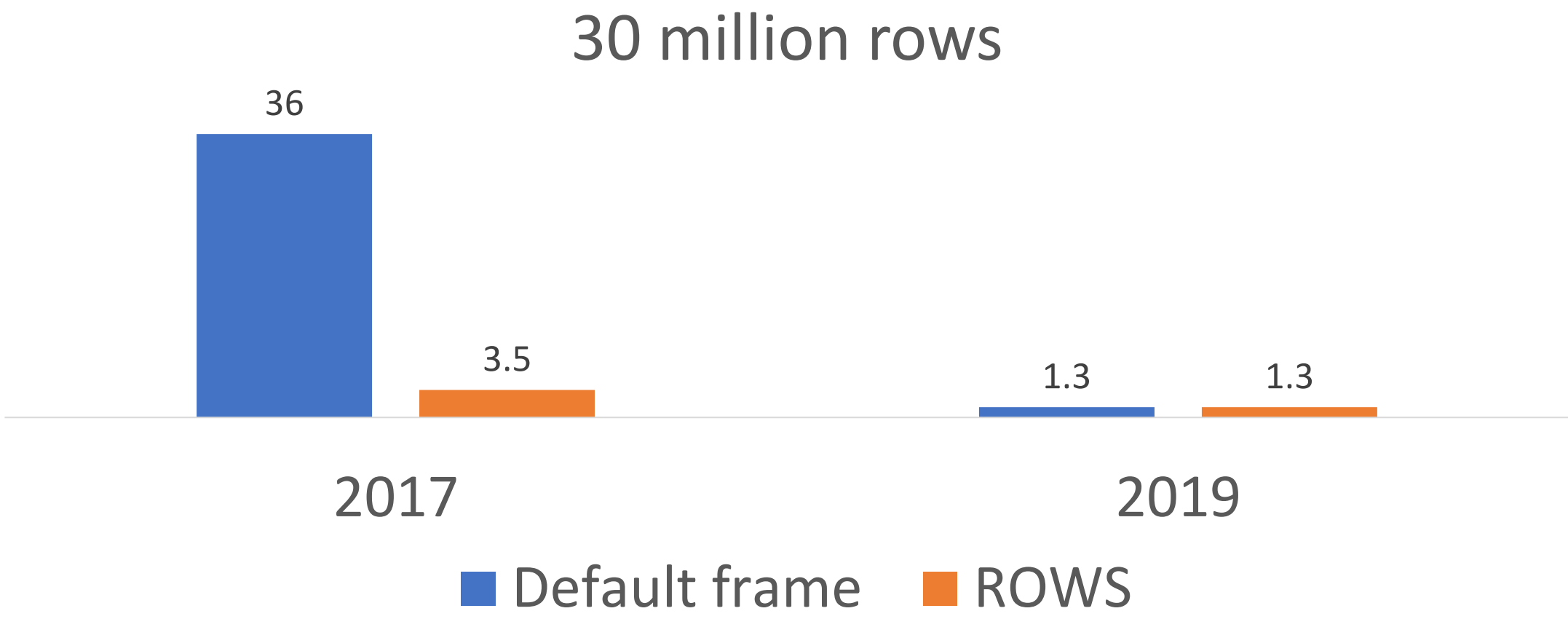
What have we done so far?

Type	Initial Performance	POC Index	Frame	Batch Mode
Ranking	OK	Good!	N/A	N/A
Window Aggregate	Poor	Slight improvement	N/A	Good!
Moving Aggregates	Poor	Slight improvement	Good!	Good!
LAG and LEAD	OK	Good!	N/A	N/A
FIRST_VALUE and LAST_VALUE	Poor	Slight improvement	Good!	N/A
Statistical	Poor	Slight improvement	N/A	Good!

Window Aggregate Performance



Running Total Performance



Resources

- Expert T-SQL Window Functions
- High-Performance T-SQL Using Window Functions
  By Itzik Ben-Gan
- Pluralsight Course
- Auntkathisql.com
- Simple Talk articles
- Kathi.Kellenberger@red-gate.com