What's New in TSQL 2012

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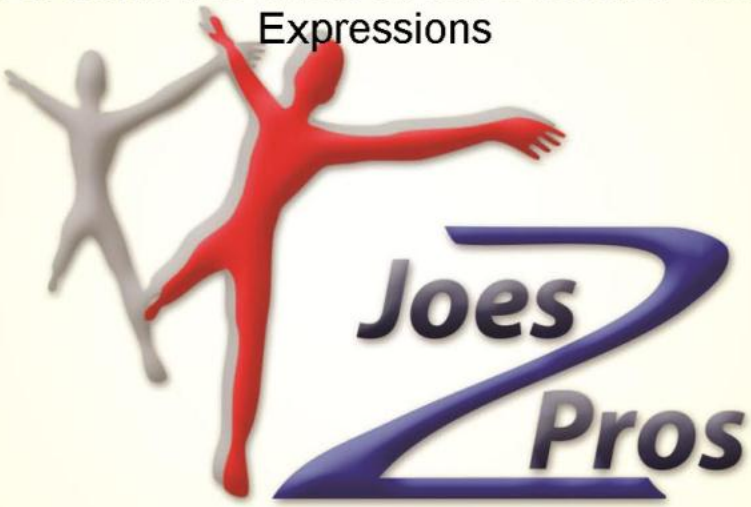
Common Table Expressions Joes 2 Pros®

A Solution Series Tutorial on everything you ever wanted to know about Common Table Expressions



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SQL Server 2012

- Introduced in Spring of 2012
  - SP1 Released November 6, 2012 with some additional features
- Many new features and enhancements
  - Always On, Column Store Index, And many others
  - Not part of this presentation
- This presentation will focus on the TSQL specific new features enhancements.
- TSQL Analytic Functions are not part of this presentation. See my blog for more info on 2012 Analytic Functions.

New Features Overview

- OVER Clause Enhancements
  - ROWS PRECEDING, FOLLOWING, UNBOUNDED
  - RANGE PRECEDING, FOLLOWING, UNBOUNDED
- IIF – Immediate IF or Inline IF (from Access)
- CHOOSE (from Access)
- OFFSET / FETCH
- FORMAT
- CONCAT
- SEQUENCE (from Oracle)

More New Features Overview

- sp_describe_first_result_set
- New Date and Time Functions
- Conversion Functions
  - PARSE, TRY_PARSE, TRY_CONVERT
- THROW exception

The Pre-2012 OVER Clause

- The OVER clause before SQL Server 2012…
- Really handy to perform aggregates over a different range than your standard grouping.

```
select *,
       avg(Revenue) OVER (PARTITION by DepartmentID) as AverageRevenue,
       sum(Revenue) OVER (PARTITION by DepartmentID) as TotalRevenue
from REVENUE
order by departmentID, year;
```

OVER Clause Enhancements

- ROWS PRECEDING, FOLLOWING, UNBOUNDED
  - Rows refers to the current row and those before or after based on preceding or following.
- RANGE PRECEDING, FOLLOWING, UNBOUNDED
  - Range means all values in the current range and those before or after.

	Year	DepartmentID	Revenue	RowsCumulative	RangeCumulative
1	2003	1	10300	10300	10300
2	2004	1	10000	20300	20300
3	2005	1	20000	40300	50300
4	2005	1	10000	50300	50300
5	2006	1	40000	90300	90300
6	2007	1	70000	160300	160300
7	2008	1	50000	210300	210300

ROWS / RANGE PRECEDING, FOLLOWING, UNBOUNDED

- ROWS or RANGE- specifying rows or range
- PRECEDING – get rows before the current one
- FOLLOWING – get rows after the current one
- UNBOUNDED – get all before or after
- CURRENT ROW

```
sum(Revenue) OVER (PARTITION by DepartmentID
                   ORDER BY [YEAR]
                   ROWS BETWEEN 3 PRECEDING AND CURRENT ROW) as Prev3
```

```
sum(Revenue) OVER (PARTITION by DepartmentID
                   ORDER BY [YEAR]
                   ROWS BETWEEN 1 PRECEDING AND 1 FOLLOWING) as BeforeAndAfter
```

ROWS/RANGE PRECEDING, FOLLOWING, UNBOUNDED - Demo

```
--ROWS PRECEDING
-- http://stevestedman.com/?p=1454
--  look at the sum of revenue over a trailing 3 year period
select Year, DepartmentID, Revenue,
   sum(Revenue) OVER (PARTITION by DepartmentID
  ORDER BY [YEAR]
  ROWS BETWEEN 3 PRECEDING AND CURRENT ROW) as Prev3
from REVENUE  order by departmentID, year;

--ROWS PRECEDING
select Year, DepartmentID, Revenue,
   sum(Revenue) OVER (PARTITION by DepartmentID
  ORDER BY [YEAR]
  ROWS BETWEEN 5 PRECEDING AND 2 PRECEDING) as Prev5to3
from REVENUE order by departmentID, year;

-- ROWS FOLLOWING
-- http://stevestedman.com/?p=1454
select Year, DepartmentID, Revenue,
   sum(Revenue) OVER (PARTITION by DepartmentID
  ORDER BY [YEAR]
  ROWS BETWEEN CURRENT ROW AND 3 FOLLOWING) as Next3
from REVENUE order by departmentID, year;

--ROWS PRECEDING
select Year, DepartmentID, Revenue,
   sum(Revenue) OVER (PARTITION by DepartmentID
  ORDER BY [YEAR]
  ROWS BETWEEN 1 PRECEDING AND 1 FOLLOWING) as BeforeAndAfter
from REVENUE order by departmentID, year;
```

IIF

- Inline IF
- Similar to MS Access
- Similar to the case statement but easier to write and it has only one condition.
- Evaluates boolean expression and returns one of two results based on that boolean

```
IIF(boolean_expression, true_value, false_value)
```

IIF Details

- Performance very similar between IIF and CASE
- IIF simplifies the code over using a CASE statement
- Can be nested up to 10 levels
- The true value and false value cannot both be NULL.

```
-- now the same functionality using IIF and simplifying the code
-- http://stevestedman.com/?p=1578
select Year, DepartmentID, Revenue, AverageRevenue,
    iif(Revenue > AverageRevenue, 'Better Than Average', 'Not') as Ranking
from (select Year, DepartmentID, Revenue
```

CHOOSE

- Function that returns the item at a specific index.
- CHOOSE(index, val_1, val_2, val_3, …)
- If the index is greater than the number of values or less than 1 it returns NULL
- Easier than CASE in some examples

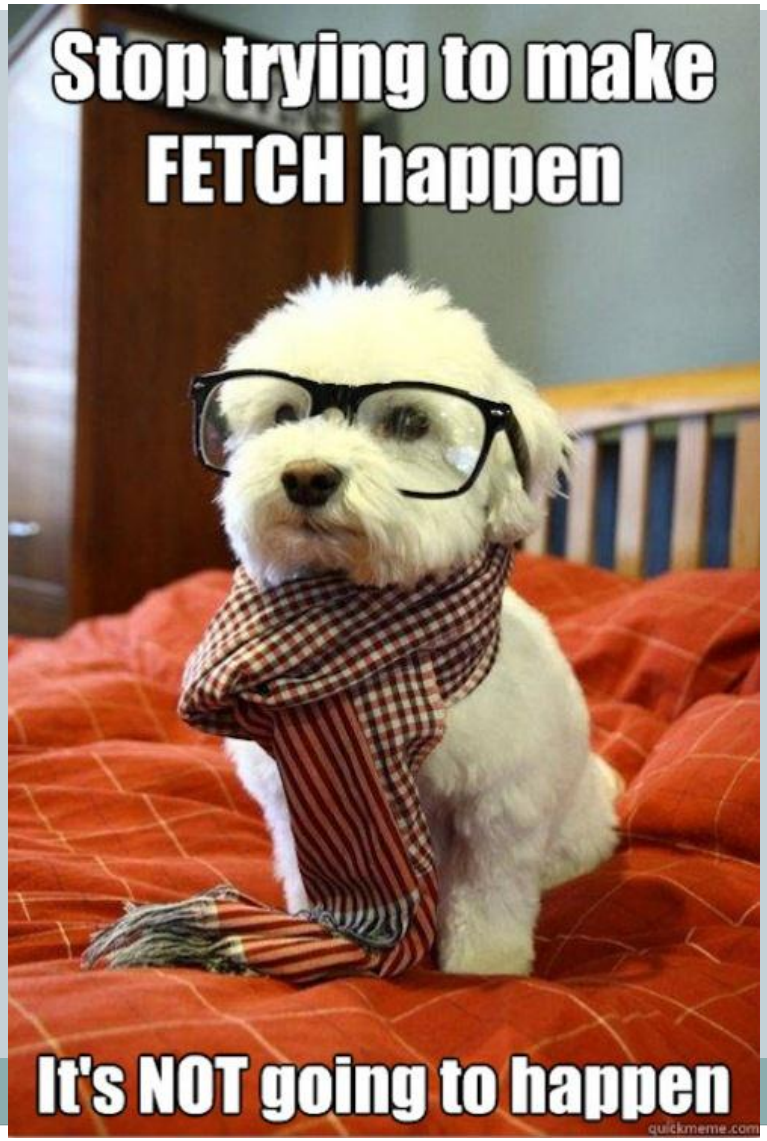
CHOOSE – Example

```
declare @corners as int = 6
SELECT choose(@corners, 'point', 'line', 'triangle', 'square',
                        'pentagon', 'hexagon', 'heptagon', 'octagon')

-- the old way using case.
SELECT CASE @corners
        WHEN 1 THEN 'point'
        WHEN 2 THEN 'line'
        WHEN 3 THEN 'triangle'
        WHEN 4 THEN 'square'
        WHEN 5 THEN 'pentagon'
        WHEN 6 THEN 'hexagon'
        WHEN 7 THEN 'heptagon'
        WHEN 8 THEN 'octagon'
        else NULL
       END;
```

OFFSET / FETCH

- Its about time….
- Similar to LIMIT in MySQL and ROWNUM in Oracle, but better
- Used for data paging
  - Easier than the CTE method of doing the same (pre SQL 2012)
  - Faster than the CTE method



OFFSET / FETCH – Example

```
-- the new way to do paging with OFFSET and FETCH
SELECT *
  FROM person.Person
 ORDER BY LastName, FirstName, MiddleName
OFFSET 10 ROWS
 FETCH NEXT 10 ROWS ONLY;
```

OFFSET / FETCH Notes

- You MUST have an order by
- You can use hard coded or dynamic values for the rows
- ROW[S] the S is optional on ROWS
- Common Questions
  - What if a row is inserted or deleted between paging queries using OFFSET and FETCH?

FORMAT

- Format strings
- Format dates
- Format currency
- and more

FORMAT

- FORMAT(value, format, [culture])
  - Value is the thing to be formatted
  - Format specifies how we want it to look
  - Optional Culture specifies the specific language/locale used for formatting.
- Easier than CONVERT

```
DECLARE @Revenue MONEY = 314159.26
SELECT '$' + CONVERT(VARCHAR(32),@Revenue,1);
SELECT FORMAT(@Revenue,'C');
```

Old Way

New Way

Formatting Types

- A valid .NET Framework format string
- C = Currency
- D = Date
- X = hexadecimal

```
-- old way
DECLARE @Revenue MONEY = 314159.26
SELECT '$' + CONVERT(VARCHAR(32),@Revenue,1);

-- now with format
DECLARE @Revenue MONEY = 314159.26
SELECT FORMAT(@Revenue,'C');
SELECT FORMAT(getdate(), 'd');
SELECT FORMAT(1234, 'X');
```

Formatting Strings

- The format strings can be found in the .NET documentation:
  - http://msdn.microsoft.com/en-us/library/az4se3k1.aspx
  - http://msdn.microsoft.com/en-us/library/8kb3ddd4.aspx
  - http://msdn.microsoft.com/en-us/library/dwhawy9k.aspx
  - http://msdn.microsoft.com/en-us/library/0c899ak8.aspx

FORMAT – Culture

- If the *culture* argument is not provided, then the language of the current session is used
  - Server default
  - SET LANGUAGE
- Examples
  - En-us, fr-fr, de-de, jp-jp

```
-- using the culture parameter
DECLARE @Revenue MONEY = 314159.26
SELECT FORMAT(@Revenue,'c','en-us') as English;
SELECT FORMAT(@Revenue,'c','fr-fr') as French;
SELECT FORMAT(@Revenue,'c','de-de') as German;
SELECT FORMAT(@Revenue,'c','ja-JP') as Japanese;
```

FORMAT - Demo

```
-- old way
DECLARE @Revenue MONEY = 314159.26
SELECT '$' + CONVERT(VARCHAR(32),@Revenue,1);
-- now with format
DECLARE @Revenue MONEY = 314159.26
SELECT FORMAT(@Revenue,'C');

-- other examples
SELECT FORMAT(getdate(), 'd');
SELECT FORMAT(1234, 'X');

-- custom format values
SELECT FORMAT(getdate(), 'MMMM dd, yyyy (dddd)');

-- using the culture parameter
DECLARE @Revenue MONEY = 314159.26
SELECT FORMAT(@Revenue,'c','en-us') as English;
SELECT FORMAT(@Revenue,'c','fr-fr') as French;
SELECT FORMAT(@Revenue,'c','de-de') as German;
SELECT FORMAT(@Revenue,'c','ja-JP') as Japanese;
```

CONCAT

- Concatenates data
- Easier than using + because all types are cast to strings
- CONCAT (string1, string2 [, stringN])
- Output is a string, input is more than one string.
- Forces conversion to string
  - PRINT 'Current Time ' + GETDATE()
  - PRINT CONCAT('Current Time ', GETDATE())

CONCAT – Demo

```
-- the old way
SELECT 1 + ' two ' + 3.0 + ' four' -- fails without a cast

SELECT cast(1 as varchar(1024)) + ' two ' + cast(3.0 as varchar(1024)) + ' four'

-- CONCAT in TSQL 2012
SELECT CONCAT(1, ' two ', 3.0, ' four');

-- another example
SELECT 'uniqueidentifier = ' + NEWID();  -- fails
SELECT CONCAT('uniqueidentifier = ', NEWID());

-- PRINT CONCAT TRICK
PRINT 'Time ' + GETDATE();  -- fails
PRINT 'Time ' + CAST(GETDATE() AS VARCHAR(30));
PRINT CONCAT('Time ', GETDATE());
```

Sequence – Take a Number

- Take a number
- Take one or take several
- For those familiar with Oracle/PLSQL, sequence has been available for years

SEQUENCE

- User-defined object that generates a sequence of numeric values
- Specify the following
  - Start
  - Increment
  - Min Value, Max Value
  - Cycle / No Cycle – starts of when the Max value is hit or not
  - Cache
- Alternative to Identity

SEQUENCE – Details

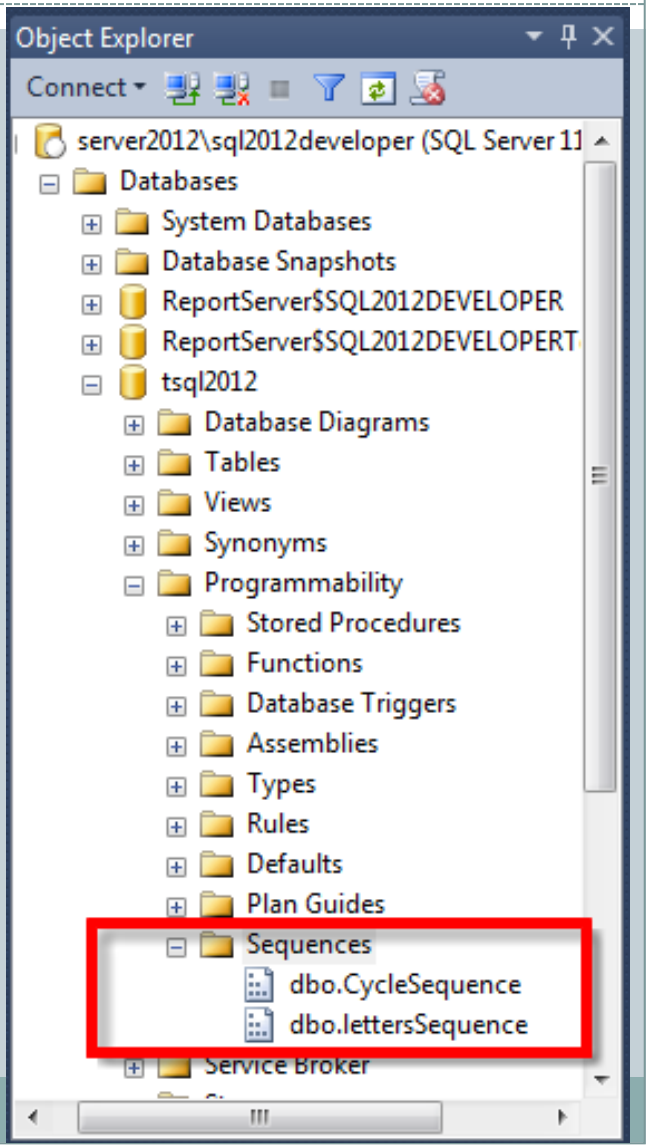
- Like identity, but you can grab it before you do an insert
- Unlike identity, not associated with a table
- Can be used shared in more than one table
- Defaults to a BIGINT if size not specified
- Gaps
  - Other people / processes can use your SEQUENCE with you knowing it, this will cause gaps
  - Rolled back transactions that ask for the NEXT VALUE and don't use it may cause gaps.

Finding SEQUENCES In Your Database

- Find it in SSMS under Programmability -> Sequences

- Query SYS.SEQUENCES to list all the sequences in the database.

```
SELECT *
  FROM sys.sequences;
```



Use a Sequence Instead of Identity When…

- The application requires a number before the insert is run.
- Sharing a single series of numbers between multiple tables or multiple columns within a table is needed.
- The application must restart the number series at some point.
- The application requires sequence values to be sorted by another field. The NEXT VALUE FOR function can apply the OVER clause to the function call.
- You need to change the specification of the sequence, such as the increment value.

SEQUENCE - Syntax

```
CREATE SEQUENCE [schema_name . ] sequence_name
    [ AS [ built_in_integer_type | user-defined_integer_type ] ]
    [ START WITH <constant> ]
    [ INCREMENT BY <constant> ]
    [ { MINVALUE [ <constant> ] } | { NO MINVALUE } ]
    [ { MAXVALUE [ <constant> ] } | { NO MAXVALUE } ]
    [ CYCLE | { NO CYCLE } ]
    [ { CACHE [ <constant> ] } | { NO CACHE } ]
    [ ; ]
```

SEQUENCE – Demo

```
CREATE SEQUENCE ordersKeySequence
    AS int
    START WITH 100
    INCREMENT BY 1 ;

CREATE TABLE Orders
    (OrderID int PRIMARY KEY,
     Name varchar(20) NOT NULL,
     Qty int NOT NULL);
GO
-- Insert three records
INSERT Orders (OrderID, Name, Qty)
    VALUES (NEXT VALUE FOR ordersKeySequence, 'Hat', 2) ;
INSERT Orders (OrderID, Name, Qty)
    VALUES (NEXT VALUE FOR ordersKeySequence, 'Shirt', 1) ;
INSERT Orders (OrderID, Name, Qty)
    VALUES (NEXT VALUE FOR ordersKeySequence, 'Shoes', 1) ;
GO
-- View the table
SELECT * FROM Orders ;
```

sp_describe_first_result_set

- Returns metadata for the result set returned from a query.
- An alternative to sp_columns

sp_describe_first_result_set – Demo

```
exec sp_describe_first_result_set
    N'SELECT * FROM MyTable';
```

	is_hidden	column_ordinal	name	is_nullable	system_type_id	system_type_name	max_length	precision	scale	collation_n
1	0	1	DepartmentID	1	56	int	4	10	0	NULL
2	0	2	Revenue	1	56	int	4	10	0	NULL
3	0	3	Year	1	56	int	4	10	0	NULL
4	0	4	Name	1	167	varchar(1024)	1024	0	0	SQL_Latir

New Date and Time Functions

- DATEFROMPARTS
- TIMEFROMPARTS
- DATETIMEFROMPARTS
- DATETIME2FROMPARTS
- SMALLDATETIMEFROMPARTS

- DATETIMEOFFSETFROMPARTS
- EOMONTH

DATEFROMPARTS

DATEFROMPARTS (year, month, day)

- **Arguments**
  - *Year* Integer expression specifying a year.
  - *Month* Integer expression specifying a month, from 1 to 12.
  - *Day* Integer expression specifying a day.

- Always Year – Month – Day order independent of language or location

TIMEFROMPARTS

TIMEFROMPARTS (hour, minute, seconds, fractions, precision)

- **Arguments**
  - *Hour* Integer expression specifying hours.
  - *Minute* Integer expression specifying minutes.
  - *Seconds* Integer expression specifying seconds.
  - *Fractions* Integer expression specifying fractions.
  - *Precision* Integer literal specifying the precision of the **time** value to be returned.

DATETIMEFROMPARTS

DATETIMEFROMPARTS (year, month, day, hour, minute, seconds, milliseconds)

- **Arguments**
  - *Year* Integer expression specifying a year.
  - *Month* Integer expression specifying a month.
  - *Day* Integer expression specifying a day.
  - *Hour* Integer expression specifying hours.
  - *Minute* Integer expression specifying minutes.
  - *Seconds* Integer expression specifying seconds.
  - *Milliseconds* Integer expression specifying milliseconds.

DATETIME2FROMPARTS

DATETIME2FROMPARTS (year, month, day, hour, minute, seconds, fractions, precision)

- **Arguments**
  - Year Integer expression specifying a year.
  - Month Integer expression specifying a month.
  - Day Integer expression specifying a day.
  - Hour Integer expression specifying hours.
  - Minute Integer expression specifying minutes.
  - Seconds Integer expression specifying seconds.
  - Fractions Integer expression specifying fractions.
  - Precision Integer literal specifying the precision of the datetime2 value to be returned.

SMALLDATETIMEFROMPARTS

- SMALLDATETIMEFROMPARTS(year,month,day,hour,minute)

- Same idea as the others….

DATETIMEOFFSETFROMPARTS

- DATETIMEOFFSETFROMPARTS (year, month, day, hour, minute, seconds, fractions, hour_offset, minute_offset, precision)

- *hour_offset* - Integer expression specifying the hour portion of the time zone offset.
- *minute_offset* - Integer expression specifying the minute portion of the time zone offset.
- *Precision* - Integer literal specifying the precision of the value to be returned.
  - Precision can be a value of 0 to 7 which specifies the precision of the fractional part of the seconds.

EOMONTH

EOMONTH (start_date [, month_to_add])

- Returns the last day of the month that contains the specified date, with an optional offset.

- **Arguments**
  - *start_date* Date expression specifying the date for which to return the last day of the month.
  - *month_to_add* Optional integer expression specifying the number of months to add to *start_date*.

Date and Time– Demo

```
-- DATEFROMPARTS(year,month,day)
-- the old way
SELECT Date=cast(Convert(datetime,convert(varchar(10),2012)+'-'+convert(varchar(10),6)+'-'+convert(varchar(10),1), 101)as date)

-- new TSQL DATEFROMPARTS
SELECT DateFROMParts ( 2012, 6, 1 ) AS Date;

--TIMEFROMPARTS (hour,minute,seconds,fractions,precision)
SELECT TimeFROMParts(11,15,20,147,3)

--DATETIMEFROMPARTS (year,month,day,hour,minute,seconds,milliseconds)
SELECT  DateTimeFROMParts(2012, 6, 16, 11, 15, 49, 147)

--DATETIME2FROMPARTS (year,month,day,hour,minute,seconds,fractions,precision)
SELECT DateTime2FROMParts(2012, 6, 16, 11, 15, 49, 147, 4);

-- this will throw an error
--   the precision is smaller than the fraction specified
SELECT DateTime2FROMParts(2012, 6, 16, 11, 15, 49, 147, 1);

--SMALLDATETIMEFROMPARTS(year,month,day,hour,minute)
SELECT SmallDateTimeFROMParts(2012, 6, 16, 11, 15);

--DATETIMEOFFSETFROMPARTS ( year, month, day, hour, minute, seconds, fractions, hour_offset, minute_offset, precision )
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 120, 8, 0, 3);

-- precision options for DATETIMEOFFSETFROMPARTS
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 0, 8, 0, 0);
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 2, 8, 0, 1);
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 20, 8, 0, 2);
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 20, 8, 0, 3);
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 20, 8, 0, 4);
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 20, 8, 0, 5);
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 20, 8, 0, 6);
SELECT DateTimeOffsetFROMParts (2012, 6, 16, 11, 15, 25, 20, 8, 0, 7);

--EOMONTH
DECLARE @date DATETIME
SET @date = DATEFROMPARTS(2012, 6, 1)
SELECT EOMONTH ( @date ) AS Result;

SELECT EOMONTH ( @date, +2) AS Result;
```

I don’t expect you to read this slide, just copy and paste into SSMS.

Conversion Functions

- **PARSE**

PARSE (string_value AS data_type [USING culture])

- **TRY_PARSE**

TRY_PARSE (string_value AS data_type [USING culture])

- **TRY_CONVERT**

TRY_CONVERT (data_type [(length)], expression [, style])

style accepts the same values as the style parameter of the CONVERT function

Conversion Functions Demo

```
-- PARSE ( string_value AS data_type [ USING culture ] )
SELECT parse('2012-06-16' as date);

-- this is an invalid date
SELECT parse('2012-06-31' as date);

-- with culture
SELECT parse('06-16-2012' as date USING 'en-us');
SELECT parse('06-16-2012' as date USING 'fr-fr');

-- TRY_PARSE ( string_value AS data_type [ USING culture ] ) similar to parse, but null is returned rather than throwing  an error for invalid dates
SELECT try_parse('2012-06-16' as date);

-- this is an invalid date
SELECT try_parse('2012-06-31' as date);

-- now with culture
SELECT try_parse('06-04-2012' as date USING 'en-us');
SELECT try_parse('06-04-2012' as date USING 'fr-fr');
SELECT try_parse('2012-06-04' as date USING 'fr-fr');
-- something invalid 6th day of 16th month in French
SELECT try_parse('06-16-2012' as date USING 'fr-fr');

-- TRY_CONVERT ( data_type [ ( length ) ], expression [, style ] )
SET DATEFORMAT dmy;
SELECT TRY_CONVERT(datetime2, '12/31/2010') AS Result;

SELECT CASE WHEN TRY_CONVERT(float, 'test') IS NULL
            THEN 'Cast failed'  ELSE 'Cast succeeded'   END AS Result;

SELECT *, try_convert(float, Name) as newValue
FROM MyTable;
```

THROW exception

- Replaces RAISERROR
- Allows for error handling, then THROW of the original error
- Percolate errors up

THROW Demo

```
SELECT 1/0

CREATE TABLE ErrorLog(ErrorTime datetime, Severity varchar(max), ErrMsg varchar(max))

-- Prior to SQL 2012
BEGIN TRY
  DECLARE @Number int = 1 / 0;
END TRY
BEGIN CATCH
  -- Log the error info, then re-throw it
  INSERT INTO ErrorLog VALUES(GETDATE(), ERROR_SEVERITY(), ERROR_MESSAGE());
  DECLARE @msg NVARCHAR(MAX) = ERROR_MESSAGE()
  RAISERROR (@msg, 16, 1)
  -- error is 50000, rather than the original error value
END CATCH

-- SQL2012 with THROW
BEGIN TRY
  DECLARE @Number int = 1 / 0;
END TRY
BEGIN CATCH
  -- Log the error info, then re-throw it
  INSERT INTO ErrorLog VALUES(GETDATE(), ERROR_SEVERITY(), ERROR_MESSAGE());
  THROW;
END CATCH

SELECT * FROM ErrorLog;
```

In Review

- OVER Clause Enhancements
  - ROWS/RANGE PRECEDING, FOLLOWING, UNBOUNDED
- IIF and CHOOSE
- OFFSET / FETCH
- FORMAT, CONCAT
- SEQUENCE
- sp_describe_first_result_set
- New Date and Time Functions
- Conversion Functions
  - PARSE, TRY_PARSE, TRY_CONVERT
- THROW exception

More Information

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- Visit my website
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- Send me an email:
  - Steve@SteveStedman.com
- Download Slides and Sample TSQL
  - http://stevestedman.com/speaking
- New SQL 2012 Functions at 4:20pm in Room 110