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Using SQL Database Projects

With Visual Studio SQL Server Data Tools

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https://github.com/xhead/FabCon2025

/mikediehlsqlbi

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Can you answer these questions?

- What did this database look like six months ago?
- Can I change the name of a column or table and not break something?
- Are there any broken references in this database?
- Can I deploy this database to a new database?
- Can I reliably upgrade the objects in an existing database?

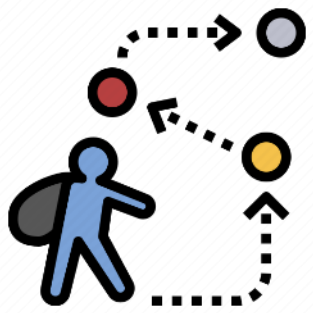
Database Projects

- Visual Studio (Data storage and processing)
- SQL files:
  - CREATE statements
    - Most files are a single CREATE; table scripts can include CREATE INDEX statements and other; separated by GO
  - Other scripts
    - One Pre-Deploy script
    - One Post-Deploy script
    - Call other scripts from these two scripts

Desired State Configuration (DSC)

The source code defines the desired end-state.

At deployment, the actions to move from current state to desired state are determined and executed



Migration-based configuration

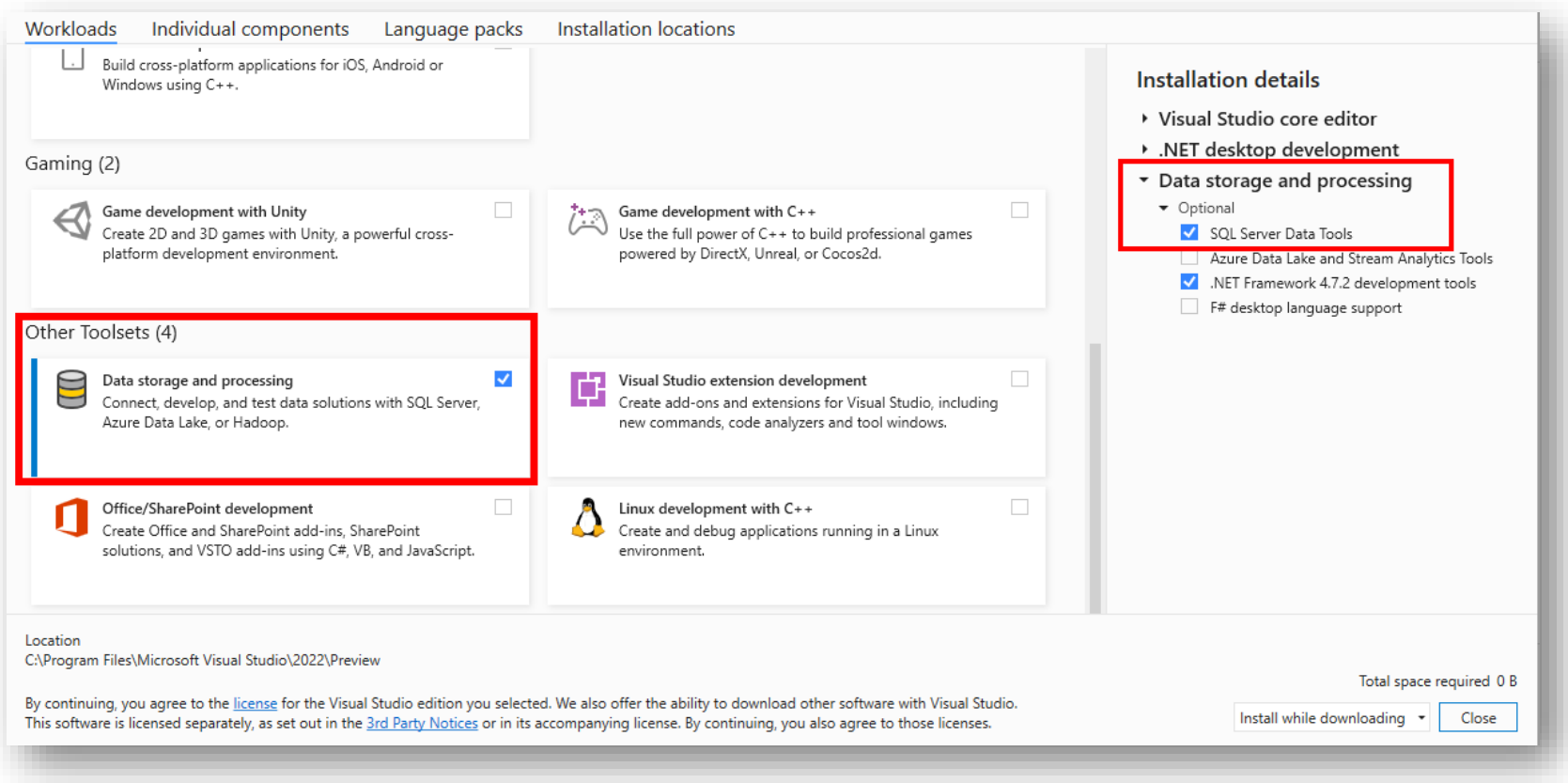
Each migration specifies actions to move from state to state

From A to B

From B to C

Software

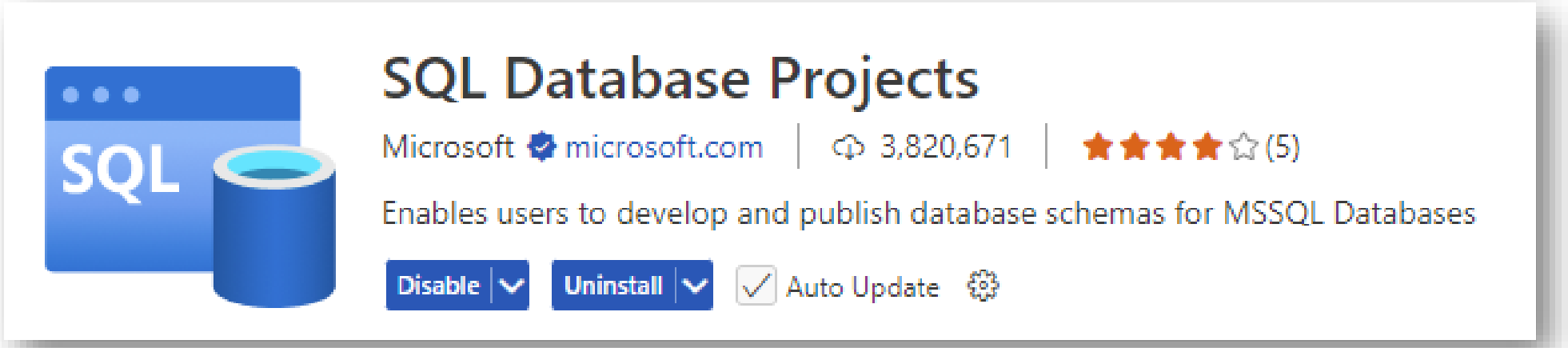
- Visual Studio (Community Edition)
  - Other toolsets
  - Data storage and processing



Software

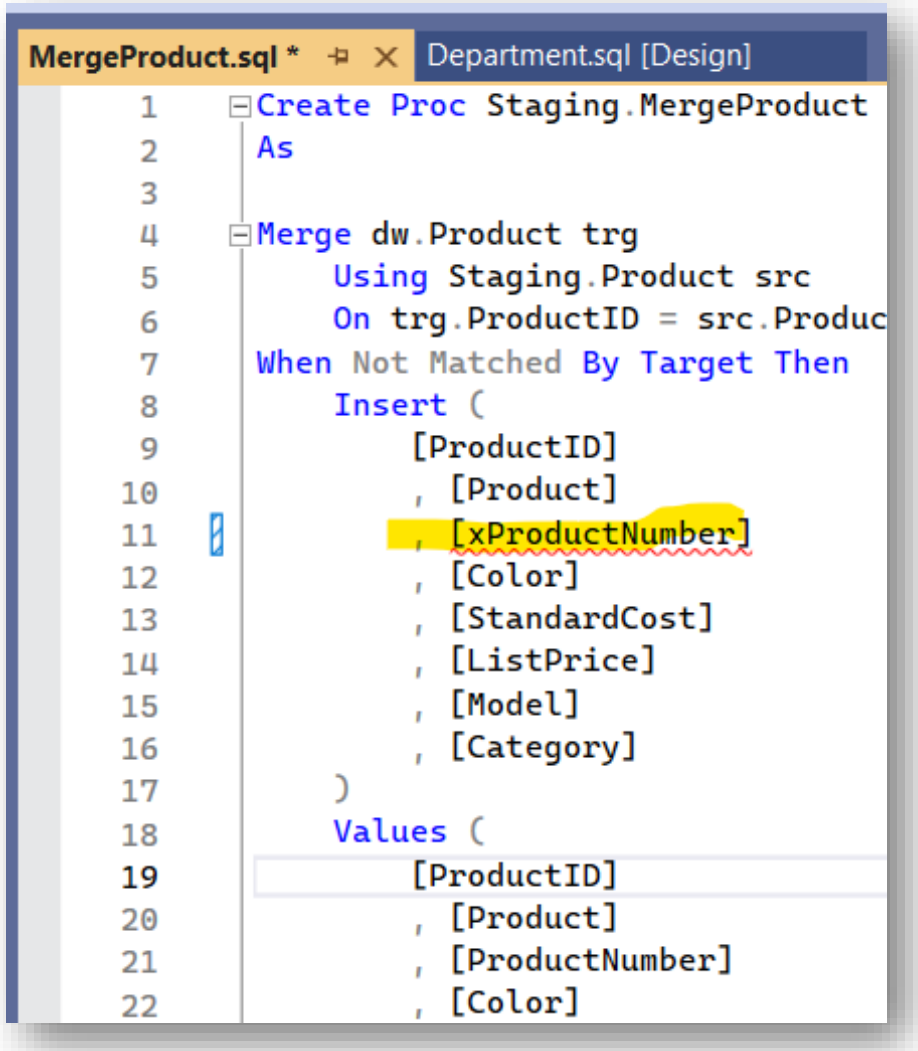
- Visual Studio Code: extension for SQL Database Projects

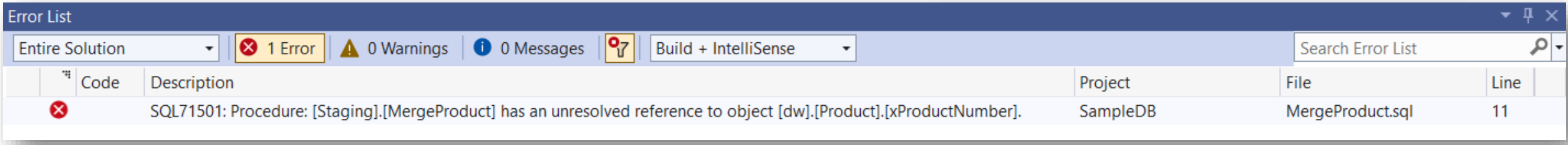
Visual Studio Code



Visual Studio bonus value

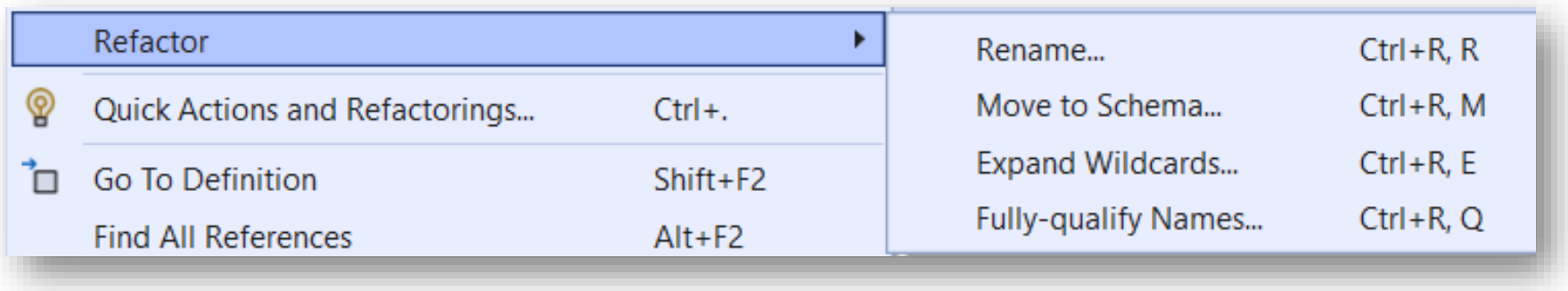
- Build project
  - Detects syntax errors and invalid references
  - Sanity check before attempting to deploy
  - DACPAC file generated





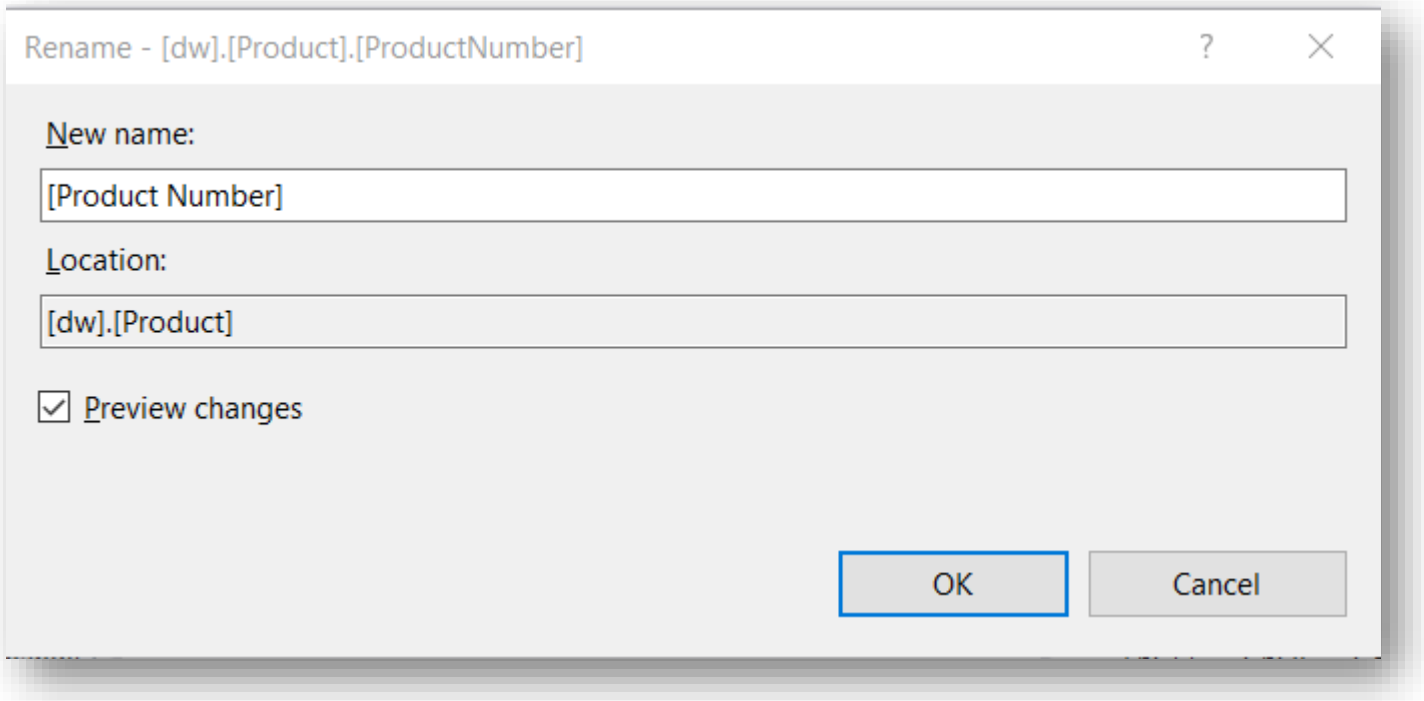
Visual Studio bonus value

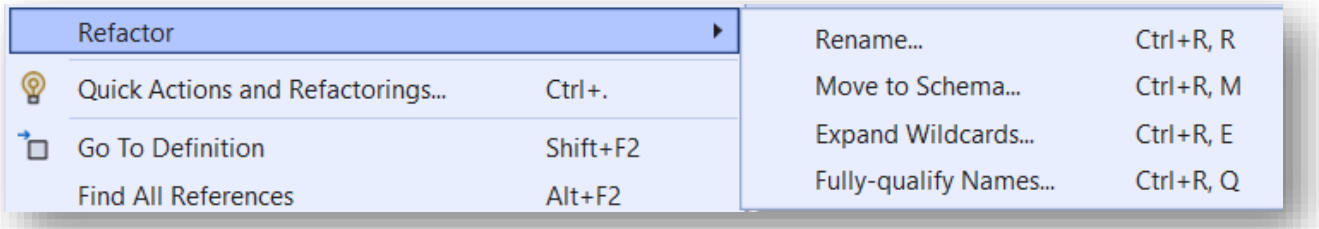
- Context menu
  - Refactor
  - Go To Definition
  - Find All References



Visual Studio bonus value

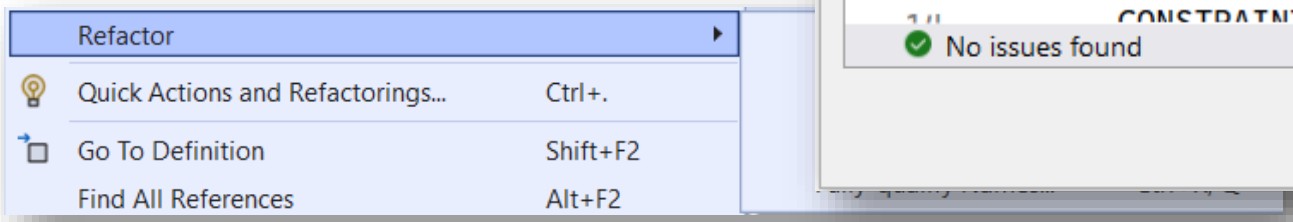
- Context menu
  - Refactor
  - Critical to avoiding data loss on deployment

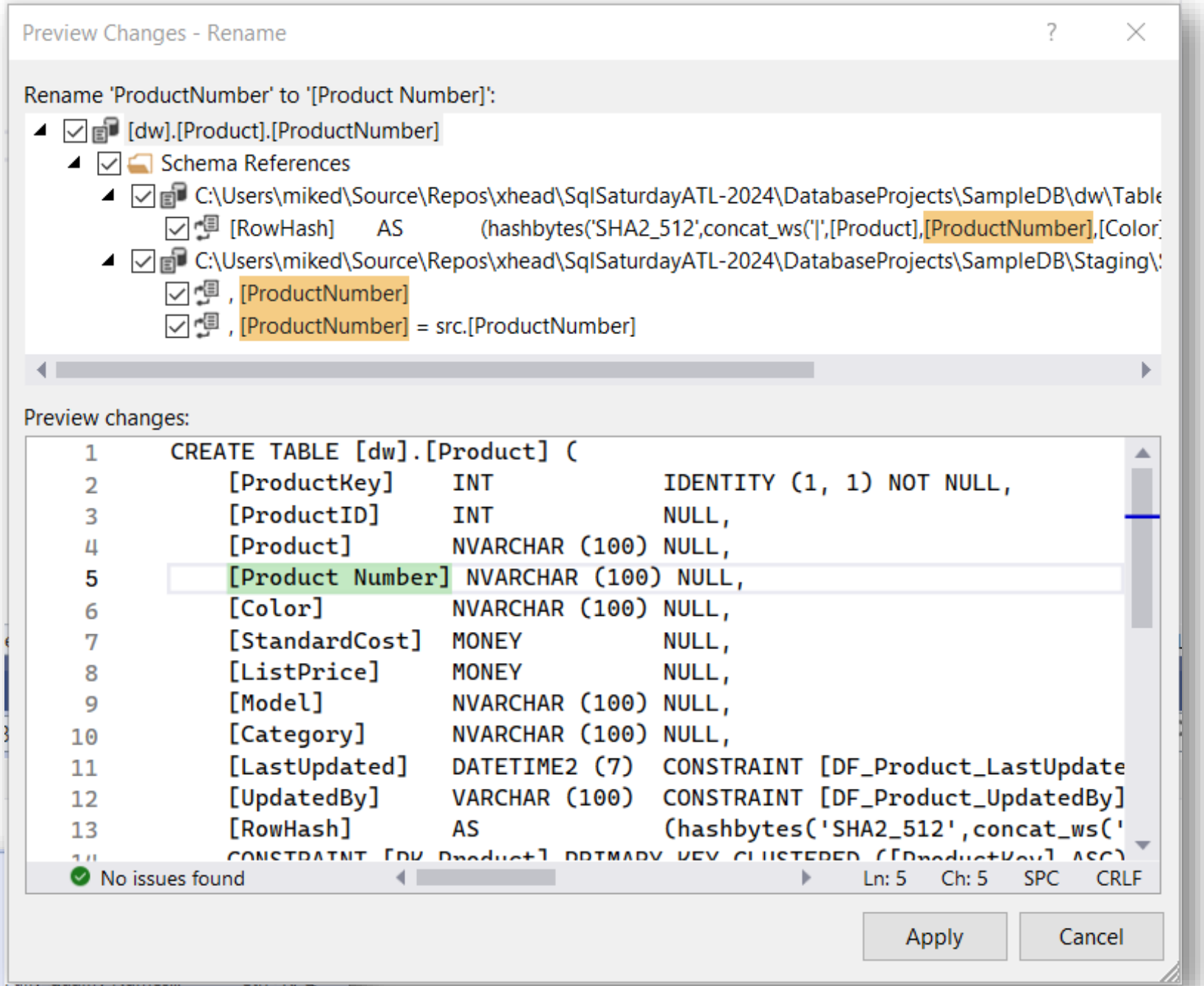




Visual Studio

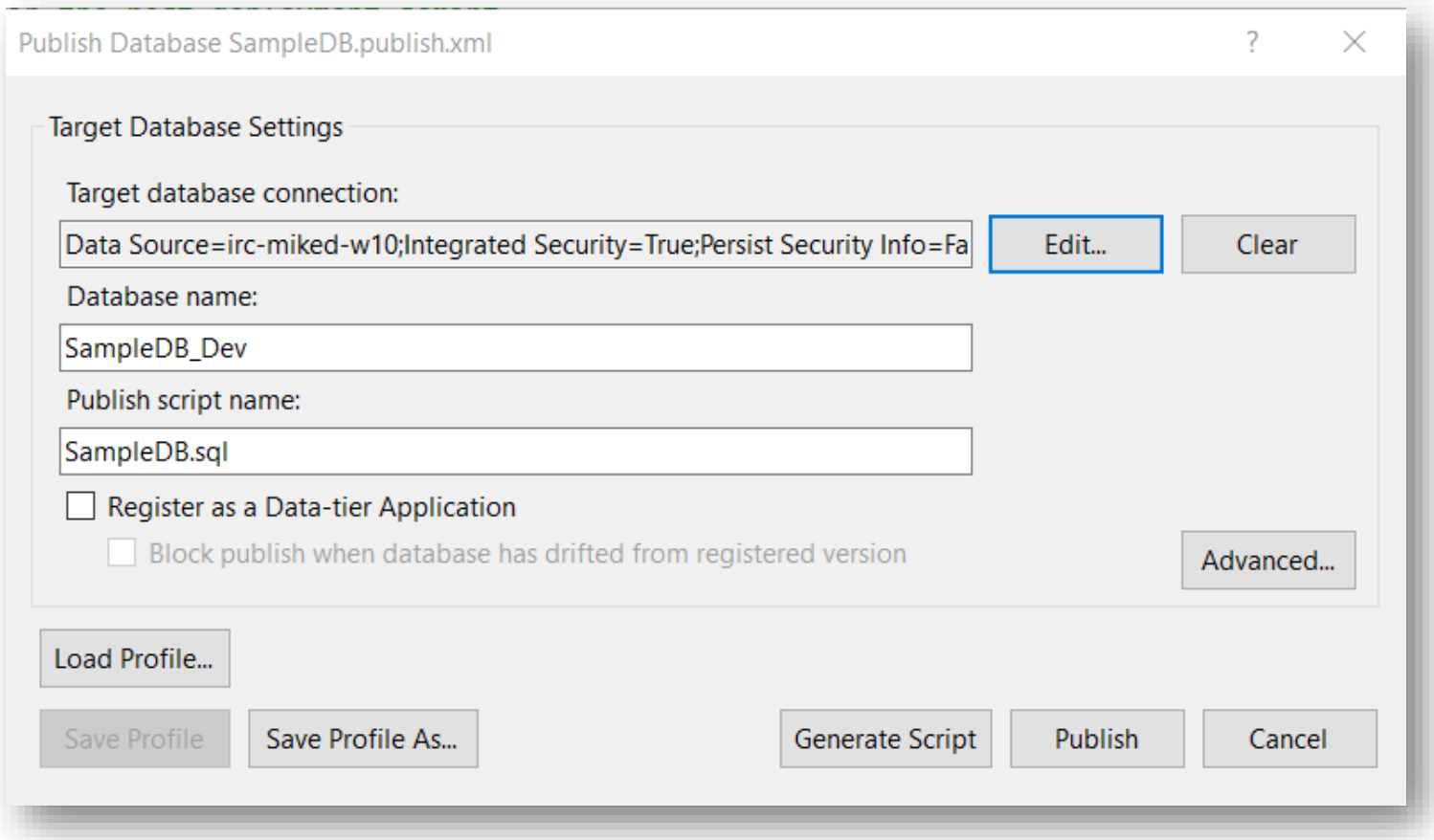
- Context menu
  - Refactor
  - Critical to avoiding data loss on deployment
  - Sp_rename vs ALTER TABLE DROP/ADD
- Refactoring tracked in SampleDB.refactorlog





Publish from Visual Studio

- Rt-click, Deploy
  - Create script
  - Publish directly
- Publish profiles (*.publish.xml)
- Critical settings in publish profile
  - Use Smart Defaults
  - Ignore column order



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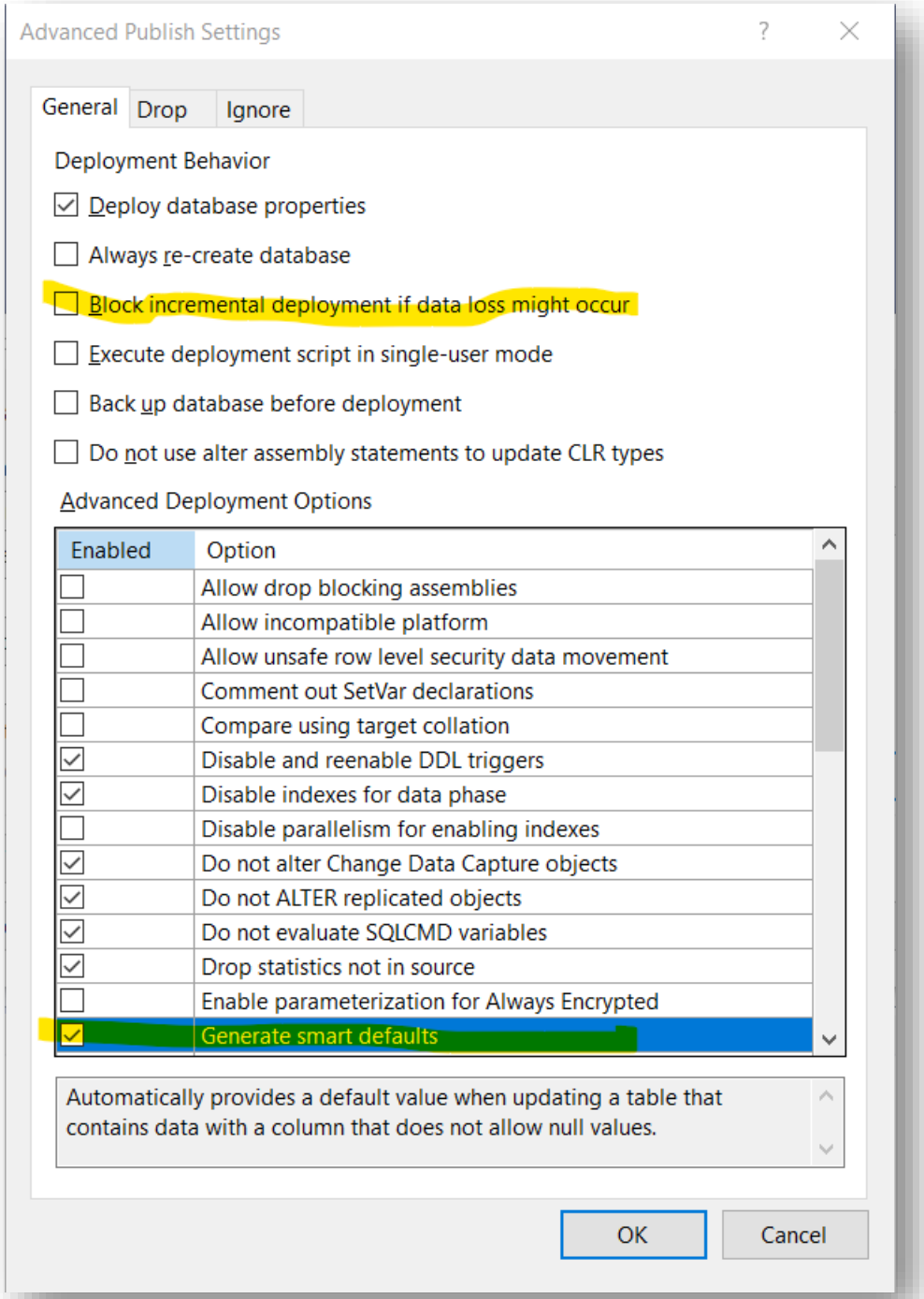

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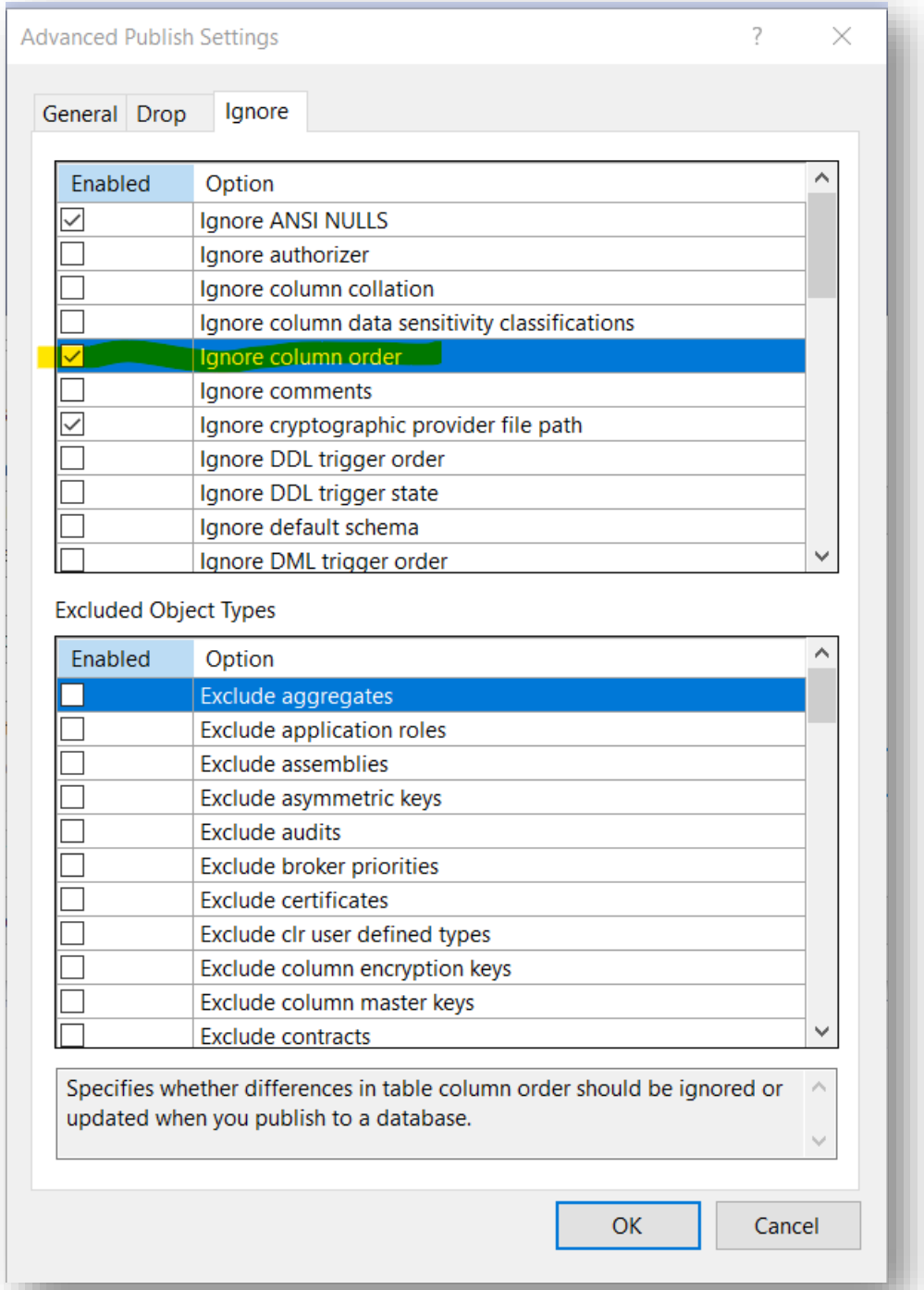
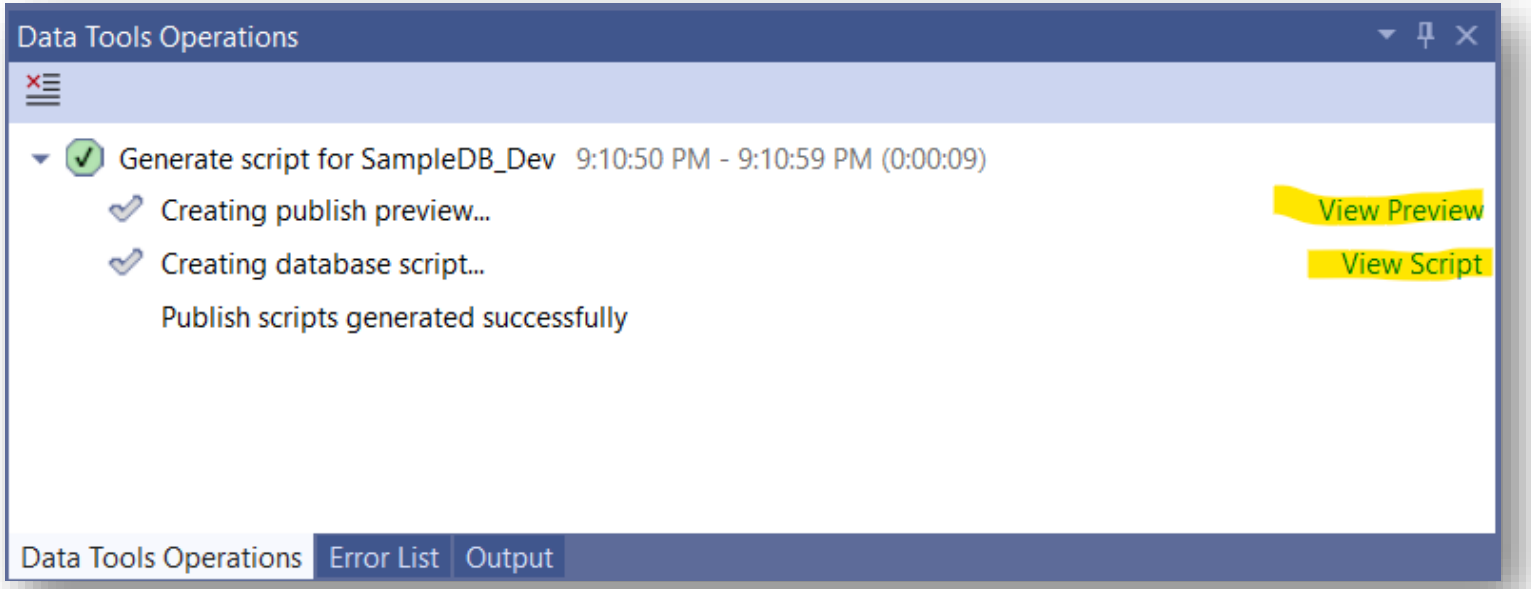


Publish from Visual Studio

- Rt-click, Deploy
  - Create script
  - Publish directly
- Preview contains summary of actions and potential warnings
  - Avoid table rebuilds



SQLPACKAGE.EXE

- Command line utility for deploying DACPAC files to SQL database
- Uses DACPAC file and publish.xml file
- Command line options
  - Generate script
  - Deploy changes
- Used by Azure DevOps deployment tasks or other CI/CD processes

Pre-/Post-deploy scripts

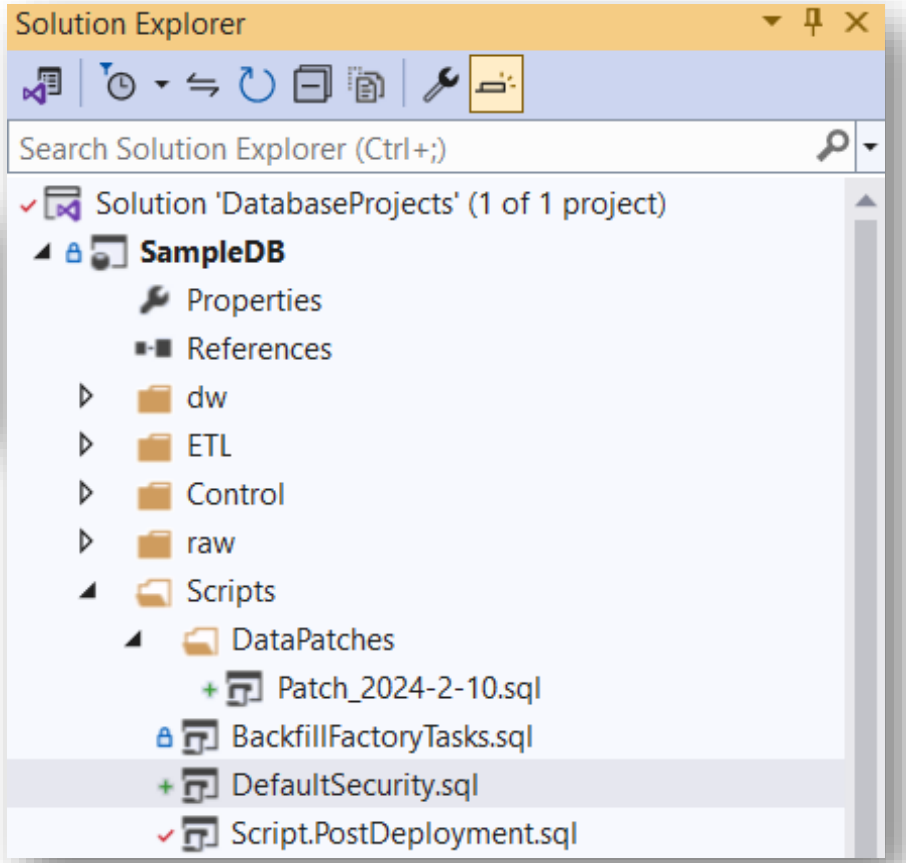
- Only one per project
  - :r .\DefaultSecurity.sql
  - :r .\BackfillReferenceData.sql
  - :r .\Patch_2024-2-10.sql
- Scripts must be idempotent
  - Run one or more times without affecting the desired outcome

SQLCMD syntax

- :r – run file
- :setVar – set variable
- $(variables)

Default security

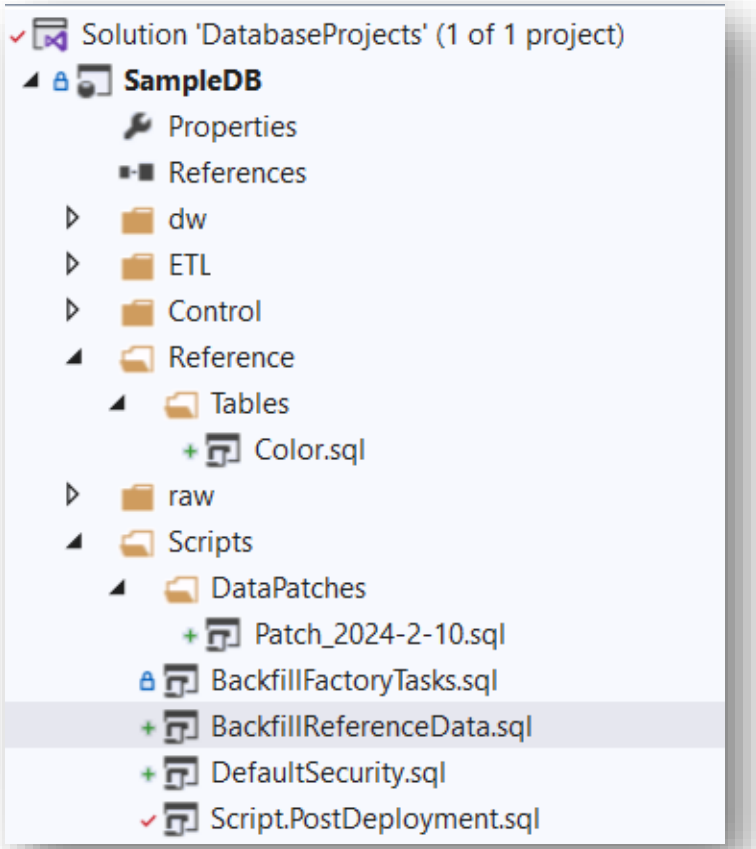
```
If Not Exists(Select * From sys.sysusers Where name = 'StandardLogin')
Begin
    Create User StandardLogin For Login StandardLogin
End
Alter Role SampleRole Add Member StandardLogin
```



Backfilling Reference Data

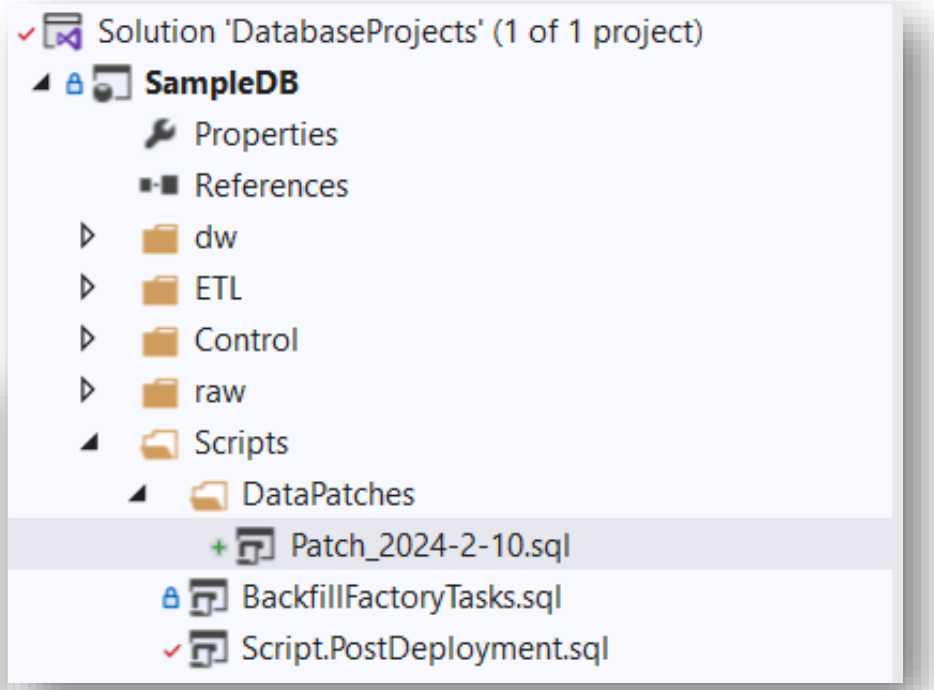
```sql
Print 'Backfilling Reference.Color';

With colors As (
    Select * From (Values (
    ('Blue'),
    ('Red'),
    ('Orange'),
    ('Green'),
    ('Black')
    )) x (Color)
)
Merge Into Reference.Color trg
Using colors src On trg.Color = src.Color

When Not Matched By Target Then
    Insert (Color) Values (src.Color)

When Not Matched By Source Then
    Delete
;
Print 'Complete'
```

```sql
/*
Post-Deployment Script Template
--------------------------------------
 This file contains SQL statements that
 Use SQLCMD syntax to include a file in
 Example:      :r .\myfile.sql
 Use SQLCMD syntax to reference a varia
 Example:      :setvar TableName MyTabl
               SELECT * FROM [$(TableNa
--------------------------------------
*/
Go
:r .\BackfillFactoryTasks.sql
Go
:r .\BackfillReferenceData.sql
Go
:r .\Datapatches\Patch_2024-2-10.sql
Go
```



Executing Data Patches

```
:SetVar Patchname Patch_2024-2-10

If Not Exists(Select * From Control.ChangeTracking Where Change = '$(PatchName)')
Begin

    Print 'Patching - $(PatchName)'

    -- do something
    -- delete from dw.MyTable where BadData = 1

    Insert Into Control.ChangeTracking (Change, AppliedOn)
    Values ('$(patchName)', GetDate())

    Print 'Patch complete.'

End
```




```
/*
Post-Deployment Script Template
--------------------------------------------------------------------------------------
 This file contains SQL statements that will be appended to the build script.
 Use SQLCMD syntax to include a file in the post-deployment script.
 Example:      :r .\myfile.sql
 Use SQLCMD syntax to reference a variable in the post-deployment script.
 Example:      :setvar TableName MyTable
               SELECT * FROM [$(TableName)]
--------------------------------------------------------------------------------------
*/
Go
:r .\BackfillFactoryTasks.sql
Go
:r .\Datapatches\Patch_2024-2-10.sql
Go
```

Importing from an existing database

- Create project then do Schema Compare
- Databases *should* be self-contained
- Often exposes errors/problems
  - Missing objects, bad names
  - Three-part and four-part names
- Replace external references with CREATE SYNONYM and $(variables)

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Database references

- What is in or out of your control? What can you deploy?
- System databases
  - master, msdb
- Other database projects
- DACPAC files (binary reference)

Database references

- What is in or out of your control? What can you deploy?
- System databases
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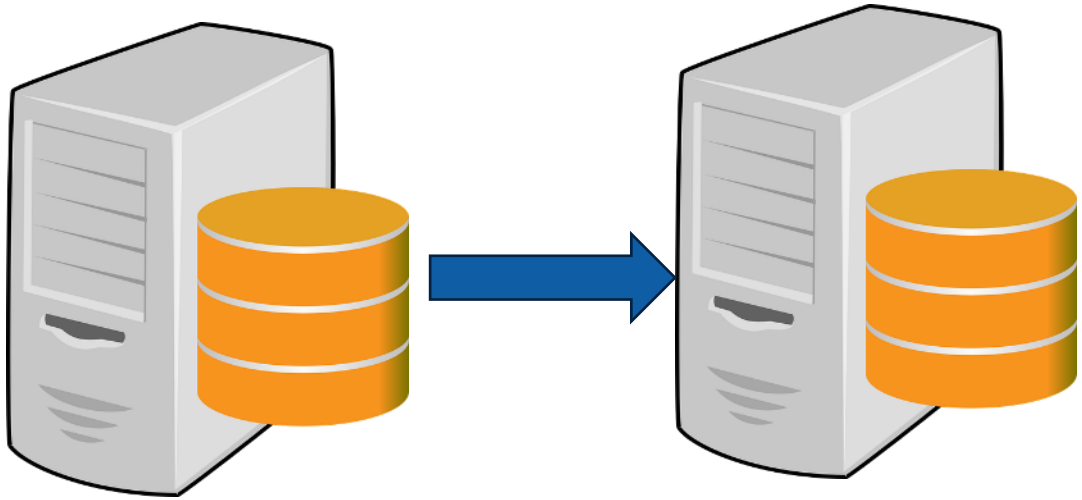
- Other database projects
- DACPAC files (binary reference)
- Target:
  - Different server, different database



Server 2/Project B

Server 1/Project A
Select * from [$(ServerX)].[$(DatabaseB)].dbo.Customer

Database references

- What is in or out of your control? What can you deploy?
- System databases
  - master, msdb
- Other database projects
- DACPAC files (binary reference)
- Target:
  - Different server, different database
  - Same server, different database

Project B

Project A
Select * from [$(DatabaseB)].dbo.Customer

Database references

- What is in or out of your control? What can you deploy?
- System databases
  - master, msdb
- Other database projects
- DACPAC files (binary reference)
- Target:
  - Different server, different database
  - Same server, different database
  - Same server, same database

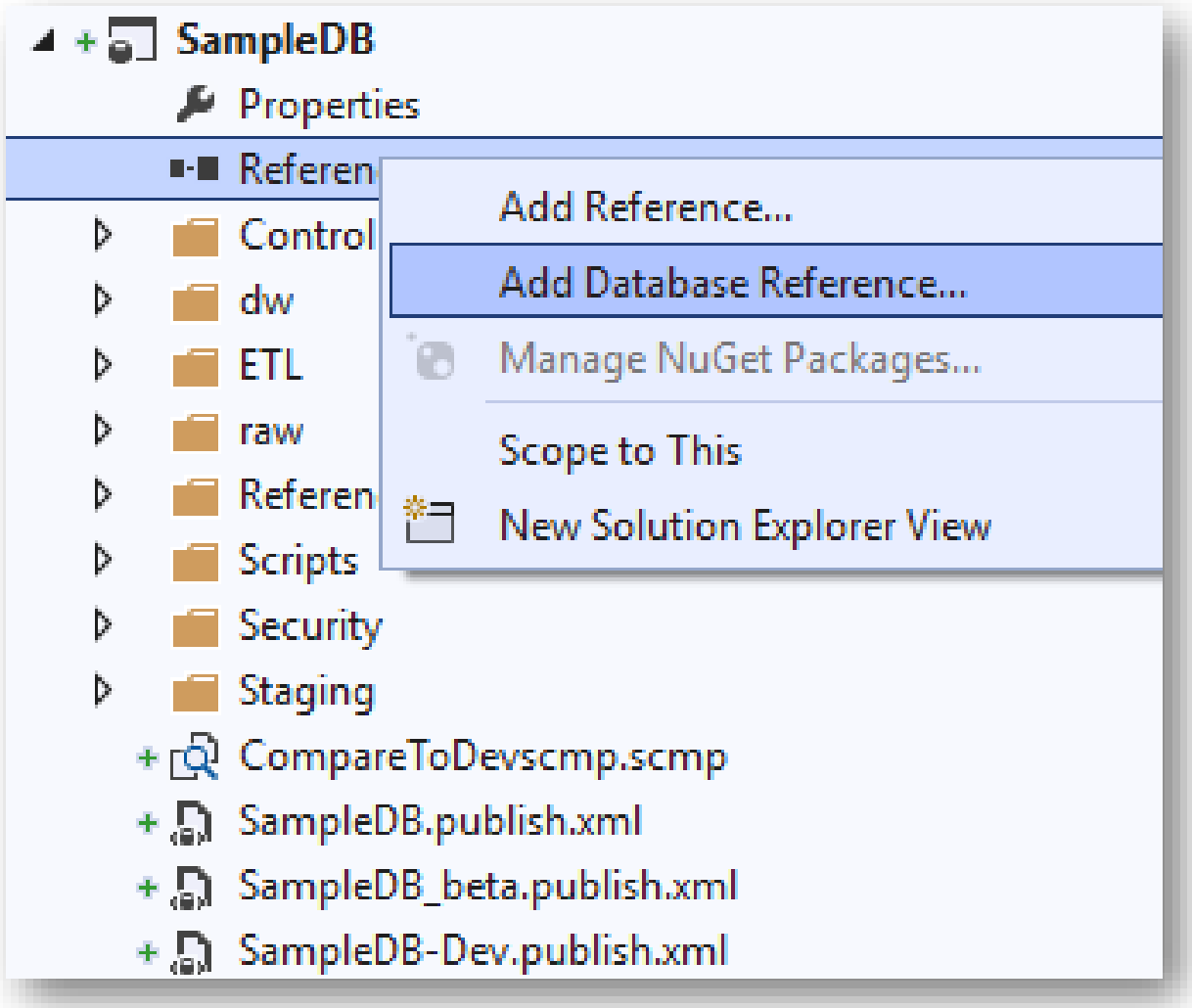
Project A

Project B

Select * from dbo.Customer

Database references

- What is in or out of your control? What can you deploy?
- System databases
  - master, msdb
- Other database projects
- DACPAC files (binary reference)



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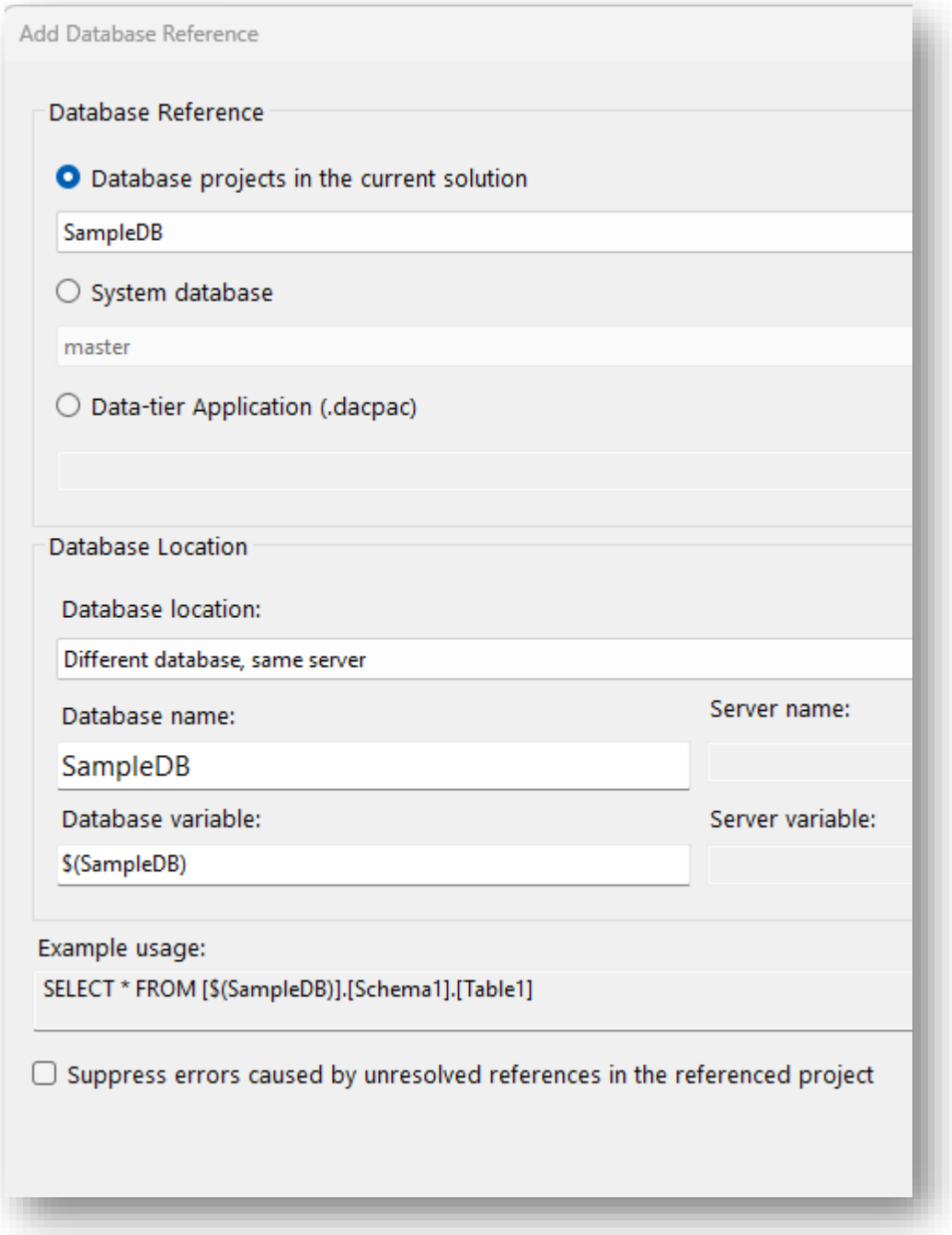
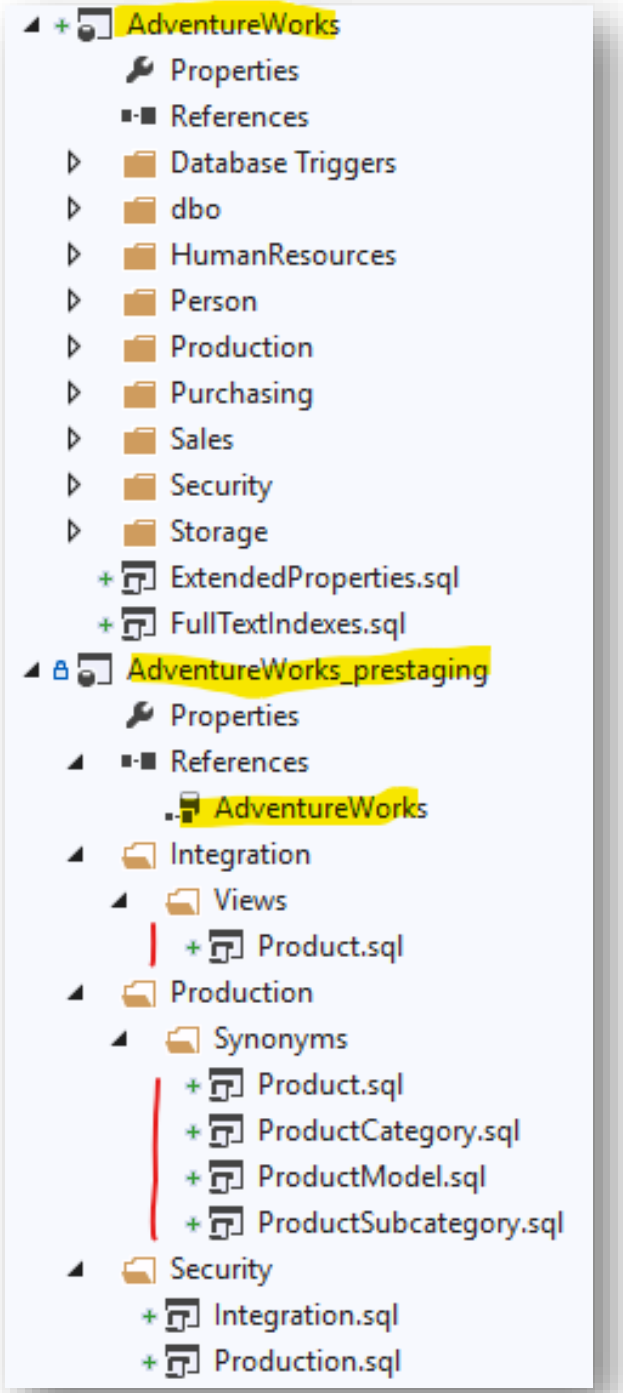


Database reference scenarios

- Cross-reference to another database outside of your control
- Same or different server, different database (dependency)
- CREATE SYNONYM to specific tables, views or sprocs

```
CREATE SYNONYM [Production].[Product]
FOR [$(AdventureWorks)].[Production].[Product];
```

- Deploy only our own objects in our own database
- Schema compare on original database



Database reference scenarios

- Cross-reference to another database outside of your control
- Same or different server, different database (dependency)
- Use schemas for clarity
- Synonym provides API to referenced database

```
CREATE SYNONYM [Production].[Product]
FOR [$(AdventureWorks)].[Production].
[Product];
```

- Source query works in both databases

```
create view Integration.Product as
select
    p.ProductID,
    p.ProductNumber,
    p.Name as ProductName,
    p.ListPrice,
    p.StandardCost,
    p.Color,
    p.Weight,
    p.Size,
    pc.Name as ProductCategory,
    ps.Name as ProductSubCategory,
    pm.Name as ProductModel
from Production.Product p
    join Production.ProductSubcategory ps
        on p.ProductSubcategoryID = ps.ProductSubcategoryID
    join Production.ProductCategory pc
        on ps.ProductCategoryID = pc.ProductCategoryID
    join Production.ProductModel pm
        on p.ProductModelID = pm.ProductModelID
```

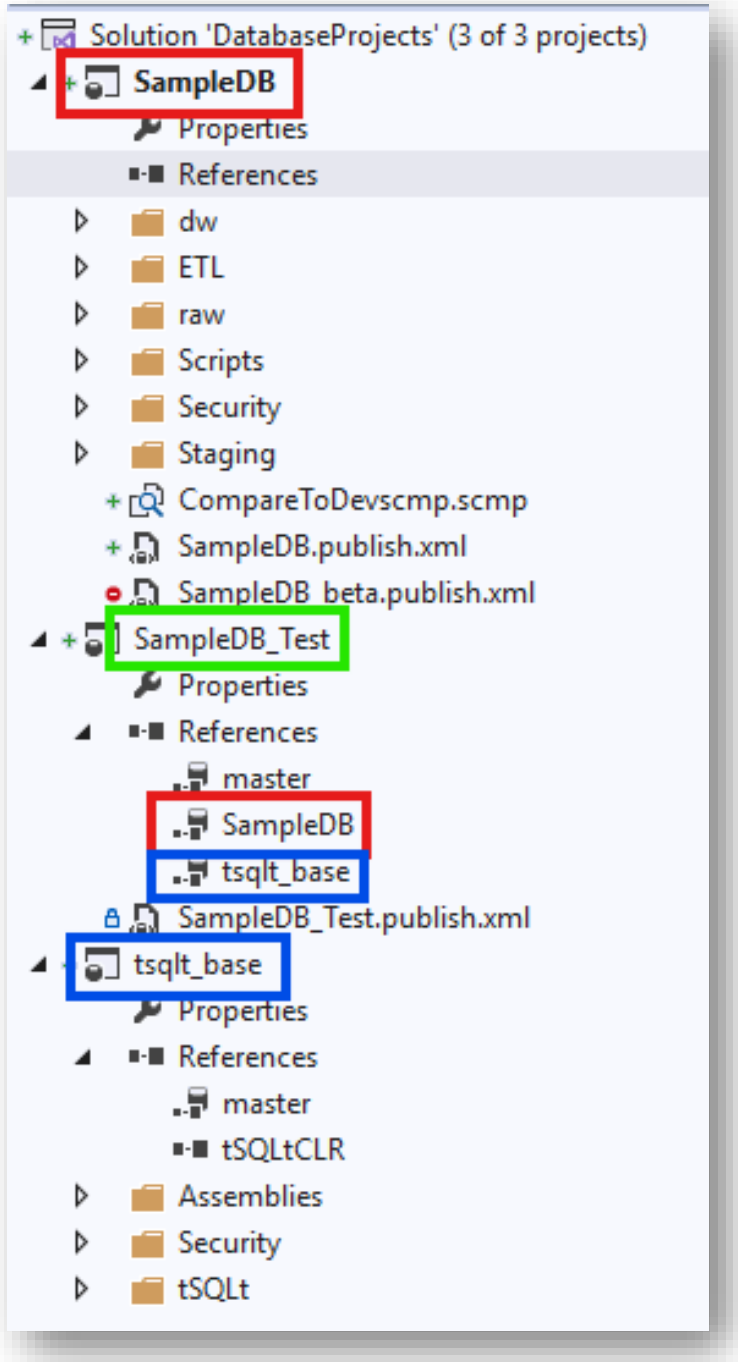
Database reference scenarios

- Cross-reference to another database outside of your control
- Same server, same database (inheritance)
  - No synonyms necessary
  - Deploy our own objects in the referenced database

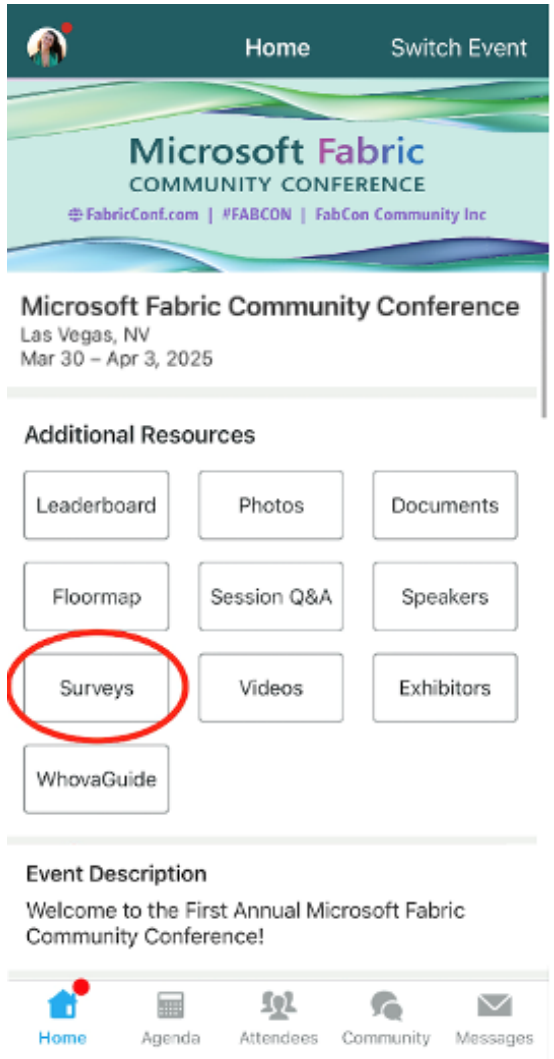
  - Don't clobber other objects in the target database
  - Our own objects could get clobbered by another deployment

Database reference scenario – Unit Testing

- Database project (SUT - system under test) SampleDB
- Unit test framework project contains framework objects (TDD) tsqlt_base
- Test database project SampleDB_Test
  - References database project under test and unit test framework project
    - Both references are “same server, same database”
  - Contains test objects (sprocs)
- Deploy test project and execute unit tests in unit test environment or part of a build
  - SUT database and TDD framework objects get deployed
  - Execute unit tests for pass/fail
- Deploy SUT normally in production environments
  - Clean deploy - no TDD or unit tests included



Session Feedback Surveys



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