

# Top 10 Best Practices for YAML Pipelines in Azure DevOps



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About me:

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Principal Consultant  
@muellermarc



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Our Products:

Multi-Tenant OpenID  
Connect Identity Provider



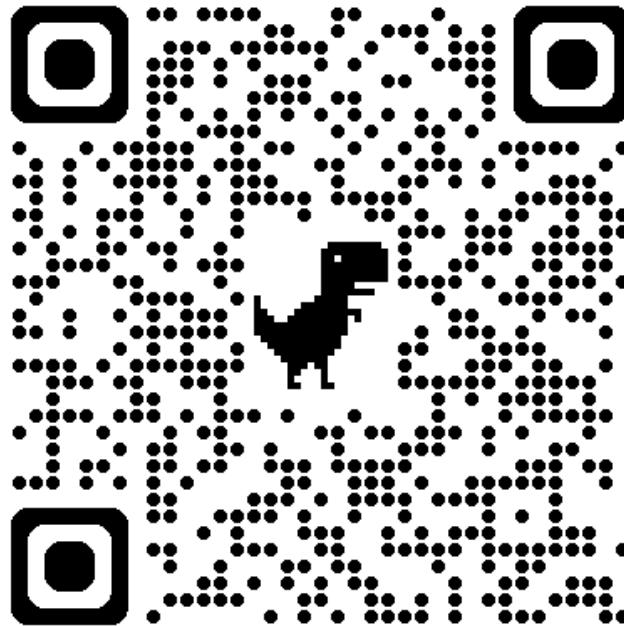
[www.proauth.net](http://www.proauth.net)

Enterprise Application  
Framework for .NET



[www.reafx.net](http://www.reafx.net)

# Slide Download



<https://www.4tecture.ch/events/azurebootcamp2024>

# Agenda

1. Configuration as Code
2. Flexibility
3. Secrets
4. Templates
5. Extend from a Template
6. Pipeline Decorators
7. Deployment Jobs and Environments
8. Incoming Webhook Trigger
9. Container Jobs and Service Containers
10. Traceability in Azure DevOps



A close-up, slightly blurred photograph of a team of rowers in a boat. Their hands are gripping yellow oars, which are angled downwards. The rowers are wearing blue and red athletic gear. The background is a bright, overexposed sky.

Top 10 Multistage YAML Pipeline Features 1/10

# Configuration as Code

# Pipeline Challenges

- Configuration as Code
- Code Changes might change pipeline definition
- Build a (very) old version
- (Configuration as) Code Duplication
- Validation of Pipeline Changes



4tecture-demo / YamlPipelinesDemo / Pipelines / Builds / 01\_HelloWorld\_Tasks / YAML

Search

Variables Run

← 01\_HelloWorld\_Tasks CI Disabled

master ▾

>HelloWorld / 01\_HelloWorld\_Tasks.yml

```
1 name: 01_HelloWorld_Tasks
2
3 trigger:
4   - master
5
6 pool:
7   vmImage: 'ubuntu-latest'
8
9 variables:
10  buildConfiguration: 'Release'
11  unitTestProjects: '**/*Unit.Tests.csproj'
12  artifactName: 'HelloWorldWeb'
13
14 steps:
15   - task: BuildVersioning@0 ...
16     Settings
17     - task: UseDotNet@2
18       displayName: 'Install .NET Core SDK'
19       inputs:
20         packageType: 'sdk'
21         version: '3.1.x'
22     Settings
23     - task: DotNetCoreCLI@2
24       displayName: 'Build in Configuration $(buildConfiguration)'
25       inputs:
26         command: 'build'
27         projects: '**/*.csproj'
28         arguments: '--configuration $(buildConfiguration)'
29     Settings
30     - task: DotNetCoreCLI@2
31       displayName: 'Run unit tests'
32       inputs:
33         command: test
34         projects: $(unitTestProjects)
35         arguments: '--configuration $(buildConfiguration) --collect "Code coverage" --logger trx'
```

Tasks

Search tasks

- .NET Core Build, test, package, or publish a dotnet application...
- A wrapper for the AzureDevOps.WikiPDF... A wrapper for the [AzureDevOps.WikiPDFExport](...)...
- Android signing Sign and align Android APK files
- Ant Build with Apache Ant
- App Center distribute Distribute app builds to testers and users via Visu...
- App Center test Test app packages with Visual Studio App Center
- Archive files Compress files into .7z, .tar.gz, or .zip
- ARM template deployment Deploy an Azure Resource Manager (ARM) templ...
- Azure App Service deploy Deploy to Azure App Service a web, mobile, or AP...
- Azure App Service manage Start, stop, restart, slot swap, slot delete, install sit...
- Azure App Service Settings Update/Add App settings an Azure Web App for ...

# YAML Pipeline Definition

- **Managed in Code Repository**
  - 1..n YAML files
  - Lives in same branch which is being built (Git)
  - Pull Request Workflow / Policies
- **Why should I care about?**
  - Configuration as Code
  - Pipeline definition always correlates to the code version
  - New features you always wanted to have...

# Demo

Pipelines in Git Repo



4ecture-demo / k8sDemo / Reps / Files / DevFun v

Search

DevFun

azure-pipelines

.azure-pipelines

Contents History

Name ↑	Last change	Commits
templates	Friday	<a href="#">3a1f2e41</a> Merged PR 257: Demo Prep Container 2022 06 Marc Müller
devfun-docs.yml	Dec 6, 2021	<a href="#">8206c6ff</a> Merged PR 240: Documentation as Code Marc Müller
devfun-prcleanup.yml	Dec 6, 2021	<a href="#">113926e3</a> Merged PR 241: Using common variables for PR cleanup Marc Müller
devfunapi-cd.yml	Apr 6	<a href="#">6ac09221</a> Merged PR 253: Updated cloud resource naming Marc Müller
devfunapi-ci.yml	Friday	<a href="#">3a1f2e41</a> Merged PR 257: Demo Prep Container 2022 06 Marc Müller
devfunweb-cd.yml	Dec 6, 2021	<a href="#">7845cc3b</a> Merged PR 239: Secrets and Templates Marc Müller
devfunweb-ci.yml	Friday	<a href="#">3a1f2e41</a> Merged PR 257: Demo Prep Container 2022 06 Marc Müller
linter.yml	Dec 6, 2021	<a href="#">9adc99b8</a> Merged PR 242: Enhance Pipelines with Secret Scan and Linter Marc Müller
secretscan.yml	Dec 6, 2021	<a href="#">9adc99b8</a> Merged PR 242: Enhance Pipelines with Secret Scan and Linter Marc Müller

az\_CreateManagedId...  
az\_DeleteManagedId...  
build\_BuildAndPublis...  
common\_variables-cd...  
common\_variables-co...  
common\_variables.yml  
docker\_BuildAndPubli...  
general\_BuildVersioni...  
general\_ReleaseInitiali...  
k8s\_CreateHelmPacka...  
k8s\_DeployHelmPack...  
pr\_DefineApiPathVariable...  
pr\_DefineWebPrVaria...  
pr\_DeleteK8sPrEnviro...  
pr\_SetupK8sPrEnviron...  
pr\_UpdateStatus.yml  
sql\_CreateAzureSqlDa...  
sql\_DeleteAzureSqlDa...  
sql\_DeployDacPac.yml  
test\_runapitests.yml  
test\_runseleniumtests...  
  
devfun-docs.yml  
devfun-prcleanup.yml  
devfunapi-cd.yml  
devfunapi-ci.yml  
devfunweb-cd.yml  
devfunweb-ci.yml  
linter.yml  
secretscan.yml

> DevFun.AdminUI  
> DevFun.Api  
> DevFun.Datamanager  
> DevFun.Web  
> docs

The image shows two side-by-side Azure DevOps Pipelines interfaces. A large red arrow points from the left panel to the right panel, indicating a comparison or migration between the two configurations.

**Left Panel (HelloWorld Pipeline):**

- Project: 4ecture-demo / YamlPipelinesDemo
- Branch: master
- Path: / pipeline
- Contents tab selected
- File list:
  - build-and-package-web.yml
  - create-release-notes.yml
  - .gitignore
  - 00\_HelloWorld\_Simple.yml
  - 00\_Variables.yml
  - 01\_HelloWorld\_Tasks.yml
  - 02\_HelloWorld\_Templates.yml
  - 03\_HelloWorld\_TemplatesExtensi... (truncated)
  - 04\_HelloWorld\_MultiStage.yml
  - 05\_HelloWorld\_Trigger\_CD.yml
  - 05\_HelloWorld\_Trigger\_CI.yml
  - GitVersion.yml
  - HelloWorld.sln
- History tab (empty)

**Right Panel (PipelineTemplates Pipeline):**

- Project: 4ecture-demo / YamlPipelinesDemo
- Branch: master
- Path: / pipeline
- Contents tab selected
- File list:
  - validation
  - versioning
    - ensure-tests.yml
    - buildversioning.yml
    - webcibase.yml
  - README.md
- History tab (empty)



Top 10 Multistage YAML Pipeline Features 2/10

# Flexibility

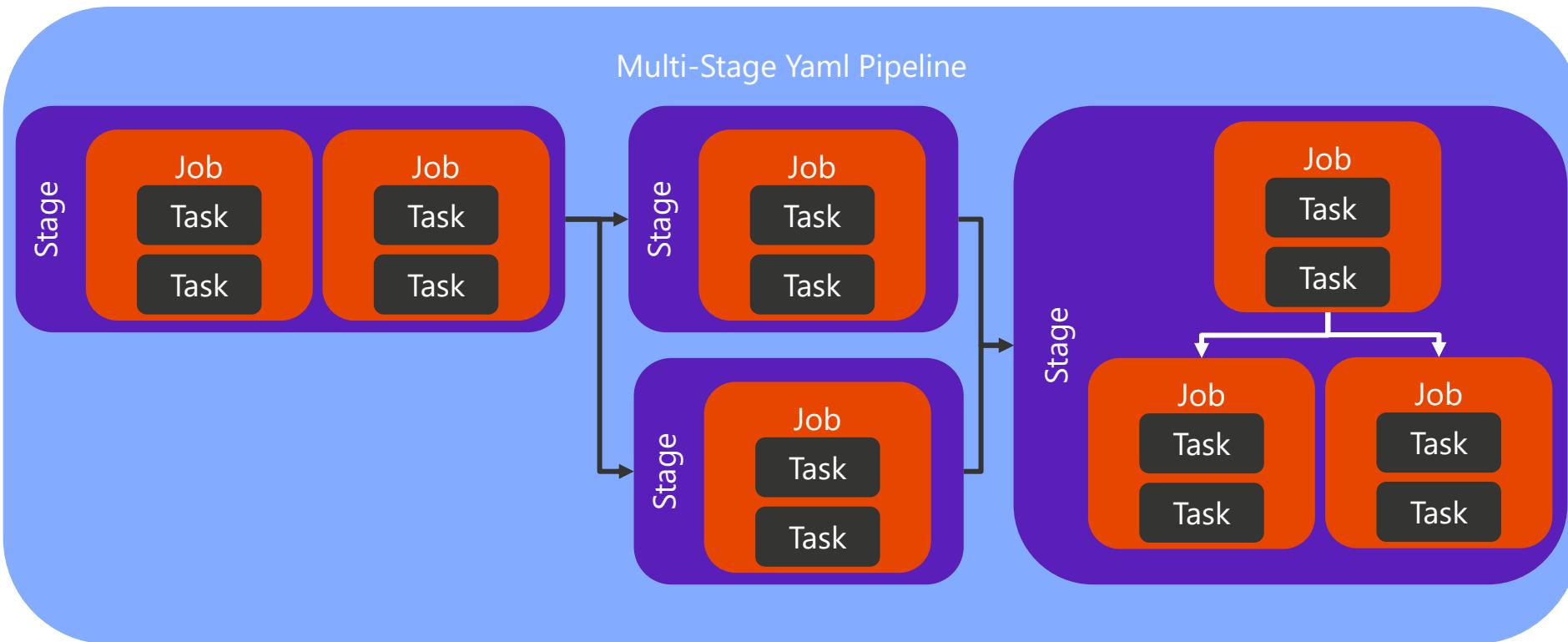
Pipelines / Stages / Jobs and Pipeline Resources

# Pipeline Challenges

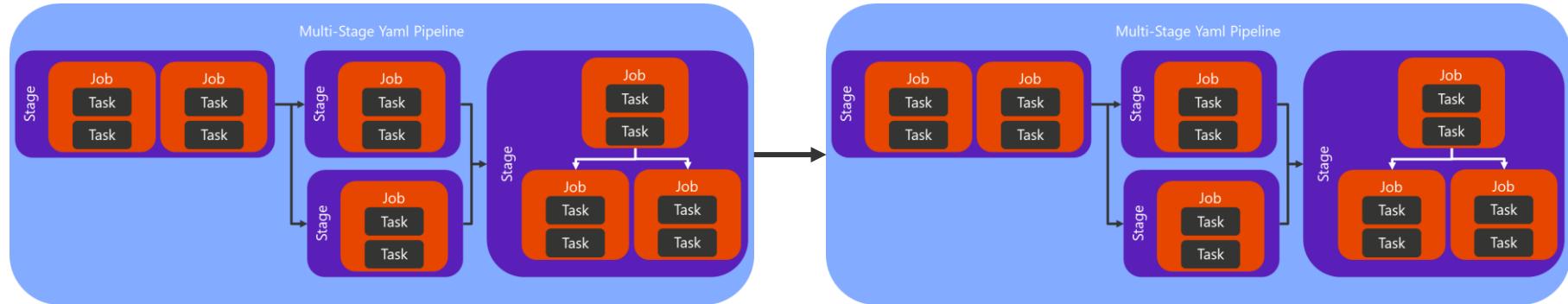
- Pipelines are not always a simple chain of 1 CI and 1 CD process
- Linear staging is often not enough
- Pipeline chaining is needed
- Pipelines need to produce and consume artifacts



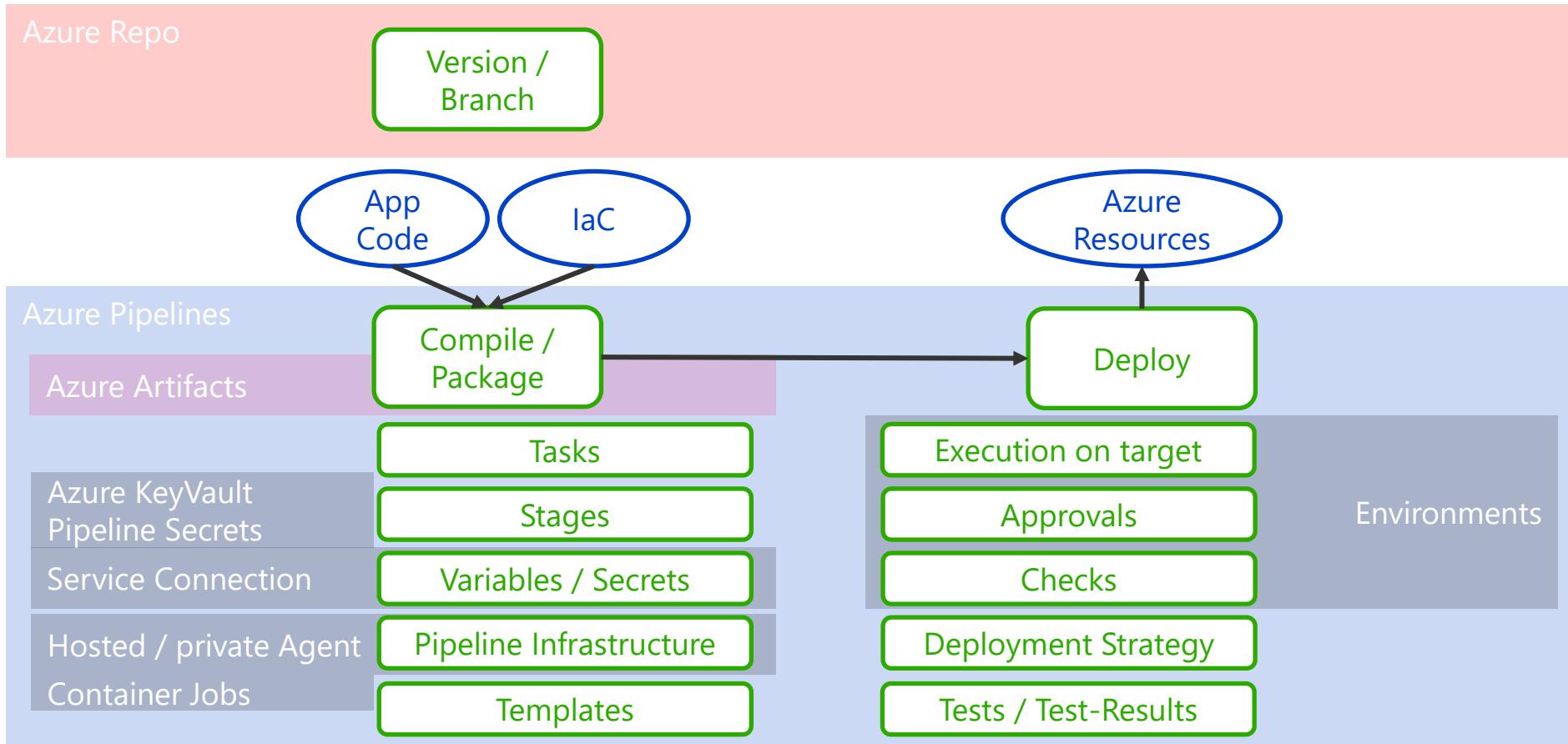
# Multistage YAML Pipelines



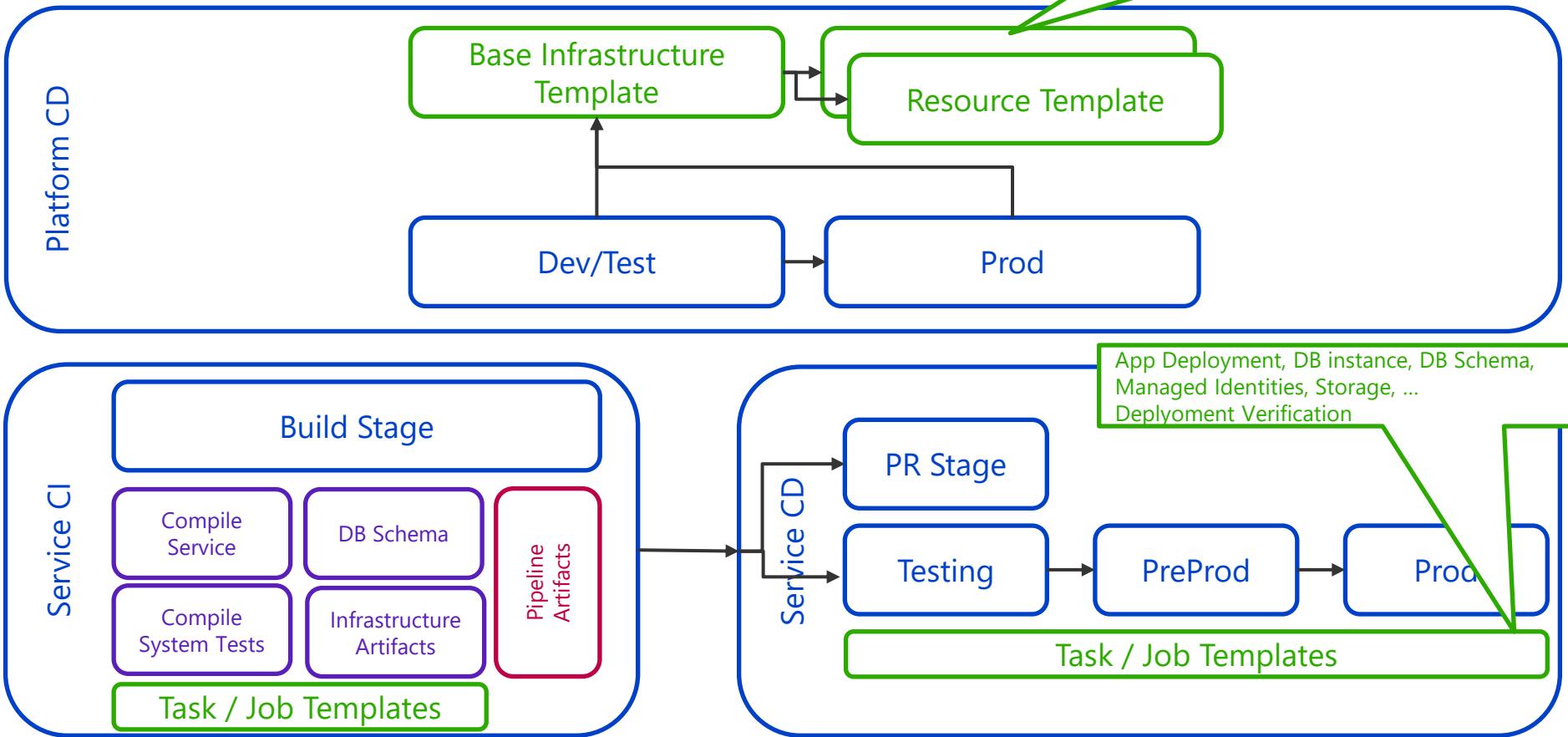
# Multistage YAML Pipelines



# Deploy your infrastructure / apps



# Best Practices



# Demo

Multistage Pipeline  
Pipeline Chaining





## ← 04\_HelloWorld\_MultiStage

Variables

Run



master ▾ HelloWorld / 04\_HelloWorld\_MultiStage.yml

```
1 name: 04_HelloWorld
2
3 trigger:
4   - master
5
6 variables:
7   - azureSubscription: 'Microsoft Azure Sponsorship (82d445a5-0bf3-454a-804b-2fd0286650c2)'
8   - artifactName: 'HelloWorldWeb'
9
10 resources:
11   - repositories:
12     - repository: templatesRepo
13       type: git
14       name: YamlPipelinesDemo/PipelineTemplates
15       ref: refs/heads/release/v1
16
17 stages:
18   - stage: build
19     displayName: 'Build the Application'
20     jobs:
21       - job: CI_Build ...
22
23       - stage: staging
24         dependsOn: build
25         displayName: 'Staging Deployment'
26         jobs:
27           - deployment: staging ...
28
29           - stage: prod
30             dependsOn: staging
31             displayName: 'Prod Deployment'
32             jobs:
33               - deployment: prod ...
34
35               - ...
36
37               - ...
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39               - ...
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41               - ...
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71               - ...
72
73               - ...
74
75               - ...
76
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79               - ...
80
81               - ...
82
83               - ...
84
```

Tasks

Search tasks



- .NET Core  
Build, test, package, or publish a dotnet applicatio...
- A wrapper for the AzureDevOps.WikiPDF...  
A wrapper for the [AzureDevOps.WikiPDFExport]...
- Android signing  
Sign and align Android APK files
- Ant  
Build with Apache Ant
- App Center distribute  
Distribute app builds to testers and users via Visu...
- App Center test  
Test app packages with Visual Studio App Center
- Archive files  
Compress files into .7z, .tar.gz, or .zip
- ARM template deployment  
Deploy an Azure Resource Manager (ARM) templ...
- Azure App Service deploy  
Deploy to Azure App Service a web, mobile, or AP...
- Azure App Service manage  
Start, stop, restart, slot swap, slot delete, install sit...
- Azure App Service Settings  
Update/Add App settings an Azure Web App for ...
- Azure CLI  
Run Azure CLI commands against an Azure subscr...

4tecture-demo / YamlPipelinesDemo / Pipelines

← 05\_HelloWorld\_Trigger\_CI

master ◆ HelloWorld / 05\_HelloWorld\_Trigger\_CI.yml

```
1 name: HelloWorld_CI
2
3 trigger:
4 - master
5
6 variables:
7 - azureSubscription: 'Microsoft Azure Sponsorship (82d445a5-0bf3-454a-804b-2fd0286650c2)'
8 - buildConfiguration: 'Release'
9 - webProjects: '**\HelloWorldWeb.csproj'
10 - unitTestProjects: '**\Unit.Tests.csproj'
11 - artifactName: 'HelloWorldWeb'
12
13 resources:
14 - repositories:
15 - repository: templatesRepo
16 - type: git
17 - name: YamlPipelinesDemo/PipelineTemplates
18 - ref: refs/heads/release/v1
19
20 extends:
21   View template
22   template: pipeline/webci.base.yml@templatesRepo
23   parameters:
24     - buildSteps:
25       - template: pipeline/build-and-package-web.yml
26         parameters:
27           - projectsToBuild: ${webProjects}
28           - unitTestProjects: ${unitTestProjects}
29           - buildConfiguration: ${buildConfiguration}
30           - pathToPublish: ${Build.ArtifactStagingDirectory}
31         publishSteps:
32           - task: PublishBuildArtifacts@1
33             displayName: 'Publish build artifact'
34             inputs:
35               - pathtoPublish: '${Build.ArtifactStagingDirectory}'
36               - artifactName: ${artifactName}
```

Variables Run

Tasks

.NET Core Build, test, package, or publish a dotnet applicatio...

A wrapper for the AzureDevOps.WikiPDFE... A wrapper for the (AzureDevOps.WikiPDFExport)...

4tecture-demo / YamlPipelinesDemo / Pipelines

← 05\_HelloWorld\_Trigger\_CD

master ◆ HelloWorld / 05\_HelloWorld\_Trigger\_CD.yml

```
1 name: 05_HelloWorld_Trigger_CD
2
3 trigger: none
4
5 variables:
6 - azureSubscription: 'Microsoft Azure Sponsorship (82d445a5-0bf3-454a-804b-2fd0286650c2)'
7 - artifactName: 'HelloWorldWeb'
8
9 resources:
10 - pipelines:
11   - pipeline: CIBuild
12     source: 05_HelloWorld_Trigger_CI
13     trigger:
14       - branches:
15         - master
16
17 stages:
18   - stage: staging
19     displayName: 'Staging Deployment'
20     jobs:
21       - deployment: staging
22         displayName: 'Deploy HelloWorld to staging web app'
23         environment: helleworldweb-staging
24         pool:
25           - vmImage: 'ubuntu-latest'
26           strategy:
27             runOnce:
28               - steps:
29                 - pwsh:
30                   - write-host "#vso[build.updatebuildnumber]${resources.pipeline.CIBuild.runName}"
31             - artifact: 'HelloWorldWeb'
32               displayName: 'Download pipeline artifacts'
33               settings:
34                 - task: AzureWebApp@1
35                   displayName: 'Deploy to azure web app staging'
36                   inputs:
37                     - azureSubscription: 'Microsoft Azure Sponsorship (82d445a5-0bf3-454a-804b-2fd0286650c2)'
38                     - appType: 'WebApp'
39                     - appName: 'helleworldweb-staging'
```

Variables Run

Tasks

.NET Core Build, test, package, or publish a dotnet applicatio...

A wrapper for the AzureDevOps.WikiPDFE... A wrapper for the (AzureDevOps.WikiPDFExport)...

Android signing Sign and align Android APK files

Ant Build with Apache Ant

App Center distribute Distribute app builds to testers and users via Visu...

App Center test Test app packages with Visual Studio App Center

Archive files Compress files into .7z, tar.gz, or zip

ARM template deployment Deploy an Azure Resource Manager (ARM) templ...

Azure App Service deploy Deploy to Azure App Service a web, mobile, or AP...

Azure App Service manage Start, stop, restart, slot swap, slot delete, install sit...

Azure App Service Settings Update/Add App settings an Azure Web App for ...

Azure CLI Run Azure CLI commands against an Azure subscr...

A photograph showing a team of rowers from behind, wearing blue and red athletic gear. They are holding yellow oars that extend across the frame. The water in front of the boat is choppy, creating white foam. A white rectangular overlay box is positioned in the upper left area of the image.

Top 10 Multistage YAML Pipeline Features 3/10

# Secrets

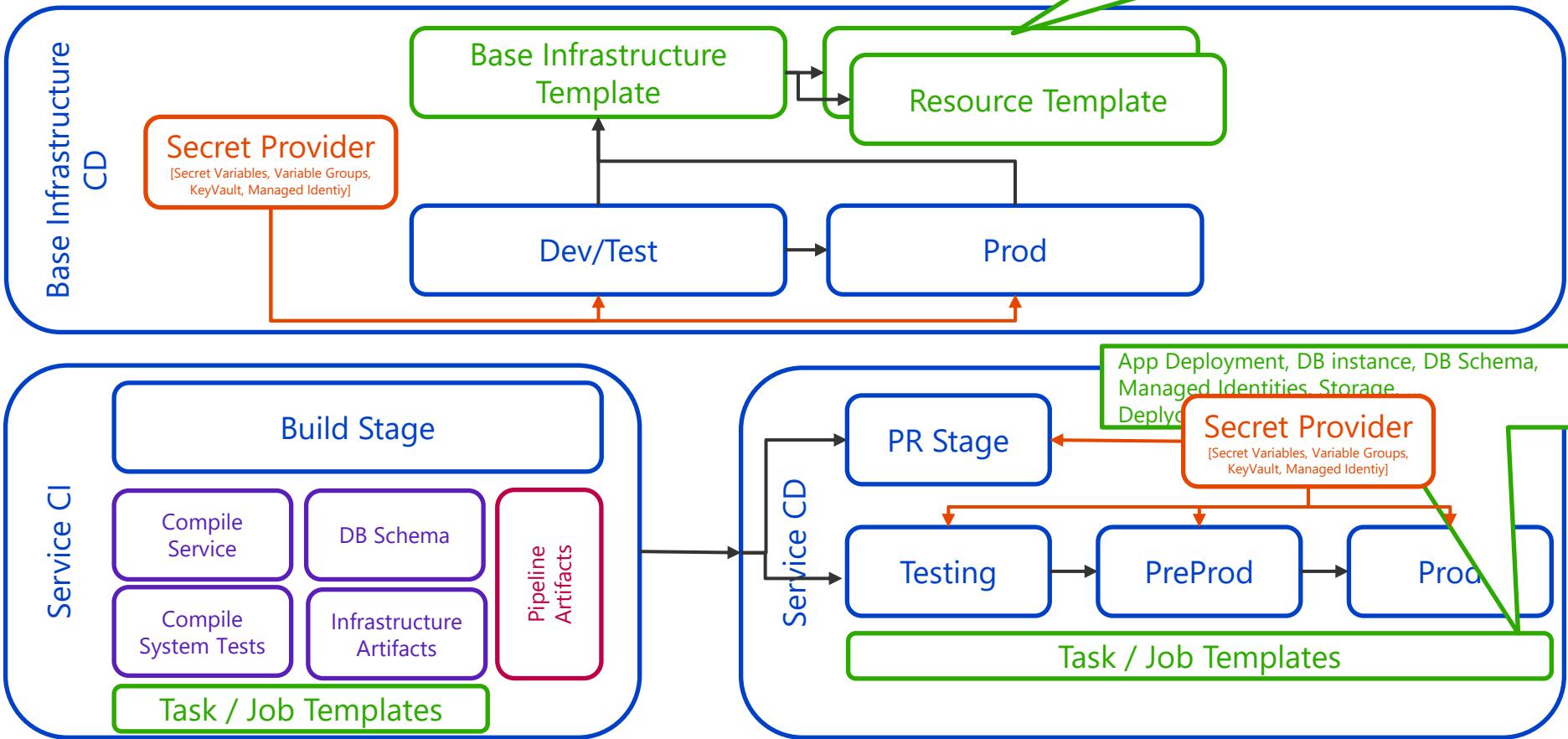
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# Secrets Challenges

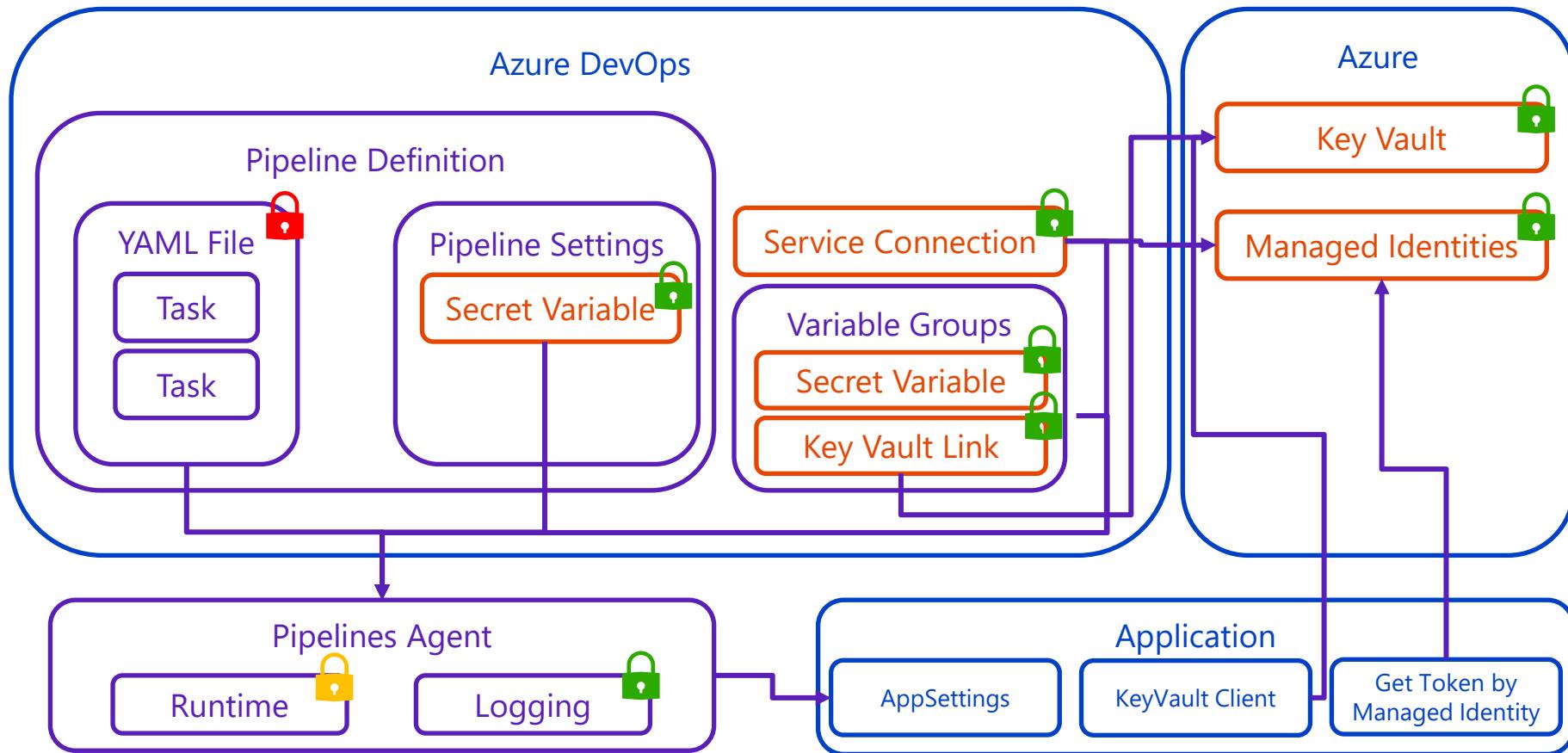
- Configuration as Code
  - Pipeline Definition and Variables are in Source Control
  - Public / Search Index
  - Validate Source Code to not contain any secrets (PR/CI)
  - Just reference secrets in your code / pipelines
- Secret Usage vs. Secret Management
  - Pipeline editors don't see values in secret variables
  - Pipeline editors only have rights to reference secrets / service connection
  - Additional authorization process for service connections
  - Management of secrets belongs only to dedicated administrators



# Best Practices



# Simplified Overview



# Demo

Variable Groups



4ecture-demo / YAMLPipelinesDemo / Pipelines / Library

Search

☰ ☰ ? 🔍

Library > DemoVariableGroup

Variable group | Save | Clone | Security | Pipeline permissions | Approvals and checks | Help

### Properties

Variable group name

DemoVariableGroup

Description

Link secrets from an Azure key vault as variables ⓘ

### Variables

Name ↑	Value	🔒
GroupSecret1	*****	
GroupValue1	Value 01	
GroupValue2	Value 02	↗

+ Add

The screenshot displays the Azure DevOps interface for managing variable groups. On the left, there's a vertical toolbar with various icons. The main content area shows a 'Variable group' configuration page for 'DemoVariableGroup'. It includes fields for the variable group name ('DemoVariableGroup'), a description, and a checkbox for linking secrets from an Azure key vault. Below this, a table lists three variables: 'GroupSecret1' with a masked value, 'GroupValue1' with the value 'Value 01', and 'GroupValue2' with the value 'Value 02'. An 'Add' button is available to create new variables.



## Library &gt; DemoKeyVaultVariableGroup

## Variable group



## Properties

## Variable group name

DemoKeyVaultVariableGroup

## Description

 Link secrets from an Azure key vault as variables 

## Azure subscription \* | Manage

Microsoft Azure Sponsorship (82d445a5-0bf3-454a-804b-2fd0286650c2)

 Scoped to subscription 'Microsoft Azure Sponsorship'

## Key vault name \* | Manage

demovaultmizr6qqogvzw



## Variables

Last refreshed: 15.02.2021

Delete	Secret name	Content type	Status	Expiration date
	theSecret		Enabled	Never

Add



4tecture-demo / YamlPipelinesDemo / Pipelines

Search ≡ ⚡ ? 🔍

Variables Run

← 02\_SecretVariableGroup

main SecretsDemo / Pipelines/02\_SecretVariableGroup.yml Show assistant

```
trigger:
- main

pool:
- vmImage: ubuntu-latest

variables:
- name: SampleVariable01
  value: "Some sample content"
- group: DemoVariableGroup
- group: DemoKeyVaultVariableGroup

steps:
- pwsh: |
  Write-Host "SampleVariable01: $(SampleVariable01)"
  displayName: "Show a plain text variable"

- pwsh: |
  Write-Host "GroupValue1: $(GroupValue1)"
  displayName: "Show a plain text variable from group"

- pwsh: |
  Write-Host "GroupSecret1: $(GroupSecret1)"
  displayName: "Show a secret variable from group"

- pwsh: |
  Write-Host "theSecret: $(theSecret)"
  displayName: "Show a secret variable from Key Vault by group"
```

⋮

- YamlPipelinesDemo +
- Overview
- Boards
- Repos
- Pipelines
- Pipelines
- Environments
- Releases
- Library
- Task groups
- Deployment groups
- Test Plans
- Artifacts

## Library

Variable groups

Secure files

+ Secure file

Security

Help

Search secure files



Upload a secure file

Upload file

Drag and drop a file here or click browse to select a file.

Browse...

OK Cancel

# Demo

Service Connection





## Project Settings

YAML Pipelines Demo

### 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](#)

## Service connections

[Filter by keywords](#)[Microsoft Azure Sponsorship](#)

### New service connection

Choose a service or connection type

 Search connection types Azure Classic Azure Repos/Team Foundation Server Azure Resource Manager Azure Service Bus Bitbucket Cloud Chef Docker Host Docker Registry Generic GitHub GitHub Enterprise Server Incoming WebHook Jenkins Jira Kubernetes

## Project Settings

YamlPipelinesDemo

### 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](#)

## Service connections

Convert your existing Azure Resource Manager service connections which use secrets to authenticate to leverage Workload identity federation maintenance.

[Filter by keywords](#)[Microsoft Azure Sponsorship](#)

## New Azure service connection

Azure Resource Manager

### Authentication method

-  Workload Identity federation (automatic) Recommended
-  Workload Identity federation (manual)
-  Service principal (automatic)
-  Service principal (manual)
-  Managed identity
-  Publish Profile

[Need help choosing a connection type?](#)[Back](#)[Next](#)

**Project Settings**  
YamlPipelinesDemo

**User permissions**

**Project Organization**

+ Add Undo Save Inheritance

User	Role	Access
[YamlPipelinesDemo]\Endpoint Administrators	Administrator	Inherited
Marc Müller	Administrator	Assigned

**Pipeline permissions**

The following YAML pipelines are allowed to use this resource. YAML pipelines from other projects are not shown in this list. All Classic pipelines can use this resource.

Pipeline
04_HelloWorld_MultiStage Pipeline
05_HelloWorld_Trigger_CD Pipeline
03_KeyVaultDemo.yml Pipeline
02_SecretVariableGroup Pipeline

**Project permissions**

The projects below have access to this service connection.

4ecture-demo / YamIPipelinesDemo / Settings / Service connections

Search

New service connection

Project Settings

YamlPipelinesDemo

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

## Service connections

Filter by keywords

Created by

Microsoft Azure Sponsorship ( )

This screenshot shows the 'Service connections' page within the 'Settings' section of a project named 'YamlPipelinesDemo'. The left sidebar contains navigation links for General, Boards, Pipelines, and Repos. In the Pipelines section, 'Service connections' is currently selected. The main content area displays a list of service connections, with one entry visible: 'Microsoft Azure Sponsorship'. A search bar at the top allows filtering by keywords, and a 'Created by' dropdown is also present.

## ← 03\_KeyVaultDemo.yml

Variables Runmain ↳ SecretsDemo / Pipelines/03\_KeyVaultDemo.ymlShow assistant

```
1 trigger:
2   - main
3
4 pool:
5   vmImage: ubuntu-latest
6
7 variables:
8   - AzureConnection: 'Microsoft Azure Sponsorship ( )'
9   buildConfiguration: 'Release'
10  webArtifactName: 'SecretsWebApp'
11  infrastructureArtifactName: 'Infrastructure'
12 stages:
13   - stage: build...
14
15   - stage: deploy
16     displayName: 'Deploy the App'
17     jobs:
18       - deployment: deployAzure
19         displayName: 'Deploy Infrastructure and App'
20         environment: secretdemowebapp
21         strategy:
22           runOnce:
23             deploy:
24               steps:
25                 - download: current
26                   artifact: '$(infrastructureArtifactName)'
27                   displayName: 'Download pipeline artifacts'
28                 - download: current
29                   artifact: '$(webArtifactName)'
30                   displayName: 'Download pipeline artifacts'
31             Settings
32             - task: AzureResourceManagerTemplateDeployment@3
33               inputs:
34                 deploymentScope: 'Resource Group'
35                 azureResourceManagerConnection: '$(AzureConnection)'
36                 action: 'Create Or Update Resource Group'
37                 resourceGroupName: 'SecretsDemo'
```



A close-up, slightly blurred photograph of several rowers in a boat, focusing on their oars and the water. The oars have yellow and black grips.

Top 10 Multistage YAML Pipeline Features 4/10

# Templates

# Pipeline Challenges

- A lot of code duplication
- Same combination of tasks are reused a lot
- Parameterization of reusable combination of tasks
- Versioning of reusable combination of tasks
- Centralized maintenance of reusable task



# Templates for

- Steps

```
steps:  
- script: npm install  
- script: npm test
```

- Jobs

```
jobs:  
- job: Build  
  steps:  
    - script: npm install  
  
- job: Test  
  steps:  
    - script: npm test
```

- Stages

```
stages:  
- stage: Angular  
  jobs:  
    - job: angularinstall  
      steps:  
        - script: npm install angular
```

- Variables

```
variables:  
  favoriteVeggie: 'brussels sprouts'
```

# Template Limitations

- No more than 100 separate YAML files may be included  
(directly or indirectly)
- No more than 20 levels of template nesting  
(templates including other templates)
- No more than 10 megabytes of memory consumed while parsing the YAML  
(in practice, this is typically between 600 KB - 2 MB of on-disk YAML, depending on the specific features used)

# Demo

Manage the pipeline across  
multiple YAML files





## ← 02\_HelloWorld\_Templates CI Disabled

Variables Run

master ✘ ◆ HelloWorld / 02\_HelloWorld\_Templates.yml

Show assistant

```
1 name: 02_HelloWorld_Templates
2
3 trigger:
4   - master
5
6 pool:
7   - vmImage: 'ubuntu-latest'
8
9 variables:
10   - buildConfiguration: 'Release'
11   - webProjects: '**/*HelloWorldWeb.csproj'
12   - unitTestProjects: '**/*Unit.Tests.csproj'
13   - artifactName: 'HelloWorldWeb'
14
15 resources:
16   - repositories:
17     - repository: templatesRepo
18       type: git
19       name: YamlPipelinesDemo/PipelineTemplates
20       ref: refs/heads/release/v1
21
22 steps:
23   - template: pipeline/versioning/buildversioning.yml@templatesRepo
24   - template: pipeline/build-and-package-web.yml
25     parameters:
26       - projectsToBuild: $(webProjects)
27       - unitTestProjects: $(unitTestProjects)
28       - buildConfiguration: $(buildConfiguration)
29       - pathToPublish: $(Build.ArtifactStagingDirectory)
30
31   - task: PublishBuildArtifacts@1
32     displayName: 'Publish build artifact'
33     inputs:
34       - pathToPublish: '$(Build.ArtifactStagingDirectory)'
35         antiExcludedNames: #/antiExcludedNames
```

[← 02\\_HelloWorld\\_Templates](#) CI Disabled

Save

 release/v1 PipelineTemplates / pipeline/versioning/buildversioning.yml Template

Show assistant

```
1 # File: .....versioning/buildversioning.yml
2 # Template type: Step Template
3 # Description: Add this step to version your current build.
4 # Author: Marc Müller
5 # Created: September 23, 2020
6 # Last Updated: February 23, 2022
7 # Prerequisites: none
8 # Ext. required: https://marketplace.visualstudio.com/items?itemName=4tecture.BuildVersioning
9
10 parameters:
11   - name: gitVersionUseLatestVersion
12     type: boolean
13     default: true
14   - name: gitVersionInstallerVersion
15     type: string
16     default: '5.3.2'
17
18 steps:
  Settings
19   - task: BuildVersioning@0
20     displayName: 'Build Versioning'
21     inputs:
22       - versionSource: 'gitversion'
23       - doInstallGitVersion: true
24       - gitversionInstallLocation: 'global'
25       - GitVersionInstallerVersion: '${{ parameters.gitVersionInstallerVersion }}'
26       - doUseLatestGitVersionInstallerVersion: ${{ parameters.gitVersionUseLatestVersion }}
27       - paramAssemblyVersion: '7'
28       - paramAssemblyFileVersion: '7'
29       - paramAssemblyInformationalVersion: '6'
30       - paramOverwriteFourthDigitWithBuildCounter: false
31       - paramVersionCode: '2'
32       - doAssemblyInfoAppendSuffix: false
33       - doConvertAssemblyInfoToLowercase: true
34       - buildNumberVersionFormat: '3'
35       - buildNumberAction: 'replace'
36       - doAssemblyInfoAppendVersion: false
```



← 02\_HelloWorld\_Templates CI Disabled

Save

master ▾ ◆ HelloWorld / pipeline/build-and-package-web.yml TemplateShow assistant

```
1 parameters:
2   projectsToBuild: '**/*.csproj'
3   unitTestProjects: '**/*Test*.csproj'
4   buildConfiguration: release
5   pathToPublish: $(Build.ArtifactStagingDirectory)
6
7 steps:
8   Settings
9     - task: UseDotNet@2
10    displayName: 'Install .NET Core SDK'
11    inputs:
12      packageType: 'sdk'
13      version: '3.1.x'
14    Settings
15     - task: DotNetCoreCLI@2
16       displayName: 'Build in Configuration ${{ parameters.buildConfiguration }}'
17       inputs:
18         command: 'build'
19         projects: |
20           ${{ parameters.projectsToBuild }}
21           ${{ parameters.unitTestProjects }}
22         arguments: '--configuration ${{ parameters.buildConfiguration }}'
23       Settings
24       - task: DotNetCoreCLI@2
25         displayName: 'Run unit tests'
26         inputs:
27           command: test
28           projects: ${{ parameters.unitTestProjects }}
29           arguments: '--configuration ${{ parameters.buildConfiguration }} --collect "Code coverage" --logger trx --no-build'
30       Settings
31       - task: PublishTestResults@2
32         inputs:
33           testResultsFormat: 'VSTest'
34           testResultsFiles: '**/*.trx'
35       Settings
36       - task: DotNetCoreCLI@2
37         displayName: 'Publish web application'
```

A close-up, low-angle shot of several rower's legs and oars in motion. The oars have yellow handles and black blades. The water is choppy, creating white spray. The rowers are wearing blue and red athletic gear.

Top 10 Multistage YAML Pipeline Features 5/10

# Extend from a Template

# Usage Pipeline Templates Challenges

- Often just a few steps are different between projects
- Complexity of maintaining all pipeline template includes
- Ensure to use mandatory templates / tasks
- Flexibility vs. Complexity



# Demo

Extend from a Template





## ← 03\_HelloWorld\_TemplatesExtends

Variables

Run

⋮

master ✘ ◆ HelloWorld / 03\_HelloWorld\_TemplatesExtends.yml

Show assistant

```
6 pool:
7   - vmImage: 'ubuntu-latest'
8
9 variables:
10  buildConfiguration: 'Release'
11  webProjects: '**/HelloWorldWeb.csproj'
12  unitTestProjects: '**/*Unit.Tests.csproj'
13  artifactName: 'HelloWorldWeb'
14
15 resources:
16  repositories:
17    - repository: templatesRepo
18      type: git
19      name: YamlPipelinesDemo/PipelineTemplates
20      ref: refs/heads/release/v1
21
22 extends:
23   Validate
24   template: pipeline/webcibase.yml@templatesRepo
25   parameters:
26     buildSteps:
27       Validate
28         - template: pipeline/build-and-package-web.yml
29           parameters:
30             projectsToBuild: ${webProjects}
31             unitTestProjects: ${unitTestProjects}
32             buildConfiguration: ${buildConfiguration}
33             pathToPublish: ${Build.ArtifactStagingDirectory}
34         publishSteps:
35           Settings
36             - task: PublishBuildArtifacts@1
37               displayName: 'Publish build artifact'
38               inputs:
39                 pathToPublish: '${Build.ArtifactStagingDirectory}'
40                 artifactName: ${artifactName}
```

## ← 03\_HelloWorld\_TemplatesExtends

Save

release/v1 PipelineTemplates / pipeline/webcibase.yml Template

Show assistant

```
1 parameters:
2 - name: buildSteps # the name of the parameter is buildSteps
3 - type: stepList # data type is StepList
4 - default: [] # default value of buildSteps
5 - name: publishSteps # the name of the parameter is buildSteps
6 - type: stepList # data type is StepList
7 - default: [] # default value of buildSteps
8 - name: minNumOfExpectedTests
9 - default: 1
10
11 stages:
12 - stage: ci_buildstage
13   jobs:
14     - job: ci_buildjob
15       steps:
16         - Validate
17         - template: versioning/buildversioning.yml
18         - pwsh: |
19           write-host "Running security scans..."
20           start-sleep 5
21           write-host "Done! 0 vulnerabilities found!"
22           displayName: 'Run security scans'
23           - ${{ each step in parameters.buildSteps }}:
24             - ${{ each pair in step }}:
25               | ${{ if ne(pair.value, 'CmdLine@2') }}:
26               |   ${{ pair.key }}: ${{ pair.value }}
27               | ${{ if eq(pair.value, 'CmdLine@2') }}:
28               |   '${{ pair.value }}': error
29             - ${{ each step in parameters.publishSteps }}:
30               - ${{ each pair in step }}:
31                 | ${{ if ne(pair.value, 'CmdLine@2') }}:
32                 |   ${{ pair.key }}: ${{ pair.value }}
33                 | ${{ if eq(pair.value, 'CmdLine@2') }}:
34                 |   '${{ pair.value }}': error
35         Validate
36         - template: validation/ensure-tests.yml
37           parameters:
```





## ← Jobs in run #0.1.34

03\_HelloWorld\_TemplatesExtends

ci\_buildstage

ci\_buildjob 1m 13s

✓ Initialize job 6s

✓ Checkout HelloWorld@... 1s

✓ Build Versioning 4s

✓ Run security scans 5s

✓ Install .NET Core SDK 7s

✓ Build in Configuration ... 12s

✓ Run unit tests 10s

✓ PublishTestResults &lt;1s

✓ Publish web application 1s

✓ Publish build artifact 22s

✓ Decorator Script &lt;1s

✓ Post-job: Checkout H... &lt;1s

✓ Finalize Job &lt;1s

✓ Check for test results &lt;1s

✓ Check # total tests run &lt;1s

## ✓ Check for test results

- 1 Started: Just now
- 2 Duration: <1s
- 3
- 4 ► Job preparation parameters

A close-up, low-angle shot of several rowers in a racing shell. They are wearing blue and red athletic gear. Their oars are extended, dipping into the water, which creates white spray at the tips. The background is blurred, suggesting motion on a body of water.

Top 10 Multistage YAML Pipeline Features 6/10

# Pipeline Decorators

# Pipeline Enterprise Policy Challenges

- Security standards need to be adopted by every pipeline
- Critical checks / tasks should not be removable by pipeline maintainer
- Centralized management of critical checks and tasks



# Demo

Pipeline Decorators



4ecture-demo / YamlPipelinesDemo / Repos / Files / Decorators

Search

Decorators

DemoDecorator

demo-decorator.yml

vss-extension.json

.gitignore

README.md

main / DemoDecorator / vss-extension.json

vss-extension.json

Contents History Compare Blame

Edit

```
1 {
2     "manifestVersion": 1,
3     "id": "4ecture-demodecorator",
4     "publisher": "4ecture",
5     "version": "0.0.3",
6     "name": "Demo Pipeline Decorator: Ensure Tests (POST)",
7     "description": "Demo Extensions for Pipeline Decorators",
8     "public": false,
9     "categories": [
10         "Azure Pipelines"
11     ],
12     "targets": [
13         {
14             "id": "Microsoft.VisualStudio.Services"
15         }
16     ],
17     "contributions": [
18         {
19             "id": "4ecture-demodecorator-required-task",
20             "type": "ms.azure-pipelines.pipeline-decorator",
21             "targets": [
22                 "ms.azure-pipelines-agent-job-post-job-tasks"
23             ],
24             "properties": {
25                 "template": "demo-decorator.yml"
26             }
27         }
28     ],
29     "files": [
30         {
31             "path": "demo-decorator.yml",
32             "addressable": true,
33             "contenttype": "text/plain"
34         }
35     ]
36 }
```

[https://dev.azure.com/4ecture-demo/YamlPipelinesDemo/\\_git/Decorators?path=/README.md&version=GBmain](https://dev.azure.com/4ecture-demo/YamlPipelinesDemo/_git/Decorators?path=/README.md&version=GBmain)

4lecture-demo / YamlPipelinesDemo / Repos / Files / Decorators

Search

Decorators

DemoDecorator

demo-decorator.yml

Contents History Compare Blame

```
1 steps:
2 - ${{ if and(eq(variables['System.TeamProject'], 'YamlPipelinesDemo'), containsValue(job.steps.*.task.id, '5541a522-603c-47ad-91fc-a4b1d163081b')) }}:
3   - task: PowerShell@2
4     inputs:
5       targetType: inline
6       script: |
7         Write-Host "Decorator script execution!"
8       pwsh: true
9     displayName: "Decorator Script"
```

vss-extension.json

.gitignore

README.md

https://dev.azure.com/4lecture-demo/YamlPipelinesDemo/\_git/Decorators?path=/DemoDecorator/demo-decorator.yml&version=G8main

4lecture-demo / YamlPipelinesDemo / Repos / Files / Decorators

Search

☰ ☰ ? 🔍

Decorators

Decorators

DemoDecorator

demo-decorator.yml

vss-extension.json

.gitignore

README.md

Edit

Contents Preview History Compare Blame

```
1 # Tooling
2 - `npm install tfx-cli -g`
3
4 # Build the extension
5 - `tfx extension create`
```

M README.md

https://dev.azure.com/4lecture-demo/YamlPipelinesDemo/\_git/Decorators?path=/README.md&version=GBmain

## Organization Settings

4ecture-demo

Search Settings

General

Overview

Projects

Users

Billing

Auditing

Global notifications

Usage

Extensions

Azure Active Directory

Security

Policies

Permissions

Boards

Process

Pipelines

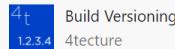
Agent pools

Settings

Deployment pools

Parallel jobs

## Installed extensions

Build Versioning  
4tectureCode Search  
MicrosoftDemo Pipeline Decorator: Ensure Tes...  
4tectureEnsure Tests  
Jesse HouwingGenerate Release Notes (Crossplatfo...  
Richard Fennell (Black Marble)GitLeaks  
FoxholenPull Request Merge Conflict Extension  
Microsoft DevLabsPull Request Utils  
Joachim DalenRenameVariables  
4tectureSARIF SAST Scans Tab  
Microsoft DevLabsTokenizer  
4tectureWIKI PDF Export Tasks  
Richard Fennell (Black Marble)

## Demo Pipeline Decorator: Ensure Tests (POST)

Uninstall

Marketplace

## Extension details

Demo Extensions for Pipeline Decorators

Publisher

4tecture

Installed version

0.0.3 (Latest)

Last updated

Dec 1, 2020 at 9:06 PM GMT+1

## History

User	Date	Action
Marc Müller	Mar 7, 2021	Enabled
Marc Müller	Feb 15, 2021	Disabled
Azure DevOps Service	Dec 1, 2020	Updated version to 0.0.3
Azure DevOps Service	Dec 1, 2020	Updated version to 0.0.2
Marc Müller	Dec 1, 2020	Installed



## ← Jobs in run #0.1.34

02\_HelloWorld\_Templates

Jobs

Job 1m 2s

Initialize job 6s

Checkout HelloWorld@... 2s

Build Versioning 12s

Install .NET Core SDK 6s

Build in Configuration ... 12s

Run unit tests 16s

PublishTestResults &lt;1s

Publish web application 1s

Publish build artifact 1s

Decorator Script &lt;1s

Post-job: Checkout H... &lt;1s

Finalize Job &lt;1s

Report build status &lt;1s

## Decorating Script

```
1 Starting: Decorator Script
2 =====
3 Task      : PowerShell
4 Description : Run a PowerShell script on Linux, macOS, or Windows
5 Version   : 2.198.0
6 Author    : Microsoft Corporation
7 Help      : https://docs.microsoft.com/azure/devops/pipelines/tasks/utility/powershell
8 =====
9 Generating script.
10 ===== Starting Command Output =====
11 /usr/bin/pwsh -NoLogo -NoProfile -NonInteractive -Command . '/home/vsts/work/_temp/f0eb4f94-c1cc-47c8-8769-cbec8d5fe3d8.ps1'
12 Decorator script execution!
13 Finishing: Decorator Script
```

A close-up, slightly blurred photograph of several rowers in a boat, focusing on their oars and the water. The oars have yellow handles and black blades. The water is choppy, creating small white caps.

Top 10 Multistage YAML Pipeline Features 7/10

# Environments

# Target Environment Challenges

- Validation and Approval Logic need to be outside the pipeline
- Multiple Pipelines can deploy into same target with same validation and approval settings
- Tracking of target environment changes
- Special deployment actions specific to target environment type



# Demo

Manage Environments





## Environments

[New environment](#)

Environment	Status	Last activity
Demo Env	Never deployed	Mar 7, 2021
Demo Environment	Never deployed	Feb 2, 2021
helloworldweb-prod	✓ #05_HelloWorld_Trigger_CD on 05_HelloWorld_Trigger_CD	Sep 20, 2019
helloworldweb-staging	✗ #04_HelloWorld on 04_HelloWorld_MultiStage	Sep 20, 2019
secretdemoazure	✓ #20220223.1 on 03_KeyVaultDemo.yml	Feb 15, 2021
VariableDemo	✓ #VariableDemo on 00_VariablesDemo	Nov 25, 2020

-  **YamlPipelinesDemo** +
-  Overview
-  Boards
-  Repos
-  **Pipelines**
-  Pipelines
-  **Environments**
-  Releases
-  Library
-  Task groups
-  Deployment groups
-  Test Plans
-  Artifacts

## ← helloworldweb-prod

Deployments **Approvals and checks**

### Check execution order

Checks will run by order, which is pre-determined by check types. Checks within the same order will run in parallel. [Learn more](#)

Order	Display name	Type
1	All approvers must approve	Approvals

### Add check

Checks will be automatically ordered upon creation based on the type of checks, this can be fine tuned and adjusted once created. [Learn more](#)

 Search check types

-  **Branch control**  
Allow deployments based on branches linked to the run
-  **Evaluate artifact (preview)**  
Ensure artifacts adhere to custom policies (container images only)
-  **Required template**  
Ensure the pipeline extends one or more YAML templates
-  **Pre-check approvals**  
Approvers should grant approval for deployment
-  **Business Hours**  
Ensure the deployment is started in a specific time window
-  **Invoke Azure Function**  
Invoke an Azure Function
-  **Invoke REST API**  
Invoke a REST API as a part of your pipeline.
-  **Query Azure Monitor alerts**  
Observe the configured Azure Monitor rules for active alerts
-  **Post-check approvals**  
Approvers should grant approval for deployment
-  **Exclusive Lock**  
Limit access to this resource to only a single stage at a time

Next

- YamlPipelinesDemo +
- Overview
- Boards
- Repos
- Pipelines
- Pipelines
- Environments
- Releases
- Library
- Task groups
- Deployment groups
- Test Plans
- Artifacts

## helloworldweb-prod

Deployments Approvals and checks

### Check execution order

Checks will run by order, which is pre-determined by check types. Checks within the same order will run in parallel. [Learn more](#)

Order	Display name	Type
1	All approvers must approve	Approvals

## Approvals

### Approvers

 Marc Müller X +

### Instructions to approvers (optional)

Should we deploy to prod?

### Advanced

Allow approvers to approve their own runs

### Control options

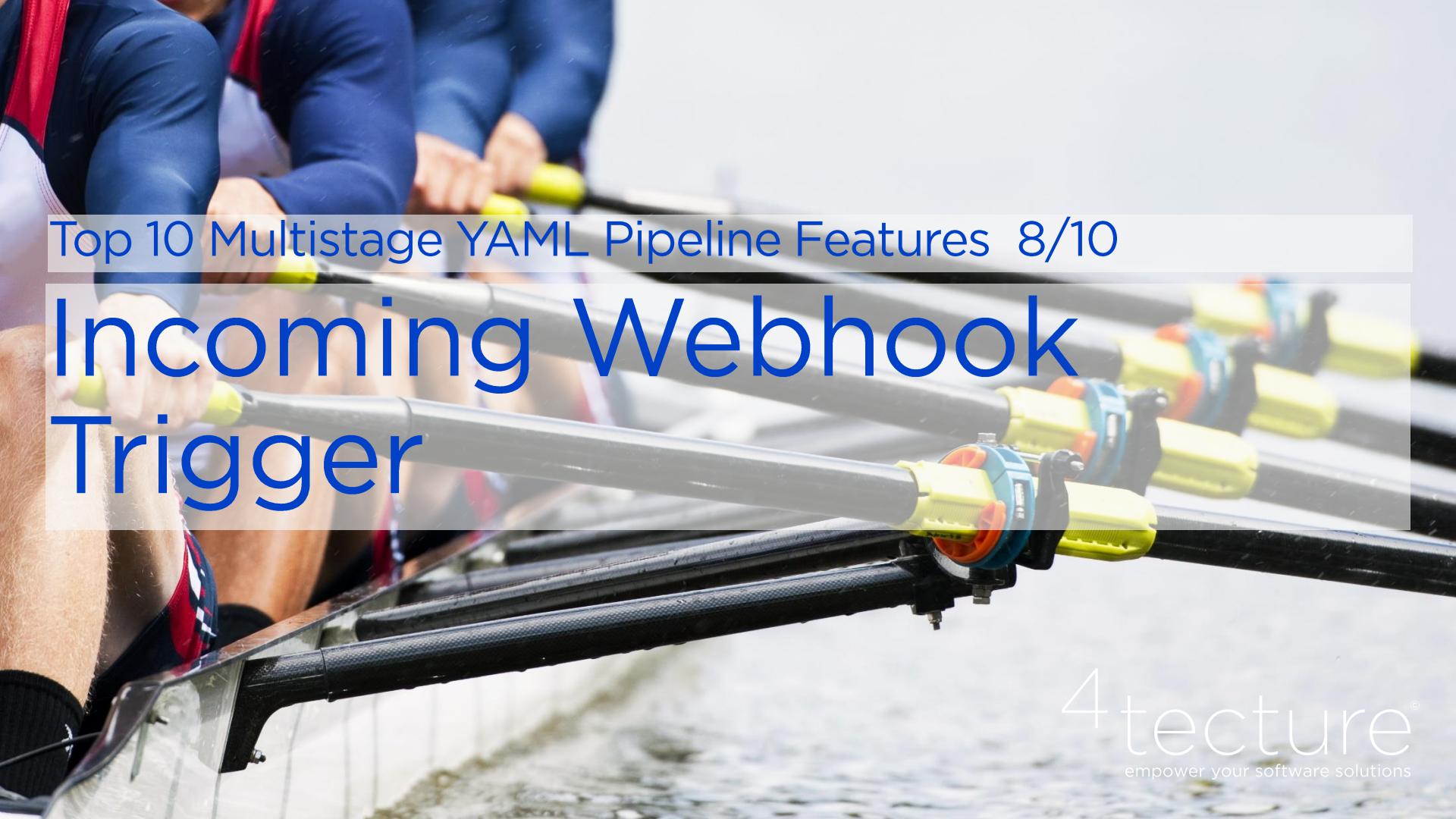
#### Timeout

0

Days

Cancel

Save

A close-up, low-angle shot of several rower's legs and the oars they are using. The oars have yellow handles and black blades. The water is slightly choppy, creating small white caps. The rowers are wearing blue and red athletic gear.

Top 10 Multistage YAML Pipeline Features 8/10

# Incoming Webhook Trigger

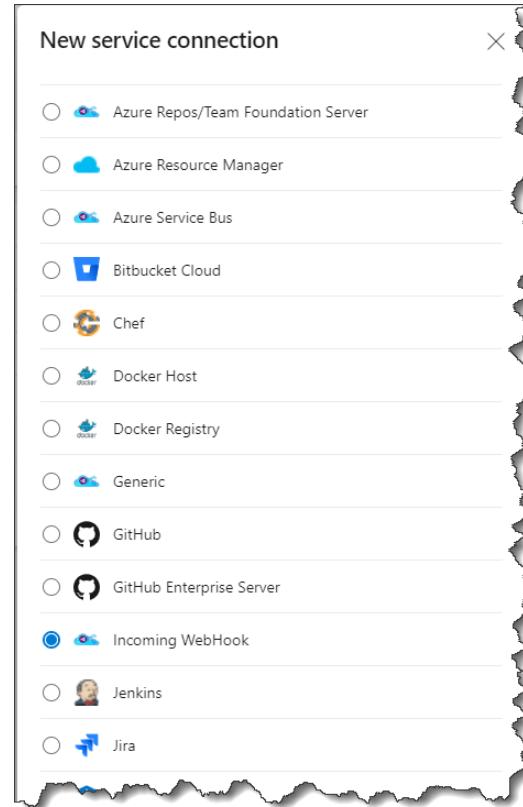
# Trigger

- Main triggers are repository / code related
- Many automation scenarios trigger from other events
  - Work Item Update
  - Pull Request Update



# Incoming Webhook Service Connection

- Incoming webhook can be defined as service connection
- Generic webhook trigger in pipelines
- Payload can be filtered



# Pipeline Resource

- Azure DevOps creates webhook endpoint based on alias
- Pipeline resource triggers pipeline
- Filters can be applied to trigger

```
1  trigger: none
2
3  pool:
4    - vmImage: ubuntu-latest
5
6  resources:
7    - # https://dev.azure.com/4tecture-demo/_apis/public/distributedtask/webhooks/prupdated?api-version=6.0-preview
8    - webhooks:
9      - webhook: PRUpdated ..... ## Webhook alias
10        connection: PREventsConnection ... ## Incoming webhook service connection
11        filters:
12          - path: eventType
13            value: git.pullrequest.updated
14          - path: publisherId
15            value: tfs
16          - path: resource.repository.name
17            value: DevFun
18
19  variables:
20    - template: templates/common_variables.yml
21      View template
22
23  workfolders:
24    - name: variables-cd
25      View template
```

# Service Hook & Incoming Webhook

- Service hooks can trigger webhooks for many Azure DevOps Events

- Build completed
- Code pushed
- Elastic agent pool resized
- Pull request commented on
- Pull request created
- Pull request merge attempted
- Pull request updated
- Release abandoned
- Release created
- Release deployment approval completed
- Release deployment approval pending
- Release deployment completed
- Release deployment started
- Run stage approval completed
- Run stage state changed
- Run stage waiting for approval
- Run state changed
- Work item commented on
- Work item created
- Work item deleted
- Work item restored
- Work item updated

The screenshot shows the 'Edit Service Hooks Subscription' dialog box divided into two main sections: 'FILTERS' on the left and 'SETTINGS' on the right.

**Trigger on this type of event:** Pull request updated

**FILTERS:**

- Repository: DevFun
- Target branch: [Any]
- Change: Status changed
- Requested by a member of group: [Any]
- Reviewer includes group: [Any]

**SETTINGS:**

- Action:** Post via HTTP
- This action posts a JSON object representation of the event to the specified URL.
- URL:** /\_apis/public/distributedtask/webhooks/prupdated?api-version
- Accept untrusted SSL certificates:**
- Basic authentication username:**
- Basic authentication password:**

At the bottom are buttons for Previous, Next, Test, Finish, and Cancel.

# Demo

Pull Request Cleanup



## Project Settings

### k8sDemo

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## Service connections

[Filter by keywords](#)[4taksDemoAcr](#)[4tecture \(MPN\)\(340488b2-0580-488a-8b5d-2e5d723bd628\)](#)[4tectureregistry](#)[aksDemoCanary-dev-aksDemo-aks-dev-1606772543573](#)[Azure DevOps 4tecture-demo](#)[Microsoft Azure Sponsorship](#)[PREventsConnection](#)[ProductsFeed](#)

## New service connection

Choose a service or connection type

 Search connection types  Azure Classic  Azure Repos/Team Foundation Server  Azure Resource Manager  Azure Service Bus  Bitbucket Cloud  Chef  Docker Host  Docker Registry  Generic  GitHub  GitHub Enterprise Server  Incoming WebHook  Jenkins  Jira  Kubernetes



## Project Settings

k8sDemo



## General

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[Agent pools](#)[Parallel jobs](#)[Settings](#)[Test management](#)[Release retention](#)[Service connections](#)[XAML build services](#)

## Repos

[Repositories](#)

## Service connections

Filter by keywords

4taksDemoAcr

4tecture (MPN)(340488b2-0580-488a-8b5d-2e5d723bd628)

4tectureregistry

aksDemoCanary-dev-aksDemo-aks-dev-1606772543573

Azure DevOps 4tecture-demo

Microsoft Azure Sponsorship

PREventsConnection

ProductsFeed

## New Incoming WebHook service connection

## Authentication

## WebHook Name

PRUpdated

Name of the WebHook

## Secret (optional)

Optional secret for the webhook. WebHook service will use this secret to calculate the payload checksum

## Http Header (optional)

Http header name on which checksum will be sent  
Details

## Service connection name

PREventsConnection

## Description (optional)

## Security

 Grant access permission to all pipelines[Learn more](#)[Troubleshoot](#)[Back](#)[Save](#)

4ecture-demo / k8sDemo / Settings / Service hooks

Search

K

Project Settings  
k8sDemo

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- Release retention
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- XAML build services

Repos

Repositories

Service Hooks

Integrate with your favorite services by notifying them when events happen in your project.

EDIT SERVICE HOOKS SUBSCRIPTION

Trigger

Select an event to trigger on and configure any filters.

Trigger on this type of event: Pull request updated

Remember that selected events are visible to users of the target service, even if they don't have permission to view the related artifact.

FILTERS

Repository: DevFun

Target branch: [Any]

Change: Status changed

Requested by a member of group: [Any]

Previous Next Test Finish Cancel

Owner	7 Day Status	State
Marc Müller	0 attempted	Enabled

4ecture-demo / k8sDemo / Settings / Service hooks

Search

Project Settings

k8sDemo

General

Overview

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Permissions

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Service Hooks

Integrate with your favorite services by notifying them when events happen in your project.

EDIT SERVICE HOOKS SUBSCRIPTION

Action

Select and configure the action to perform.

Perform this action

Post via HTTP

Owner: Marc Müller

7 Day Status: 0 attempted

State: Enabled

https://dev.azure.com/4ecture-demo/\_apis/public/distributedtask/webhooks/prupdated?api-version=6.0-preview

including any authentication headers  
[more about Webhooks](#)

SETTINGS

URL  required

Accept untrusted SSL certificates optional

Basic authentication username optional

Basic authentication password optional

Previous Next Test Finish Cancel

Sources

Project configuration

Team configuration

Github connections

Pipelines

Agent pools

Parallel jobs

Settings

Test management

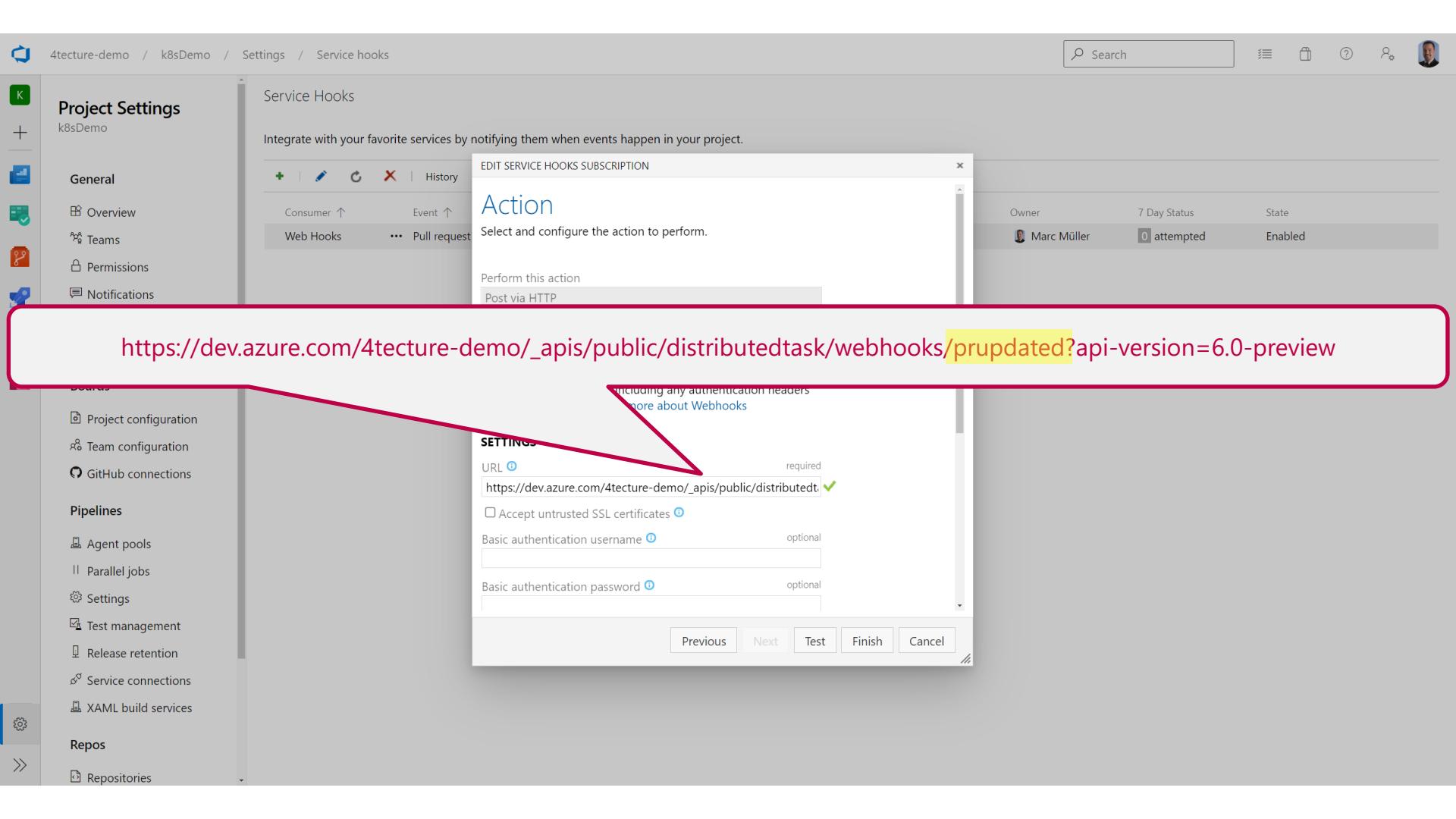
Release retention

Service connections

XAML build services

Repos

Repositories





## Project Settings

k8sDemo

### General

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### Repos

[Repositories](#)

## Service Hooks

Integrate with your favorite services by notifying them when events happen in your project.



Consumer ↑ Event ↑

Web Hooks ... Pull request

EDIT SERVICE HOOKS SUBSCRIPTION

[https://dev.azure.com/4ecture-demo/\\_apis/public/distributedtask/v4/hooks?api-version=4.1](https://dev.azure.com/4ecture-demo/_apis/public/distributedtask/v4/hooks?api-version=4.1) ✓

Accept untrusted SSL certificates ⓘ

Basic authentication username ⓘ optional

Basic authentication password ⓘ optional

HTTP headers ⓘ optional

Resource details to send ⓘ optional

All

Messages to send ⓘ optional

All

Detailed messages to send ⓘ optional

All

RESOURCE VERSION

1.0

Previous Next Test Finish Cancel

Owner	7 Day Status	State
Marc Müller	0 attempted	Enabled

# Sample event payload

```
Method: POST
URI: https://dev.azure.com/4tecture-demo/_apis/public/distributedtask/webhooks/prupdated?api-version=6.0-preview
HTTP Version: 1.1
Headers:
{
  Content-Type: application/json; charset=utf-8
}
Content:
{
  "subscriptionId": "1de80ac8-b9a7-42d0-a2fe-5441c2b7ffc2",
  "notificationId": 14,
  "id": "af07be1b-f3ad-44c8-a7f1-c4835f2df06b",
  "eventType": "git.pullrequest.updated",
  "publisherId": "tfs",
  "message": {
    "text": "Jamal Hartnett marked the pull request as completed",
    "html": "Jamal Hartnett marked the pull request as completed",
    "markdown": "Jamal Hartnett marked the pull request as completed"
  },
  "detailedMessage": {
    "text": "Jamal Hartnett marked the pull request as completed\r\n\r\n- Merge status: Succeeded\r\n- Merge commit: eef717(https://fabrikam.visualstudio.com/DefaultCollection/\_apis/git/repositories/4bc14d40-c903-45e2-872e-0462c7748079/commits/eef717f69257a6333f221566c1c987dc94cc0d72)>eef717</a></li>\r\n- Merge status: Succeeded</li>\r\n- Merge commit: <a href="https://fabrikam.visualstudio.com/DefaultCollection/\_apis/git/repositories/4bc14d40-c903-45e2-872e-0462c7748079/commits/eef717f69257a6333f221566c1c987dc94cc0d72>eef717</a>></li>\r\n- Merge status: Succeeded\r\n- Merge commit: [eef717](https://fabrikam.visualstudio.com/DefaultCollection/\_apis/git/repositories/4bc14d40-c903-45e2-872e-0462c7748079/commits/eef717f69257a6333f221566c1c987dc94cc0d72)>eef717</a>"]
  },
  "resource": {
    "repository": {
      "id": "4bc14d40-c903-45e2-872e-0462c7748079",
      "name": "Fabrikam",
      "url": "https://fabrikam.visualstudio.com/DefaultCollection/_apis/git/repositories/4bc14d40-c903-45e2-872e-0462c7748079",
      "project": {
        "id": "6ce954b1-ce1f-45d1-b94d-e6bf2464ba2c",
        "name": "Fabrikam",
        "url": "https://fabrikam.visualstudio.com/DefaultCollection/_apis/projects/6ce954b1-ce1f-45d1-b94d-e6bf2464ba2c",
        "state": "wellFormed",
        "visibility": "unchanged",
        "lastUpdateTime": "2001-01-01T00:00:00"
      },
      "defaultBranch": "refs/heads/master",
      "remoteUrl": "https://fabrikam.visualstudio.com/DefaultCollection/_git/Fabrikam"
    },
    "pullRequestId": 1,
    "status": "Completed",
    "createdBy": {
      "displayName": "Jamal Hartnett",
      "url": "https://fabrikam.vssps.visualstudio.com/\_apis/Identities/54d125f7-69f7-4191-904f-c5b96b6261c8",
      "id": "54d125f7-69f7-4191-904f-c5b96b6261c8",
      "uniqueName": "fabrikamfiber@hotmail.com",
      "imageUrl": "https://fabrikam.visualstudio.com/DefaultCollection/\_api/\_common/identityImage?id=54d125f7-69f7-4191-904f-c5b96b6261c8"
    },
    "creationDate": "2014-06-17T16:55:46.589889Z",
    "closedDate": "2014-06-30T18:59:12.3660573Z",
    "title": "my first pull request",
    "description": "- test2\r\n",
    "sourceRefName": "refs/heads/mytopic",
    "targetRefName": "refs/heads/master"
  }
}
```

## k8sDemo

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## ← DevFun PR Cleanup

Variables

Run



master DevFun / .azure-pipelines/devfun-prcleanup.yml

Show assistant

```
1 trigger: none
2
3 pool:
4   vmImage: ubuntu-latest
5
6 resources:
7   # https://dev.azure.com/4tecture-demo/_apis/public/distributedtask/webhooks/prupdated?api-version=6.0-preview
8   webhooks:
9     - webhook: PRUpdated ..... ### Webhook alias
10       connection: PREventsConnection ..... ### Incoming webhook service connection
11       filters:
12         - path: eventType
13           value: git.pullrequest.updated
14         - path: publisherId
15           value: tfs
16         - path: resource.repository.name
17           value: DevFun
18
19 variables:
20   Validate
21   - template: templates/common_variables.yml
22   Validate
23   - template: templates/common_variables-cd.yml
24
25 stages:
26   - stage: CleanupPr
27     jobs:
28       - deployment: CleanupPrEnvironment
29         displayName: 'Cleanup PR environment'
30         environment: devfuncleanuppr
31         condition: or(eq('${{ parameters.PRUpdated.resource.status }}', 'completed'), eq('${{ parameters.PRUpdated.resource.status }}', 'abandoned'))
32         strategy:
33           runOnce:
34             deploy:
35               steps:
36                 - download: none
```

Incoming  
WebHook as  
resource with  
trigger

Additional conditions for  
dynamic payload evaluation

## k8sDemo



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## ← DevFun PR Cleanup

Variables

Run



master DevFun / .azure-pipelines/devfun-prcleanup.yml

Show assistant

```
  strategy:
    runOnce:
      deploy:
        steps:
          - download: none
          - pwsh: |
              $prId = "${{ parameters.PRUpdated.resource.pullRequestId }}"
              $dbname = "devfun-pr$($prId)"
              Write-Host "##vso[task.setvariable variable=dbname;]$dbname"
              Write-Host "##vso[task.setvariable variable=k8sNamespace;]pr-$($prId)"
              Write-Host "##vso[task.setvariable variable=managedIdentityApi;]devfunapi-pr-$($prId)"
              Write-Host "##vso[task.setvariable variable=deploymentManagedIdentityApi;]devfunapi-deployment-pr-$($prId)"
              displayName: "Calculate PR related variables"
```

Calculate PR specific variables

```
  template: templates/pr_DeleteK8sPrEnvironment.yml
  parameters:
    azureSubscription: '$(AzureSubscription)'
    clusterResourceGroup: '$(AzureResourceGroup)'
    clusterName: '$(KubernetesCluster)'
    clusterNamespace: '$(k8sNamespace)'
    continueOnError: true
```

Delete deployment

```
  template: templates/sql_DeleteAzureSqlDatabase.yml
  parameters:
    AzureSubscription: '$(AzureSubscription)'
    ResourceGroup: '$(AzureResourceGroup)'
    AzureSqlName: '$(dbservername)'
    DbName: '$(dbname)'
    continueOnError: true
```

Delete database

```
  template: templates/az_DeleteManagedIdentity.yml
  parameters:
    AzureSubscription: '$(AzureSubscription)'
    ManagedIdentity: '$(managedIdentityApi)'
    ManagedIdentityResourceGroup: '$(ManagedIdentityResourceGroup)'
    continueOnError: true
```

Delete Identities

A close-up, low-angle shot of several rowers in a racing shell. Their legs and the oars are visible, with water splashing around the blades. The rowers are wearing blue and red athletic gear.

Top 10 Multistage YAML Pipeline Features 9/10

# Container Jobs and Service Containers

# CI Tool Versioning Challenges

- Storing all VM images need a lot of storage
- Build VM snapshots not integrated in standard process
- Where to store the VM configuration?



# Container Jobs



- Work with hosted pools and private pools
- Pipeline Job runs inside the container
- Each step runs inside the container

# Demo

Container Job





## ← ConsoleDemoDotnetCore

Variables

Run



master ▾ ◆ ConsoleDemoDotnetCore / azure-pipelines.yml

Show assistant

```
1 trigger:
2   - master
3
4 pool:
5   - vmImage: 'ubuntu-latest'
6   - #name: Default
7
8   container: 4tecture/corebuilddemoenv:0.0.1
9
10 variables:
11   - buildConfiguration: 'Release'
12   - solution: '**/ConsoleDemoCoreExtended.sln'
13
14
15 steps:
16   - task: DotNetCoreCLI@2
17     inputs:
18       command: 'restore'
19       projects: ${solution}
20       feedsToUse: 'select'
21   - task: DotNetCoreCLI@2
22     inputs:
23       command: 'build'
24       projects: ${solution}
```

4ecture-demo / DockerCIDemo / Repos / Files / CustomContainerImages

CustomContainerImages

CoreBuildEnv

Dockerfile

DbTestWorker

WinBuildEnv

README.md

master

CoreBuildEnv / Dockerfile

Dockerfile

Edit

Contents History Compare Blame

```
1 FROM mcr.microsoft.com/dotnet/core/sdk:3.1
2
3 RUN curl -sl https://deb.nodesource.com/setup_14.x | bash - \
4   && apt-get update \
5   && apt-get apt-utils \
6   && apt-get install -y nodejs \
7   && npm install typescript -g
```

I

This screenshot shows the Azure DevOps interface for a repository named 'CustomContainerImages'. The repository path is 'DockerCIDemo/CustomContainerImages'. The current branch is 'master'. The 'Dockerfile' is selected in the file list. The Dockerfile content is displayed in the main editor area:

```
1 FROM mcr.microsoft.com/dotnet/core/sdk:3.1
2
3 RUN curl -sl https://deb.nodesource.com/setup_14.x | bash - \
4   && apt-get update \
5   && apt-get apt-utils \
6   && apt-get install -y nodejs \
7   && npm install typescript -g
```

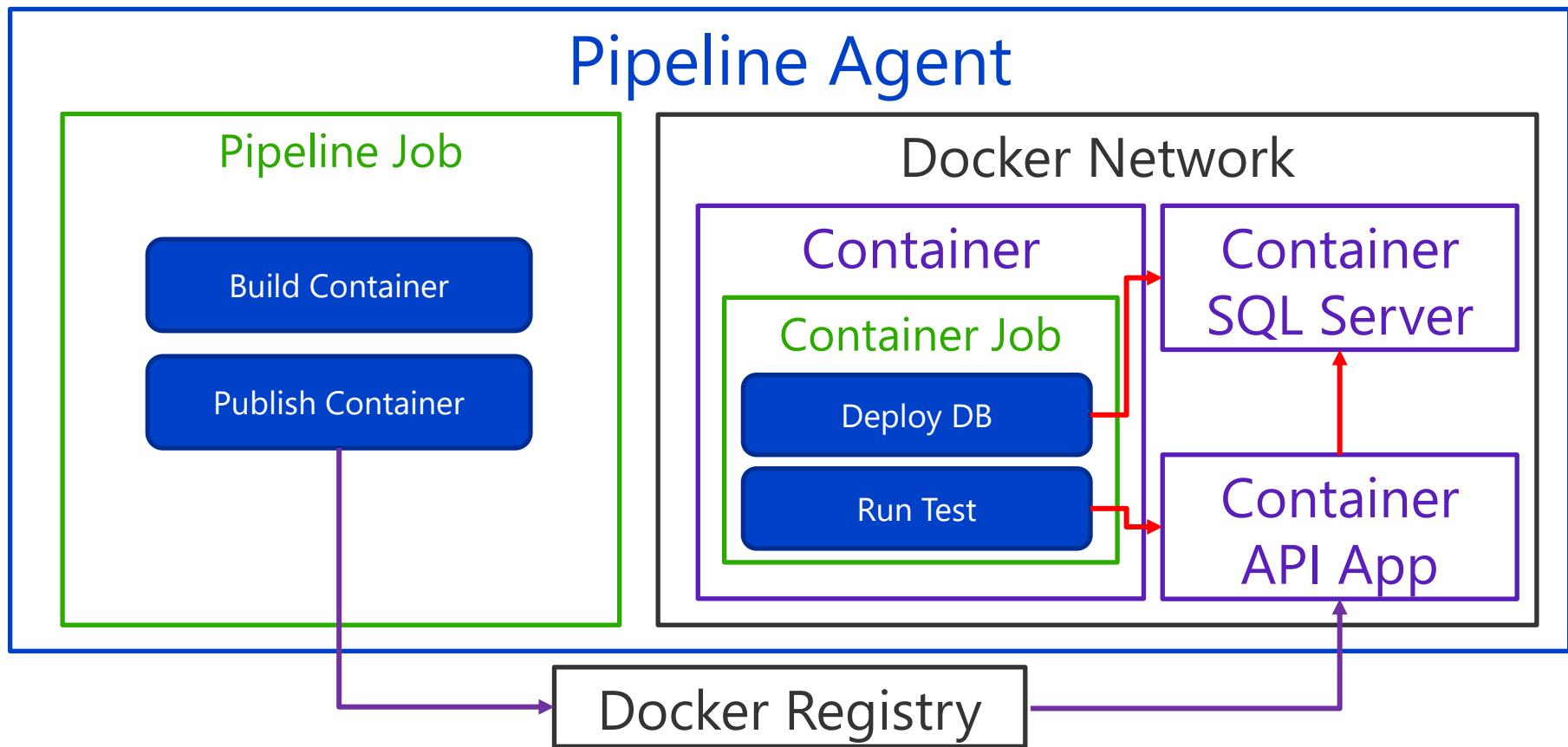
The interface includes a left sidebar with various icons for build, test, and deployment tasks, and a bottom navigation bar with a URL: [https://dev.azure.com/4ecture-demo/DockerCIDemo/\\_git/CustomContainerImages?path=/CoreBuildEnv/Dockerfile&version=G8master](https://dev.azure.com/4ecture-demo/DockerCIDemo/_git/CustomContainerImages?path=/CoreBuildEnv/Dockerfile&version=G8master).

# CI Challenges

- Complex System Testing Environment Setup
- Shift-Left / Fast-Feedback
- Target multiple versions



# Bringing all together – Shift left



# Demo

Service Containers



K k8sDemo

← DevFunApi-Cl

Variables

Save



```
26
27 resources:
28   containers:
29     - container: sql2022
30       image: mcr.microsoft.com/mssql/server:2022-latest
31       env:
32         - SA_PASSWORD: "$(containerdbpassword)"
33         - ACCEPT_EULA: "Y"
34     - container: sql2019
35       image: mcr.microsoft.com/mssql/server:2019-latest
36       env:
37         - SA_PASSWORD: "$(containerdbpassword)"
38         - ACCEPT_EULA: "Y"
39     - container: sql2017
40       image: mcr.microsoft.com/mssql/server:2017-latest
41       env:
42         - SA_PASSWORD: "$(containerdbpassword)"
43         - ACCEPT_EULA: "Y"
44     - container: api
45       image: '$(ImageName):$(Build.BuildNumber)'
46       endpoint: 4taksDemoAcr
47       env:
48         - DEVFUNOPTIONS__DEPLOYMENTENVIRONMENT: "Development"
49         - CONNECTIONSTRINGS__DEVFUNDATABASE: "Server=tcp:$(containerdbserver),1433;Database=$(containerdbname);User ID=$(containerdbuser);Password=$(containerdbpassword);Encrypt=True;TrustServerCertificate=False"
50         - LICENSE__LICENSEDATA: "$(LicenseData)"
51     - container: worker
52       image: 4taksdemocr.azurecr.io/linuxworker:latest
53       endpoint: 4taksDemoAcr
54
55 stages:
56   - stage: Build
57     jobs:
58       - job: CI_Build...
59       - job: DataInitializer_Build...
60
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```

Container  
Resources

K k8sDemo +

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Project settings <<

## &lt; DevFunApi-CI

Variables

Save

⋮

```
master DevFun / .azure-pipelines/devfunapi-ci.yml *
```

```
168     - stage: IntegrationTests
169       displayName: 'Run Integration Tests'
170       dependsOn: Build
171       jobs:
172         - job: SystemTest
173           displayName: 'System tests with SQL Server'
174           pool:
175             vmImage: 'ubuntu-latest'
176             name: Default
177             strategy:
178               matrix:
179                 sql2017:
180                   containerResource: sql2017
181                 sql2019:
182                   containerResource: sql2019
183                 sql2022:
184                   containerResource: sql2022
185             services:
186               sql: ${variables['containerResource']}
187               api: api
188             container: worker
189             steps:
190               - download: current
191                 artifact: SystemTests
192                 displayName: Download the SystemTests artifact
193               - download: current
194                 artifact: TestDataInitializer
195                 displayName: Download the TestDataInitializer artifact
196               - download: current
197                 artifact: dacpacs
198                 displayName: Download the Database artifact
199                 View template
200               - template: templates/sql_DeployDacPac.yml
201               parameters:
202                 dbServernameFqdn: sql
203                 dbName: $(containerdbname)
```

Matrix → run test in different environments in parallel

Dynamic service container selection based on matrix variable

K k8sDemo +

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Project settings <

## ← DevFunApi-Cl

Variables

Save



```
181      sql2019:  
182      containerResource: sql2019  
183      sql2022:  
184      containerResource: sql2022  
185      services:  
186      sql: ${variables['containerResource']}  
187      api: api  
188      container: worker  
189      steps:  
190      download: current  
191      artifact: SystemTests  
192      displayName: Download the SystemTests artifact  
193      download: current  
194      artifact: TestDataInitializer  
195      displayName: Download the TestDataInitializer artifact  
196      download: current  
197      artifact: dacpacs  
198      displayName: Download the Database artifact  
  
View template  
199      template: templates/sql_DeployDacPac.yml  
200      parameters:  
201      dbServernameFqdn: sql  
202      dbName: $(containerdbname)  
203      dbUser: $(containerdbuser)  
204      dbPassword: $(containerdbpassword)  
205      dacpacFile: $(Dacpacfile)  
206      trustServerCertificate: true  
  
View template  
207      template: templates/test_runapitests.yml  
208      parameters:  
209      SystemTestArtifactLocation: $(Pipeline.Workspace)/SystemTests  
210      DatainitializerArtifactLocation: $(Pipeline.Workspace)/TestDataInitializer  
211      ApiUrl: http://api  
212      RunSettingsFileName: container.runsettings  
  
- stage: PullRequest
```

DB schema deployment

Run integration / system tests

## k8sDemo

## ← DevFunApi-Cl

Variables

Save



```
master ⚡ DevFun / .azure-pipelines/devfunapi-ci.yml *
```

```
181     sql2019:
182     containerResource: sql2019
183     sql2022:
184     containerResource: sql2022
185     services:
186     sql: ${variables['containerResource']}
187     api: api
188     container: worker
189     steps:
190       download: current
191       artifact: SystemTests
192       displayName: Download the SystemTests artifact
193       download: current
194       artifact: TestDataInitializer
195       displayName: Download the TestDataInitializer artifact
196       download: current
197       artifact: dacpacs
198       displayName: Download the Database artifact
View template
199     - template: templates/sql_DeployDacPac.yml
200     parameters:
201       dbServernameFqdn: sql
202       dbName: $(containerdbname)
203       dbUser: $(containerdbuser)
204       dbPassword: $(containerdbpassword)
205       dacpacFile: $(Dacpacfile)
206       trustServerCertificate: true
View template
207     - template: templates/test_runapitests.yml
208     parameters:
209       SystemTestArtifactLocation: $(Pipeline.Workspace)/SystemTests
210       DatainitializerArtifactLocation: $(Pipeline.Workspace)/TestDataInitializer
211       ApiUrl: http://api
212       RunSettingsFileName: container.runsettings
213
214   - stage: PullRequest
```

Docker network container alias

Docker network container alias

A close-up, low-angle shot of several rowers in a racing shell. Their hands are gripping yellow oars, which are blurred due to motion. They are wearing blue athletic gear. The water below is choppy.

Top 10 Multistage YAML Pipeline Features 10/10

# Traceability in Azure DevOps – Release Notes

# CI / CD Traceability Challenges

- What Code Changes and Work Items are associated with the Pipeline run?
- Manual update of changelog is cumbersome



# Demo

Release Notes



4tecture-demo / ReleaseNotesDemo / Pipelines

Search

R Variables Run :

## ← 05\_HelloWorld\_Trigger\_CD

master ✘ HelloWorld / 05\_HelloWorld\_Trigger\_CD.yml

Show assistant

```
47      displayName: 'Prod Deployment'
48
49  - deployment: prod
50    displayName: 'Deploy HelloWorld to prod web app'
51    environment: helloworldweb-prod
52    pool:
53      vmImage: 'ubuntu-latest'
54    strategy:
55      runOnce:
56        deploy:
57          steps:
58            - download: CIBuild
59              artifact: 'HelloWorldWeb'
60              displayName: 'Download pipeline artifacts'
61            - download: CIBuild
62              artifact: 'MarkdownTemplates'
63              displayName: 'Download markdown templates artifacts'
64              settings:
65                task: AzureWebApp@1
66                displayName: 'Deploy to azure web app prod'
67                inputs:
68                  azureSubscription: 'Microsoft Azure Sponsorship (82d445a5-0bf3-454a-a04b-2fd0286650c2)'
69                  appType: 'webApp'
70                  appName: 'helloworldweb-prod'
71                  package: '$(Pipeline.Workspace)/**/HelloWorldWeb.zip'
72                  deploymentMethod: 'auto'
73
74      - ${{ if eq(variables['System.TeamProject'], 'ReleaseNotesDemo') }}:
75        View template
76        - template: pipeline/create-release-notes.yml
77        parameters:
78          Validate
79          template: '$(Pipeline.Workspace)/CIBuild/MarkdownTemplates/release-notes-template.md'
```



## ← 05\_HelloWorld\_Trigger\_CD

Save

master ▾ ◆ HelloWorld / pipeline/create-release-notes.yml Template

Show assistant

```
1 parameters:
2   Validate
3   addToPipelineSummary: true
4   addWikiPage: true
5   addWikiSummaryLink: true
6   addArtifact: true
7   outputFile: '$(Pipeline.Workspace)/ReleaseNotes_${resources.pipeline.CIBuild.runName}.md'
8   wikiUrl: 'dev.azure.com/4tecture-demo/ReleaseNotesDemo/_git/ReleaseNotesDemo.wiki'
9   wikiReleaseNotesPage: 'ReleaseNotes/ReleaseNotes_${resources.pipeline.CIBuild.runName}.md'
10  wikiReleaseNotesOverviewPage: 'Release-Note-Demo.md'
11  template: 'pipeline/release-notes-template.md'
```

```
12 steps:
13   Settings
14     - task: XplatGenerateReleaseNotes@3
15       displayName: 'RN: Generate release notes'
16       inputs:
17         - outputFile: ${{ parameters.outputfile }}
18         - templateLocation: 'File'
19         - templatefile: ${{ parameters.template }}
20         - checkStage: true
21         - dumpPayloadToConsole: false
22         - dumpPayloadToFile: false
23         - replaceFile: true
24         - getParentsAndChildren: false
25         - getAllParents: true
26         - customHandlebarsExtensionCode: |
27           module.exports = {removeLinebreaks(str) {
28             return str.replace(/(?:\r\n|\r|\n)/g, '<br>');
29           }};
30   Settings
31     - task: WikiUpdaterTask@1
32       displayName: 'RN: Upload release notes to wiki'
33       inputs:
34         - repo: ${{ parameters.wikiUrl }}
35         - filename: ${{ parameters.wikiReleaseNotesPage }}
```





## ← 05\_HelloWorld\_Trigger\_CD

Save

master ▾ ◆ HelloWorld / pipeline/create-release-notes.yml Template

Show assistant

```
28     };
29     Settings
30     - task: WikiUpdaterTask@1
31       displayName: 'RN: Upload release notes to wiki'
32       inputs:
33         repo: ${{ parameters.wikiUrl }}
34         filename: ${{ parameters.wikiReleaseNotesPage }}
35         replaceFile: true
36         dataIsFile: true
37         sourceFile: ${{ parameters.outputfile }}
38         message: 'added release notes'
39         gitname: 'Pipeline'
40         gitemail: 'info@4tecture.ch'
41         userAgentToken: true
42         localpath: '$(System.DefaultWorkingDirectory)\repo'
43         condition: and(succeeded(), eq('${{ parameters.addWikiPage }}', true))
44     Settings
45     - task: WikiUpdaterTask@1
46       displayName: 'RN: Update wiki index for new release notes'
47       inputs:
48         repo: ${{ parameters.wikiUrl }}
49         filename: ${{ parameters.wikiReleaseNotesOverviewPage}}
50         replaceFile: false
51         appendToFile: true
52         dataIsFile: false
53         contents: |+
54           -- [ReleaseNotes_${{resources.pipeline.CIBuild.runName}}] /ReleaseNotes/ReleaseNotes_${{resources.pipeline.CIBuild.runName}}
55         message: 'added release notes'
56         gitname: 'Pipeline'
57         gitemail: 'info@4tecture.ch'
58         userAgentToken: true
59         localpath: '$(System.DefaultWorkingDirectory)\repo'
60         condition: and(succeeded(), eq('${{ parameters.addWikiSummaryLink }}', true))
61     Settings
62     - task: CopyFiles@2
63       displayName: 'RN: Copy release notes for artifact upload'
64       ...
```

[← 05\\_HelloWorld\\_Trigger\\_CD](#)

Save

master

HelloWorld / pipeline/create-release-notes.yml

Template

Show assistant

```
52  n- [ReleaseNotes_${resources.pipeline.CIBuild.runName}](/ReleaseNotes/ReleaseNotes_${resources.pipeline.CIBuild.runName})
53  message: 'added release notes'
54  gitname: 'Pipeline'
55  gitemail: 'info@4tecture.ch'
56  useAgentToken: true
57  localpath: '$(System.DefaultWorkingDirectory)\repo'
58  condition: and(succeeded(), eq('${{ parameters.addWikiSummaryLink }}', true))
Settings
59  - task: CopyFiles@2
60  displayName: 'RN: Copy release notes for artifact upload'
61  inputs:
62    SourceFolder: '$(Pipeline.Workspace)'
63    Contents: '${{ parameters.outputfile }}'
64    TargetFolder: '$(Build.ArtifactStagingDirectory)/ReleaseNotes'
65    condition: and(succeeded(), eq('${{ parameters.addArtifact }}', true))
Settings
66  - task: PublishBuildArtifacts@1
67  displayName: 'RN: Publish release notes as pipeline artifact'
68  inputs:
69    pathToPublish: '$(Build.ArtifactStagingDirectory)/ReleaseNotes'
70    artifactName: 'ReleaseNotes'
71    condition: and(succeeded(), eq('${{ parameters.addArtifact }}', true))
- pwsh:
  - write-host "##vso[task.addattachment type=Distributedtask.Core.Summary;name=Release Notes;]${{ parameters.outputfile }}"
  displayName: 'RN: Add release notes as pipeline summary'
  condition: and(succeeded(), eq('${{ parameters.addToPipelineSummary }}', true))
```



## #0.1.63 Merged PR 229: Demo Feature

05\_HelloWorld\_Trigger\_CD

Run new

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

View retention leases

Summary Environments Extensions Scans

### Release Notes

#### Release Notes

- Build Number: 0.1.63
- Build Trigger PR Number:
- Compared to: 0.1.62

#### Pull Requests (1)

Id	Title
----	-------

229 Demo Feature

#### Work Items (1)

Id	Work Item Info	Release Notes	Tags	Assigned
150	#150	Very important new business functionality has been added.		Marc Müller

#### Associated Commits (1)

Commit Hash	Message	Committed by	Files
f6929076a13aaaae55c02b124abfa39ad24b9051	Merged PR 229: Demo Feature Updated Index.cshtml	Marc Müller	<ul style="list-style-type: none"><li>/HelloWorldWeb</li><li>/HelloWorldWeb/Views</li><li>/HelloWorldWeb/Views/Home</li><li>/HelloWorldWeb/Views/Home/Index.cshtml</li></ul>

Related work items: # 150

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**Release Note Demo**

 ReleaseNotesDemo Build Service ... Sep 20, 2021

**Overview of Release Notes**

- [ReleaseNotes\\_0.1.41](#)
- [ReleaseNotes\\_0.1.42](#)
- [ReleaseNotes\\_0.1.45](#)
- [ReleaseNotes\\_0.1.48](#)
- [ReleaseNotes\\_0.1.49](#)
- [ReleaseNotes\\_0.1.50](#)
- [ReleaseNotes\\_0.1.51](#)
- [ReleaseNotes\\_0.1.52](#)
- [ReleaseNotes\\_0.1.53](#)
- [ReleaseNotes\\_0.1.56](#)
- [ReleaseNotes\\_0.1.57](#)
- [ReleaseNotes\\_0.1.58](#)
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- ReleaseNotes\_0.1.41
- ReleaseNotes\_0.1.42
- ReleaseNotes\_0.1.45
- ReleaseNotes\_0.1.48
- ReleaseNotes\_0.1.49
- ReleaseNotes\_0.1.50
- ReleaseNotes\_0.1.51
- ReleaseNotes\_0.1.52
- ReleaseNotes\_0.1.53
- ReleaseNotes\_0.1.56
- ReleaseNotes\_0.1.57
- ReleaseNotes\_0.1.58
- ReleaseNotes\_0.1.59
- ReleaseNotes\_0.1.62
- ReleaseNotes\_0.1.63

ReleaseNotes\_0.1.63

ReleaseNotesDemo Build Service ... Sep 20, 2021

## Release Notes

- Build Number: 0.1.63
- Build Trigger PR Number:
- Compared to: 0.1.62

### Pull Requests (1)

Id	Title
<a href="#">229</a>	Demo Feature

### Work Items (1)

Id	Work Item Info	Release Notes	Tags	Assigned
<a href="#">150</a>	<a href="#">150 Demo Feature</a>   Done	Very important new business functionality has been added.		Marc Müller

### Associated Commits (1)

Commit Hash	Message	Committed by	Files
f6929076a13aaaaea55c02b124abfa39ad24b9051	Merged PR 229: Demo Feature Updated Index.cshtml Related work items: # 150	Marc Müller	<ul style="list-style-type: none"><li>/HelloWorldWeb</li><li>/HelloWorldWeb/Views</li><li>/HelloWorldWeb/Views/Home</li><li>/HelloWorldWeb/Views/Home/Index.cshtml</li></ul>

New page

1 visit in last 30 days

A close-up, low-angle shot of several rowers in a racing shell. Their legs and the oars are visible, with water splashing around the blades. The background is blurred.

## Top 10 Multistage YAML Pipeline Features

# Q & A

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# Thank you for your attention!

If you have any questions do not hesitate to contact us:

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A close-up photograph of several hands reaching towards a central wooden puzzle piece. The puzzle piece is light-colored wood with a dark green and red section. The hands belong to different people, suggesting collaboration. The background is blurred.

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