DevOps Overview for Senior Managers

Wolfgang Ofner
Senior Cloud Architect

Agenda

Overview Azure DevOps

Demo Workflow

Automate Deployments

Overview GitHub

Wolfgang Ofner

Freelance Cloud Architect, Toronto, Canada

Focus on Azure, Kubernetes, and DevOps

programmingwithwolfgang.com

wolfgangofner

@programmingwithwolfgang

Organization Settings

ProgrammingWithWolfgang
New organization

ProgrammingWithWolfgang

+ New project

Projects | My work items | My pull requests

Filter projects

- M MicroserviceDemo
- P Presentation
- Y Youtube
- A AzureArcDemo

- A AzureArcDemo
- K K8sAdoAgent
- M MicroserviceDemo
- P Presentation
- W WindowsDeveloperArcDemo
- Y Youtube

What's new
Sprint 241
With this update, we improved the structure of personal access tokens to boost security.

Organization settings

Organization Settings

Manage global settings:

- Manage users and their licenses
- Configure billing
- Extensions
- Microsoft Entra
- Processes
- Global settings for repositories

Access Level

Basic

- Provides access to all features except Test Plans

Access Level

Basic

- Provides access to all features except Test Plans

Visual Studio Subscriber

- Same features as Basic
- “Free” license
- Visual Studio Enterprise allows for an additional parallel build

Access Level

Basic + Test Plans

- Same as Basic plus Test Plans

Access Level

Basic + Test Plans

- Same as Basic plus Test Plans

Stakeholder

- Unlimited free users
- Limited features including no repository or pipeline access

Billing

Microsoft hosted agents have 1800 minutes / month includes for free

Microsoft hosted agents allow 1 parallel job for free

5 Basic licenses are included for free

Billing

Billing needs an Azure subscription

- More than 5 Basic licenses
- Additional build minutes
- Additional parallel jobs

Extensions

Free and paid extensions

Bring additional features to ADO

- Time tracking
- Pipeline tasks
- Integration with other tools, e.g. Jira

Microsoft Entra

Microsoft Entra, formerly Azure Active Directory
Used for user and billing management

Process

Manage existing project processes

- Scrum
- Agile
- CMMI
- Basic

Process

“Create inherited process” based on an existing process

- Change existing items and workflows
- Create new items and workflows

Agent Pools

Collection of (pipeline) agents

- Manage groups of agents instead of individual ones
- Group agents based on capabilities → operating system, installed software
- Overview of all executed jobs

Agent Pools

Microsoft offers one agent in the Azure Pipelines pool for free

Microsoft-hosted agents vs. Self-hosted agents

Parallel Jobs

Overview of available jobs

Purchase additional jobs

- Microsoft-hosted agent: 40 USD / month
- Self-hosted agent: 15 USD / month

Project Settings

Permissions

Configure permissions for users or groups (groups are preferred)

- Allow
- Deny
- Not set (has a deny effect)

Permissions

Permissions can be inherited

Direct permissions win over inherited ones

Service Hooks

Integrate third party tools with ADO

- Teams
- Slack
- Azure Service Bus
- Datadog
- Grafana

Service Hooks

Supported events

- Work item update
- Code pushed
- Build complete
- Release deployed

Project Configuration

Configure settings for the project

- Create and configure iterations
- Create and manage areas of the project

Team Configuration

Configure settings for individual teams

- Team settings such as backlog, workdays and bug handling
- Manage iterations
- Manage areas
- Create templates for work items

Service Connections

Configure connection to third party tools

- Azure
- DockerHub
- GitHub
- Jira
- NuGet
- Npm

Project Menu Items

Overview

Summary

- Provides project description
- Readme file or Wiki

Overview

Dashboard

- Create dashboards
- Pipeline status, work item count, burndown chart, etc.

Overview

Wiki

- Document where the code resides
- Link work items and code commits
- Uses Git in the background
- Markdown

Boards

Manage work items with different boards

- Boards
- Backlog
- Sprints
- Queries
- Delivery Plans

Boards

Plan team capacity per sprint

Burndown chart for sprints

Boards

Create custom queries

- Work items where status change > 180 days
- All closed work items in a timeframe
- Work items approved by team member XYZ

Boards

Delivery plans

- Visualize milestones and delivery plan over all teams
- Update iterations
- Used by Product Owner / Release Manager

Azure DevOps Features and Stories

Azure DevOps team all up

Settings

Repos

Overview of everything Git related

- Files
- Commits
- Branches
- Tags
- Pull Requests

Repos

Advanced Security (GitHub Advanced Security for Azure DevOps)

- Comprehensive security suite
- Secret scanning
- Dependency scanning
- Static code scanning
- 49$ per month per active committer → too expensive

Pipelines

Pipelines

- YAML pipelines
- Used for build and deployments tasks
- File is stored in Git repo

Pipelines

Environments

- Can be created in a pipeline or portal
- Overview of when and what was deployed to a specific environment
- Configure approvals and checks before deployment is executed

Pipelines

Outdated features

- Releases
- Task groups
- Deployment groups

Pipelines

Library

- Create variable groups which can be shared across multiple pipelines
- Securely store sensitive files such as certificates
- However, using Azure Key Vault is the recommended way

Test Plans

Needs additional license

Used for manual testing and exploratory testing

- Test cases can be linked to work items
- Specify test configuration, e.g. operating system, browser, etc.
- Tester can add screenshots or screen recordings

Artifacts

Create private feeds for packages

- NuGet
- Npm
- Maven
- Pip

Git

Git

Distributed version control

Commit changes with a message

Creates a history of all commits

Git

Commits are made to a branch

Branches are individual work areas

Use .gitignore file to exclude files or extensions

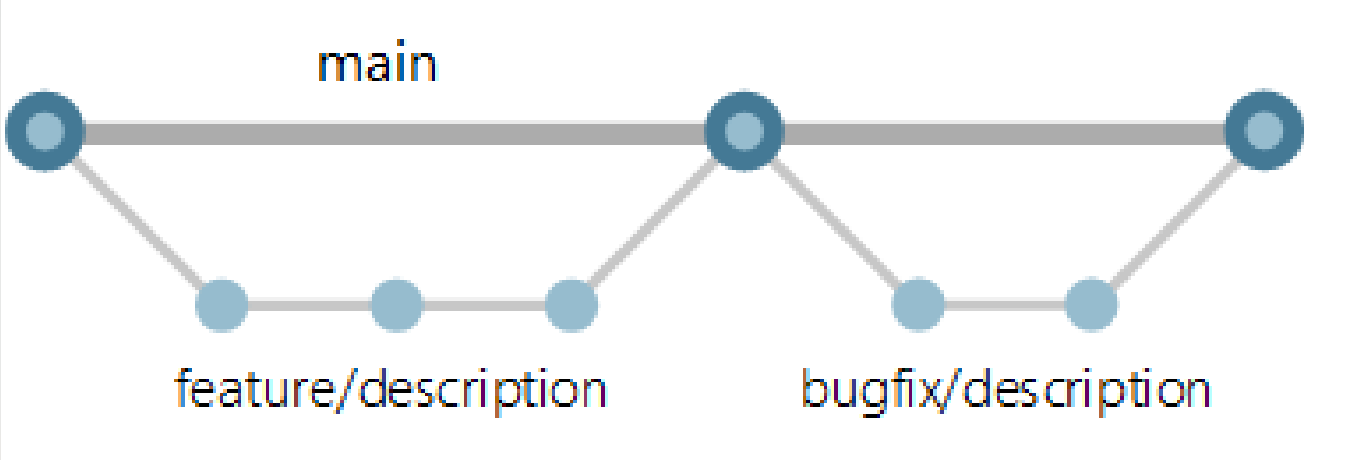
Git Branches

Main branch should only contain tested / deployable code

Developers work with “feature” branches

Once a feature is completed, feature branch will be merged into main branch

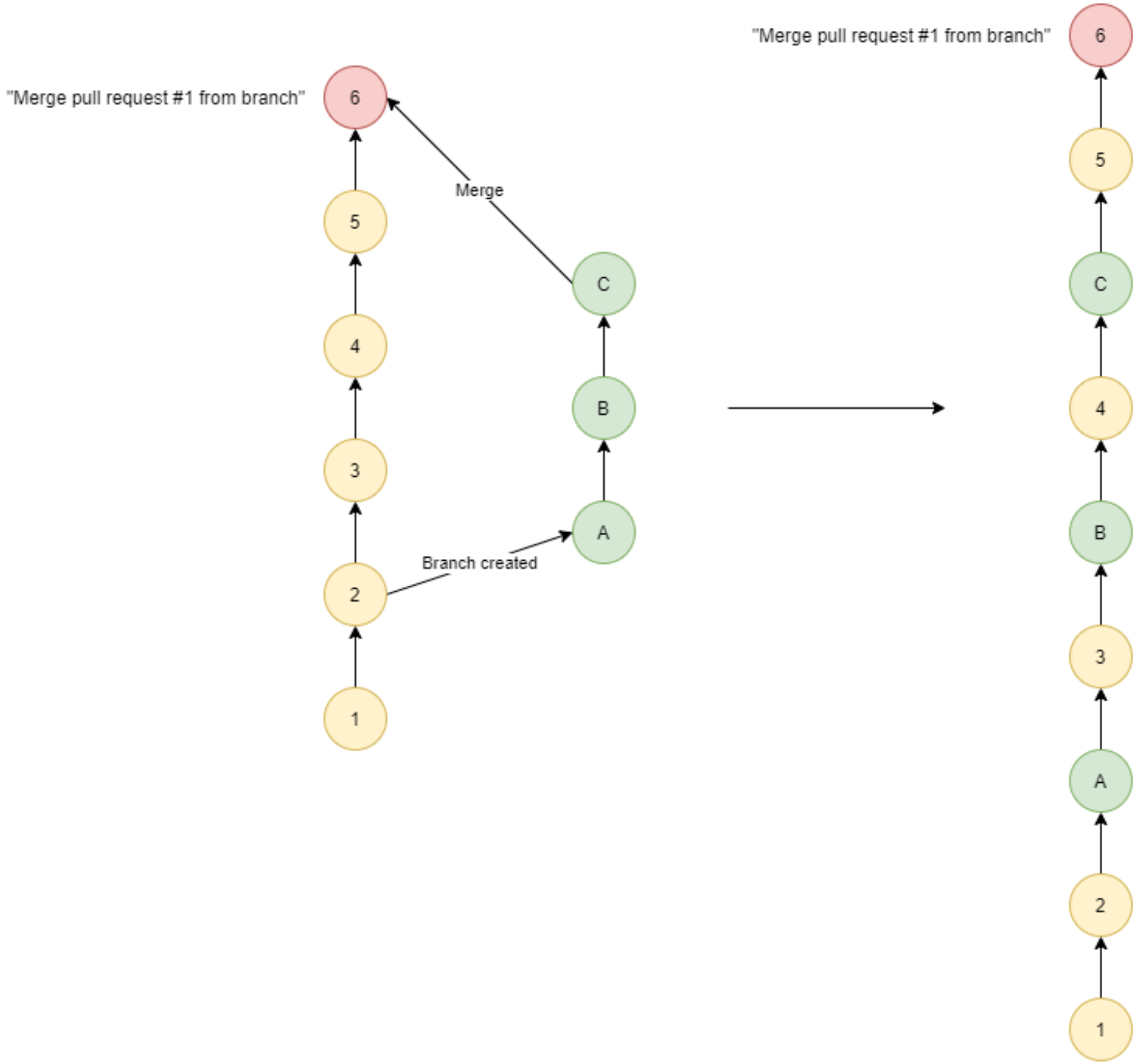
Git Branches



Git Branches

Various merge strategies are available

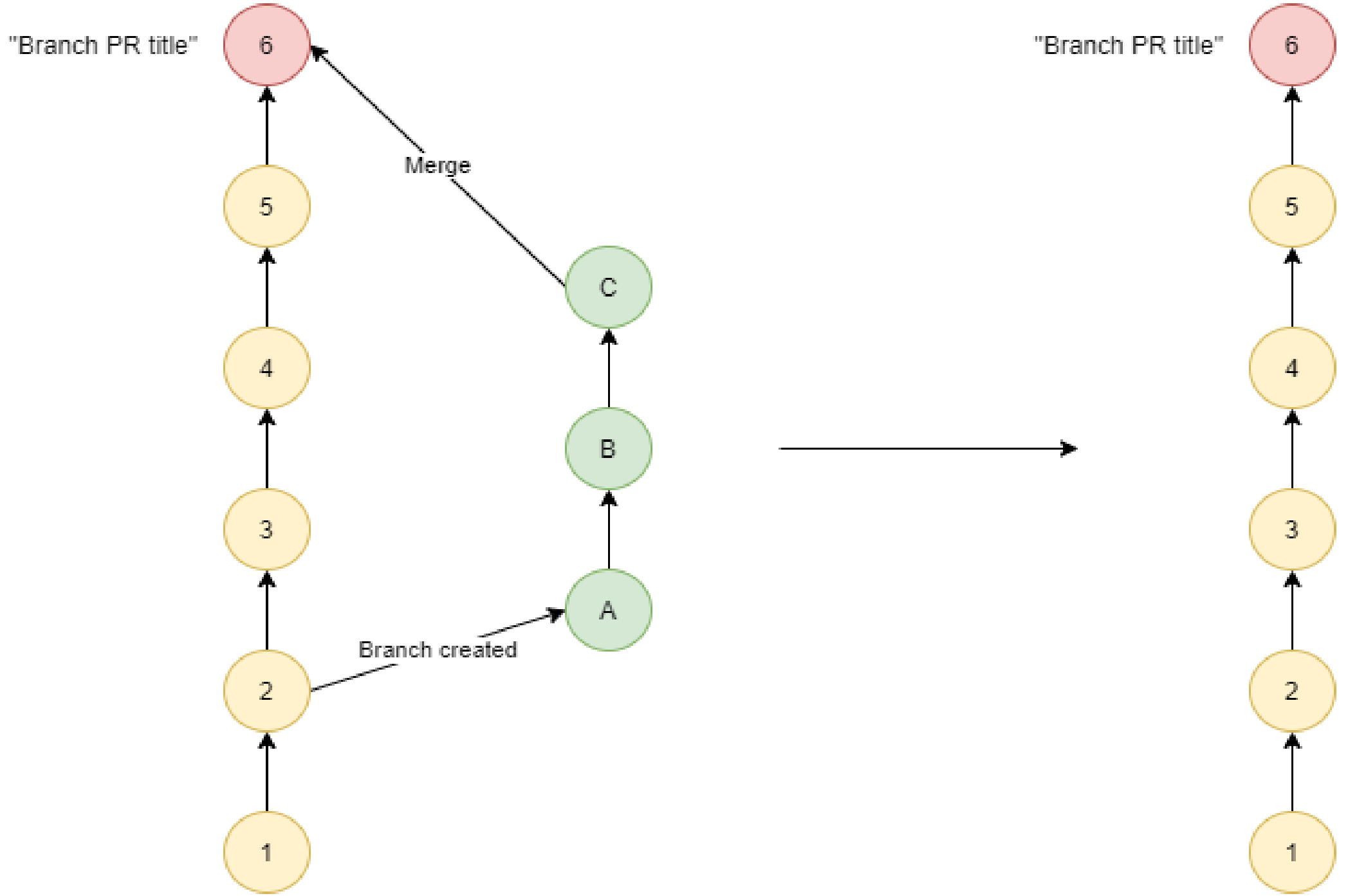
- Basic Merge


"Merge pull request #1 from branch"
6
5
4
3
2
1
Merge
C
B
A
Branch created
"Merge pull request #1 from branch"
6
5
C
4
B
3
A
2
1

Git Branches

Various merge strategies are available

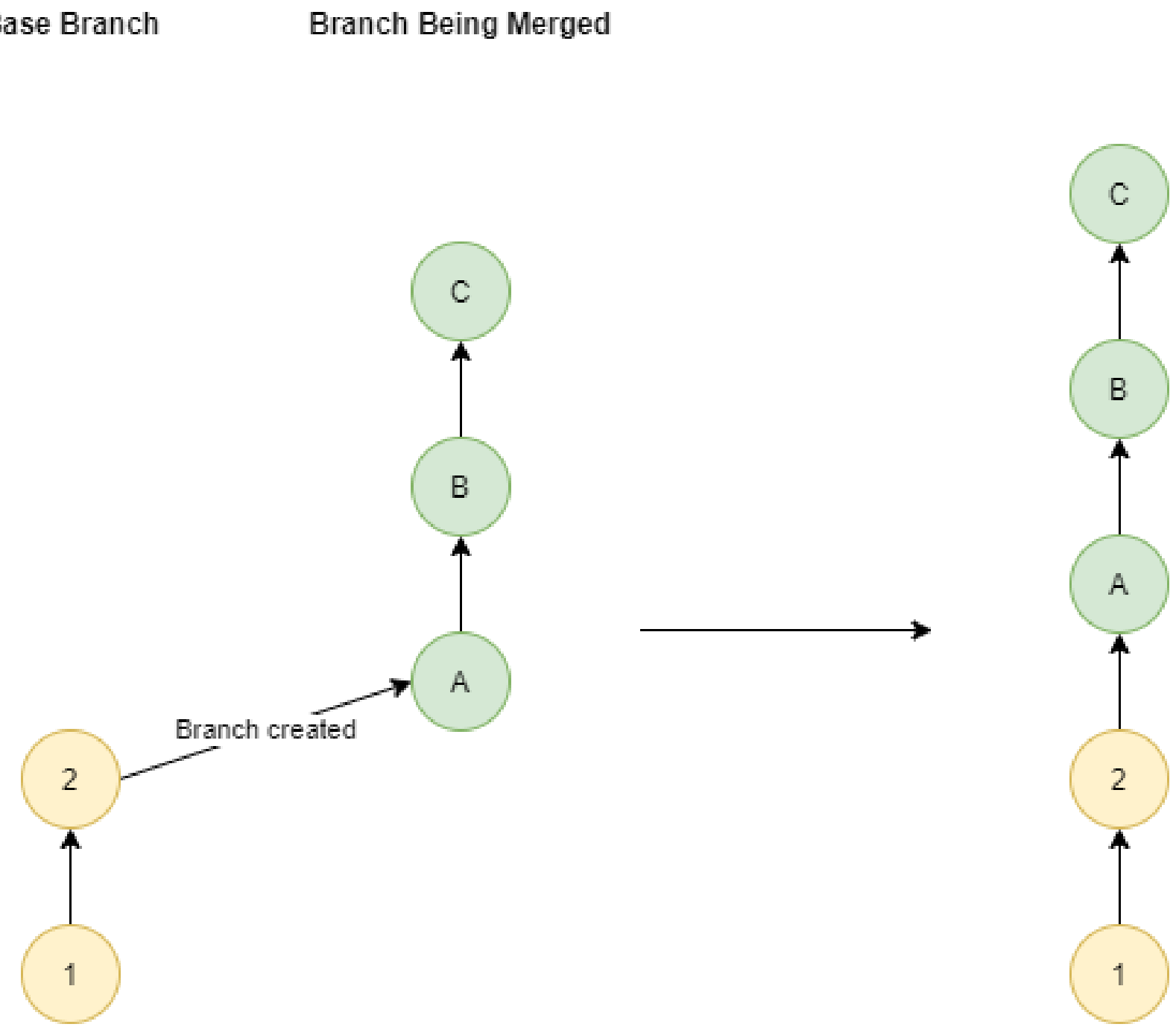
- Basic Merge
- Squash Merge


"Branch PR title"
6
5
4
3
2
1
Merge
C
B
A
Branch created
"Branch PR title"
6
5
4
3
2
1

Git Branches

Various merge strategies are available

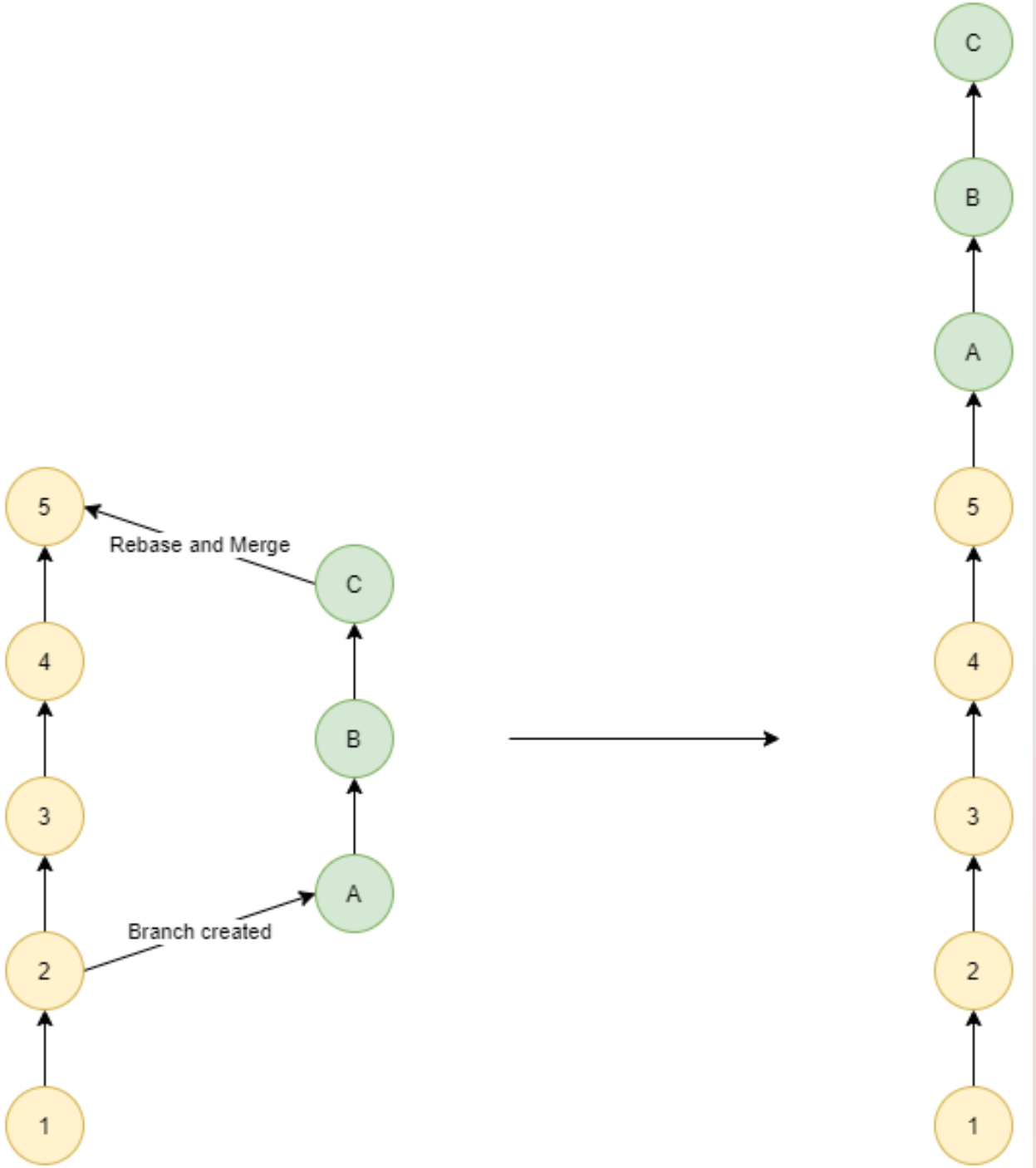
- Basic Merge
- Squash Merge
- Fast-Forward Merge


Base Branch
Branch Being Merged
C
B
A
Branch created
2
1
C
B
A
2
1

Git Branches

Various merge strategies are available

- Basic Merge
- Squash Merge
- Fast-Forward Merge
- Rebase


5
Rebase and Merge
C
4
B
3
A
Branch created
2
1
C
B
A
5
4
3
2
1

Merge Conflicts

Git tries to determine the correct version if multiple developers change the same file

If Git can’t figure it out → merge conflict and developers have to manually resolve it

Merge Conflicts

Pull destination branch and merge it locally to resolve the conflict

Use short-lived branches and merge often

Demo Project

Presentation
Overview
Boards
Repos
Files
Commits
Pushes
Branches
Tags
Pull requests
Advanced Security
Pipelines
Test Plans
Artifacts

Presentation is empty. Add some code!

Clone to your computer

HTTPS SSH https://ProgrammingWithWolfgang@dev.azure.com/ProgrammingW OR Clone in VS Code

Generate Git Credentials

Having problems authenticating in Git? Be sure to get the latest version Git for Windows or our plugins for IntelliJ, Eclipse, Android Studio or Windows command line.

Push an existing repository from command line

HTTPS SSH

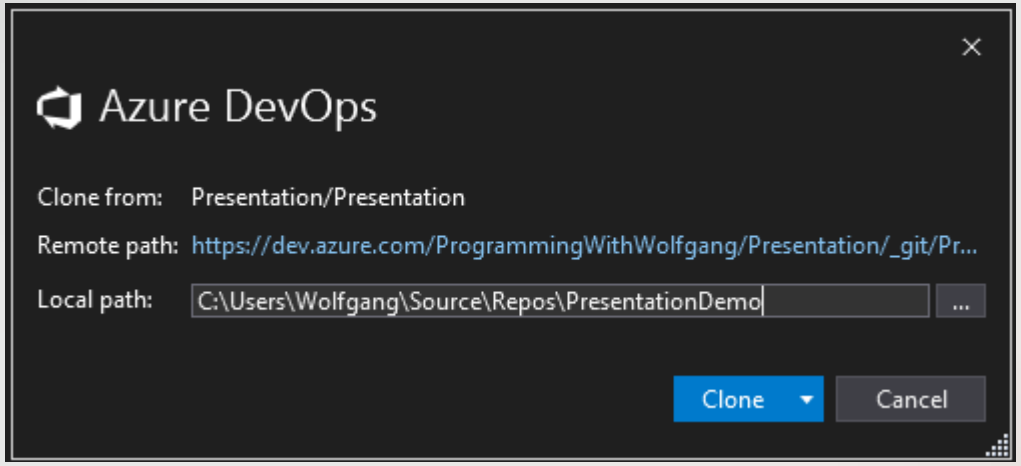
```
git remote add origin
https://ProgrammingWithWolfgang@dev.azure.com/ProgrammingWithWolfgang/Pre
```

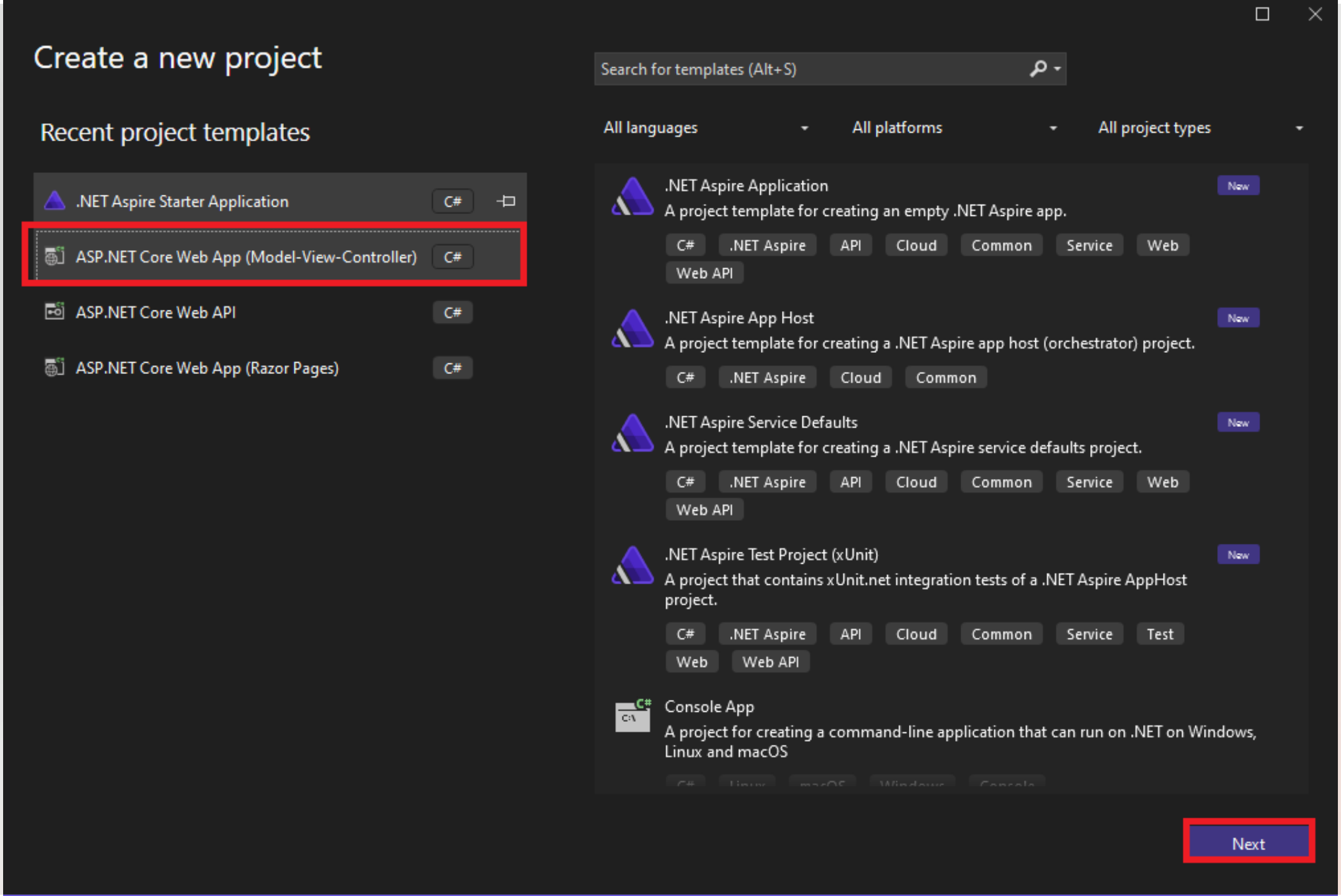
Import a repository

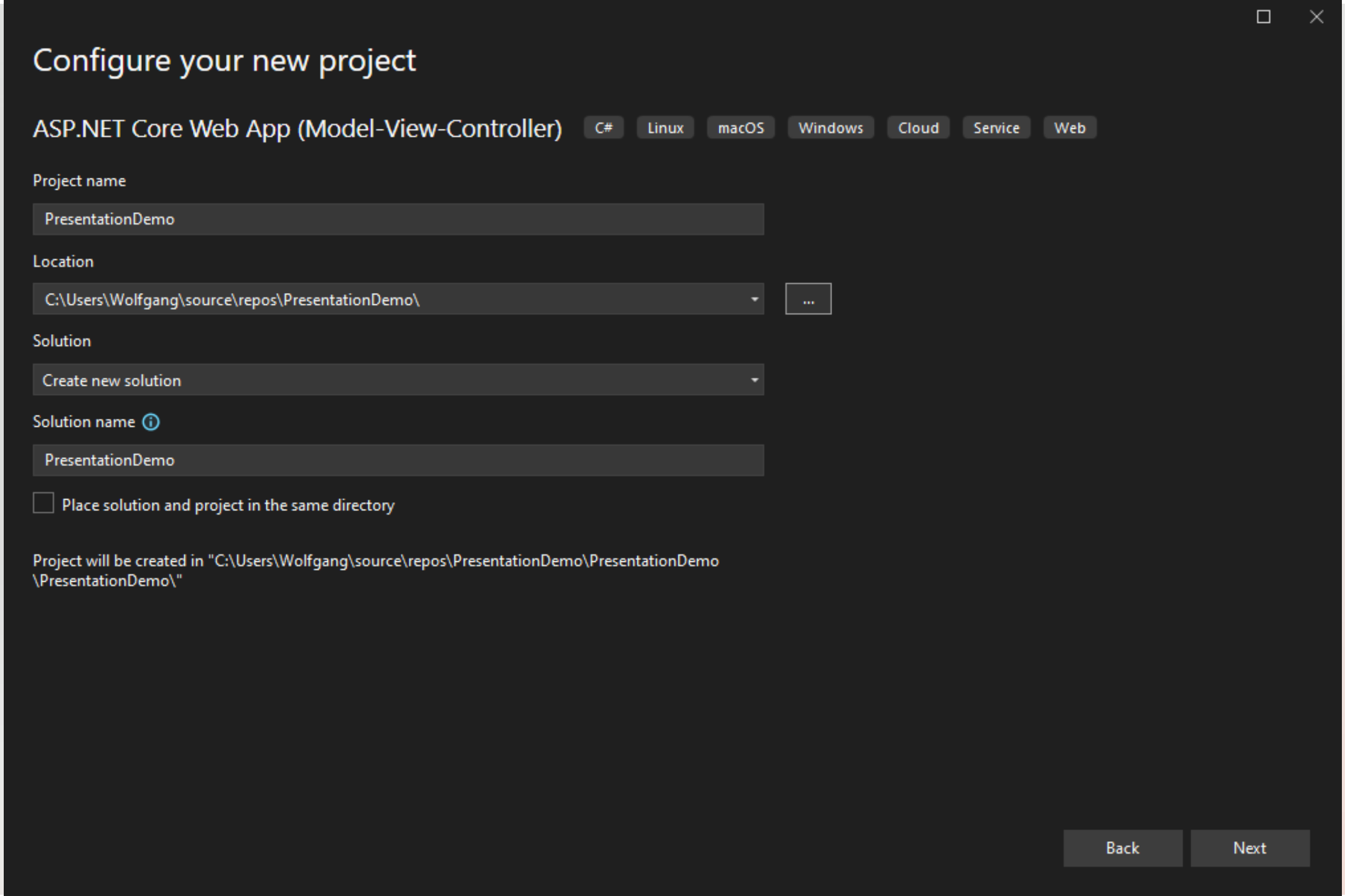
Import

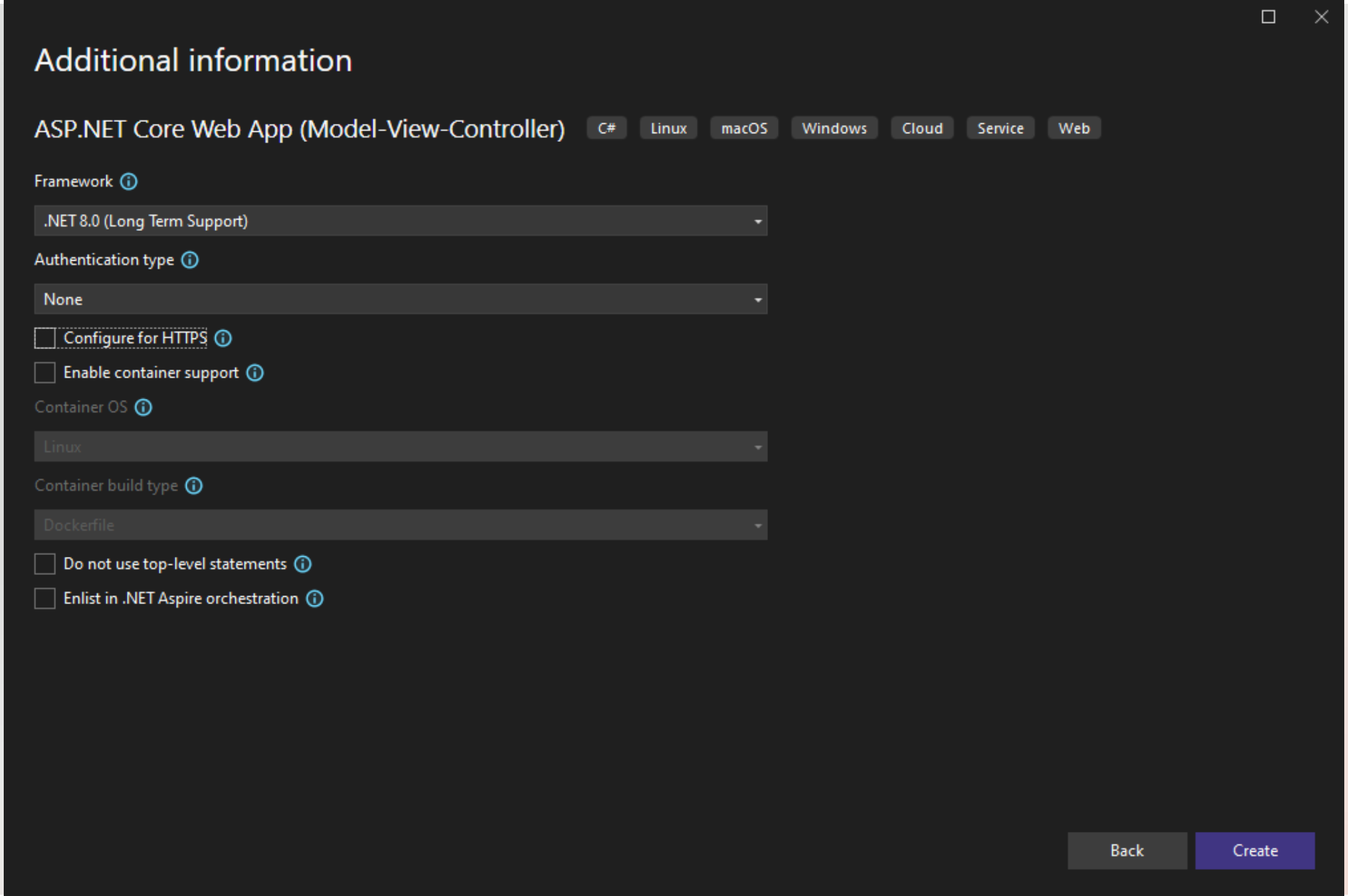
Initialize master branch with a README or gitignore

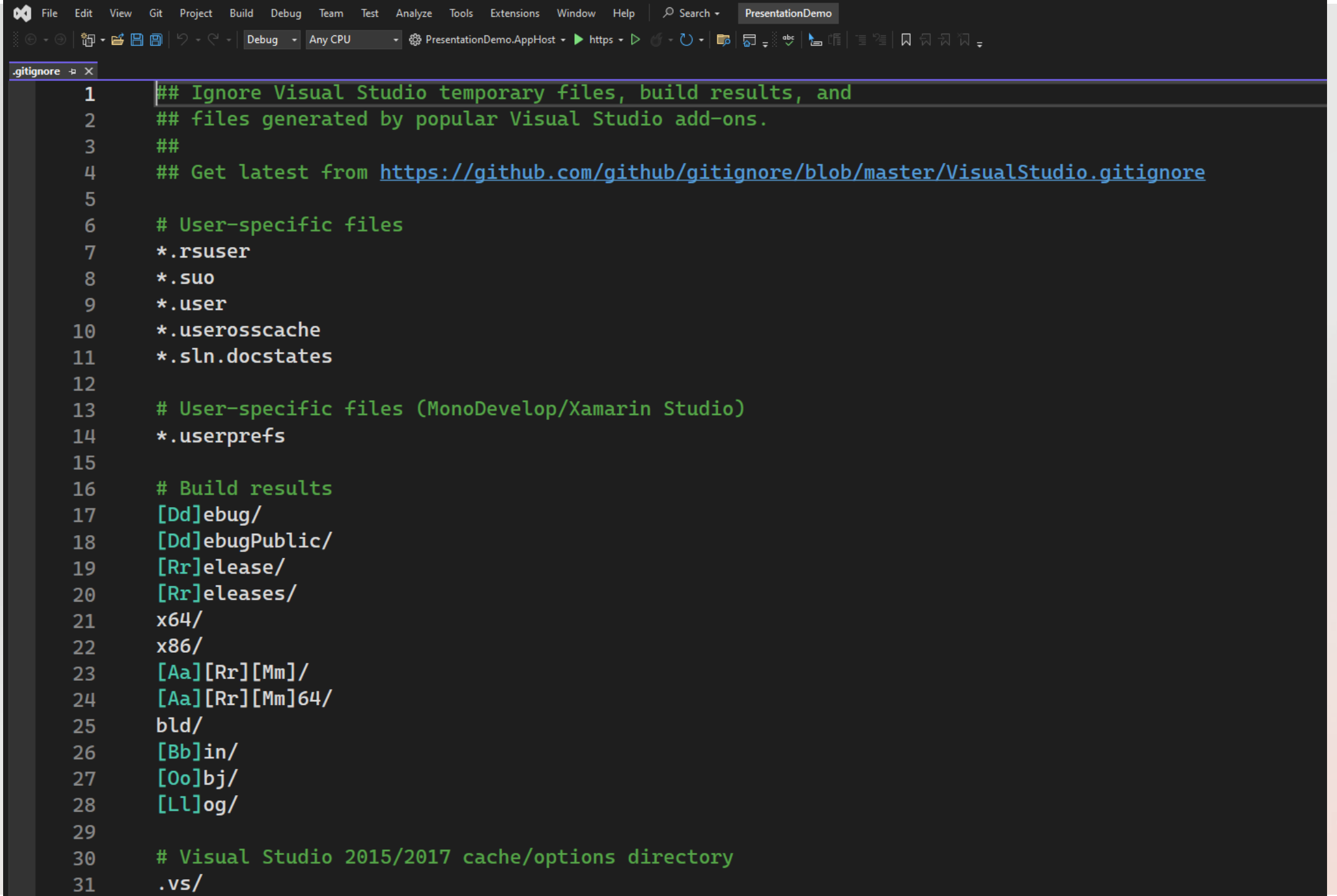
Add a README Add a .gitignore: None Initialize

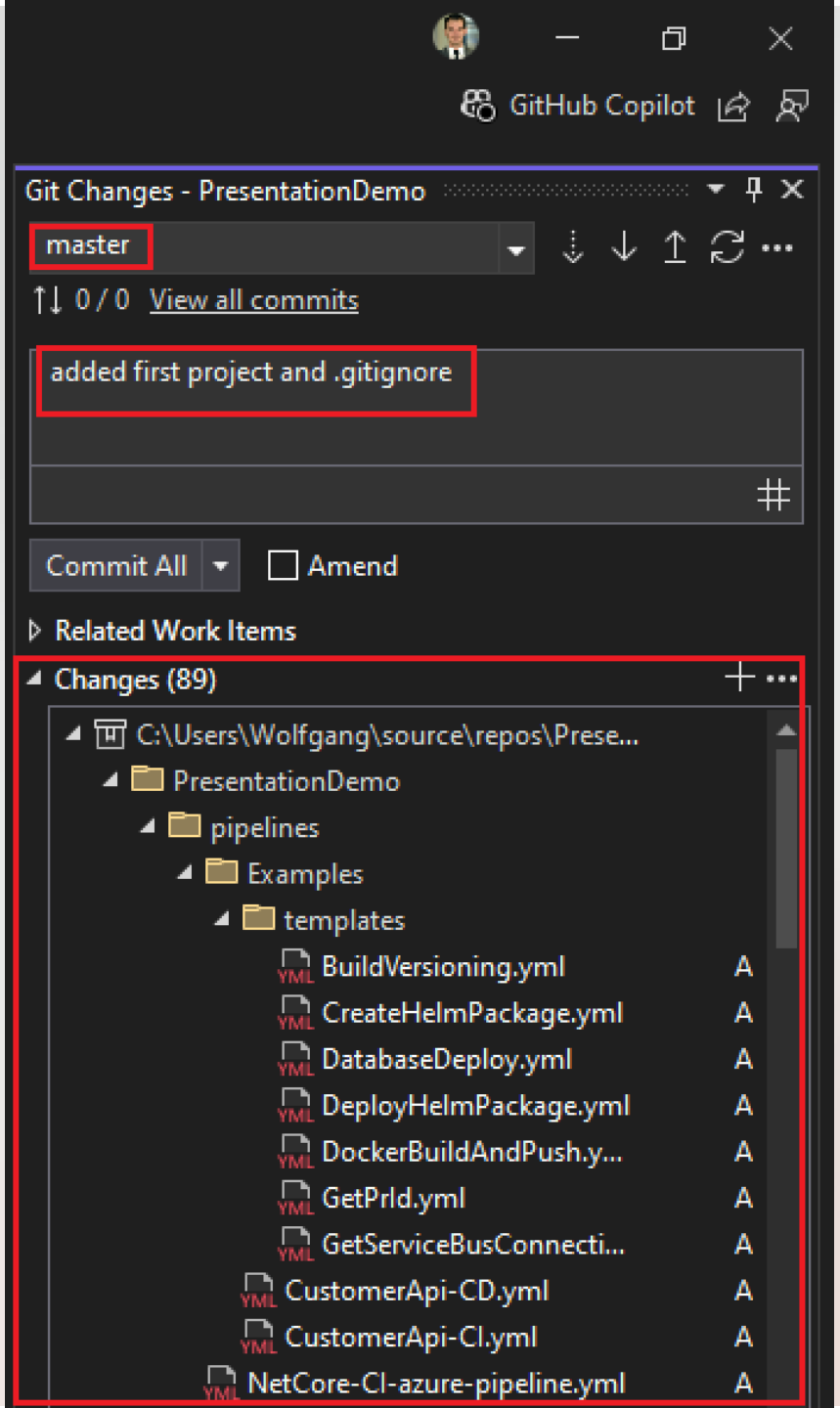

Azure DevOps
Clone from: Presentation/Presentation
Remote path: https://dev.azure.com/ProgrammingWithWolfgang/Presentation/_git/Pr...
Local path: C:\Users\Wolfgang\Source\Repos\PresentationDemo
...
Clone
Cancel

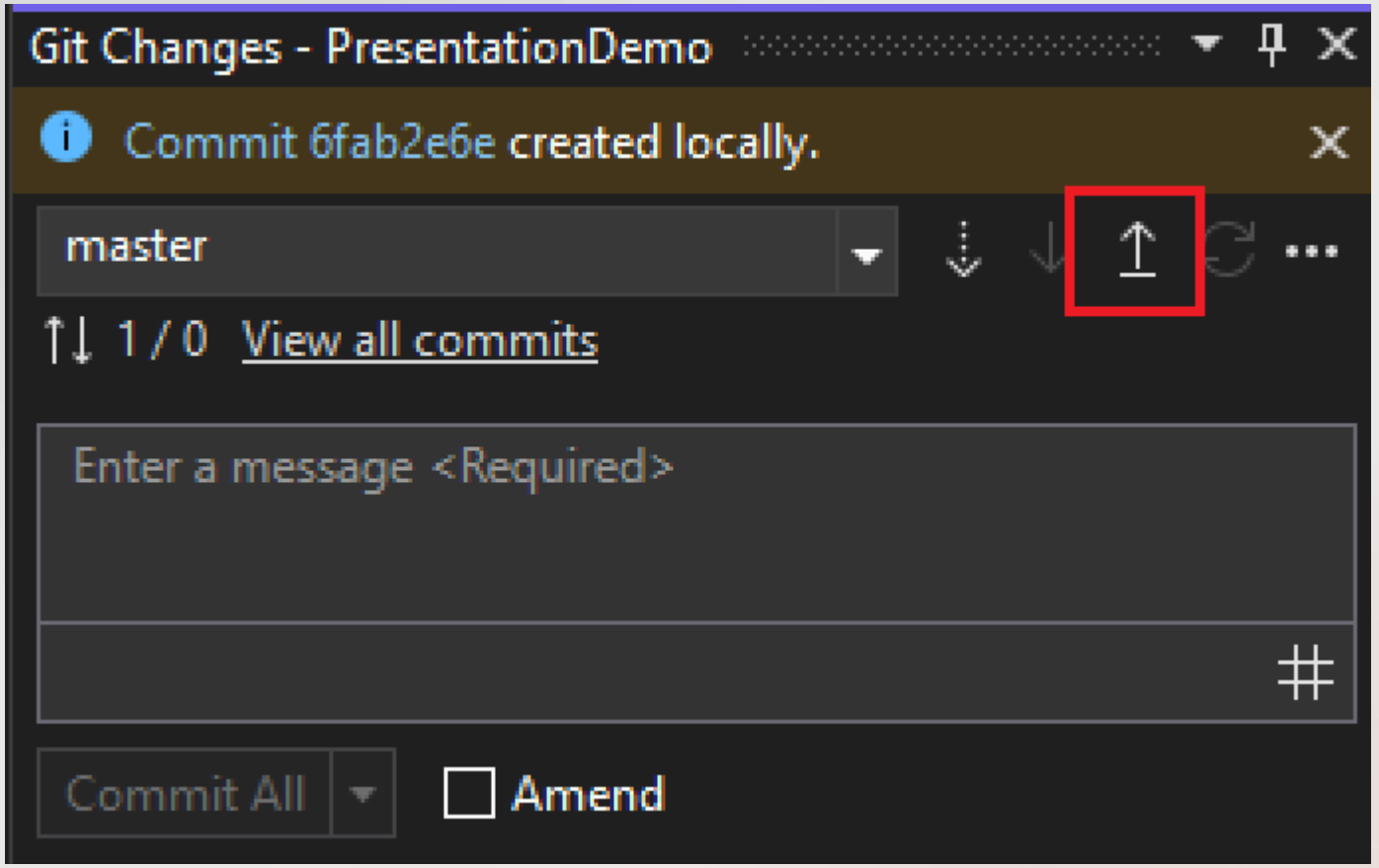

Create a new project
Search for templates (Alt+S)
Recent project templates
All languages
All platforms
All project types
.NET Aspire Starter Application
C#
ASP.NET Core Web App (Model-View-Controller)
C#
ASP.NET Core Web API
C#
ASP.NET Core Web App (Razor Pages)
C#
.NET Aspire Application
New
A project template for creating an empty .NET Aspire app.
C# .NET Aspire API Cloud Common Service Web Web API
.NET Aspire App Host
New
A project template for creating a .NET Aspire app host (orchestrator) project.
C# .NET Aspire Cloud Common
.NET Aspire Service Defaults
New
A project template for creating a .NET Aspire service defaults project.
C# .NET Aspire API Cloud Common Service Web Web API
.NET Aspire Test Project (xUnit)
New
A project that contains xUnit.net integration tests of a .NET Aspire AppHost project.
C# .NET Aspire API Cloud Common Service Test Web Web API
Console App
A project for creating a command-line application that can run on .NET on Windows, Linux and macOS
Next


Configure your new project
ASP.NET Core Web App (Model-View-Controller)
C#
Linux
macOS
Windows
Cloud
Service
Web
Project name
PresentationDemo
Location
C:\Users\Wolfgang\source\repos\PresentationDemo\
...
Solution
Create new solution
Solution name
PresentationDemo
Place solution and project in the same directory
Project will be created in "C:\Users\Wolfgang\source\repos\PresentationDemo\PresentationDemo\PresentationDemo\"
Back
Next


Additional information
ASP.NET Core Web App (Model-View-Controller)
C#
Linux
macOS
Windows
Cloud
Service
Web
Framework
.NET 8.0 (Long Term Support)
Authentication type
None
Configure for HTTPS
Enable container support
Container OS
Linux
Container build type
Dockerfile
Do not use top-level statements
Enlist in .NET Aspire orchestration
Back
Create


File Edit View Git Project Build Debug Team Test Analyze Tools Extensions Window Help
Search
PresentationDemo
Debug
Any CPU
PresentationDemo.AppHost
https
.gitignore
Ignore Visual Studio temporary files, build results, and
files generated by popular Visual Studio add-ons.
##
Get latest from https://github.com/github/gitignore/blob/master/VisualStudio.gitignore
User-specific files
*.rsuser
*.suo
*.user
*.userosscache
*.sln.docstates
User-specific files (MonoDevelop/Xamarin Studio)
*.userprefs
Build results
[Dd]ebug/
[Dd]ebugPublic/
[Rr]elease/
[Rr]eleases/
x64/
x86/
[Aa][Rr][Mm]/
[Aa][Rr][Mm]64/
bld/
[Bb]in/
[Oo]bj/
[Ll]og/
Visual Studio 2015/2017 cache/options directory
.vs/


GitHub Copilot
Git Changes - PresentationDemo
master
0 / 0
View all commits
added first project and .gitignore
Commit All
Amend
Related Work Items
Changes (89)
C:\Users\Wolfgang\source\repos\Prese...
PresentationDemo
pipelines
Examples
templates
BuildVersioning.yml A
CreateHelmPackage.yml A
DatabaseDeploy.yml A
DeployHelmPackage.yml A
DockerBuildAndPush.y... A
GetPrId.yml A
GetServiceBusConnecti... A
CustomerApi-CD.yml A
CustomerApi-CI.yml A
NetCore-CI-azure-pipeline.yml A


Git Changes - PresentationDemo
Commit 6fab2e6e created locally.
master
1 / 0
View all commits
Enter a message <Required>
Commit All
Amend

Presentation

Overview

Boards

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PresentationDemo

.gitignore

master / Type to find a file or folder...

Files

Set up build | Clone

Contents | History

Name ↑	Last change	Commits
PresentationDemo	5m ago	6fab2e6e added first project and .gitignore Wolfga...
.gitignore	5m ago	6fab2e6e added first project and .gitignore Wolfga...

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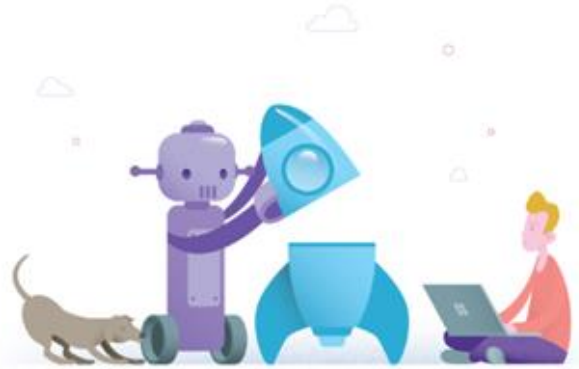
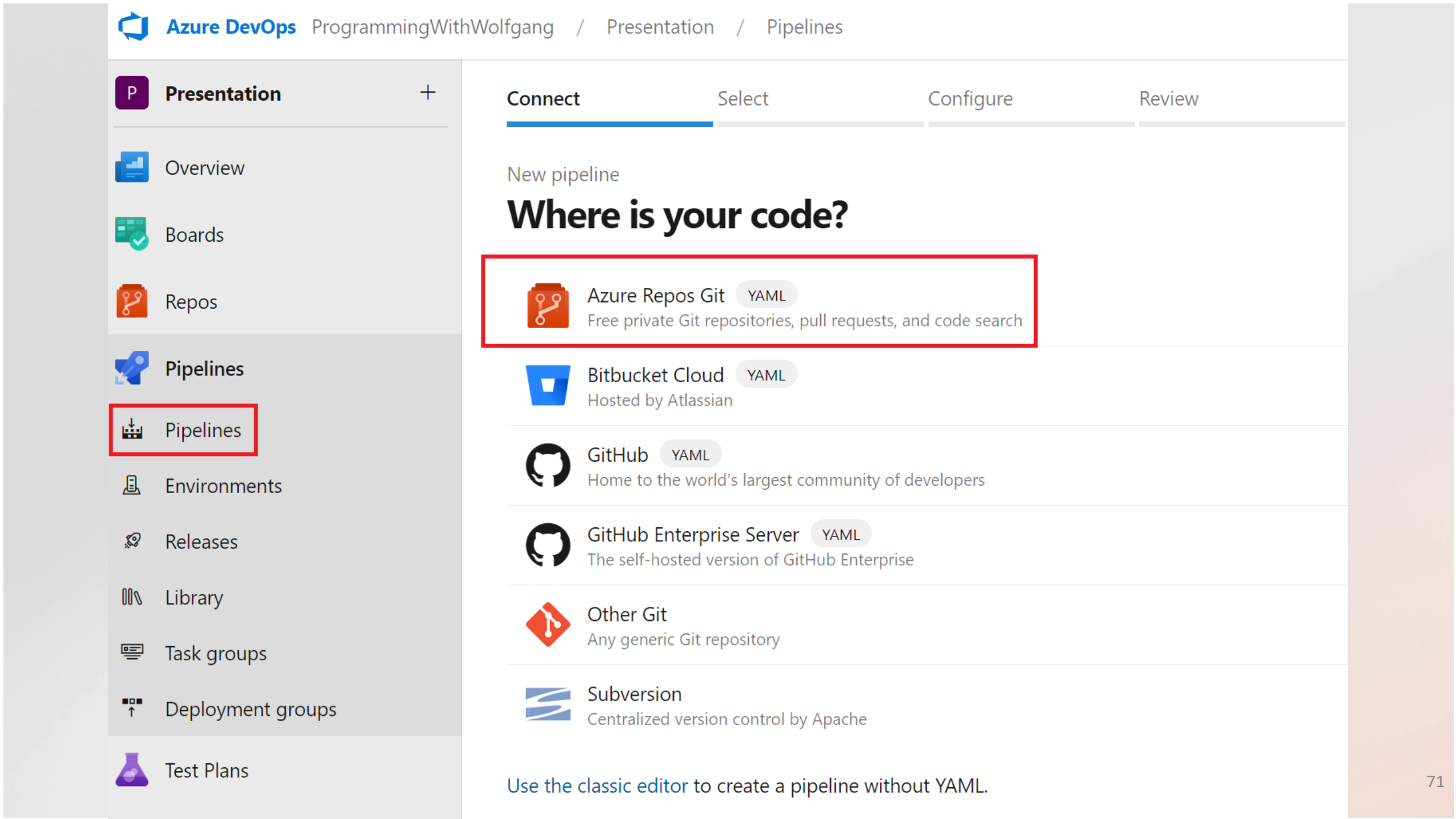


Create your first Pipeline

Automate your build and release processes using our wizard, and go from code to cloud-hosted within minutes.

Create Pipeline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New pipeline
Where is your code?
Azure Repos Git YAML
Free private Git repositories, pull requests, and code search
Bitbucket Cloud YAML
Hosted by Atlassian
GitHub YAML
Home to the world's largest community of developers
GitHub Enterprise Server YAML
The self-hosted version of GitHub Enterprise
Other Git
Any generic Git repository
Subversion
Centralized version control by Apache
Use the classic editor to create a pipeline without YAML.

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✓ Connect | Select | Configure | Review

New pipeline

Select a repository

Filter by keywords Presentation

Presentation

Presentation +

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Xamarin.iOS
Build a Xamarin.iOS project.

Starter pipeline
Start with a minimal pipeline that you can customize to build and deploy your code.

Existing Azure Pipelines YAML file
Select an Azure Pipelines YAML file in any branch of the repository.

.NET Core Function App to Windows on Azure
Build a .NET Core function app and deploy it to Azure as a Windows function App.

Android
Build your Android project with Gradle.

Ant
Build your Java projects and run tests with Apache Ant.

ASP.NET Core
Build and test ASP.NET Core projects targeting .NET Core.

C/C++ with GCC
Build your C/C++ project with GCC using make.

Deploy to Azure Kubernetes Service
Build and push image to Azure Container Registry; Deploy to Azure Kubernetes Service

Docker
Build a Docker image

Docker
Build and push an image to Azure Container Registry

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✓ Connect ✓ Select ✓ Configure Review

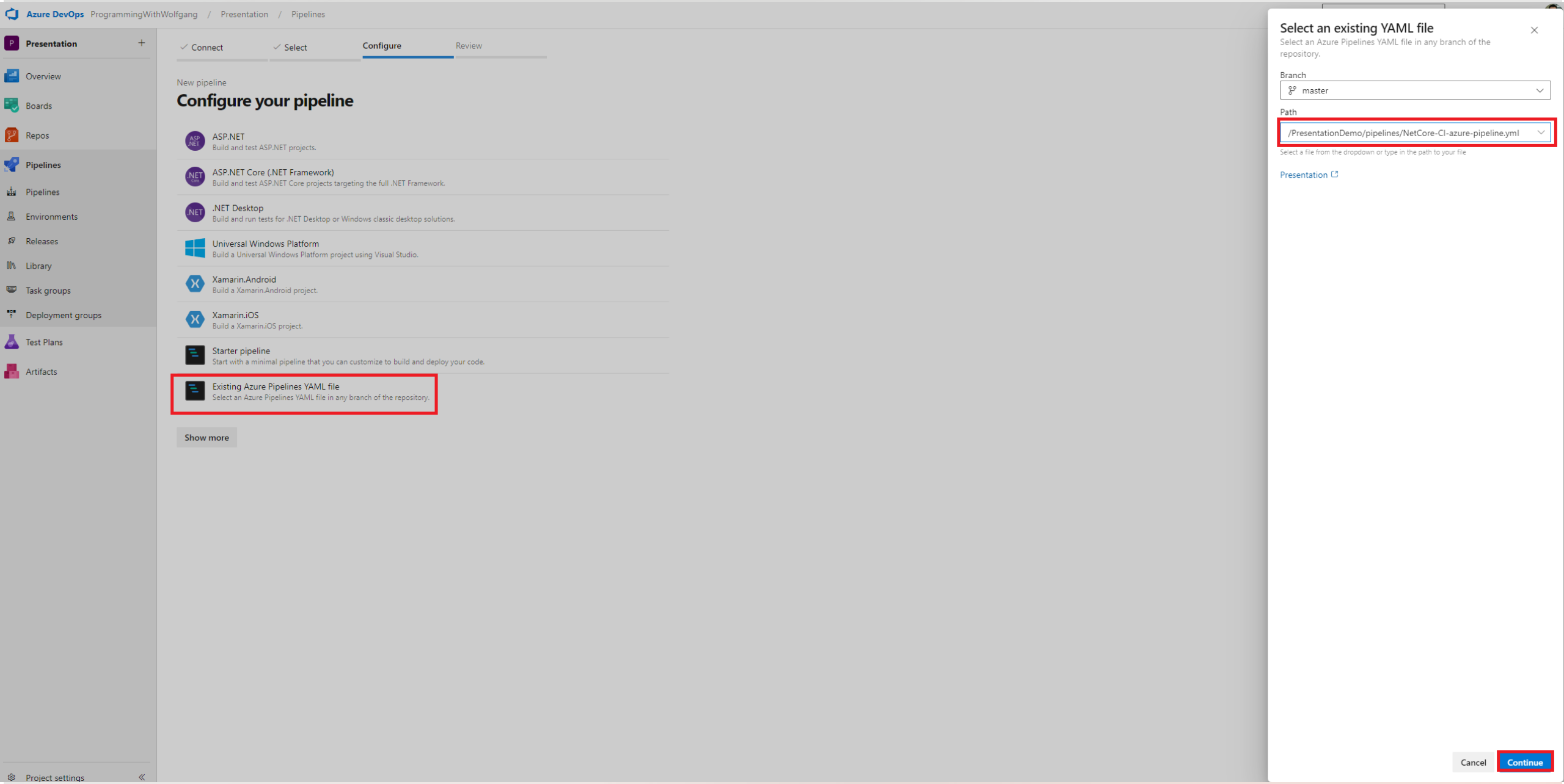
New pipeline

Review your pipeline YAML

Variables | Save and run

Presentation / azure-pipelines.yml * | Show assistant

```yaml
# ASP.NET Core
# Build and test ASP.NET Core projects targeting .NET Core.
# Add steps that run tests, create a NuGet package, deploy, and more:
# https://docs.microsoft.com/azure/devops/pipelines/languages/dotnet-core

trigger:
- master

pool:
  vmImage: ubuntu-latest

variables:
  buildConfiguration: 'Release'

steps:
- script: dotnet build --configuration $(buildConfiguration)
  displayName: 'dotnet build $(buildConfiguration)'

```


Azure DevOps ProgrammingWithWolfgang / Presentation / Pipelines
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✓ Select
Configure
Review
New pipeline
Configure your pipeline
ASP.NET
Build and test ASP.NET projects.
ASP.NET Core (.NET Framework)
Build and test ASP.NET Core projects targeting the full .NET Framework.
.NET Desktop
Build and run tests for .NET Desktop or Windows classic desktop solutions.
Universal Windows Platform
Build a Universal Windows Platform project using Visual Studio.
Xamarin.Android
Build a Xamarin.Android project.
Xamarin.iOS
Build a Xamarin.iOS project.
Starter pipeline
Start with a minimal pipeline that you can customize to build and deploy your code.
Existing Azure Pipelines YAML file
Select an Azure Pipelines YAML file in any branch of the repository.
Show more
Select an existing YAML file
Select an Azure Pipelines YAML file in any branch of the repository.
Branch
master
Path
/PresentationDemo/pipelines/NetCore-CI-azure-pipeline.yml
Select a file from the dropdown or type in the path to your file
Presentation
Cancel
Continue

✓ Connect ✓ Select ✓ Configure Review

New pipeline

Review your pipeline YAML

Variables Run

Presentation / PresentationDemo/pipelines/**NetCore-CI-azure-pipeline.yml**

Show assistant

```yaml
name : NetCore-PresentationDemo-CI
trigger: none

pool:
  vmImage: 'ubuntu-latest'

variables:
  buildConfiguration: 'Release'

steps:
Settings
- task: DotNetCoreCLI@2
  inputs:
    command: 'restore'
    projects: '**/PresentationDemo*.csproj'
  displayName: 'Restore Nuget Packages'

Settings
- task: DotNetCoreCLI@2
  inputs:
    command: 'build'
    projects: '**/PresentationDemo*.csproj'
    arguments: '--no-restore'
  displayName: 'Build projects'

Settings
- task: DotNetCoreCLI@2
  inputs:
    command: 'test'
    projects: '**/*Test.csproj'
    arguments: '--no-restore --no-build'
  displayName: 'Run Tests'

Settings
- task: DotNetCoreCLI@2
  inputs:
    command: 'publish'
    publishWebProjects: false
    projects: '**/PresentationDemo.csproj'
    arguments: '--configuration $(buildConfiguration) --no-restore'
    modifyOutputPath: false
  displayName: 'Publish PresentationDemo'
  condition: and(succeeded(), ne(variables['Build.Reason'], 'PullRequest'))
```

#NetCore-PresentationDemo-CI • added first project and .gitignore

Presentation

Cancel

Summary | Code Coverage

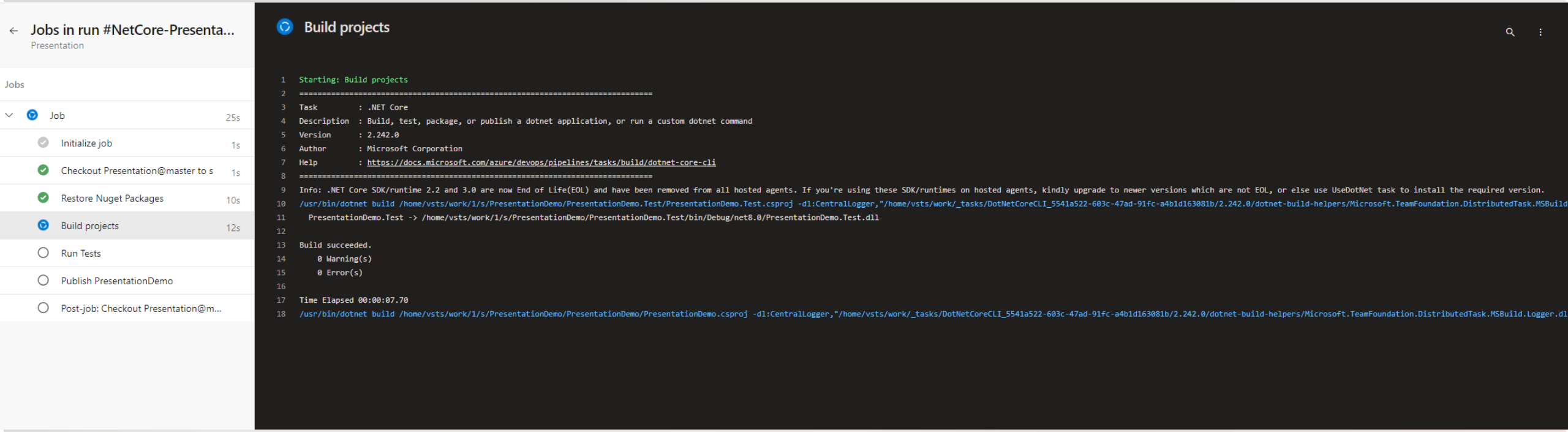
Manually run by Wolfgang Ofner

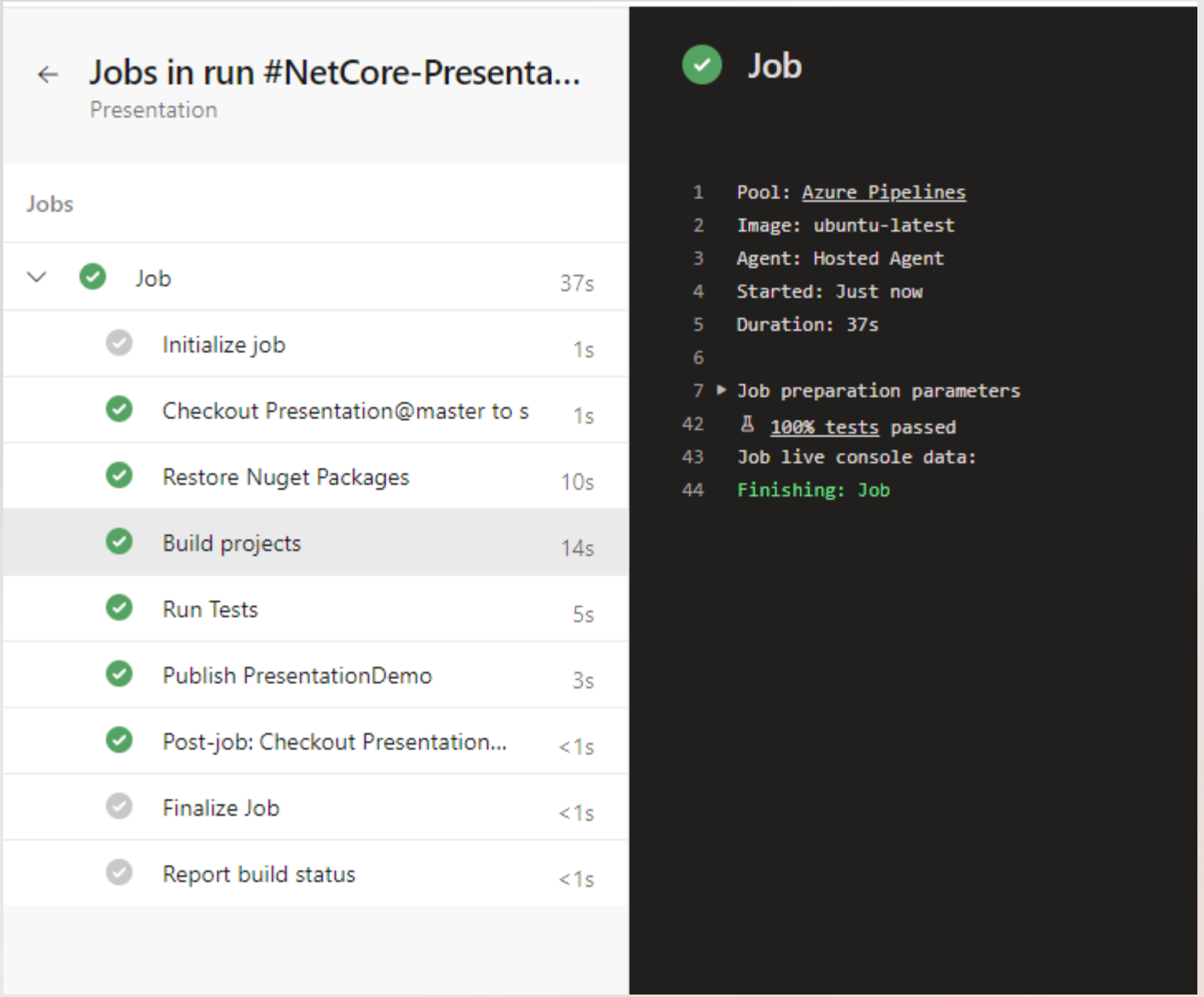
View 7 changes

Repository and version	Time started and elapsed	Related	Tests and coverage
Presentation	Just now	0 work items	Get started
master ac557633	-	0 artifacts	

Jobs

Name	Status	Duration
Job	Queued	


Jobs in run #NetCore-Presenta...
Presentation
Jobs
Job 25s
Initialize job 1s
Checkout Presentation@master to s 1s
Restore Nuget Packages 10s
Build projects 12s
Run Tests
Publish PresentationDemo
Post-job: Checkout Presentation@m...
Build projects
1 Starting: Build projects
2 ==
3 Task : .NET Core
4 Description : Build, test, package, or publish a dotnet application, or run a custom dotnet command
5 Version : 2.242.0
6 Author : Microsoft Corporation
7 Help : https://docs.microsoft.com/azure/devops/pipelines/tasks/build/dotnet-core-cli
8 ==
9 Info: .NET Core SDK/runtime 2.2 and 3.0 are now End of Life(EOL) and have been removed from all hosted agents. If you're using these SDK/runtimes on hosted agents, kindly upgrade to newer versions which are not EOL, or else use UseDotNet task to install the required version.
10 /usr/bin/dotnet build /home/vsts/work/1/s/PresentationDemo/PresentationDemo.Test/PresentationDemo.Test.csproj -dl:CentralLogger,"/home/vsts/work/_tasks/DotNetCoreCLI_5541a522-603c-47ad-91fc-a4b1d163081b/2.242.0/dotnet-build-helpers/Microsoft.TeamFoundation.DistributedTask.MSBuild
11 PresentationDemo.Test -> /home/vsts/work/1/s/PresentationDemo/PresentationDemo.Test/bin/Debug/net8.0/PresentationDemo.Test.dll
12
13 Build succeeded.
14 0 Warning(s)
15 0 Error(s)
16
17 Time Elapsed 00:00:07.70
18 /usr/bin/dotnet build /home/vsts/work/1/s/PresentationDemo/PresentationDemo/PresentationDemo.csproj -dl:CentralLogger,"/home/vsts/work/_tasks/DotNetCoreCLI_5541a522-603c-47ad-91fc-a4b1d163081b/2.242.0/dotnet-build-helpers/Microsoft.TeamFoundation.DistributedTask.MSBuild.Logger.dl


Jobs in run #NetCore-Presenta...
Presentation
Jobs
Job 37s
Initialize job 1s
Checkout Presentation@master to s 1s
Restore Nuget Packages 10s
Build projects 14s
Run Tests 5s
Publish PresentationDemo 3s
Post-job: Checkout Presentation... <1s
Finalize Job <1s
Report build status <1s
Job
1 Pool: Azure Pipelines
2 Image: ubuntu-latest
3 Agent: Hosted Agent
4 Started: Just now
5 Duration: 37s
6
7 ▶ Job preparation parameters
42 100% tests passed
43 Job live console data:
44 Finishing: Job

#NetCore-PresentationDemo-CI • added first project and .gitignore

Presentation

This run is being retained as one of 3 recent runs by master (Branch).

Summary | Tests | Code Coverage

Summary

1 Run(s) Completed (1 Passed, 0 Failed)

1	Passed	100%	904ms	0
Total tests	1 Passed, 0 Failed, 0 Others	Pass percentage	Run duration	Tests not reported
+1		↑ 100%	↑ +904ms	

Bug | Link

Filter by test or run name

Hooray! There are no test failures.

Change the test outcome filter to view tests relevant to you.

Pull Request Policies

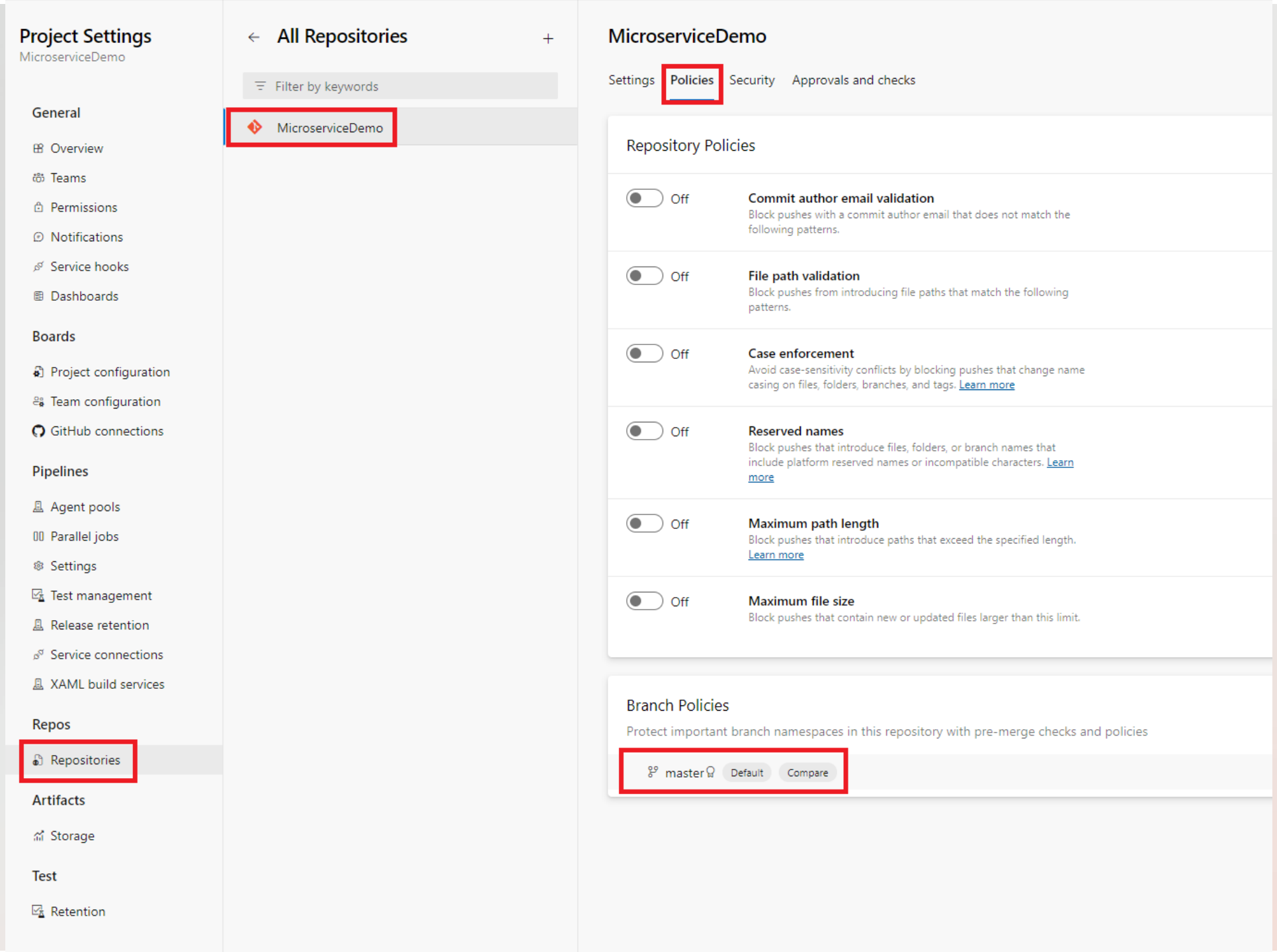
Pull Request Policies

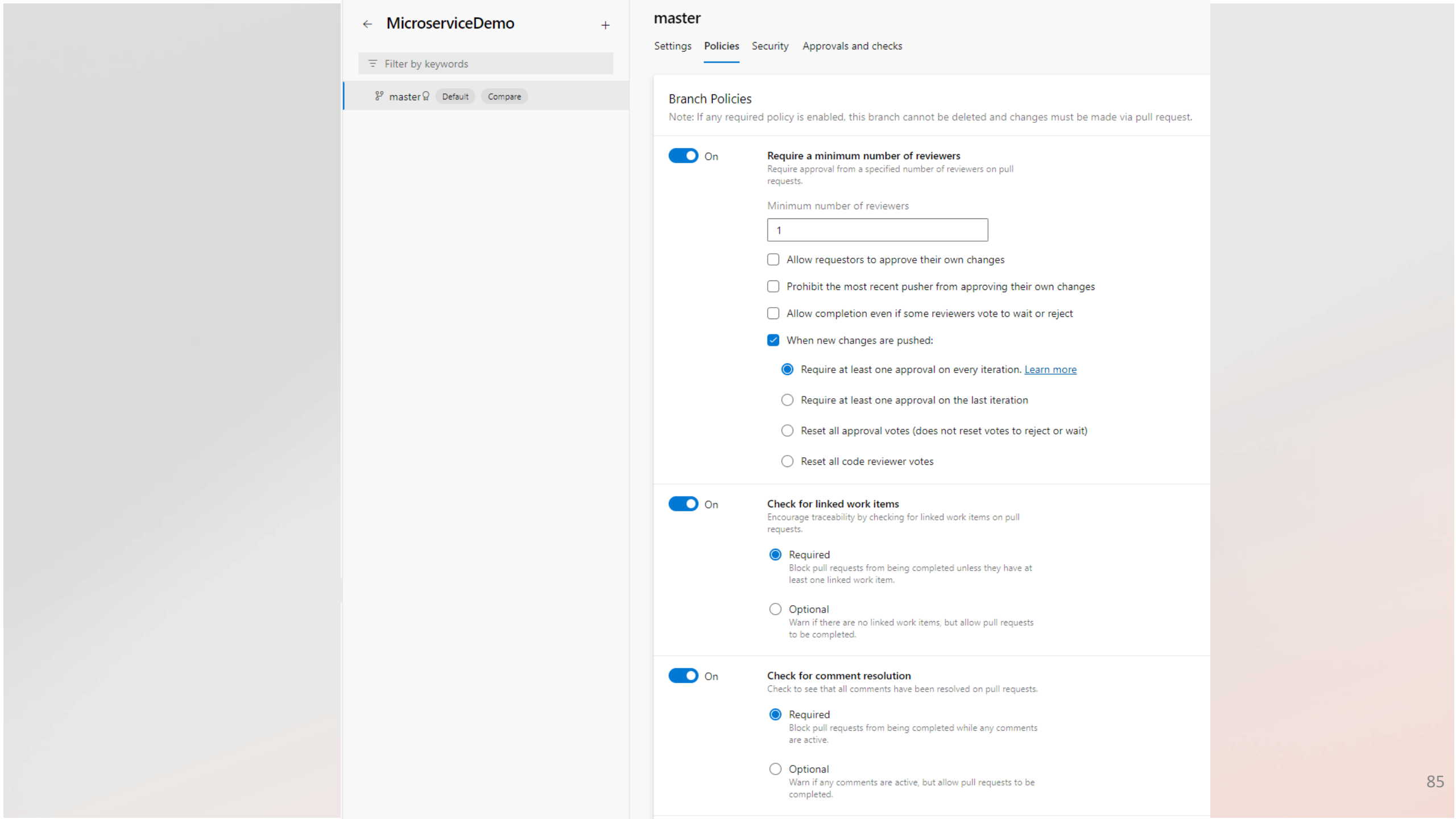
The main branch should always be in a deployable state

Create pull request policies to protect the main branch

Pull Request Policies

- Enforce reviewers
- Validate that the code builds before merging
- Run unit tests
- Enforce linking of work items (no work should be done without a work item)
- Deploy the application to a test environment
- Enforce merge strategies


Project Settings
MicroserviceDemo
General
Overview
Teams
Permissions
Notifications
Service hooks
Dashboards
Boards
Project configuration
Team configuration
GitHub connections
Pipelines
Agent pools
Parallel jobs
Settings
Test management
Release retention
Service connections
XAML build services
Repos
Repositories
Artifacts
Storage
Test
Retention
All Repositories
Filter by keywords
MicroserviceDemo
MicroserviceDemo
Settings
Policies
Security
Approvals and checks
Repository Policies
Off
Commit author email validation
Block pushes with a commit author email that does not match the following patterns.
Off
File path validation
Block pushes from introducing file paths that match the following patterns.
Off
Case enforcement
Avoid case-sensitivity conflicts by blocking pushes that change name casing on files, folders, branches, and tags. Learn more
Off
Reserved names
Block pushes that introduce files, folders, or branch names that include platform reserved names or incompatible characters. Learn more
Off
Maximum path length
Block pushes that introduce paths that exceed the specified length.
Learn more
Off
Maximum file size
Block pushes that contain new or updated files larger than this limit.
Branch Policies
Protect important branch namespaces in this repository with pre-merge checks and policies
master
Default
Compare


MicroserviceDemo
Filter by keywords
master
Default
Compare
master
Settings
Policies
Security
Approvals and checks
Branch Policies
Note: If any required policy is enabled, this branch cannot be deleted and changes must be made via pull request.
On
Require a minimum number of reviewers
Require approval from a specified number of reviewers on pull requests.
Minimum number of reviewers
1
Allow requestors to approve their own changes
Prohibit the most recent pusher from approving their own changes
Allow completion even if some reviewers vote to wait or reject
When new changes are pushed:
Require at least one approval on every iteration. Learn more
Require at least one approval on the last iteration
Reset all approval votes (does not reset votes to reject or wait)
Reset all code reviewer votes
On
Check for linked work items
Encourage traceability by checking for linked work items on pull requests.
Required
Block pull requests from being completed unless they have at least one linked work item.
Optional
Warn if there are no linked work items, but allow pull requests to be completed.
On
Check for comment resolution
Check to see that all comments have been resolved on pull requests.
Required
Block pull requests from being completed while any comments are active.
Optional
Warn if any comments are active, but allow pull requests to be completed.

On

Limit merge types

Control branch history by limiting the available types of merge when pull requests are completed.

Allowed merge types:

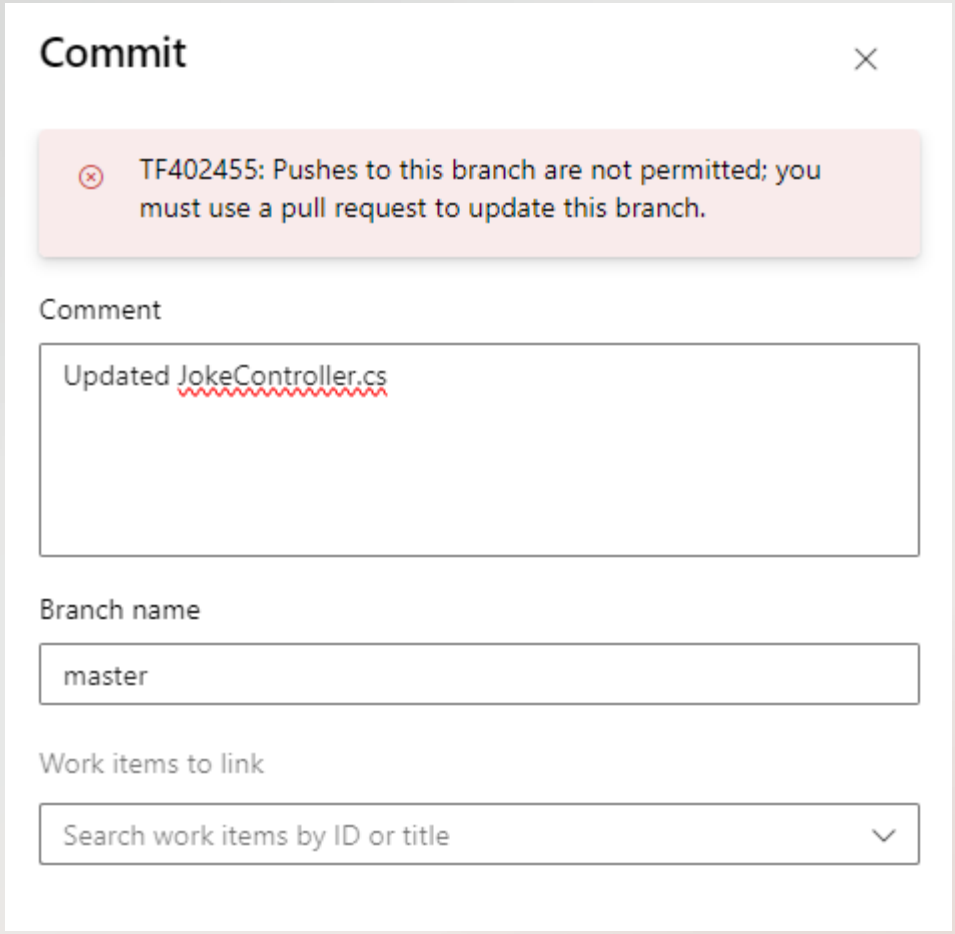
- [ ] Basic merge (no fast-forward)
  Preserves history exactly as it happened during development
- [x] Squash merge
  Creates a linear history by condensing the source branch commits into a single new commit on the target branch
- [ ] Rebase and fast-forward
  Creates a linear history by replaying the source branch commits onto the target without a merge commit
- [ ] Rebase with merge commit
  Creates a semi-linear history by replaying the source branch commits onto the target and then creating a merge commit

Build Validation 1

Validate code by pre-merging and building pull request changes.

Enabled	Name ↑	Path filter	Trigger
On	**CustomerApi-CI** Required	*/CustomerApi/*	Automatic Expires after 12 hours

Enforce Pull Requests



Wiki

Wiki

Create documentation using markdown

Have your documentation in the same place as your code and work items

Seamlessly link work items and code commits

Wiki

Some items are only available when the repository is checked out

- .attachments folder with all uploaded files
- .order file with order of files

3rd Party Repository Access

3rd Party Repository Access

3rd parties might need access to your repository

- GitOps to monitor branches and deploy changes
- Access a private NuGet feed
- Manage Agent Pools

3rd Party Repository Access

Allow access with Personal Access Token

- Token has an expire date
- Define permissions as needed
- Token value is only displayed after creation

s Token

Create a new personal access token

Name

MyToken

Organization

ProgrammingWithWolfgang

Expiration (UTC)

30 days | 8/18/2024

Scopes

Authorize the scope of access associated with this token

Scopes ○ Full access

● Custom defined

Work Items

Work items, queries, backlogs, plans, and metadata

Read ☑ Read & write ☐ Read, write, & manage

Code

Source code, repositories, pull requests, and notifications

☐ Read ☐ Read & write ☐ Read, write, & manage ☐ Full ☑ Status

Build

Artifacts, definitions, requests, queue a build, and update build properties

☐ Read ☐ Read & execute

Release

Read, update, and delete releases, release pipelines, and stages

☑ Read ☐ Read, write, & execute ☐ Read, write, execute, & manage

Test Management

Read, create, and update test plans, cases, and results

☐ Read ☐ Read & write

Packaging

Create, read, update, and delete feeds and packages

☐ Read ☐ Read & write ☐ Read, write, & manage

Show all scopes (29 more)

Create Cancel

Success!

You have successfully added a new personal access token. Copy the token now!

MyToken token

hvvwaurczmthqlwwreftgm

⚠ Warning - Make sure you copy the above token now. We don't store it and you will not be able to see it again.

3rd Party Repository Access

Use public SSH keys

- 3rd party has the same access as the user who added the SSH key
- Use PATs whenever possible

SSH Public Keys

Azure DevOps

User settings
Wolfgang Ofner

Account
- Profile
- Time and Locale
- Permissions

Preferences
- Notifications
- Theme
- Usage

Security
- Personal access tokens
- SSH public keys
- Authorizations

SSH Public Keys

Connect to your Git repos through SSH Public Keys when you can't use the recommended Git Credential Managers or Personal Access Tokens to securely connect to

Compare the server fingerprint when you connect via Git to ensure you've connected to Azure DevOps. The fingerprint should match one of the following:
Server MD5 Fingerprint 97:70:33:82:fd:29:3a:73:39:af:6a:07:ad:f8:80:49 (RSA)
Server SHA256 Fingerprint ohD8VZEXGWo6Ez8GSEJQ9WpafgLFsOfLOtGGQCQo6Og (RSA)

There are no SSH public keys added to your account on this organization.

Visit the documentation to learn how to generate your first SSH Key and select New Key to add it to your account.

Add New SSH Key

Name*

MyKey

Public Key Data*

ssh-rsa
AAAAB3NzaC1yc2EAAAABIwAAAQEAklOUpkDHrfHY17SbrmTIp
NLTGK9Tjom/BWDSU
GPI+nafzIHDTYW7hdI4yZ5ew18JH4JW9jbhUFrviQzM7xlELEVf4h
9IFX5QVkbPppSwg0cda3
Pbv7kOdJ/MTyBIWXFCR+HAo3FXRitBqxiX1nKhXpHAZsMciLq8V
6RjsNAQwdsdMFvSIVK/7XA
t3FaoJoAsncM1Q9x5+3V0Ww68/eIFmb1zuUFIjQJKprrX88XypND
vjYNby6vw/Pb0rwert/En

One Project
vs
Multiple Projects

Project Management

One project per product with several teams
Microsoft recommendations

- Use single project due to lowered administrative effort
- Use multiple project if you want custom processes or different administrative policies
- Private vs. public projects

GitHub

Free

The basics for individuals and organizations

$0 USD per user/month

Create a free organization

- Unlimited public/private repositories
- Dependabot security and version updates
- 2,000 CI/CD minutes/month
  Free for public repositories
- 500MB of Packages storage
  Free for public repositories
- Issues & Projects
- Community support

FEATURED ADD-ONS

- GitHub Copilot Access
- GitHub Codespaces Access

Team

Advanced collaboration for individuals and organizations

$4 USD per user/month

Continue with Team

← Everything included in Free, plus...

- Access to GitHub Codespaces
- Repository rules
- Multiple reviewers in pull requests
- Draft pull requests
- Code owners
- Required reviewers
- Pages and Wikis
- Environment deployment branches and secrets
- 3,000 CI/CD minutes/month
  Free for public repositories
- 2GB of Packages storage
  Free for public repositories
- Web-based support

FEATURED ADD-ONS

- GitHub Secret Protection
- GitHub Code Security

RECOMMENDED

Enterprise

Security, compliance, and flexible deployment

Starting at

$21 USD per user/month

Start a free trial | Contact Sales

← Everything included in Team, plus...

- Data residency
- Enterprise Managed Users
- User provisioning through SCIM
- Enterprise Account to centrally manage multiple organizations
- Environment protection rules
- Repository rules
- Audit Log API
- SOC1, SOC2, type 2 reports annually
- FedRAMP Tailored Authority to Operate (ATO)
- SAML single sign-on
- Advanced auditing
- GitHub Connect
- 50,000 CI/CD minutes/month
  Free for public repositories
- 50GB of Packages storage
  Free for public repositories

EXCLUSIVE ADD-ON

- Premium support

Feature	Organization	Enterprise
Purpose	A collaborative space for teams and projects.	A container for managing multiple organizations.
Billing	Billing is managed at the organization level.	Billing is centralized for all included organizations.
Management	Administrators manage repository access, team permissions, and organization-level settings.	Administrators can centrally enforce policies, manage user accounts, and audit activity across all organizations.
Security	Offers security features like required two-factor authentication (2FA) and team-based access controls.	Provides more advanced features such as IP allow lists, audit log streaming, and Enterprise Managed Users (EMUs).
Scale	Best suited for small to medium-sized businesses or large open-source projects.	Designed for large corporations with complex structures that need to manage multiple departments or business units.

Azure DevOps
vs
GitHub

Feature	GitHub Enterprise	Azure DevOps
Primary Focus	Git-based code hosting, collaboration, and open-source ecosystem. A "developer-first" platform.	A comprehensive suite of tools for the entire software development lifecycle (SDLC).
Version Control	**Git** only. The de-facto standard for modern Git-based workflows.	**Git** and **Team Foundation Version Control (TFVC)**. TFVC support caters to legacy enterprise projects.
CI/CD	**GitHub Actions**: Flexible, event-driven, and has a vast marketplace of pre-built actions.	**Azure Pipelines**: Highly mature, robust, and offers advanced release management features like approval gates and multi-stage pipelines. Supports both YAML and a classic GUI editor.
Project Management	**GitHub Issues** and **Projects**: Simple, built-in tools for tracking work and creating Kanban-style boards.	**Azure Boards**: A powerful and highly customizable tool for agile, Scrum, and Kanban methodologies with advanced reporting and portfolio management.
Security	**GitHub Advanced Security**: Provides code scanning (CodeQL), secret scanning, and dependency management (Dependabot).	**Azure Pipelines** and **Microsoft Entra ID**: Strong identity management and role-based access controls. Security features are often integrated across the broader Azure ecosystem.
Third-Party Integration	Excellent for open-source and modern cloud-native tools. Integrates with thousands of GitHub Actions and external services.	Deeply integrated with the Microsoft ecosystem (Visual Studio, Microsoft Entra ID, Azure services) but also supports integrations with many third-party tools.

DevOps Overview for Senior Managers

Wolfgang Ofner
Senior Cloud Architect