Building dates

TIME SERIES ANALYSIS IN SQL SERVER

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What you will learn

- Working with component date parts
- Translating strings to dates, including date-time offsets and invalid dates
- Filtering, grouping, and aggregating data by time periods
- Downsampling data
- Aggregations over windows
- Upsampling
- Calculating running totals and moving averages
- Finding overlap in date ranges

(Photo by **Aron Visuals**)

Building a date

```
SELECT
    GETDATE() AS DateTime_LTz,
    GETUTCDATE() AS DateTime_UTC;
```

```
SELECT
    SYSDATETIME() AS DateTime2_LTz
    SYSUTCDATETIME() AS DateTime2_UTC;
```

Results:

DateTime_LTz	DateTime_UTC	DateTime2_LTz	DateTime2_UTC
2019-03-07 21:21:33.670	2019-03-08 02:21:33.670	2019-03-07 21:21:33.6716402	2019-03-08 02:21:33.6716402

Breaking down a date

```
DECLARE
    @SomeDate DATETIME2(3) = '2019-03-01 08:17:19.332';
```

```
SELECT YEAR(@SomeDate);
```

```
SELECT MONTH(@SomeDate);
```

```
SELECT DAY(@SomeDate);
```

`YEAR` = 2019

`MONTH` = 3

`DAY` = 1

Parsing dates with date parts

Functions

`DATEPART()`

```
SELECT
  DATEPART(YEAR, @dt) AS TheYear;
```

`DATENAME()`

```
SELECT
  DATENAME(MONTH, @dt) AS TheMonth;
```

Parts

- Year / Month / Day
- Day of year
- Day of week
- Week of year
- ISO week of year
- Minute / Second
- Millisecond / Nanosecond

Adding and subtracting dates

```
DECLARE
    @SomeTime DATETIME2(7) = '1992-07-14 14:49:36.2294852';
SELECT
    DATEADD(DAY, 1, @SomeTime) AS NextDay,
    DATEADD(DAY, -1, @SomeTime) AS PriorDay;
SELECT
    DATEADD(HOUR, -3, DATEADD(DAY, -4, @SomeTime)) AS Minus4Days3Hours;
```

NextDay	PriorDay
1992-07-15 14:49:36.2294852	1992-07-13 14:49:36.2294852

Minus4Days3Hours
1992-07-10 11:49:36.2294852

Comparing dates

```
DECLARE
    @StartTime DATETIME2(7) = '2012-03-01 14:29:36',
    @EndTime DATETIME2(7) = '2012-03-01 18:00:00';
```

```
SELECT
    DATEDIFF(SECOND, @StartTime, @EndTime) AS SecondsElapsed,
    DATEDIFF(MINUTE, @StartTime, @EndTime) AS MinutesElapsed,
    DATEDIFF(HOUR, @StartTime, @EndTime) AS HoursElapsed;
```

SecondsElapsed	MinutesElapsed	HoursElapsed
12624	211	4

Rounding dates

```
DECLARE @SomeTime DATETIME2(7) = '2017-05-12 16:25:16.2248991';

SELECT
    DATEADD(DAY, DATEDIFF(DAY, 0, @SomeTime), 0) AS RoundedToDay,
    DATEADD(HOUR, DATEDIFF(HOUR, 0, @SomeTime), 0) AS RoundedToHour,
    DATEADD(MINUTE, DATEDIFF(MINUTE, 0, @SomeTime), 0) AS RoundedToMinute;
```

```
RoundedToDay          RoundedToHour         RoundedToMinute
2017-05-12 00:00:00   2017-05-12 16:00:00   2017-05-12 16:25:00
```

Let's practice!

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Formatting dates for reporting

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Formatting functions

`CAST()`

`CONVERT()`

`FORMAT()`

The CAST() function

- Supported since at least SQL Server 2000
- Converts one data type to another, including date types
- No control over formatting from dates to strings
- ANSI SQL standard, meaning most relational and most non-relational databases have this function

Using the CAST() function

```
DECLARE
    @SomeDate DATETIME2(3) = '1991-06-04 08:00:09',
    @SomeString NVARCHAR(30) = '1991-06-04 08:00:09',
    @OldDateTime DATETIME = '1991-06-04 08:00:09';
```

```
SELECT
    CAST(@SomeDate AS NVARCHAR(30)) AS DateToString,
    CAST(@SomeString AS DATETIME2(3)) AS StringToDate,
    CAST(@OldDateTime AS NVARCHAR(30)) AS OldDateToString;
```

DateToString	StringToDate	OldDateToString
1991-06-04 08:00:09.000	1991-06-04 08:00:09.000	Jun 4 1991 8:00AM

The CONVERT() function

- Supported going back at least to SQL Server 2000
- Useful for converting one data type to another data type, including date types
- Some control over formatting from dates to strings using the style parameter
- Specific to T-SQL

Using the CONVERT() function

```
DECLARE
    @SomeDate DATETIME2(3) = '1793-02-21 11:13:19.033';
```

```
SELECT
    CONVERT(NVARCHAR(30), @SomeDate, 0) AS DefaultForm,
    CONVERT(NVARCHAR(30), @SomeDate, 1) AS US_mdy,
    CONVERT(NVARCHAR(30), @SomeDate, 101) AS US_mdyyyy,
    CONVERT(NVARCHAR(30), @SomeDate, 120) AS ODBC_sec;
GO
```

DefaultForm	US_mdy	US_mdyyyy	ODBC_sec
Feb 21 1793 11:13 AM	02/21/93	02/21/1793	1793-02-21 11:13:19

Sample CONVERT() styles

Style Code	Format
1 / 101	United States m/d/y
3 / 103	British/French d/m/y
4 / 104	German d.m.y
11 / 111	Japanese y/m/d
12 / 112	ISO standard yyyymmdd
20 / 120	ODBC standard (121 for ms)
126	ISO8601 yyyy-mm-dd hh:mi:ss.mmm
127	yyyy-mm-ddThh:mi:ss.mmmZ

The FORMAT() function

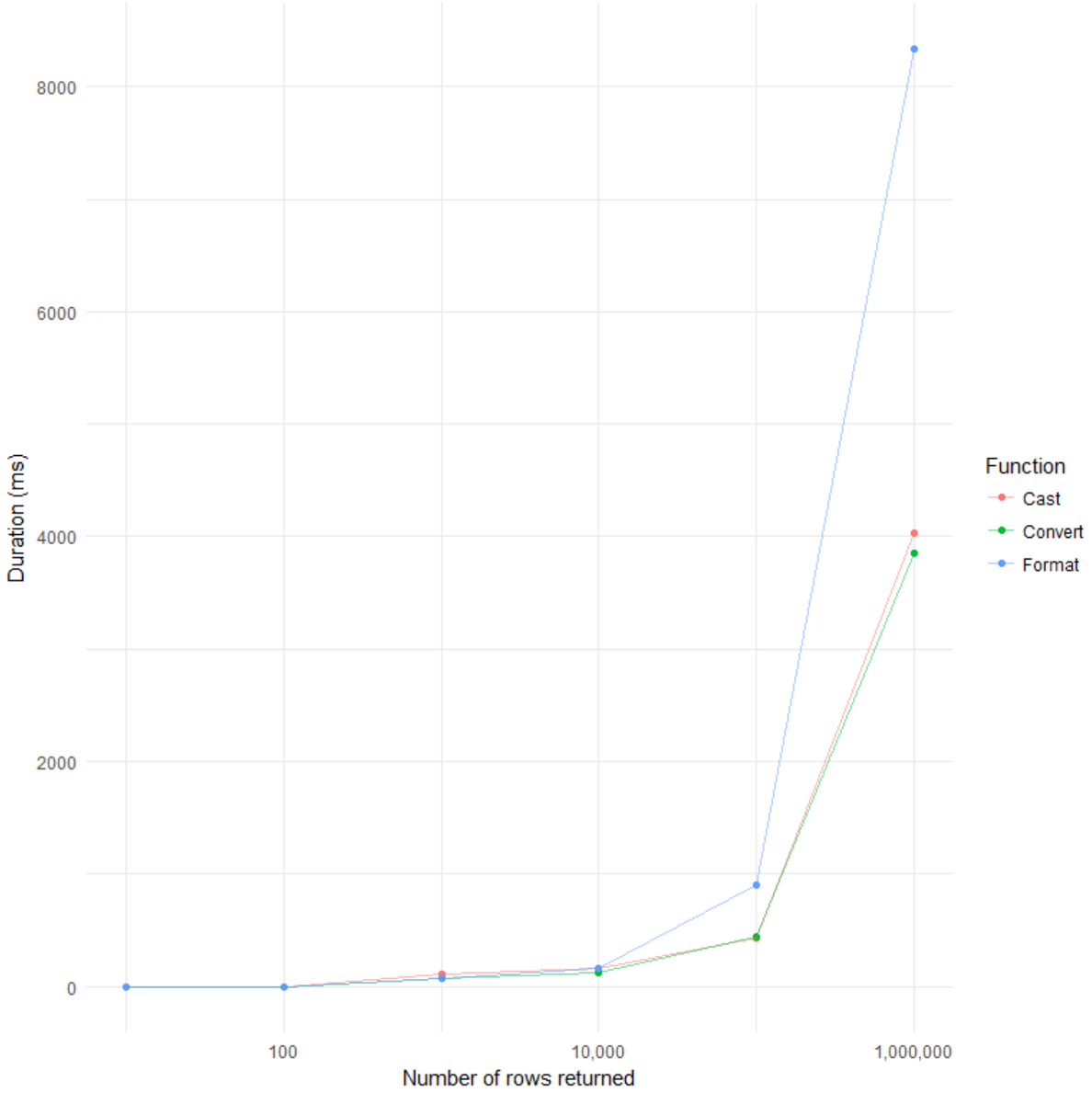
- Supported as of SQL Server 2012
- Useful for formatting a date or number in a particular way for reporting
- Much more flexibility over formatting from dates to strings than either `CAST()` or `CONVERT()`
- Specific to T-SQL
- Uses the .NET framework for conversion
- Can be slower as you process more rows

Using the FORMAT() function

```
DECLARE
    @SomeDate DATETIME2(3) = '1793-02-21 11:13:19.033';
```

```
SELECT
    FORMAT(@SomeDate, 'd', 'en-US') AS US_d,
    FORMAT(@SomeDate, 'd', 'de-DE') AS DE_d,
    FORMAT(@SomeDate, 'D', 'de-DE') AS DE_D,
    FORMAT(@SomeDate, 'yyyy-MM-dd') AS yMd;
```

US_d	DE_d	DE_D	yMd
2/21/1793	21.02.1793	Donnerstag, 21. February 1793	1793-02-21


8000
6000
4000
2000
0
Duration (ms)
100
10,000
1,000,000
Number of rows returned
Function
Cast
Convert
Format

Let's practice!

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Working with calendar tables

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What is a calendar table?

```
SELECT *
FROM dbo.Calendar;
```

DateKey	Date	Day	DayOfWeek	DayName	...
20000101	2000-01-01	1	7	Saturday	...
20000102	2000-01-02	2	1	Sunday	...
20000103	2000-01-03	3	2	Monday	...

Contents of a calendar table

General Columns

- Date
- Day Name
- Is Weekend

Calendar Year

- Calendar month
- Calendar quarter
- Calendar year

Fiscal Year

- Fiscal week of year
- Fiscal quarter
- Fiscal first day of year

Specialized Columns

- Holiday name
- Lunar details
- ISO week of year

Building a calendar table

```
CREATE TABLE dbo.Calendar
(
    DateKey INT NOT NULL,
    [Date] DATE NOT NULL,
    [Day] TINYINT NOT NULL,
    DayOfWeek TINYINT NOT NULL,
    DayName VARCHAR(10) NOT NULL,
    ...
)
```

```
SELECT
    CAST(D.DateKey AS INT) AS DateKey,
    D.[DATE] AS [Date],
    CAST(D.[day] AS TINYINT) AS [day],
    CAST(d.[dayofweek] AS TINYINT) AS [DayOfWeek],
    CAST(DATENAME(WEEKDAY, d.[Date]) AS VARCHAR(10)) AS [DayName],
    ...
```

Using a calendar table

```
SELECT
    c.Date
FROM dbo.Calendar c
WHERE
    c.MonthName = 'April'
    AND c.DayName = 'Saturday'
    AND c.CalendarYear = 2020
ORDER BY
    c.Date;
```

Date
2020-04-04
2020-04-11
2020-04-18
2020-04-25

Using a calendar table

```
SELECT
    c.Date
FROM dbo.Calendar c
WHERE
    c.MonthName = 'April'
    AND c.DayName = 'Saturday'
    AND c.CalendarYear = 2020
ORDER BY
    c.Date;
```

Date
2020-04-04
2020-04-11
2020-04-18
2020-04-25

A quick note on APPLY()

```
SELECT
    FYStart =
        DATEADD(MONTH, -6,
            DATEADD(YEAR,
                DATEDIFF(YEAR, 0,
                    DATEADD(MONTH, 6, d.[date])), 0)),
    FiscalDayOfYear =
        DATEDIFF(DAY,
            DATEADD(MONTH, -6,
                DATEADD(YEAR,
                    DATEDIFF(YEAR, 0,
                        DATEADD(MONTH, 6, d.[date])), 0)), d.[Date]) + 1,
    FiscalWeekOfYear =
        DATEDIFF(WEEK,
            DATEADD(MONTH, -6,
                DATEADD(YEAR,
                    DATEDIFF(YEAR, 0,
                        DATEADD(MONTH, 6, d.[date])), 0)), d.[Date]) + 1
FROM dbo.Calendar d;
```

A quick note on APPLY()

```
SELECT
    fy.FYStart,
    FiscalDayOfYear = DATEDIFF(DAY, fy.FYStart, d.[Date]) + 1,
    FiscalWeekOfYear = DATEDIFF(WEEK, fy.FYStart, d.[Date]) + 1
FROM dbo.Calendar d
    CROSS APPLY
    (
        SELECT FYStart =
            DATEADD(MONTH, -6,
                DATEADD(YEAR,
                    DATEDIFF(YEAR, 0,
                        DATEADD(MONTH, 6, d.[date])), 0))
    ) fy;
```

Let's practice!

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