Database Design: Size DOES Matter!

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Confio Software

Why Are You Here?

- You have data
- It is growing larger
- Performance suffers
- You want to make things better
  – Or you have been *told* to make things better

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A little about me…

Microsoft CERTIFIED Master | SQL Server 2008

MVP Microsoft Most Valuable Professional

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LaRock

@sqlrockstar

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Agenda

- What's the problem?
- Why datatypes matter
- Solution options

THE PROBLEM

The Problem

- Your database has a design
  - Just like a ship, or a car, has a design

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- Databases are mixed-use
- Data professionals are often asked to convert a pickup truck into a Ferrari
- Great database performance starts with great database design

How Database Designs Fail

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- Many designs do not account for size
- Rowcounts *might* be considered
- What about *inside* the rows?
  - Those are the columns
  - Their width is often overlooked

WHY DATATYPES MATTER

What Is A Database, Really?

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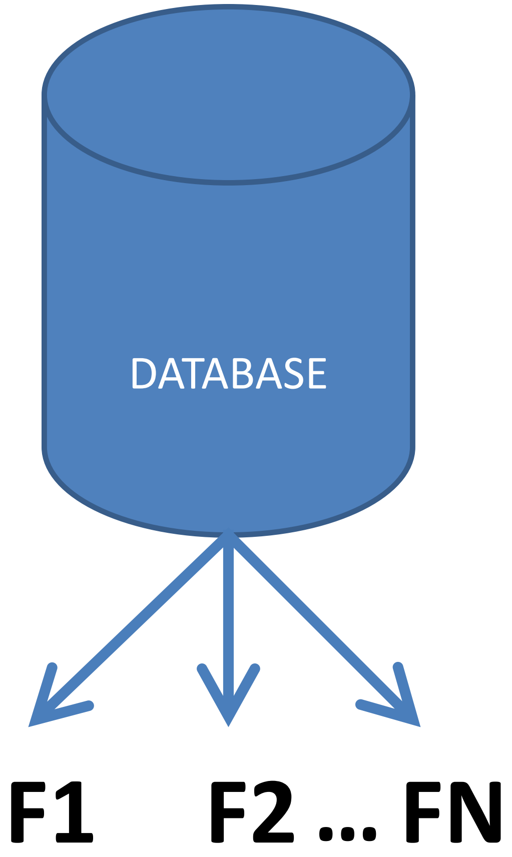

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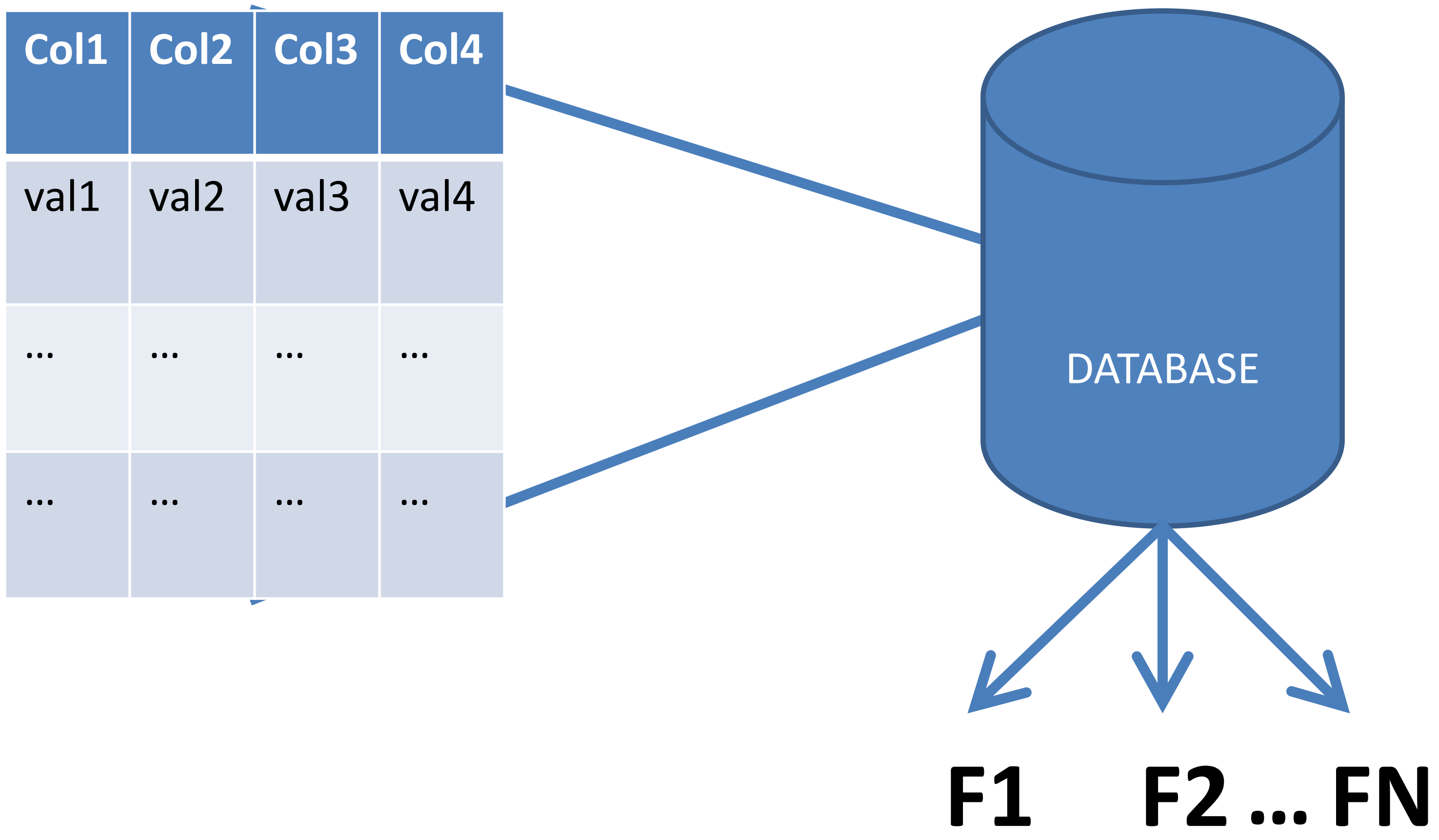

Col1	Col2	Col3	Col4
val1	val2	val3	val4
…	…	…	…
…	…	…	…

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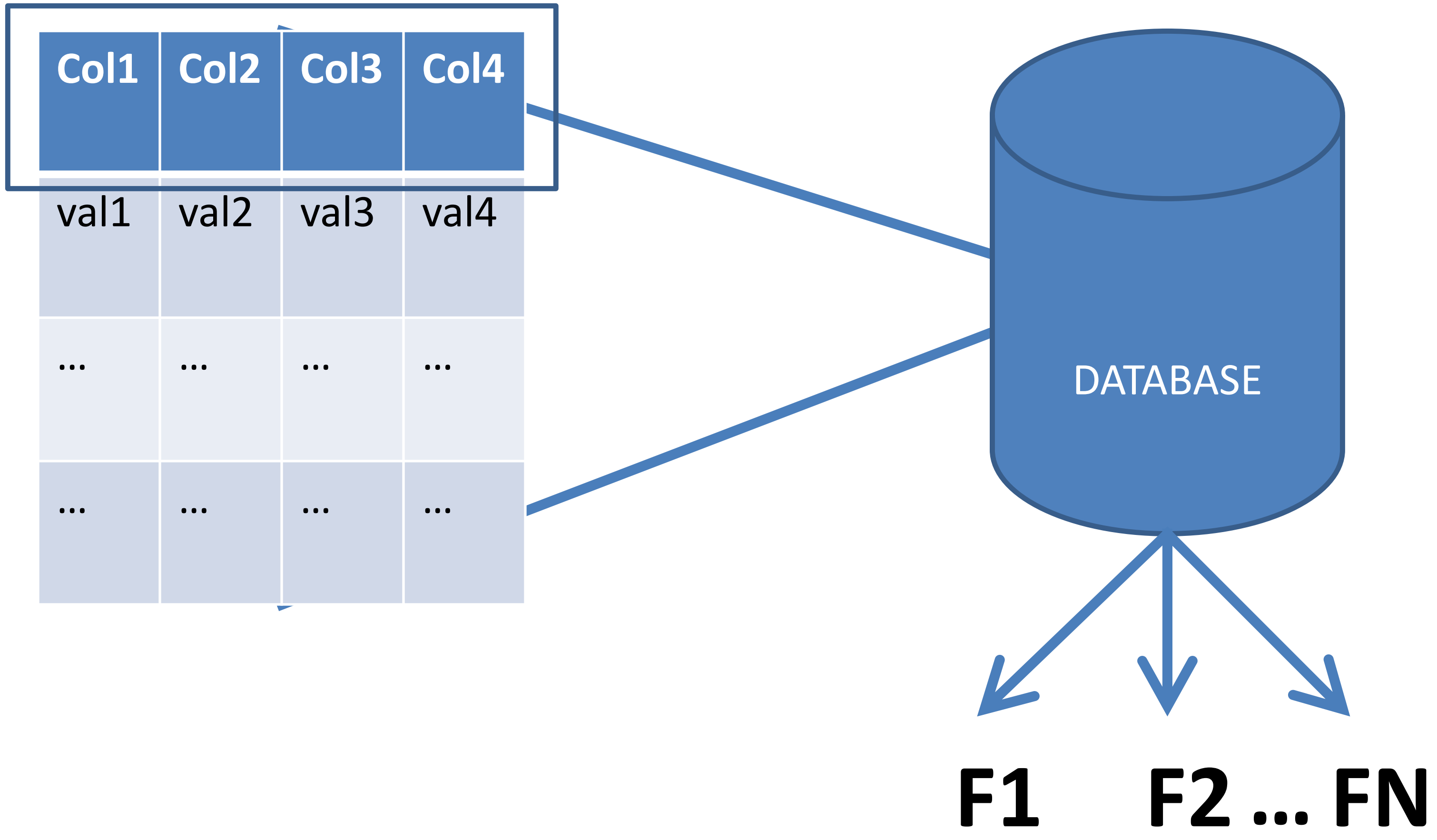

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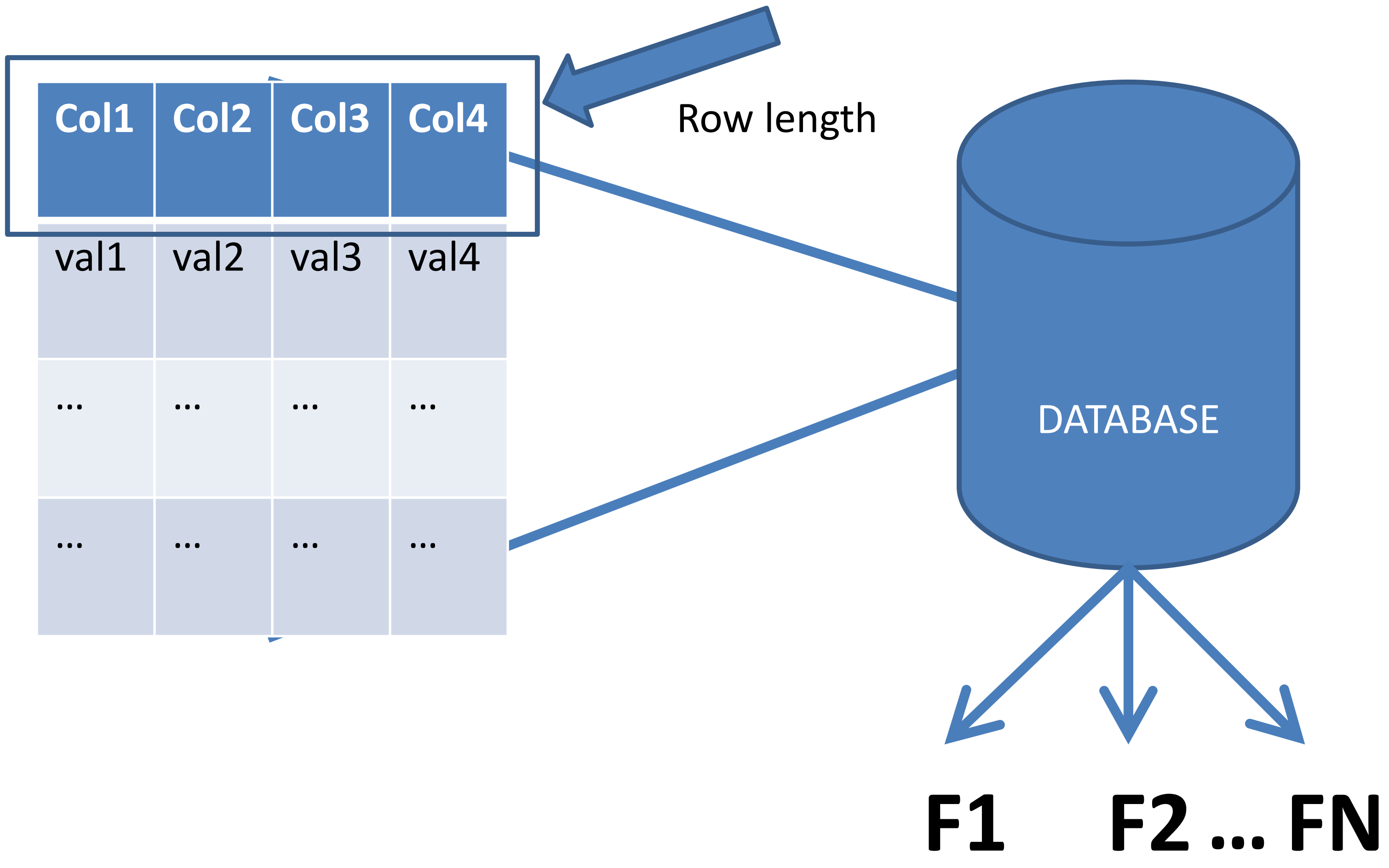

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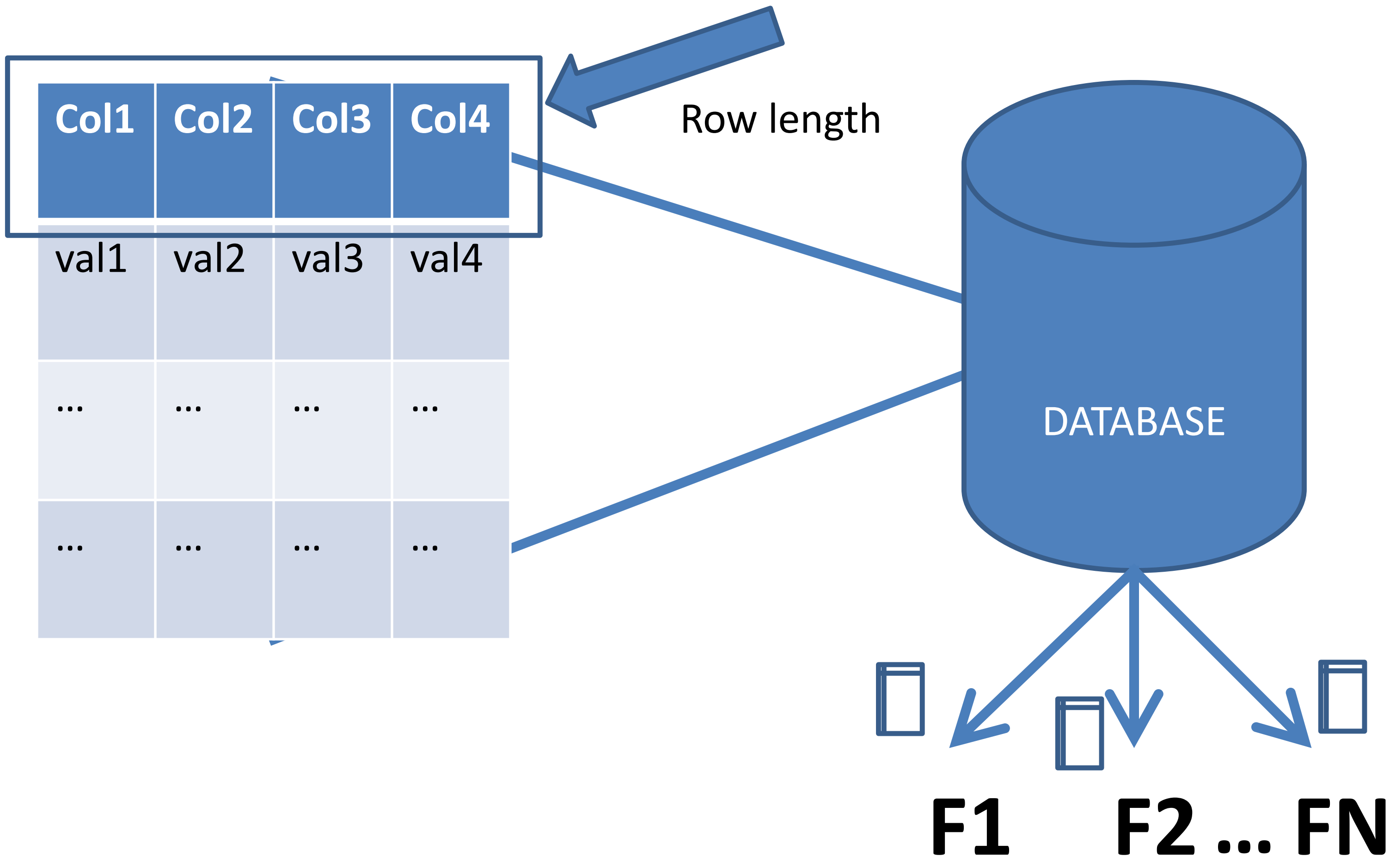

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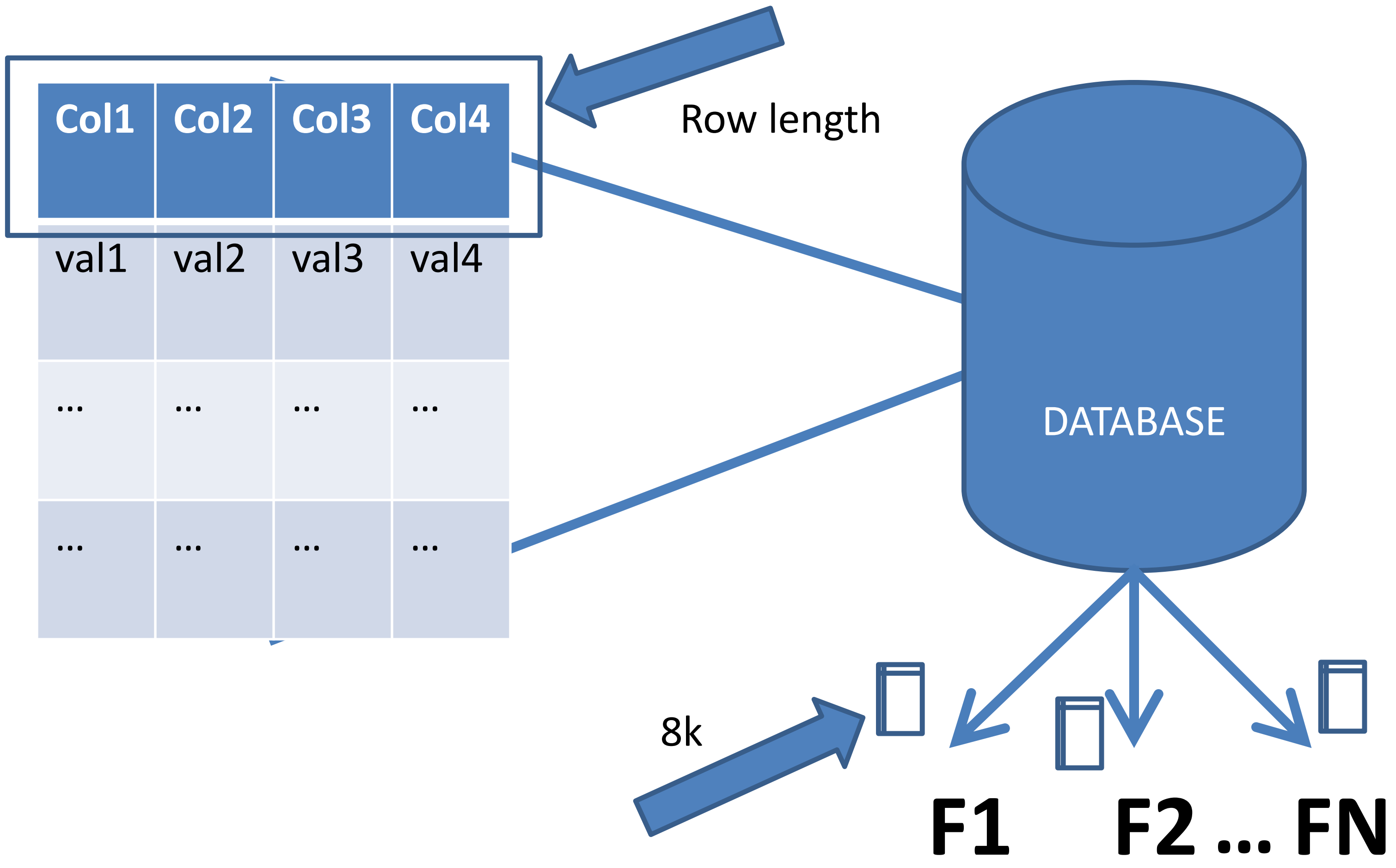

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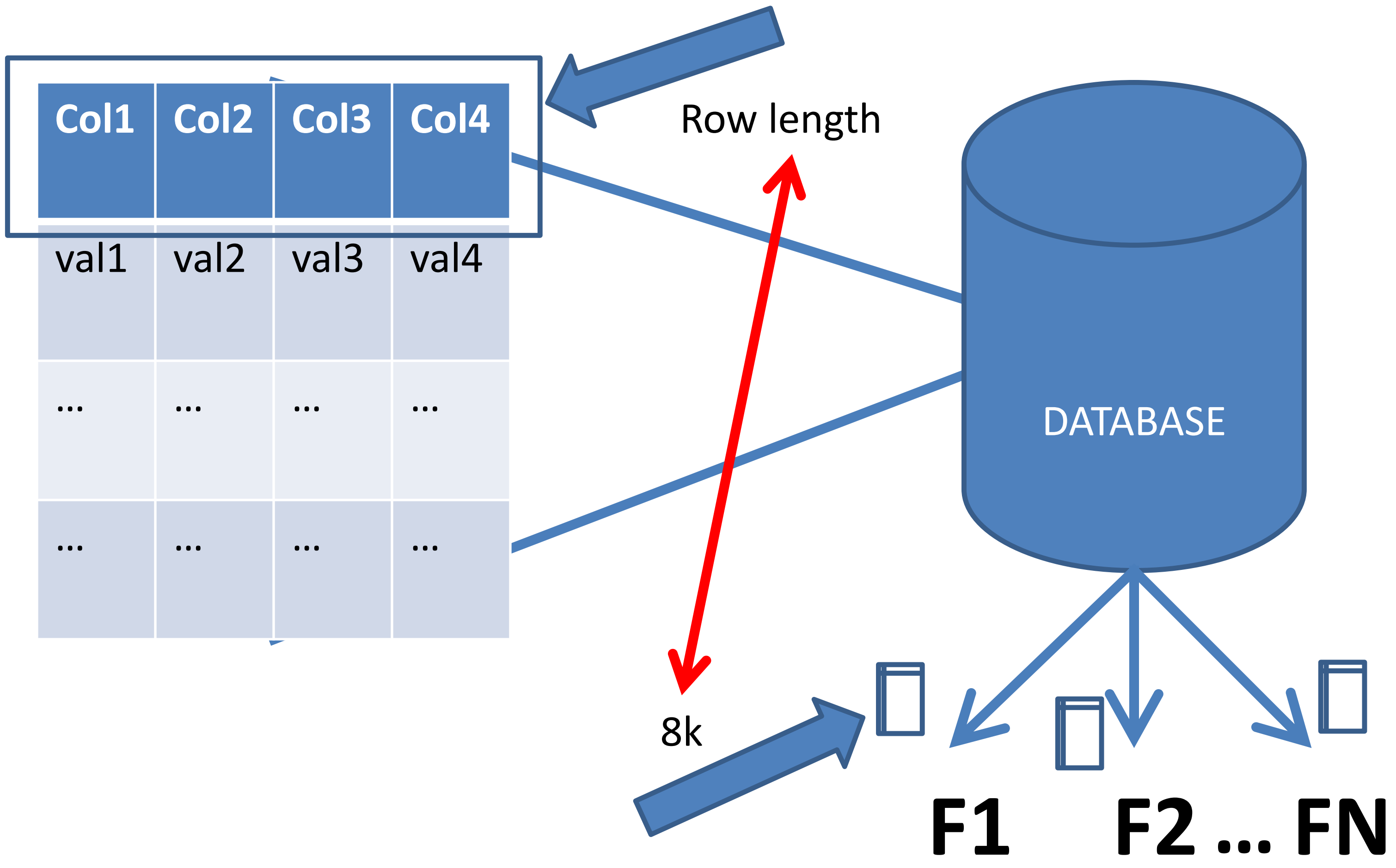

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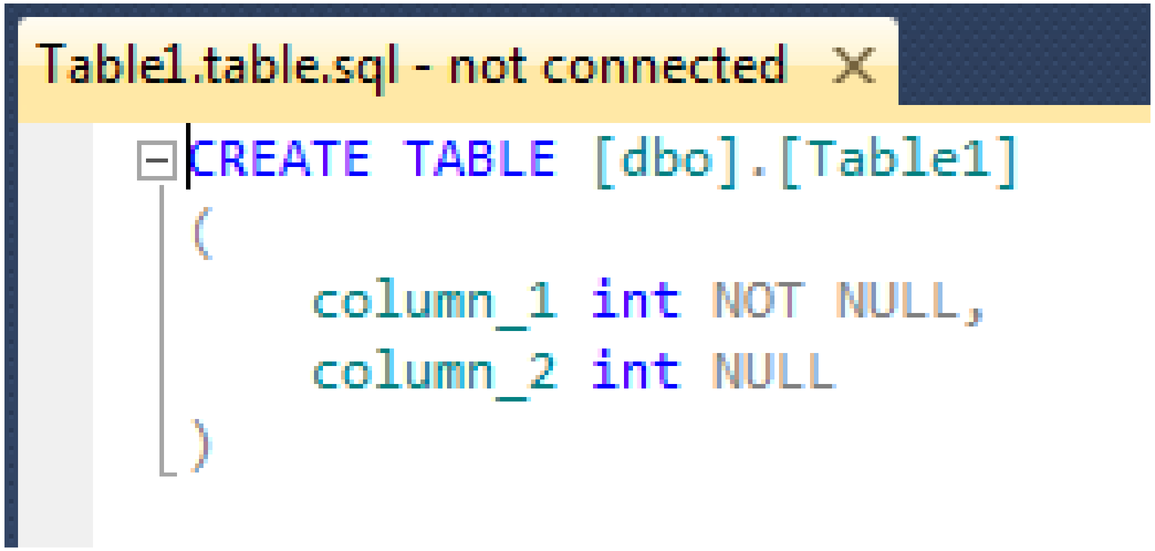
- Do you see a disconnect there?

Visual Studio Defaults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```
CREATE TABLE [dbo].[Table1]
(
	column_1 int NOT NULL,
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)
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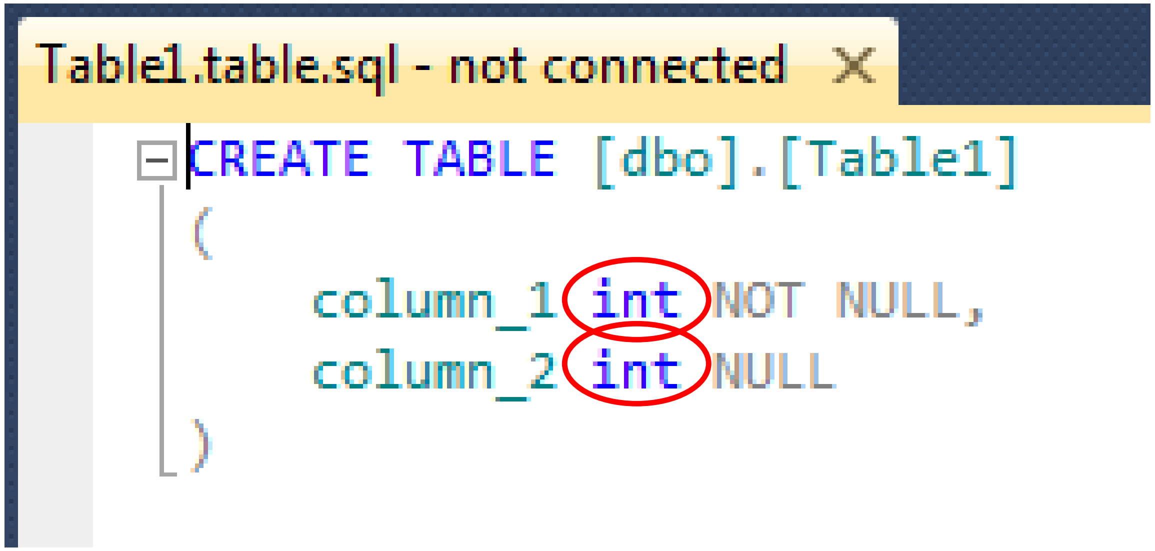
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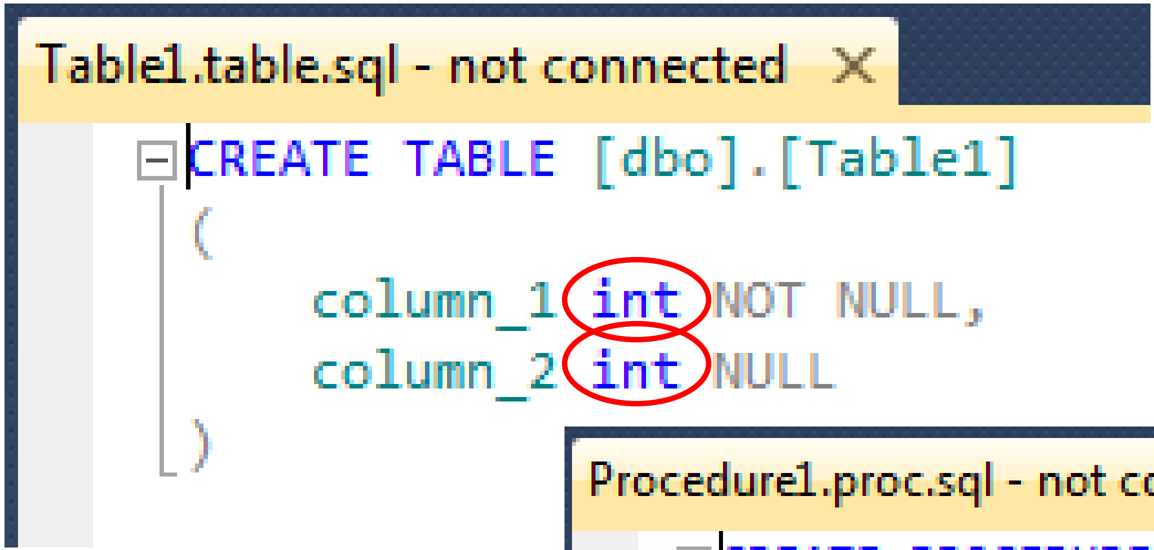

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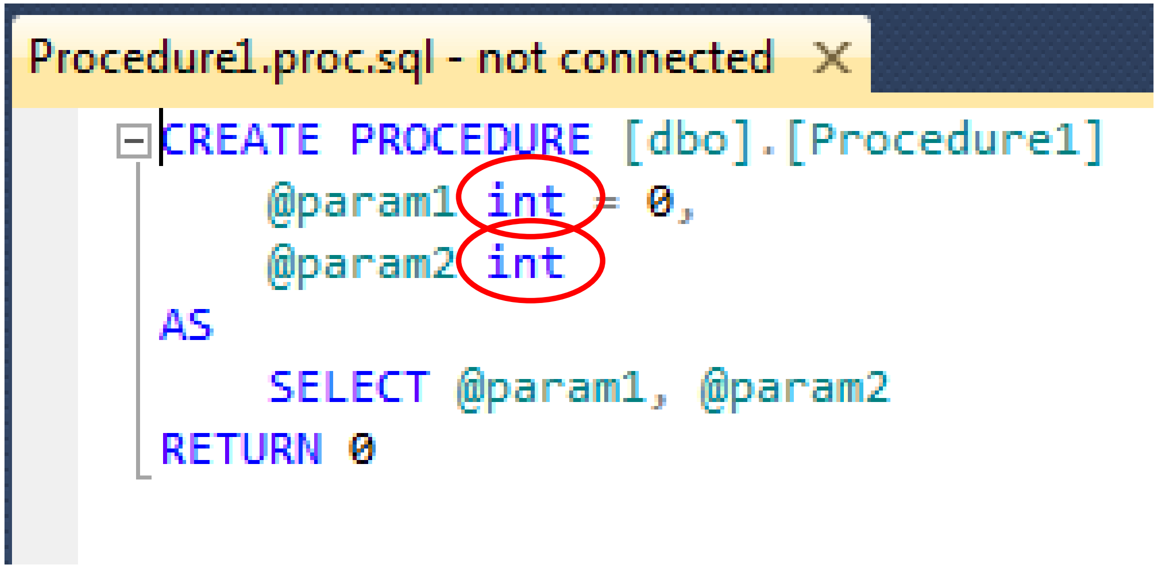

Procedure1.proc.sql - not connected

```
CREATE PROCEDURE [dbo].[Procedure1]
    @param1 int = 0,
    @param2 int
AS
    SELECT @param1, @param2
RETURN 0
```

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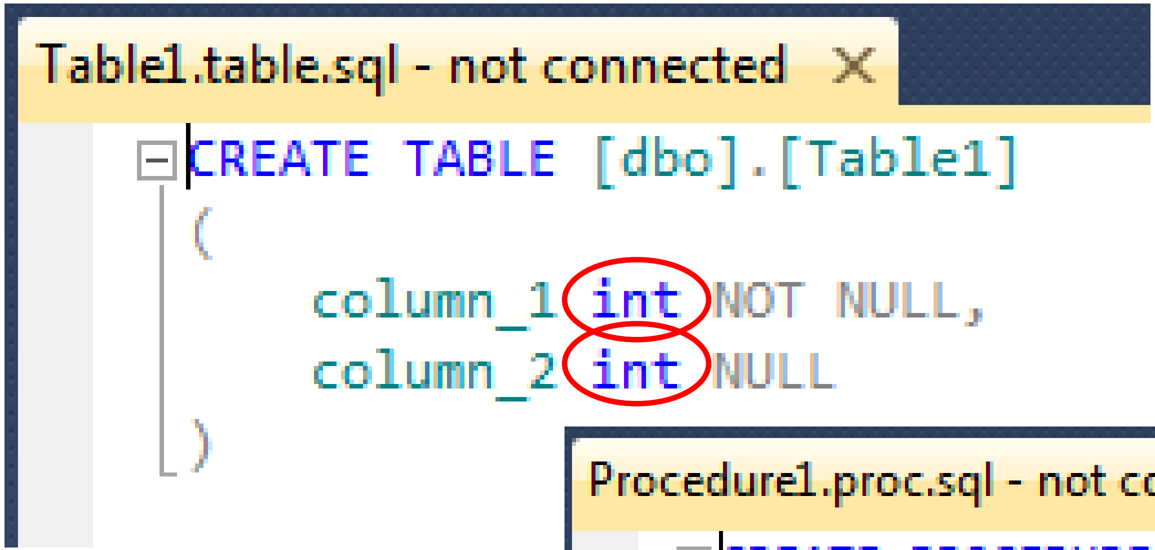

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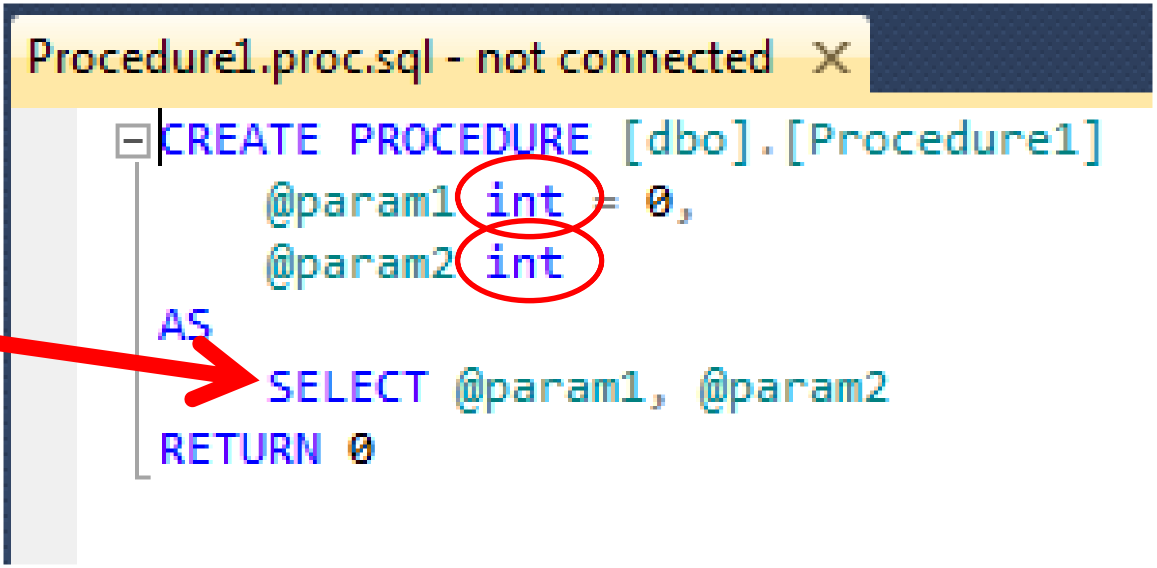

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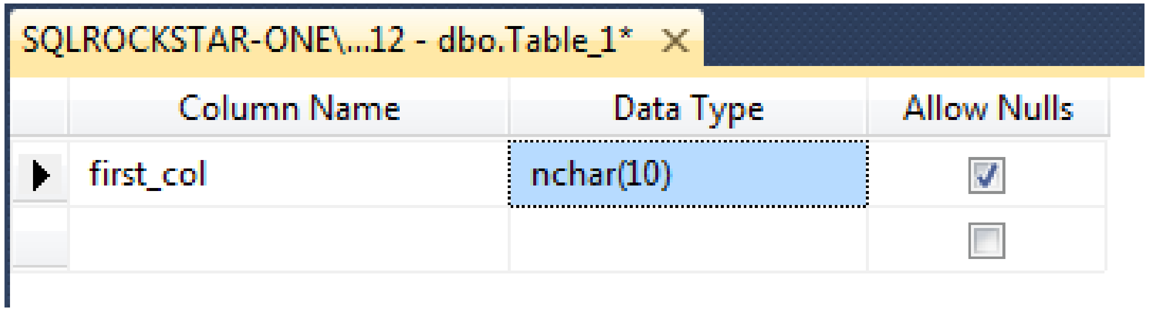
Mismatch Likely!

SSMS Defaults



SQLROCKSTAR-ONE\...12 - dbo.Table_1*

	Column Name	Data Type	Allow Nulls
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			☐

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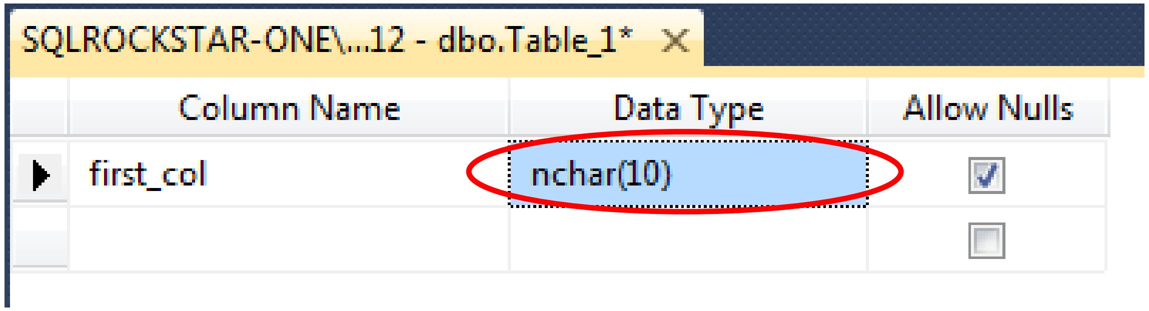

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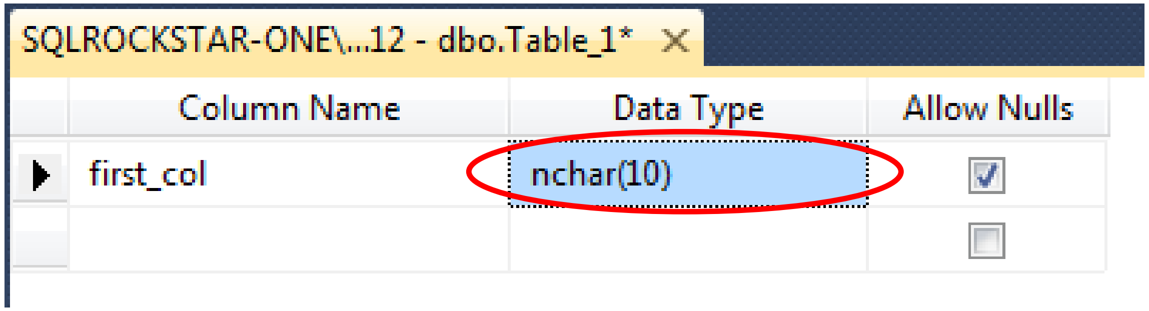
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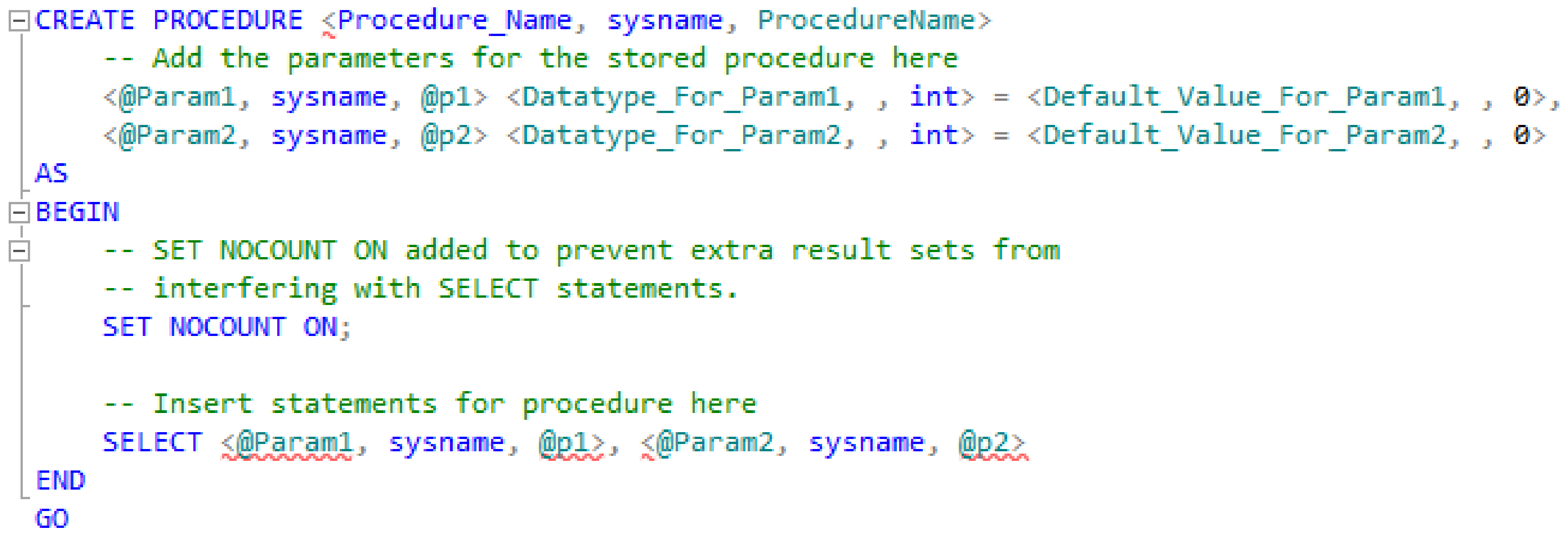
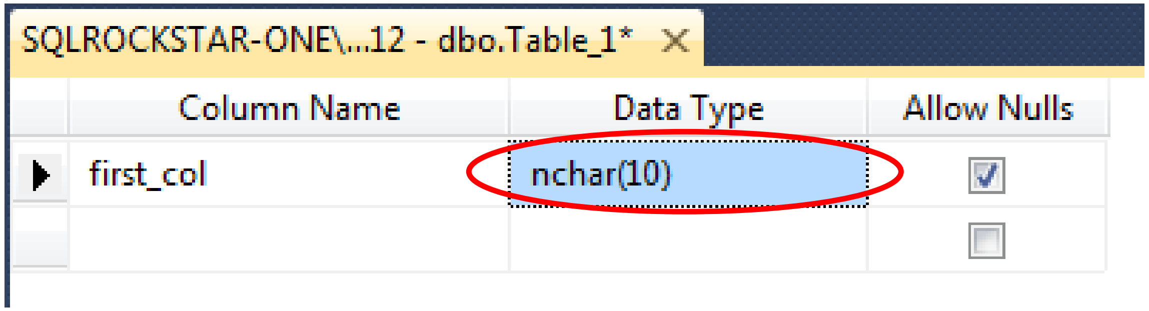

```
CREATE PROCEDURE <Procedure_Name, sysname, ProcedureName>
    -- Add the parameters for the stored procedure here
    <@Param1, sysname, @p1> <Datatype_For_Param1, , int> = <Default_Value_For_Param1, , 0>,
    <@Param2, sysname, @p2> <Datatype_For_Param2, , int> = <Default_Value_For_Param2, , 0>
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

    -- Insert statements for procedure here
    SELECT <@Param1, sysname, @p1>, <@Param2, sysname, @p2>
END
GO
```

SSMS Defaults



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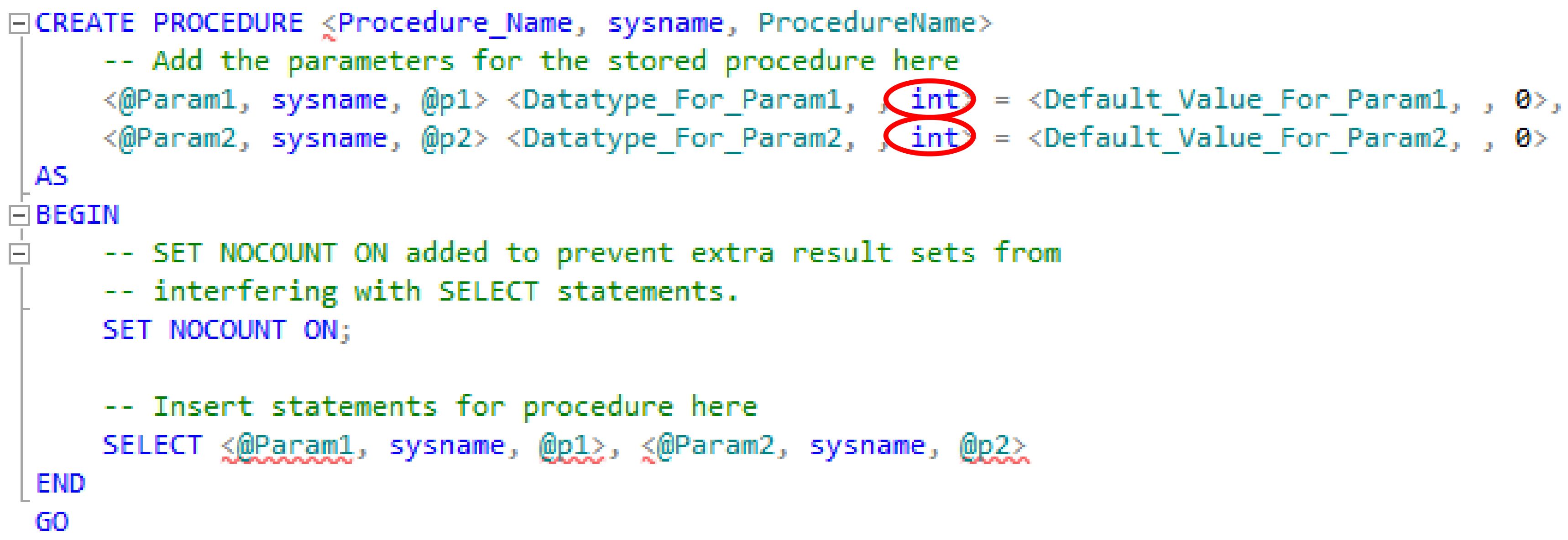

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```

Date Example

Datatype Name	Length (bytes)
Date	3
Smalldatetime	4
Time	5
Datetime2	6, 7, or 8
Datetime	8
Datetimeoffset	10

Where Will This Hurt?

- Disk space
- Memory space
- Performance

Datatype Pain #1: Disk Space

- Disk is cheap…sure it is…but there are hidden costs!
  - More storage = longer maintenance
  - More storage = longer database backups
  - More storage = longer tape backups

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- Disk is cheap…sure it is…but there are hidden costs!
  - More storage = longer maintenance
  - More storage = longer database backups
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- Most are unaware how that tiny piece of data is stored multiple times
  - Wide clustering key is spread to EVERY NC index!

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- Those extra bytes are read from disk into SQL Server buffer cache
- Extra Logical I/O needed to return a query result
- What about indexes?
  - Same thing, they drag around the extra I/O

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EXTRA LOGICAL I/O

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Datatype Pain #3: Performance

- Datatype mismatch results in implicit conversions
- Optimizer knows this is bad, will display a warning for you
- It is up to you to make a change, SQL Server won’t change your code for you!
- Issue with code generators (ADO.NET 3.5, EMF, nHibernate, LINQ)
  - Supposedly fixed?

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IMPLICIT CONVERSIONS

SOLUTION OPTIONS

First Step: Admit You Have a Problem!

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- First sign: when OLAP queries interfere with OLTP processing
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- Another sign: plan cache bloat

Solutions

- **Find duplicate/unused/misused indexes**
- Compression
- Filtered indexes
- Archiving/partitioning
- Verify datatypes are correct
- Update code
- Update architecture

Index Maintenance

- Want to reduce the extra I/O
  - Remove duplicate indexes
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- Test thoroughly!
  - Examine plan cache to find if indexes are used
  - Plan cache resets on service restart (or manual)

Finding Mis-used Indexes

```
SELECT o.name, indexname=i.name, i.index_id
, reads=user_seeks + user_scans + user_lookups
, writes =  user_updates
, rows = (SELECT SUM(p.rows) FROM sys.partitions p WHERE p.index_id = s.index_id
AND s.object_id = p.object_id)
, CASE
         WHEN s.user_updates < 1 THEN 100
         ELSE 1.00 * (s.user_seeks + s.user_scans + s.user_lookups) /
s.user_updates
  END AS reads_per_write
, 'DROP INDEX ' + QUOTENAME(i.name)
+ ' ON ' + QUOTENAME(c.name) + '.' + QUOTENAME(OBJECT_NAME(s.object_id)) as 'drop
statement'
FROM sys.dm_db_index_usage_stats s
INNER JOIN sys.indexes i ON i.index_id = s.index_id AND s.object_id = i.object_id
INNER JOIN sys.objects o on s.object_id = o.object_id
INNER JOIN sys.schemas c on o.schema_id = c.schema_id
WHERE OBJECTPROPERTY(s.object_id,'IsUserTable') = 1
AND s.database_id = DB_ID() AND i.type_desc = 'nonclustered'
AND i.is_primary_key = 0 AND i.is_unique_constraint = 0
AND (SELECT SUM(p.rows) FROM sys.partitions p WHERE p.index_id = s.index_id AND
s.object_id = p.object_id) > 10000
ORDER BY reads
```

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ROW/PAGE COMPRESSION

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  - Page compression
  - Each table/index requires compression to be enabled
- ColumnStore
  - Dictionary compression
  - Segments and batches

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Filtered Indexes

- Look like regular indexes
  - Contain a WHERE clause
- Smaller footprint
- Less logical I/O

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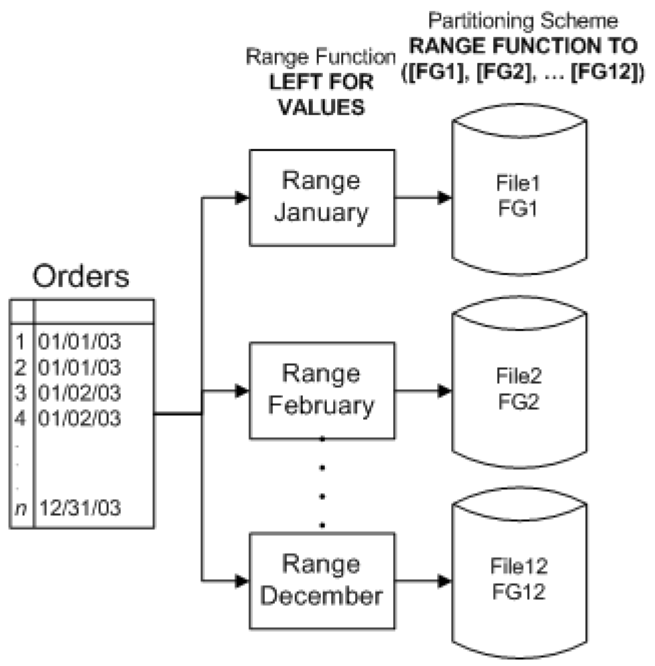

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- You can estimate savings
  - Space as well as LIO
- Can be intrusive to alter
  - Especially if PK/FK defined
- Periodically check to make sure you are not running out!

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VERIFY DATATYPES

Solutions

- Find duplicate/unused/misused indexes
- Compression
- Filtered indexes
- Archiving/partitioning
- Verify datatypes are correct
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Update Code/Architecture

- If you are seeing the signs, then you may consider updating code
- Some frameworks are not optimal
  - ADO.NET 3.5
  - LINQ to SQL
  - EMF
- Scale out architecture
  - Create real reporting solution
  - AlwaysOn

10 Steps For Right Sizing

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1. Understand the storage requirements for every datatype you consider
2. Review all design decisions based on the shape of the data – where it is now and where it is likely to be later.
3. Set datatypes based on business requirements, not tool defaults

10 Steps For Right Sizing

4. Measure and monitor fit of the data to its datatypes regularly

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6. Measure for unused and duplicate indexes regularly

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8. Find longest running and most often used queries
9. Look for implicit conversions in your plan cache
10. Remember that ***size matters***

Summary

- What’s the problem?
- Why datatypes matter
- Solution options

For More Information

- http://tinyurl.com/sql-datatypes
- http://tinyurl.com/imp-cols-in-plan-cache
- http://tinyurl.com/data-access-perf
- http://tinyurl.com/row-compression