Microsoft

# SQL Projects for Database Development

Drew Skwiers-Koballa, Program Manager
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https://aka.ms/azuredatastudio-sqlprojects
https://github.com/dzsquared/sql-development-tools

**Drew Skwiers-Koballa**
***(squire's co- ball –a)***
**he/him**

- Program Manager @ Microsoft focusing on SQL tools
- Hobbies: pugs, chickens, gardening
- Formerly application and database developer

https://aka.ms/azuredatastudio-sqlprojects
https://github.com/dzsquared/sql-development-tools

# Agenda

- Data-tier artifacts and SqlPackage
- SQL database projects
- Demo in Azure Data Studio
- Mssql extension in VS Code

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https://github.com/dzsquared/sql-development-tools

# Data-tier application artifacts

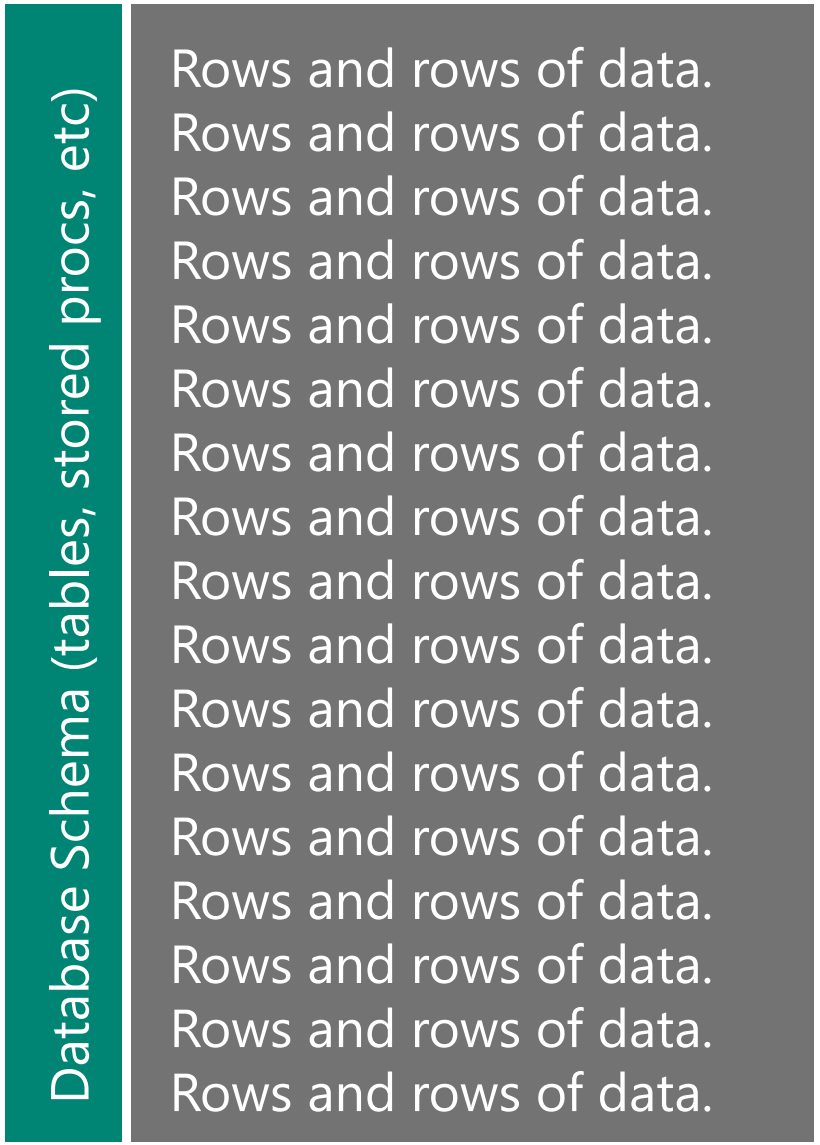
# A familiar pathway for developers:


1. Write code in a tool of your choice
2. Compile, test locally, pull request review
3. Bundled or packaged code is deployed

# Data-tier Applications

Database Schema
(tables, stored procs, etc)

Dacpac




Bacpac

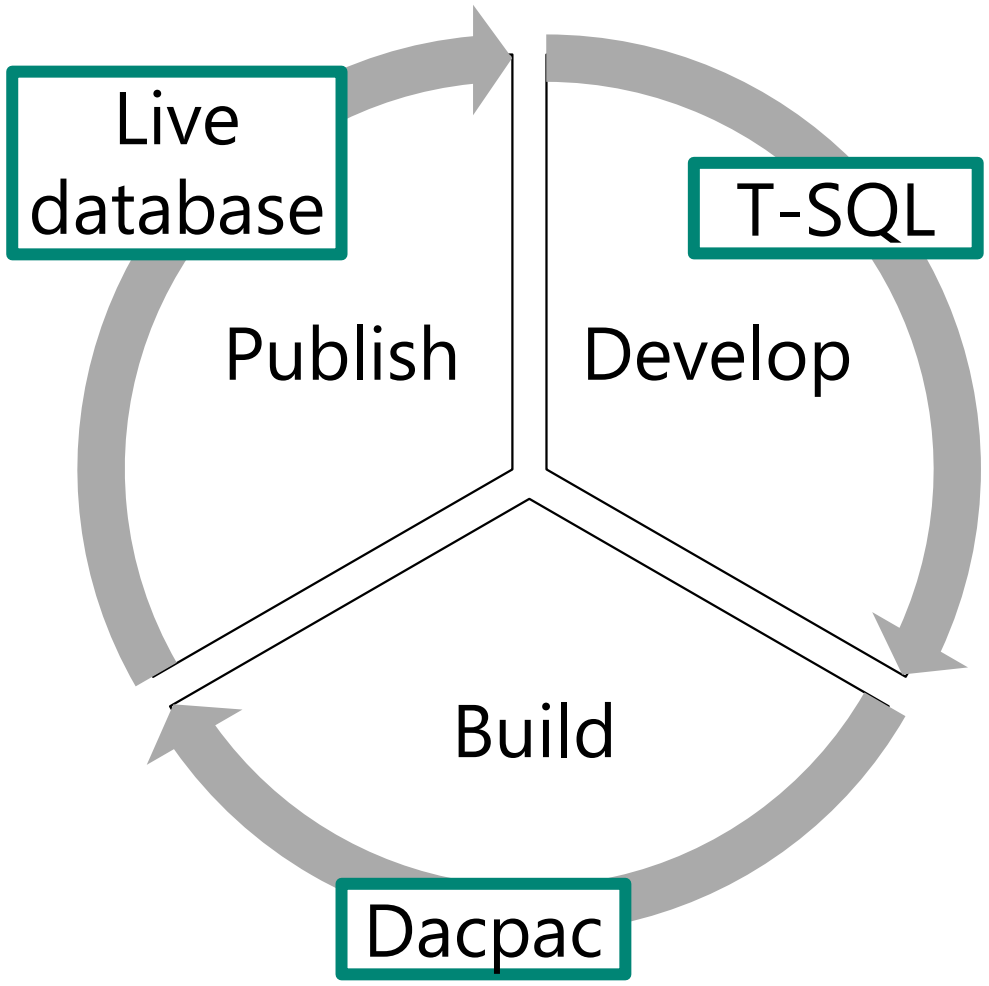
# Declarative Database Development

Development of the desired end state

- Also known as state based development
- Tooling manages change and migration during deployment

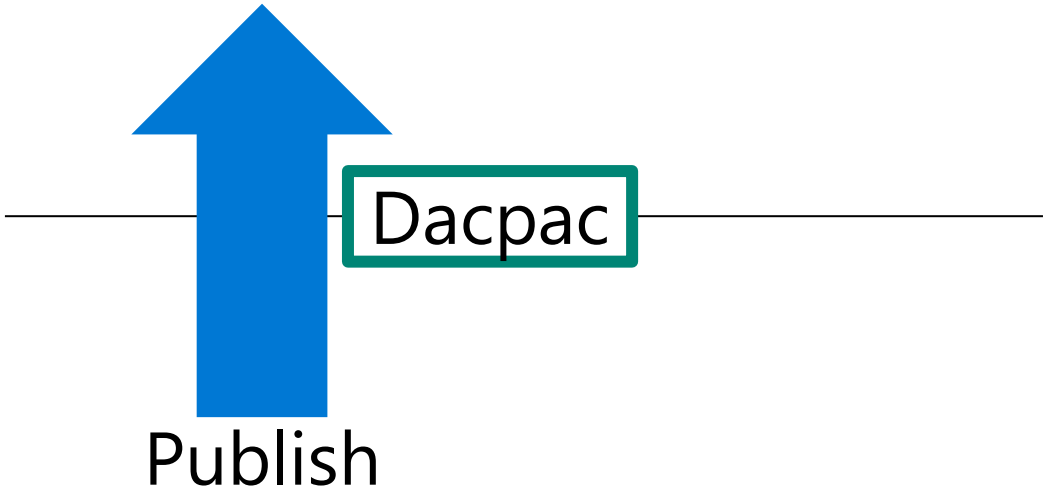
Facilitates version control

**Dacpac** is the result from building a database project



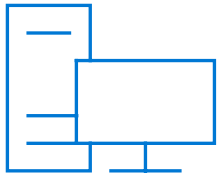
# SqlPackage

Command line interface to DacFx framework

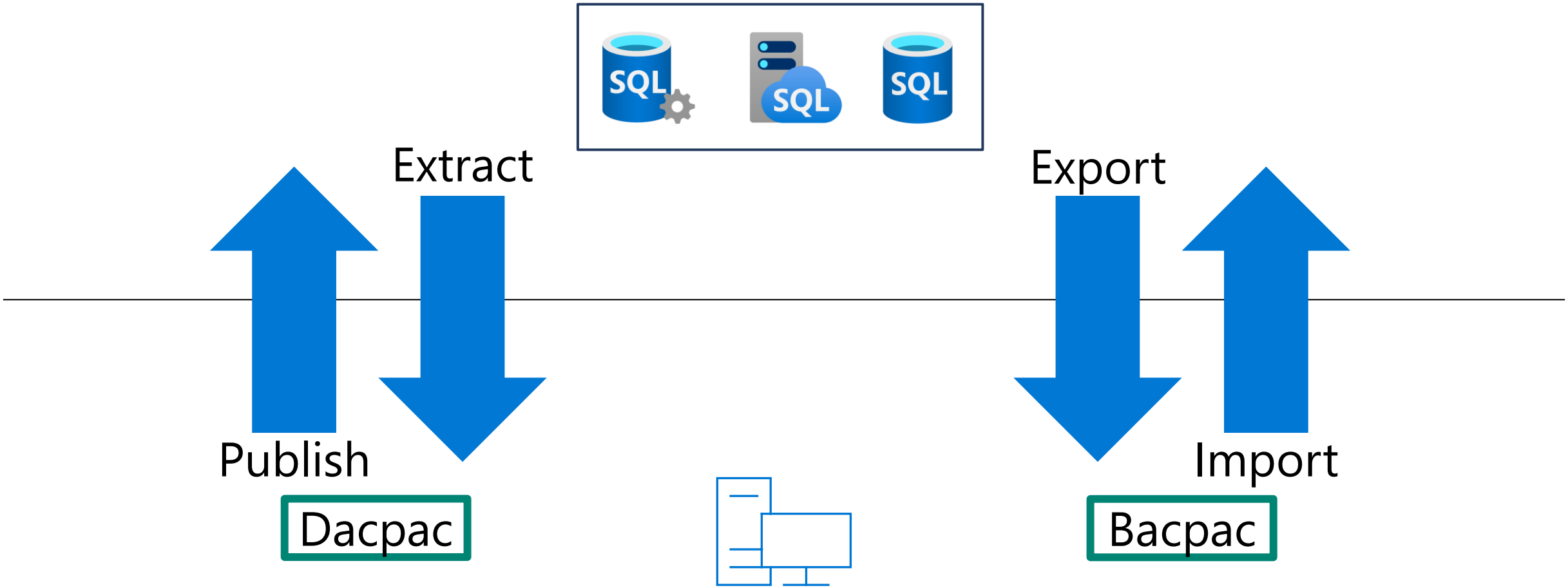

Publish is an incremental operation

Updates the existing database schema to match the dacpac



# SqlPackage

Command line interface to DacFx framework




http://aka.ms/sqlpackage

# SqlPackage Command Syntax

```
SqlPackage /Action:{action}
/{additionalParameter}:{parameterValue}
```

---

```
SqlPackage /Action:Extract /SourceServerName:localhost
/SourceDatabaseName:AdventureWorksLT2019
/TargetFile:c:\Users\drskwier\AdventureWorksLT.dacpac
```

---

Parameters have long and short form names

| | |
|---|---|
| /Action: | /a: |
| /SourceServerName: | /ssn: |
| /TargetFile: | /tf: |

# Database Projects

# SQL Project Development

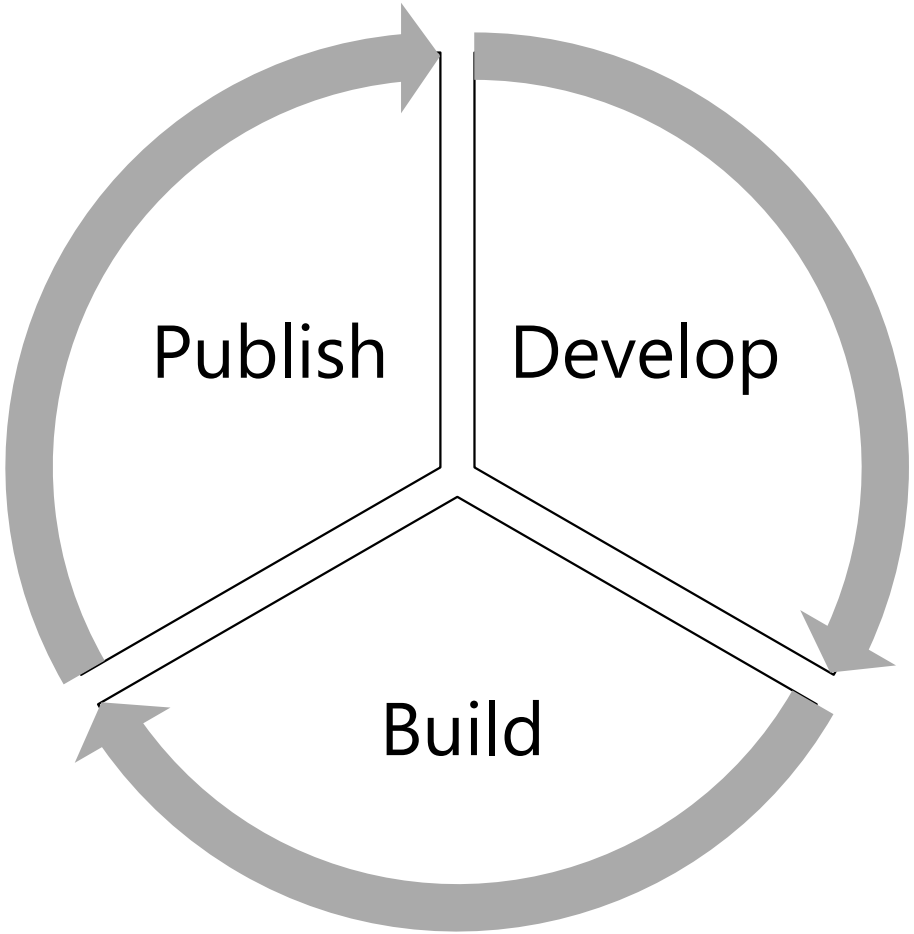
## SQL Server Data Tools

Available in “Data Platform” workload of Visual Studio 2019

## SQL Database Projects extension

Extension in Azure Data Studio

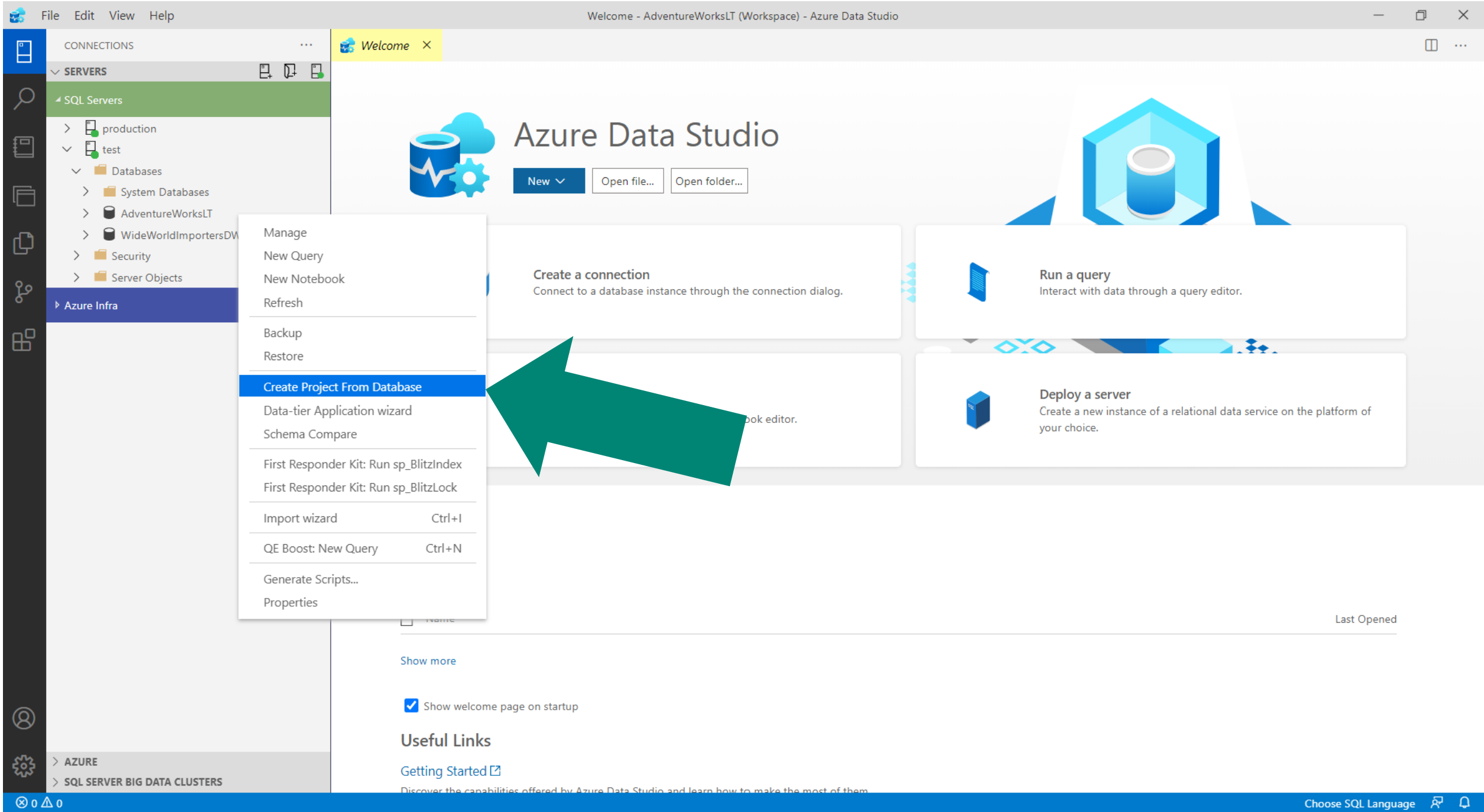
Leverages .NET Core SDK to bring SQL Projects to macOS and Linux

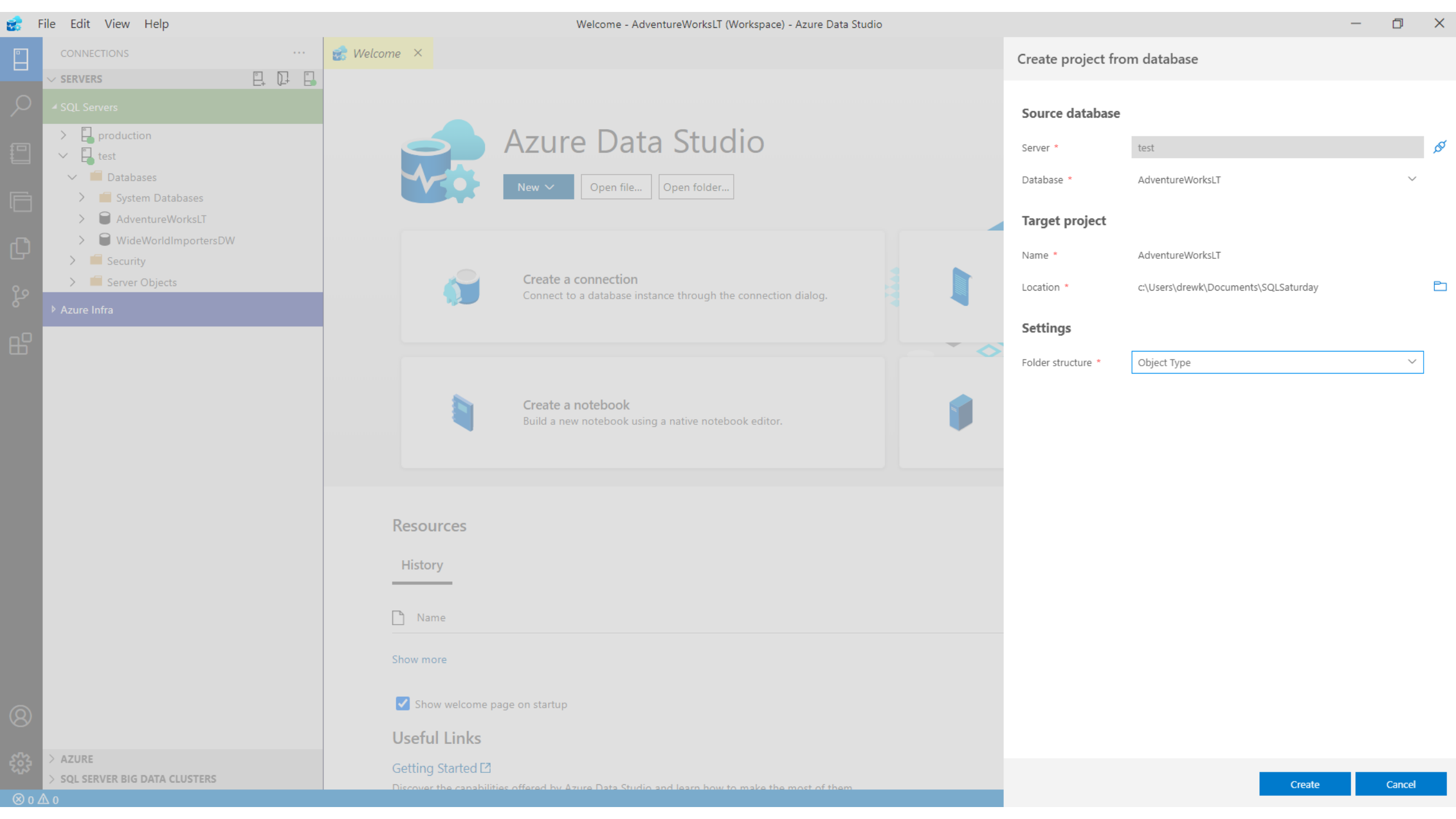


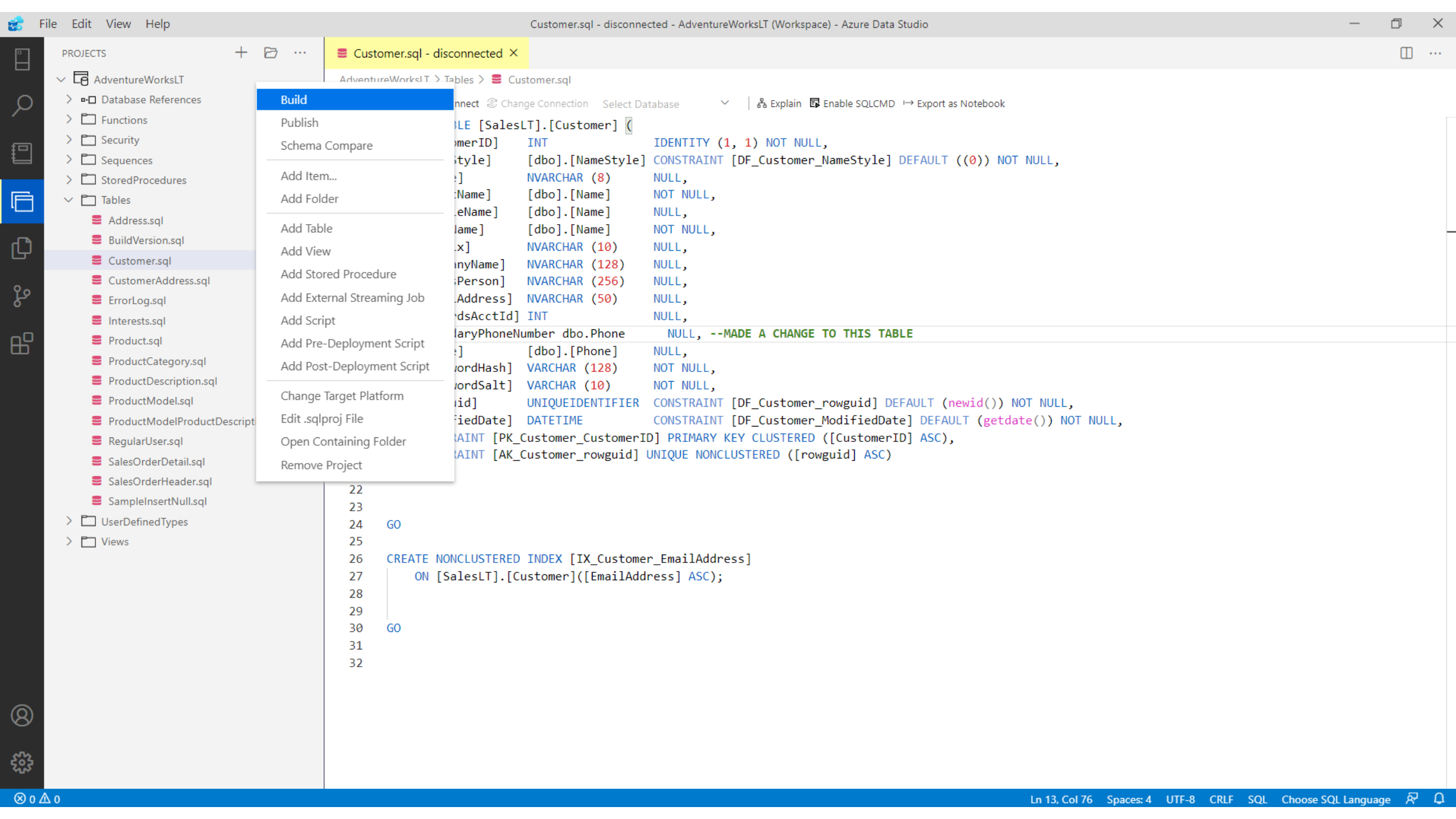

https://aka.ms/azuredatastudio-sqlprojects

# Database projects in Azure Data Studio

- Create project from existing database
- Update/change the project
- Generate scripts, review, and deploy
- Use post-deployment script to insert some data
- Use schema compare to view differences between production and test


File Edit View Help
Welcome - AdventureWorksLT (Workspace) - Azure Data Studio
CONNECTIONS
SERVERS
SQL Servers
production
test
Databases
System Databases
AdventureWorksLT
WideWorldImportersDW
Security
Server Objects
Azure Infra
Welcome
Azure Data Studio
New
Open file...
Open folder...
Create a connection
Connect to a database instance through the connection dialog.
Run a query
Interact with data through a query editor.
Deploy a server
Create a new instance of a relational data service on the platform of your choice.
Manage
New Query
New Notebook
Refresh
Backup
Restore
Create Project From Database
Data-tier Application wizard
Schema Compare
First Responder Kit: Run sp_BlitzIndex
First Responder Kit: Run sp_BlitzLock
Import wizard Ctrl+I
QE Boost: New Query Ctrl+N
Generate Scripts...
Properties
Last Opened
Show more
Show welcome page on startup
Useful Links
Getting Started
AZURE
SQL SERVER BIG DATA CLUSTERS
Choose SQL Language


File
Edit
View
Help
Welcome - AdventureWorksLT (Workspace) - Azure Data Studio
CONNECTIONS
SERVERS
SQL Servers
production
test
Databases
System Databases
AdventureWorksLT
WideWorldImportersDW
Security
Server Objects
Azure Infra
AZURE
SQL SERVER BIG DATA CLUSTERS
Welcome
Azure Data Studio
New
Open file...
Open folder...
Create a connection
Connect to a database instance through the connection dialog.
Create a notebook
Build a new notebook using a native notebook editor.
Resources
History
Name
Show more
Show welcome page on startup
Useful Links
Getting Started
Create project from database
Source database
Server *
test
Database *
AdventureWorksLT
Target project
Name *
AdventureWorksLT
Location *
c:\Users\drewk\Documents\SQLSaturday
Settings
Folder structure *
Object Type
Create
Cancel


File Edit View Help
Customer.sql - disconnected - AdventureWorksLT (Workspace) - Azure Data Studio
PROJECTS
AdventureWorksLT
Database References
Functions
Security
Sequences
StoredProcedures
Tables
Address.sql
BuildVersion.sql
Customer.sql
CustomerAddress.sql
ErrorLog.sql
Interests.sql
Product.sql
ProductCategory.sql
ProductDescription.sql
ProductModel.sql
ProductModelProductDescripti
RegularUser.sql
SalesOrderDetail.sql
SalesOrderHeader.sql
SampleInsertNull.sql
UserDefinedTypes
Views
Build
Publish
Schema Compare
Add Item...
Add Folder
Add Table
Add View
Add Stored Procedure
Add External Streaming Job
Add Script
Add Pre-Deployment Script
Add Post-Deployment Script
Change Target Platform
Edit .sqlproj File
Open Containing Folder
Remove Project
Customer.sql - disconnected
AdventureWorksLT > Tables > Customer.sql
Change Connection
Select Database
Explain
Enable SQLCMD
Export as Notebook
BLE [SalesLT].[Customer] (
omerID] INT IDENTITY (1, 1) NOT NULL,
Style] [dbo].[NameStyle] CONSTRAINT [DF_Customer_NameStyle] DEFAULT ((0)) NOT NULL,
e] NVARCHAR (8) NULL,
Name] [dbo].[Name] NOT NULL,
eName] [dbo].[Name] NULL,
lame] [dbo].[Name] NOT NULL,
x] NVARCHAR (10) NULL,
nyName] NVARCHAR (128) NULL,
Person] NVARCHAR (256) NULL,
Address] NVARCHAR (50) NULL,
dsAcctId] INT NULL,
laryPhoneNumber dbo.Phone NULL, --MADE A CHANGE TO THIS TABLE
e] [dbo].[Phone] NULL,
ordHash] VARCHAR (128) NOT NULL,
ordSalt] VARCHAR (10) NOT NULL,
id] UNIQUEIDENTIFIER CONSTRAINT [DF_Customer_rowguid] DEFAULT (newid()) NOT NULL,
iedDate] DATETIME CONSTRAINT [DF_Customer_ModifiedDate] DEFAULT (getdate()) NOT NULL,
AINT [PK_Customer_CustomerID] PRIMARY KEY CLUSTERED ([CustomerID] ASC),
AINT [AK_Customer_rowguid] UNIQUE NONCLUSTERED ([rowguid] ASC)
GO
CREATE NONCLUSTERED INDEX [IX_Customer_EmailAddress]
ON [SalesLT].[Customer]([EmailAddress] ASC);
GO
0 0
Ln 13, Col 76
Spaces: 4
UTF-8
CRLF
SQL
Choose SQL Language

File Edit View Help

AdventureWorksLT (Workspace) - Azure Data Studio

PROJECTS

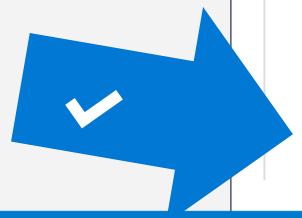
- AdventureWorksLT
  - Database References
  - Functions
  - Security
  - Sequences
  - StoredProcedures
  - Tables
    - Address.sql
    - BuildVersion.sql
    - Customer.sql
    - CustomerAddress.sql
    - ErrorLog.sql
    - Interests.sql
    - Product.sql
    - ProductCategory.sql
    - ProductDescription.sql
    - ProductModel.sql
    - ProductModelProductDescription.sql
    - RegularUser.sql
    - SalesOrderDetail.sql
    - SalesOrderHeader.sql
    - SampleInsertNull.sql
  - UserDefinedTypes
  - Views



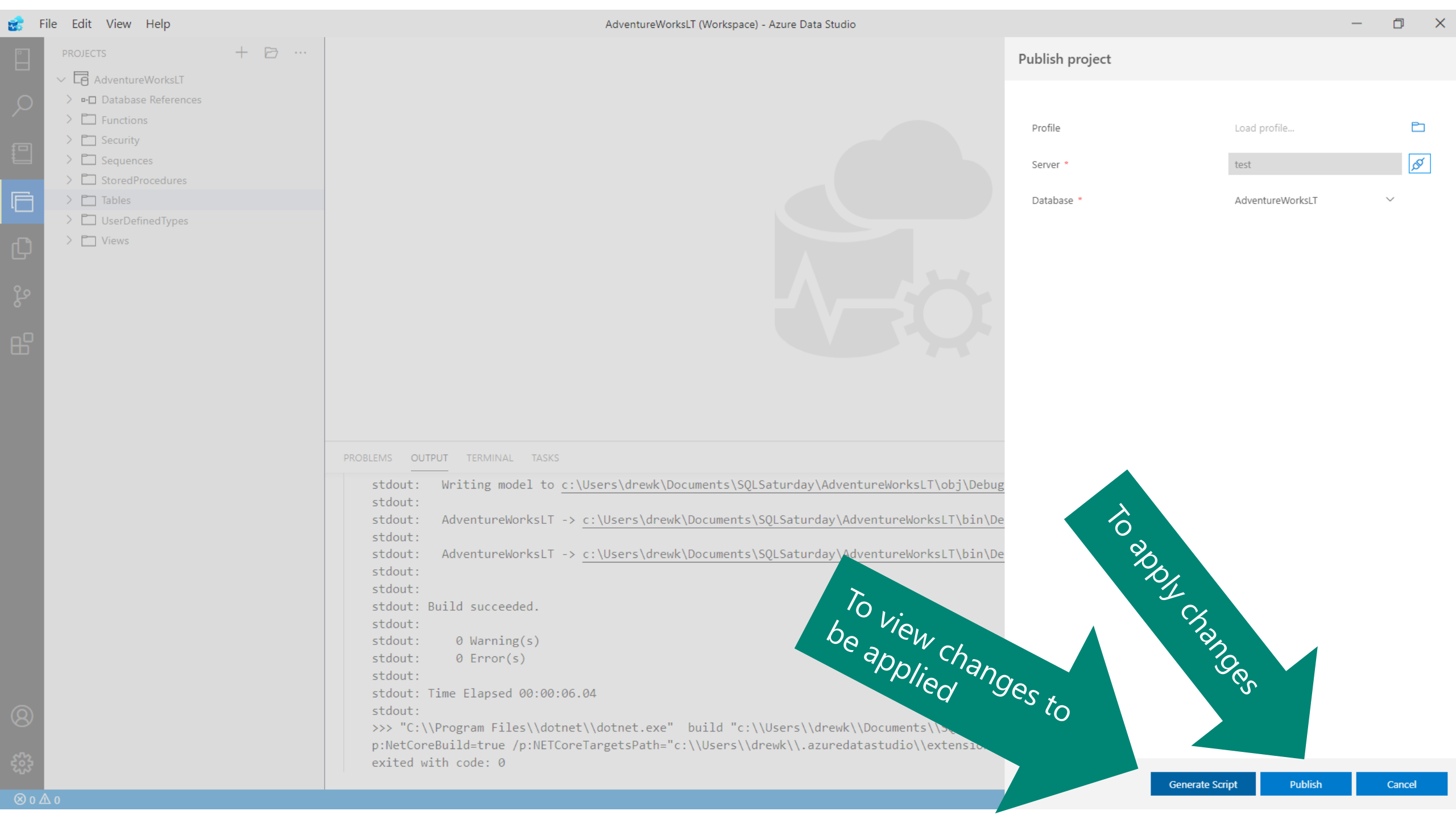
PROBLEMS OUTPUT TERMINAL TASKS

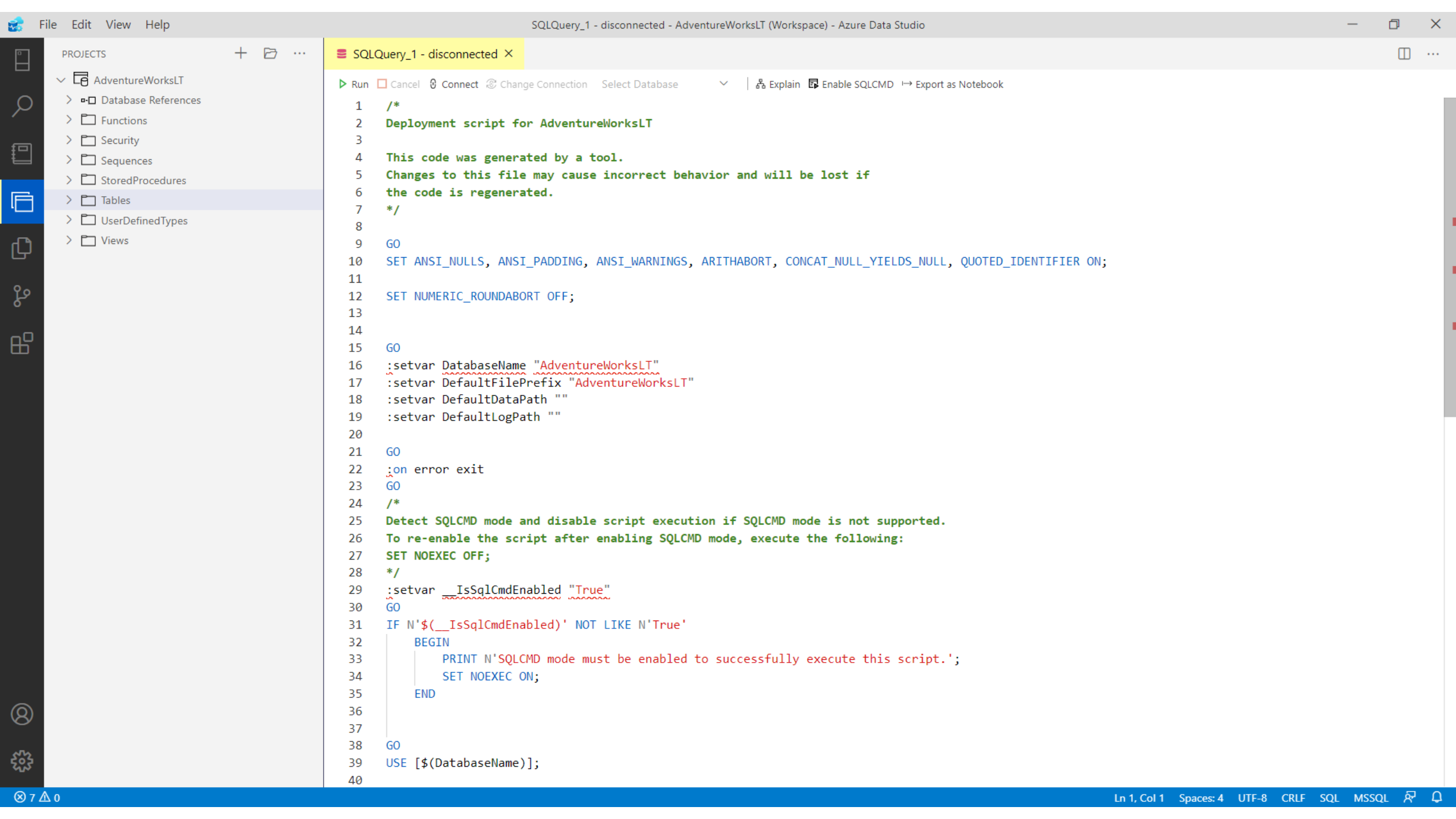
Database Projects

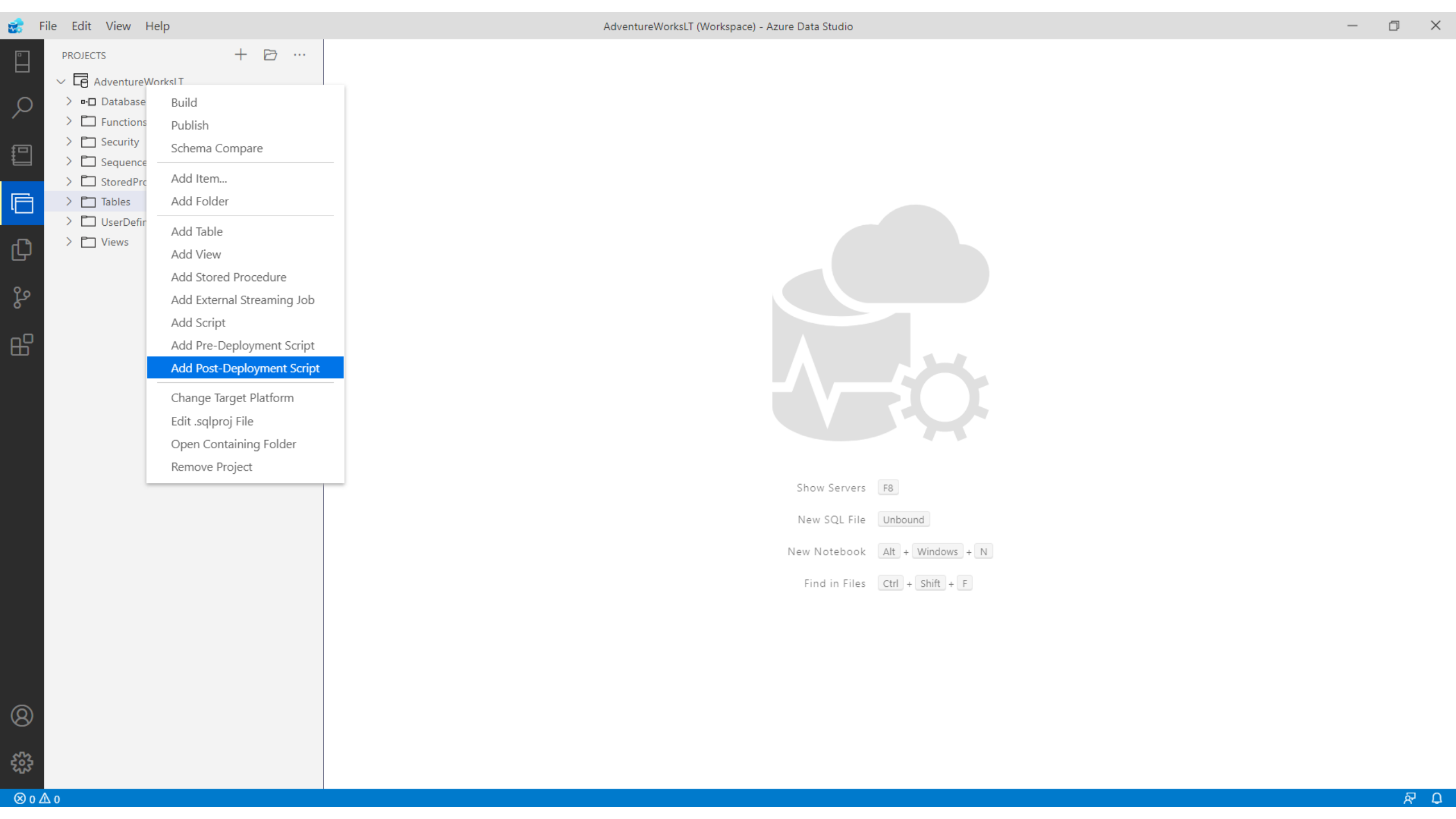
```
stdout:   Writing model to c:\Users\drewk\Documents\SQLSaturday\AdventureWorksLT\obj\Debug\Model.xml...
stdout:
stdout:   AdventureWorksLT -> c:\Users\drewk\Documents\SQLSaturday\AdventureWorksLT\bin\Debug\AdventureWorksLT.dll
stdout:
stdout:   AdventureWorksLT -> c:\Users\drewk\Documents\SQLSaturday\AdventureWorksLT\bin\Debug\AdventureWorksLT.dacpac
stdout:
stdout:
stdout: Build succeeded.
stdout:
stdout:     0 Warning(s)
stdout:     0 Error(s)
stdout:
stdout: Time Elapsed 00:00:06.04
stdout:
>>> "C:\\Program Files\\dotnet\\dotnet.exe"  build "c:\\Users\\drewk\\Documents\\SQLSaturday\\AdventureWorksLT\\AdventureWorksLT.sqlproj" /
p:NetCoreBuild=true /p:NETCoreTargetsPath="c:\\Users\\drewk\\.azuredatastudio\\extensions\\microsoft.sql-database-projects-0.5.1\\BuildDirectory"    …
exited with code: 0
```

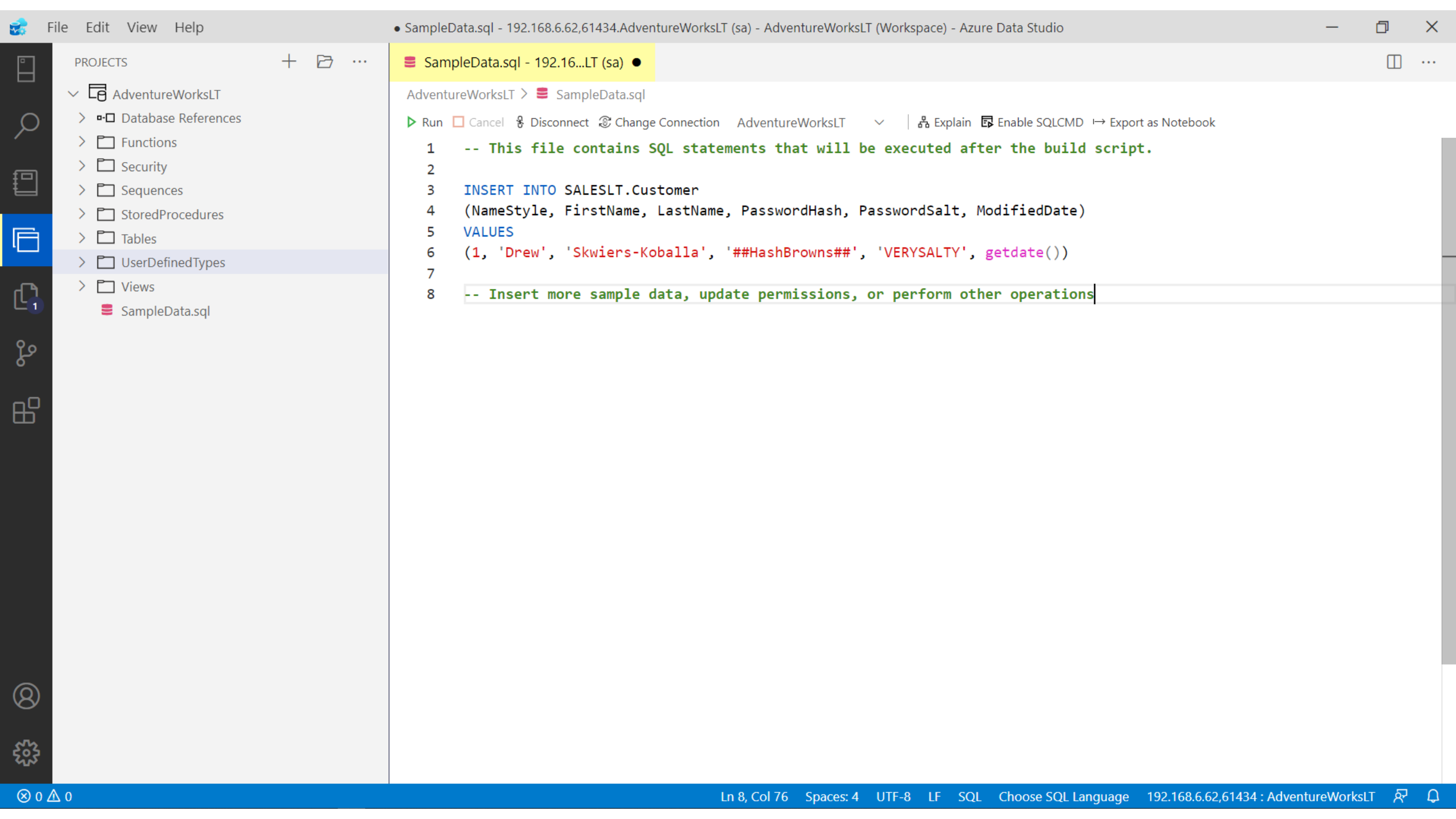


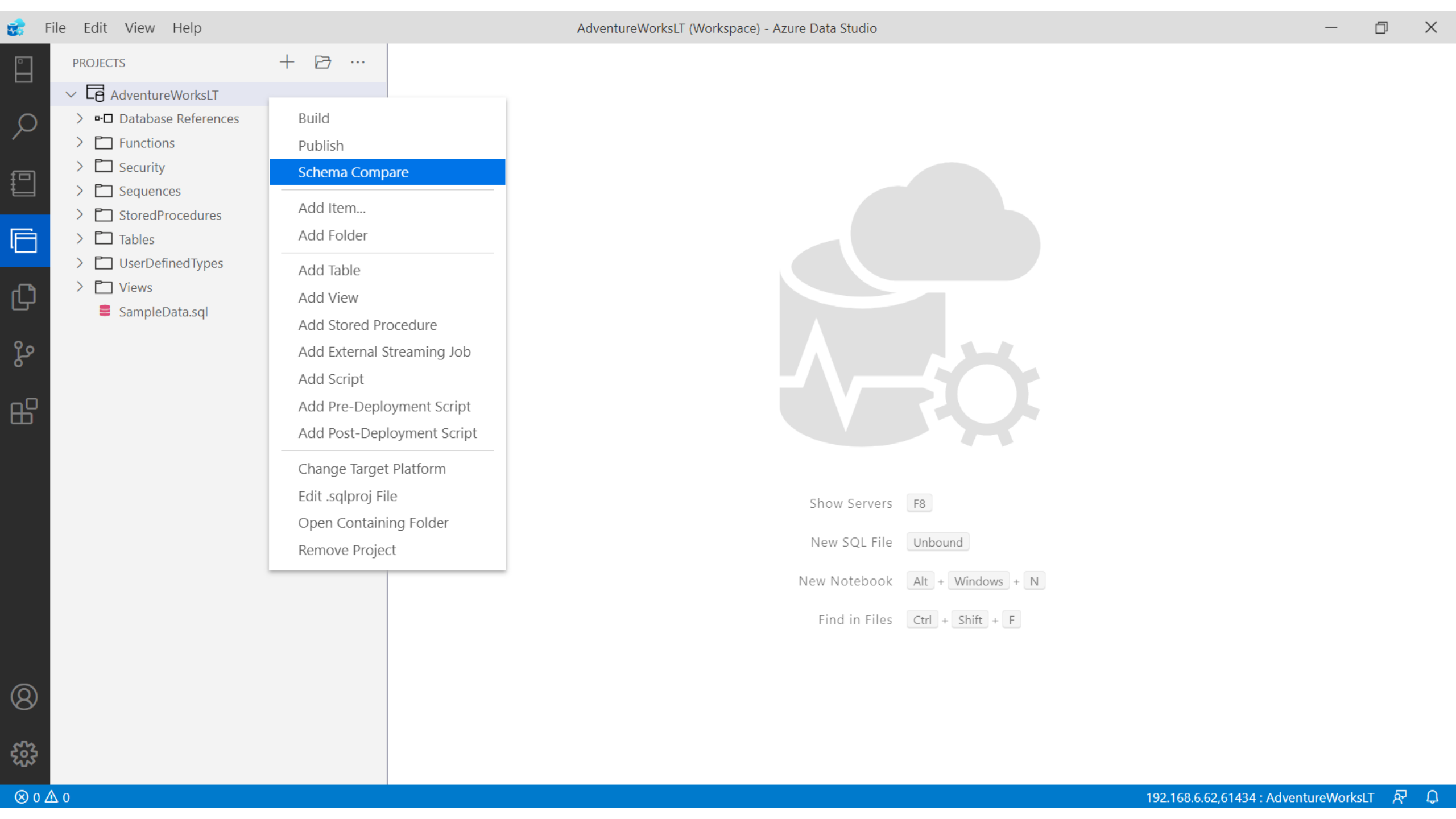
⊗0 ⚠0

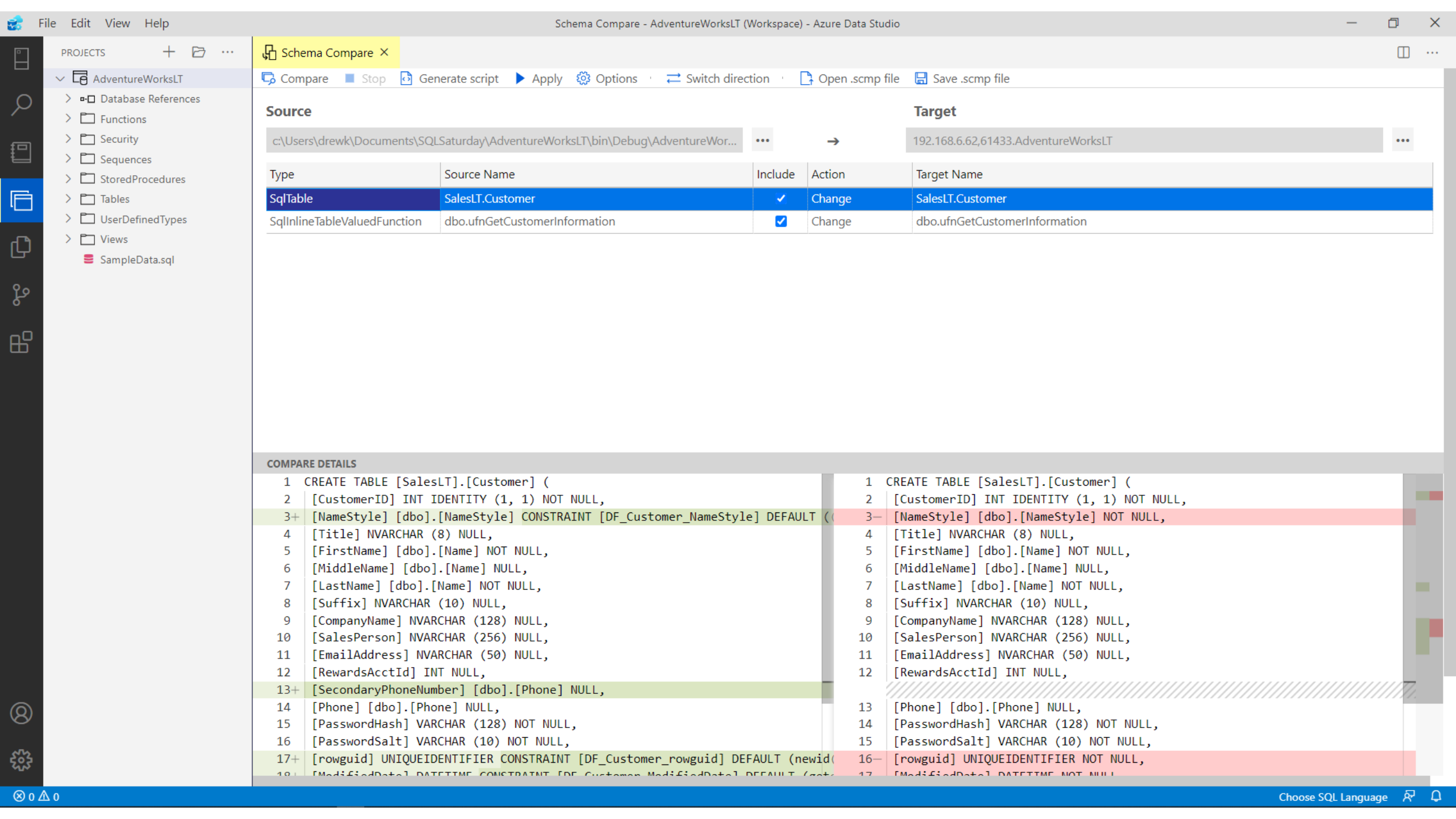

File Edit View Help
AdventureWorksLT (Workspace) - Azure Data Studio
PROJECTS
AdventureWorksLT
Database References
Functions
Security
Sequences
StoredProcedures
Tables
UserDefinedTypes
Views
PROBLEMS OUTPUT TERMINAL TASKS
stdout: Writing model to c:\Users\drewk\Documents\SQLSaturday\AdventureWorksLT\obj\Debug
stdout:
stdout: AdventureWorksLT -> c:\Users\drewk\Documents\SQLSaturday\AdventureWorksLT\bin\De
stdout:
stdout: AdventureWorksLT -> c:\Users\drewk\Documents\SQLSaturday\AdventureWorksLT\bin\De
stdout:
stdout:
stdout: Build succeeded.
stdout:
stdout: 0 Warning(s)
stdout: 0 Error(s)
stdout:
stdout: Time Elapsed 00:00:06.04
stdout:
>>> "C:\\Program Files\\dotnet\\dotnet.exe" build "c:\\Users\\drewk\\Documents\\
p:NetCoreBuild=true /p:NETCoreTargetsPath="c:\\Users\\drewk\\.azuredatastudio\\extensio
exited with code: 0
Publish project
Profile
Load profile...
Server *
test
Database *
AdventureWorksLT
To view changes to be applied
To apply changes
Generate Script
Publish
Cancel


File Edit View Help
SQLQuery_1 - disconnected - AdventureWorksLT (Workspace) - Azure Data Studio
PROJECTS
AdventureWorksLT
Database References
Functions
Security
Sequences
StoredProcedures
Tables
UserDefinedTypes
Views
SQLQuery_1 - disconnected
Run Cancel Connect Change Connection Select Database Explain Enable SQLCMD Export as Notebook
/*
Deployment script for AdventureWorksLT
This code was generated by a tool.
Changes to this file may cause incorrect behavior and will be lost if
the code is regenerated.
*/
GO
SET ANSI_NULLS, ANSI_PADDING, ANSI_WARNINGS, ARITHABORT, CONCAT_NULL_YIELDS_NULL, QUOTED_IDENTIFIER ON;
SET NUMERIC_ROUNDABORT OFF;
GO
:setvar DatabaseName "AdventureWorksLT"
:setvar DefaultFilePrefix "AdventureWorksLT"
:setvar DefaultDataPath ""
:setvar DefaultLogPath ""
GO
:on error exit
GO
/*
Detect SQLCMD mode and disable script execution if SQLCMD mode is not supported.
To re-enable the script after enabling SQLCMD mode, execute the following:
SET NOEXEC OFF;
*/
:setvar __IsSqlCmdEnabled "True"
GO
IF N'$(__IsSqlCmdEnabled)' NOT LIKE N'True'
BEGIN
PRINT N'SQLCMD mode must be enabled to successfully execute this script.';
SET NOEXEC ON;
END
GO
USE [$(DatabaseName)];
⊗ 7 ⚠ 0
Ln 1, Col 1 Spaces: 4 UTF-8 CRLF SQL MSSQL


File
Edit
View
Help
AdventureWorksLT (Workspace) - Azure Data Studio
PROJECTS
AdventureWorksLT
Database
Functions
Security
Sequence
StoredPro
Tables
UserDefin
Views
Build
Publish
Schema Compare
Add Item...
Add Folder
Add Table
Add View
Add Stored Procedure
Add External Streaming Job
Add Script
Add Pre-Deployment Script
Add Post-Deployment Script
Change Target Platform
Edit .sqlproj File
Open Containing Folder
Remove Project
Show Servers F8
New SQL File Unbound
New Notebook Alt + Windows + N
Find in Files Ctrl + Shift + F
0 0


File Edit View Help
• SampleData.sql - 192.168.6.62,61434.AdventureWorksLT (sa) - AdventureWorksLT (Workspace) - Azure Data Studio
PROJECTS
AdventureWorksLT
Database References
Functions
Security
Sequences
StoredProcedures
Tables
UserDefinedTypes
Views
SampleData.sql
SampleData.sql - 192.16...LT (sa) •
AdventureWorksLT > SampleData.sql
Run Cancel Disconnect Change Connection AdventureWorksLT Explain Enable SQLCMD Export as Notebook
1 -- This file contains SQL statements that will be executed after the build script.
2
3 INSERT INTO SALESLT.Customer
4 (NameStyle, FirstName, LastName, PasswordHash, PasswordSalt, ModifiedDate)
5 VALUES
6 (1, 'Drew', 'Skwiers-Koballa', '##HashBrowns##', 'VERYSALTY', getdate())
7
8 -- Insert more sample data, update permissions, or perform other operations
0 0
Ln 8, Col 76 Spaces: 4 UTF-8 LF SQL Choose SQL Language 192.168.6.62,61434 : AdventureWorksLT

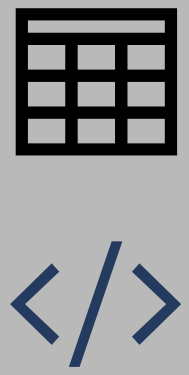

File
Edit
View
Help
AdventureWorksLT (Workspace) - Azure Data Studio
PROJECTS
AdventureWorksLT
Database References
Functions
Security
Sequences
StoredProcedures
Tables
UserDefinedTypes
Views
SampleData.sql
Build
Publish
Schema Compare
Add Item...
Add Folder
Add Table
Add View
Add Stored Procedure
Add External Streaming Job
Add Script
Add Pre-Deployment Script
Add Post-Deployment Script
Change Target Platform
Edit .sqlproj File
Open Containing Folder
Remove Project
Show Servers F8
New SQL File Unbound
New Notebook Alt + Windows + N
Find in Files Ctrl + Shift + F
0 0
192.168.6.62,61434 : AdventureWorksLT


File Edit View Help
Schema Compare - AdventureWorksLT (Workspace) - Azure Data Studio
PROJECTS
AdventureWorksLT
Database References
Functions
Security
Sequences
StoredProcedures
Tables
UserDefinedTypes
Views
SampleData.sql
Schema Compare
Compare
Stop
Generate script
Apply
Options
Switch direction
Open .scmp file
Save .scmp file
Source
c:\Users\drewk\Documents\SQLSaturday\AdventureWorksLT\bin\Debug\AdventureWor...
Target
192.168.6.62,61433.AdventureWorksLT
Type
Source Name
Include
Action
Target Name
SqlTable
SalesLT.Customer
Change
SalesLT.Customer
SqlInlineTableValuedFunction
dbo.ufnGetCustomerInformation
Change
dbo.ufnGetCustomerInformation
COMPARE DETAILS
CREATE TABLE [SalesLT].[Customer] (
[CustomerID] INT IDENTITY (1, 1) NOT NULL,
[NameStyle] [dbo].[NameStyle] CONSTRAINT [DF_Customer_NameStyle] DEFAULT (
[Title] NVARCHAR (8) NULL,
[FirstName] [dbo].[Name] NOT NULL,
[MiddleName] [dbo].[Name] NULL,
[LastName] [dbo].[Name] NOT NULL,
[Suffix] NVARCHAR (10) NULL,
[CompanyName] NVARCHAR (128) NULL,
[SalesPerson] NVARCHAR (256) NULL,
[EmailAddress] NVARCHAR (50) NULL,
[RewardsAcctId] INT NULL,
[SecondaryPhoneNumber] [dbo].[Phone] NULL,
[Phone] [dbo].[Phone] NULL,
[PasswordHash] VARCHAR (128) NOT NULL,
[PasswordSalt] VARCHAR (10) NOT NULL,
[rowguid] UNIQUEIDENTIFIER CONSTRAINT [DF_Customer_rowguid] DEFAULT (newid(
CREATE TABLE [SalesLT].[Customer] (
[CustomerID] INT IDENTITY (1, 1) NOT NULL,
[NameStyle] [dbo].[NameStyle] NOT NULL,
[Title] NVARCHAR (8) NULL,
[FirstName] [dbo].[Name] NOT NULL,
[MiddleName] [dbo].[Name] NULL,
[LastName] [dbo].[Name] NOT NULL,
[Suffix] NVARCHAR (10) NULL,
[CompanyName] NVARCHAR (128) NULL,
[SalesPerson] NVARCHAR (256) NULL,
[EmailAddress] NVARCHAR (50) NULL,
[RewardsAcctId] INT NULL,
[Phone] [dbo].[Phone] NULL,
[PasswordHash] VARCHAR (128) NOT NULL,
[PasswordSalt] VARCHAR (10) NOT NULL,
[rowguid] UNIQUEIDENTIFIER NOT NULL,
Choose SQL Language

# SQL Database Projects extension for Azure Data Studio

## Open Existing or Create New Project


## Edit Project



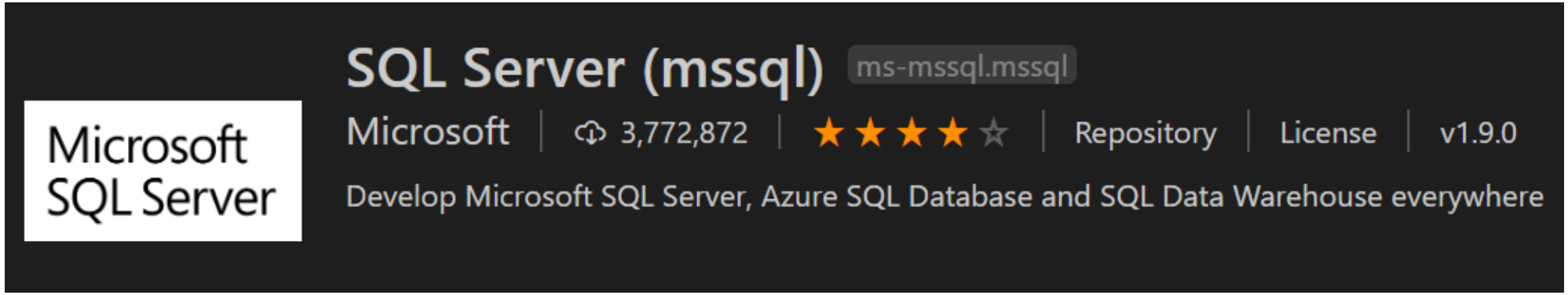
## Build Project

## Publish Project

# Mssql Extension in VS Code

# Visual Studio Code (aka VS Code)

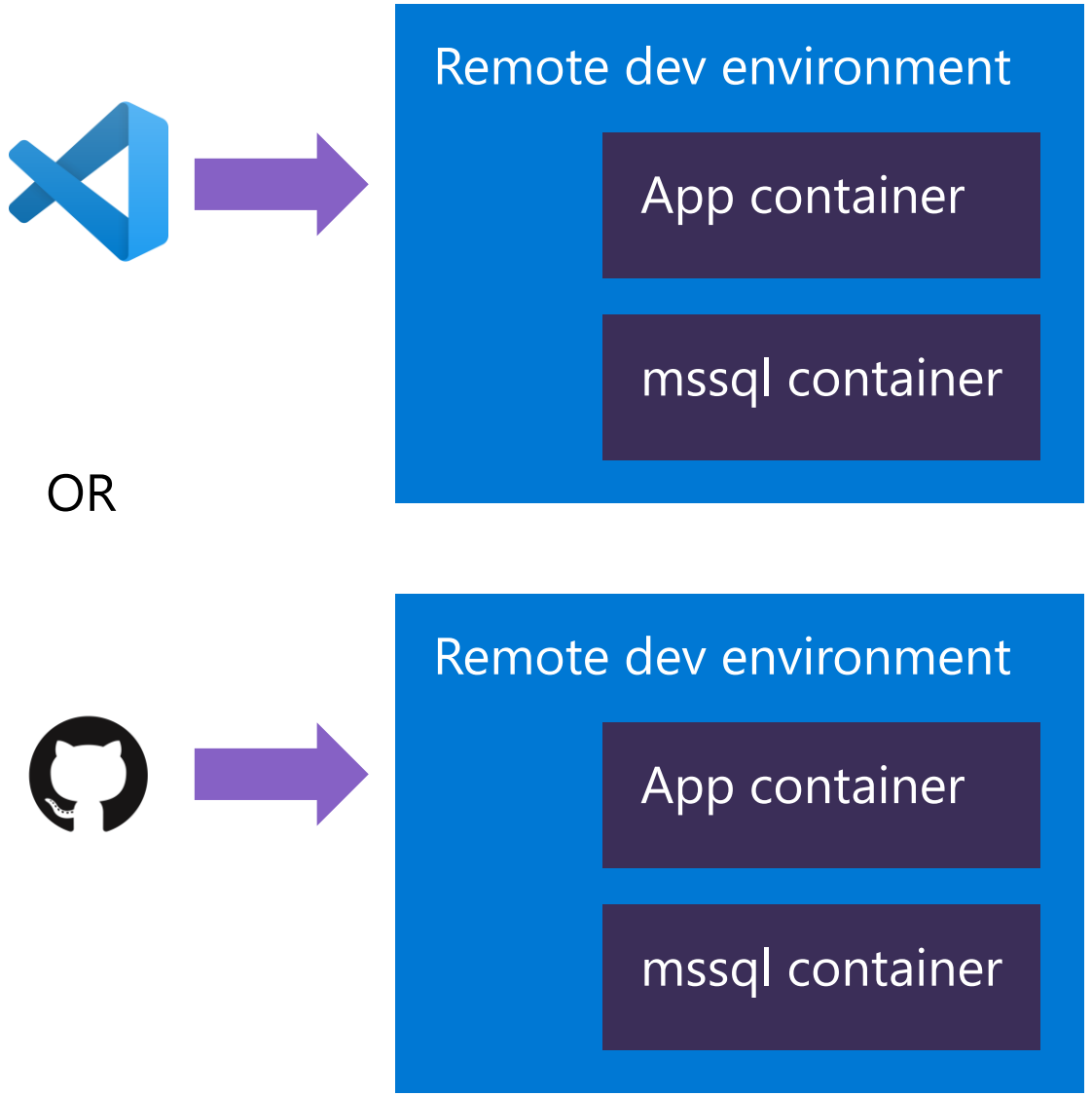
- **mssql extension**
- Connect and query database servers – MS SQL and Azure SQL




- **Remote – Container** development connects VS Code UI directly to container instance(s)

# Remote Development in VS Code with mssql

- Load mssql extension
- Connect to SQL instance from mssql container
- Use SqlPackage, sqlcmd, or other command line tools to deploy data-tier application components



# .devcontainer with mssql container

docker-compose.yml addition

```yaml
db:
  image: mcr.microsoft.com/mssql/server:2019-latest
  restart: unless-stopped
  environment:
    SA_PASSWORD: P@ssw0rd
    ACCEPT_EULA: Y
  network_mode: host
```

# .devcontainer with mssql container

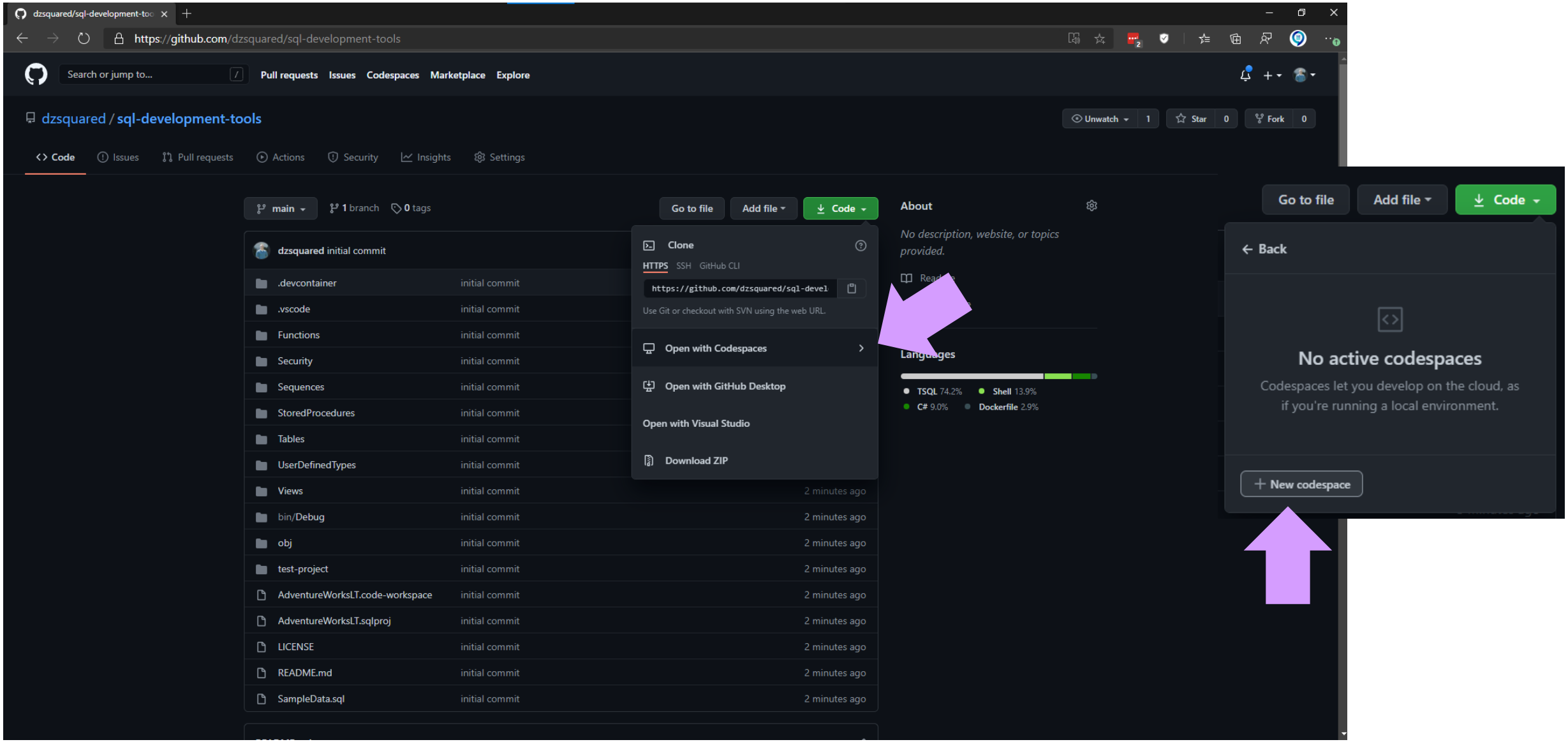
## devcontainer.json edits

```
"settings": {
  "terminal.integrated.shell.linux": "/bin/bash",
  "mssql.connections": [
    {
      "server": "localhost,1433",
      "database": "",
      "authenticationType": "SqlLogin",
      "user": "sa",
      "password": "P@ssw0rd",
      "emptyPasswordInput": false,
      "savePassword": false,
      "profileName": "mssql-container"
    }
  ]
},
"extensions": [
  "ms-dotnettools.csharp",
  "ms-mssql.mssql"
],
```

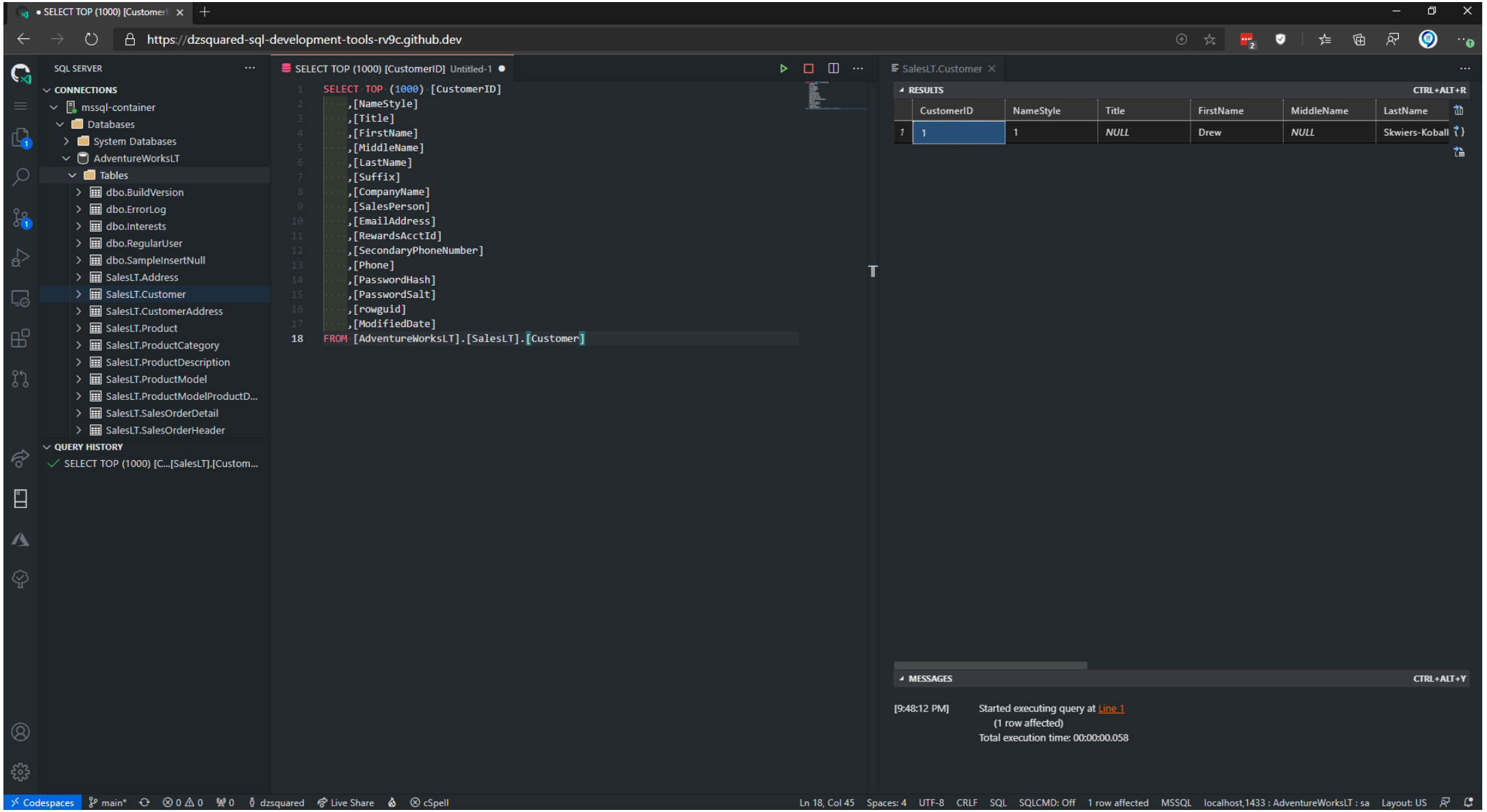
# Resources for Remote Development

- **Getting started:** https://code.visualstudio.com/docs/remote/remote-overview
- **Our example code:** https://github.com/dzsquared/sql-development-tools
- **.NET Core + mssql template:** https://github.com/microsoft/vscode-dev-containers/tree/master/containers/dotnet-mssql

# Remote development in Codespaces



# Same dev environment from VS Code… in the browser.



# Recap

- Database development can leverage a *similar* development cycle as general applications
- Database projects extension in Azure Data Studio (and SSDT) enables developing databases with data-tier applications
- Container-based development can place a reusable data layer with application code

https://aka.ms/azuredatastudio-sqlprojects
https://github.com/dzsquared/sql-development-tools

Microsoft

**Drew Skwiers-Koballa**
Program Manager
drew.skwierskoballa@microsoft.com
@SysAdminDrew

https://aka.ms/azuredatastudio-sqlprojects
https://github.com/dzsquared/sql-development-tools