SQLSATURDAY

#1068 - Jacksonville, FL - May 4th, 2024

Intro to Automated Database Deployments with Azure DevOps

Erin Dempster (she/her)

Principal Cloud Architect

Trean Corporation

#SQLSatJax

JACKSONVILLE SQL SERVER USERS GROUP

Costume Contest Rules

1. Take a picture with the SQL Saturday Backdrop during the event

2. Post the picture to Twitter/X and include the hashtag #SQLSatJax24CC

3. The tweet using the hashtag that has the most "likes" wins a prize!

Erin Dempster

She/Her

MVP Microsoft® Most Valuable Professional

Principal Cloud Architect

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- SQL Server DBA
- Azure Administrator
- Azure DevOps Administrator

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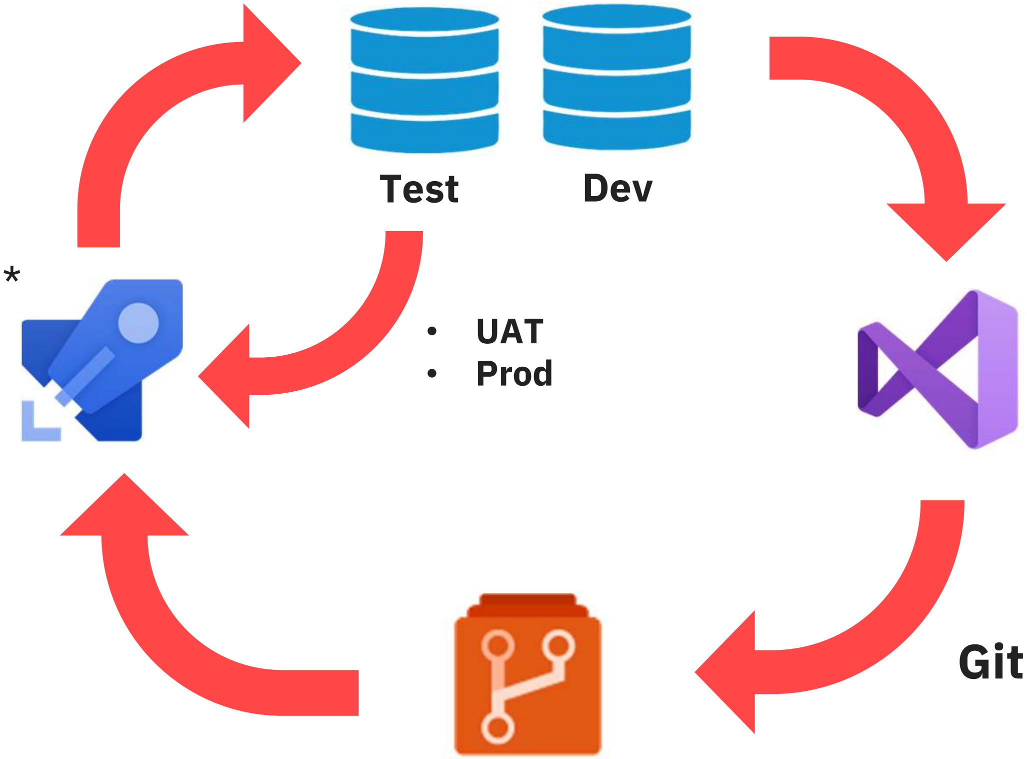
Speaker – PASS Summit, SQLBits +

Author – SQLServerCentral.com

Agenda

Azure Pipelines

1. Build
2. Automated Tests*
3. Approve
4. Deploy
5. Repeat 3&4



Test **Dev**

- **UAT**
- **Prod**

Visual Studio

- Reverse Engineer
- Develop
- Unit Test
- Commit Changes

Git Client

Azure Repos

Git Repositories

Who’s in the Audience?

- Application Developers?
- Database Developers?
- Database Administrators?
- IT Managers?

URL to Git Repo

https://github.com/endlessautomation/SQLSat/JAX24

Who am I Expecting Today?

- Everyone, of course, especially

- Application Developers working with Databases

- Database Developers

- Have **some familiarity** with source control

Main Vendors

Developer Tools

Microsoft	Red Gate
Visual Studio	Flyway
Visual Studio Code	SQL Source Control (EOL announced)
Azure Data Studio	

Source Control Solutions

Microsoft	Others
Azure DevOps	Bitbucket Cloud
GitHub	GitLab
	Subversion

Installed Tools Used Today

- Visual Studio 2022 Community Edition
  - https://aka.ms/vs2022
  - Current Version - 17.9.x (bi-weekly or monthly updates)
  - Community Edition is freely available TO EVERYONE
- Azure Pipelines Self-hosted Agent
- SQLPackage.exe – used for deployments
  - https://aka.ms/sqlpackage

Azure DevOps vs GitHub

Azure DevOps vs GitHub

	Azure DevOps	GitHub
Git Repositories	Yes!	Of course!!
Continuous Deployment	Azure Pipelines	GitHub Actions
Sprint/Kanban Boards	Yes	No (Issue Tracking)
Manual/Automated Testing	Available (different license)	No

Azure DevOps vs GitHub

Easy, peasy!!

	Azure DevOps	GitHub		
Authentication Method	**All Levels**	**Free**	**Team**	**Enterprise**
“Standard”	Guest Access (external users)	Email address/password		
“Enhanced”	Entra ID	N/A		Managed Users SAML

Major bummer!

Introduction to Local Source Control

Git Client

Git Client

- Local source control repository
- Command Line-based
- Works with hosted Git
  - Azure DevOps
  - GitHub
  - ...WHERE Name LIKE ‘Git%’

Git Client

Integrated into Popular Developer Tools

- Visual Studio
- Azure Data Studio
- Eclipse
- ...many others

Git Client

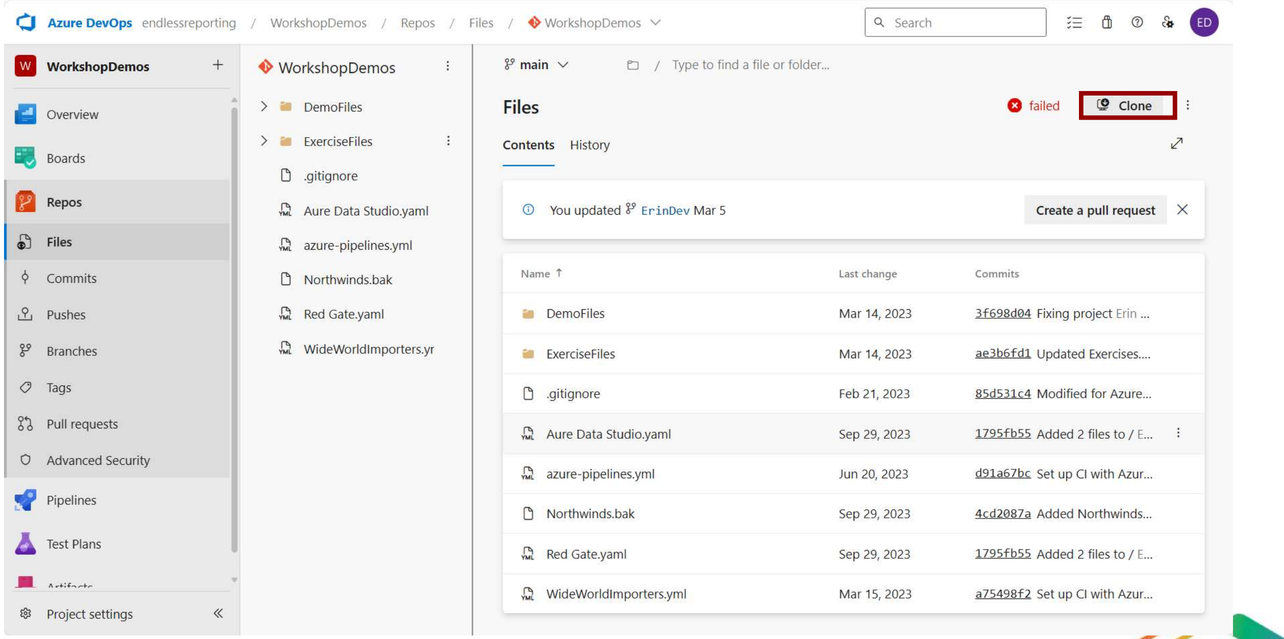
- Download URL
  - https://git-scm.com/downloads
- Choose your platform
  - Windows
  - macOS
  - Linux/Unix

Common Git Commands

- Clone – copy a remote repo locally (1-time)
- Fetch – syncs local metadata from remote
- Pull – syncs local files from remote
- Add/Rm – add or remove files/folders
- Commit – check-in changes
- Push – syncs remote files from local
- Branch – manage code branches
- Checkout – switch branches

Azure Repos

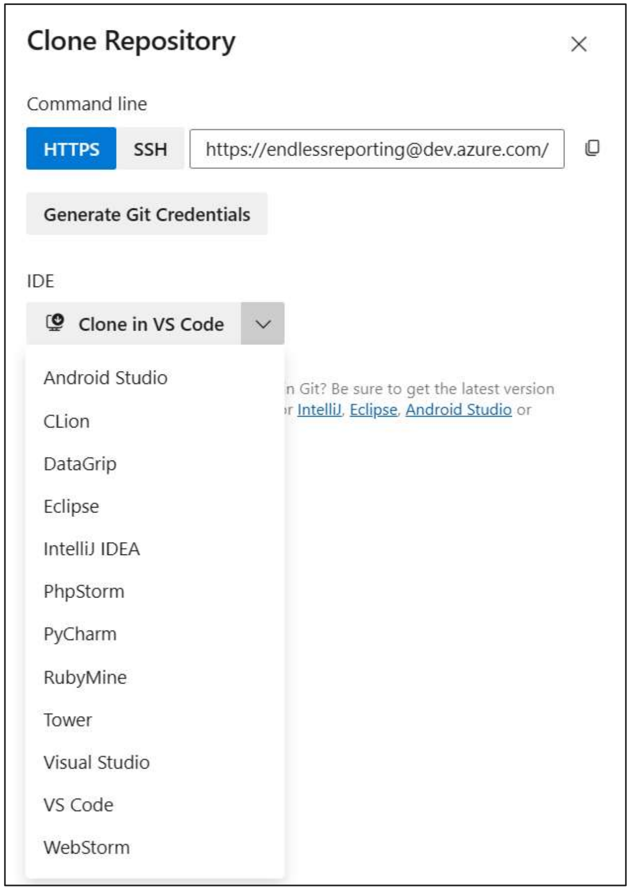
- Clone – copy a remote repo locally (1-time)



You updated ErinDev Mar 5

Name ↑	Last change	Commits
DemoFiles	Mar 14, 2023	3f698d04 Fixing project Erin ...
ExerciseFiles	Mar 14, 2023	ae3b6fd1 Updated Exercises....
.gitignore	Feb 21, 2023	85d531c4 Modified for Azure...
Aure Data Studio.yaml	Sep 29, 2023	1795fb55 Added 2 files to / E...
azure-pipelines.yml	Jun 20, 2023	d91a67bc Set up CI with Azur...
Northwinds.bak	Sep 29, 2023	4cd2087a Added Northwinds...
Red Gate.yaml	Sep 29, 2023	1795fb55 Added 2 files to / E...
WideWorldImporters.yml	Mar 15, 2023	a75498f2 Set up CI with Azur...

Azure Repos



Clone Repository ✕

Command line

HTTPS SSH https://endlessreporting@dev.azure.com/

Generate Git Credentials

IDE

Clone in VS Code ⌄

- Android Studio
- CLion
- DataGrip
- Eclipse
- IntelliJ IDEA
- PhpStorm
- PyCharm
- RubyMine
- Tower
- Visual Studio
- VS Code
- WebStorm

n Git? Be sure to get the latest version
r IntelliJ, Eclipse, Android Studio or

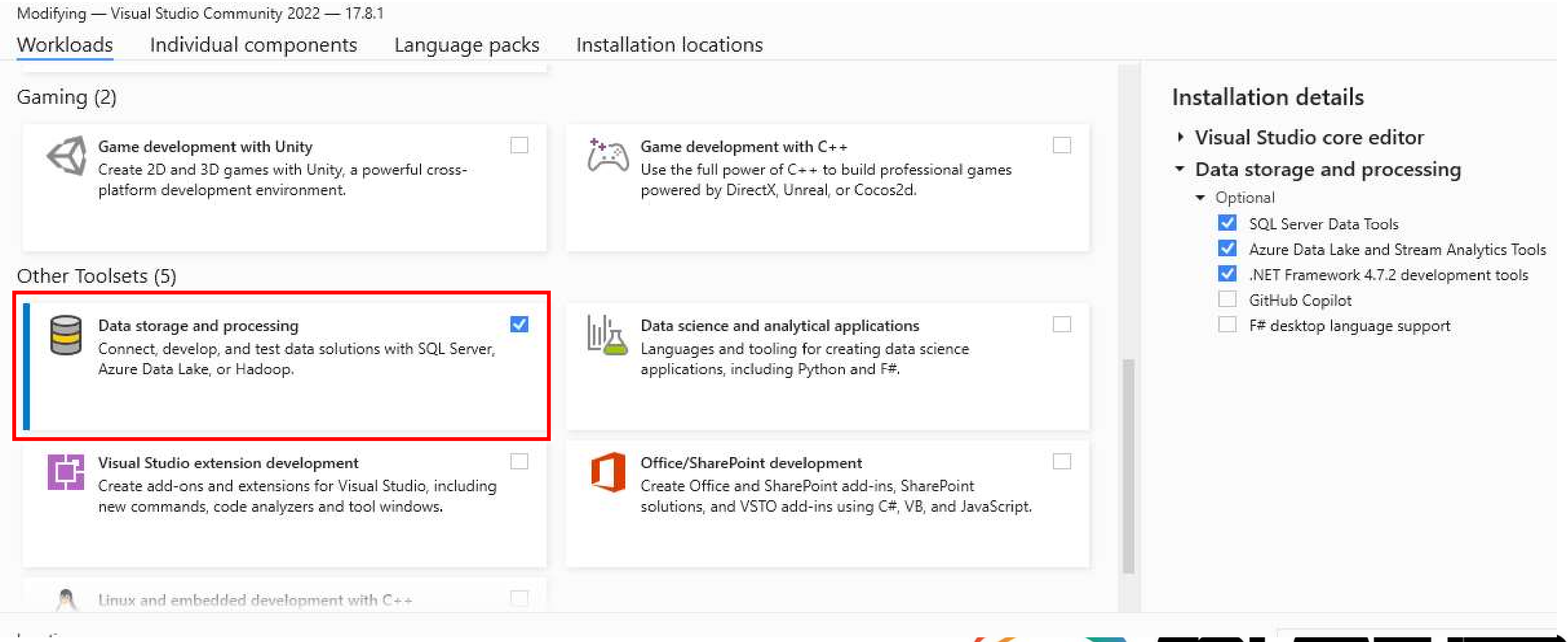
Introduction to Visual Studio

SQL Database Project

Visual Studio – SQL Database Project

- Long-Time Support for SQL Databases
- Build Projects with msbuild.exe
- Creates a .DACPAC for Deployment

Visual Studio Installer



Modifying — Visual Studio Community 2022 — 17.8.1

Gaming (2)

Game development with Unity □
Create 2D and 3D games with Unity, a powerful cross-platform development environment.

Game development with C++ □
Use the full power of C++ to build professional games powered by DirectX, Unreal, or Cocos2d.

Other Toolsets (5)

Data storage and processing ☑
Connect, develop, and test data solutions with SQL Server, Azure Data Lake, or Hadoop.

Data science and analytical applications □
Languages and tooling for creating data science applications, including Python and F#.

Visual Studio extension development □
Create add-ons and extensions for Visual Studio, including new commands, code analyzers and tool windows.

Office/SharePoint development □
Create Office and SharePoint add-ins, SharePoint solutions, and VSTO add-ins using C#, VB, and JavaScript.

Linux and embedded development with C++ □

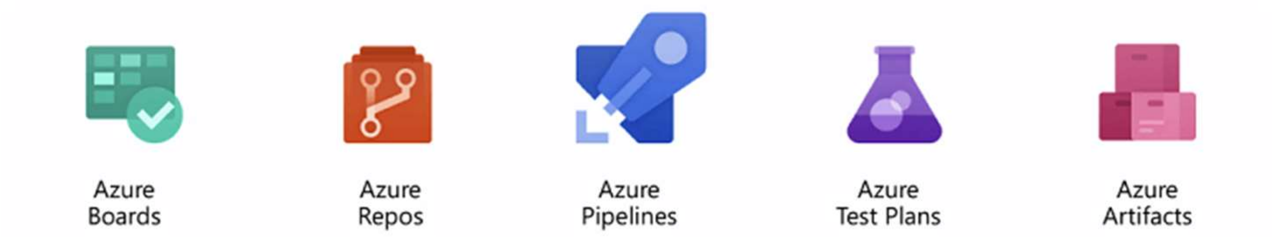
Installation details

- Visual Studio core editor
- Data storage and processing
  - Optional
    - ☑ SQL Server Data Tools
    - ☑ Azure Data Lake and Stream Analytics Tools
    - ☑ .NET Framework 4.7.2 development tools
    - □ GitHub Copilot
    - □ F# desktop language support

SQL Database Project Demo

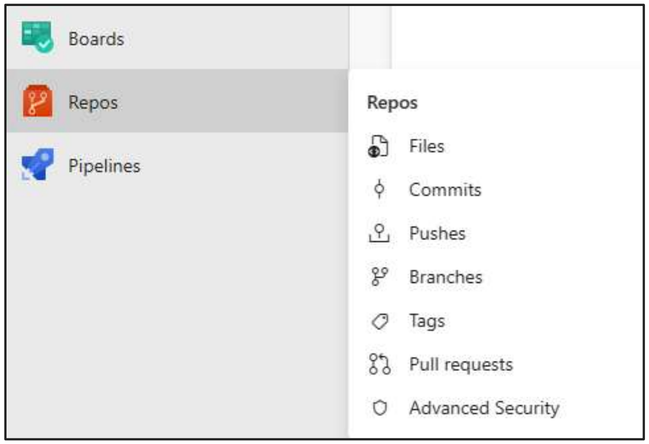
Introduction to Azure DevOps

Azure DevOps – Key Components



Azure Repos

- Centralized Git Repository
- Manage
  - History (Commits)
  - Branches
  - Pull Requests

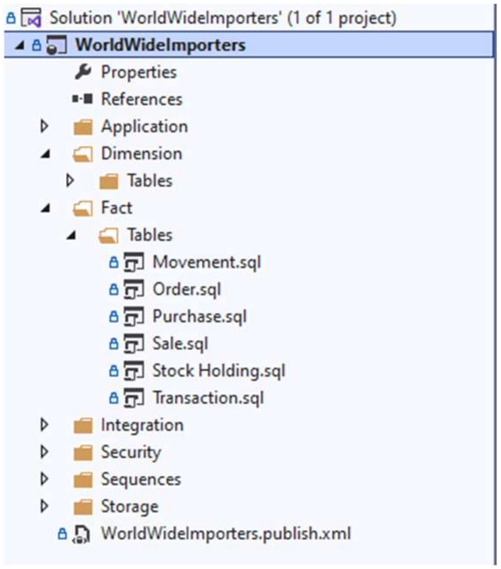


Introduction to Azure Pipelines

Azure Pipelines

- Manages code builds and deployments

- Triggered by source code check-ins



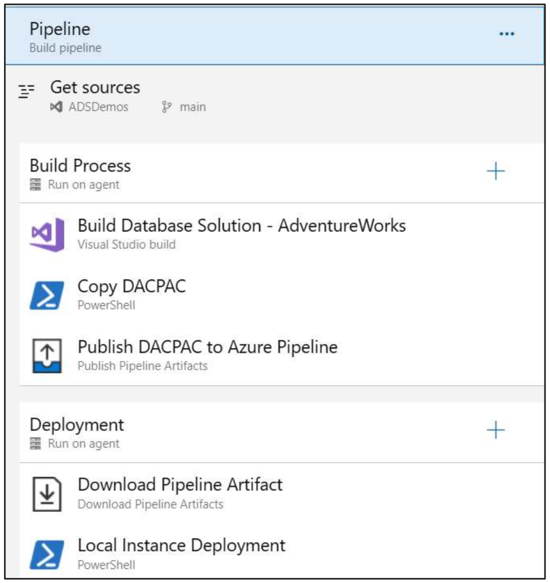
```
Solution 'WorldWideImporters' (1 of 1 project)
  WorldWideImporters
      Properties
      References
      Application
      Dimension
        Tables
      Fact
        Tables
          Movement.sql
          Order.sql
          Purchase.sql
          Sale.sql
          Stock Holding.sql
          Transaction.sql
      Integration
      Security
      Sequences
      Storage
      WorldWideImporters.publish.xml
```

Azure Pipelines

Azure Pipelines

- Many pre-defined tasks
  - Visual Studio Build
  - Publish & Download Artifacts
- Scripting tasks
  - PowerShell

Define **YOUR** workflow in YAM



Pipeline
Build pipeline

Get sources
ADSDemos main

Build Process
Run on agent

Build Database Solution - AdventureWorks
Visual Studio build

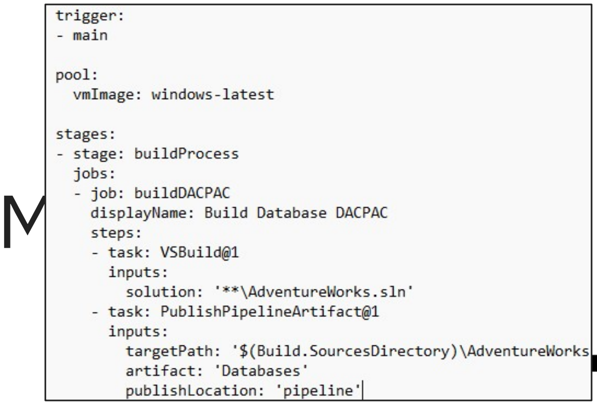
Copy DACPAC
PowerShell

Publish DACPAC to Azure Pipeline
Publish Pipeline Artifacts

Deployment
Run on agent

Download Pipeline Artifact
Download Pipeline Artifacts

Local Instance Deployment
PowerShell



```
trigger:
- main

pool:
  vmImage: windows-latest

stages:
- stage: buildProcess
  jobs:
  - job: buildDACPAC
    displayName: Build Database DACPAC
    steps:
    - task: VSBuild@1
      inputs:
        solution: '**\AdventureWorks.sln'
    - task: PublishPipelineArtifact@1
      inputs:
        targetPath: '$(Build.SourcesDirectory)\AdventureWorks
        artifact: 'Databases'
        publishLocation: 'pipeline'
```

Azure Pipelines

- YAML Schema - https://tinyurl.com/4z7x3mkw
- Task Index - https://tinyurl.com/56vf436z
- Pipeline Variables - https://tinyurl.com/ye2ypvum

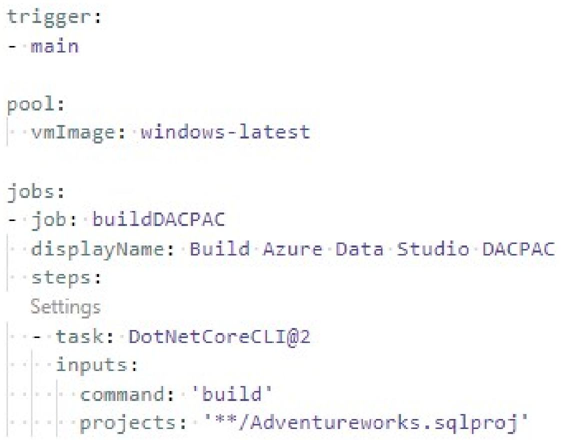
What is YAML?

“**Y**AML **A**in’t **M**arkup **L**anguage”

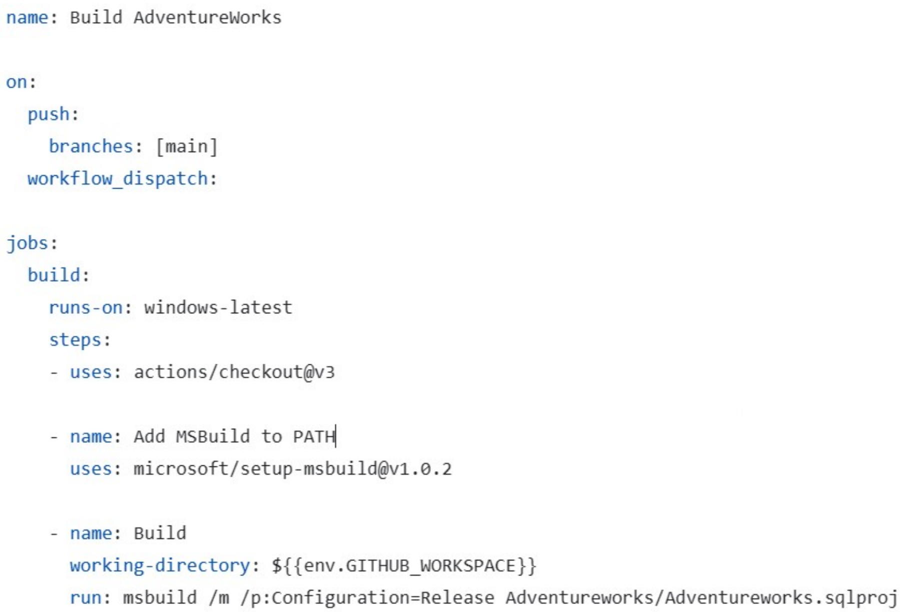
Configuration Layout

Used by both Azure DevOps and GitHub Actions

YAML - Azure Pipelines vs GitHub Actions



```
trigger:
- main

pool:
  vmImage: windows-latest

jobs:
- job: buildDACPAC
  displayName: Build Azure Data Studio DACPAC
  steps:
  Settings
  - task: DotNetCoreCLI@2
    inputs:
      command: 'build'
      projects: '**/Adventureworks.sqlproj'
```



```
name: Build AdventureWorks

on:
  push:
    branches: [main]
  workflow_dispatch:

jobs:
  build:
    runs-on: windows-latest
    steps:
    - uses: actions/checkout@v3

    - name: Add MSBuild to PATH
      uses: microsoft/setup-msbuild@v1.0.2

    - name: Build
      working-directory: ${{env.GITHUB_WORKSPACE}}
      run: msbuild /m /p:Configuration=Release Adventureworks/Adventureworks.sqlproj
```

Configuration Layout

Hierarchical

<Pipeline>

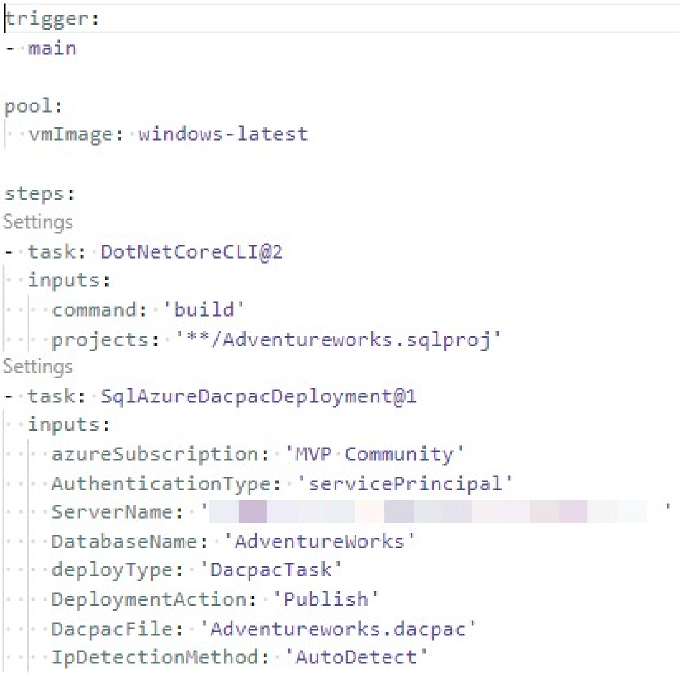
Stages

Jobs

Steps

Task

Basic Pipeline



```
trigger:
- main

pool:
  vmImage: windows-latest

steps:
Settings
- task: DotNetCoreCLI@2
  inputs:
    command: 'build'
    projects: '**/Adventureworks.sqlproj'
Settings
- task: SqlAzureDacpacDeployment@1
  inputs:
    azureSubscription: 'MVP Community'
    AuthenticationType: 'servicePrincipal'
    ServerName: '[redacted]'
    DatabaseName: 'AdventureWorks'
    deployType: 'DacpacTask'
    DeploymentAction: 'Publish'
    DacpacFile: 'Adventureworks.dacpac'
    IpDetectionMethod: 'AutoDetect'
```

Implied Single Stage with one job

1st task – builds the project

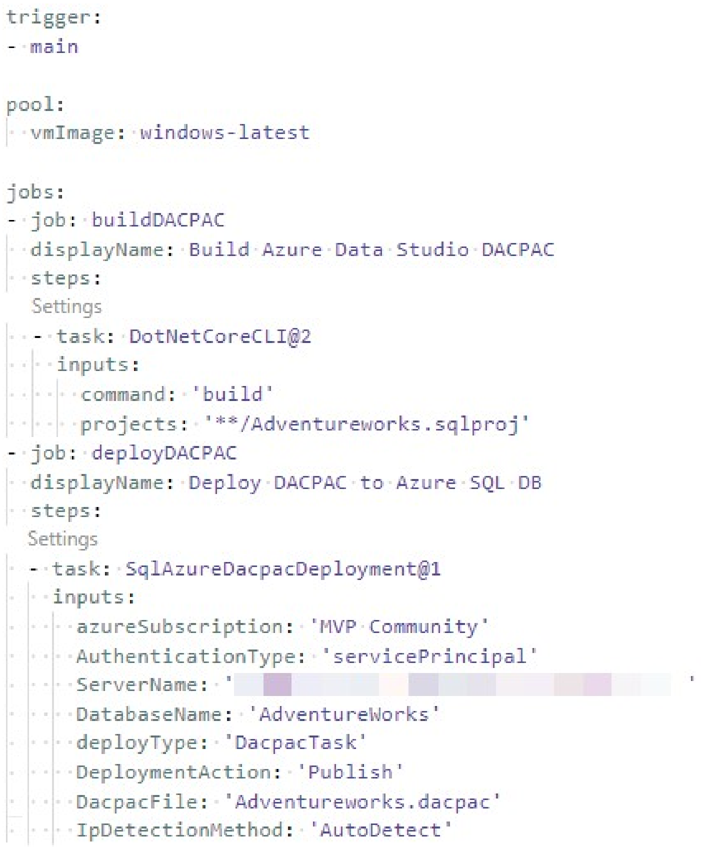
2nd task – deploys the DACPAC using SQLPackage.exe

Both tasks run in the same agent instance

When to use this scenario?

- Proof of concept
- Testing connections
- Build Validation/Automated Testing

Explicit Job Definitions

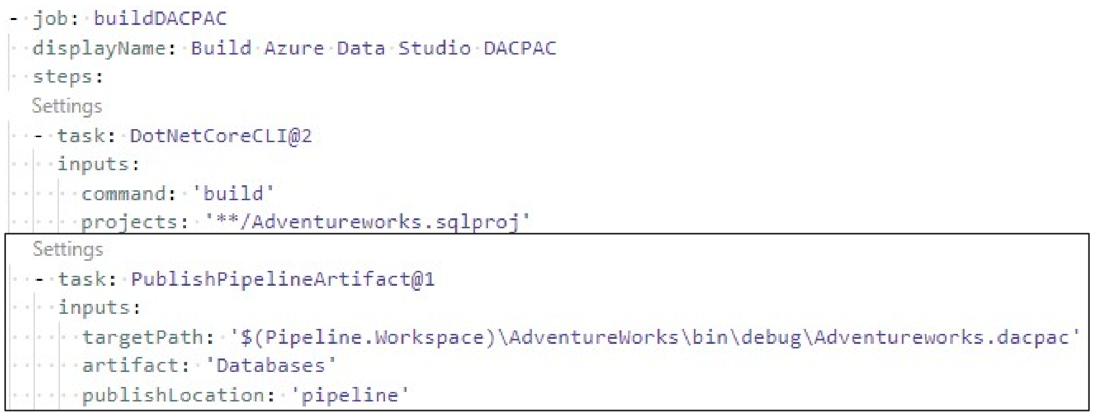


```
trigger:
- main

pool:
  vmImage: windows-latest

jobs:
- job: buildDACPAC
  displayName: Build Azure Data Studio DACPAC
  steps:
  Settings
  - task: DotNetCoreCLI@2
    inputs:
      command: 'build'
      projects: '**/Adventureworks.sqlproj'
- job: deployDACPAC
  displayName: Deploy DACPAC to Azure SQL DB
  steps:
  Settings
  - task: SqlAzureDacpacDeployment@1
    inputs:
      azureSubscription: 'MVP Community'
      AuthenticationType: 'servicePrincipal'
      ServerName: '[redacted]'
      DatabaseName: 'AdventureWorks'
      deployType: 'DacpacTask'
      DeploymentAction: 'Publish'
      DacpacFile: 'Adventureworks.dacpac'
      IpDetectionMethod: 'AutoDetect'
```

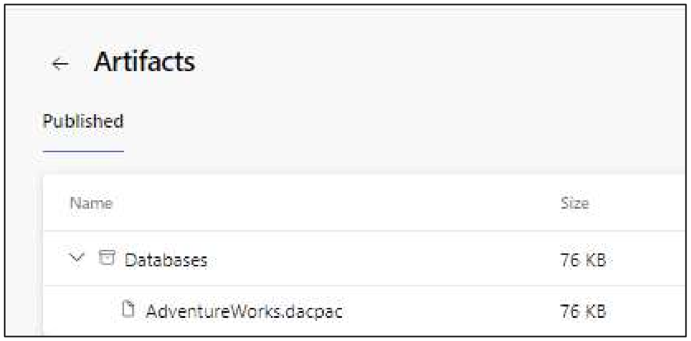
What’s wrong with this pipeline?

DACPAC is not shared between jobs

Publish DACPAC as a Pipeline Artifact



```
- job: buildDACPAC
  displayName: Build Azure Data Studio DACPAC
  steps:
  Settings
  - task: DotNetCoreCLI@2
    inputs:
      command: 'build'
      projects: '**/Adventureworks.sqlproj'
  Settings
  - task: PublishPipelineArtifact@1
    inputs:
      targetPath: '$(Pipeline.Workspace)\AdventureWorks\bin\debug\Adventureworks.dacpac'
      artifact: 'Databases'
      publishLocation: 'pipeline'
```

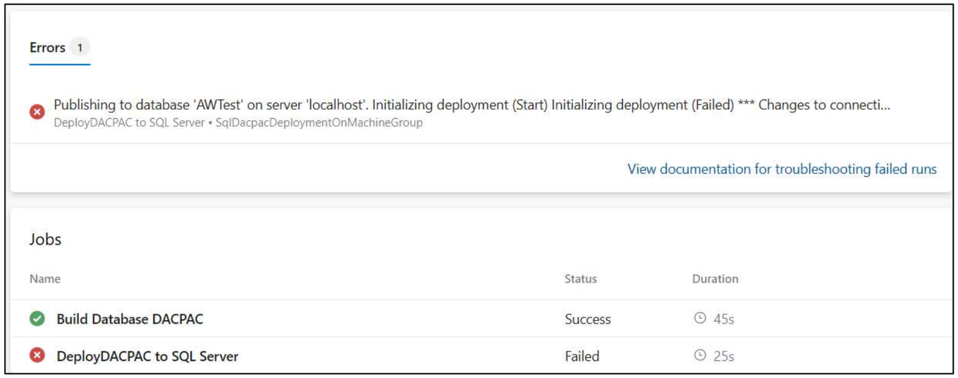


← Artifacts

Published

Name	Size
Databases	76 KB
AdventureWorks.dacpac	76 KB

Explicit Stage Declaration



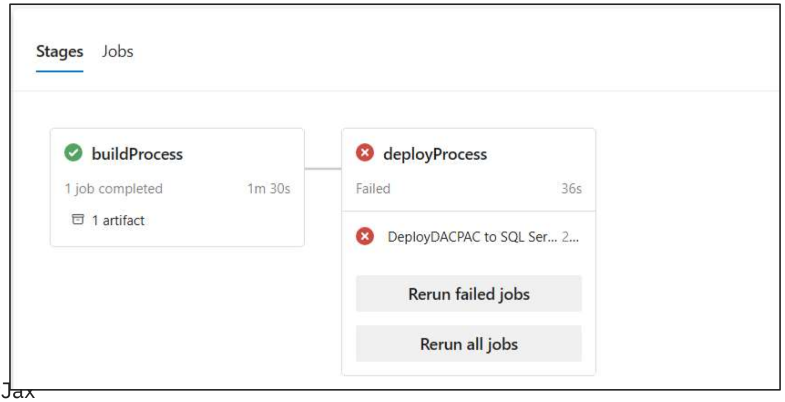
Errors 1

✗ Publishing to database 'AWTest' on server 'localhost'. Initializing deployment (Start) Initializing deployment (Failed) *** Changes to connecti...
DeployDACPAC to SQL Server • SqlDacpacDeploymentOnMachineGroup

View documentation for troubleshooting failed runs

Jobs

Name	Status	Duration
✓ Build Database DACPAC	Success	45s
✗ DeployDACPAC to SQL Server	Failed	25s

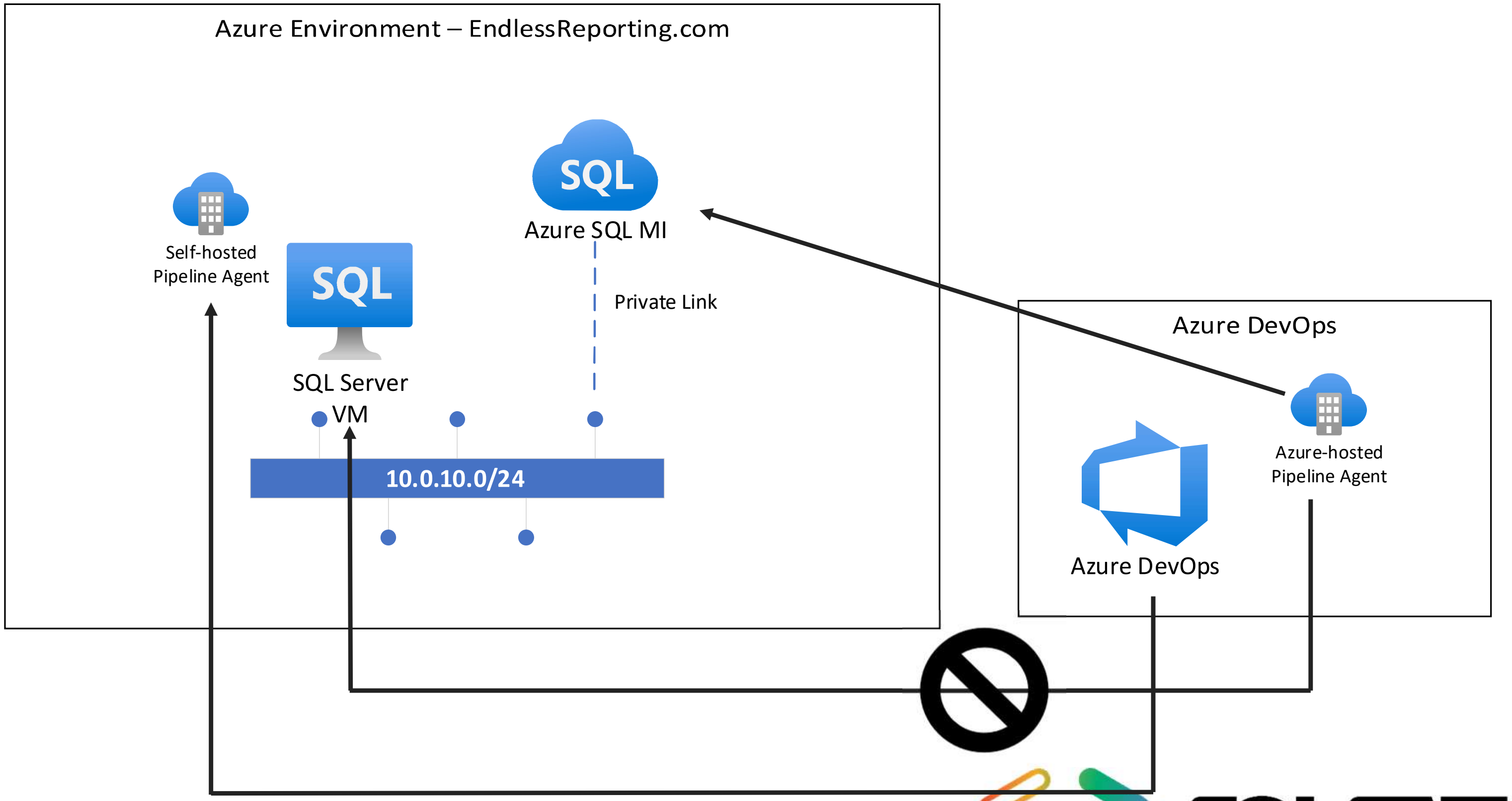


```
trigger:
- main

pool:
  vmImage: windows-latest

stages:
- stage: buildProcess
  jobs:
  - job: buildDACPAC
    displayName: Build Database DACPAC
    steps:

- stage: deployProcess
  jobs:
  - job: deployDACPACToTest
    displayName: DeployDACPAC to SQL Server
    pool: WorkshopPool
    steps:
```

Network Communications

Azure Pipelines and Azure SQL DB/MI vs SQL Server Instances

Azure Pipeline Agents



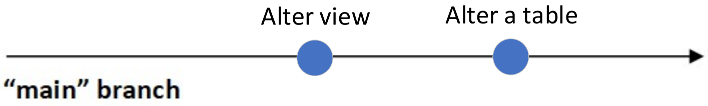
Azure Pipelines Demo

Create YAML Pipeline for SQL Server Deployment

Branching Code

Branching Strategy

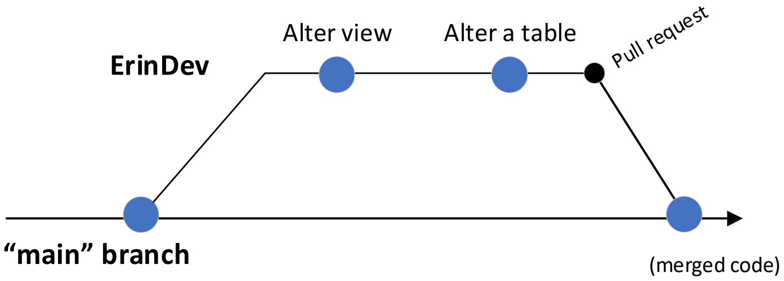
- main branch



- Harder to determine automations
  - Trigger after table change or view change?

Branching Strategy

- Developer branch and main



- Changes are merged into main together
- Pull Request (PR) can start automations

Pull Request

- Developer believes code is finished
- Changes are grouped together
- Associate work items
  - Requirements
  - Bugs
- Require approval by another team member

Code Validation

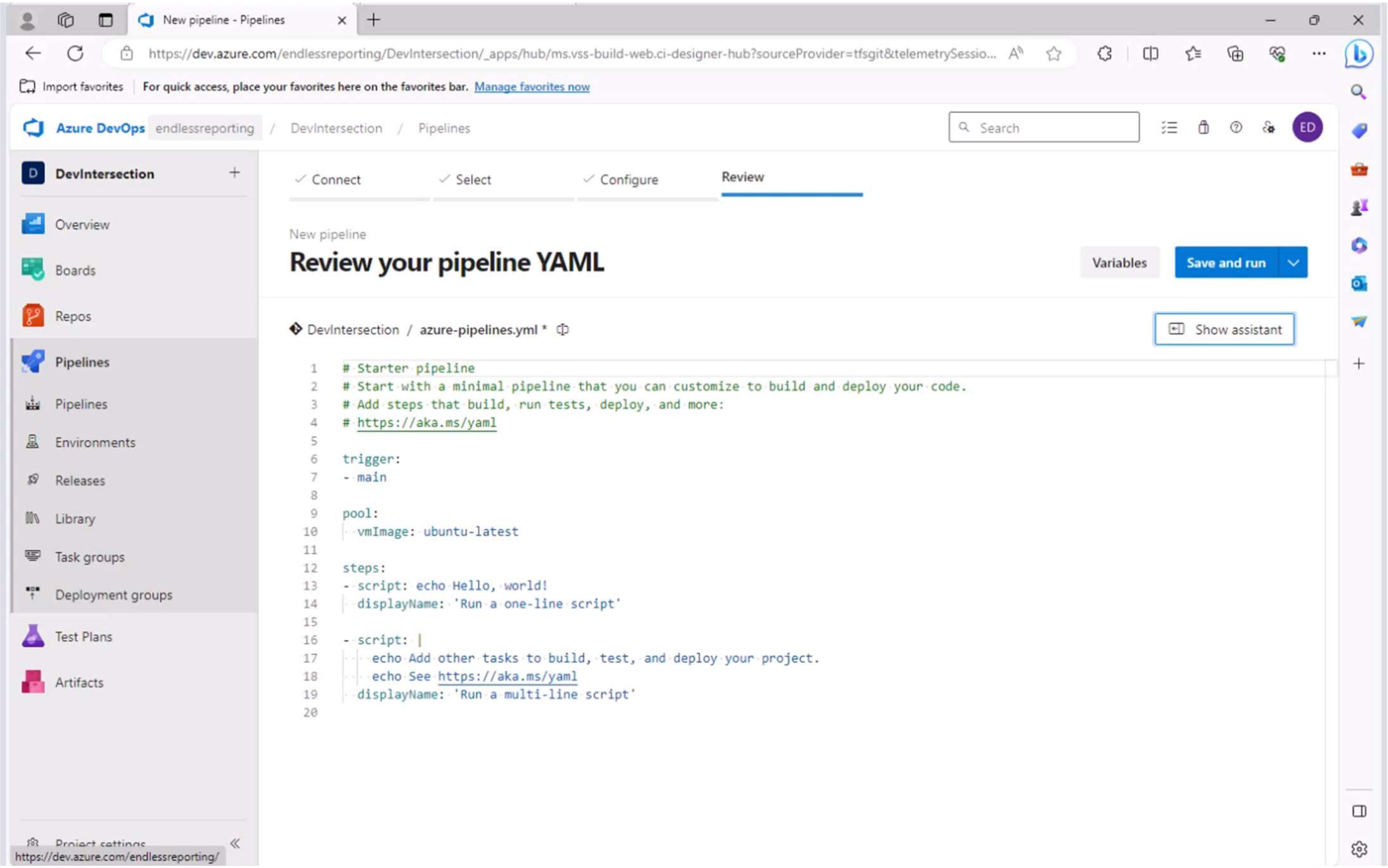
- Does the code build?

- Does it meet basic tests?

Fix it before it gets to QA!

Build Validation Demo

Stopping a BAD change set early

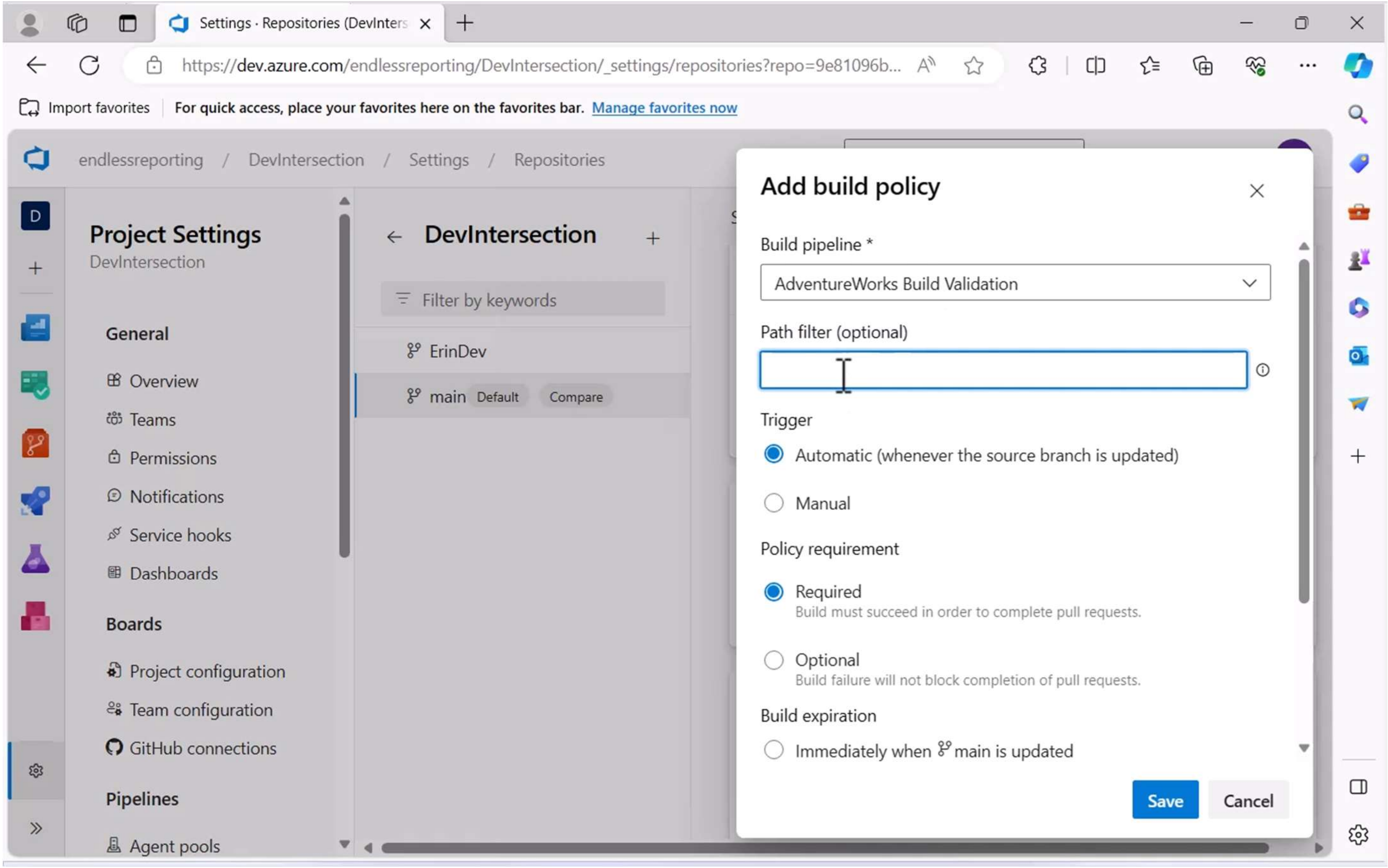


New pipeline

Review your pipeline YAML

DevIntersection / azure-pipelines.yml *

```yaml
# Starter pipeline
# Start with a minimal pipeline that you can customize to build and deploy your code.
# Add steps that build, run tests, deploy, and more:
# https://aka.ms/yaml

trigger:
- main

pool:
  vmImage: ubuntu-latest

steps:
- script: echo Hello, world!
  displayName: 'Run a one-line script'

- script: |
    echo Add other tasks to build, test, and deploy your project.
    echo See https://aka.ms/yaml
  displayName: 'Run a multi-line script'

```



Settings · Repositories (DevInters
https://dev.azure.com/endlessreporting/DevIntersection/_settings/repositories?repo=9e81096b...
Import favorites
For quick access, place your favorites here on the favorites bar. Manage favorites now
endlessreporting / DevIntersection / Settings / Repositories
D
Project Settings
DevIntersection
General
Overview
Teams
Permissions
Notifications
Service hooks
Dashboards
Boards
Project configuration
Team configuration
GitHub connections
Pipelines
Agent pools
DevIntersection
Filter by keywords
ErinDev
main Default Compare

Add build policy

Build pipeline *

AdventureWorks Build Validation

Path filter (optional)

Trigger

● Automatic (whenever the source branch is updated)

○ Manual

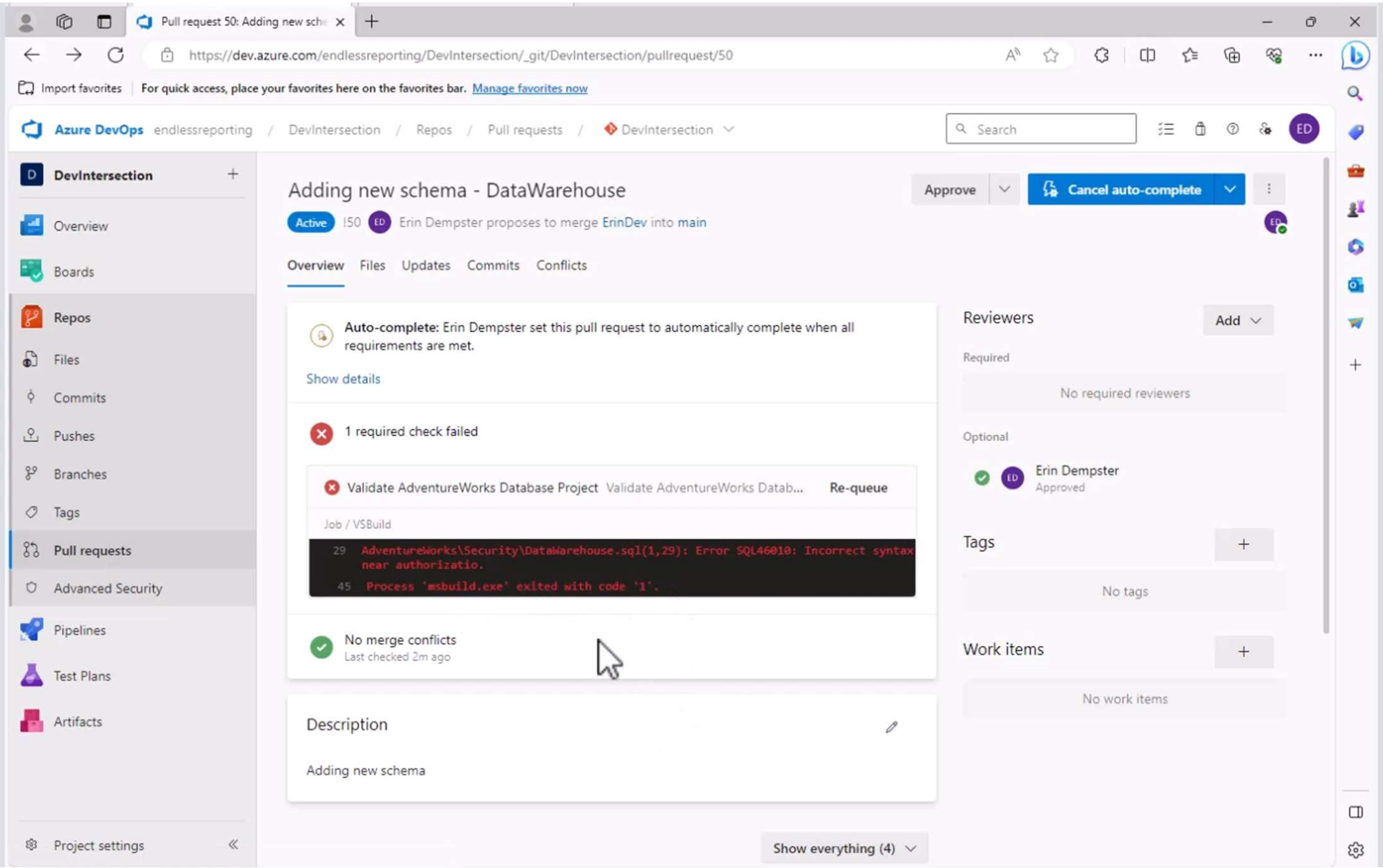
Policy requirement

● Required
Build must succeed in order to complete pull requests.

○ Optional
Build failure will not block completion of pull requests.

Build expiration

○ Immediately when main is updated


Pull request 50: Adding new sche
https://dev.azure.com/endlessreporting/DevIntersection/_git/DevIntersection/pullrequest/50
Import favorites
For quick access, place your favorites here on the favorites bar. Manage favorites now
Azure DevOps
endlessreporting / DevIntersection / Repos / Pull requests / DevIntersection
Search
ED
DevIntersection
Overview
Boards
Repos
Files
Commits
Pushes
Branches
Tags
Pull requests
Advanced Security
Pipelines
Test Plans
Artifacts
Project settings
Approve
Cancel auto-complete
Overview
Files
Updates
Commits
Conflicts
Show everything (4)

Adding new schema - DataWarehouse

Active !50 ED Erin Dempster proposes to merge ErinDev into main

Auto-complete: Erin Dempster set this pull request to automatically complete when all requirements are met.

Show details

1 required check failed

Validate AdventureWorks Database Project Validate AdventureWorks Datab... Re-queue

Job / VSBuild

```
29  AdventureWorks\Security\DataWarehouse.sql(1,29): Error SQL46010: Incorrect syntax
    near authorizatio.
45   Process 'msbuild.exe' exited with code '1'.
```

No merge conflicts
Last checked 2m ago

Description

Adding new schema

Reviewers

Add

Required

No required reviewers

Optional

Erin Dempster
Approved

Tags

No tags

Work items

No work items

Wrap-up

- Power Duo – Visual Studio and Azure DevOps
- Manage Database Schema Alongside Application Code
- Build and deploy changes
  - Consistently
  - Little effort

Event Evaluation

Fill out event evaluation card in your bag and visit all sponsors to be entered to win an Xbox Series X – (Must be present to win)

Questions???