Runbook for CI/CD with Azure DevOps for Cora SeQuence projects

For Cora SeQuence V9.*x*

December 2021

Contents

Notice

What is CI/CD with Azure DevOps?

CI/CD with Azure DevOps is an automated platform on the Azure cloud that enables you to continuously integrate developed applications (projects) with the Azure cloud and continuously deploy the developed application to any Cora SeQuence environment like UAT or production (Live) seamlessly via pipelines. After all the pipelines are created and set up properly, the whole process can run automatically without any manual intervention.

Continuous Integration (CI) is the practice used by development teams to automate the merging and testing of code. Implementing CI helps to catch bugs early in the development cycle, which makes it less expensive to fix. Automated tests run as part of the CI process to ensure quality. Artifacts are produced from CI systems and fed to release processes to drive frequent deployments. The Build service in the Azure DevOps Server helps you set up and manage CI for your applications.

Continuous Delivery (CD) is a process by which code is built, tested, and deployed to one or more test and production environments. Deploying and testing in multiple environments drives quality. CI systems produce the deployable artifacts including infrastructure and apps. Automated release processes, CD processes, consume these artifacts to release new versions and fixes to existing systems. Monitoring and alerting systems run continually to drive visibility into the entire CD process. The Release service in the Azure DevOps Server helps you set up and manage CD for your applications.

To configure CI and CD, you create pipeline definitions. A pipeline definition is a representation of the automation process that you want to run to build and test your application. The automation process is defined as a collection of tasks. Azure DevOps pipelines have a few inbuilt tasks to help you build and test your application. You can further customize your pipelines by adding your own command lines, PowerShell commands, or Shell scripts in your automation.

Want to learn more?

What is CI/CD?

What is Azure DevOps?

CI/CD with Azure DevOps

Application life cycle: from the developer's machine to the production environment

1. The developer (with permissions) creates a project in his/her local machine.

2. The CI/CD System Admin creates a repository (repos) in the local machine using GIT commands (Source control system).
   A repository, also called repos for short, is a folder with version control tools that you can use to manage your code.
   Version control systems are software that help you track changes you make in your code over time. As you edit your code, you tell the version control system to take a snapshot of your files. The version control system saves that snapshot permanently so you can recall it later if you need it.
   Use version control to save your work and coordinate code changes across your team.

3. The developer creates an Azure repo in Azure DevOps (cloud server).

   Note that the Azure repo in Azure DevOps is the implementation of GIT in the Azure cloud.

4. The developer then creates a CI pipeline in the Azure portal to push the project from the developer's machine repo into the Azure DevOps repos. The result is an artifact that is stored in the Azure cloud.

The pipeline contains build tasks that are composed of tasks like getting the source code, building the solution, running tests, packaging artifacts, and finally publishing the artifacts.

A pipeline is similar to a script with a list of command tasks that are executed in sequence. They could include commands such copy file, delete file, execute a PowerShell command, and others. The artifact is the packaged software that results after the pipeline completely executes all its commands and tasks.

5. The CI pipeline (that is, the build job and tasks) is run by an agent machine. Azure usually provides a VM (Microsoft hosted machine) that is used as the agent machine. However, the developer can use his/her own hosted machine as the agent machine.

6. The developer creates a CD pipeline (consisting of a list of tasks) that is used for deploying and testing the artifact into multiple environments, like Dev, QA, or Production.

   Note that the CD pipeline is also run by the agent machine.

7. The developer can add approvals at certain stages so that projects can be approved by QA. For example, before the project gets deployed into production.

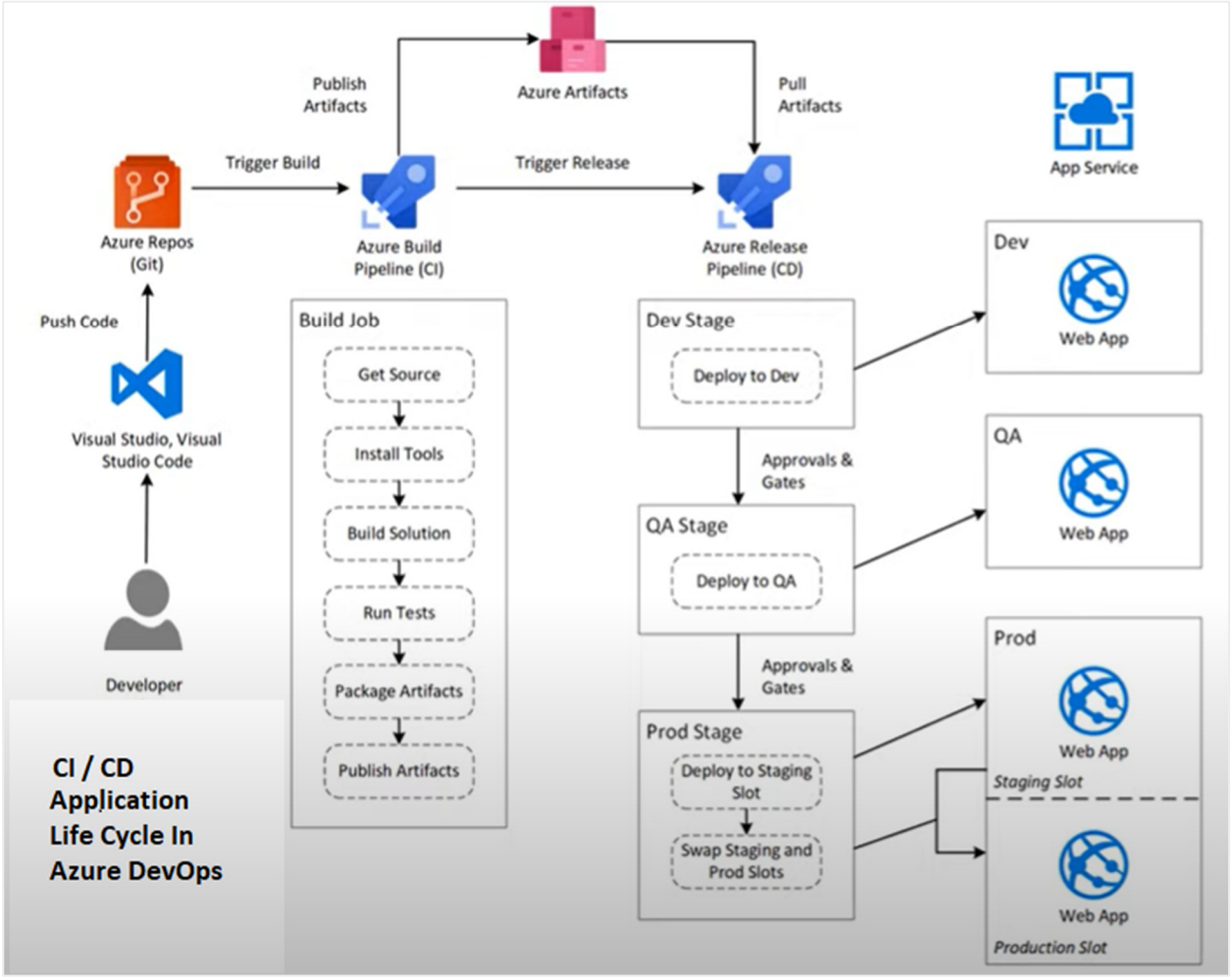
The CI/CD process can be fully or partially automated.

In a fully automated CI/CD process, there's no user intervention. As soon as the user pushes the source code in the GIT repo of the local machine, the whole CD/CD process gets executed and all the environments (UAT, Production, and others) are updated as per the configured CI/CD process.

In a partially automated CI/CD process, some of the processes, like copying the files to the Azure repo, are done manually. Or the pipelines are triggered manually by the user.

The CI/CD process at a very high level

Deploying an application to different environments using the CI/CD process.



CI/CD for Cora SeQuence

In order to set up the pipelines, the **DevOps System Admin** needs relevant project details, such as server name, database username and password, Administration folder name, and SeQuence Administration URLs.

These details are usually provided by the **Tech Lead** or **Project Manager** who created the Cora SeQuence project on the Azure DevOps platform.

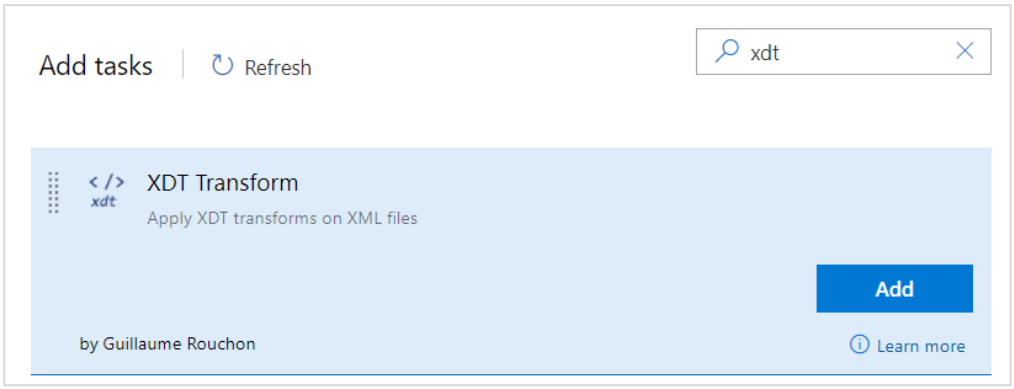
Setup prerequisites

The **Tech Lead** or **Project Manager** needs to set up the following components:

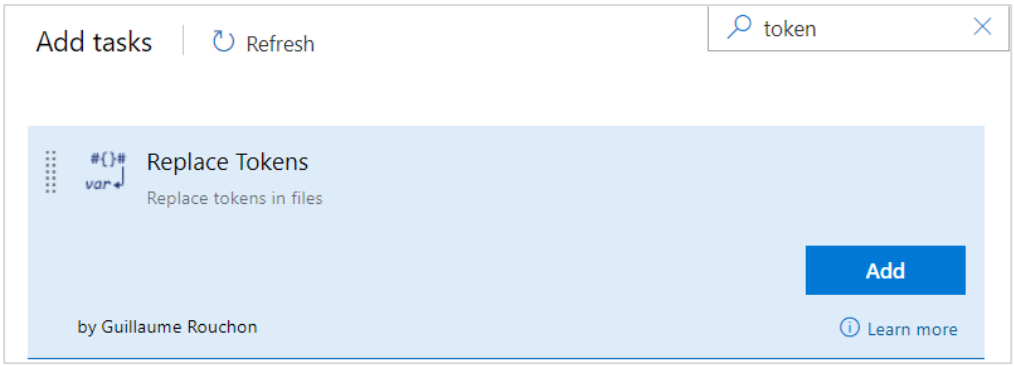
- **Servers**: The DEV, TEST, and PROD servers need to be setup.
- **Users**: The Tech Lead or Project Manager needs to create users in the Azure DevOps platform for whoever needs to access the Azure portal. Because all users need access to the Repos section, they need to have at least the basic license (not the Stakeholders license).
- **Network**: There needs to be physical network connectivity between the servers and the Azure DevOps application. Several URLs need to be whitelisted to ensure a seamless experience with Azure DevOps.

  For more information, see this article: Allowed IP addresses and domain URLs

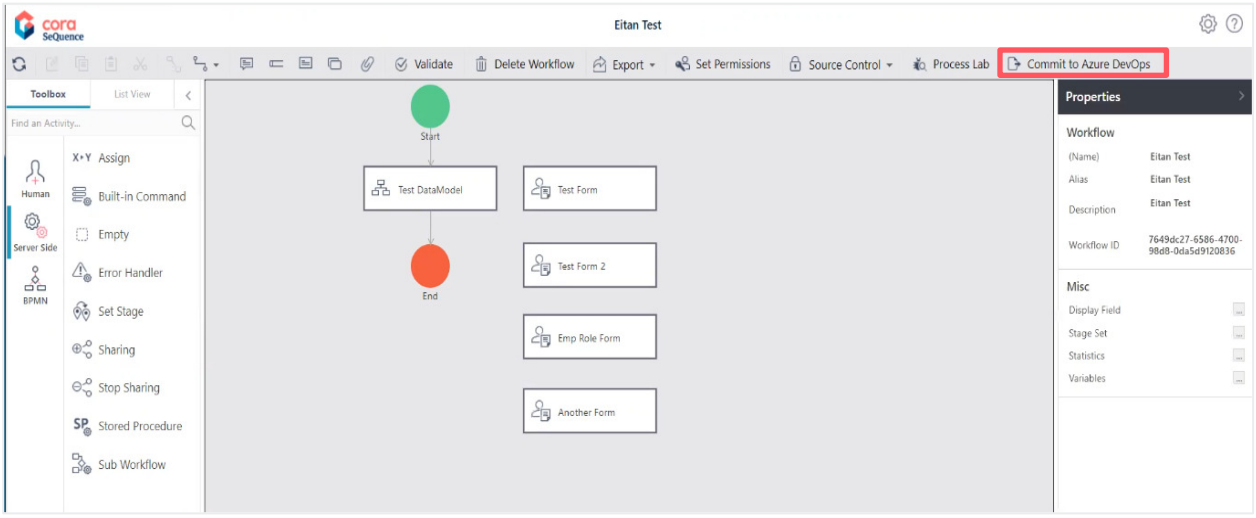
- **Additional tasks**: The Tech Lead or Project Manager needs to add the following tasks to the Azure DevOps platform through the Marketplace:
  - XDT Transform



  - Replace Tokens



After the project is configured, the **DevOps System Admin** can set up the pipelines in the Azure DevOps platform. The setup includes installing the CI/CD tool on each server and making the **Commit to Azure DevOps** button available in the Administration site.

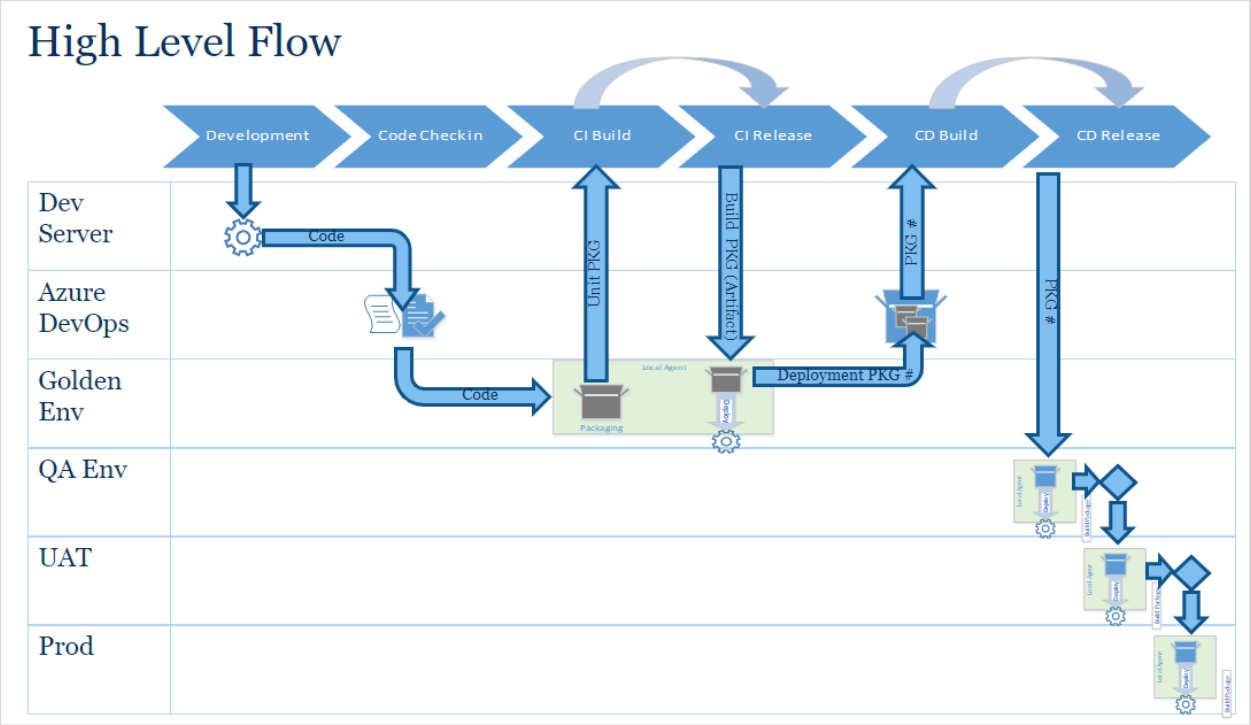


Update workflows or customize applications

You use CI/CD pipelines for two main purposes:

- Update workflows or workflow-related applications.
- Customize Cora SeQuence features.

The following diagram provides a very high-level overview of the CI/CD process for Cora SeQuence projects and applications.



Note

The **Golden environment** is where the artifact (software package) is stored after running the CI pipelines. The artifact is used by the CD pipeline to propagate the software to other environments.

Update workflows

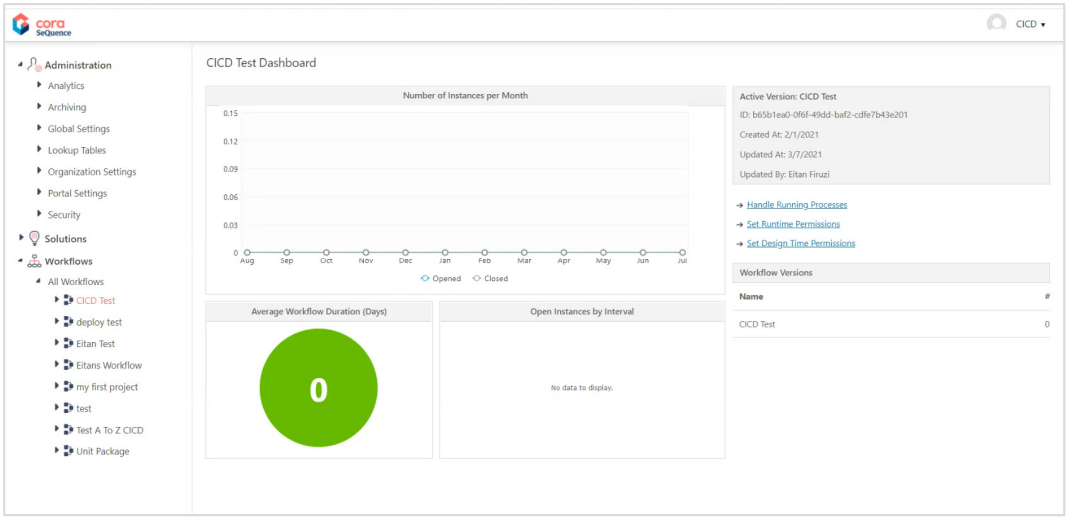
You can use two pipeplines to deploy workflows and workflow elements on different environments.

- **Unit Package (CI Pipeline)**: packages workflows that have been committed to Azure and creates an artifact in the project's repo.
- **Processes Release (CD Pipeline)**: takes the artifact from the Azure repo and deploys it to the target environment as specified in the pipeline

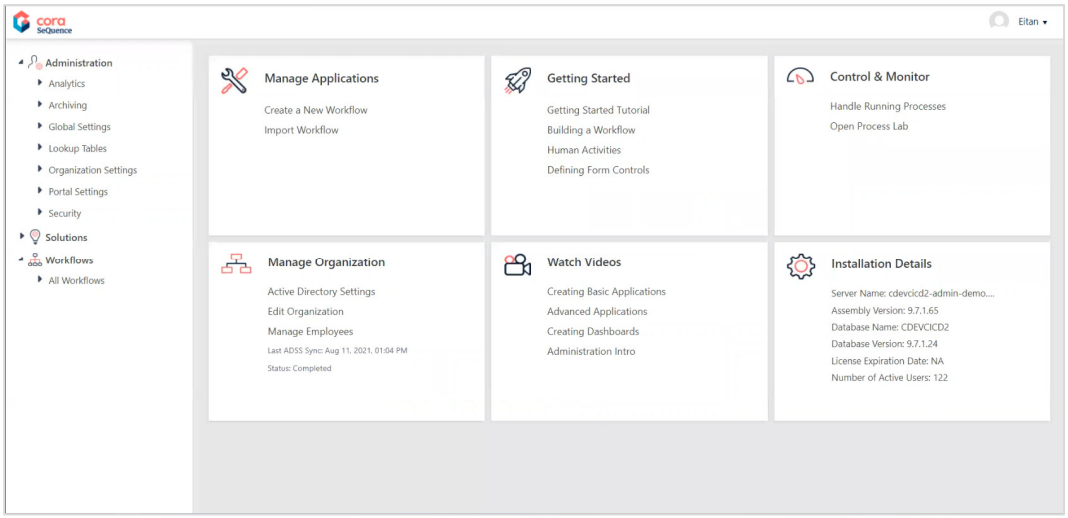
We are going to use an **example** to demonstrate how to use the two pipelines.

Assume you already have two Cora SeQuence environments set up:

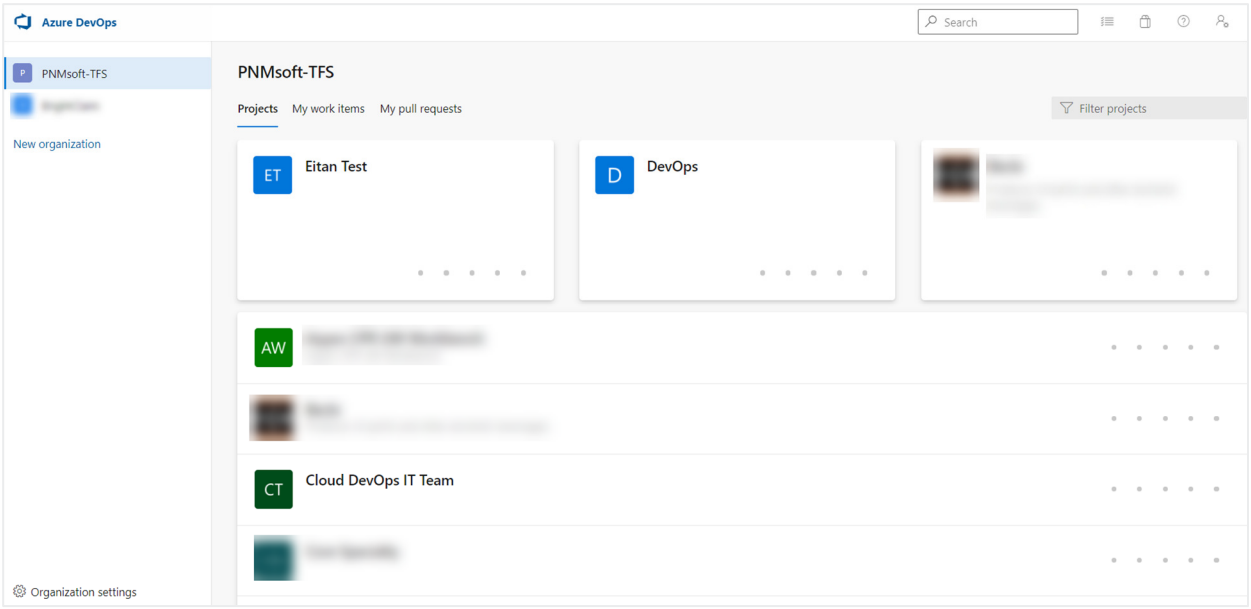
- Environment 1: CDEVCICD1 (Dev server)



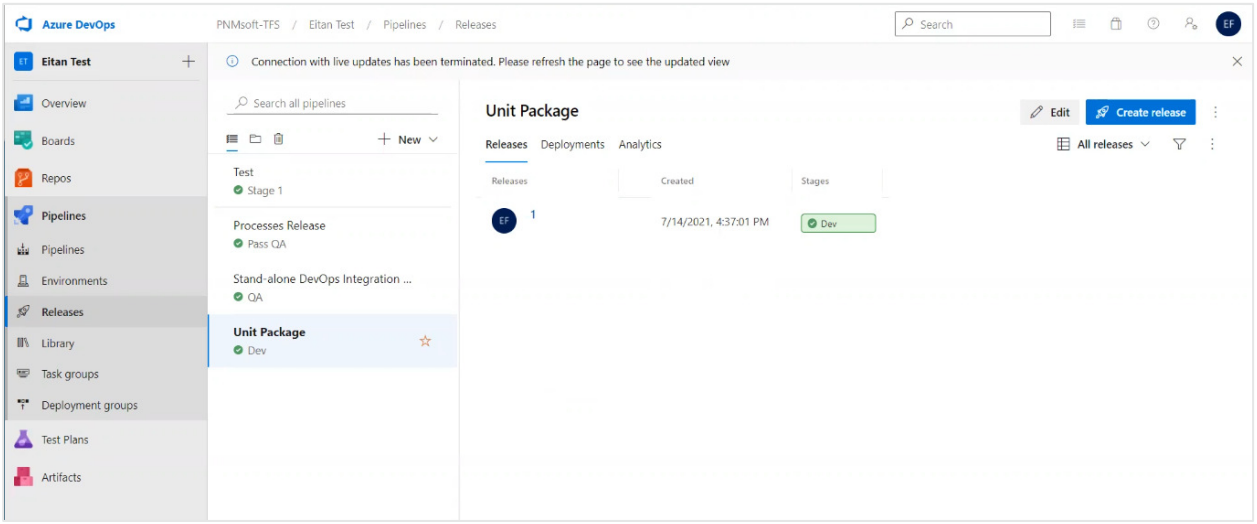
- Environment 2: CDEVCICD2 (Test server)



Let's have a look at the pipelines in the Azure DevOps Portal.



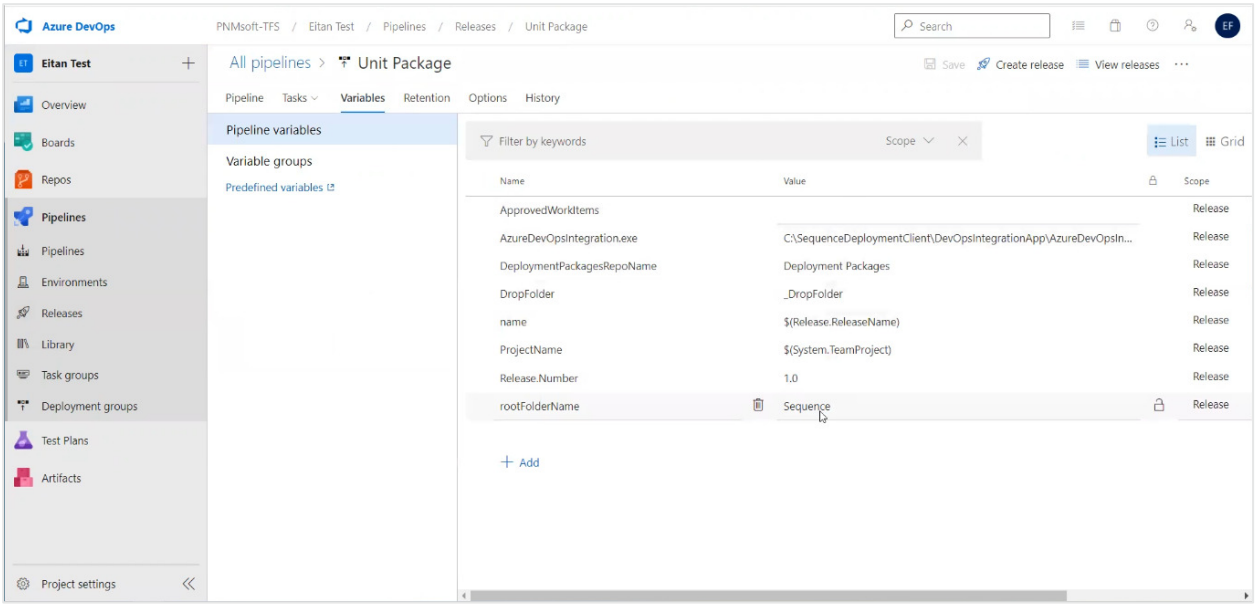
We have an Organization, PNMsoft-TFS, and under that Organization, we have the project Eitan Test.



Under the Eitan Test project, there are a few pipelines, including Unit Package (CI Pipeline) and Processes Release (CD Pipeline).

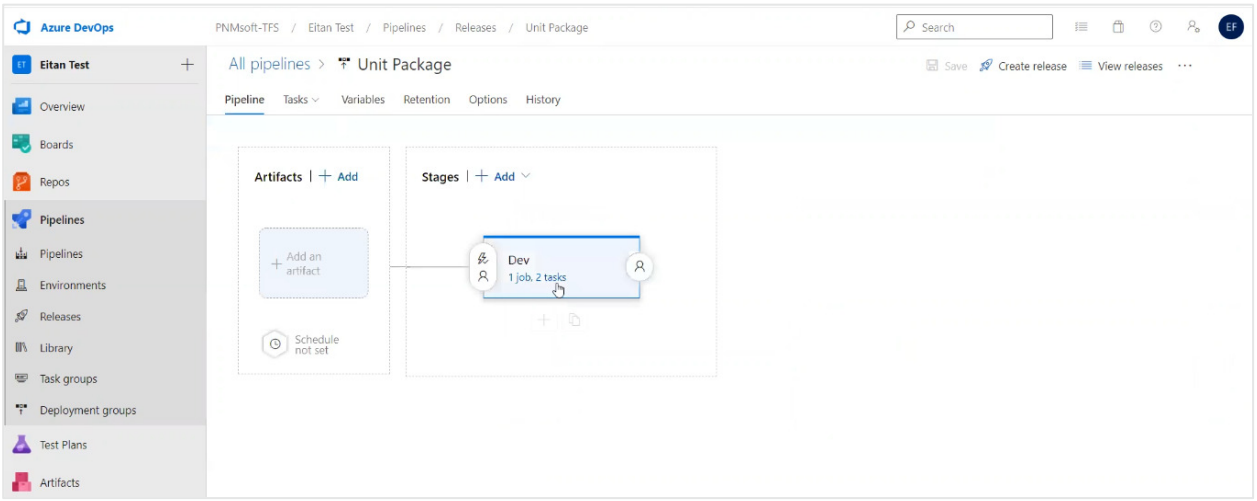
The Unit Package pipeline

Variables available in the Unit Package (CI) pipeline.

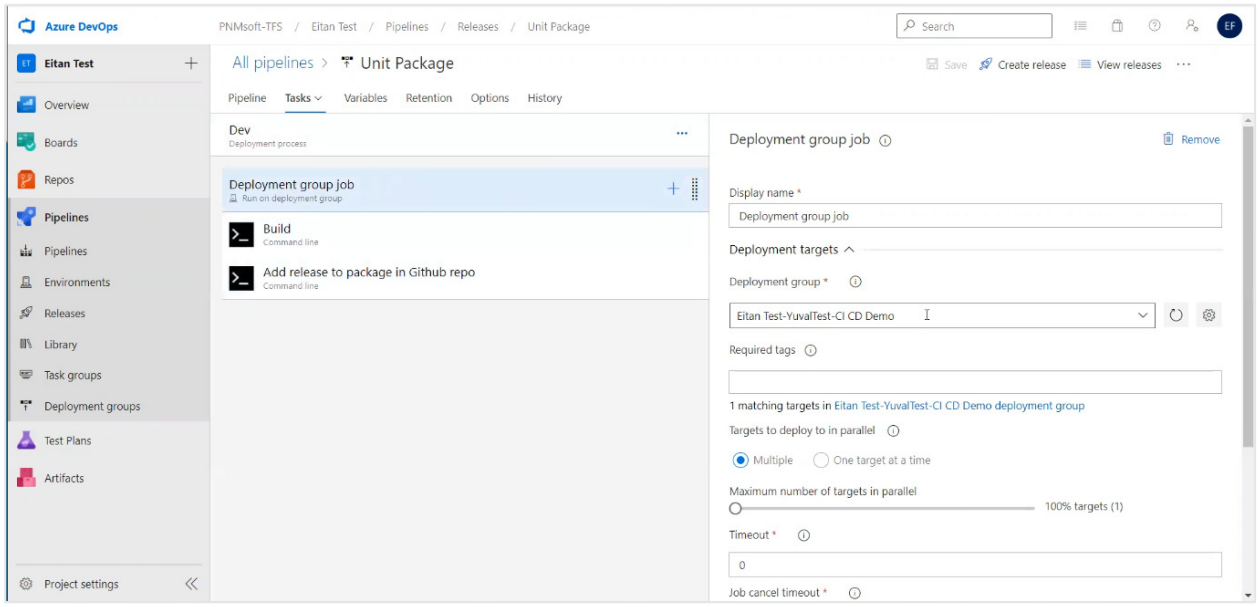


We use the variables to specify the repos of the source project and destination repos of the artifact and other properties needed for the CI process. This configuration is currently done by the PS CI/CD System Admin.

Graphic view of the Unit Package pipeline

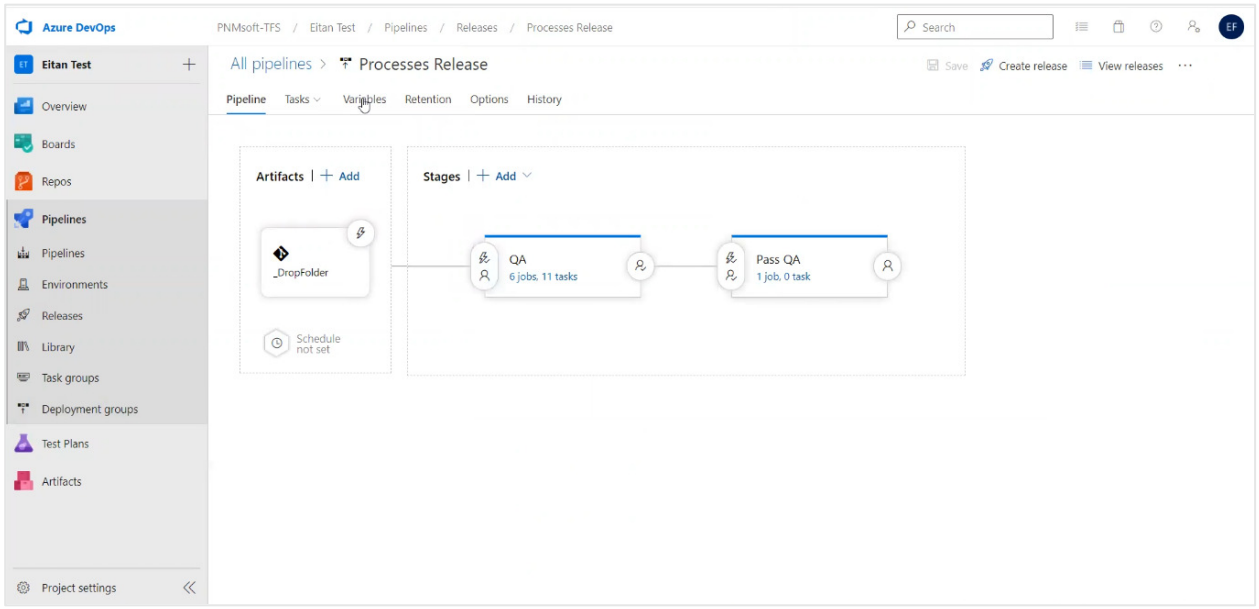


Unit Package pipeline tasks

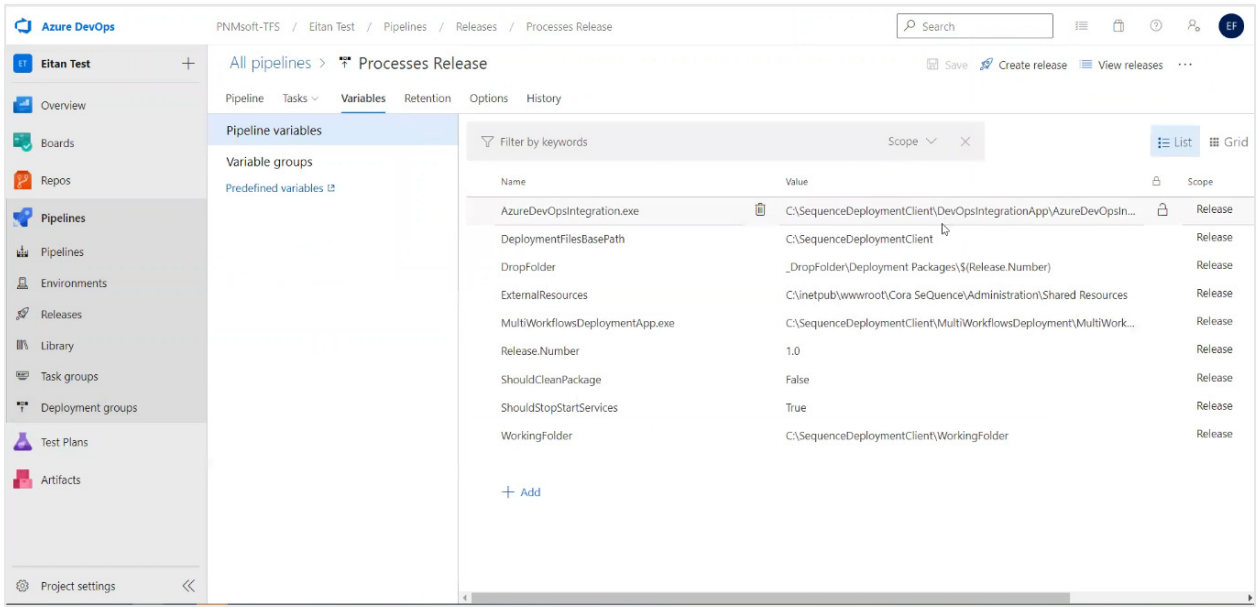


The Processes Release pipeline

Graphic view of the Process Release (CD) pipeline. There are two stages in the pipeline: QA and Pass QA.

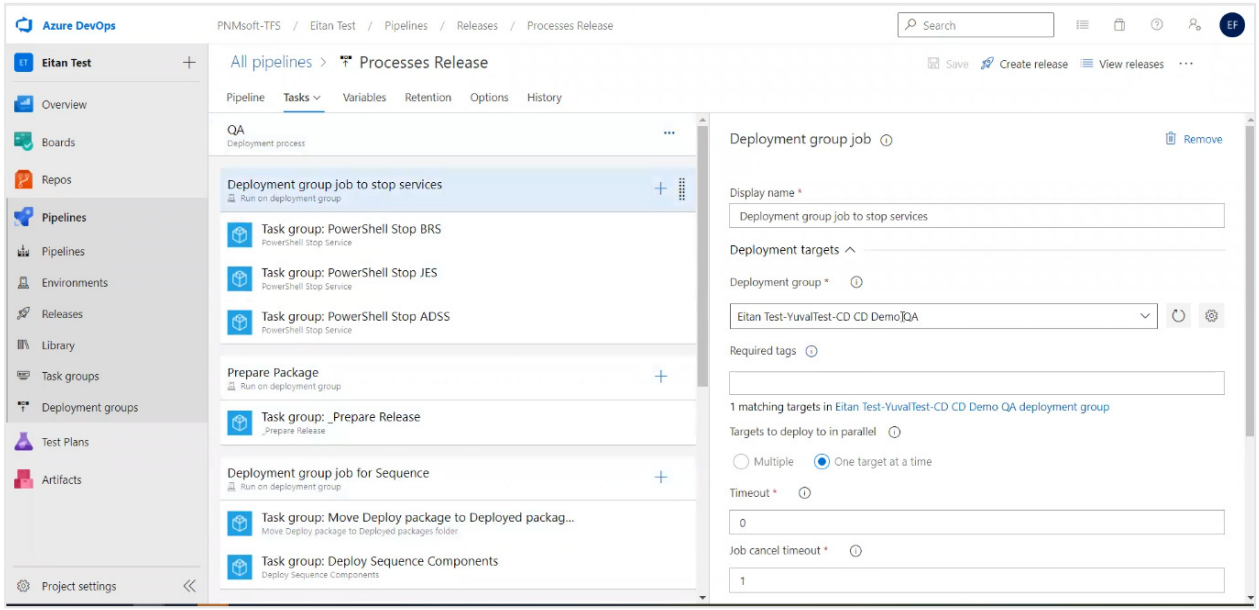


Variables available in the Process Release (CD) pipeline.

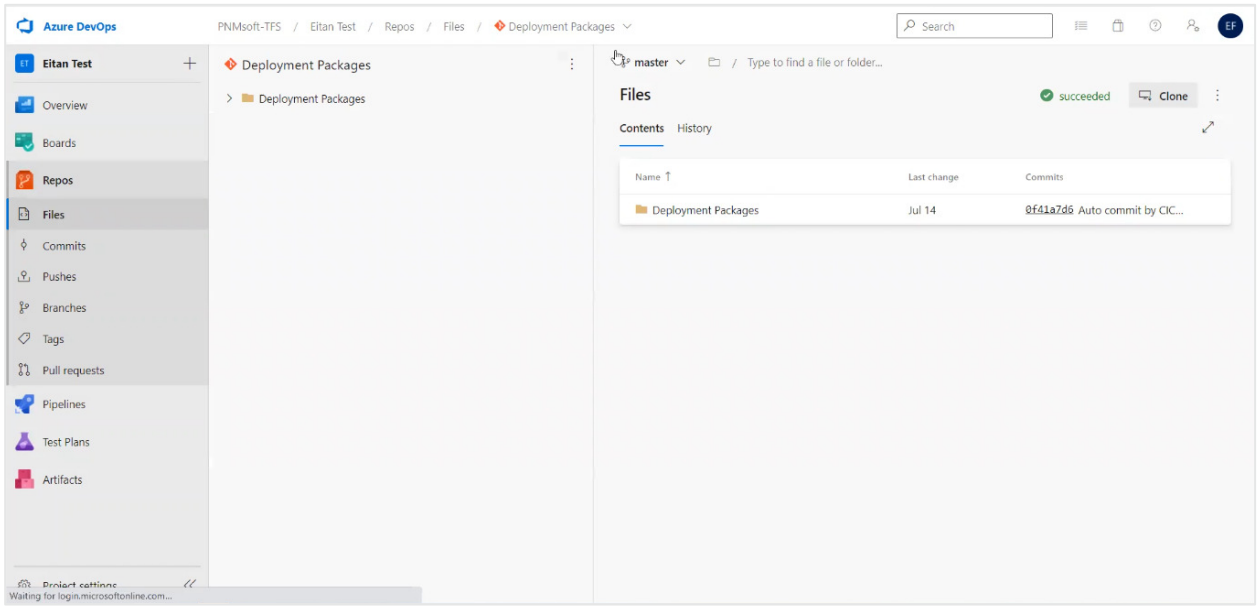


These variables specify the artifact repos and the destination repos where the applications will be deployed, and additional properties needed for the CD process.

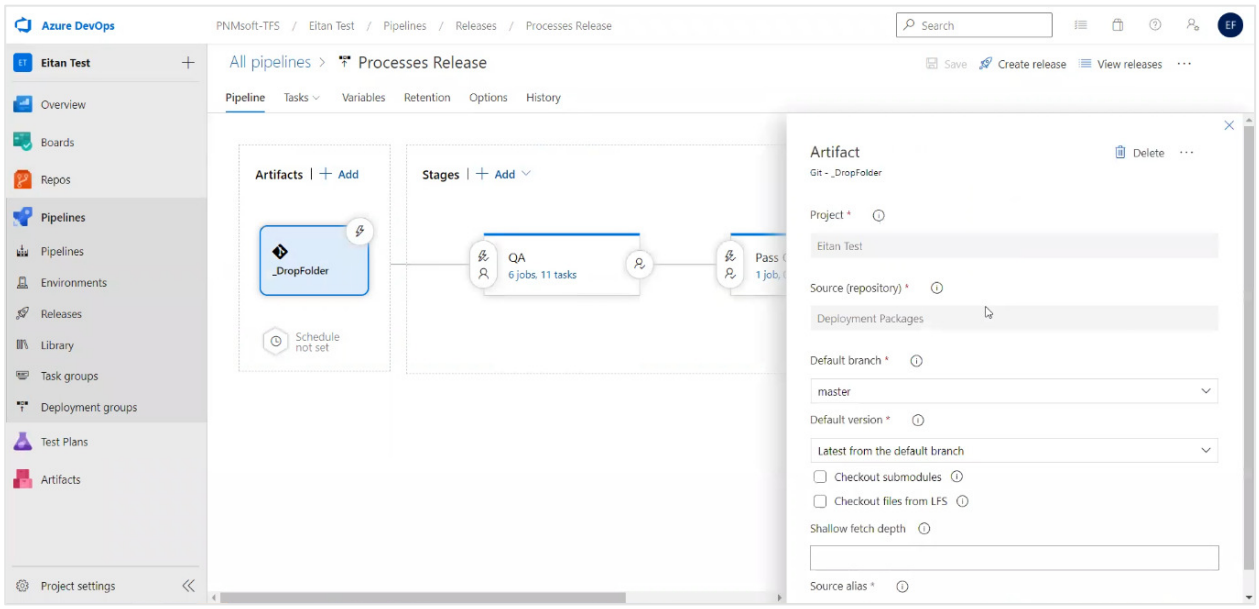
Process Release (CD) pipeline tasks



This is the repo of the Azure DevOps where the CI pipeline stores the project after processing. That is, the Deployment packages folder.



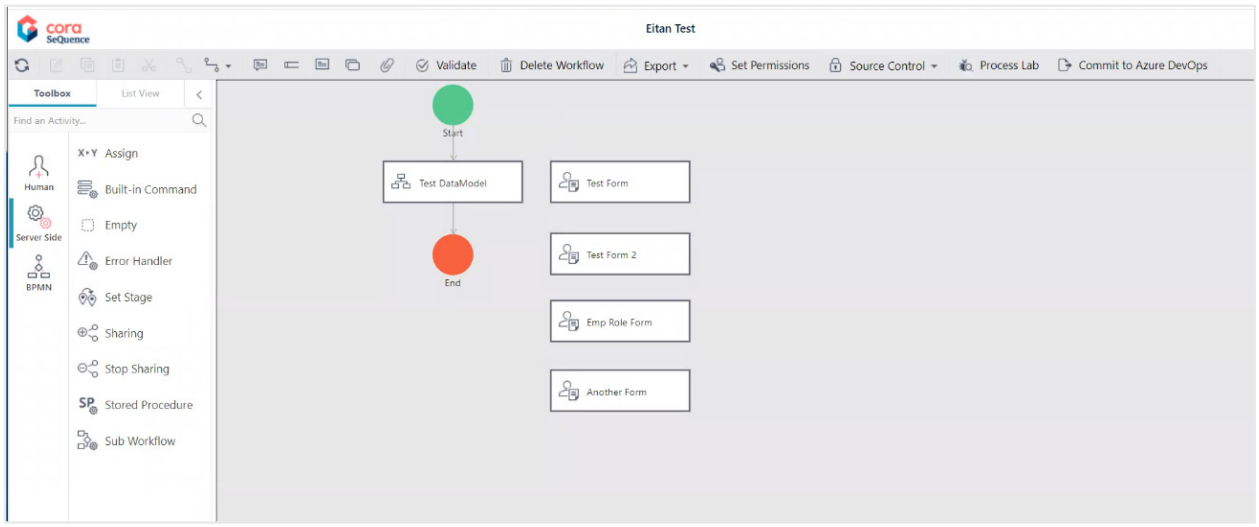
The Artifact source points to the repo configured in the previous screenshot. That is, the Deployment Packages folder.



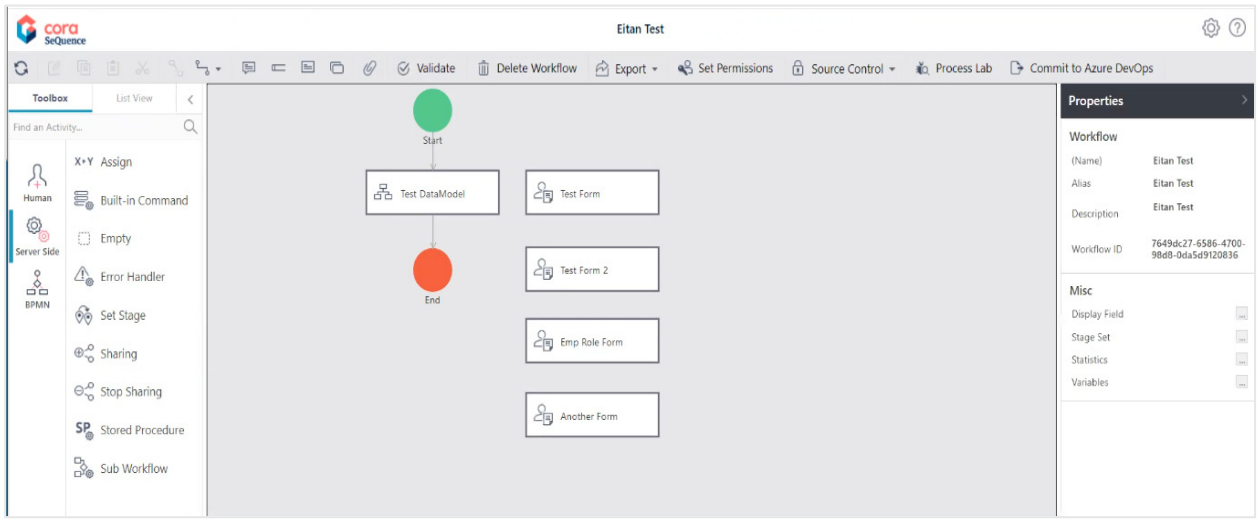
Executing the pipelines

In this example, we're going to change the Development server, CDEVCICD1, and then propagate the change to the Test server, CDEVCICD2.

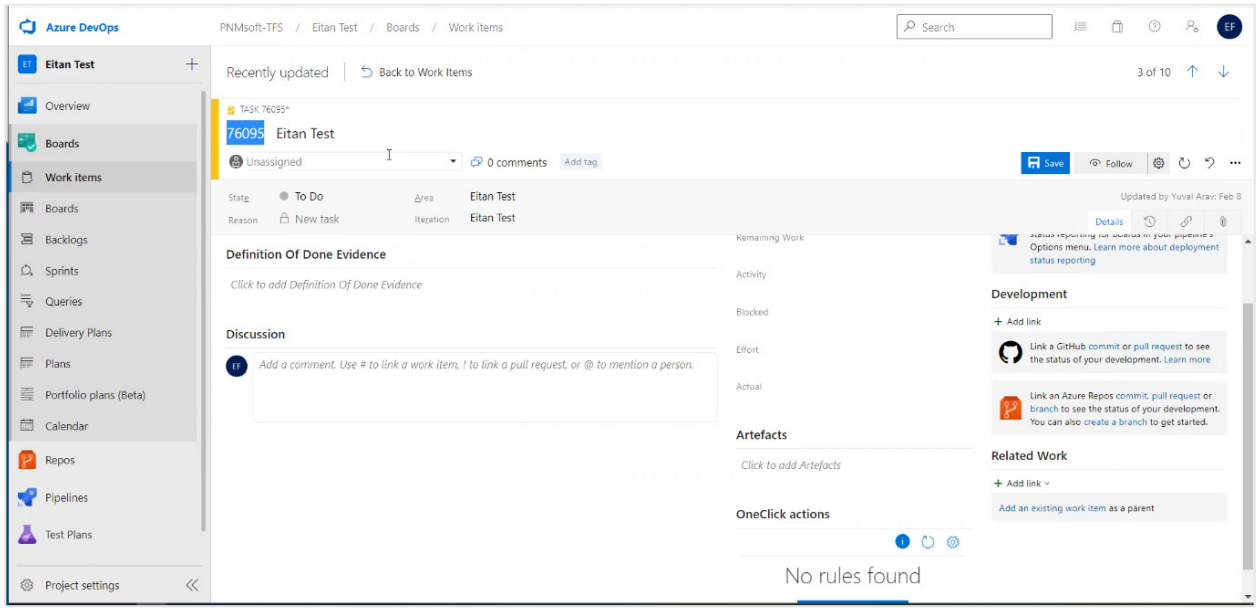
Development server CDEVCICD1



Test server CDEVCICD2



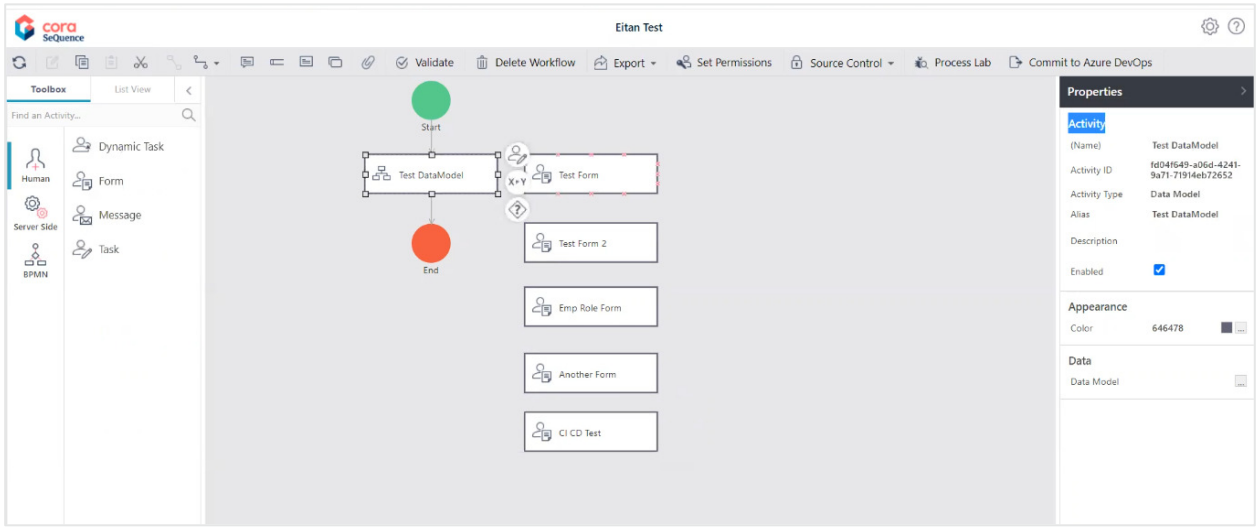
You need to connect the change to a work item on Azure DevOps. The work item includes detailed instructions about the change and it can also include related documentation.
In this example, we use the work item 76095.



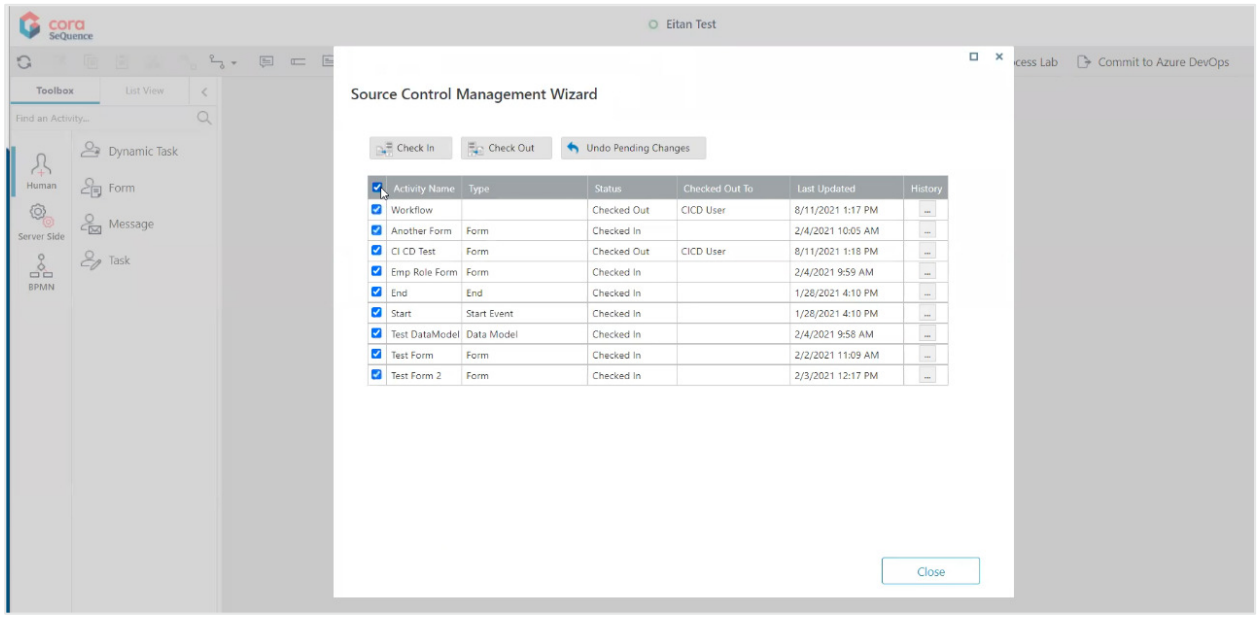
Note
If a work item doesn't exist, you can create it in Azure DevOps.

Commit to Azure DevOps

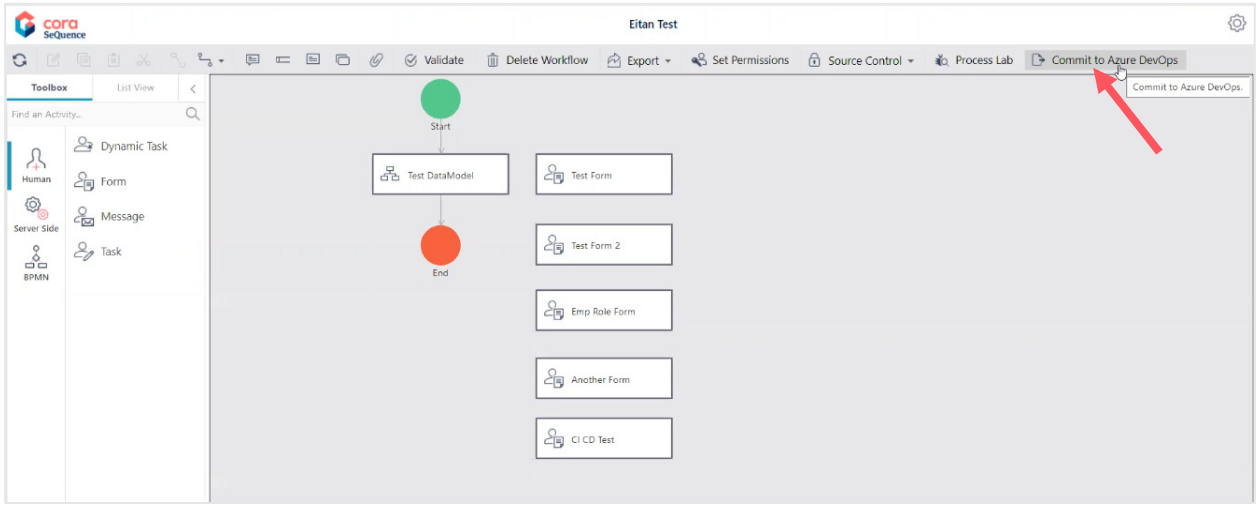
In the following example, we've added a Form activity called **CI/CD Test** to the workflow Eitan Test in the Development server.



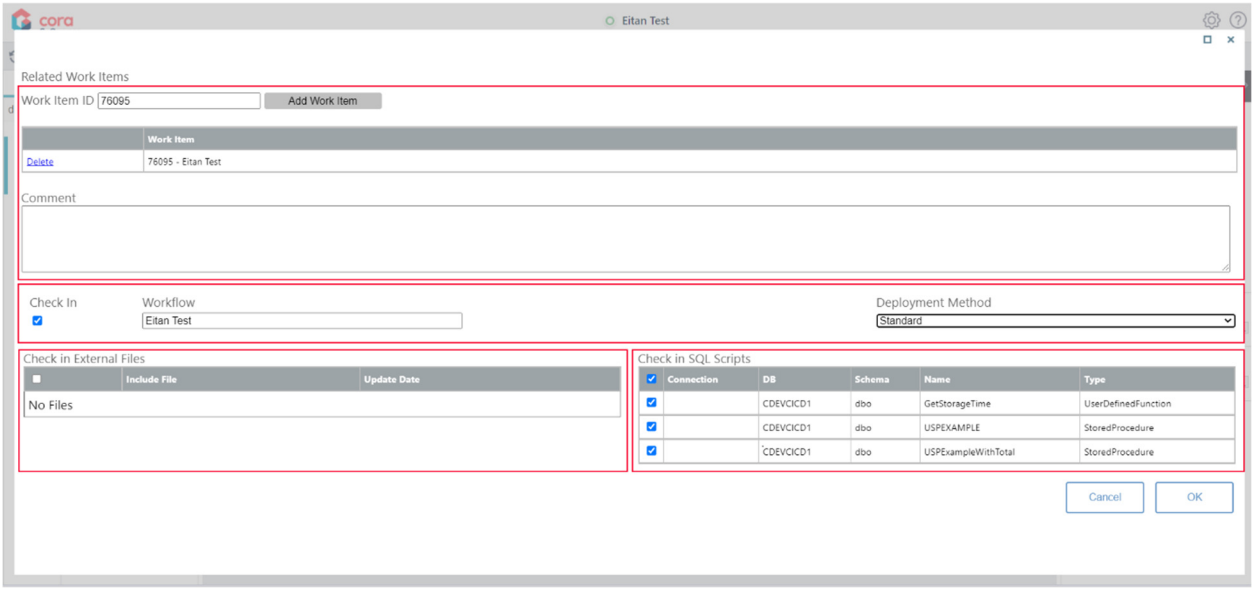
After adding the new form, check in the workflow.



After check-in, commit the workflow to Azure DevOps. Click the **Commit to Azure DevOps** button.



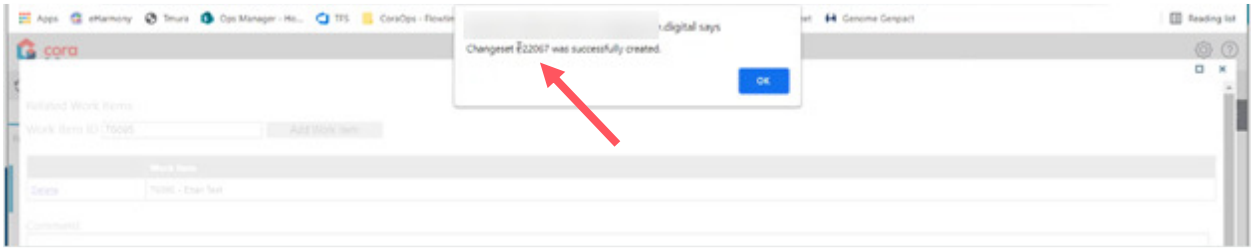
After you click **Commit to Azure DevOps**, the following screen displays:



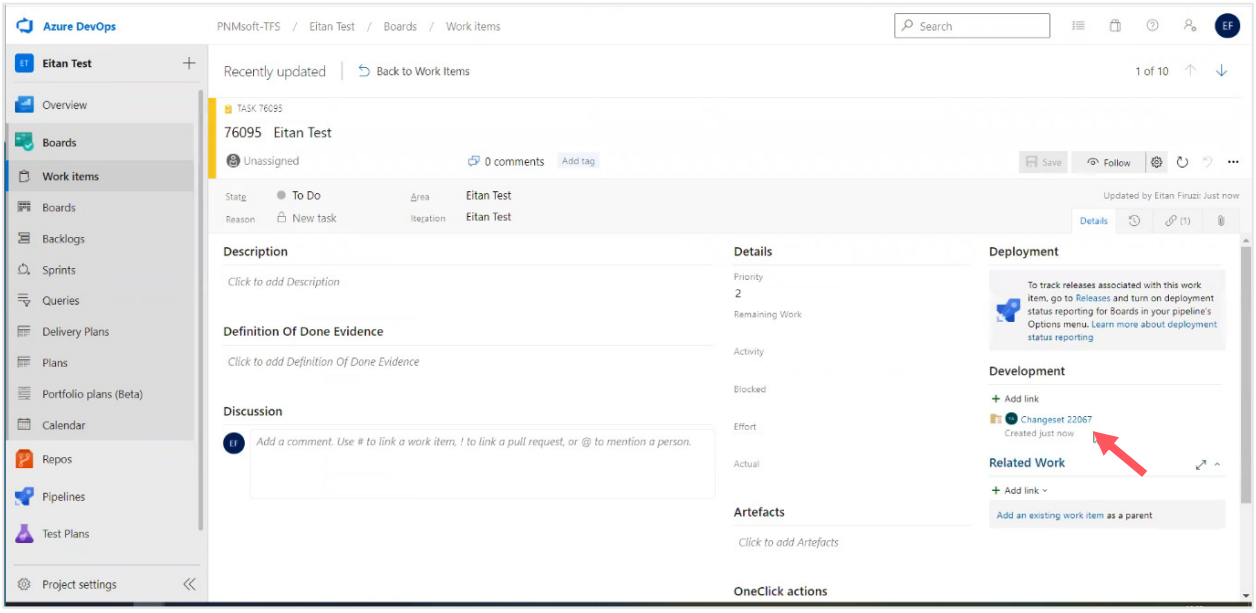
It includes the following main configuration areas:

1. **Work Item**
   a. Click **Add Work Item**.
   We need to connect every change to a work item in Azure DevOps.
   You can link multiple changes to the same work item.
   In this example, the work item ID is 76095.
2. **Workflow**
   a. Select the **Check In** checkbox.
   b. Verify that the displayed workflow name is the correct one.
   In this example, it is **Eitan Test**.
   c. Select the relevant deployment method.
   For more information about deployment methods, see Deployment methods.
3. **External files**
   We need to indicate all the files that are relevant to the change that we made.
   a. Under Check In External Files, select the relevant files, if required.
   Our example doesn't include external files.
4. **SQL scripts**
   We need to indicate all the *database objects* that are relevant to the change that we made.
   a. Under Check In SQL Scripts, select the relevant database objects.
   In our example, all the stored procedures are required.

After the commit is successful, we get a changeset number.



You can also view the changeset in Azure DevOps under the work item number 76095.



Deployment methods

Related only to the workflow that we are deploying and not to files and database objects.

Method	Description
Standard	Deploys the workflow, including all its activities, permissions, and Cora SeQuence standard tables within the workflows. This method doesn't deploy stored procedures, views, reference data, and all the end points definition within the workflow (system objects elements).

Method	Description
End Point	Deploys the workflows and its end points. For example, the web consumer's definition and URLs, without the referenced data within the workflow. Doesn't deploy the permissions.
Data Incremental	Deploys data within the workflow. For example, lookup tables, in an incremental method. Doesn't deploy the permissions.
Data Overwrite	Deploys data within the workflow. For example, lookup tables, in an overwrite method – overwrite the exiting data in the target environment. Doesn't deploy the permissions.

Best practices

Dos

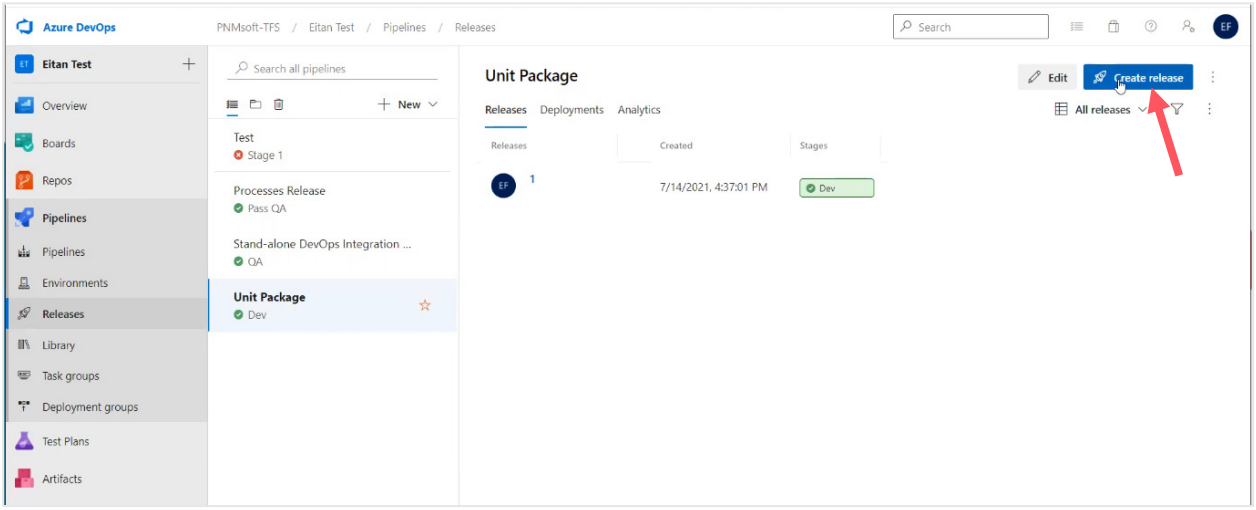
- Have a separate workflow that holds only the end points.
  Deploy the workflow using the End Point deployment method.
- Have a separate workflow with the data model that holds only the data objects.
  For example, tables and stored procedures.
  Deploy the workflow using the relevant data deployment method (Incremental or Overwrite).

Don'ts

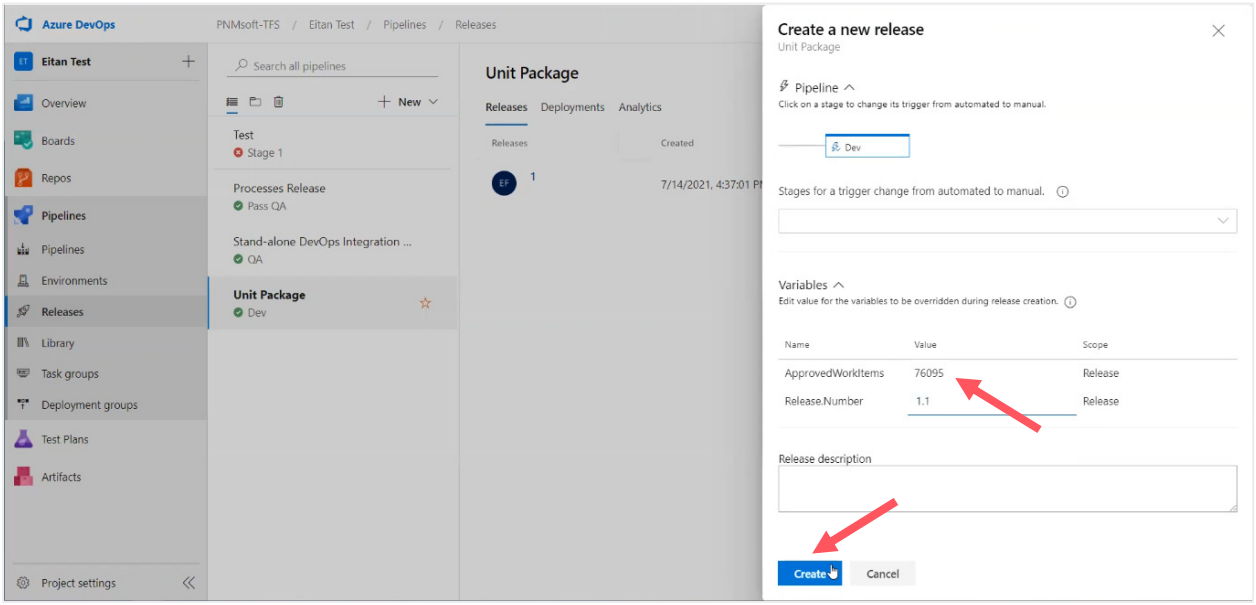
- Don't deploy the same workflow with several deployment methods to create End Points/Data.
  If required, create a separate workflow for deploying end points and another one, for deploying data.

Execute the Unit Package pipeline

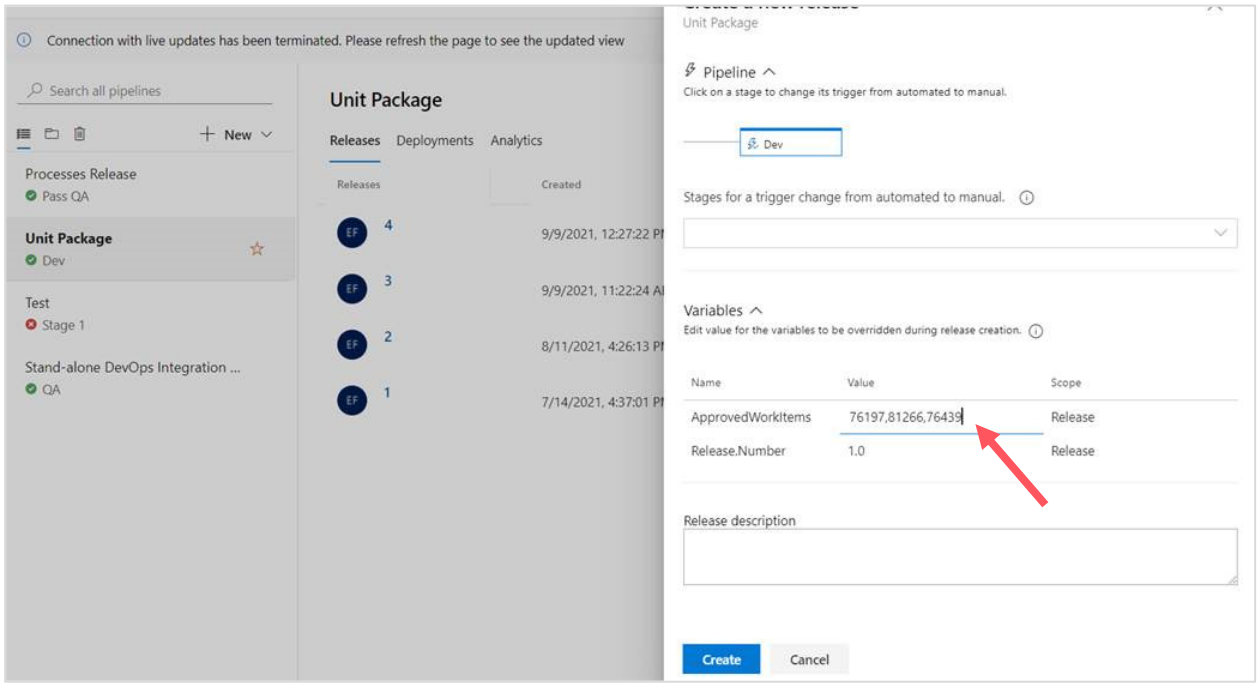
After the commit has been made, we need to execute the CI pipeline Unit Package in Azure DevOps by clicking on the **Create Release** button.



We add the work item number in the **ApprovedWorkItem** text box, 76095, and the Release Number, 1.1 (in this example). And then, click the **Create** button to start the Job.

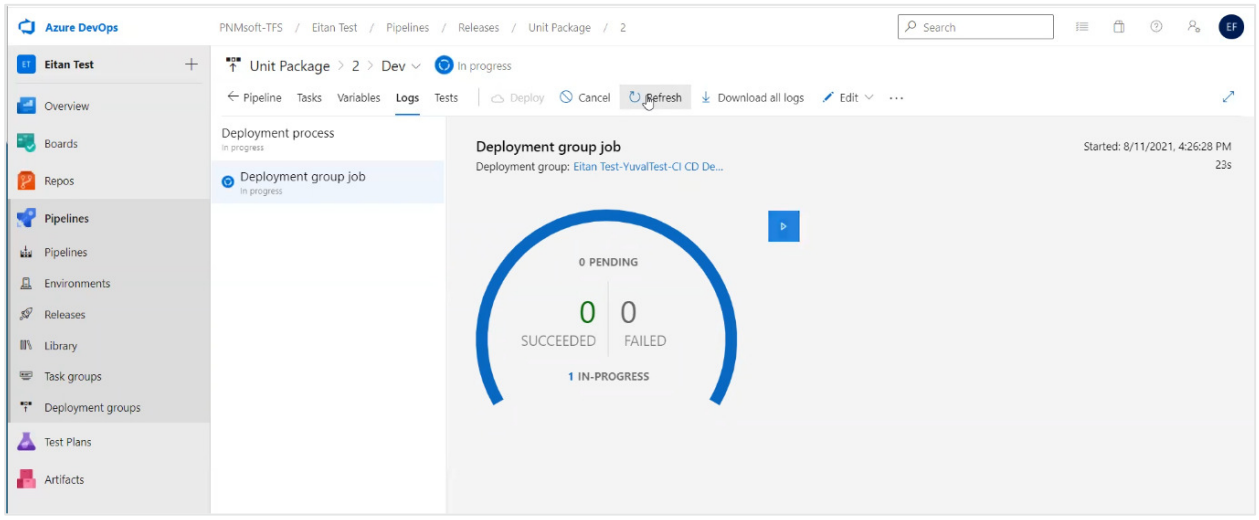


In case we want to deploy multiple work items in one go (that is, multiple changesets) in the Unit Package, we can add multiple work items by separating them with a comma without any space (see screenshot below).

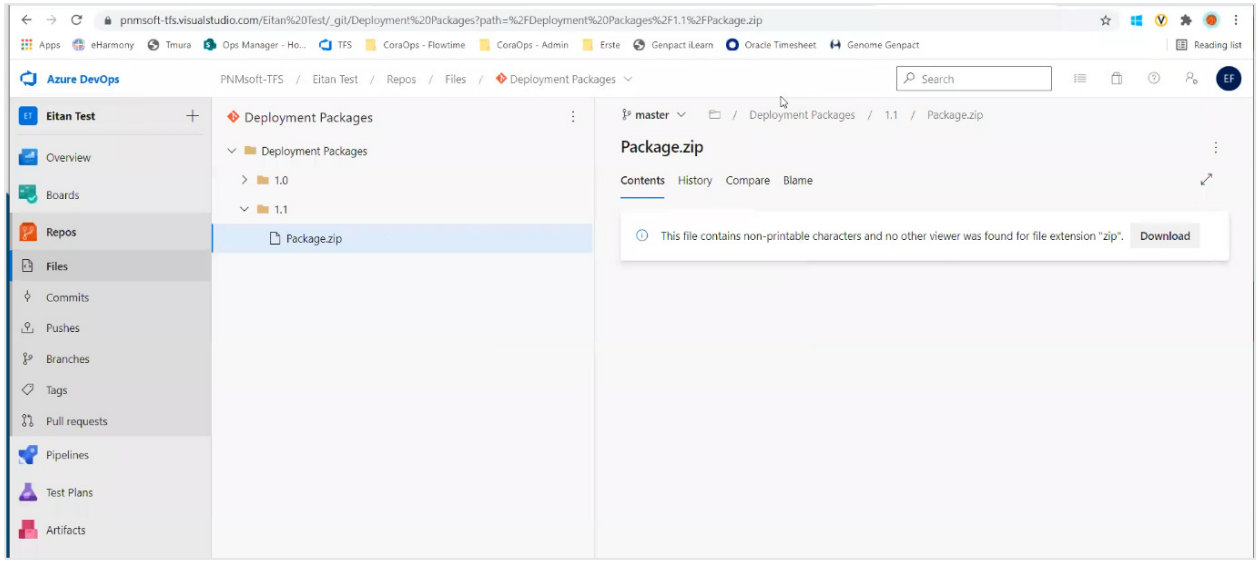


Deploying several changesets saves time and provides the option to package a few workflows from different work items to the same package.

After the CI pipeline job has started, we can track its progress on the following screen:

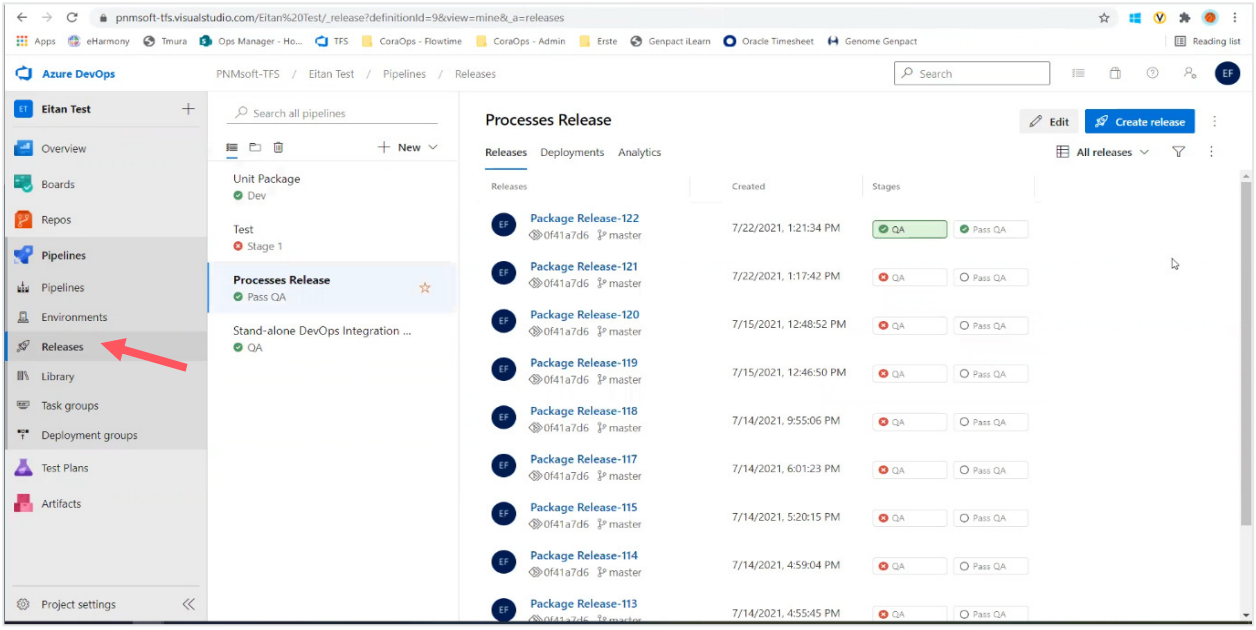


After the CI pipeline finishes running, the **Package.zip** is created as an artifact in the deployment package folder.



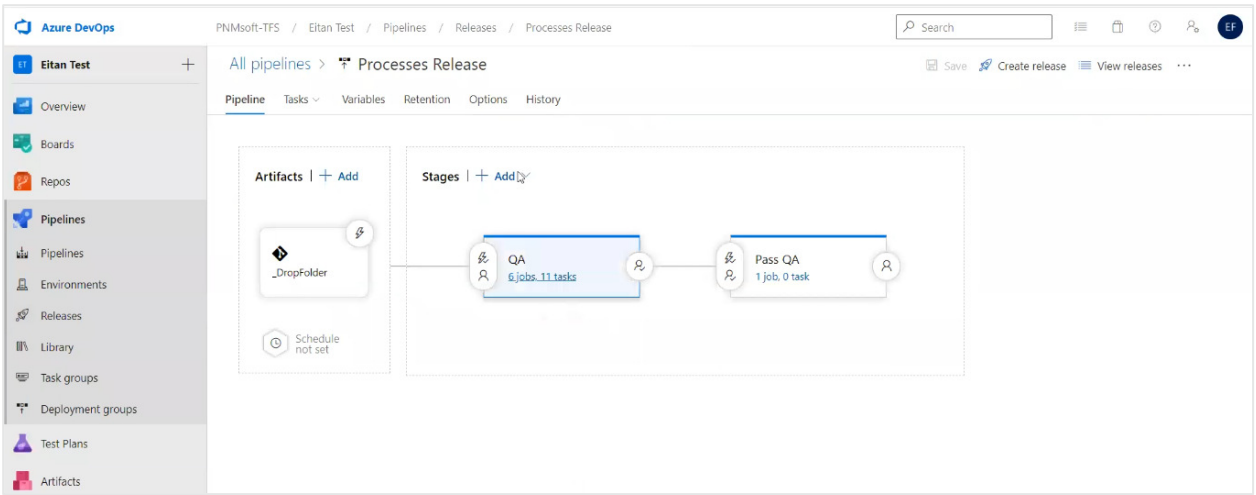
Execute the Processes Release pipeline

After the artifact Package.zip has been created, we can now execute the CD pipeline (Processes Release pipeline).

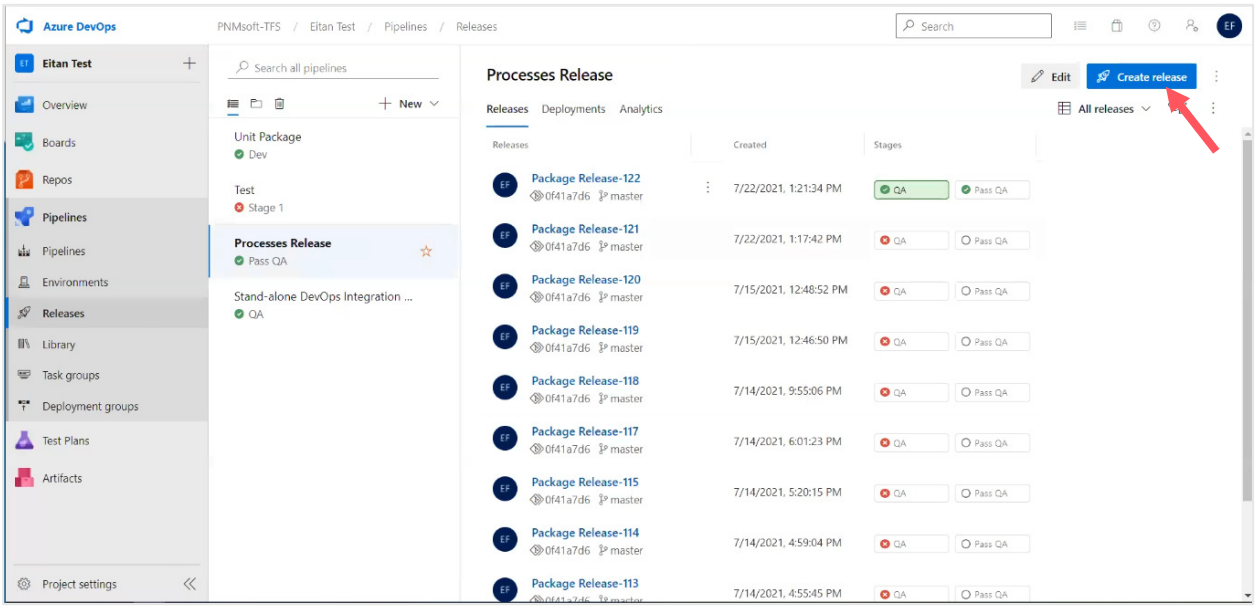


To view a list of the pipelines, in the Azure DevOps portal, in the left-panel menu, click **Releases**, and then select **Processes Release**.

Graphical view of the Processes Release CD pipeline

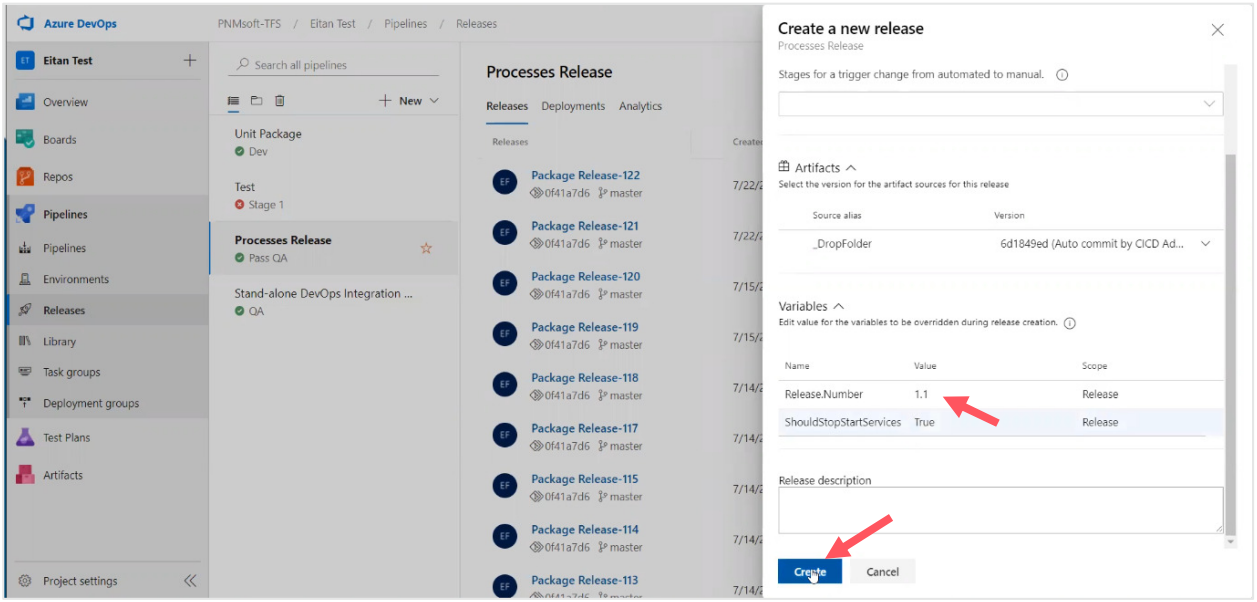


To execute the pipeline, click the **Create release** button.

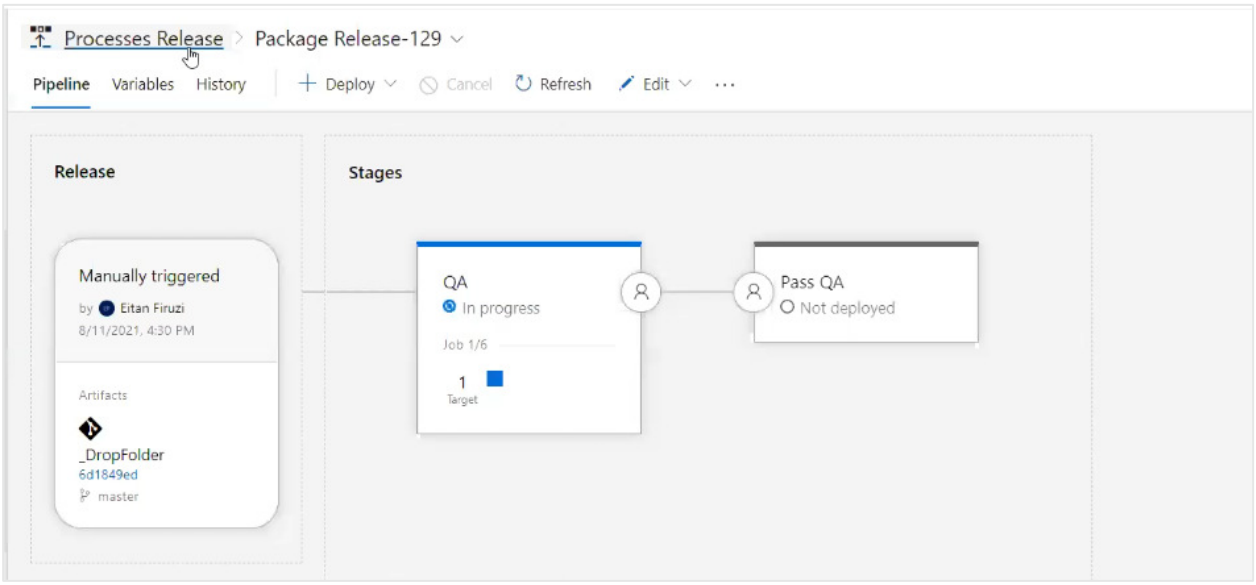


Enter values for the **ReleaseNumber** (give a version number to the release) and **ShouldStopStartServices** fields (specify if IIS should be stopped and restarted after the packages are deployed).

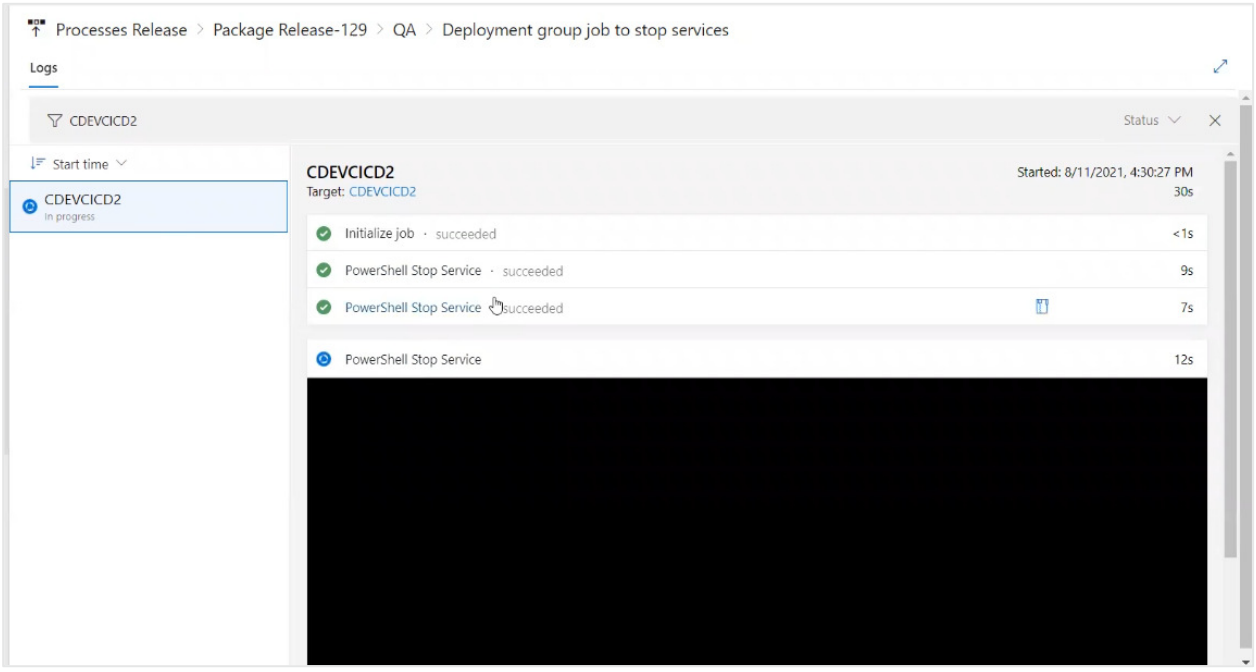
To begin execution, click **Create**.



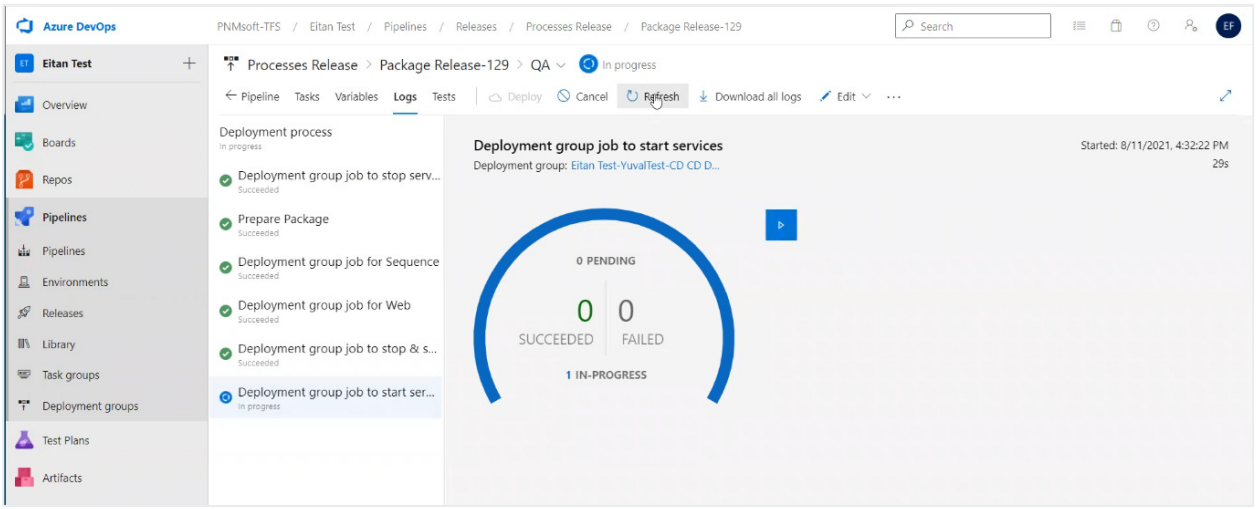
You can track the progress of the execution (see below).



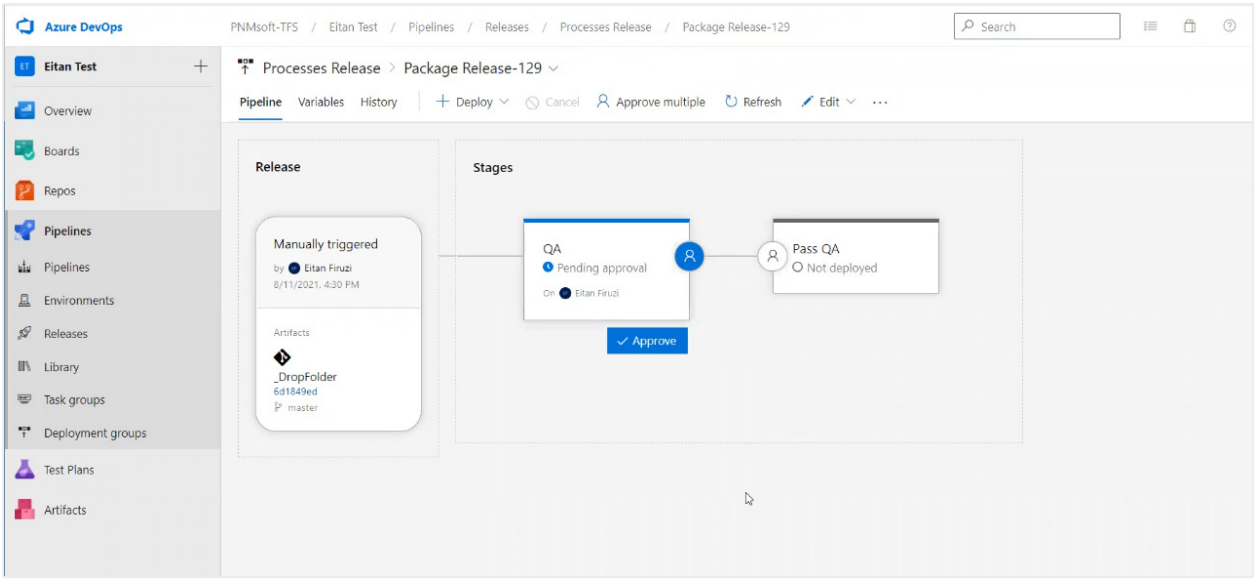
You can also follow the process in the logs view.



In the above screenshot, the process is in the last stage.

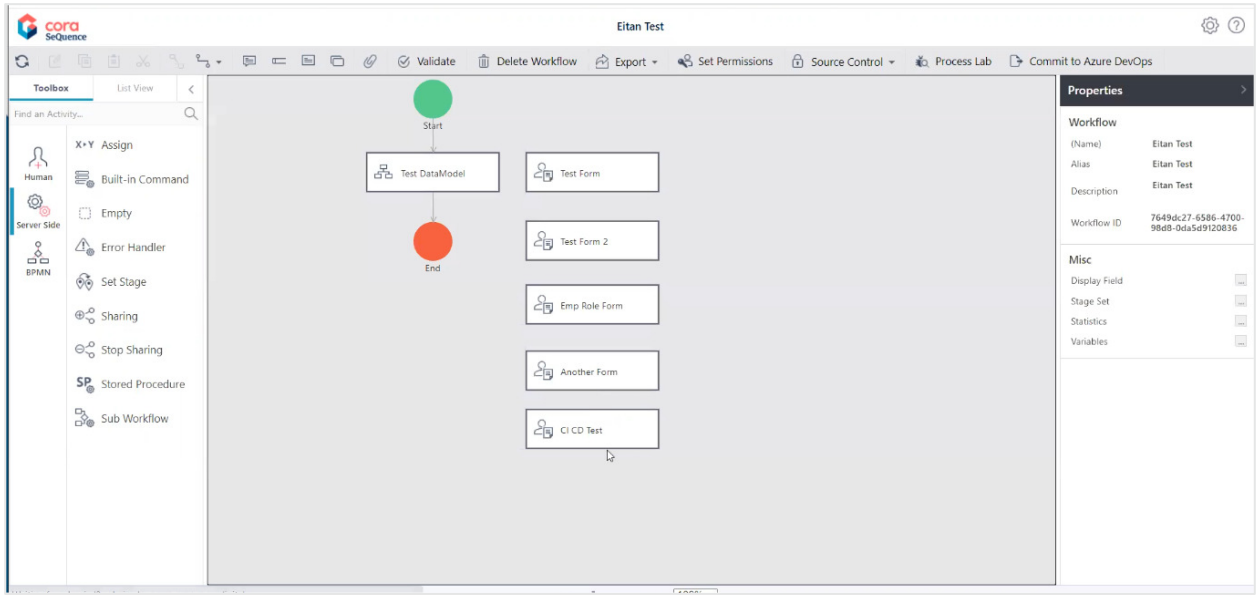


The Processes release pipeline has two stages: QA and Pass QA.



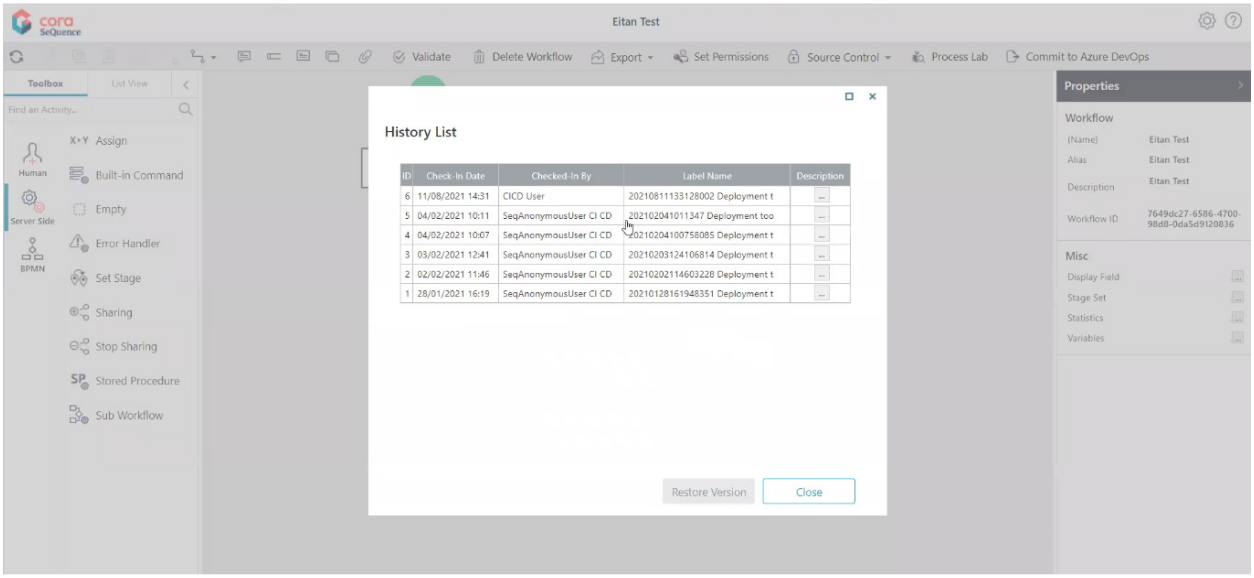
In the QA stage, the administrator needs to check and confirm if the deployment was done correctly and then select **Approve**.

Let's check the workflow in the Test server to see if the deployment has been successful.

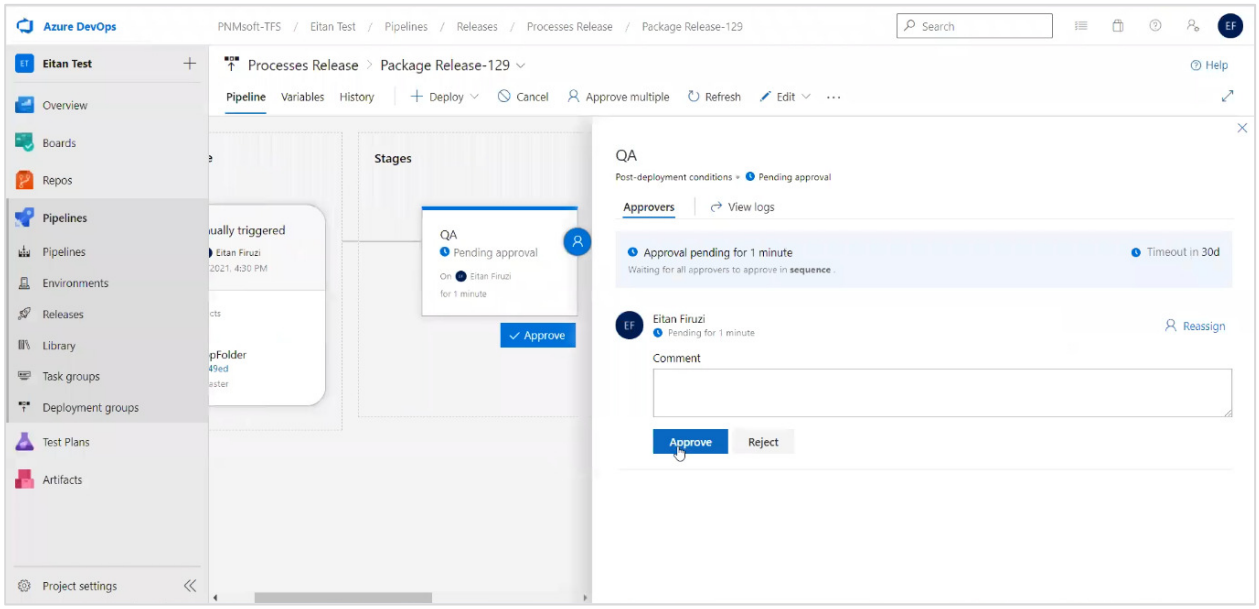


The deployment was successful. The CICD form has been added to the workflow.

If we check the Source control history, we can see that the last user who checked in the workflow was the CI/CD user.

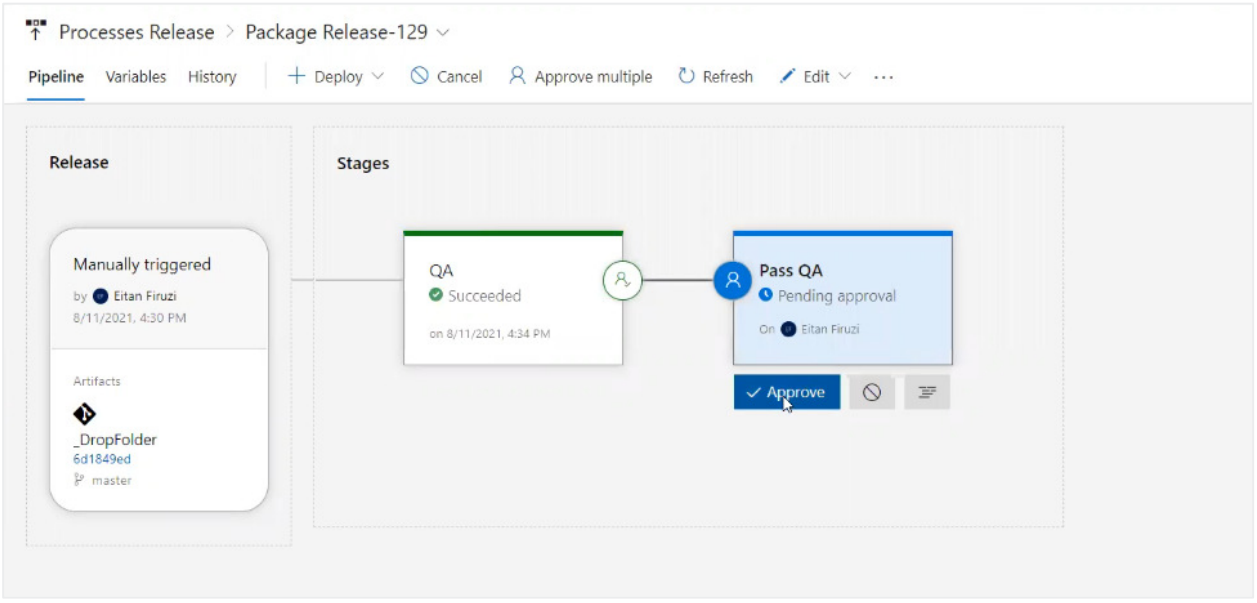


The first approval is done by the user who executes the pipeline. This user needs to verify that the implementation completed successfully, based on its purpose.

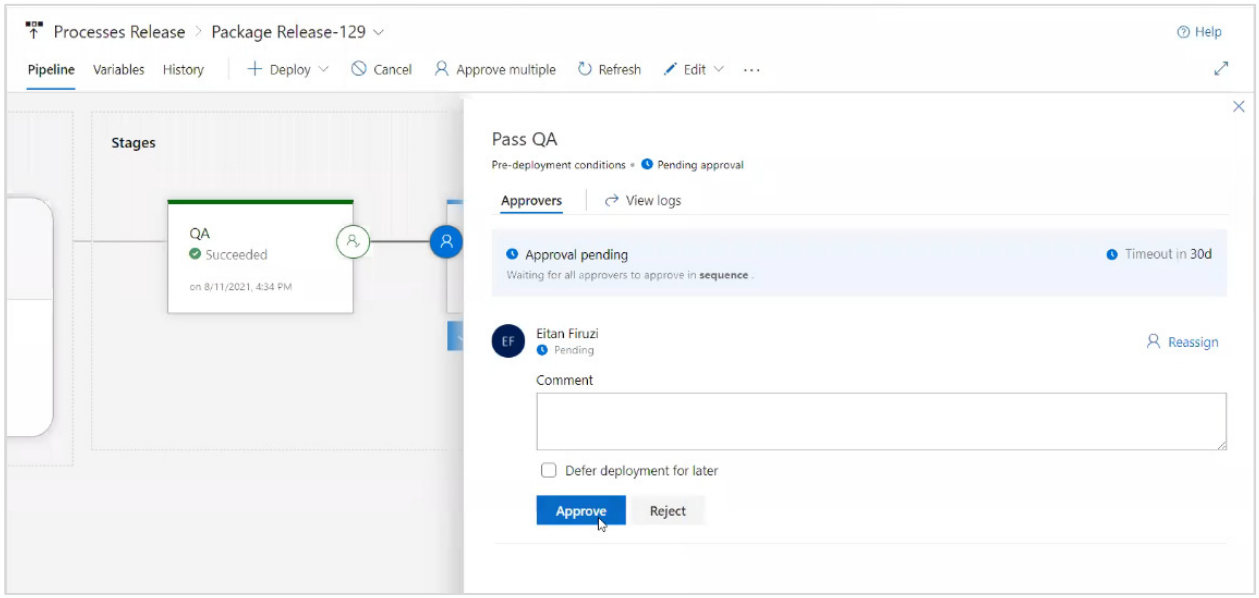


After approval, the pipeline moves to the Pass QA stage.

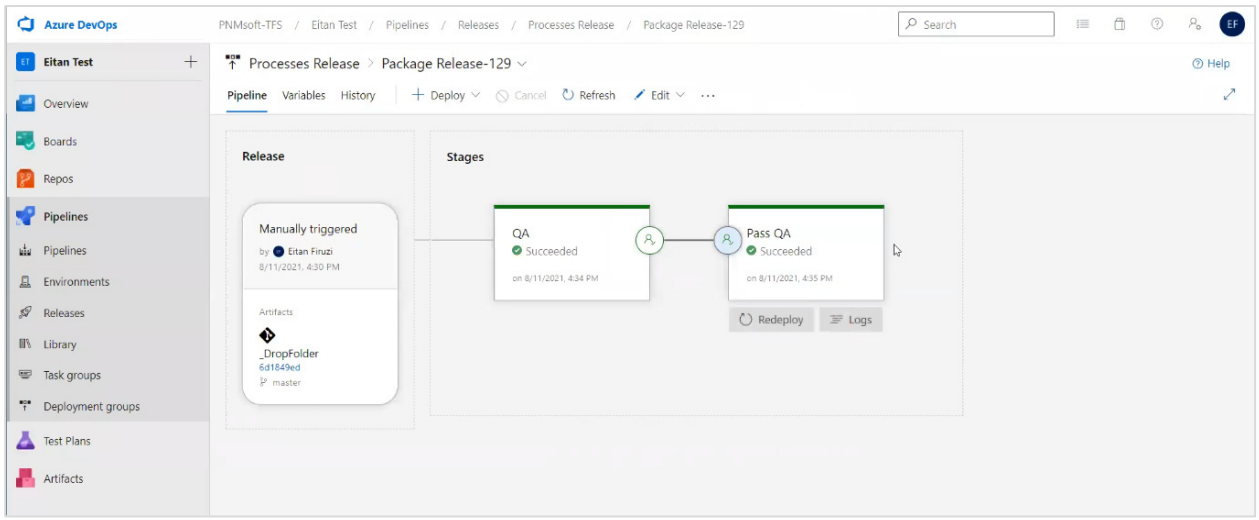
After this stage is completed, the QA person needs to approve the changes to complete the process. This approval cycle is not mandatory, but it's recommended. The QA user should make sure that the workflows have been deployed and that they are working properly.



Pass QA stage approval screen.



After Pass QA is approved, the CD process is completed.



After QA is approved, the deployment continues to the next environment, usually Production, but it depends on the specific project.

Important
When deploying to Production, or Production-like environments, make sure that the package that you deploy is approved and final.

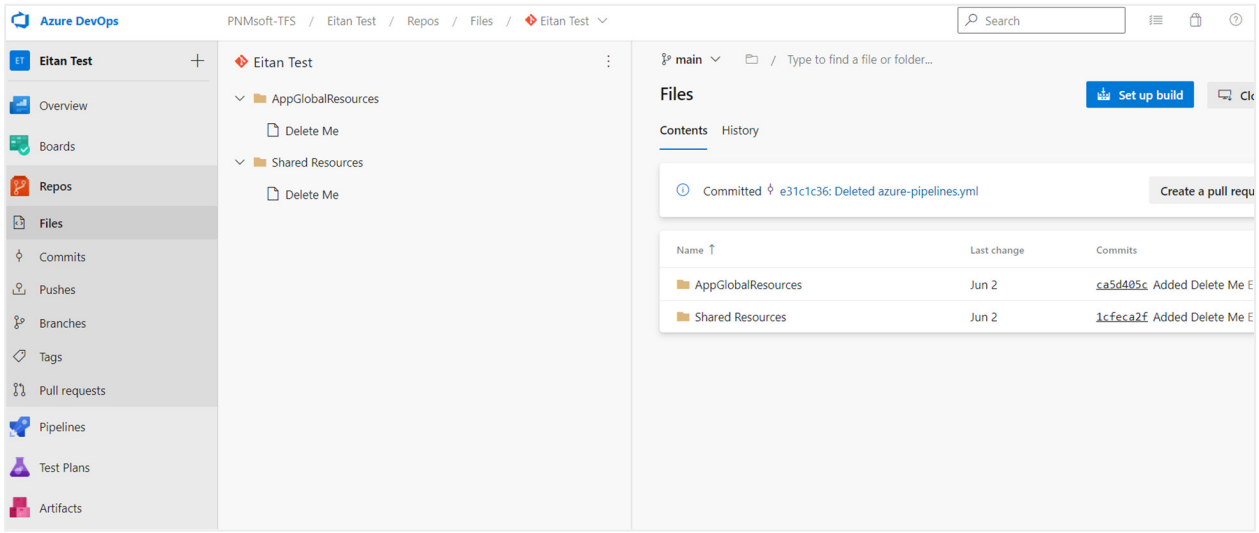
Customize Cora SeQuence

The pipepline available for Cora SeQuence customizations is the **Release Shared Resources** pipeline.

The Release Shared Resources pipeline reads files from a specified repo and propagates them in the required Cora SeQuence folders of the target server.

We need to create a repo to be used by the customization pipeline:

- Repo type: GIT
- Repo name: Same name as the Azure DevOps project name.

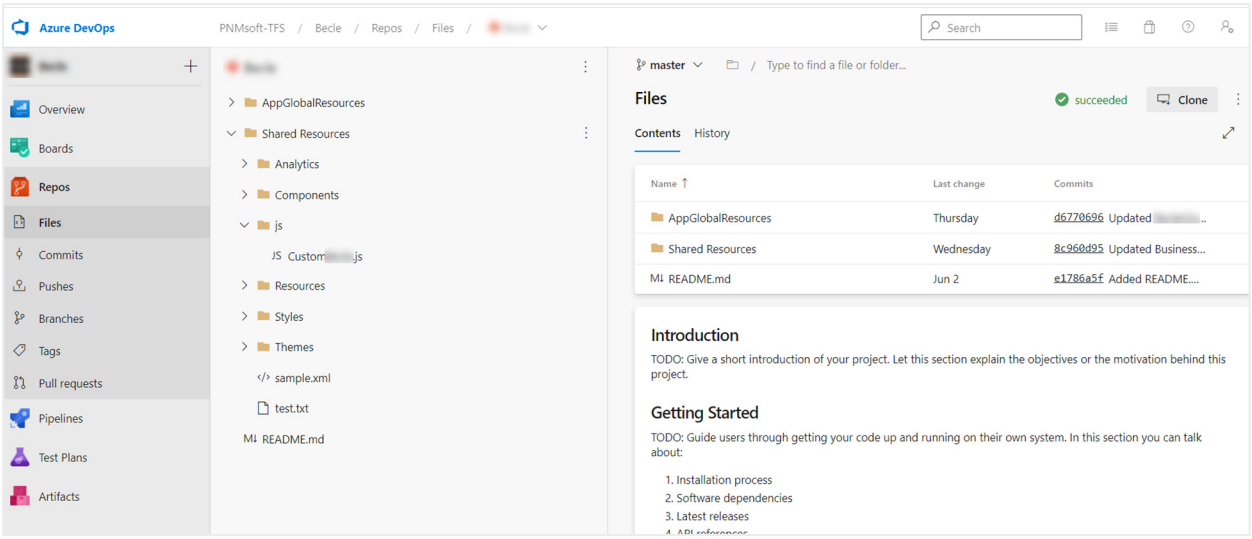


Note
It is recommended to create a separate repo for each customer.
The naming convention is **<CustomerName+CICD>**.

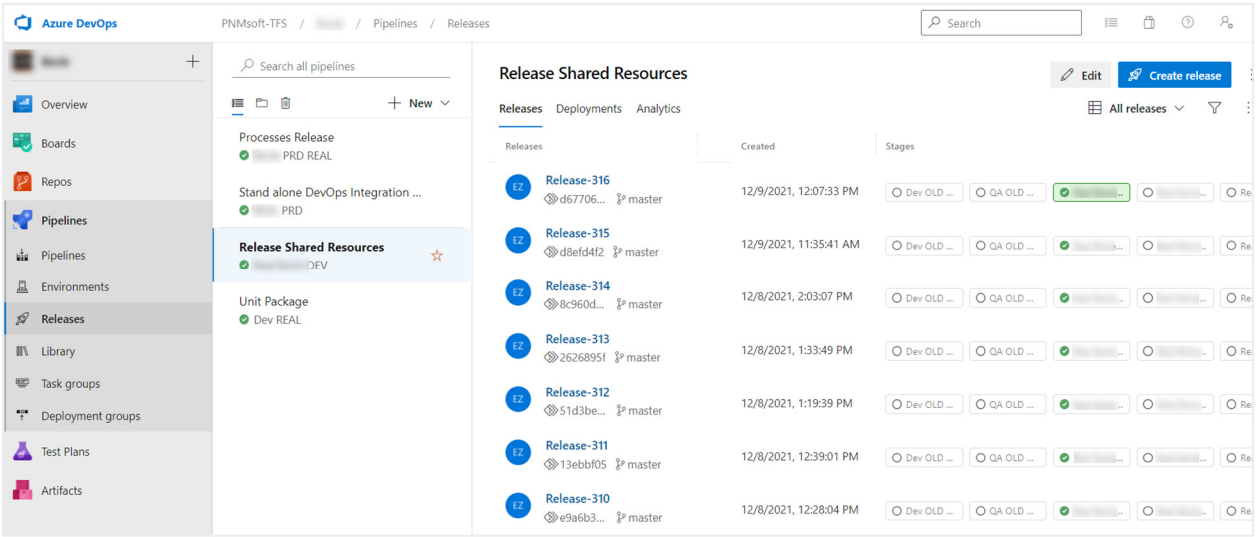
The developers upload their files directly into the repos that have been created for them in the appropriate folder.

For example, if developers have made changes to javascript files that are used by forms, all they need to do is to upload the updated files to the appropriate folder in the repo. In our example, it's the folder **shared resources\js**. See screenshot below.

Example of repo (the customer name has been hidden).



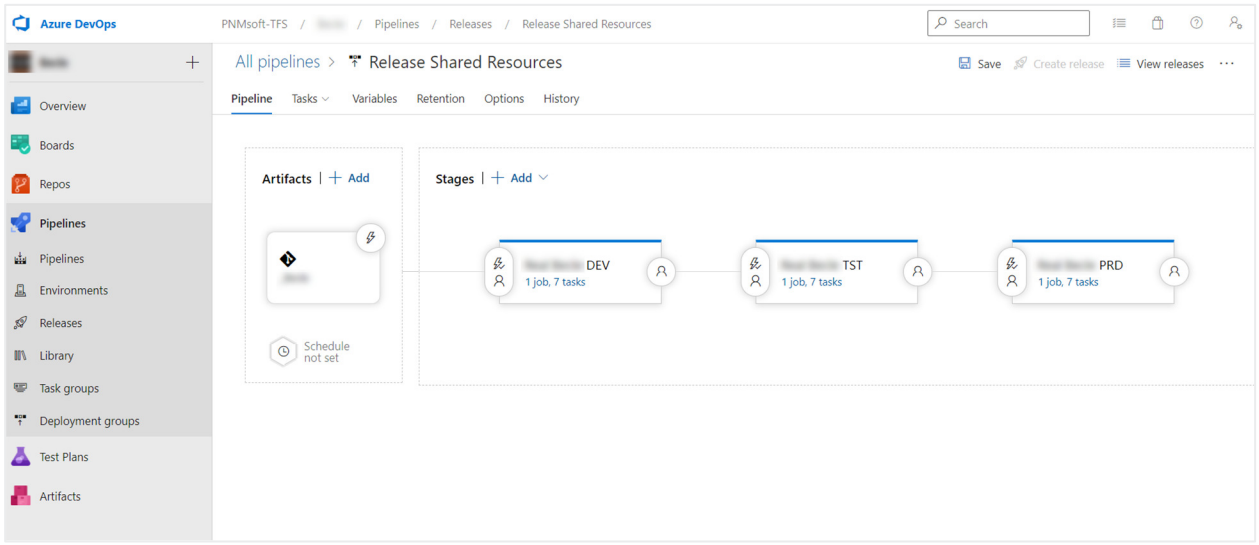
The **Release Shared Resources** pipeline is used for customizations. It's the main pipeline used for customer deployments.



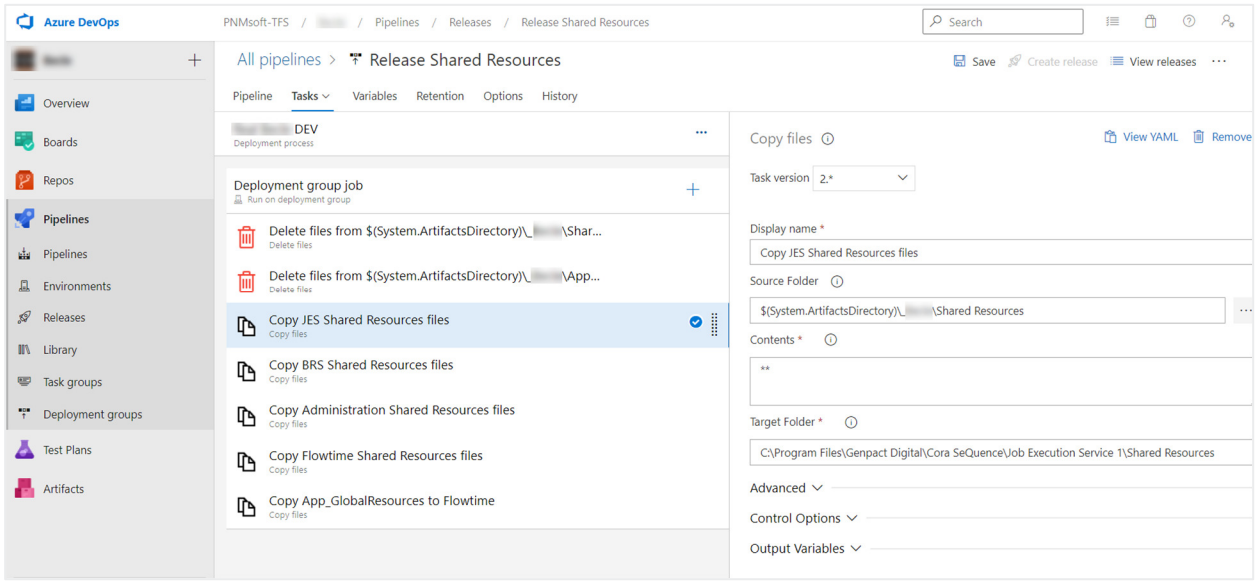
Important

The DevOps platform includes additional pipelines, which are used for the initial Cora SeQuence installation. These pipelines are not covered as they are used only by CI/CD System Admins.

The Release Shared Resources pipeline takes files from the repo (artifacts) and updates the Dev and QA environments.



Most of the tasks in the Release Shared Resources pipeline are to **delete** files and **copy** files, which replace them with the ones from the repo.



The pipeline executes each task in the list in the specified order.

The successful completion of the pipeline indicates that the customization has been deployed to all the configured environments (commonly in this order DEV > TEST > PROD).