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# Real world DevOps challenges with SQL Server and SQL DB

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# Session objectives and takeaways

At the end of this session, you should be better able to use the SQLDOM parser and the DACFX libraries to:

- Minimize downtime due to database schema changes
- Deploy at scale across hundreds or thousands of databases
- Ensure end-to-end security at the DB layer regardless of the type of the query

# Working with Transact-SQL

Have you ever wanted easily to:

- Limit SQL Injection attacks?
- Inspect T-SQL code for best (worse) practices
- Easily parameterize your queries?
  - i.e. use Always Encrypted without having to rewrite your application.
- Format (Pretty Print) your Transact-SQL code?
- Perform static Transact-SQL code analysis?

# Scenario: Unparameterized Transact-SQL

## Customer Scenario

Vendor A had a solution for the Oil and Gas Industry that had over 10,000 places where dynamic Transact-SQL was generated

## Core Issue

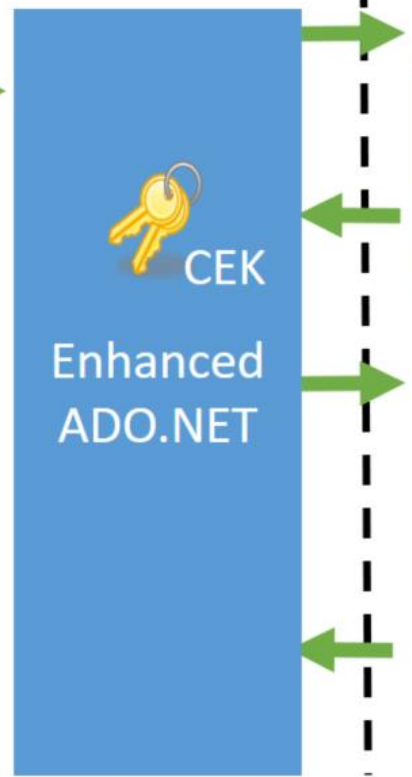
A potential new customer wanted all code to be parameterized to reduce the likelihood of SQL Injection

## Fix It!

SqlCommandFilters to the rescue!



```
using (SqlCommand cmd = new SqlCommand(
"SELECT Name FROM Patients WHERE SSN =
@SSN"
, conn))
{
cmd.Parameters.Add(new SqlParameter(
"@SSN", SqlDbType.VarChar, 11).Value =
"111-22-3333");
SqlDataReader reader =
cmd.ExecuteReader();
```



```
exec sp_describe_parameter_encryption
@params = N'@SSN VARCHAR(11)'
, @tsql = N'SELECT * FROM Patients WHERE SSN = @SSN'
```

Param	Encrypted CEK Value	CMK Store Provider Name	CMK Path
@SSN		CERTIFICATE_STORE	Current User/My/f2260...

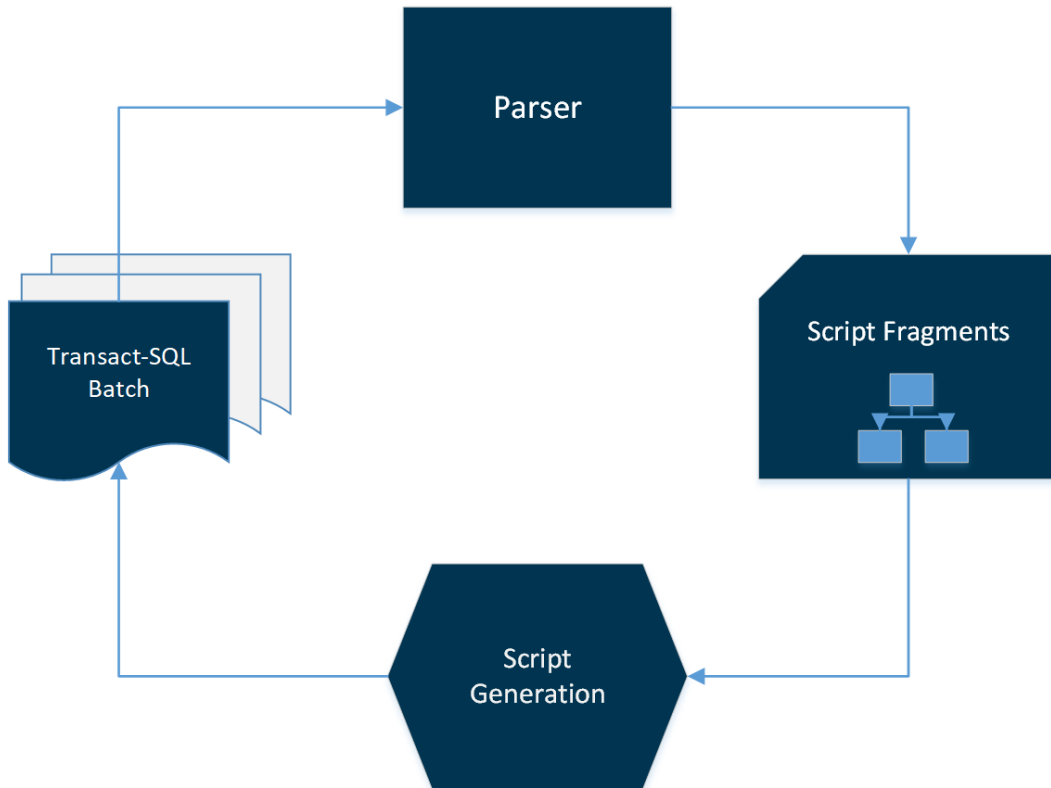
```
EXEC sp_execute_sql
N'SELECT * FROM Patients WHERE SSN = @SSN'
, @params = N'@SSN VARCHAR(11)', @SSN=0x7ff654ae6d
```



Name
Jim Gray

Name	SSN
0x19ca706...	0x7ff654ae...
0xfbd9ae...	0x654ae6...

# The 'Crown Jewels'



Part of the SQL Server 2016 [Feature Pack](#)



# Getting started

Obtaining the parsers and DACFX (download locations)

- SSMS

- DACFX redistributable (GAC considerations)

- SQLServer PowerShell module

'Use specific version' consideration in .NET

SSDT: Always ensure you are updated!

(<https://docs.microsoft.com/en-us/sql/ssdt/download-sql-server-data-tools-ssdt>)



## In a nutshell

```
// Get the parse tree
```

```
TSqlFragment tree = parser.Parse(rdr, out errors);
```

```
//Use the visitor pattern to examine the parse tree
```

```
TsqlBatchVisitor visit = new TsqlBatchVisitor(  
    cmd, reparse);
```

```
// Now walk the tree and do our work
```

```
tree.Accept(visit);
```

# How to use SqlCommandFilters?

```
con.Open();  
SqlCommand cmd = new SqlCommand();  
cmd.Connection = con;  
cmd.CommandText = "your code"  
SqlCommandFilters.Parameters.Parameterize(ref cmd);  
// cmd is now parameterized!
```

# Demo: ExplicitVisitor and CommandFilters

# Scenario: Project Database Settings vs. SQL defaults

## Customer Scenario

Customer used a T-SQL script to change compatibility level of 400 databases in an elastic pool to compatibility 130. Some weeks later, they found the compatibility level magically changed back to 120

## Core Issue

Making changes directly to the database is not a great idea! Changing compatibility level directly in the DB and not in the SSDT project will cause changes to be 'rolled back' on subsequent DACPAC deployments

## Fix It!

DevOps with DACPACs is all about declaratively changing schema / code in the SSDT project and then 'deploying that forward' into the DB. Always make changes to the SSDT project first, and be aware of certain non-default settings!

Database Settings ? X

Common Operational Miscellaneous

Default Filegroup

Default filegroup: PRIMARY

Default filestream filegroup:

Automatic

☐ Auto close ☐ Auto shrink

☒ Auto create statistics ☒ Auto update statistics

☐ Auto create incremental

☐ Auto update statistics asynchronously

Cursor

☐ Close cursor on commit enabled

Default cursor: LOCAL

Recovery

Recovery: FULL

Target recovery time (seconds): 0

Page verify: NONE

Snapshot Options

☐ Allow snapshot isolation ☐ Read committed snapshot

☐ Memory optimized elevate to snapshot

Transactions

Delayed durability:

Query Store

Operation mode: Off

Query capture mode: All

Stale query threshold (days): 367

Data flush interval (seconds): 900

Max storage size (MB): 100

OK Cancel

# Scenario: Importing a 'bad' BACPAC

## Customer Scenario

A large SaaS ISV was using BACPACs to provide an 'offline backup' for their customer databases (Azure SQL DB). One day, they found a particular BACPAC would not import successfully

## Core Issue

The database had a set of default constraints which had names conflicting with auto-generated default constraint names (demo will help you visualize this!)

## Fix It!

We were able to use a custom deployment contributor to auto-name unnamed default constraints, thereby avoiding the name conflict

# Scenario: Online ALTER COLUMN

## Customer Scenario

A large SaaS ISV was forced to take planned downtime (hundreds of DBs) during their DACPAC deployments due to database blocking issues

## Core Issue

DACPAC deployment internally produces a script which uses ALTER TABLE... ALTER COLUMN in some cases. These take out restrictive schema modification locks, causing blocking

## Fix It!

Azure SQL DB supports online ALTER COLUMN operations, but for DACPAC deployment to take advantage of this, we needed to implement a custom deployment contributor

# Deployment Contributors

What are they?

Where can they be used?

- Import / Export BACPAC

- Extract / Deploy DACPAC

What is already available?

Syntax

- SQLPackage

- SSDT deploy

- DACFX



# Demo: Importing a 'bad' BACPAC and Online ALTER COLUMN

# In review: session objectives and takeaways

- Minimize downtime due to database schema changes?
- Deploy at scale across hundreds or thousands of databases?
- Ensure end-to-end security at the DB layer regardless of the type of the query?
- By using the SQLDOM parser and the DACFX libraries to accomplish these objectives

# Session resources

## Sample Code Repositories

<https://github.com/Microsoft/DACExtensions/>

<https://github.com/arvindshmicrosoft/SQLScriptDomSamples>

<https://github.com/sqlbobt/SqlCommandFilters>

<https://github.com/GoEddie/ScriptDomVisualizer/tree/master/release>

## More on SQLDOM

<https://www.youtube.com/watch?v=CciVxRFXgH8>

<https://blogs.msdn.microsoft.com/arvindsh/tag/sqlldom/>

## Slidedeck and forked demos

<https://github.com/ikdonev/SQLSatSofia642>

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