Azure DevOps

Creating an end to end Pipeline using Microsoft azure DevOps

Abstract

To get a basic idea about Azure DevOps and its benefits.

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Azure DevOps CI/CD Pipeline

DevOps

DevOps is the blending of the terms development and operations, meant to represent a collaborative or shared approach to the tasks performed by a company's application development and IT operations teams. The term DevOps is used in several ways. In its most broad meaning, DevOps is an operational philosophy that promotes better communication between these teams -- and others. In its most narrow interpretation, DevOps describes the adoption of automation and programmable software development and infrastructure deployment and maintenance. The term may also label a culture that strategically looks at the entire software delivery chain, overseeing shared services and promoting the use of new development tools and best practices.

While DevOps is not a technology, there are tools commonly used in DevOps environments. These include continuous integration and continuous delivery or continuous deployment tools, with an emphasis on task automation. Other products to support DevOps include real-time monitoring and incident response systems as well as collaboration platforms.

A DevOps approach can coexist with Agile software development; IT service management frameworks, such as IT Infrastructure Library; project management directives, such as lean and six sigma; and other strategies to execute IT projects to meet business needs. While it is typically associated with Agile development, the two methodologies do not need to be used in concert.

Patrick Debois, a software development consultant, is credited with coming up with the term DevOps in 2009 by naming a conference DevOps Days. The concept of DevOps was then popularized with the book The Phoenix Project in 2013. The Phoenix Project is a novel about DevOps, using a fictional narrative as an example to help IT managers understand the concepts and benefits of collaboration and shared technologies. It illustrates the endemic problems in IT that DevOps solves, such as division and mistrust between developers and IT admins, lack of automation leading to long lead times and errors, and misalignment of business requirements and projects to serve them.

Cloud computing and software-defined infrastructures, microservices, containers and automation are commonly implemented concurrently with DevOps methodologies.

DevOps vs. Waterfall development

In Waterfall development, developers test new code in an isolated environment for quality assurance (QA) and -- if requirements are met -- release the code to operations for use in production, usually in a bundle with other releases so that operations can tightly control the process. The operations team deploys the program and maintains it from that point on. Waterfall approaches usually engender a long time between software releases and because developer and operations teams work separately and the development team is not always aware of operational roadblocks that might prevent code from working as anticipated.

The DevOps approach seeks to meld application development and deployment into a more streamlined process that aligns development, QA and IT operations team efforts with fewer gates and more continuous flow. This approach also shifts some

of the operations team's responsibilities onto the development team to facilitate continuous development, continuous integration, continuous delivery and continuous monitoring processes. It is a way to tear down the metaphorical silos that isolate steps in the software delivery process to release code faster and more often.

DevOps and Agile development

Agile is a software development approach focused on incremental and rapid cycles of code creation and delivery referred to as sprints. Each sprint iterates upon the last, creating a high level of flexibility, as changes and scope and direction can be evaluated between each cycle. However, it is possible for the original vision of a project to be lost through this cycle.

DevOps arose from the success in the speed of development in Agile, when it became clear that there is a lack of communication between development and operations teams that put a significant hindrance on speed and flexibility of code delivery to users.

As Agile development became more efficient, it became clear having development and operations work apart from each other was inefficient. Before DevOps, development and operations teams worked in a way where those who wrote the code had separate objectives and leadership from those who deployed and supported the code. With DevOps and Agile, communication between development and operations ensures code can be managed by both teams fluently without miscommunications or confusion. DevOps does not have an official framework, nor does it consider speed as a core focus (rather speed in development is achieved through what DevOps focuses on). Agile relies on the agile manifesto and often is formalized with a framework, such as Scrum.

DevOps Stages

A) Code Commit and Version Control

B) Code Build

C) Units and Integration Tests

D) Code Quality Checks

E) Artifacts Upload

F) Artifacts Download

E) Deployment

G) Notifications Configuration

H) Maintenance

Problem Statement

Build an end to end CI/CD pipeline to build, test and deploy .NET web projects.

Why DevOps?

1. Shorter Development cycles, faster Innovation.
2. Reduced Deployment failures, rollbacks and Time to recover.
3. Improved communication and collaboration.
4. Increased Efficiencies.
5. Reduced costs and IT Headcount.

Azure DevOps

Azure DevOps captures over 15 years of investment and learnings in providing tools to support software development teams. In the last month, over 80,000 internal Microsoft users and thousands of our customers, in teams both small and large, used these services to ship products to you.

Each Azure DevOps service is open and extensible. They work great for any type of application regardless of the framework, platform, or cloud. You can use them together for a full DevOps solution or with other services. If you want to use Azure Pipelines to build and test a Node service from a repo in GitHub and deploy it to a container in AWS, go for it. Azure DevOps supports both public and private cloud configurations. Run them in our cloud or in your own data center. No need to purchase different licenses.

Azure DevOps includes:

1. Azure Pipelines

CI/CD that works with any language, platform, and cloud. Connect to GitHub or any Git repository and deploy continuously.

Powerful work tracking with Kanban boards, backlogs, team dashboards, and custom reporting.

2. Azure Artifacts

Powerful work tracking with Kanban boards, backlogs, team dashboards, and custom reporting.

Maven, npm, and NuGet package feeds from public and private sources.

3. Azure Repos

Unlimited cloud-hosted private Git repos for your project. Collaborative pull requests, advanced file management, and more.

4. Azure Test Plans

All in one planned and exploratory testing solution.

Tasks Used In Azure Build Pipeline –

1. **Azure Repos** – It is Azure DevOps native repository for SCM.
2. **Hosted Agent** – A job is a logical grouping of tasks that defines the runtime target on which the tasks will execute. An agent job executes tasks on an agent in an agent pool. These jobs are executed by the agent either Hosted or Private.
3. **Nuget Tool Installer** – Acquires a specific version of NuGet from the internet or the tools cache and adds it to the PATH. Use this task to change the version of NuGet used in the NuGet tasks.
4. **NuGet Restore** – Restore, pack, or push NuGet packages, or run a NuGet command. Supports NuGet.org and authenticated feeds like Package Management and MyGet. Uses NuGet.exe and works with .NET Framework apps. For .NET Core and .NET Standard apps, use the .NET Core task.
5. **Prepare Analysis on SonarCloud** – Prepare SonarCloud analysis configuration
6. **Build Solution** - Build with MSBuild and set the Visual Studio version property.
7. **NuGet pack** – Restore, pack, or push NuGet packages, or run a NuGet command. Supports NuGet.org and authenticated feeds like Package Management and MyGet. Uses NuGet.exe and works with .NET Framework apps. For .NET Core and .NET Standard apps, use the .NET Core task.
8. **NuGet push** – Restore, pack, or push NuGet packages, or run a NuGet command. Supports NuGet.org and authenticated feeds like Package Management and MyGet. Uses NuGet.exe and works with .NET Framework apps. For .NET Core and .NET Standard apps, use the .NET Core task.
9. **Test Assemblies** – Run unit and functional tests (Selenium, Appium, Coded UI test, etc.) using the Visual Studio Test (VsTest) runner. Test frameworks that have a Visual Studio test adapter such as MsTest, xUnit, NUnit, Chutzpah (for JavaScript tests using QUnit, Mocha and Jasmine), etc. can be run. Tests can be distributed on multiple agents using this task
10. **Run code analysis** – Run scanner and upload the results to the SonarCloud server.
11. **Publish quality gate result** – Publish SonarCloud's Quality Gate result on the Azure Pipelines build result. To be used after the actual analysis.
12. **Publish symbols path** – Index your source code and publish symbols to a file share or Azure Artifacts Symbol Server
13. **Publish Artifact** - Publish build artifacts to Azure Pipelines/TFS or a file share.

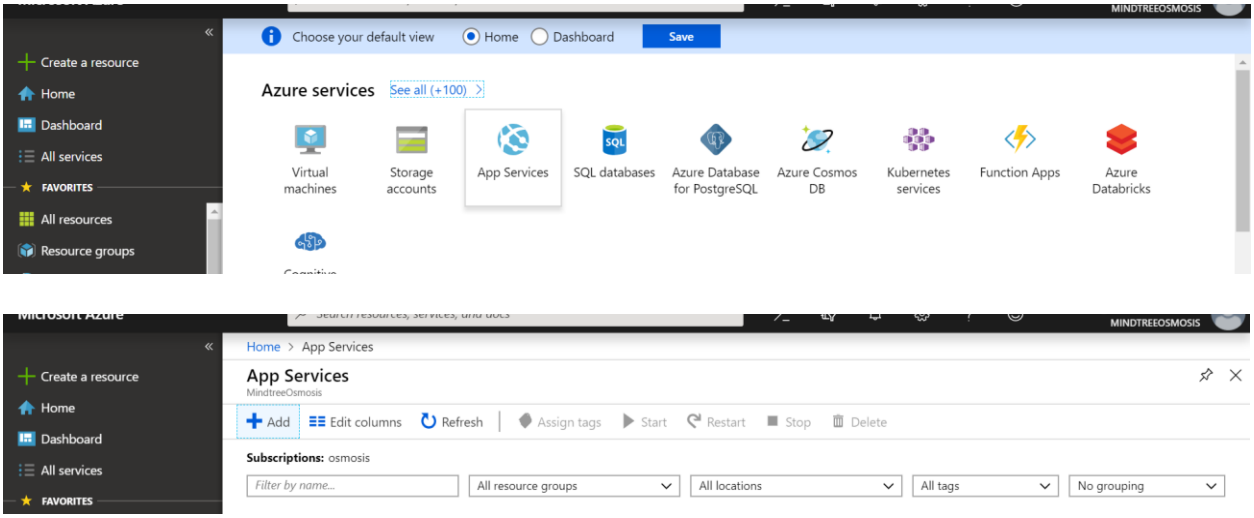
Tasks Used in Azure Release Pipeline –

14. **Deploy Azure App Service** - Update Azure App Services on Windows, Web App on Linux with built-in images or Docker containers, ASP.NET, .NET Core, PHP, Python or Node.js based Web applications, Function Apps on Windows or Linux with Docker Containers, Mobile Apps, API applications, Web Jobs using Web Deploy / Kudu REST APIs.

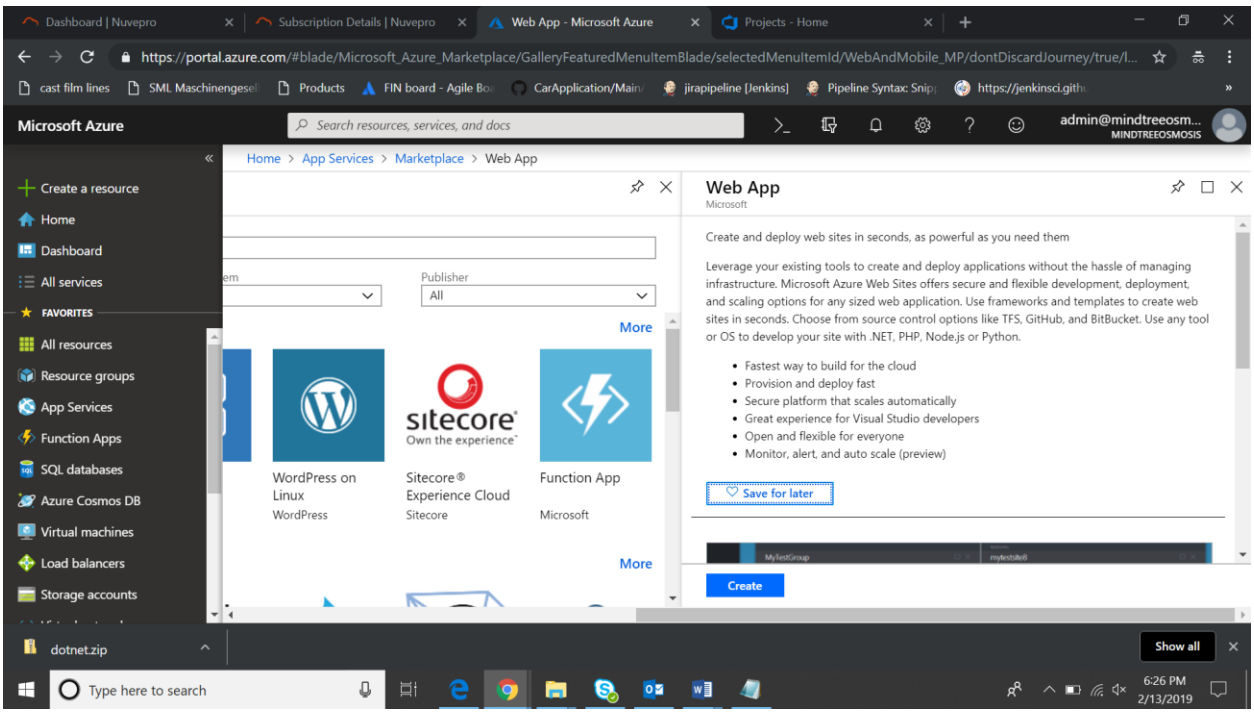
Creating WebApps for Application Deployment using Azure Portal.

1. Login into Azure Portal.
   https://azure.microsoft.com/en-in/features/azure-portal/

2. Click on “App services” and click “Add”.



3. Select “WebApp” and click on “Create”.

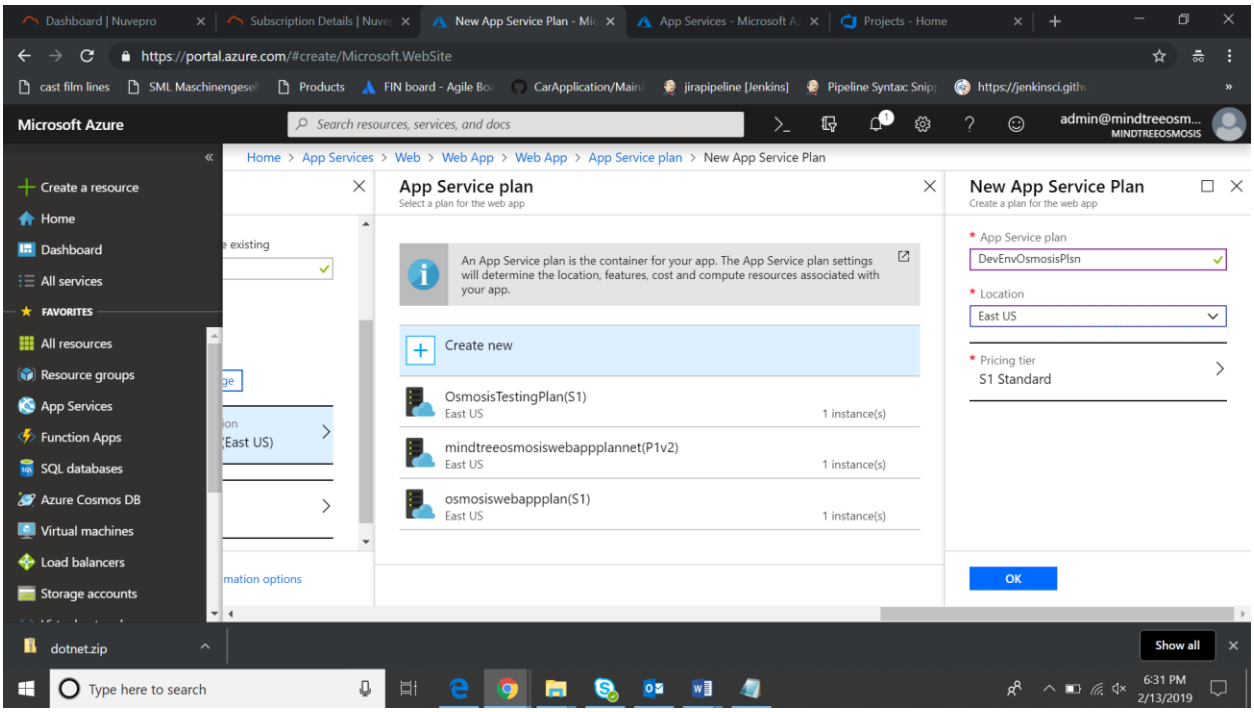


4. Enter App Name, Subscription is already chosen by default, Resource Group is also created and has the name same as the App Name.

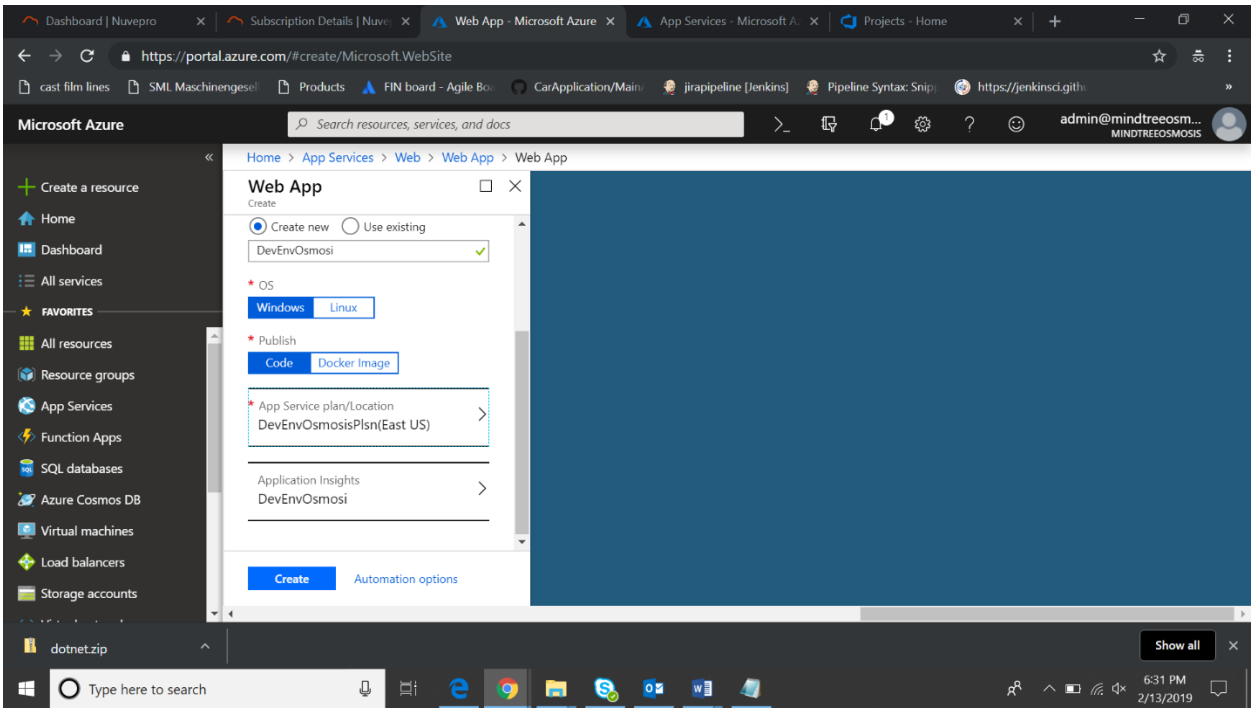
5. OS should be set to “Windows” and Publish to “Code”.

6. Click on App Service Plan.

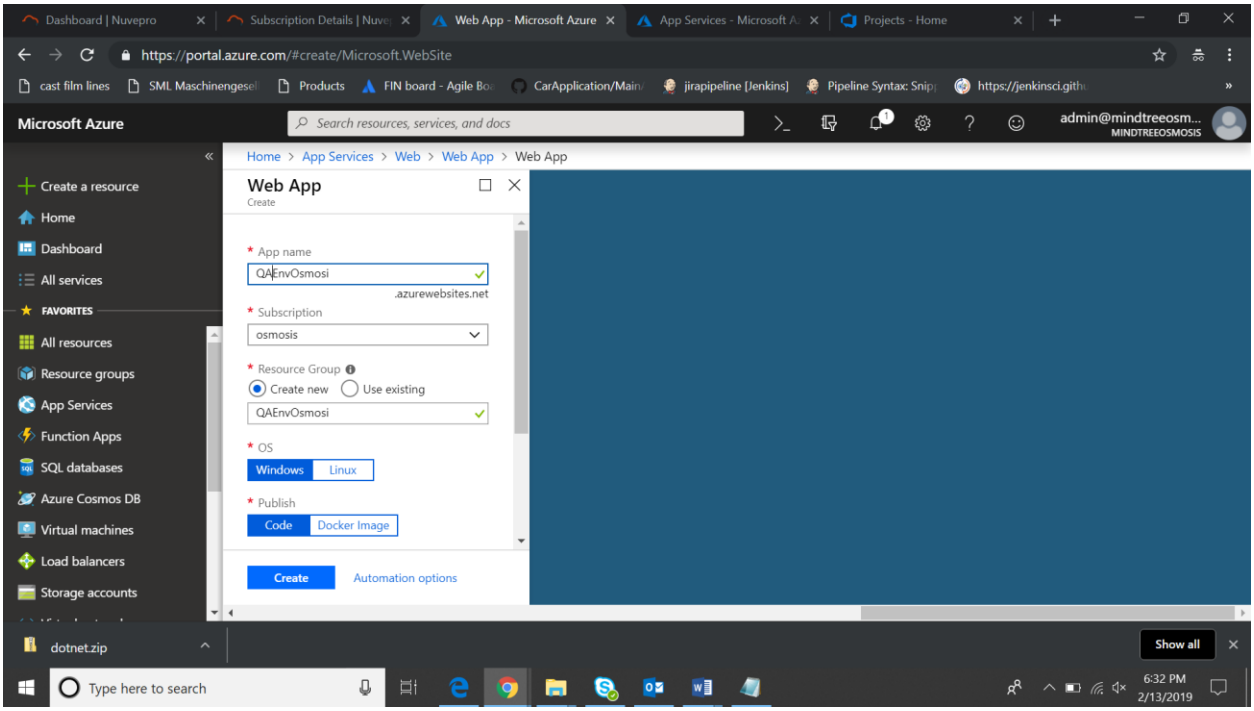
7. Click on “Create New” → Add a name → Location to “East Us” → Pricing Tier to “Standard S1”.



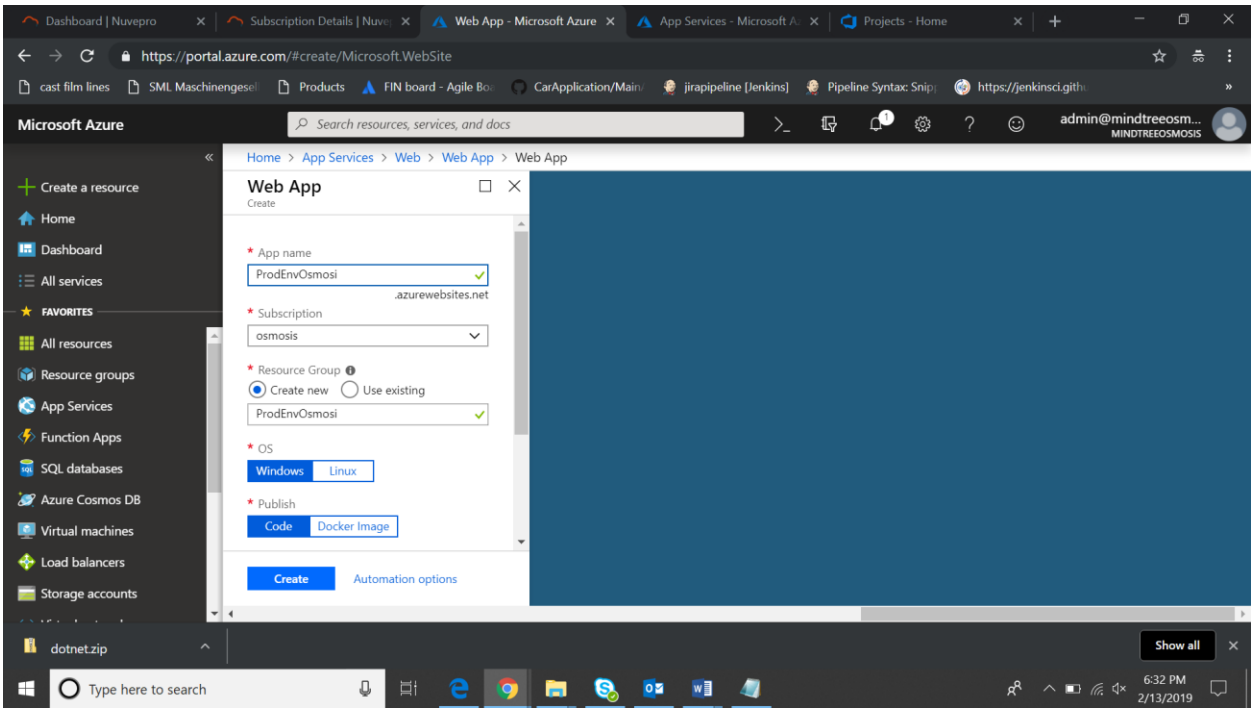
8. Click on “Create”.



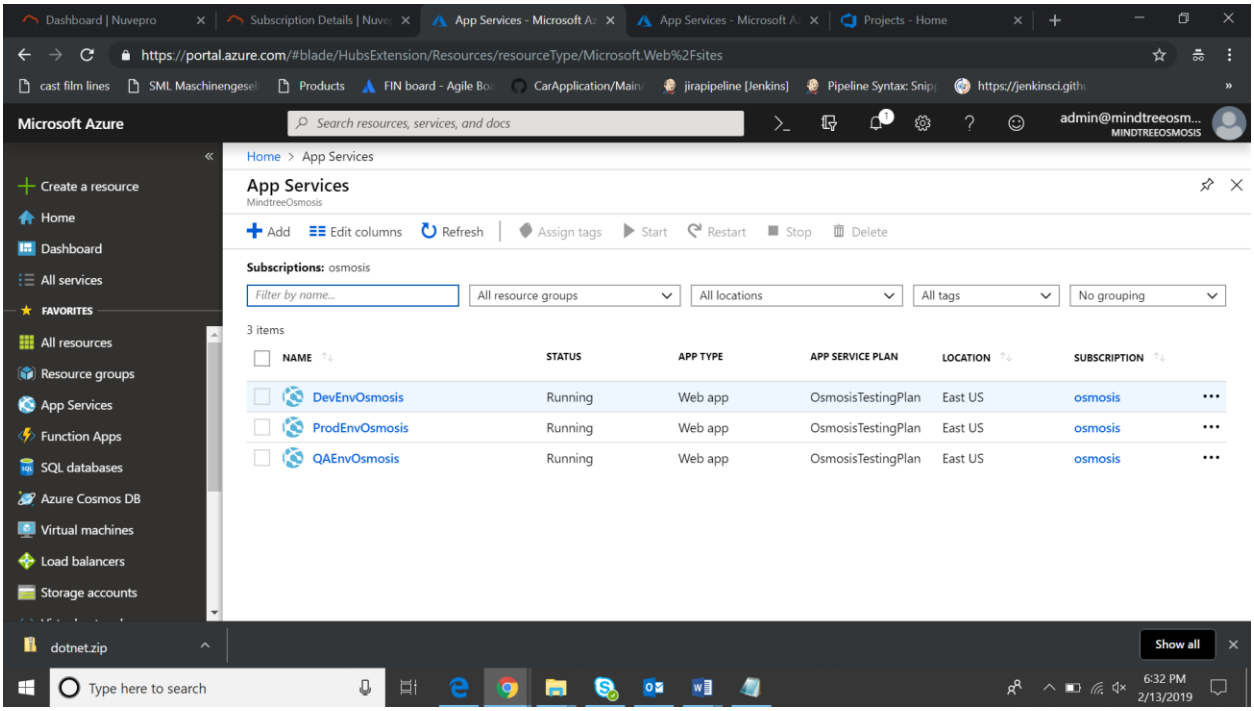
9. Create one for QA and Production Environments also following the above steps.
   QA Environment Web APP



Production Environment Web App



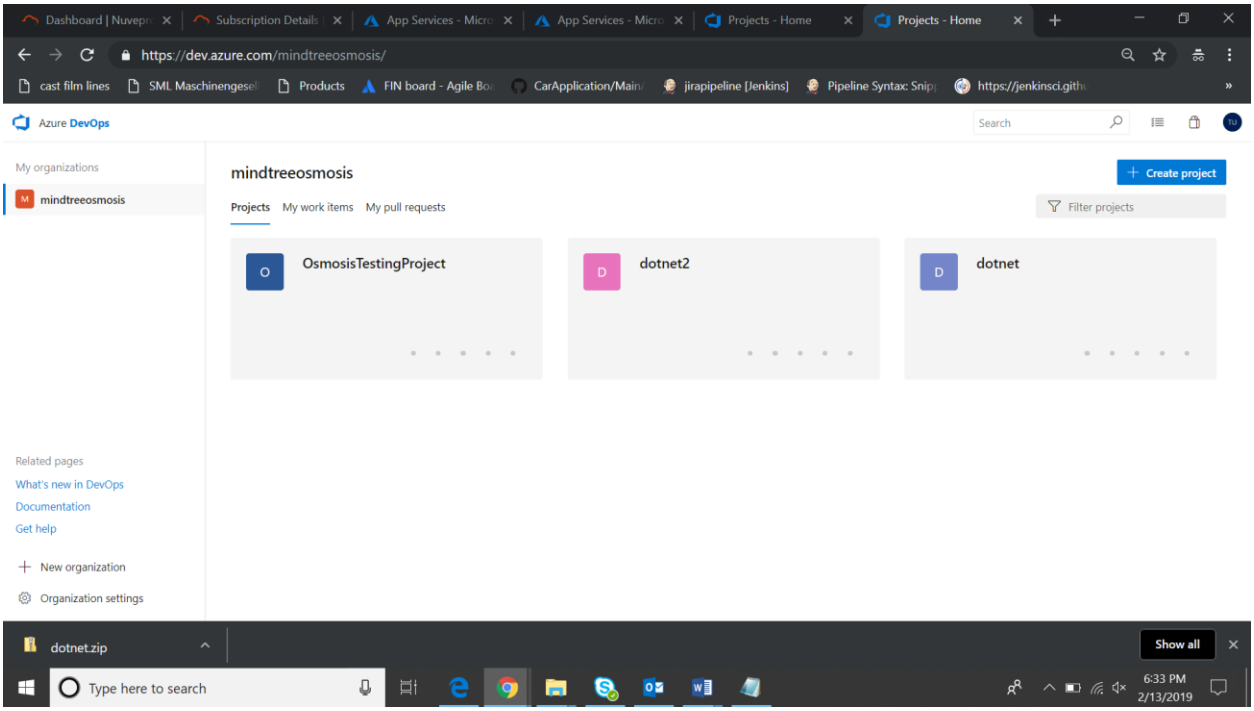
10. On the side bar Click on App Services. If the deployments are over then you should be able to see the webapps you just created.



Building CI/CD Pipeline with Azure DevOps.

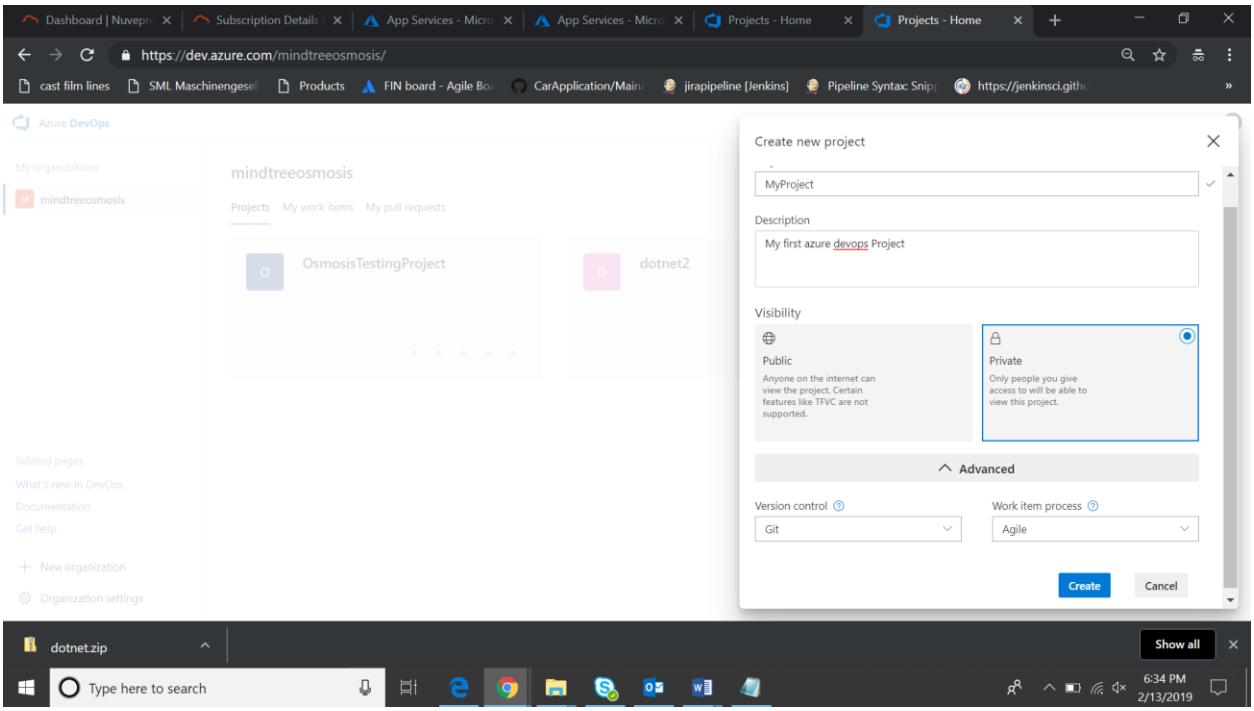
11. Login into Azure DevOps.
    https://azure.microsoft.com/en-in/services/devops/

    Note: Click on "Start Free " if you are an first time user.



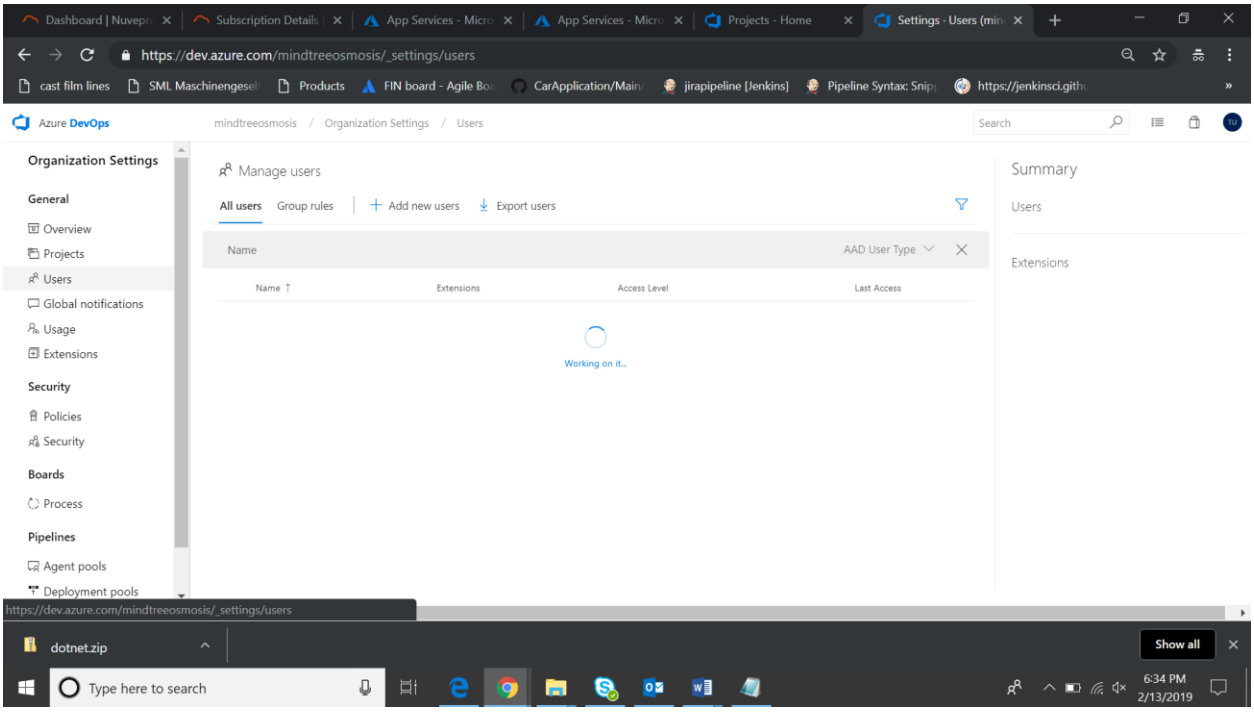
12. Click on “Create Project”.

13. Enter the Project Name → Description (Optional) → Visibility to “Private” → Click “Advanced” → Ensure Version Control is “Git” and the other option is “Agile”

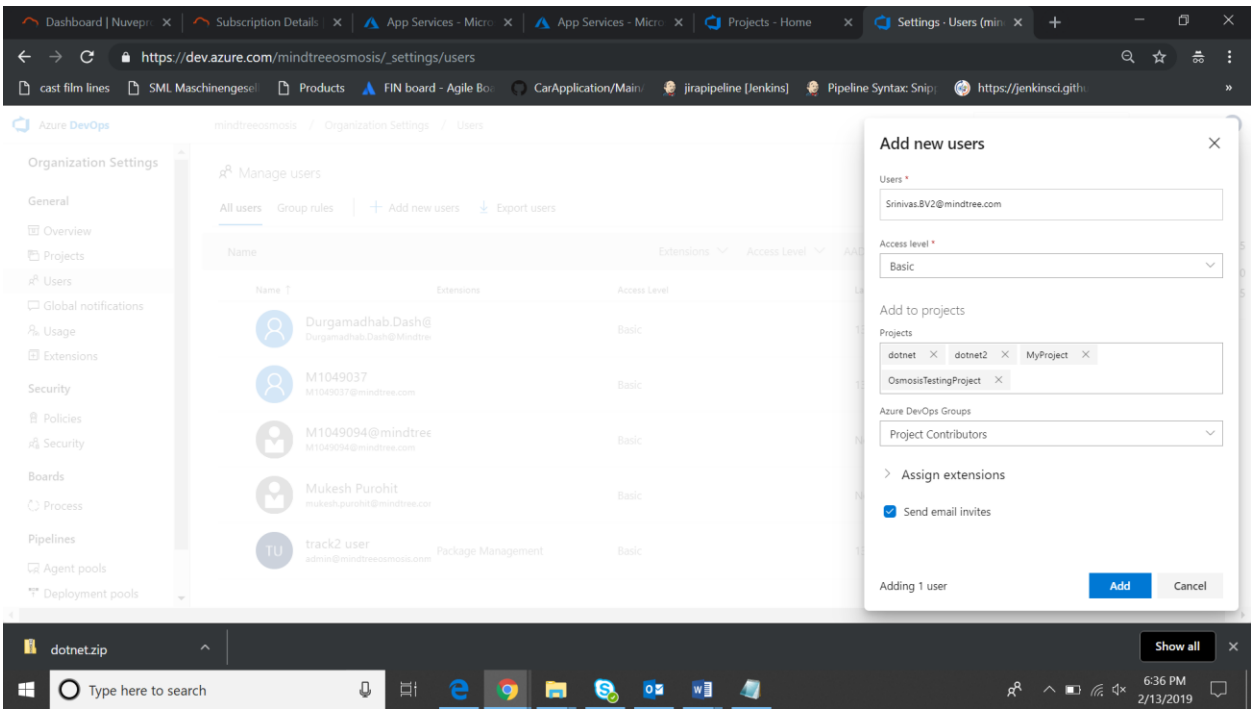


14. The project is created and now we have to add user who can use and make changes to this project.

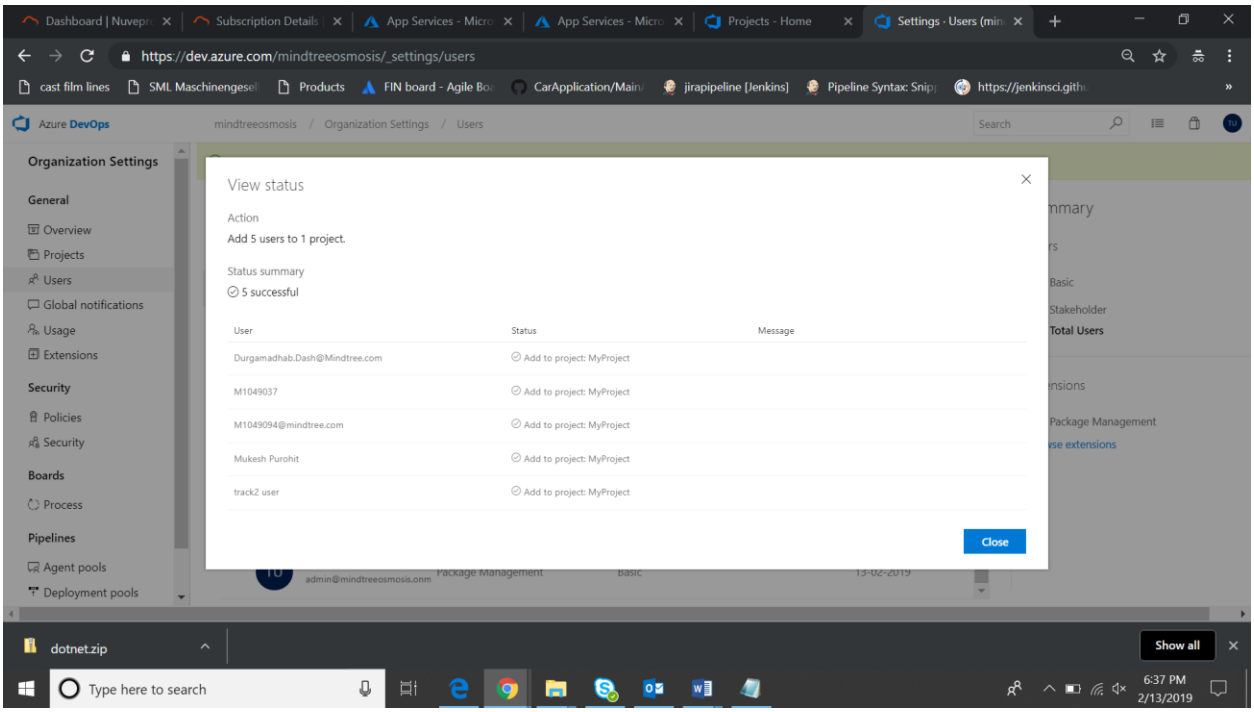
15. Click on “Organization Settings” → Click on “Users” → Click on “Add new User”.



16. Enter the user name (“email id” or “mid”) → Set access level to “Basic” → Depending on your needs you can assign projects (When you click on the drop down in projects all the projects available in that account will be displayed) → Set Azure DevOps Groups to “Project Contributors” → Check “Send Email Invites” → Click Add.



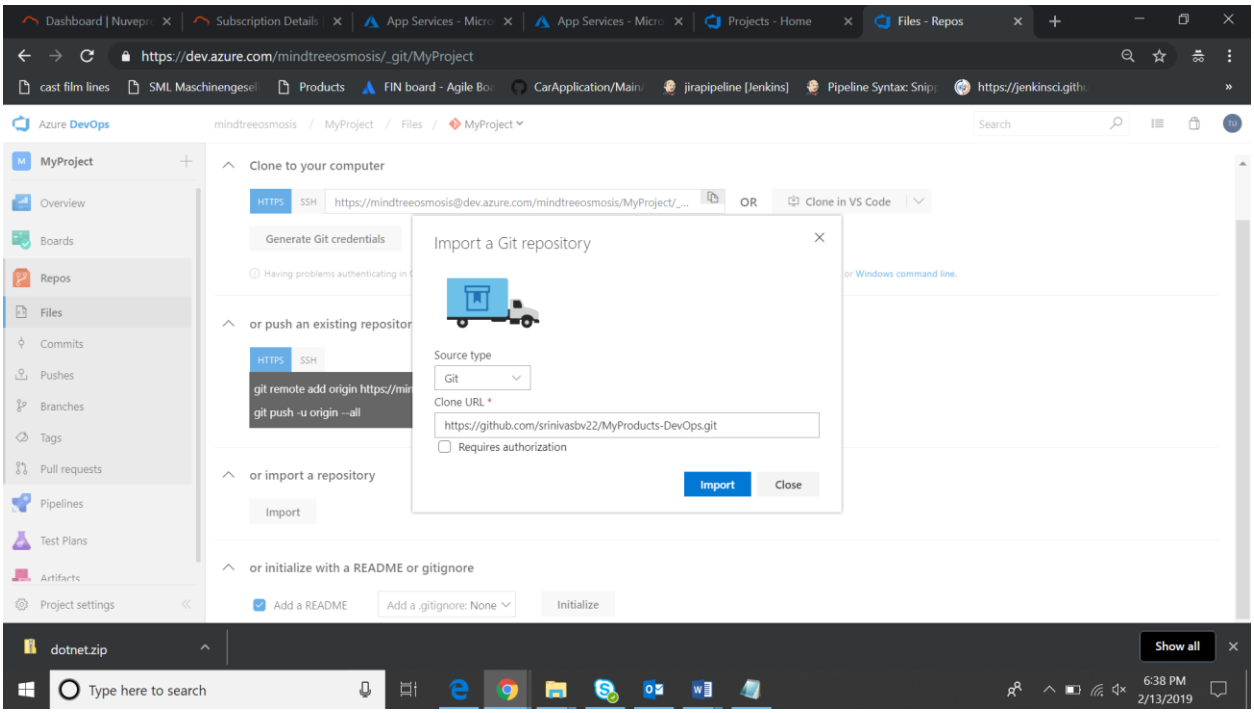
After Adding the Screen looks like.



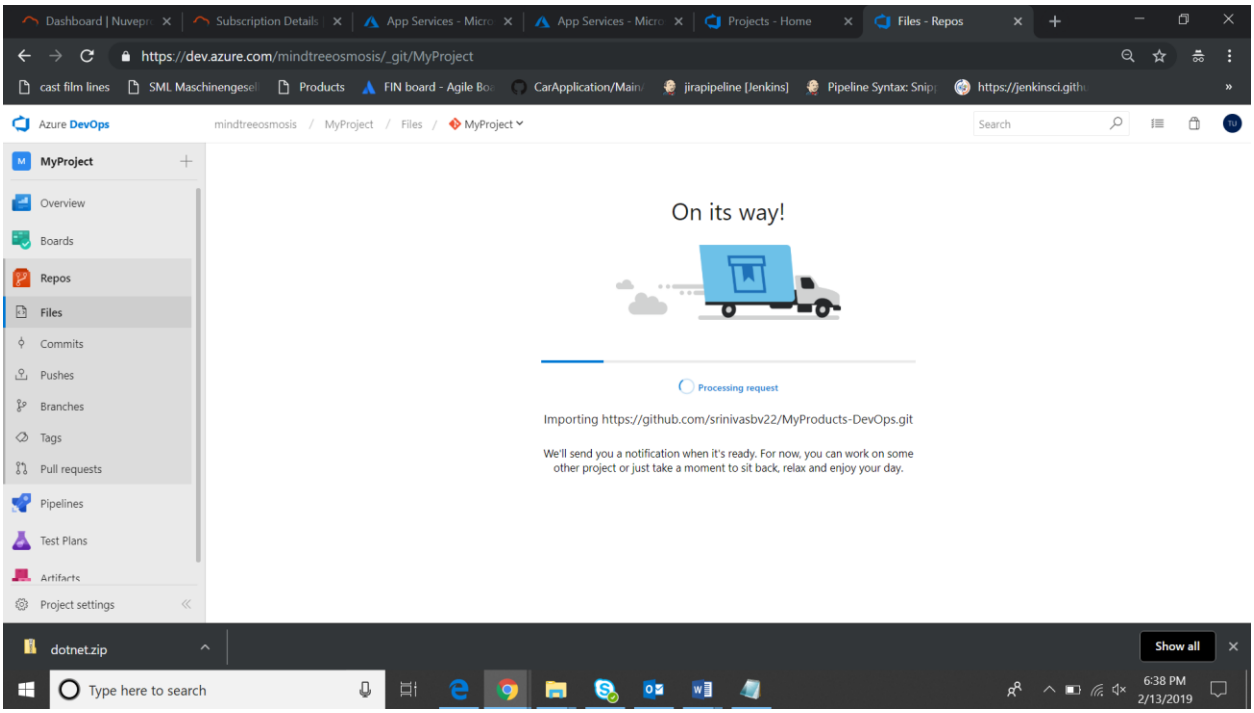
17. Click on Azure DevOps and Select your Project.

Azure Repos.

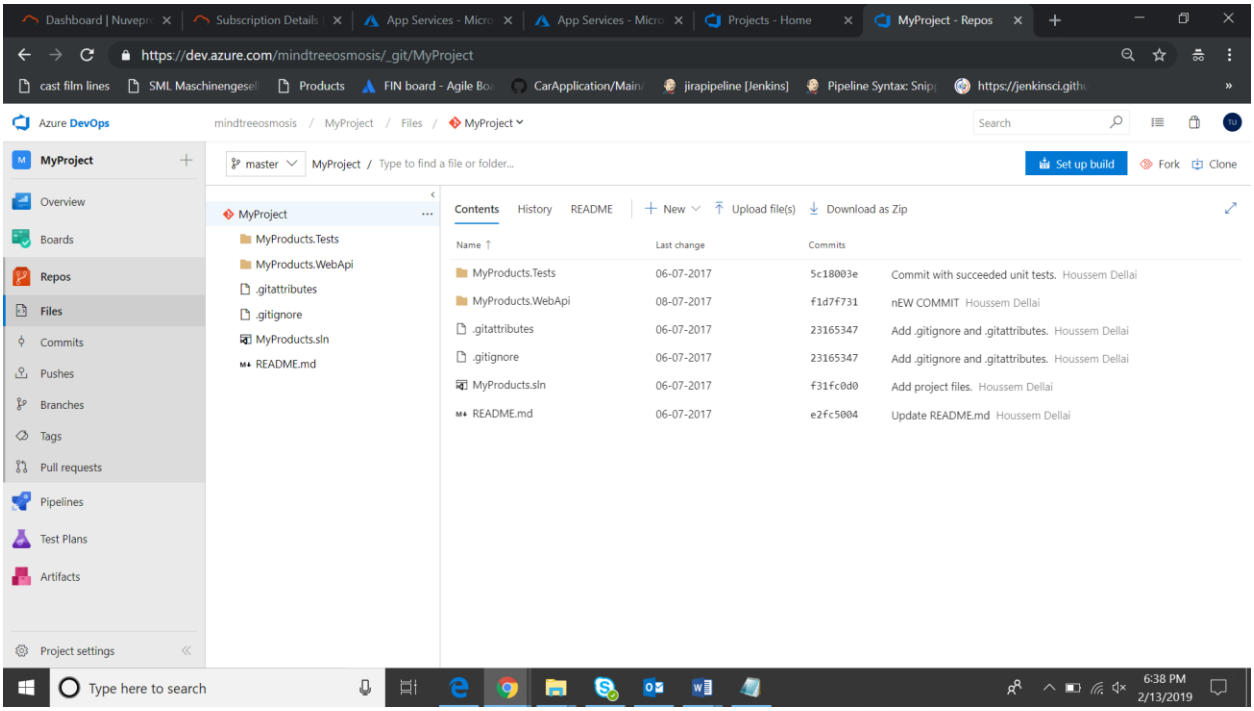
18. In the left bullet bar click on “Repos”.
19. Click on “import”.
20. Set source type to “Git” and add the Project Git Repository URL.
21. Click on “Import”.



It takes a while to load the code as shown below.

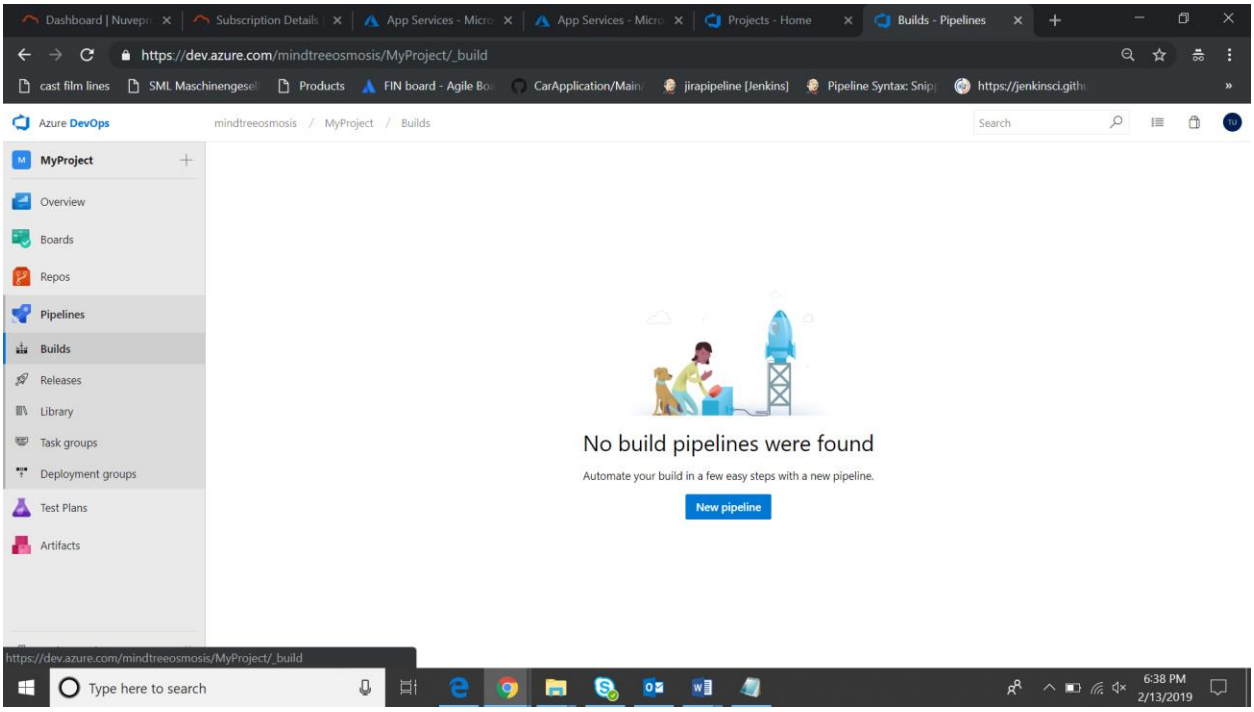


22. By clicking on “File” under “Repos” you will be able to see you imported project.

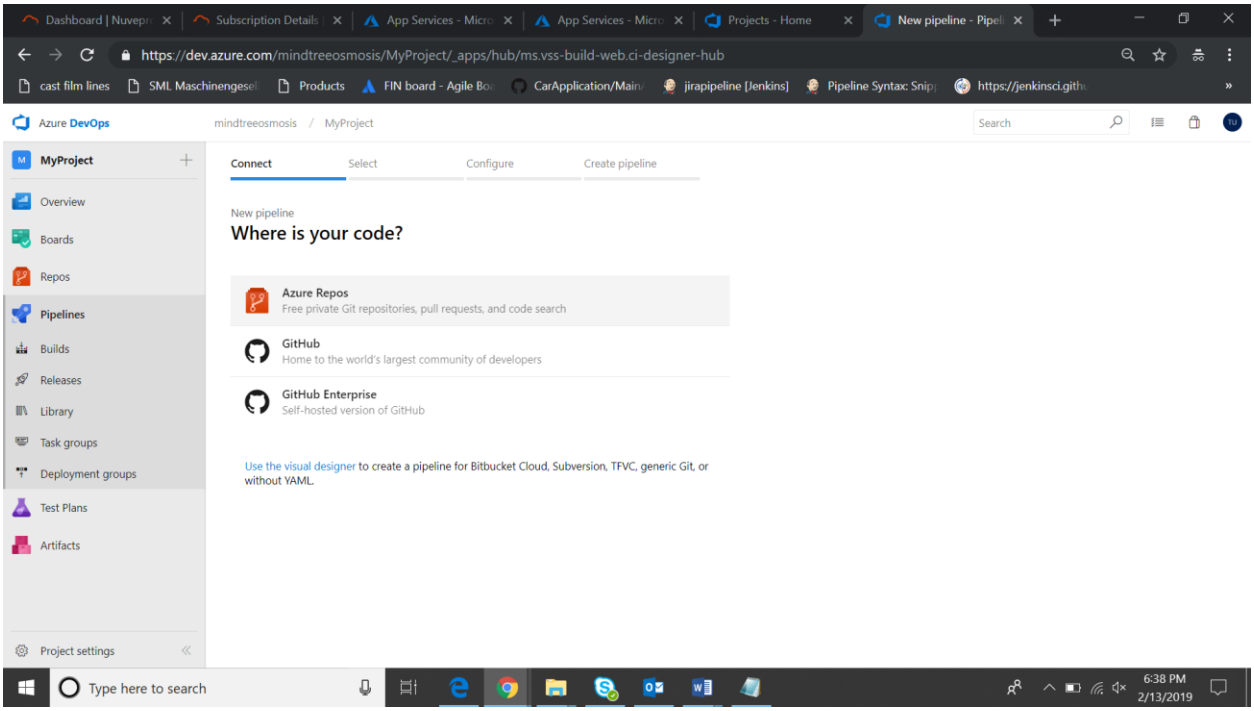


Build Pipeline

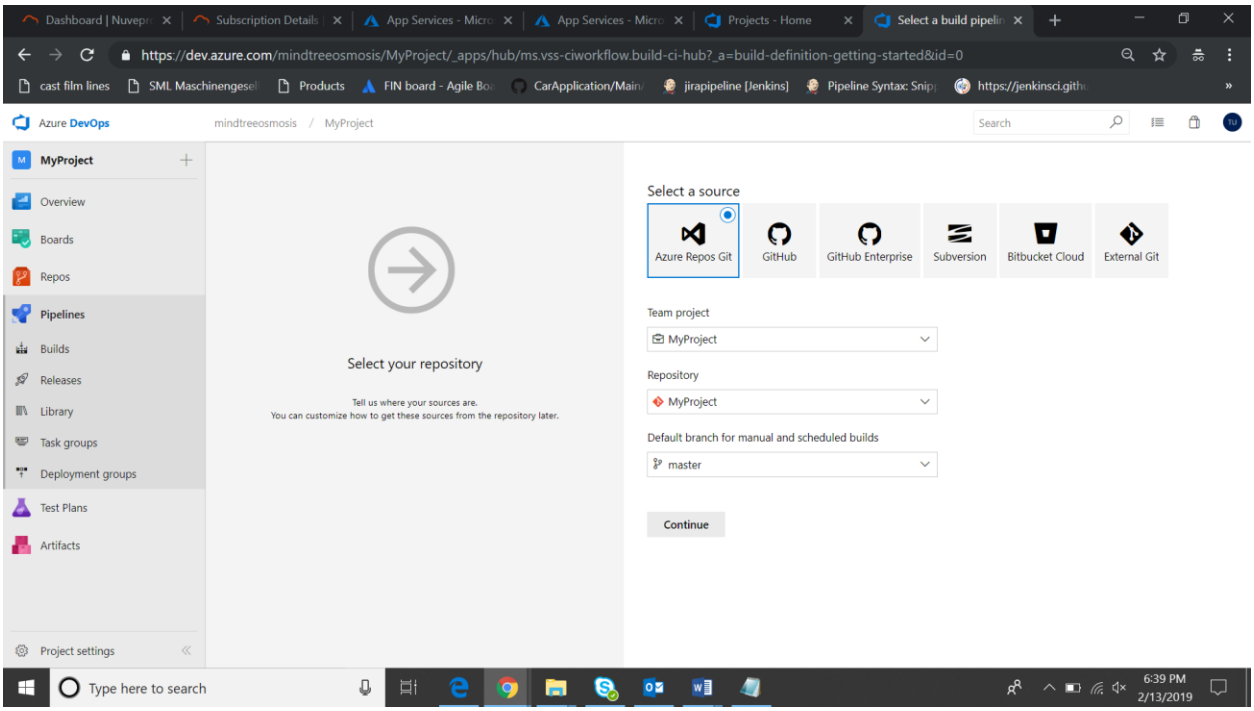
23. Click on “Pipelines” on the left Bullet bar → Click On “Builds” → Click on “New Pipeline”.



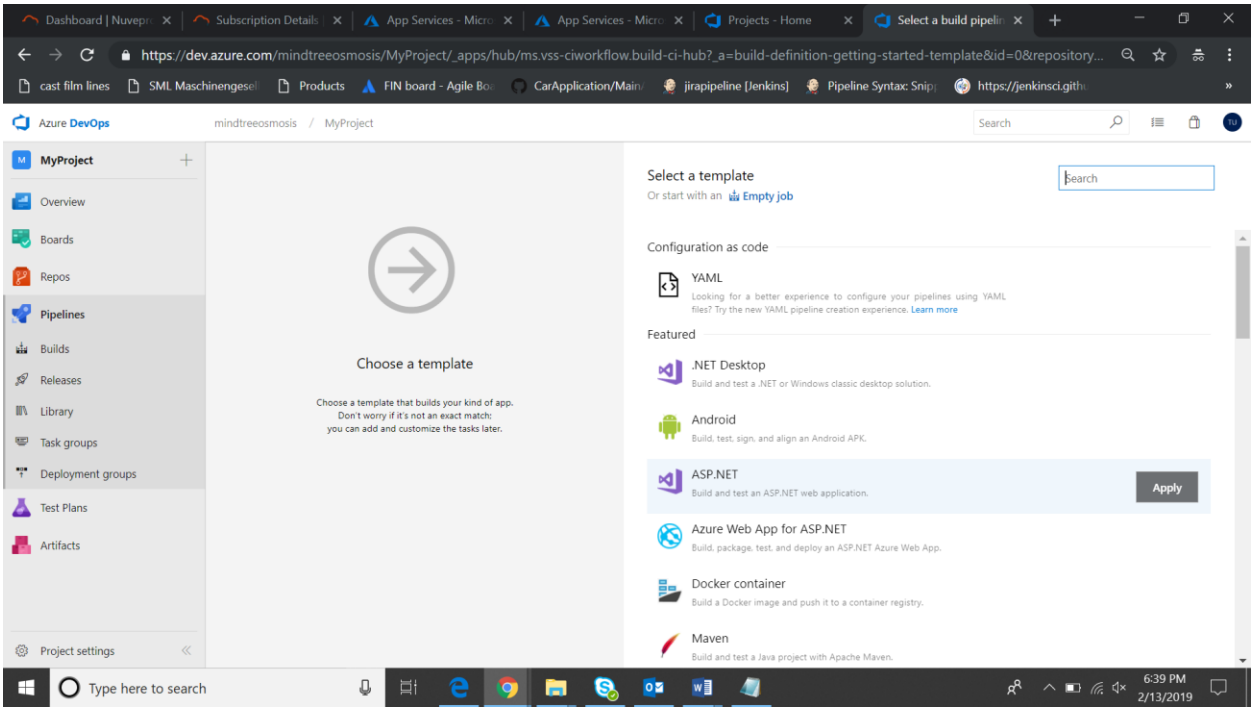
24. Click on “Use the Visual Designer”.



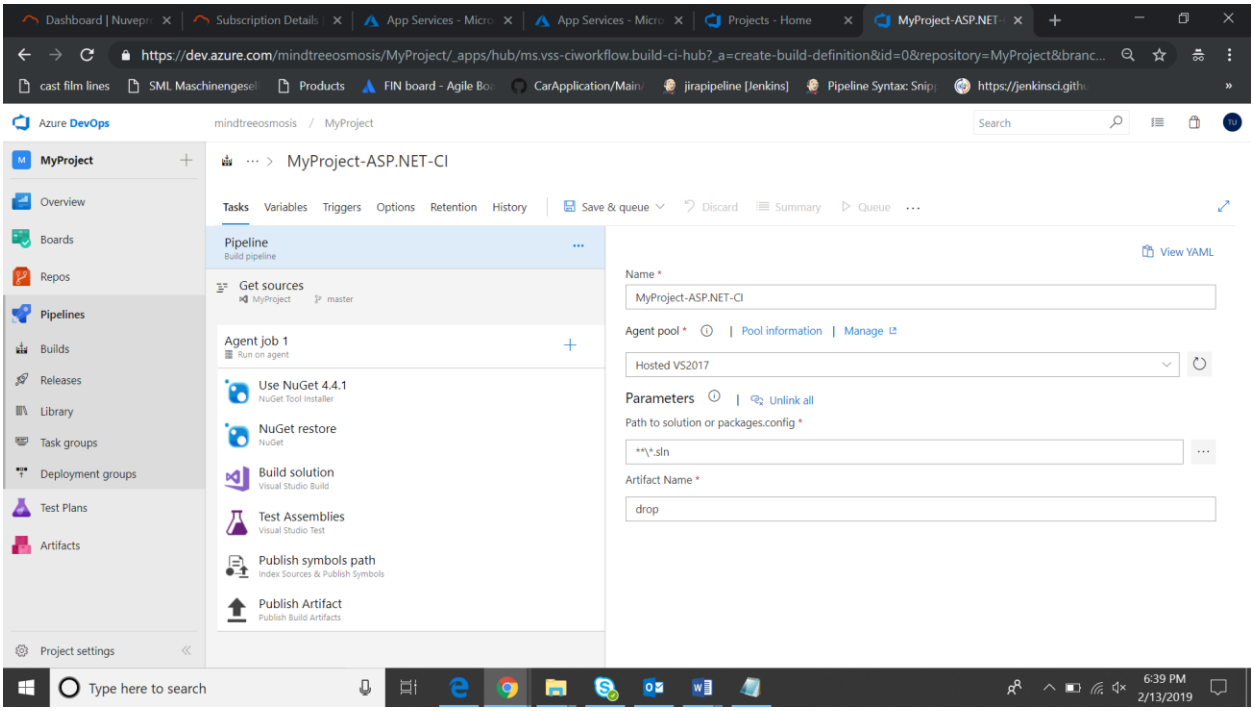
25. Click on "Azure Repos Git" → Select your "Team Project", "Repository". The branch will be set to "Master" by default (You can change depending on your requirements). → Click "Continue"



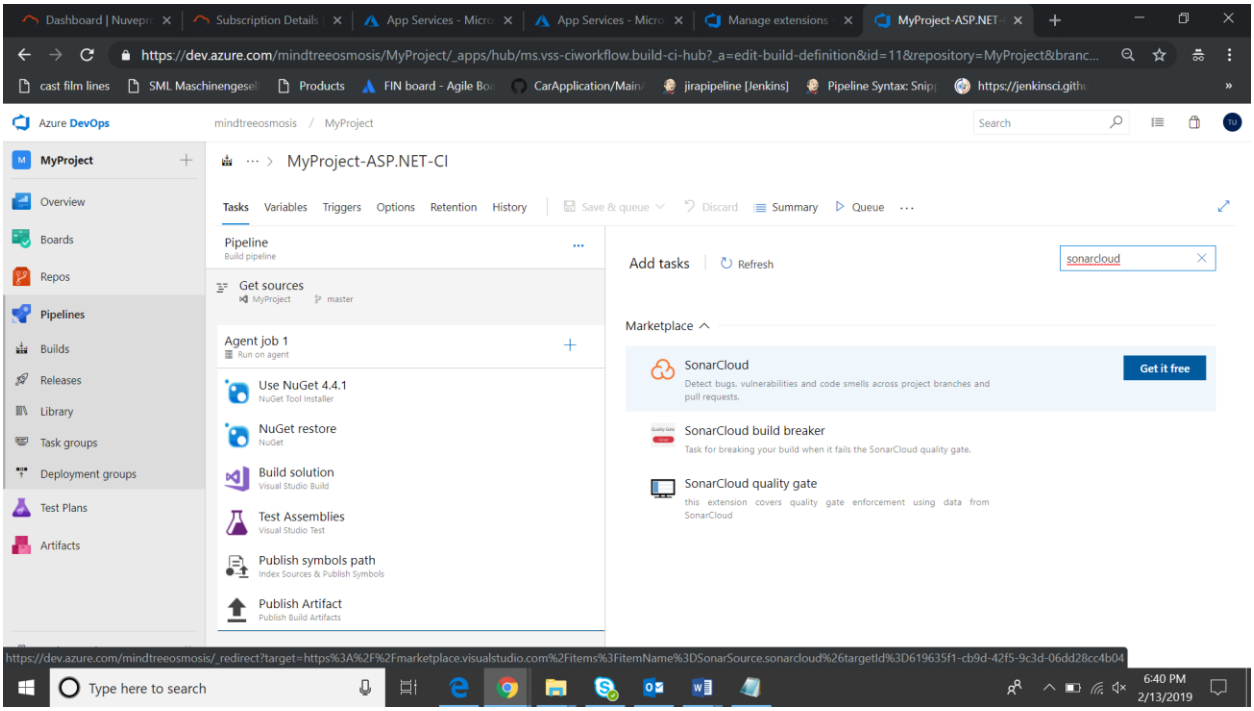
26. Select "ASP.NET".



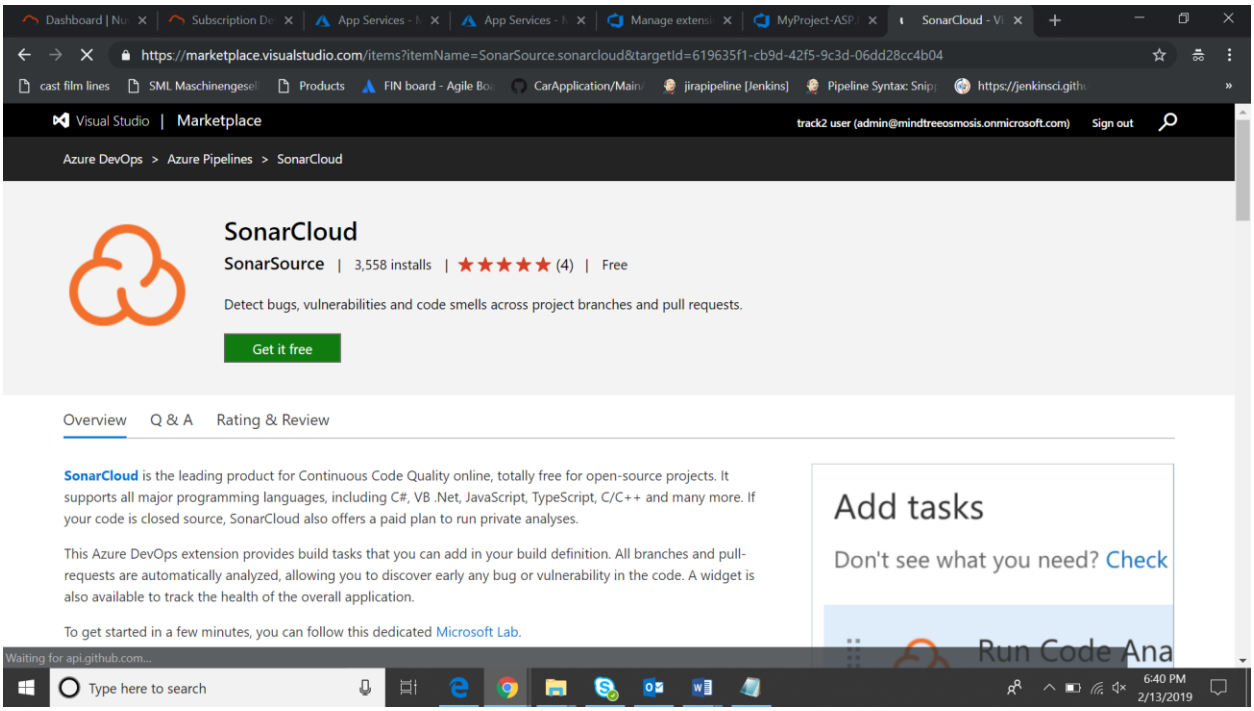
27. Verify that the next page set according to the below window.



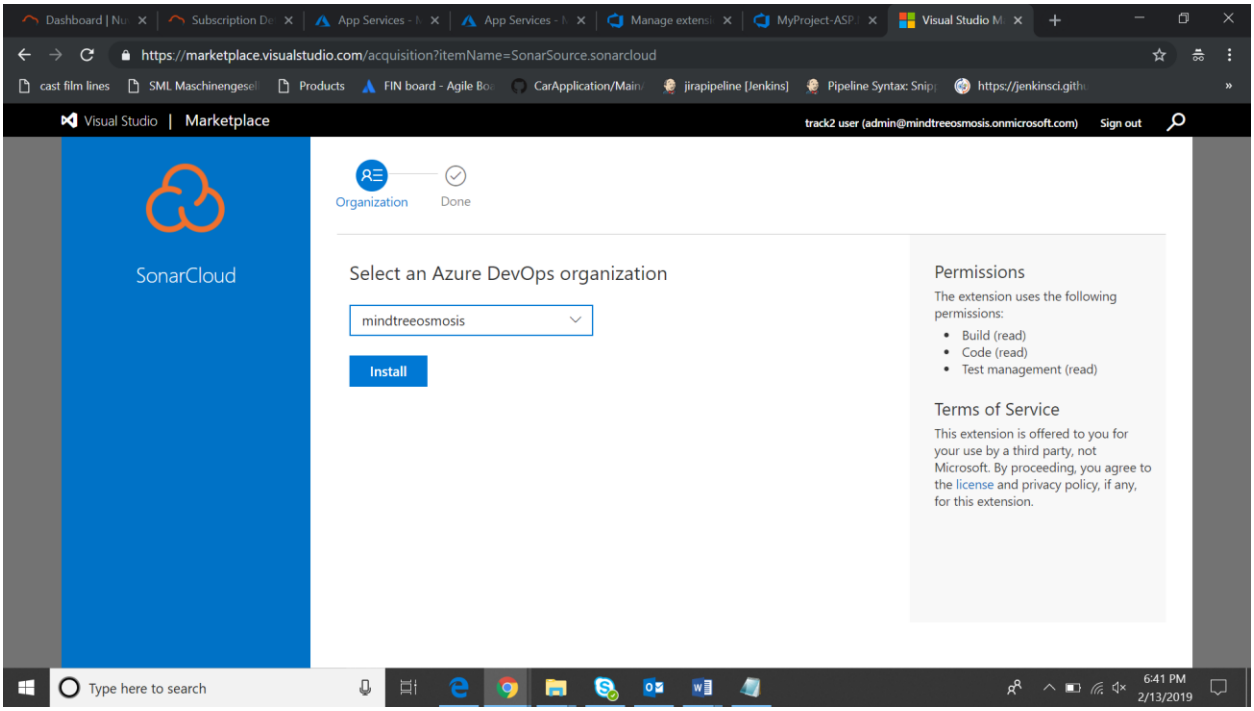
28. Click on the "+" in Agent Job 1 (It is used for adding tasks to the Pipeline) → Search for "SonarCloud".



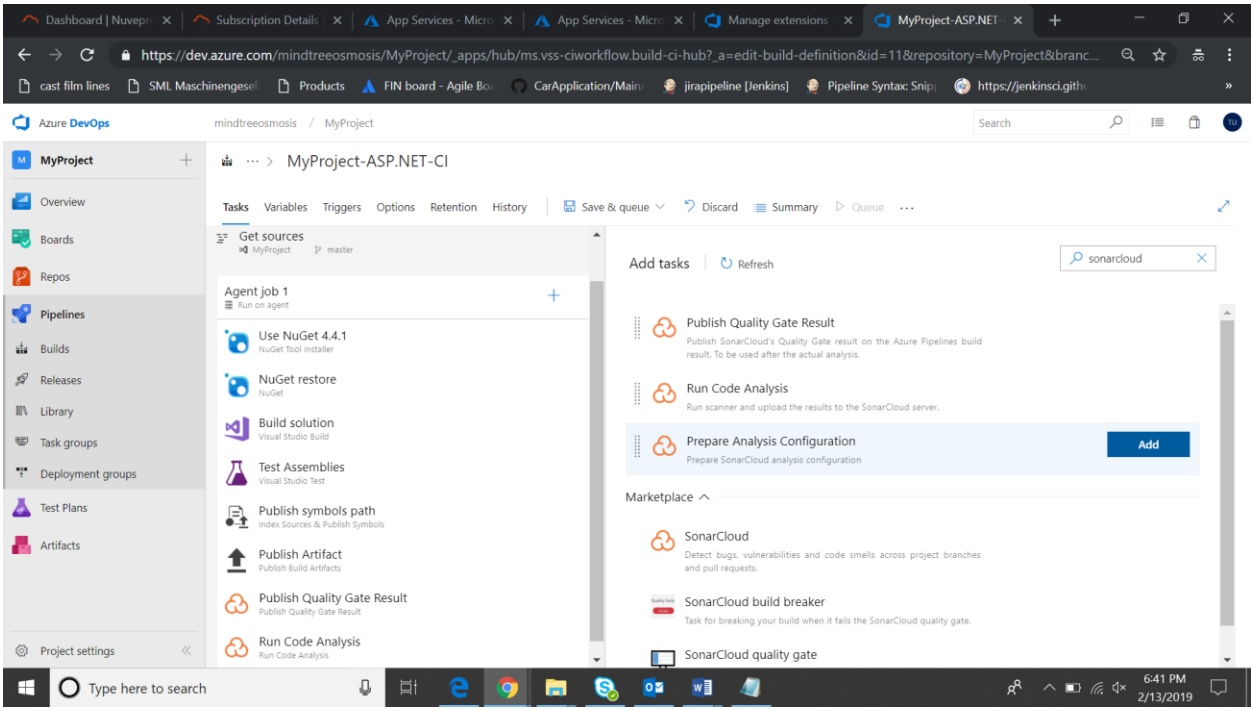
29. Click on "Get it Free" → Click "Get it Free" on the Redirected Page.



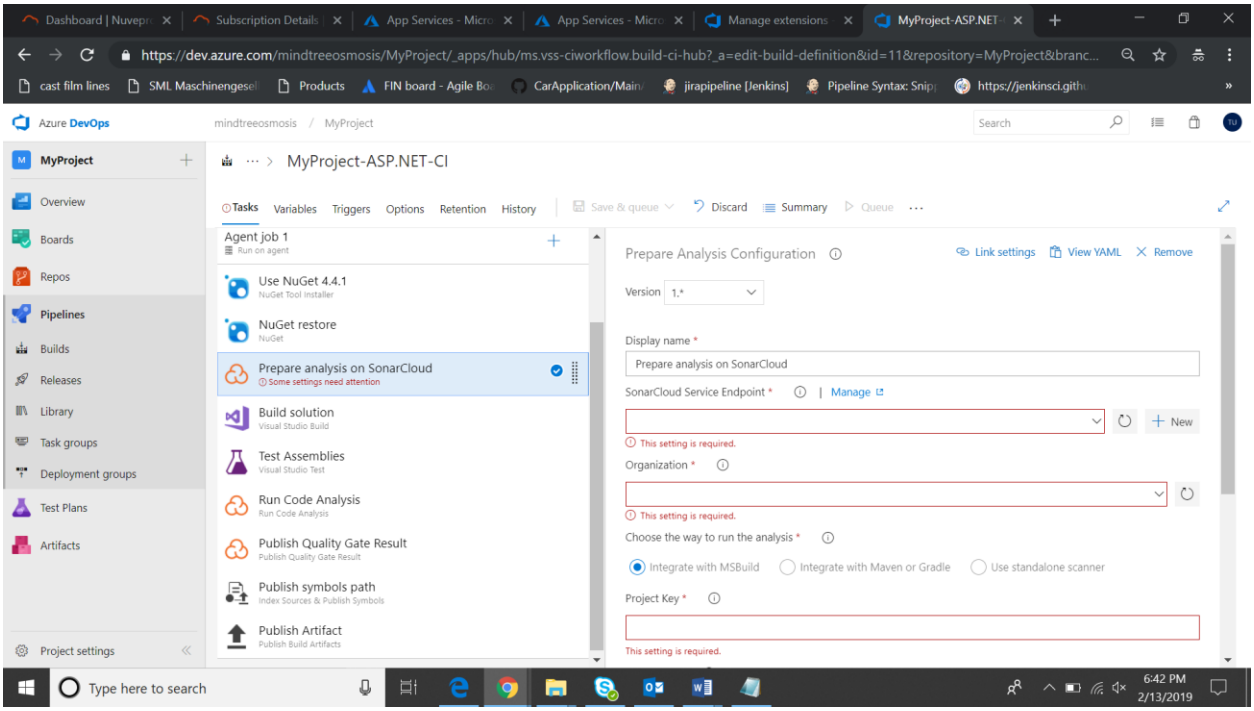
30. Click "Install".



31. Click “Proceed to Organization”.
32. Now add the SonarCloud Tasks → Add “Prepare Analysis Configuration” → Add “Run Code Analysis” → Add “Publish Quality Gate Result”.

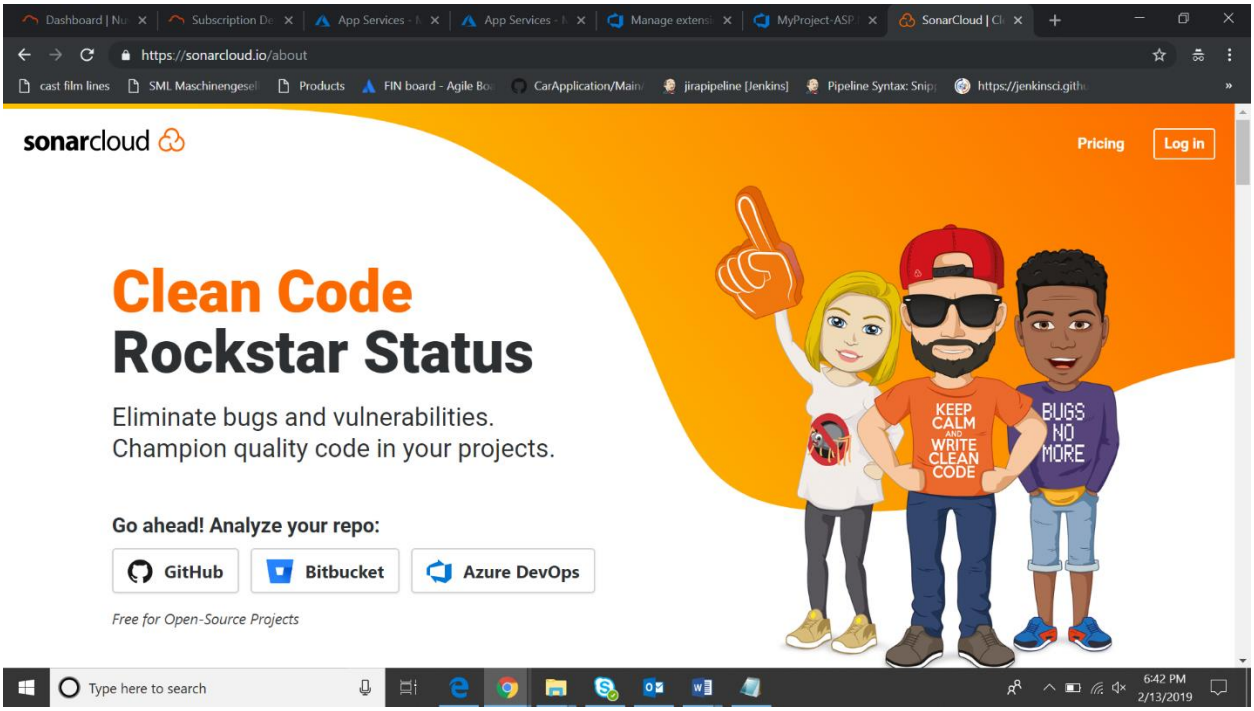


33. The arrangement of tasks should be in the order as shown in the window.

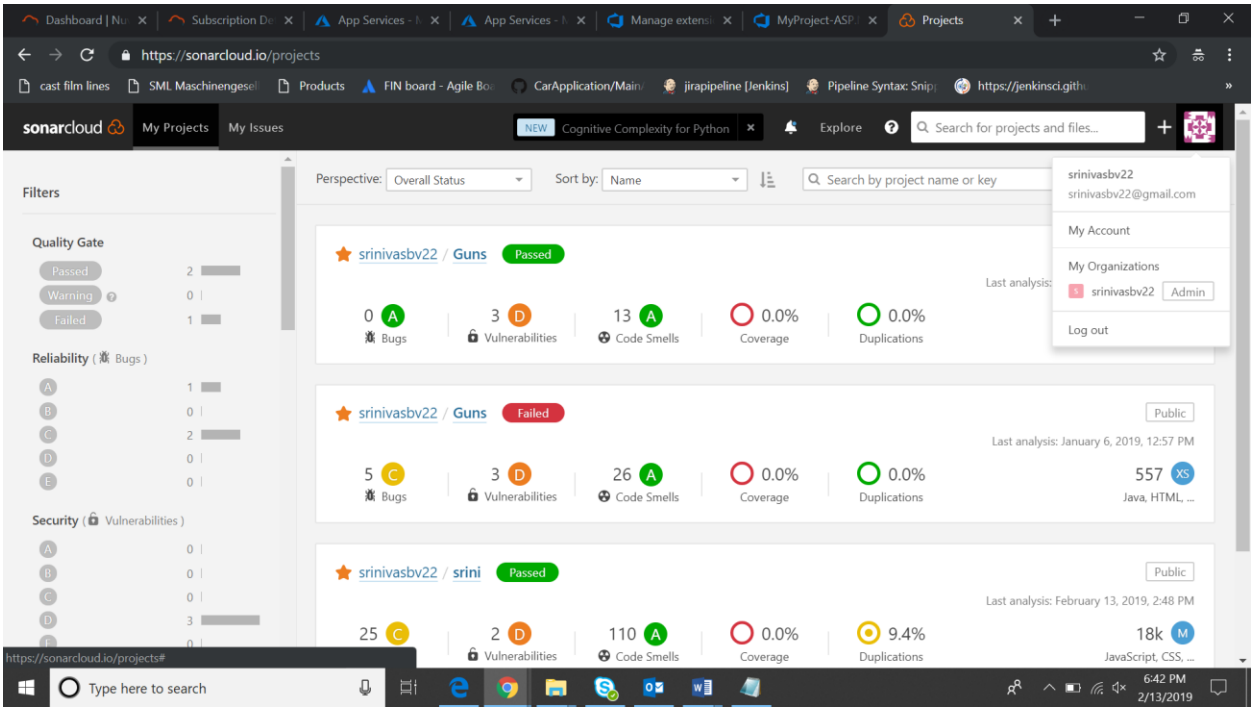


34. On the Browser go to “Sonarcloud.io”.
    https://sonarcloud.io/about

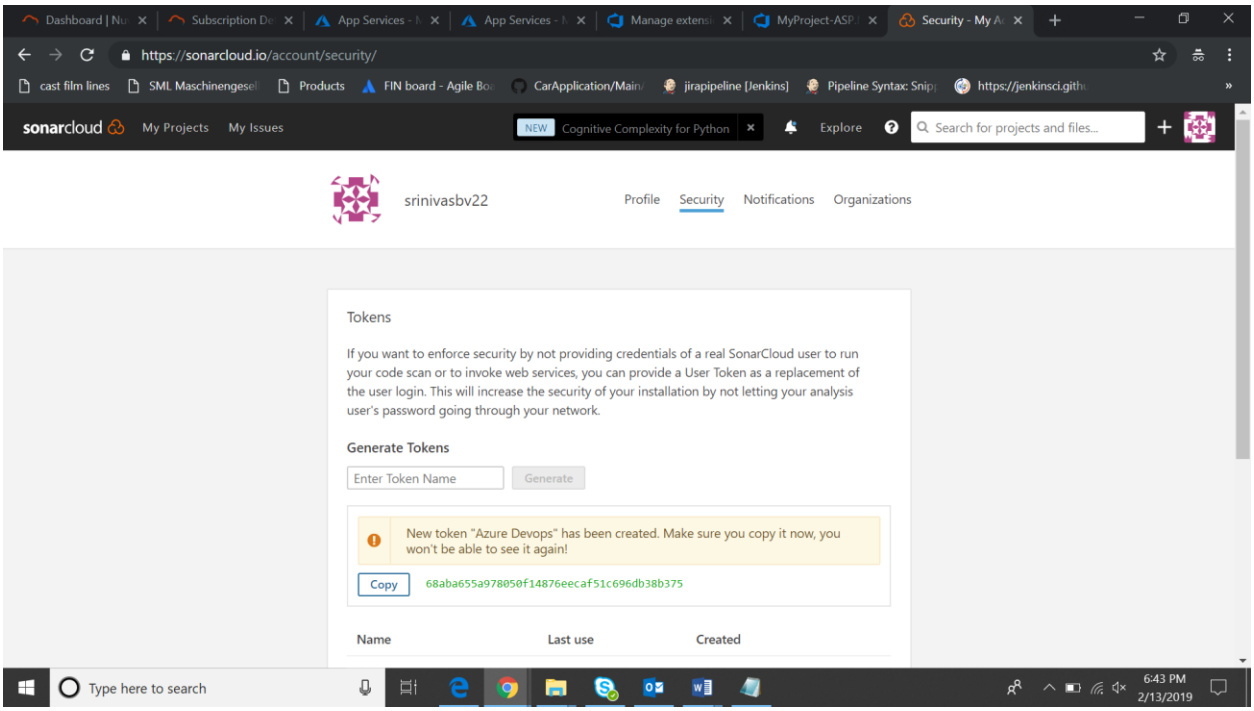
35. Login with “GitHub”.



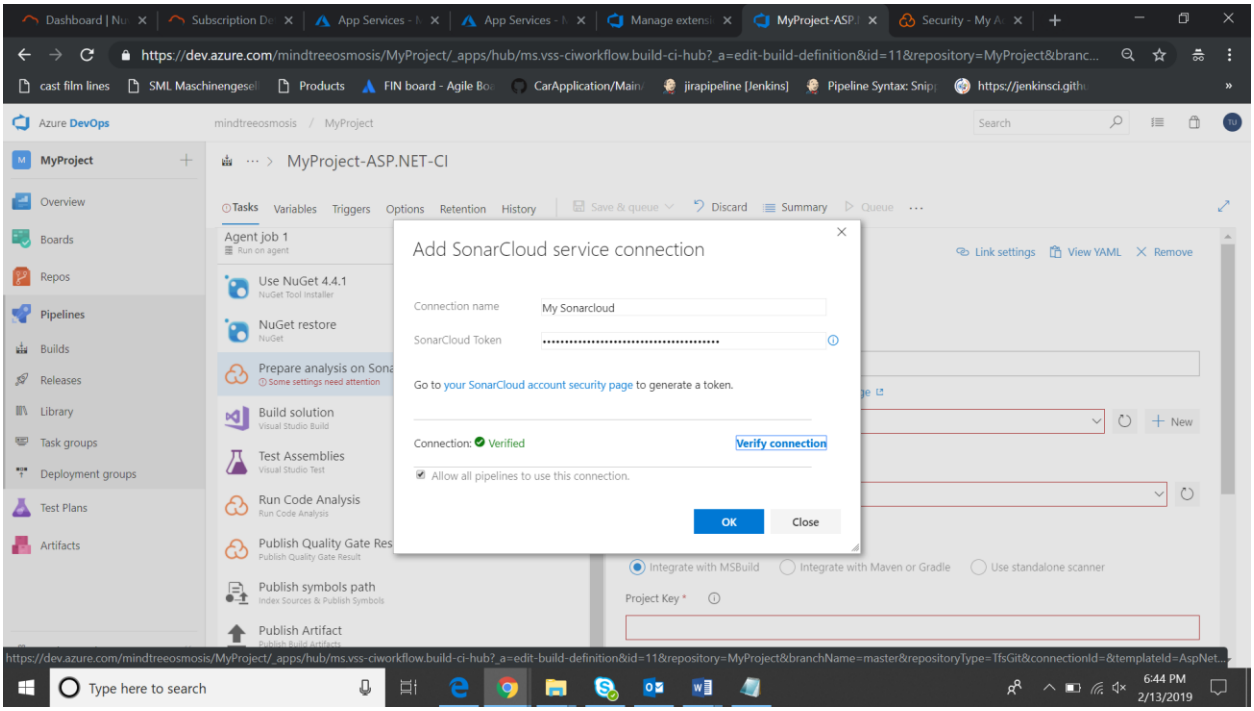
36. Click on “Account” → Click on “My Account”[For account click on right top Photo].



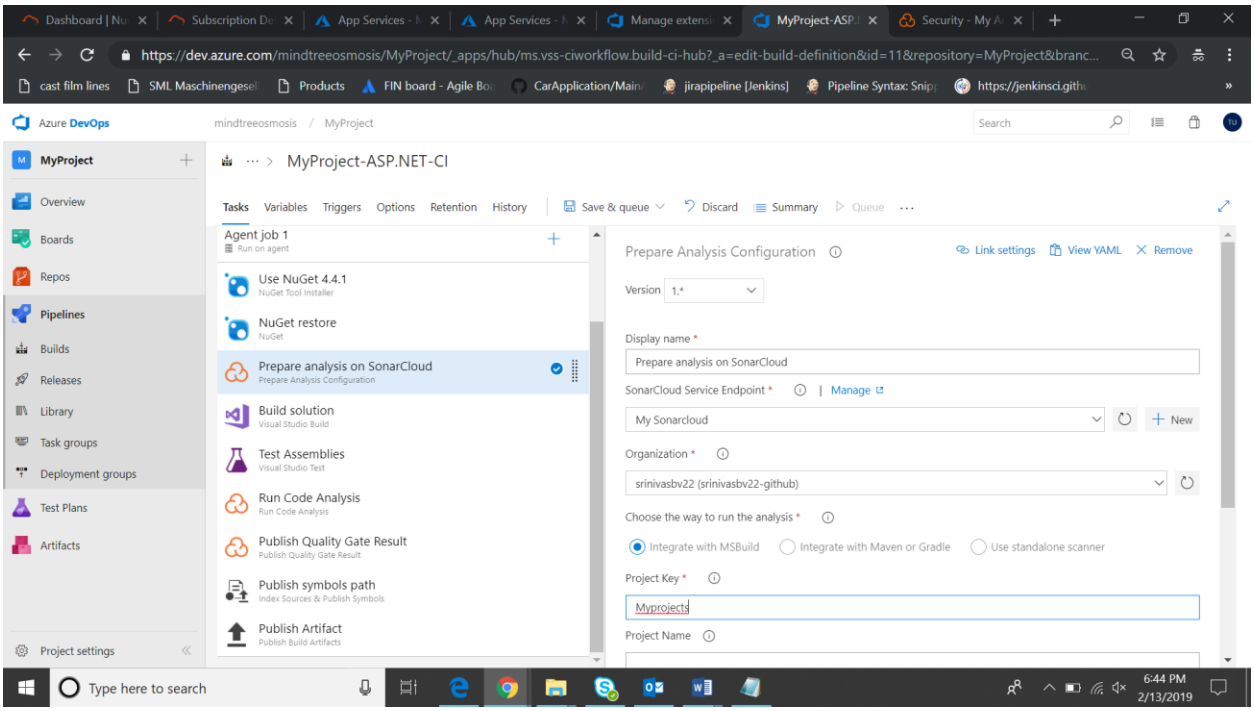
37. Click on "Security" → Give a name for the token → Click "Generate" → Copy the "Access Key".



38. Get back to you Azure DevOps Project and Click "Prepare Analysis on SonarCloud" → On the right Bullet tab Click on "+ New" → Give the connection a name → Paste the token generated in SonarCloud.io → Click Verify Connection → Click "Ok".



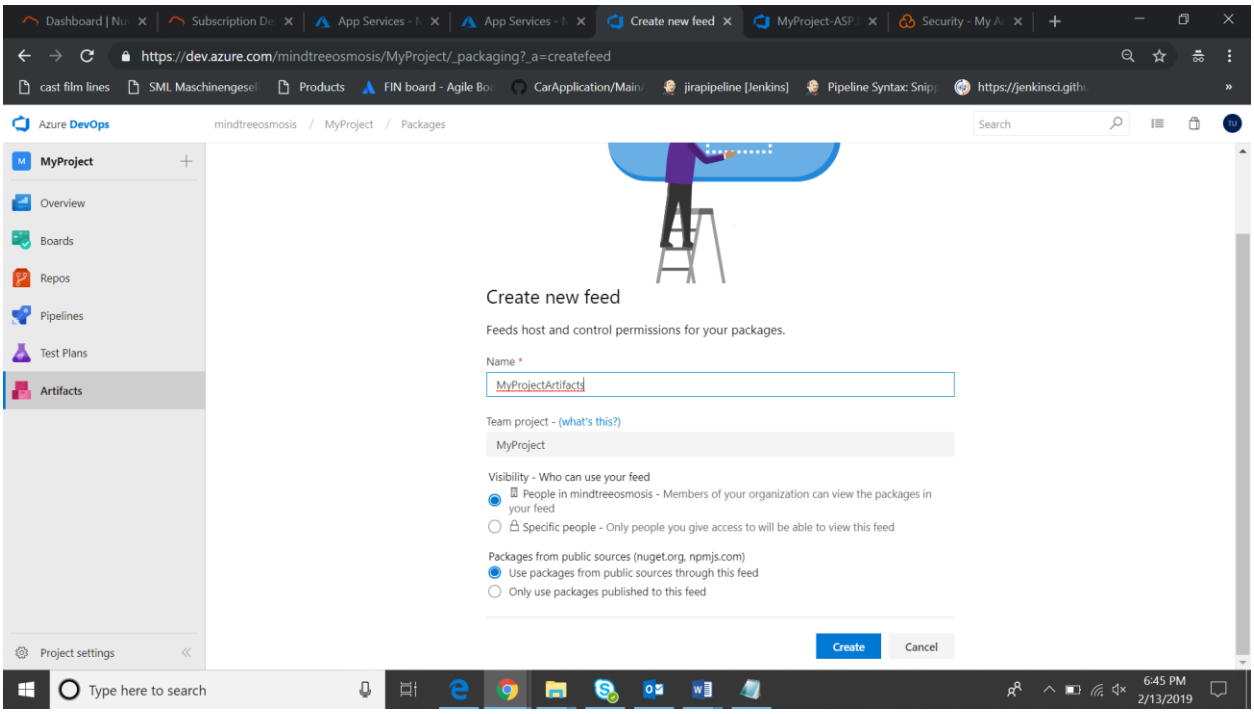
39. Select your “Organization” from the drop down and give the “Project key” a Unique Name.



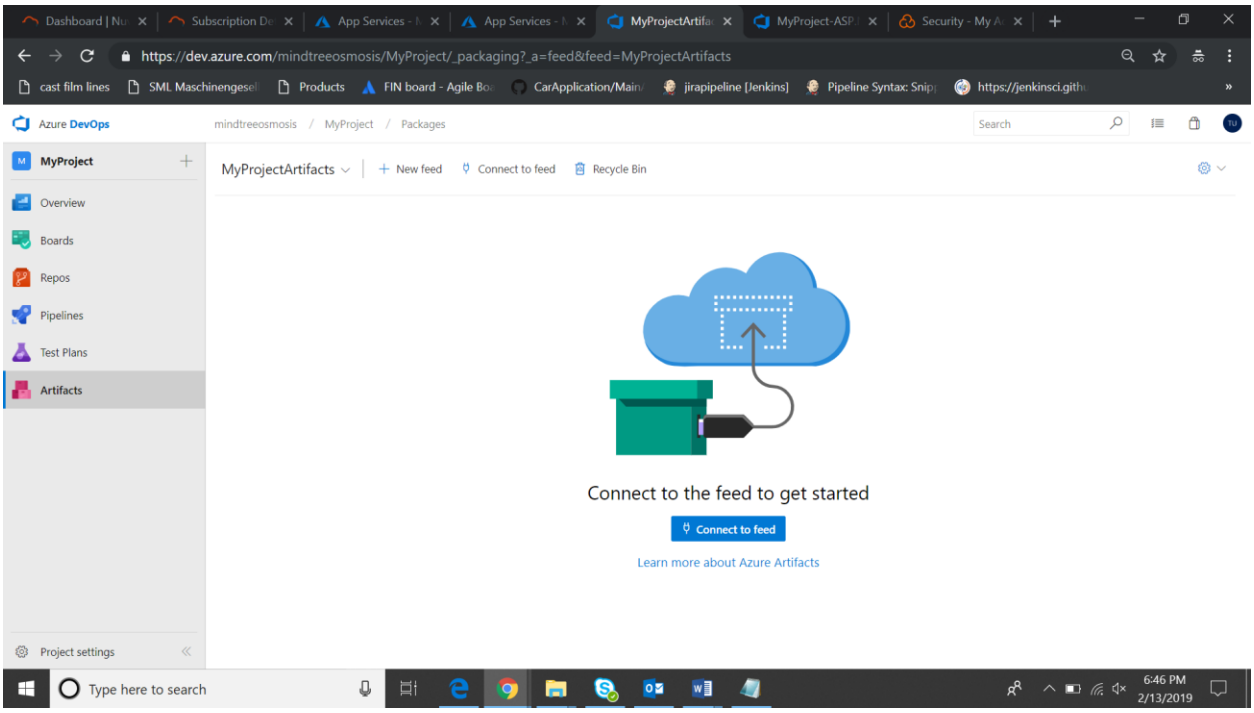
40. Click on “Save” at the top.

Azure Artifacts

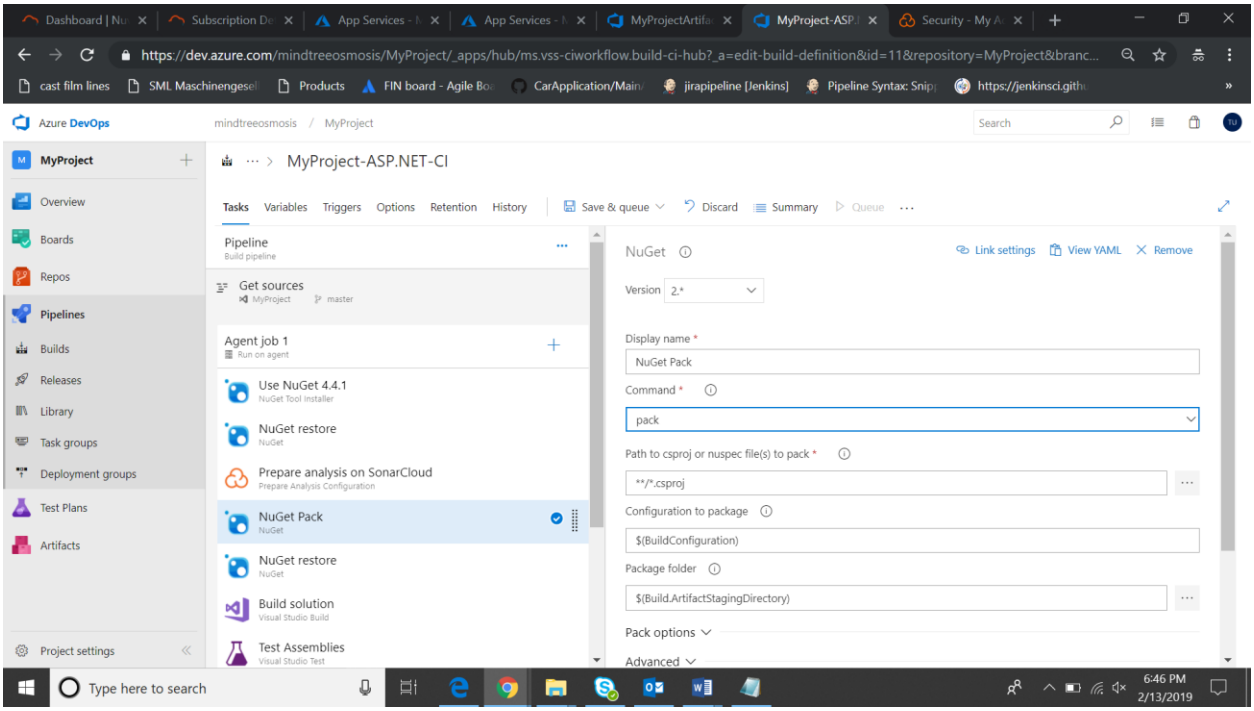
41. Click on "Artifacts" in the right bullet tab → Click on "+ New Feed" → Give the feed a name → Click "Create".



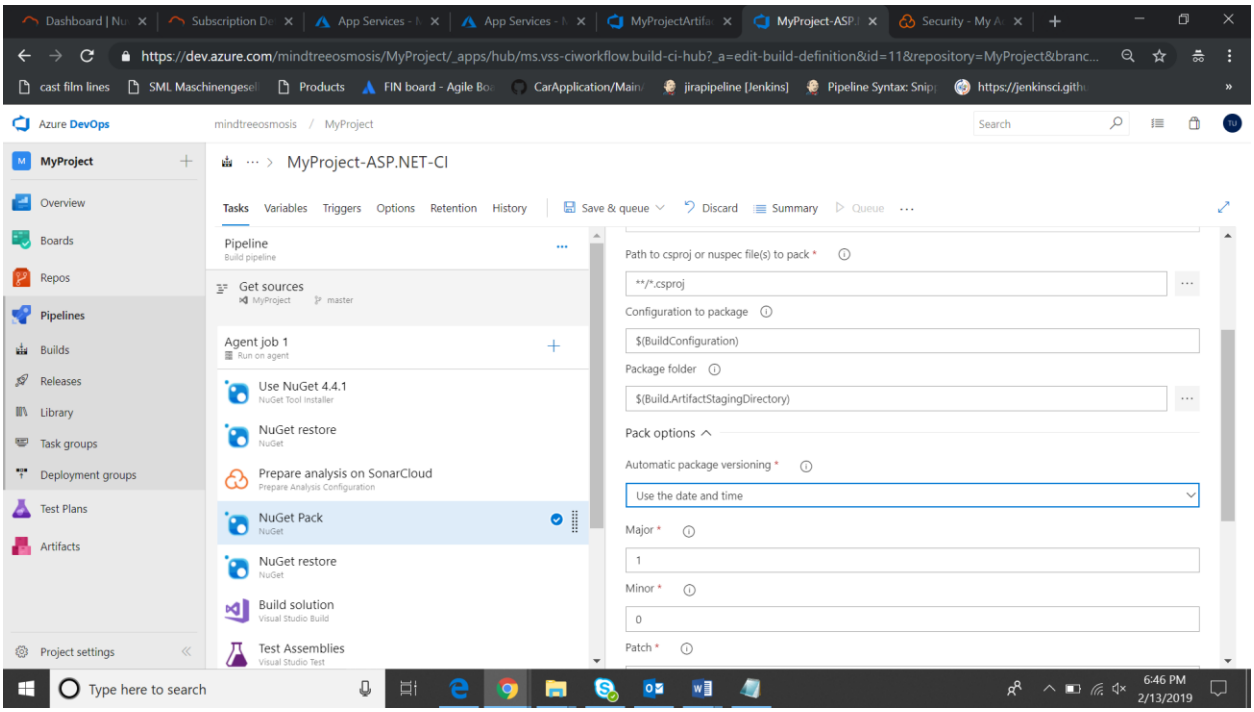
The below screen would be displayed after Create.



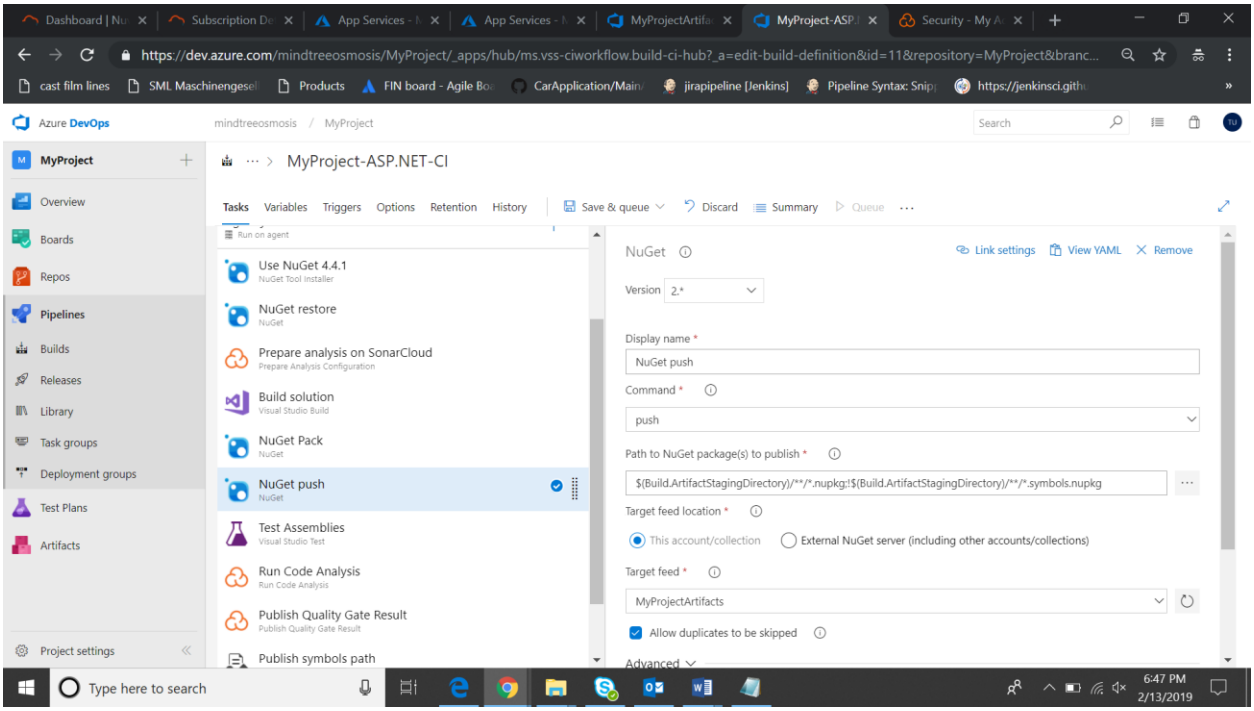
42. Click on "Pipelines" → "Builds" → "Edit" → Click on "+" to add tasks for artifactory Package and Push → Search for "Nuget" → Apply 2 times.



43. Rename the first Nuget Task to "Nuget Pack" → Select "Pack" for Command → Click on "Pack Options" → Select "Use the date and time" for Automatic Packaging Version.

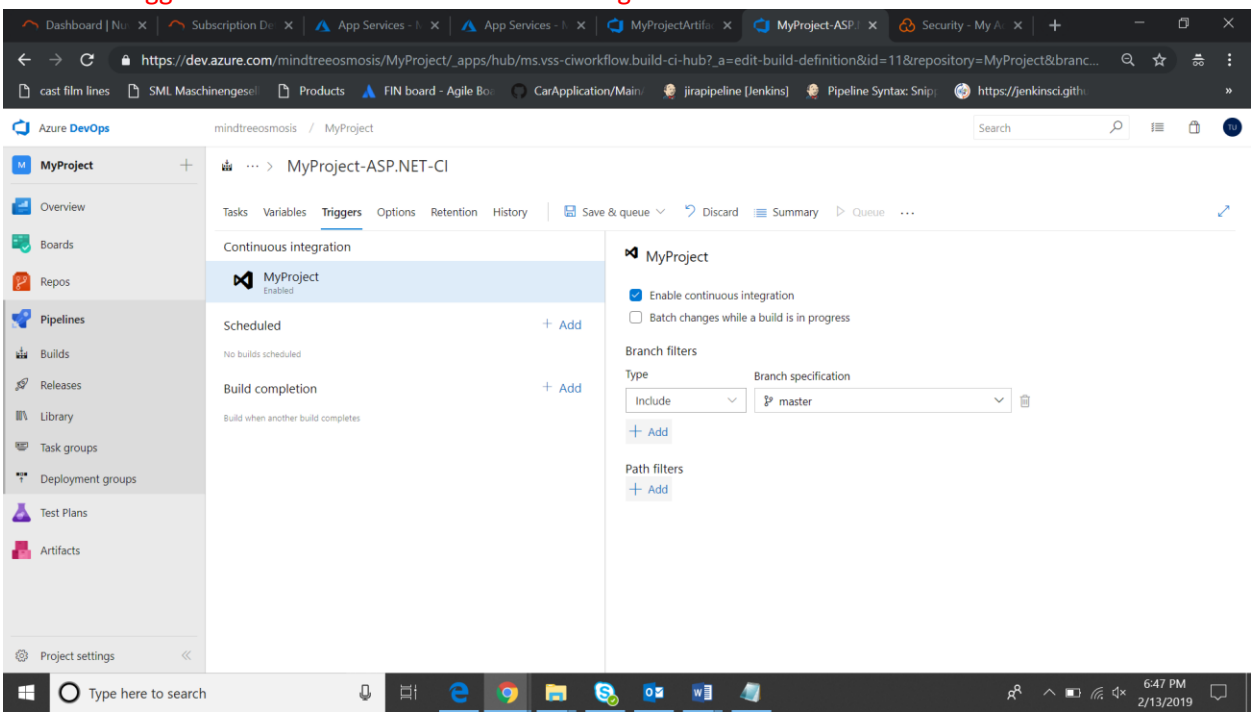


44. Click on the second Nuget and rename it to "Nuget Push" → Set the Command to "Push" → Select the Target Feed from the dropdown (The name should appear that you have given while creating the Feeds in Artifacts) → Check "Allow Duplicates to be skipped".

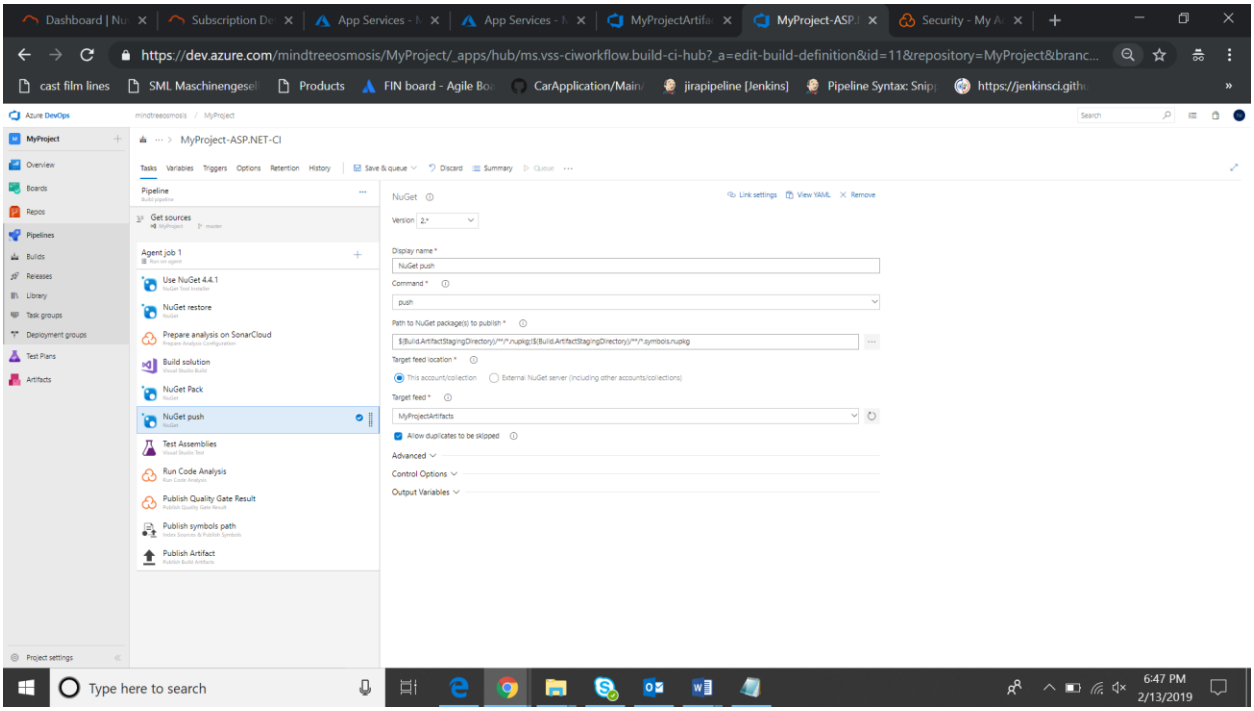


Note – Please make sure that the order of the tasks as in the order shown in the above window.

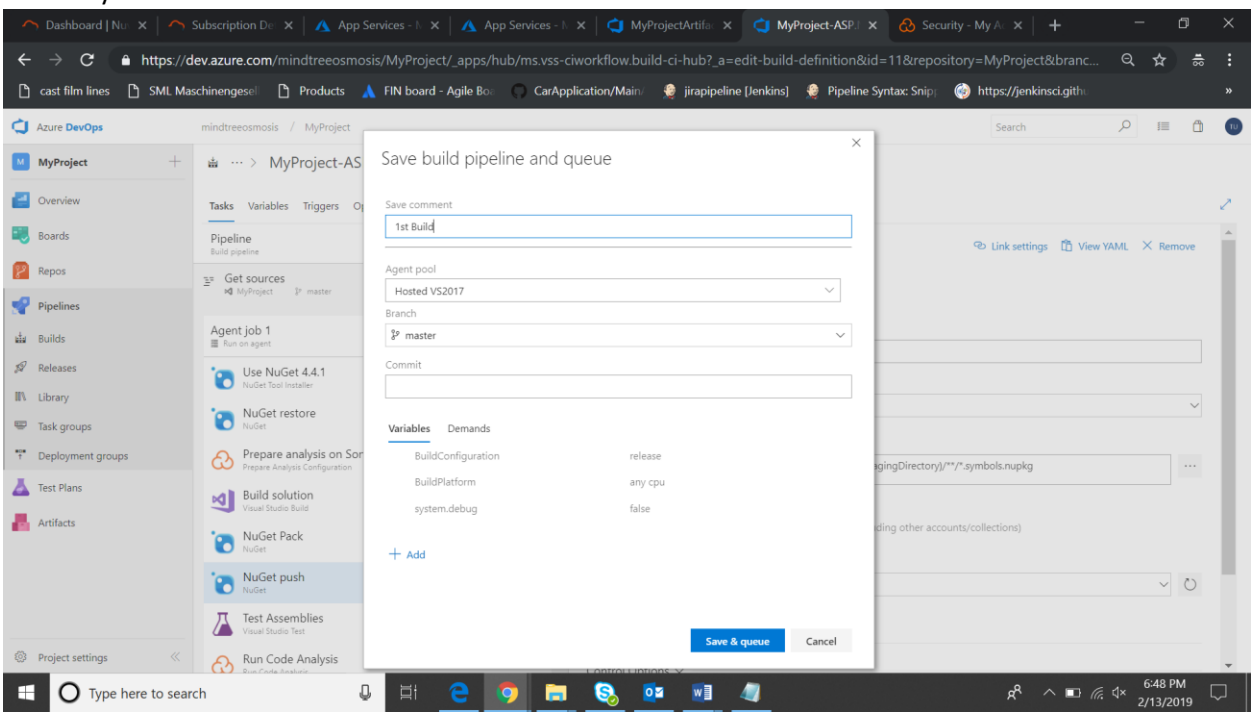
45. Click on "Triggers" -> Check "Enable Continious Integration".



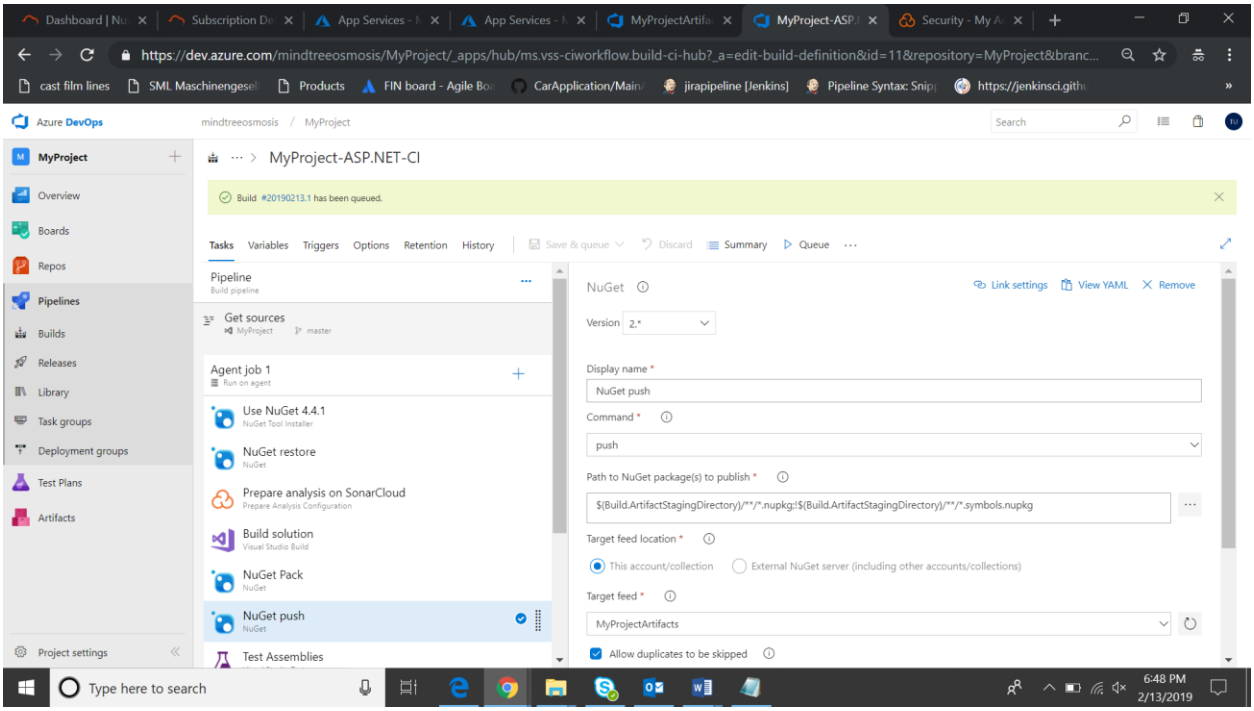
46. Below window shows the order of the tasks.



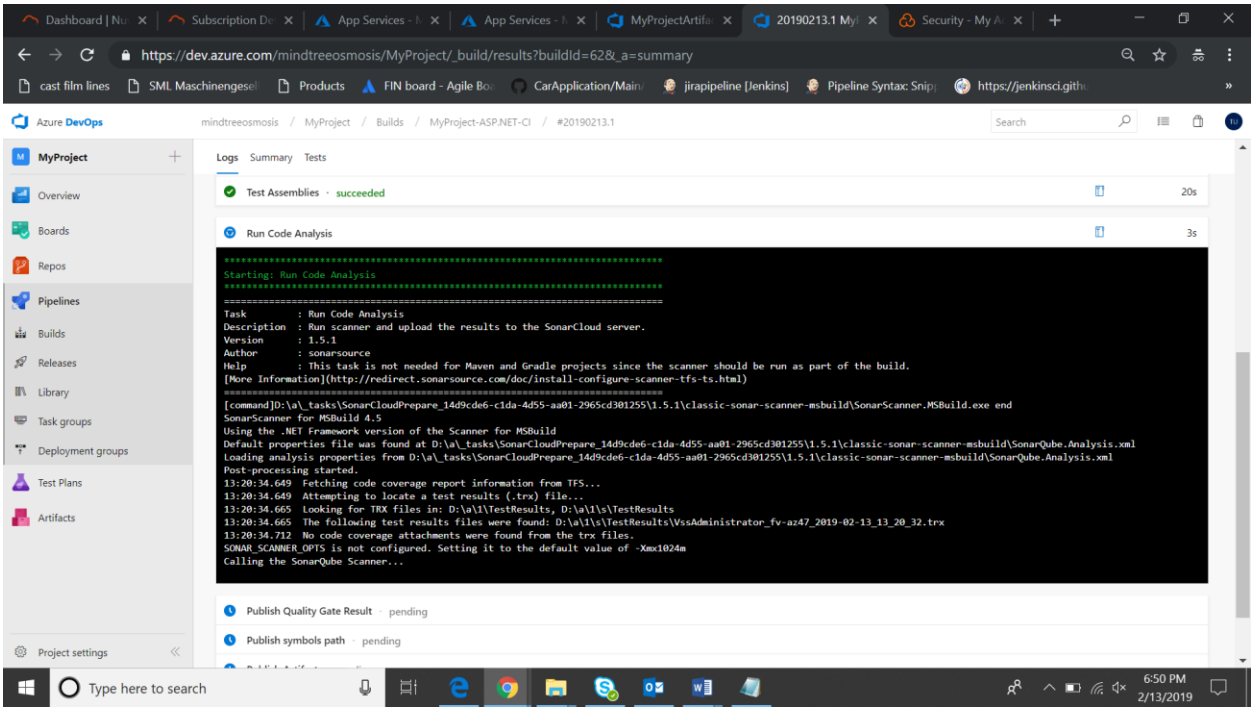
47. Click on "Save and Queue" → This will start a build → In a new Project the first Build has to be initiated manually.



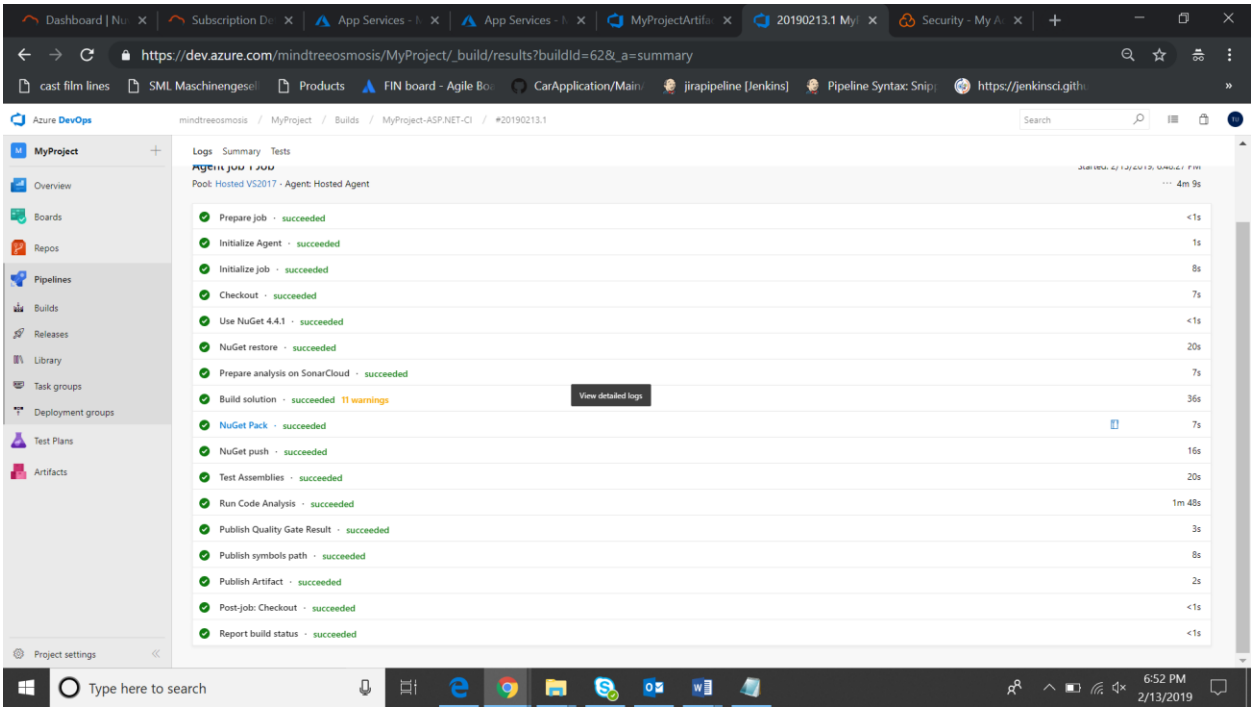
48. The build has started.



49. Tasks assigned are being performed by the agent.[Click on #201902131 to view this]

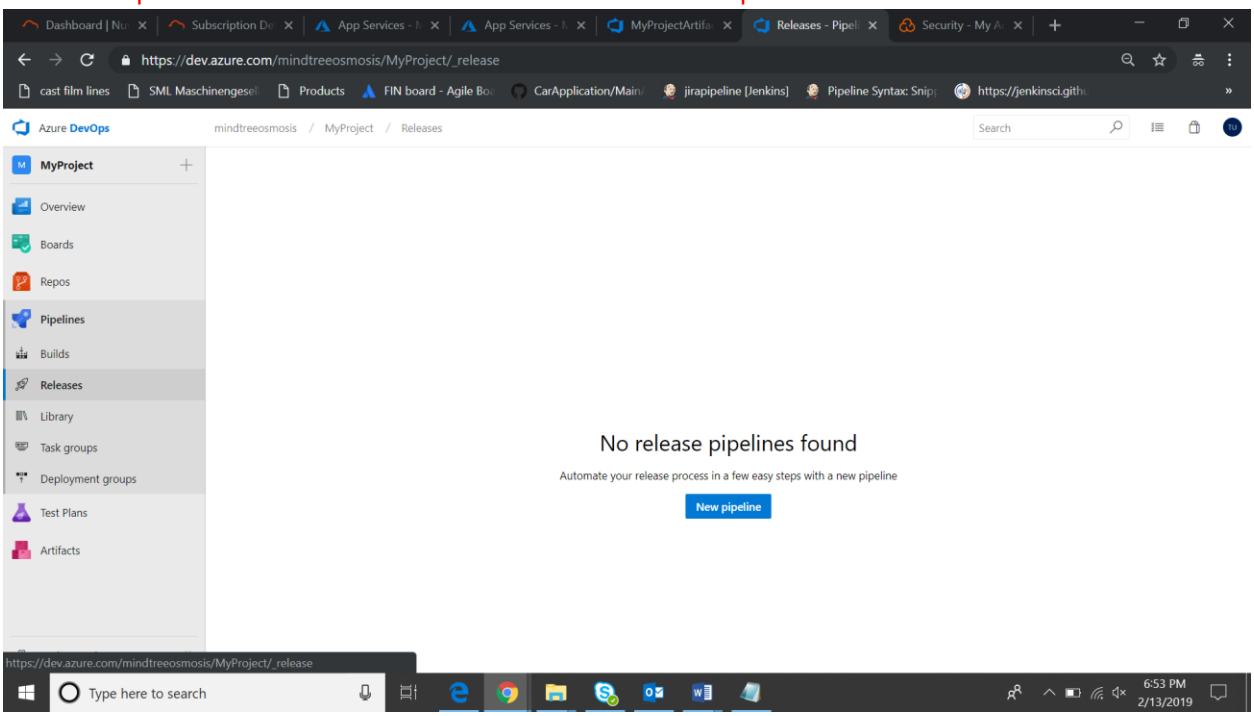


50. Build has successfully completed with all the below tasks executed completely.

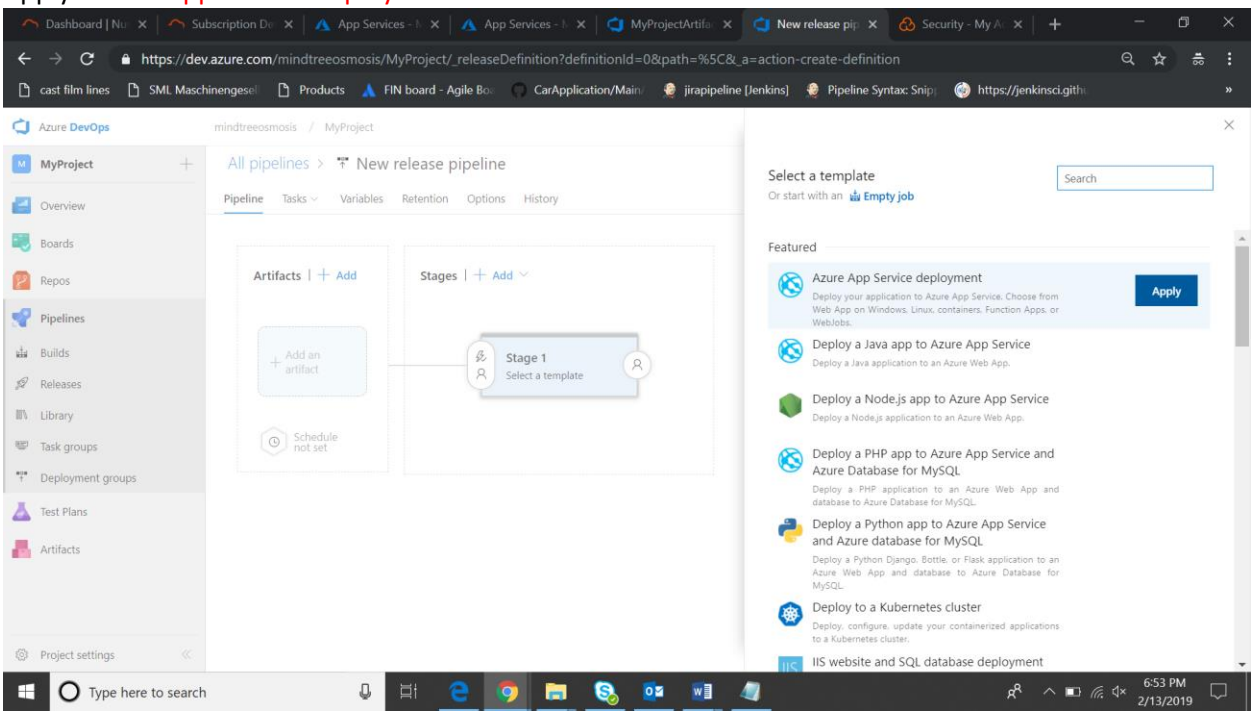

https://dev.azure.com/mindtreeosmosis/MyProject/_build/results?buildId=62&_a=summary
Azure DevOps
MyProject
Overview
Boards
Repos
Pipelines
Builds
Releases
Library
Task groups
Deployment groups
Test Plans
Artifacts
Project settings
Logs
Summary
Tests
Pool: Hosted VS2017 · Agent: Hosted Agent
4m 9s
Prepare job · succeeded <1s
Initialize Agent · succeeded 1s
Initialize job · succeeded 8s
Checkout · succeeded 7s
Use NuGet 4.4.1 · succeeded <1s
NuGet restore · succeeded 20s
Prepare analysis on SonarCloud · succeeded 7s
Build solution · succeeded 11 warnings 36s
View detailed logs
NuGet Pack · succeeded 7s
NuGet push · succeeded 16s
Test Assemblies · succeeded 20s
Run Code Analysis · succeeded 1m 48s
Publish Quality Gate Result · succeeded 3s
Publish symbols path · succeeded 8s
Publish Artifact · succeeded 2s
Post-job: Checkout · succeeded <1s
Report build status · succeeded <1s
Type here to search
6:52 PM
2/13/2019

Release Pipeline

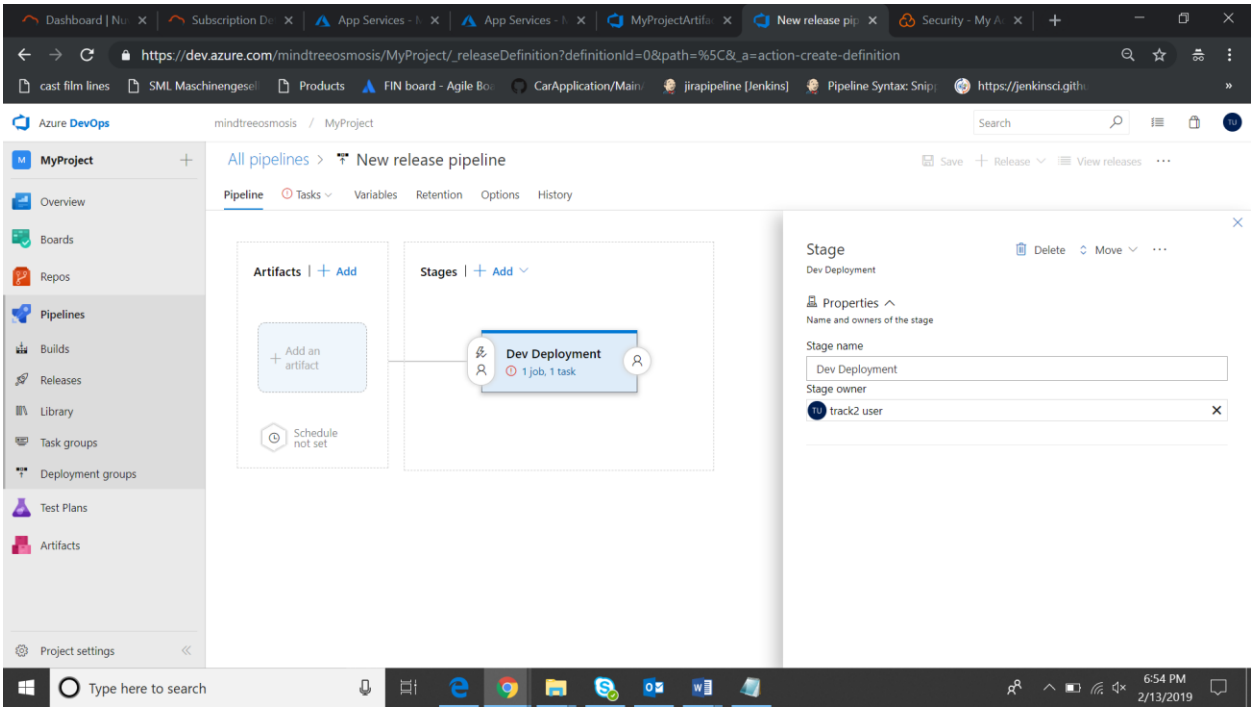
51. Click on “Pipelines” → Click on “Releases” → Click on “New Pipeline”.



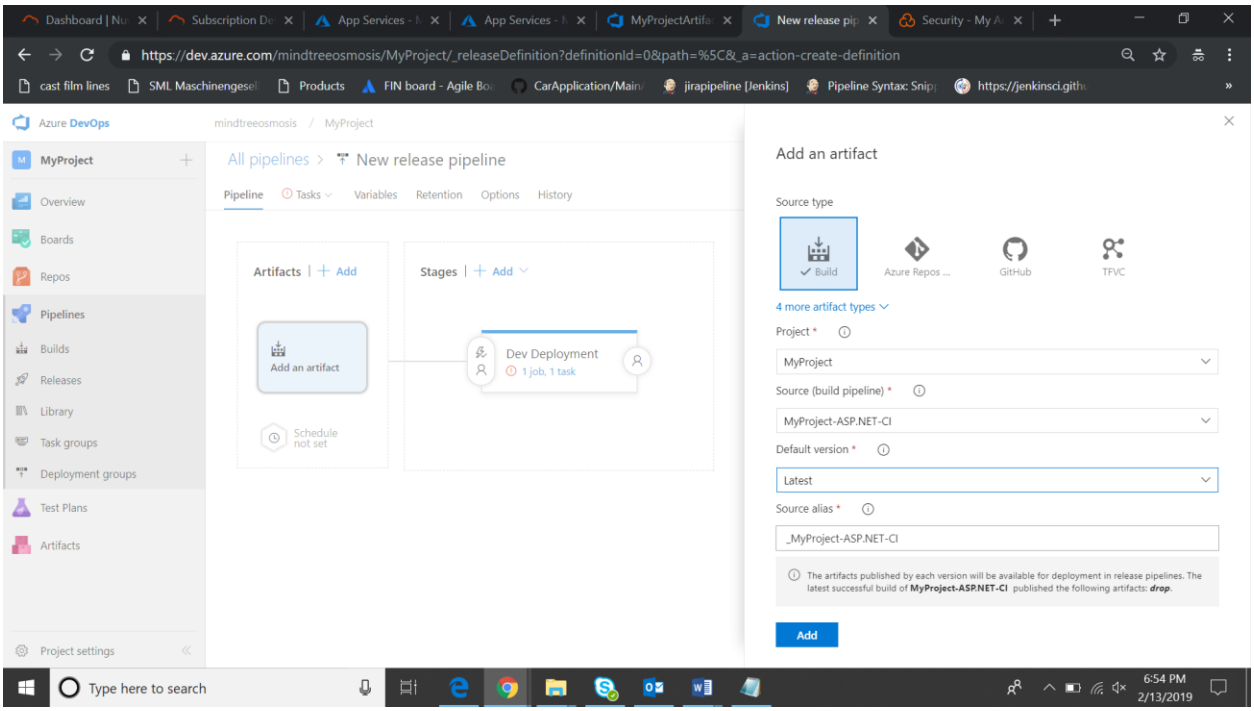
52. Apply “Azure App Service Deployment”.



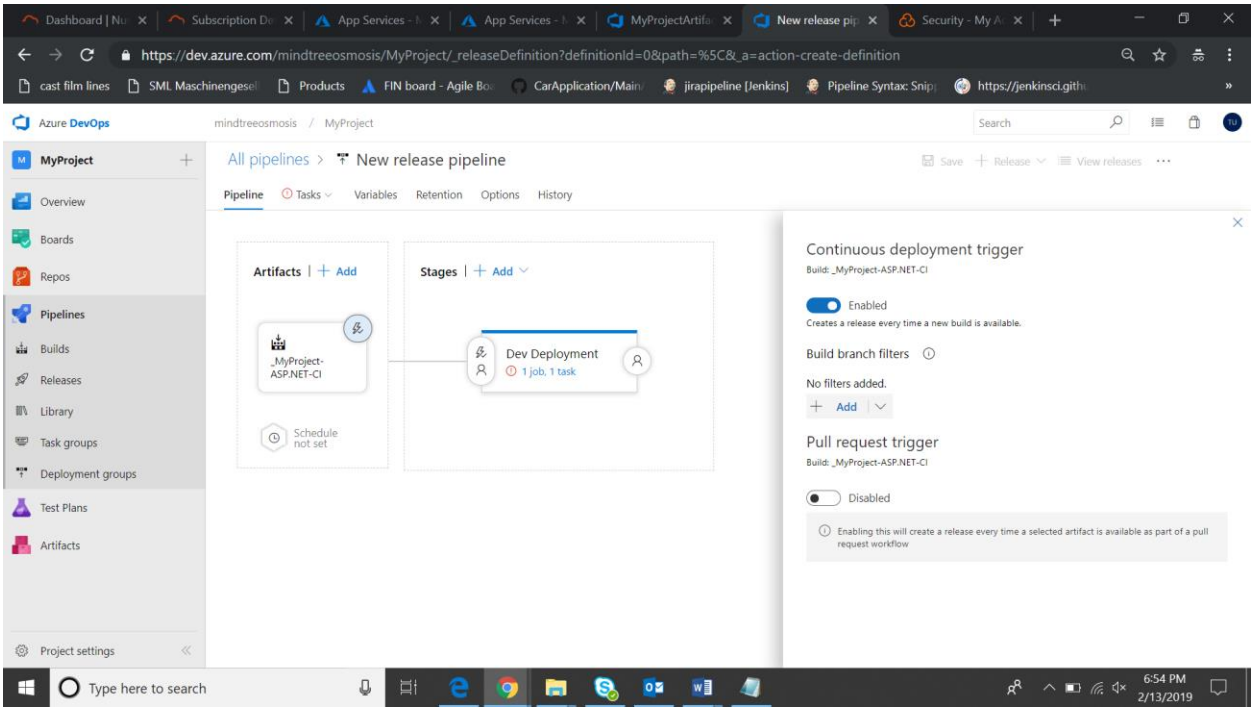
53. Name the stage as “Dev Deployment” → And close the right Bullet tab.



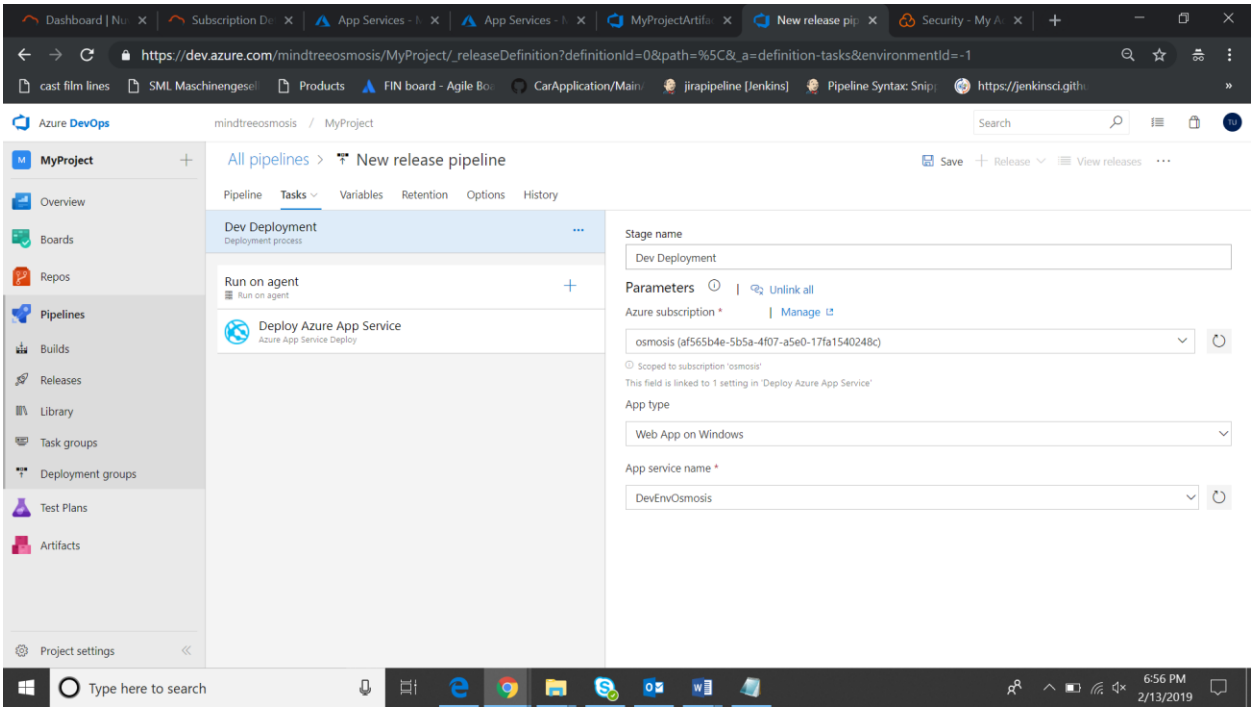
54. Click on "Add an Artifact" → Select the source from the drop down → Select the version to be Latest → Click on Add.



55. Click on the "Lightning Symbol" → Click on "Enable" under Continious Deployment Trigger → Close the bullet tab.



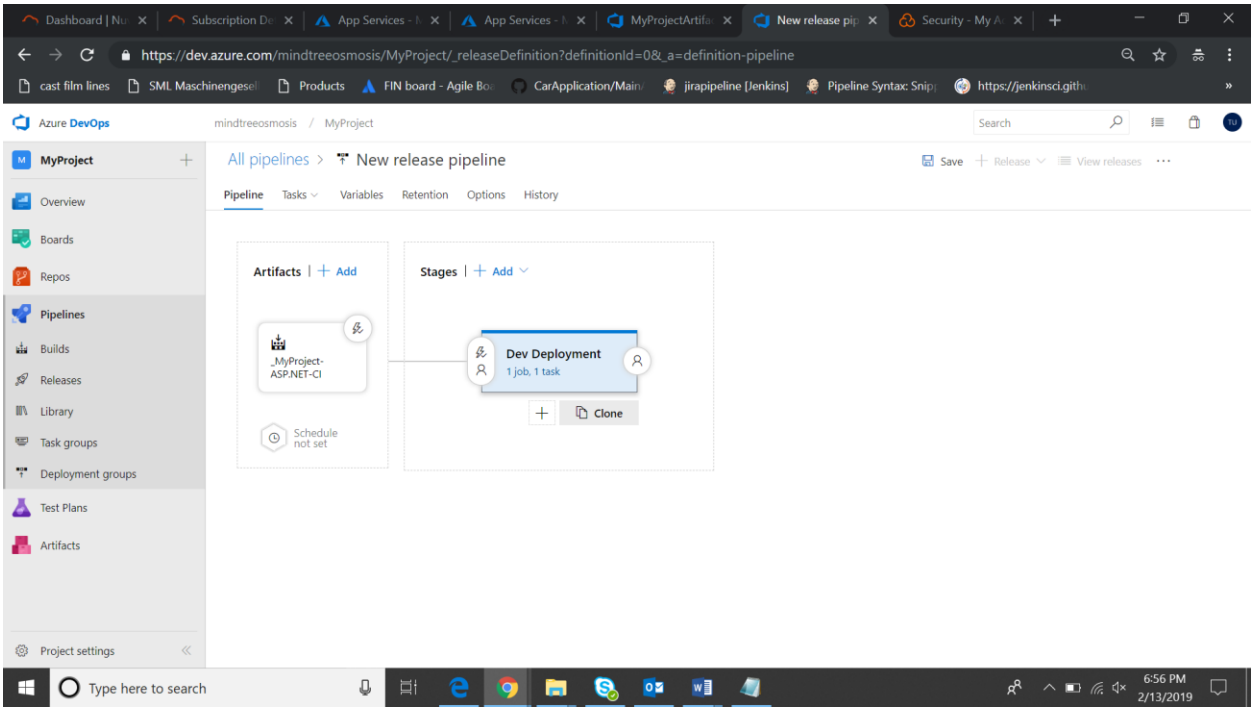
56. In stages under Dev Deployment → Click on "1 job, 1 task" → Select you Azure Subscription from the drop down → Click on "Authorize" → App Type should be set to "Web App on Windows" → Select the App Service Name from the drop down depending on your working environment (Dev Deployment in this case hence DevEnvOsmosis).



Note: The remaining steps are for Manual approval for team managers deployment and Higher authority approval.

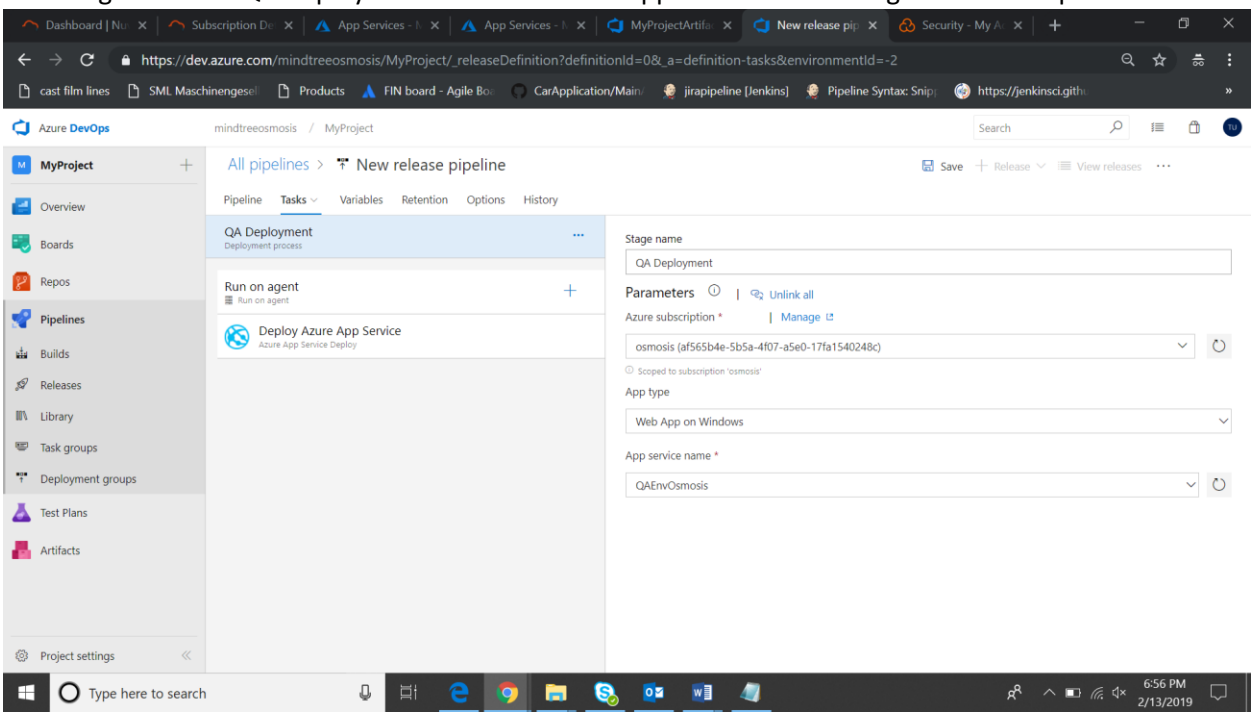
Otherwise continue with step 61.

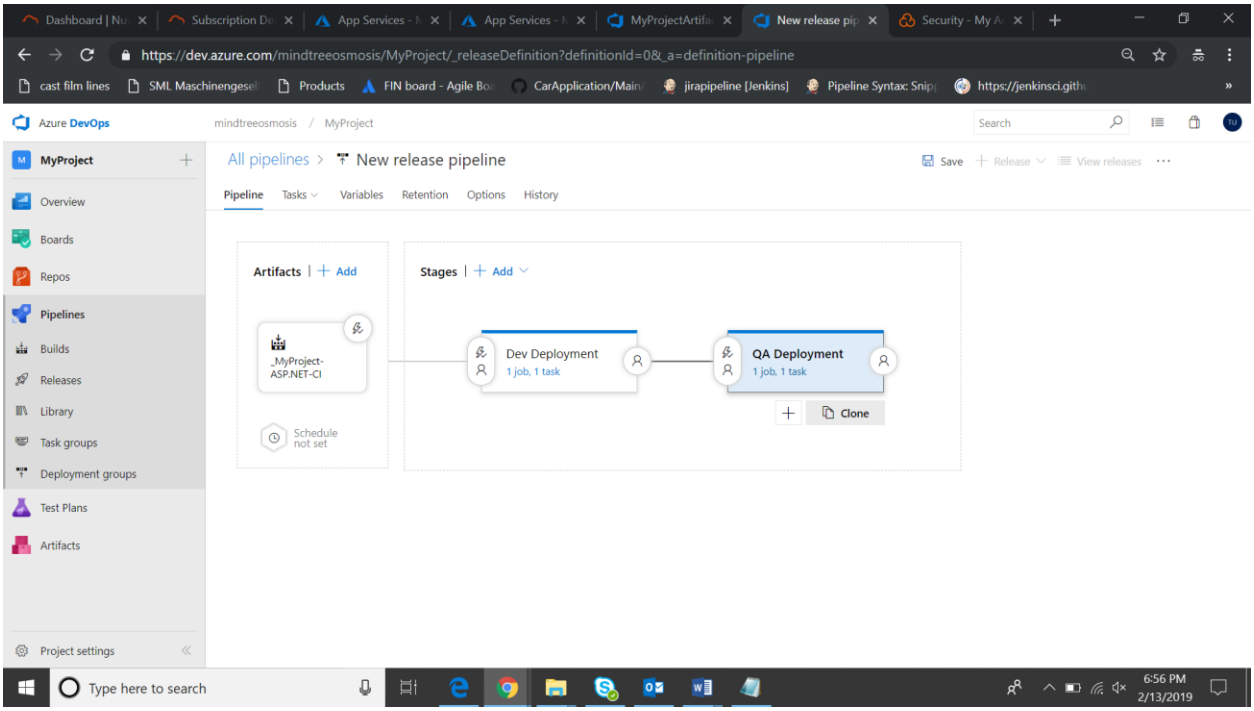
57. Close the bullet tab → Click on Clone and follow the same steps for other environments.



Click "1 job, 1 task"

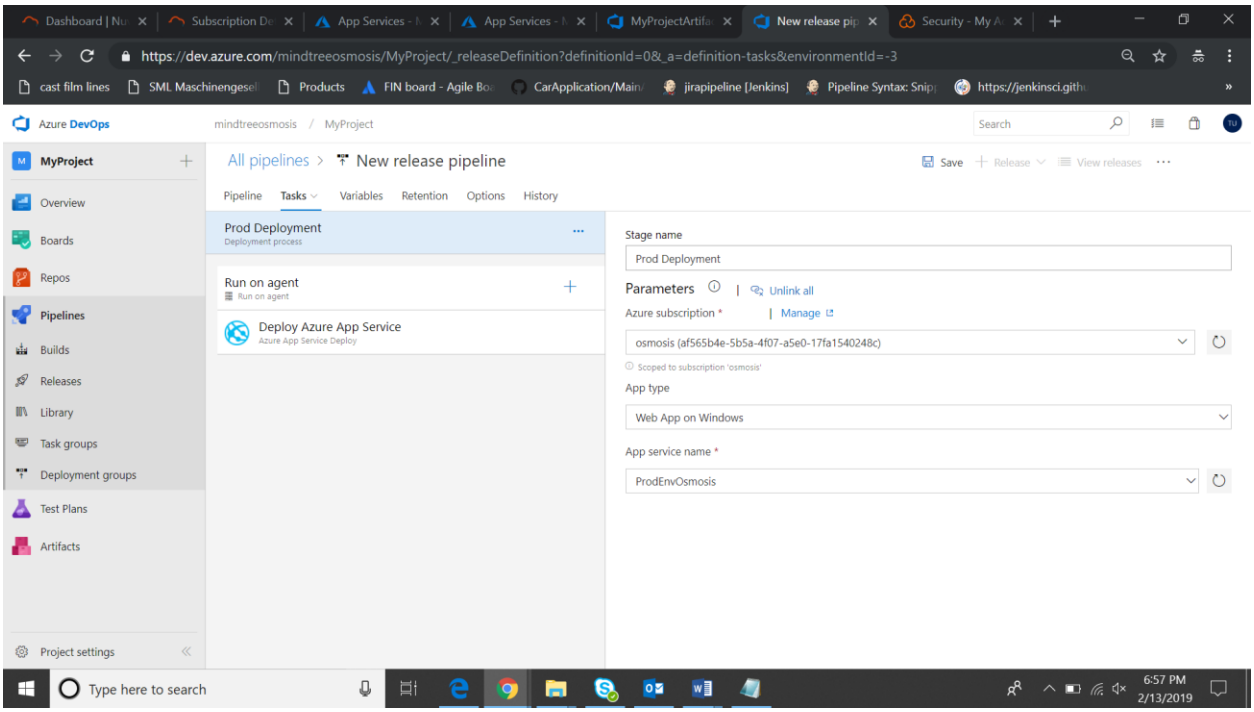
Give stage name as QA Deployment like and select "App service name" as given in azure portal.

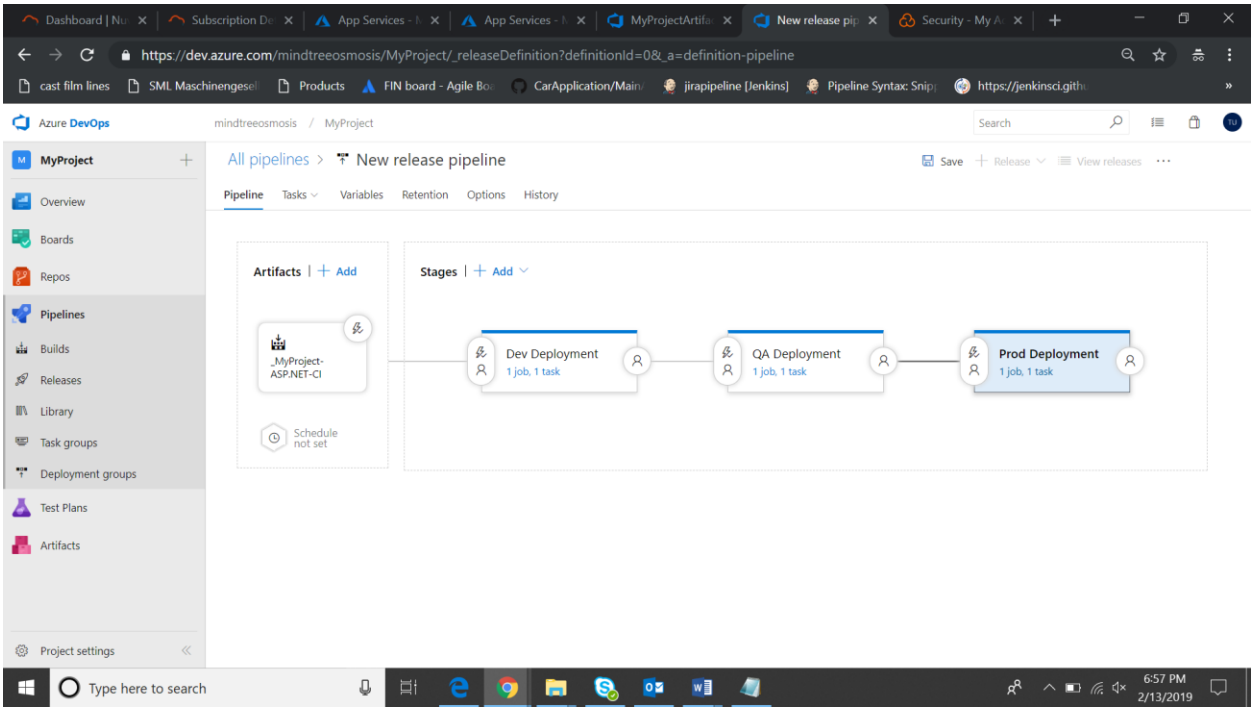




Click “1 job, 1 task”

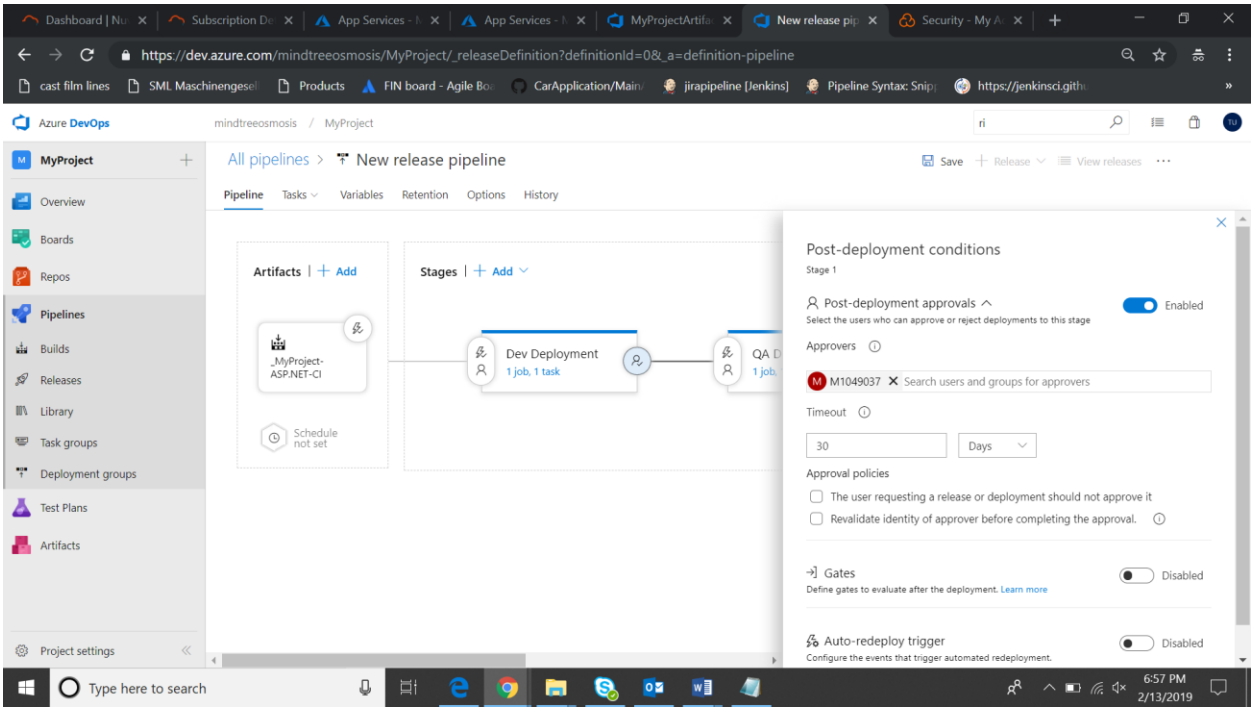
Give stage name as QA Deployment like and select “App service name” as given in azure portal.



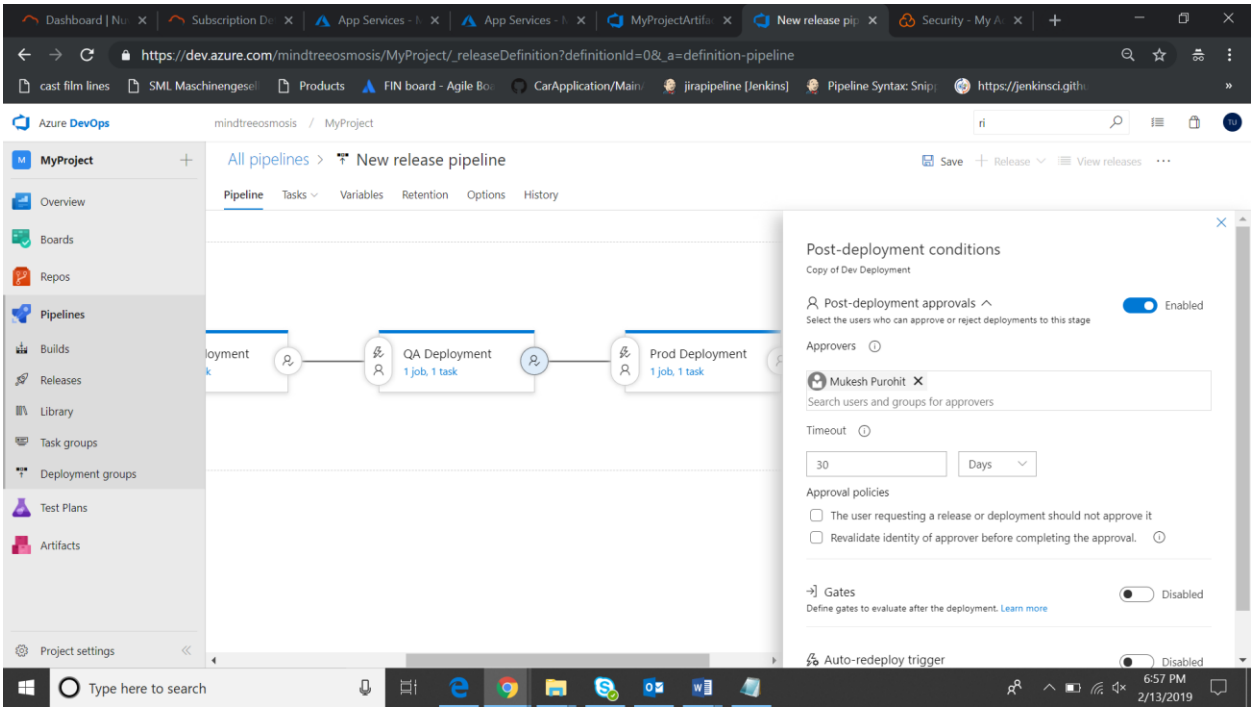


58. The Release pipeline is almost ready.

59. The QA and Production environments should get deployments only after manual approvals hence we need to set Post deployments Conditions → Click on the man icon → Enable Post deployment approvals and add the approver.



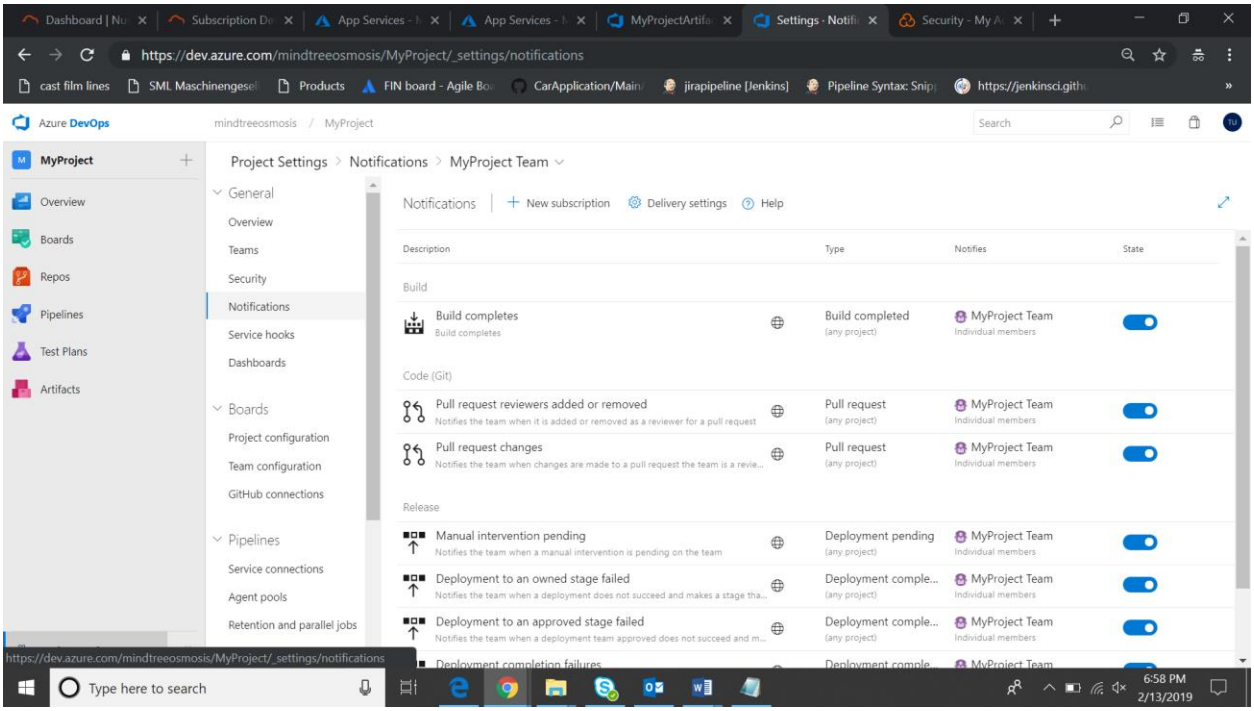
60. Similarly for QA to Production.



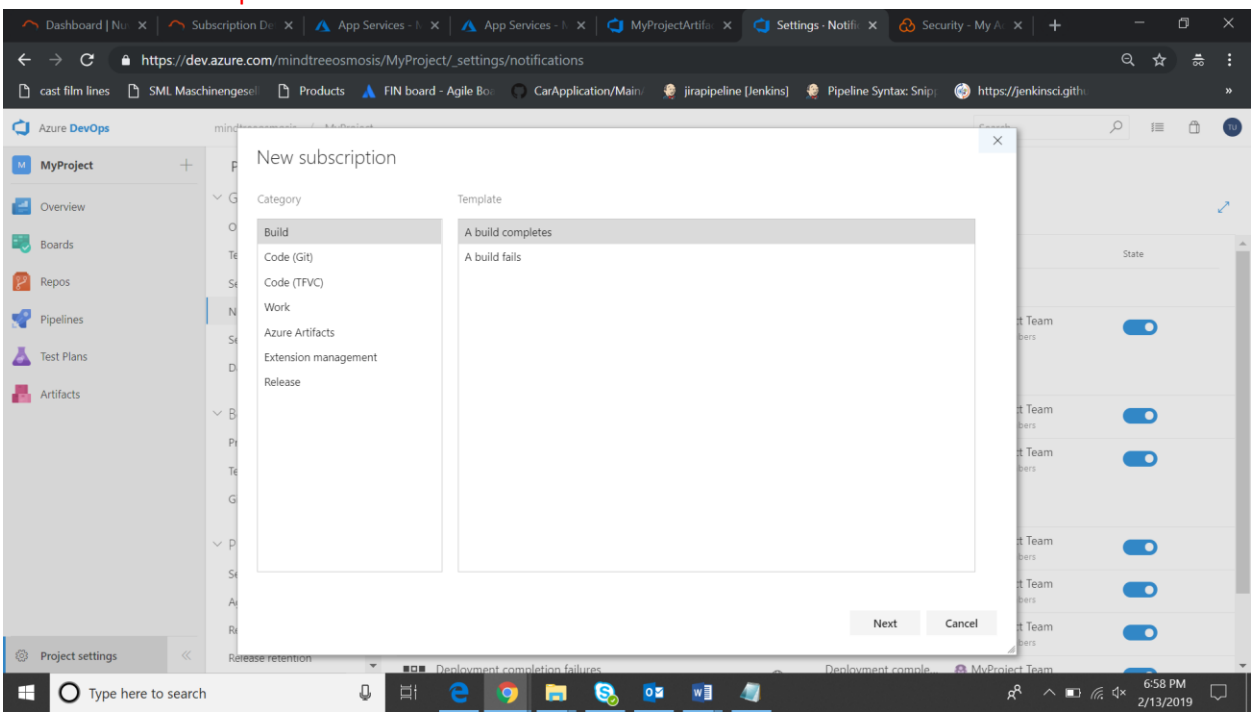
61. Click on “Save”.

Adding Notification services.

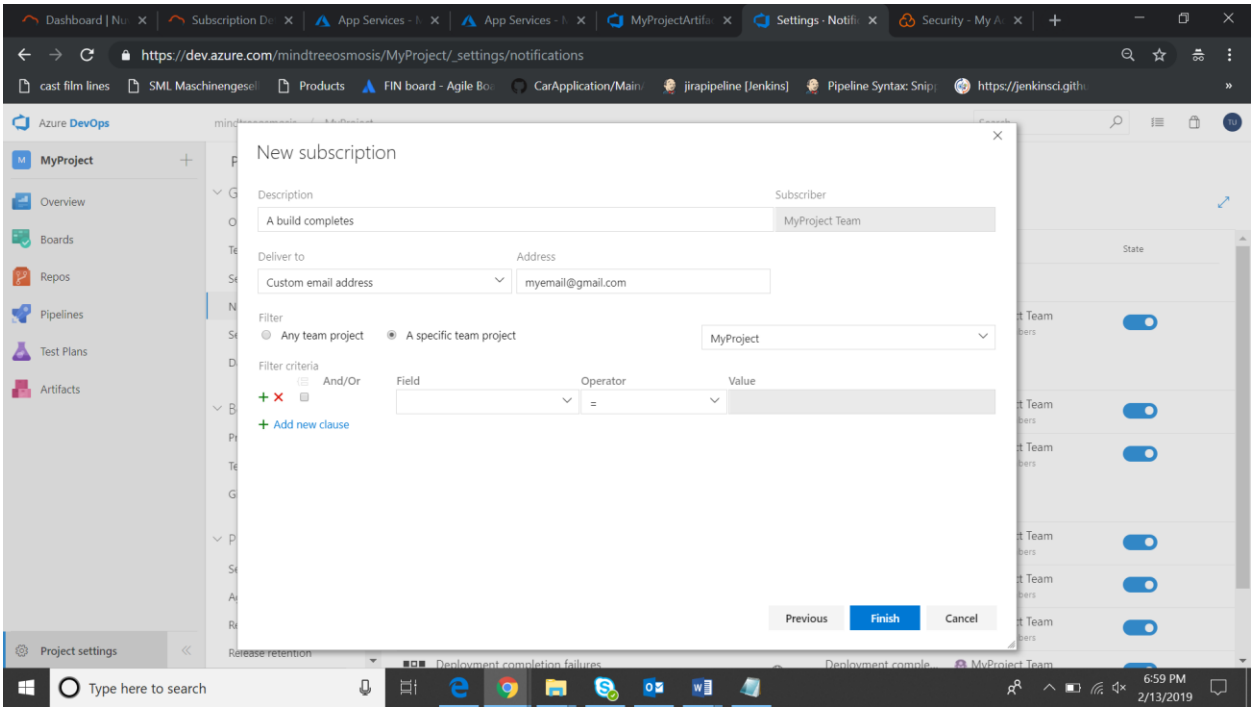
62. Click on “Project Settings”.
63. Click on “Notifications”.

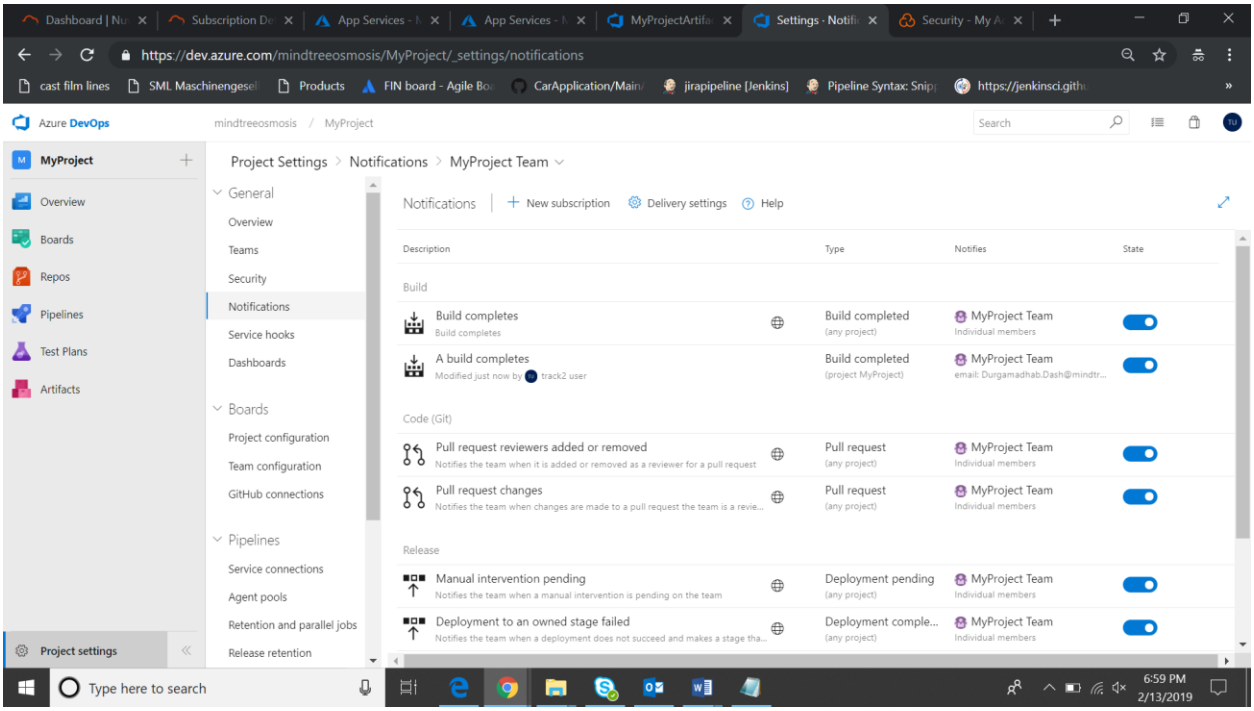


64. Click on "+ New Subscription".
65. Select "A build Completes" → Click "Next"



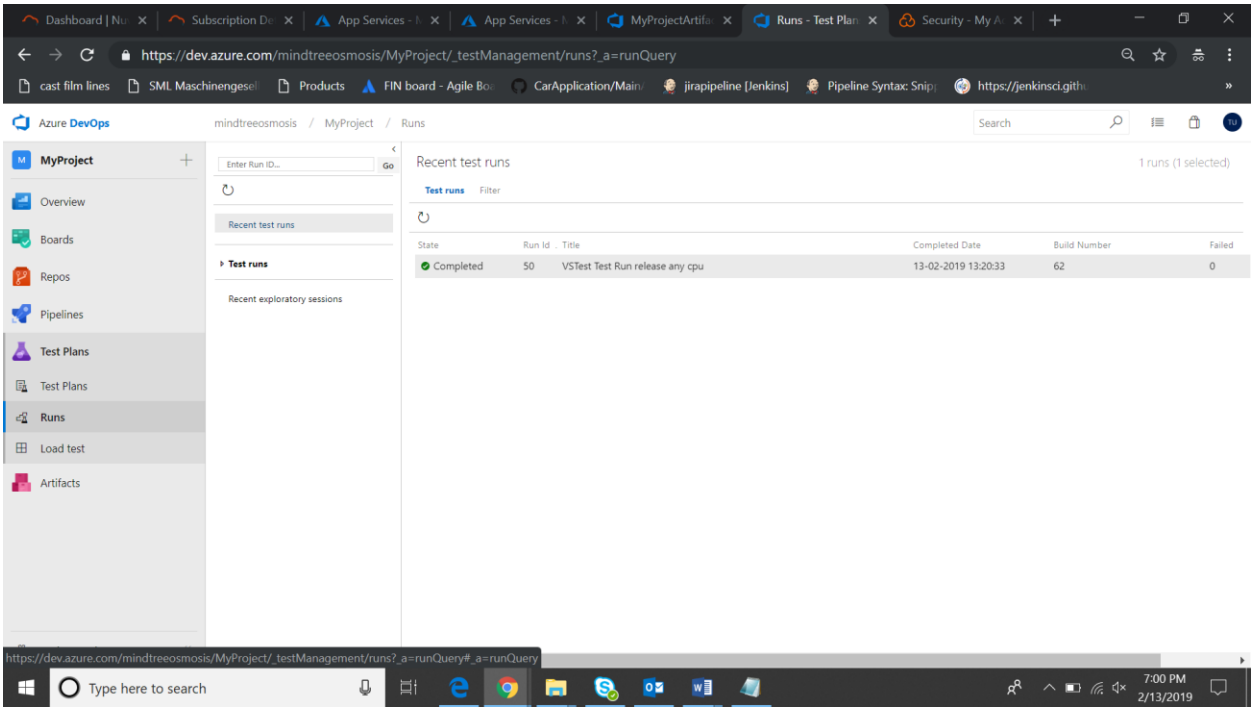
66. Add a description → Select "Custom email address" in Deliver to → Type the email address you want to send the notifications to in the Address bar → Click "Finish".



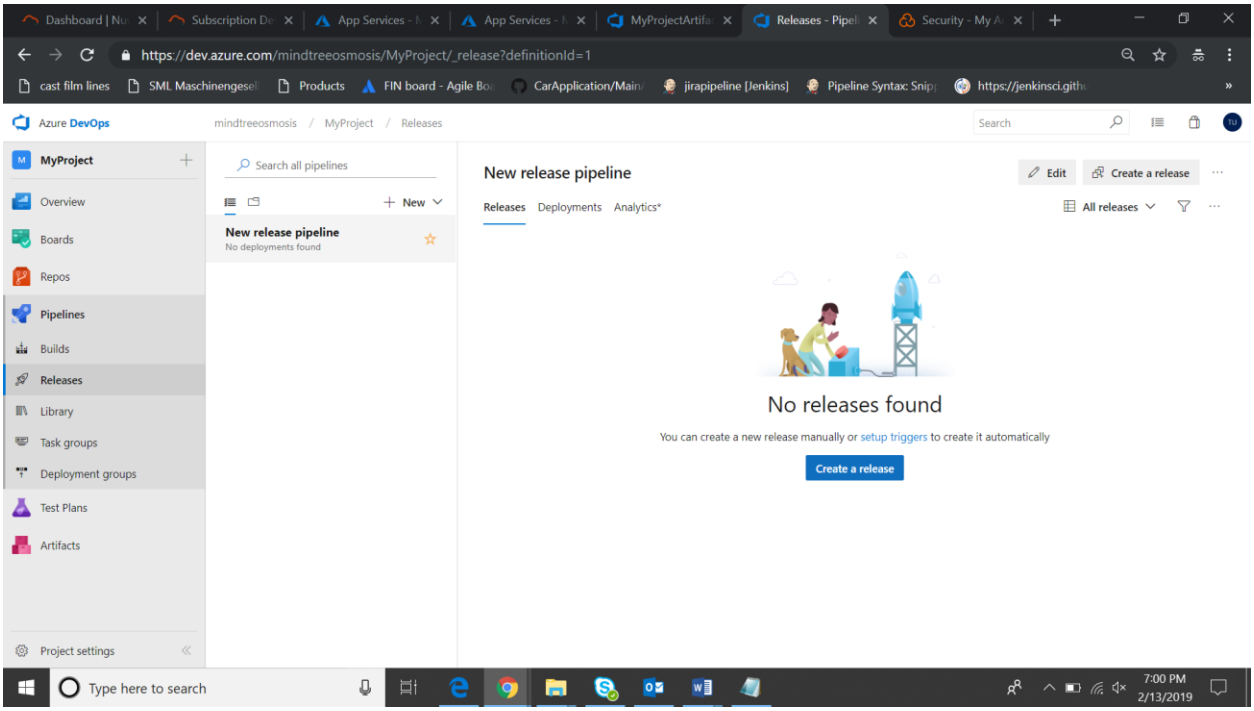


67. As the build has completed the tests written in the project has also been executed. The status of these test cases can be seen by clicking as follows.

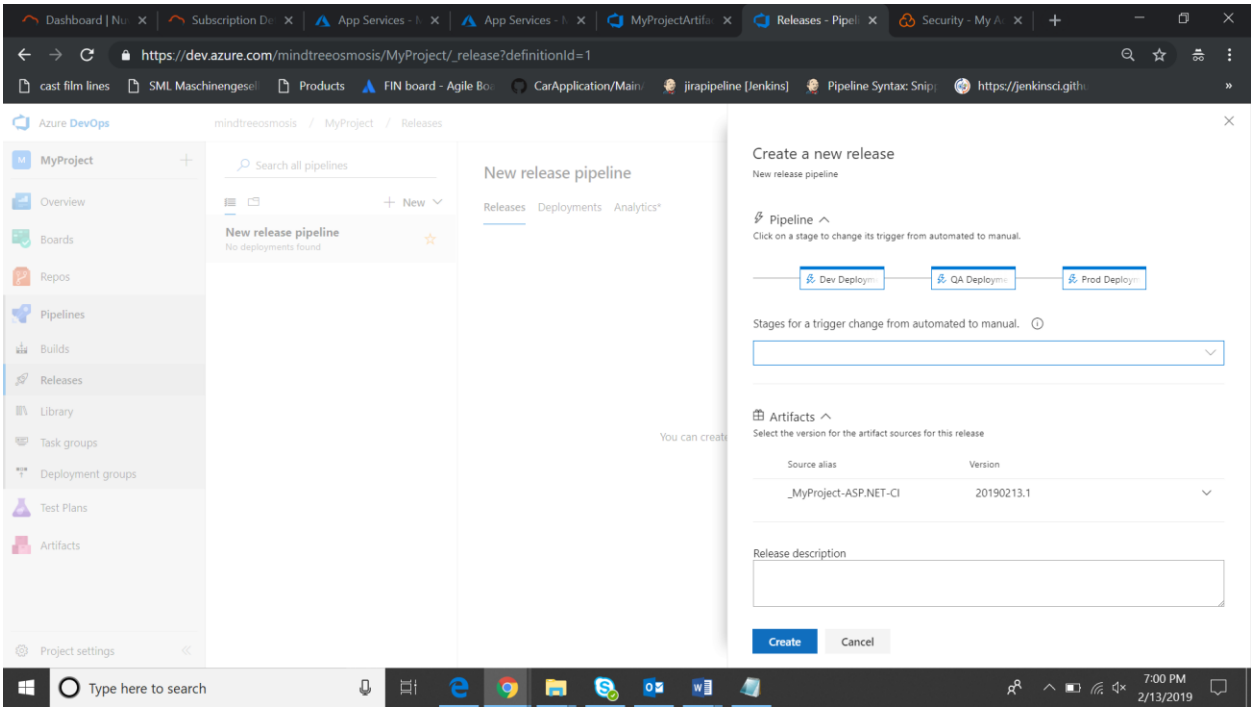
68. Click on "Test Plans" on the right bullet bar → Click on "Runs".



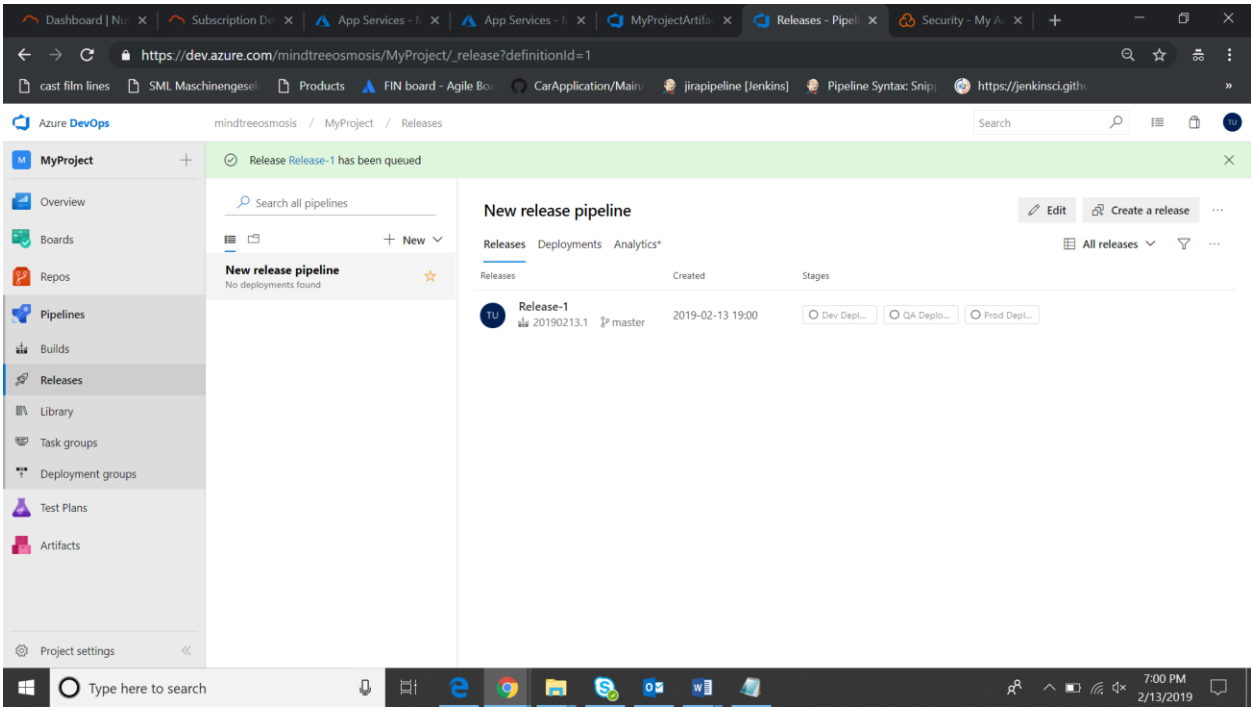
69. The build has succeeded and it's time to create a release.
70. Click on "Pipelines" → Click on "Releases" → Click on "Create a release".



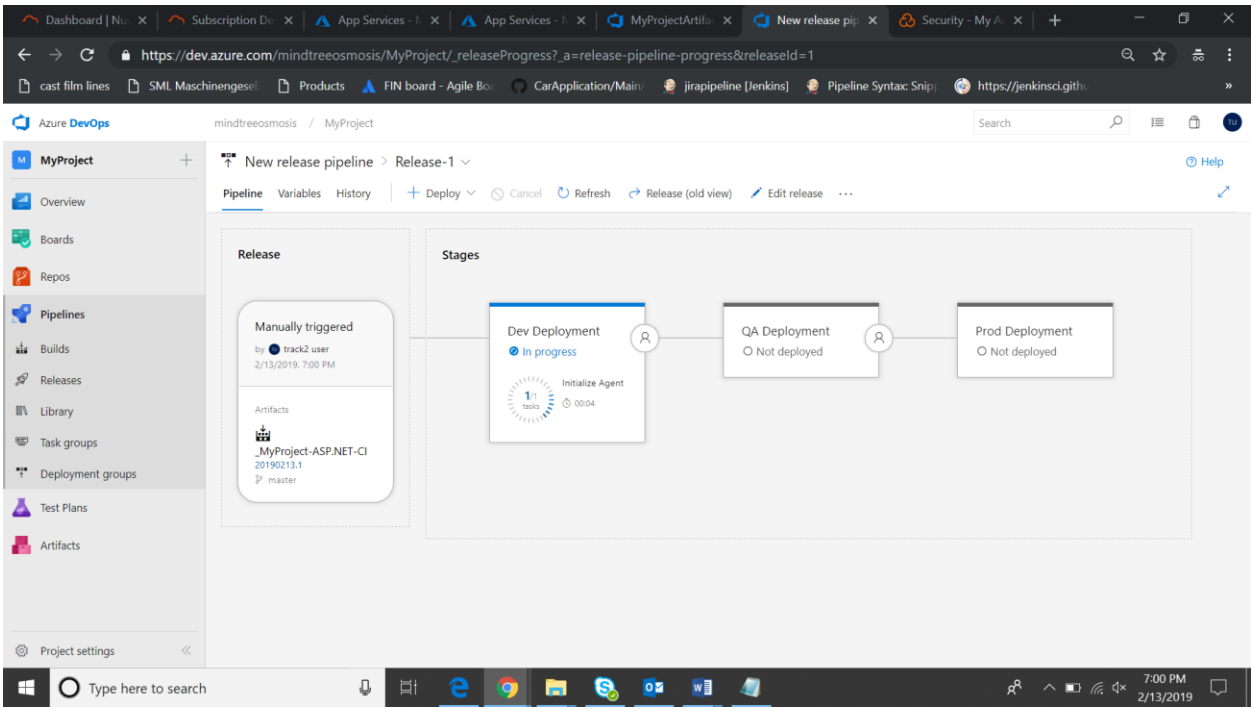
71. Add some description if you wish to → Click on "Create".



72. The first Release has been queued.

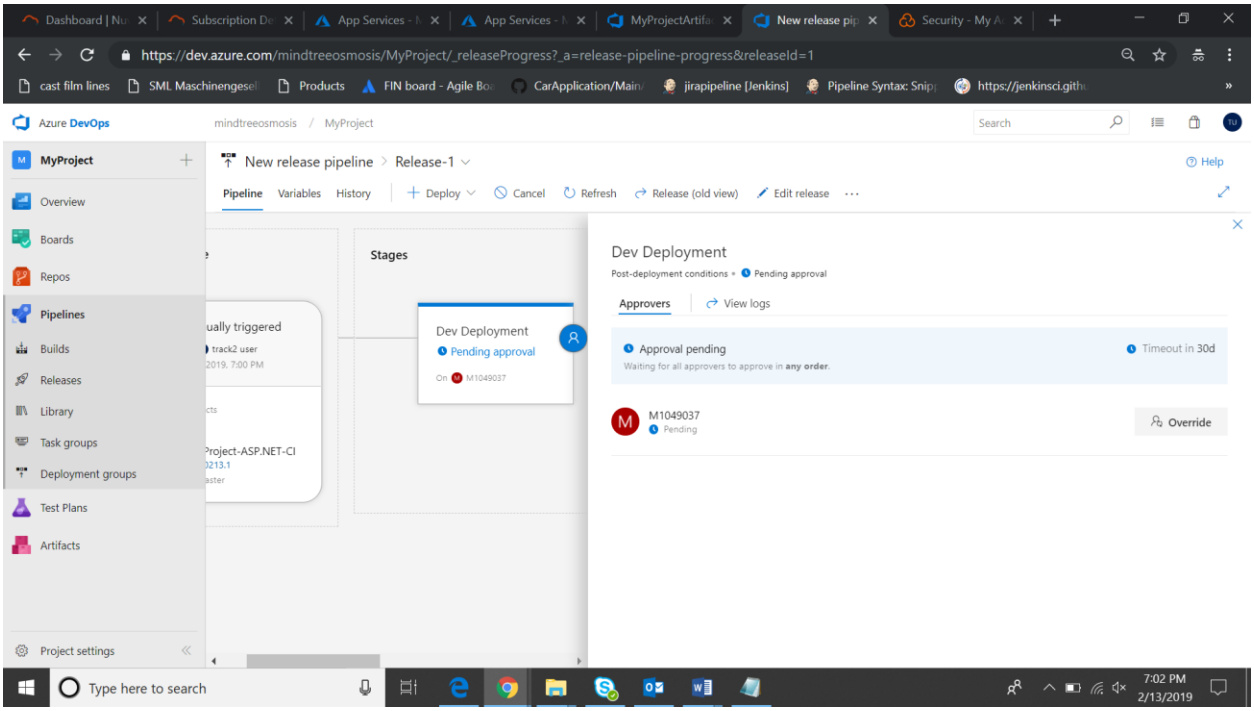


73. Click on the release name or stages and it will redirect you to a page where you can view the progress and also give approvals.



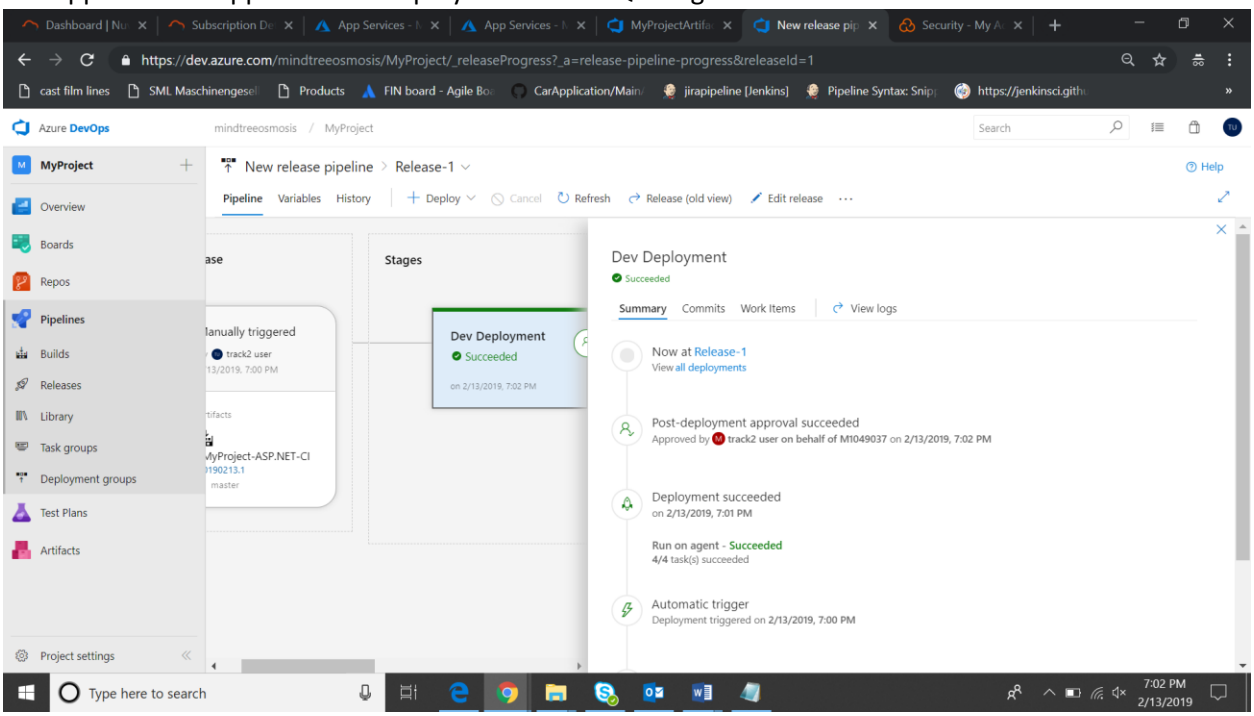
Note: https://portal.azure.com/#blade/HubsExtension/Resources/resourceType/Microsoft.Web%2Fsites
Go to this link -> Select your app service -> Click one the URL to view your application.

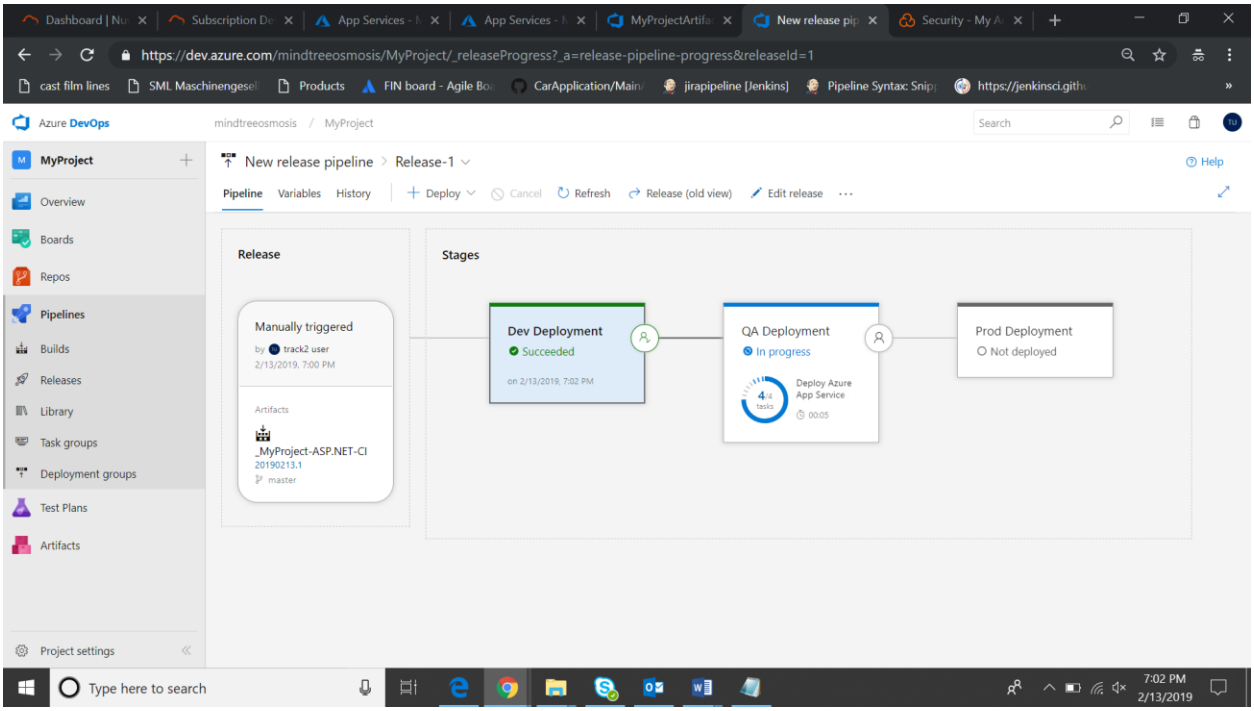
74. So the application has been deployed to the Dev Deployment stage/environment and is awaiting approval to be deployed to the QA stage/environment.



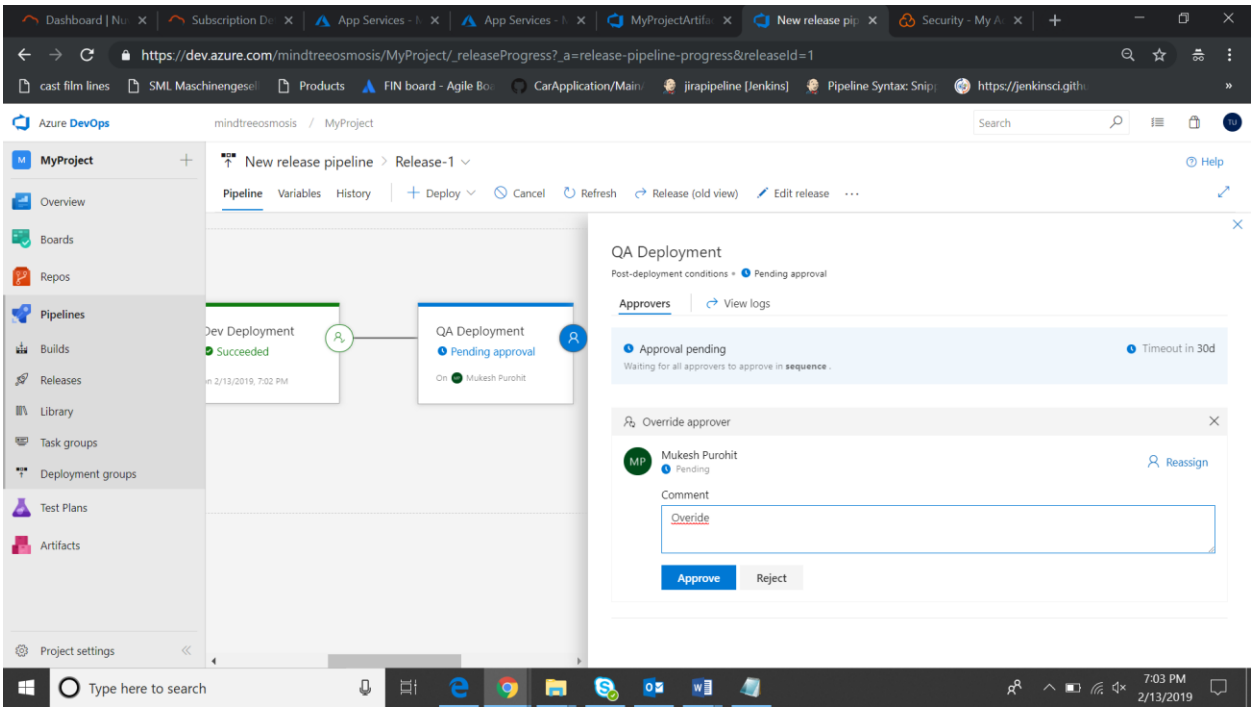
75. The assigned person can approve the QA deployment by clicking on “Approve”.

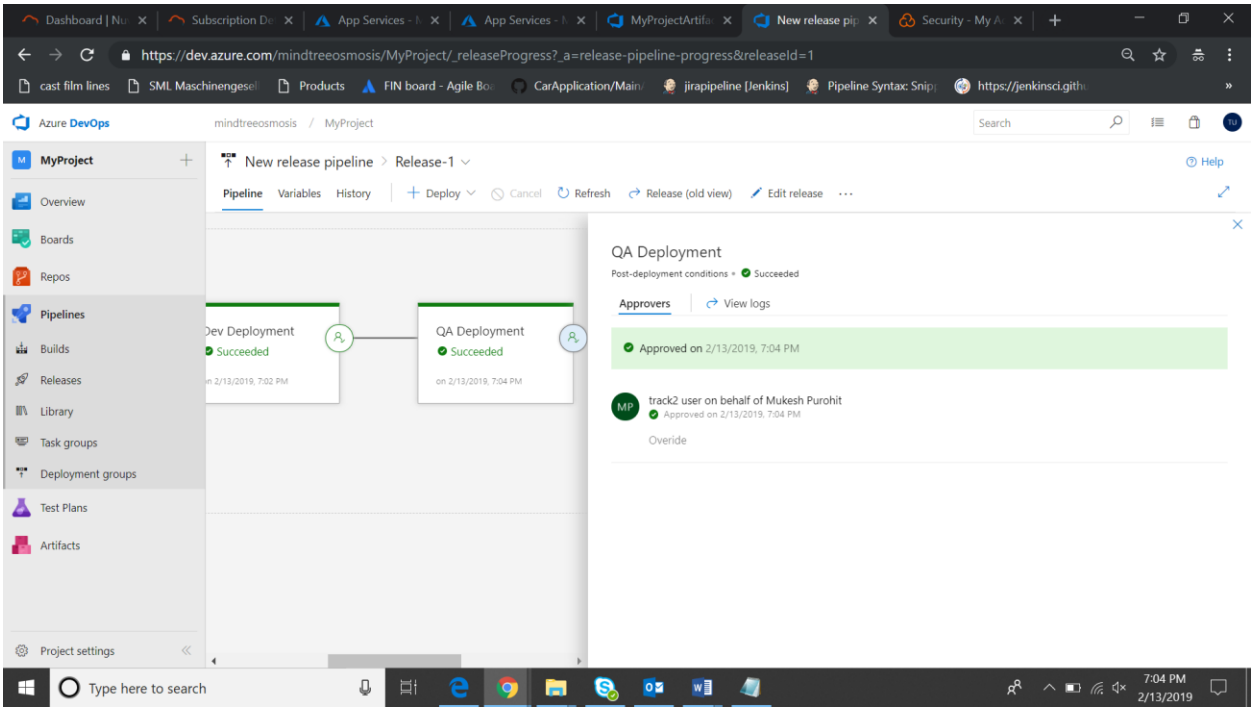
76. The approver has approved the deployment to the QA stage.



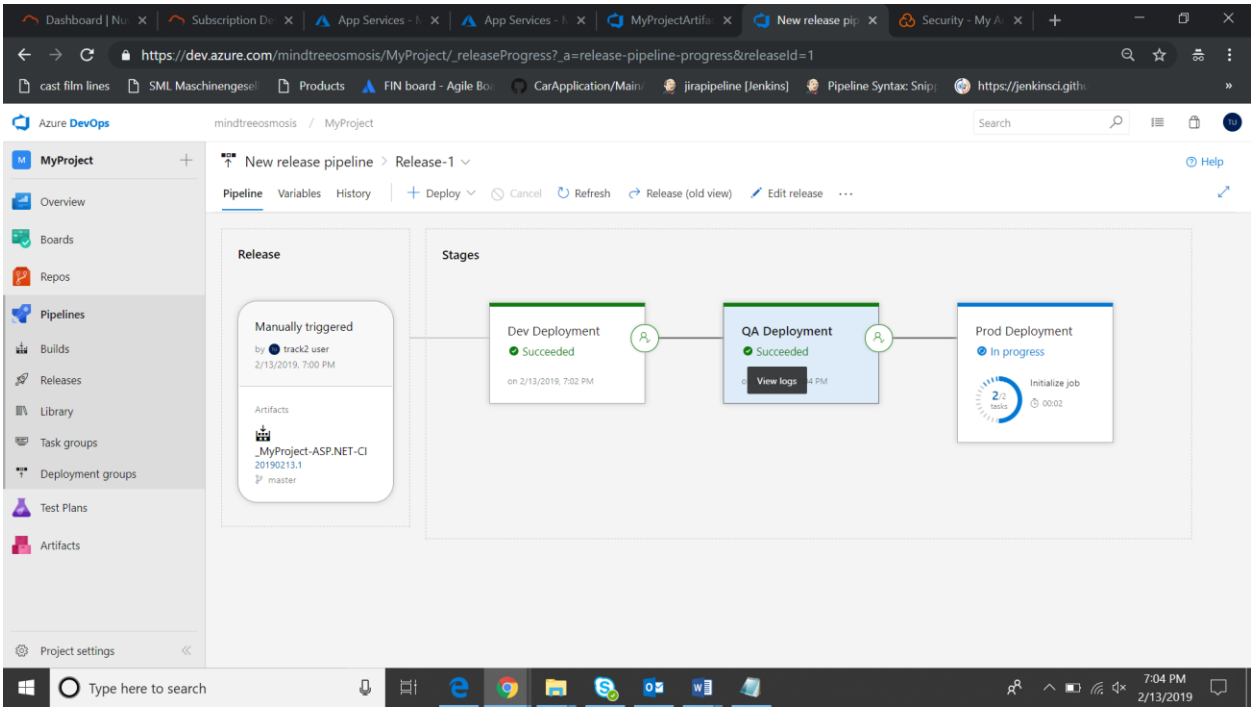


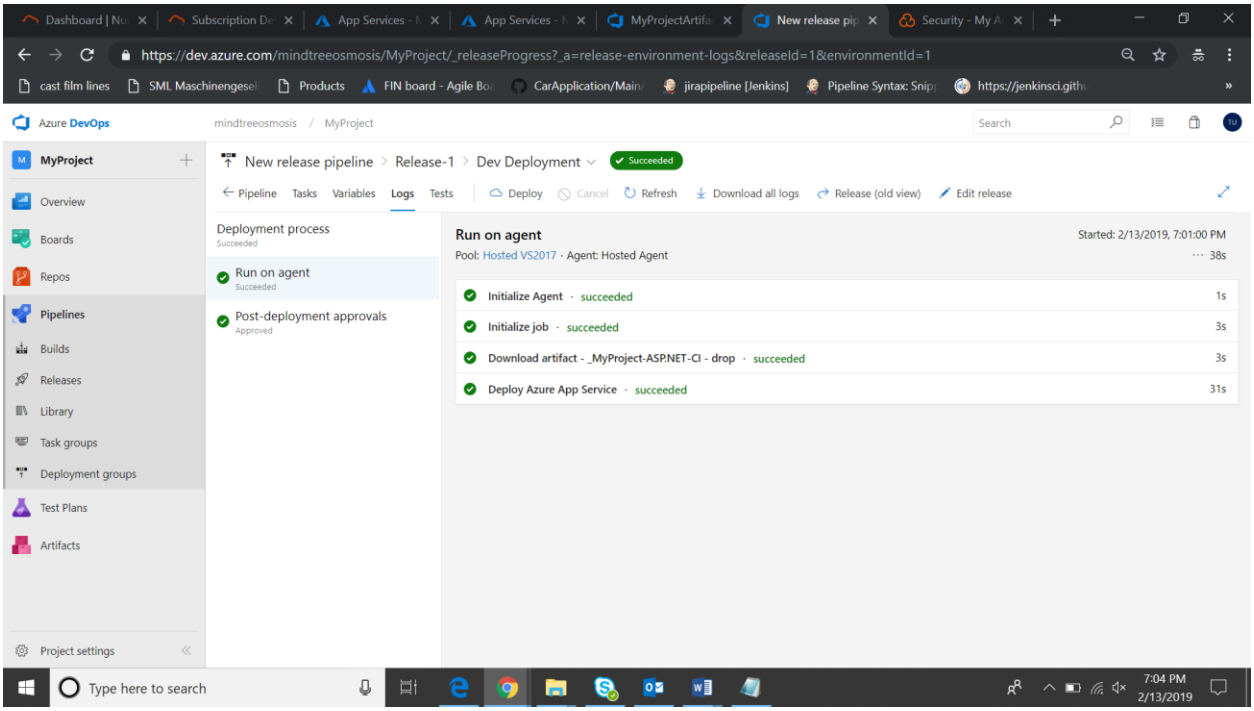
77. Has been deployed in the QA stage and is awaiting approval in for the Production stage/environment.
78. The assigned person can approve the deployment by clicking on “Approve”.



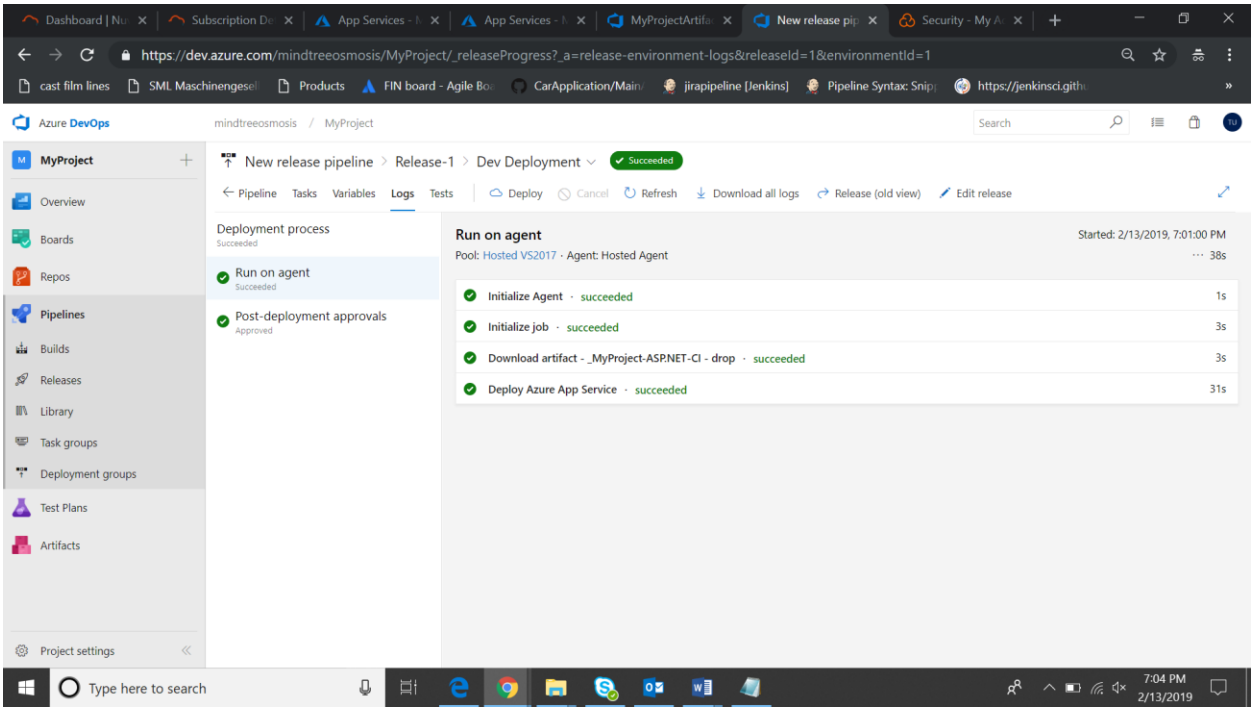


After approval the pipeline looks like this.

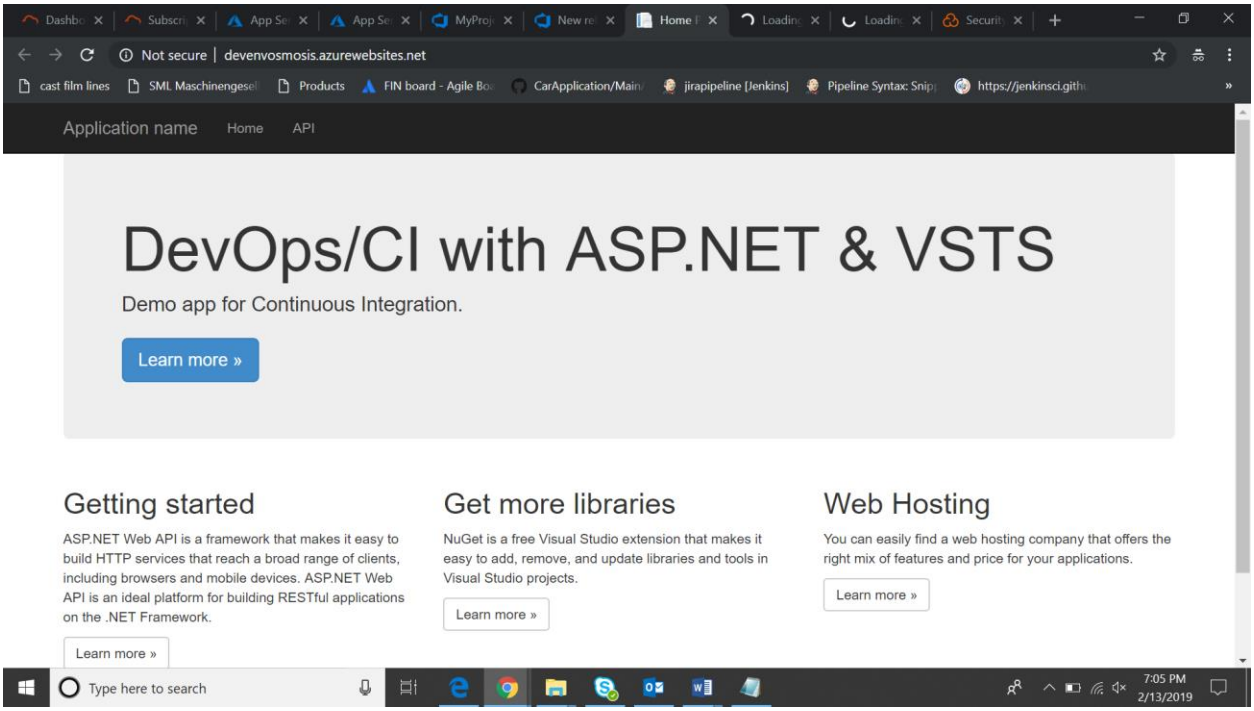




79. Release to all the three stages/environments have succeeded.



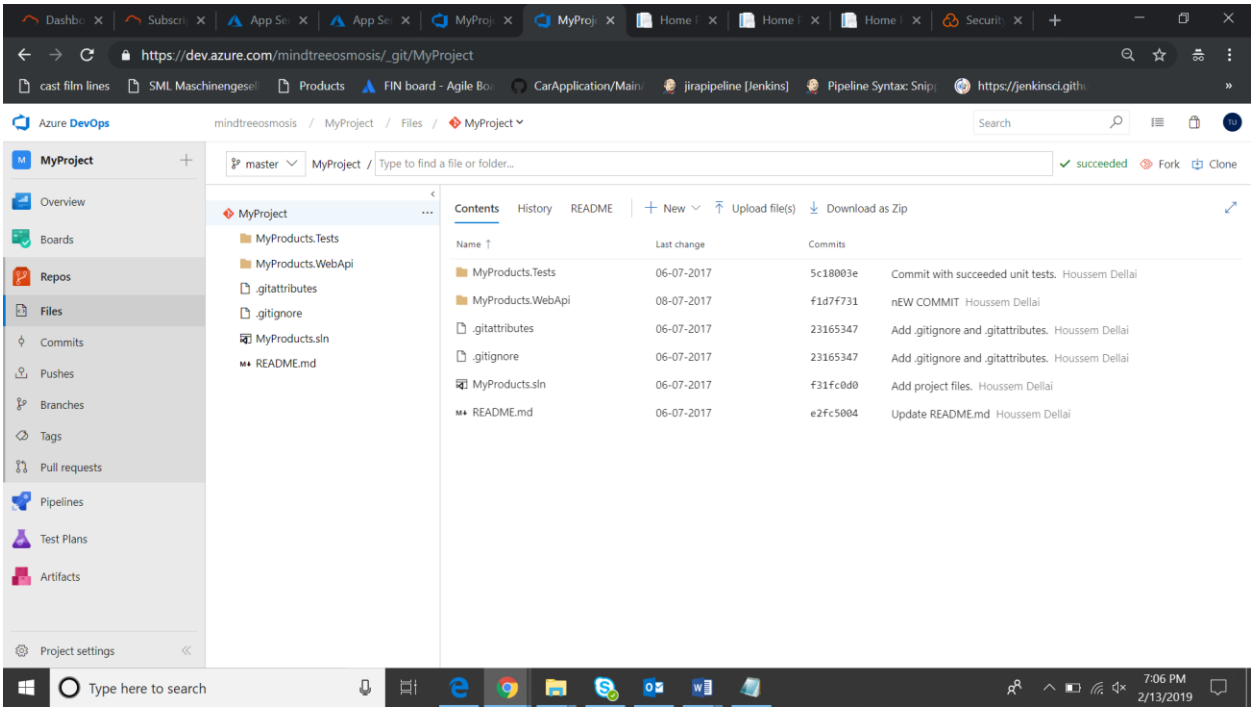
80. Click on Deploy Azure App Service and scroll down to the bottom of the logs page, you can find the url which can be pasted on the browser to see the applications.



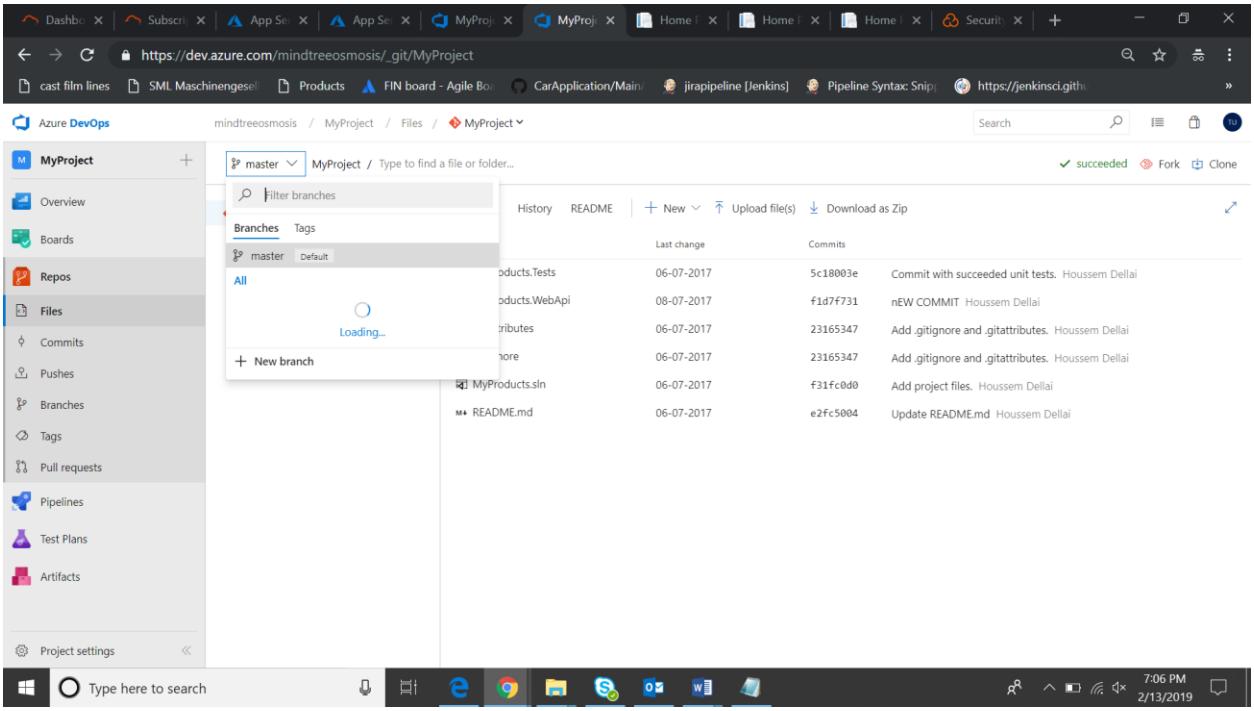
Azure Boards → Boards are used to assign tasks to developers and testers so that they can update or add new features to existing projects. The tasks assigned are done by creating a different branch that is a mirror image of the master.

81. Creating the branch to assign some user with a task. To be performed by the user on this created branch. His work is only merged with the master after various checks and approvals by the assigner.

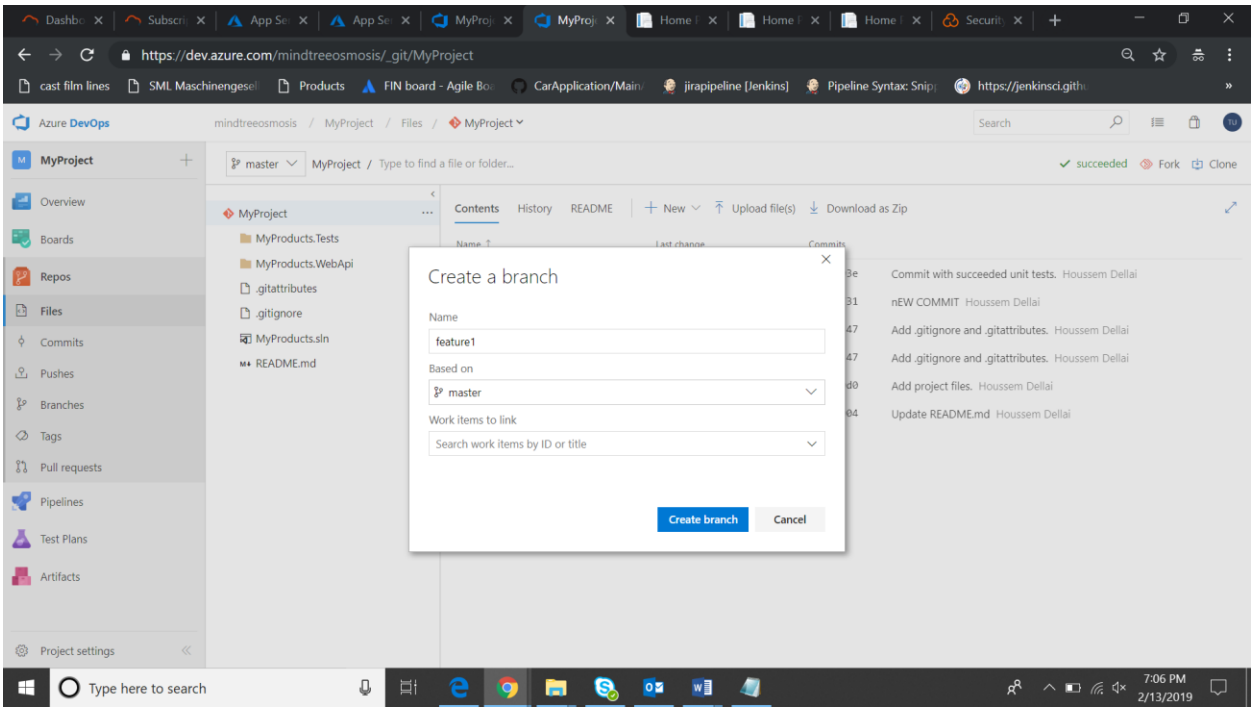
82. Click on "Repos" → Click on "Files".

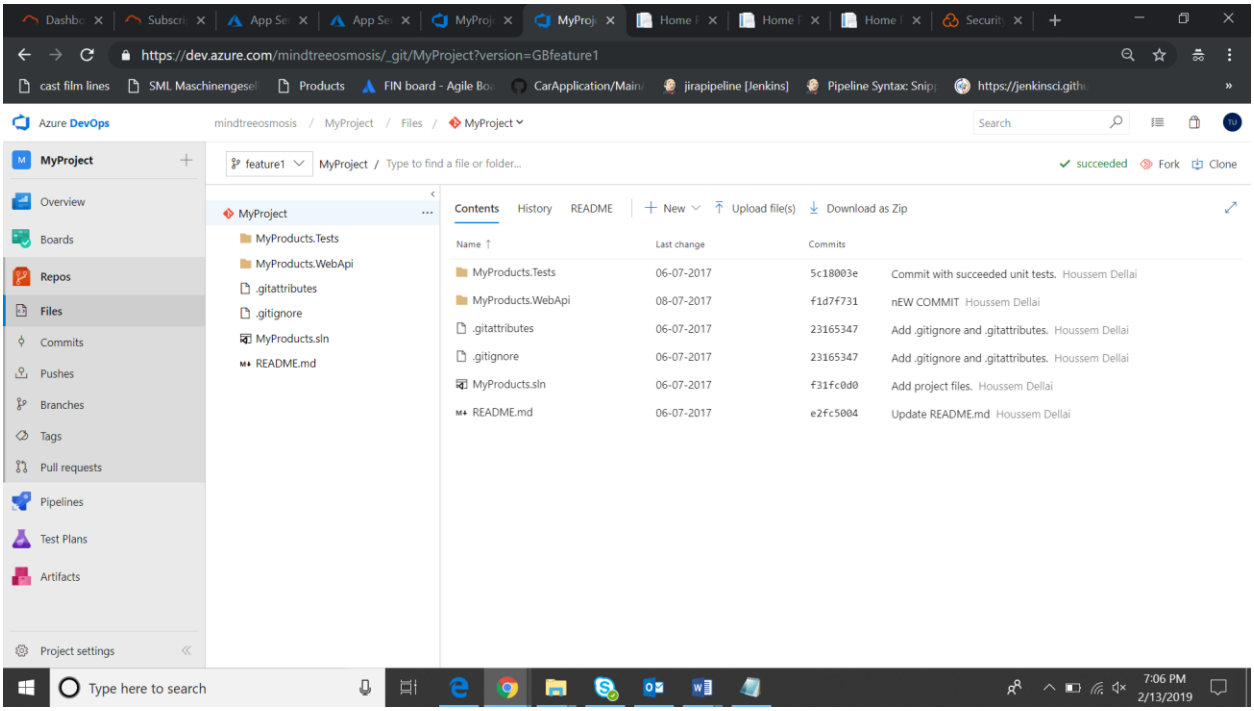


83. Click on the drop down showing “master” branch → Click on “New Branch”

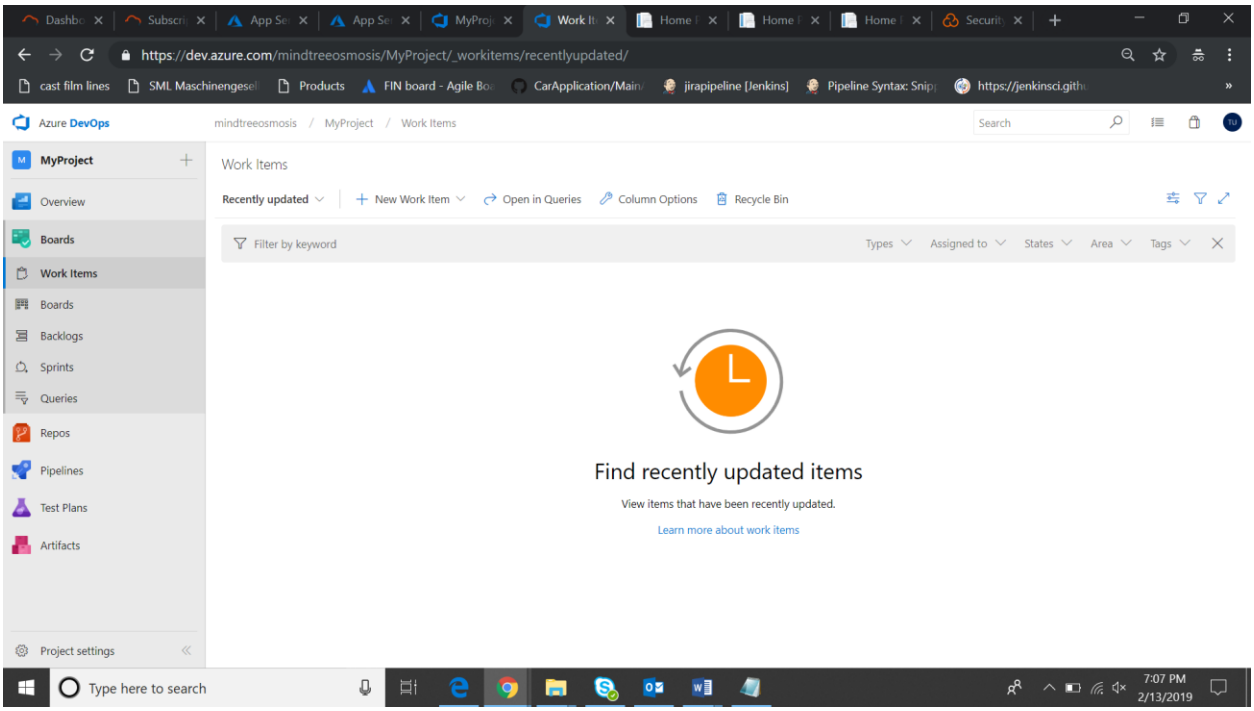


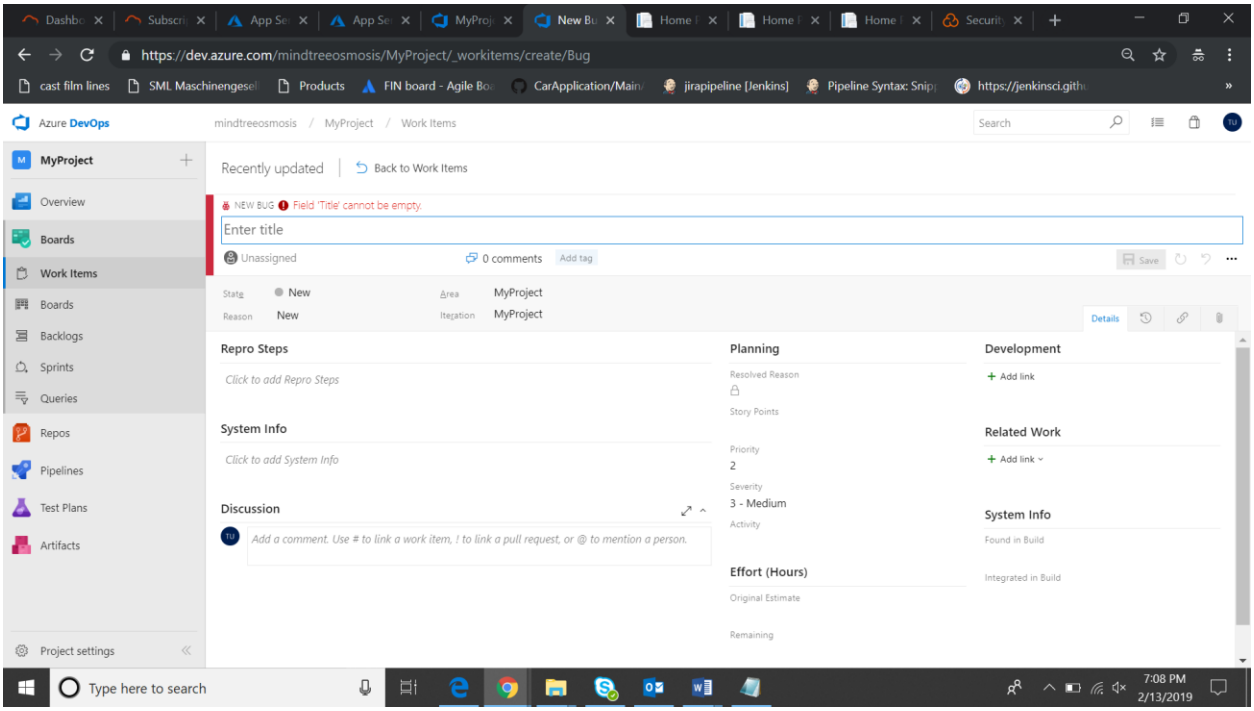
84. Give it a name → Based on “master” (Depends on the assigner) → Click “Create Branch”.



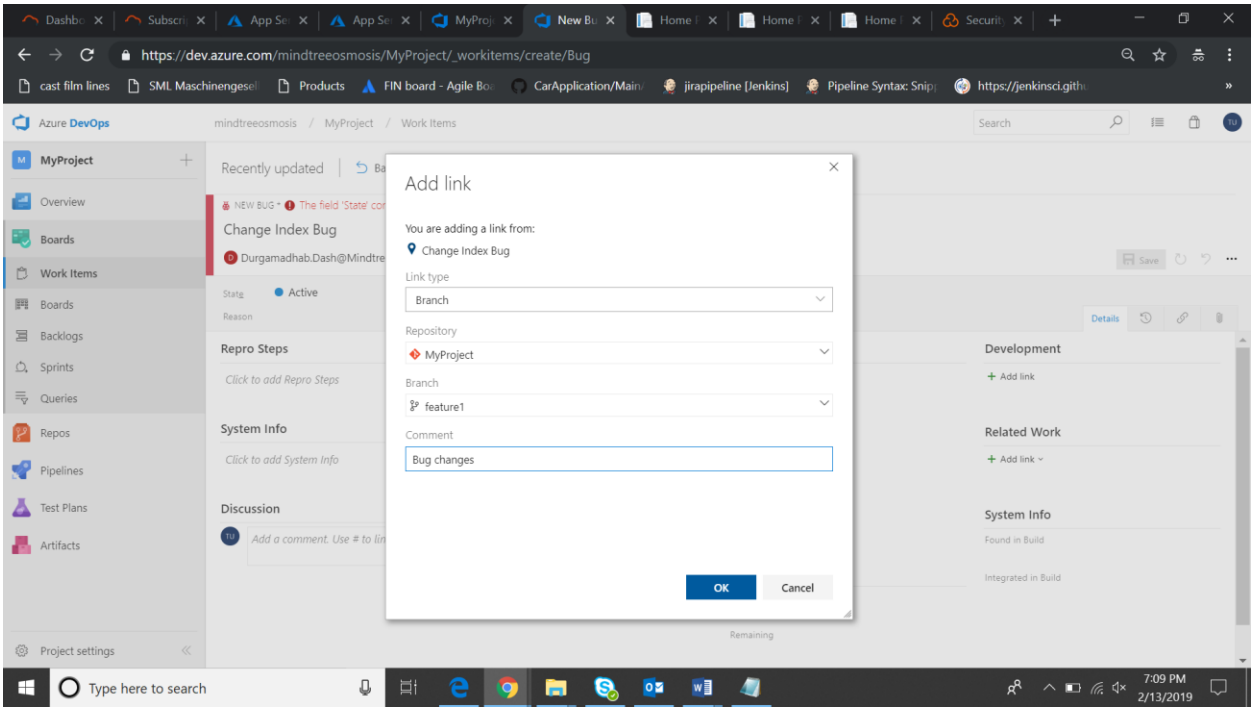


85. Click on "Boards" on the left bullet panel → Click on "Work Items" → Click on "+ New Work Item".

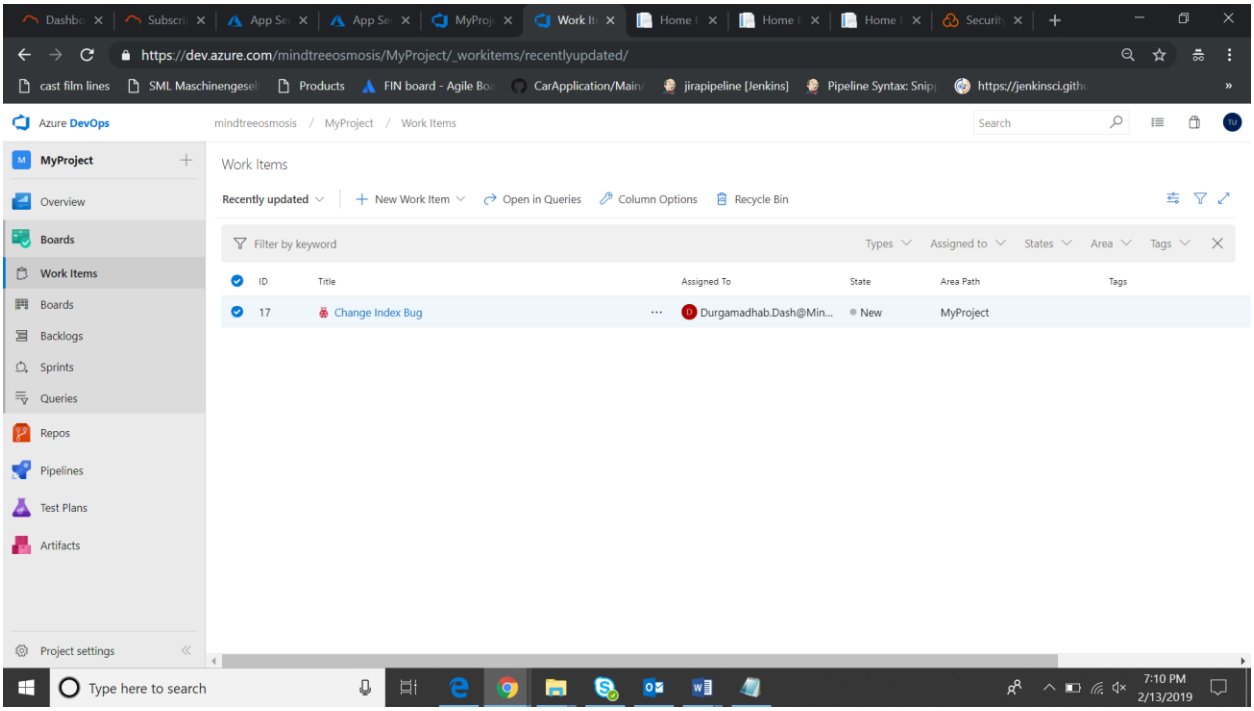




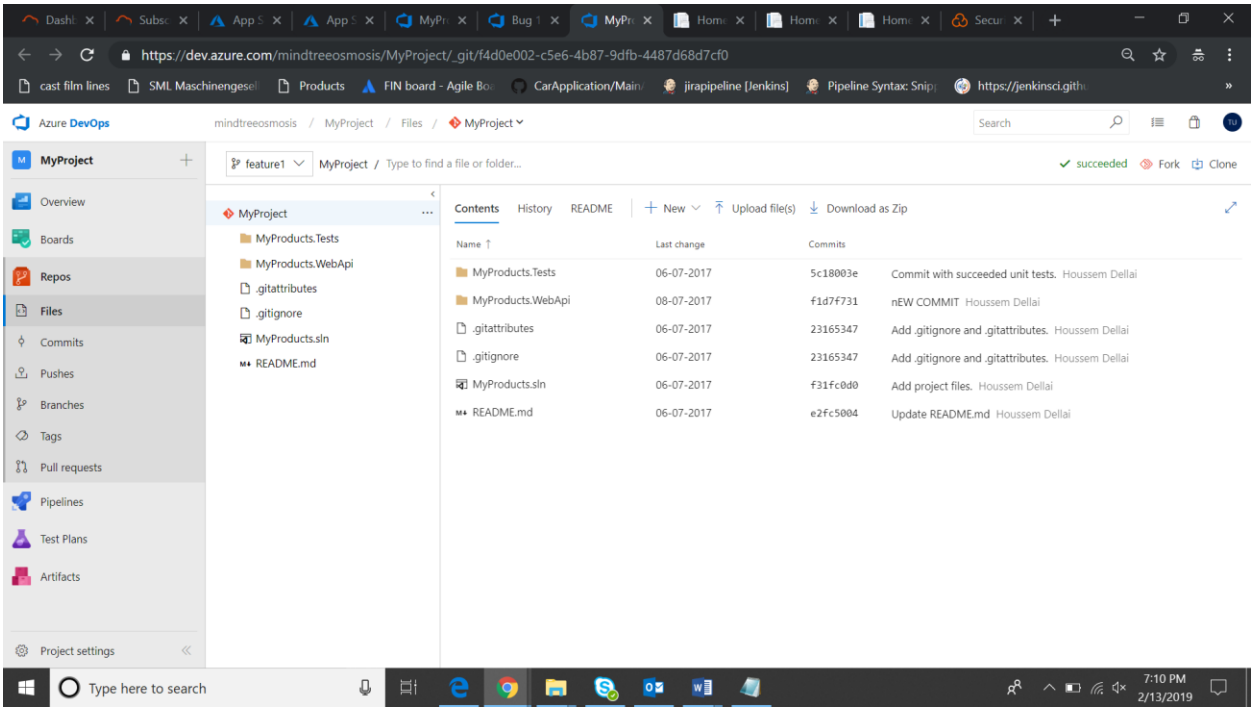
86. Enter the title → Assign the task by giving the name in the below tab → Change the status to "Active" → Click on "+ Add Link" (This is where the concerned has to visit to perform the job) → Select Link type to "Branch" → Select Repository to the one you have imported for this project at the beginning of this documentation → Branch should be set to "Feature 1" (where the work has to performed so that if anything goes wrong it doesn't mess up the "master".



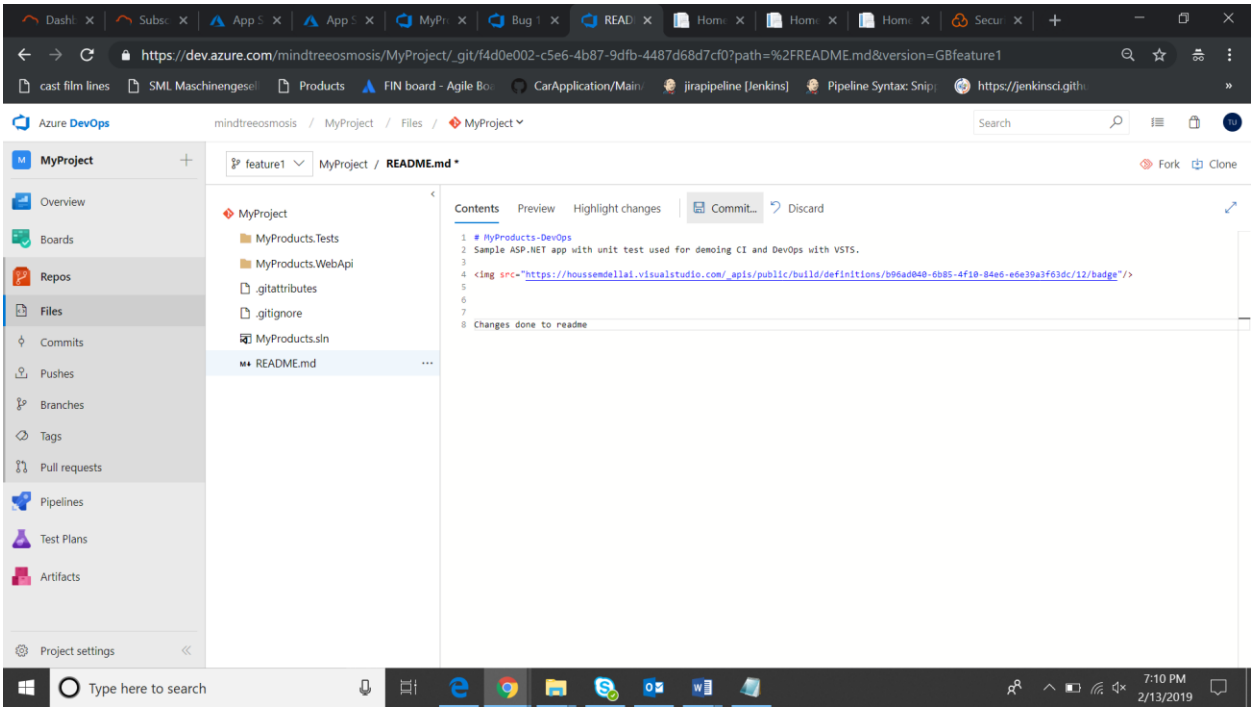
87. Click "Save".
88. The assignee can see the tasks from his account on his board can get into that by clicking on it to perform his task.

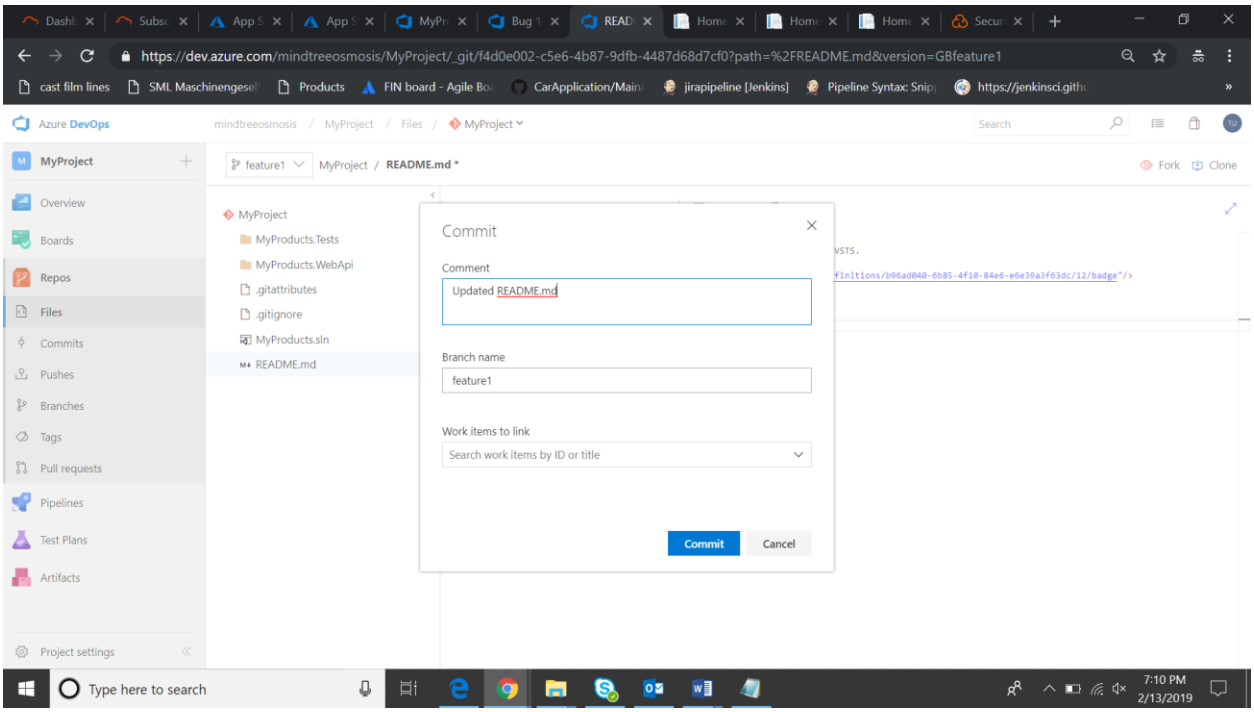


89. Click on "feature 1" → Redirected to the imported Repo but at branch "Feature 1".

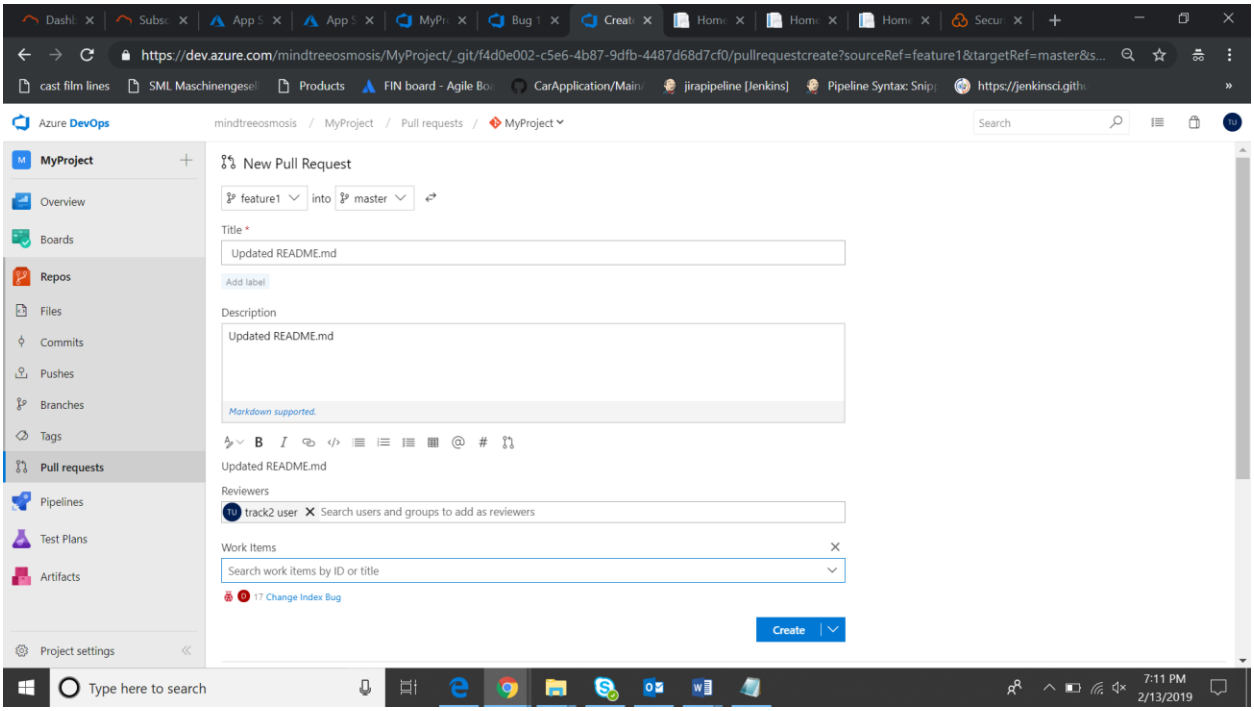


90. Do the necessary changes → Commit.

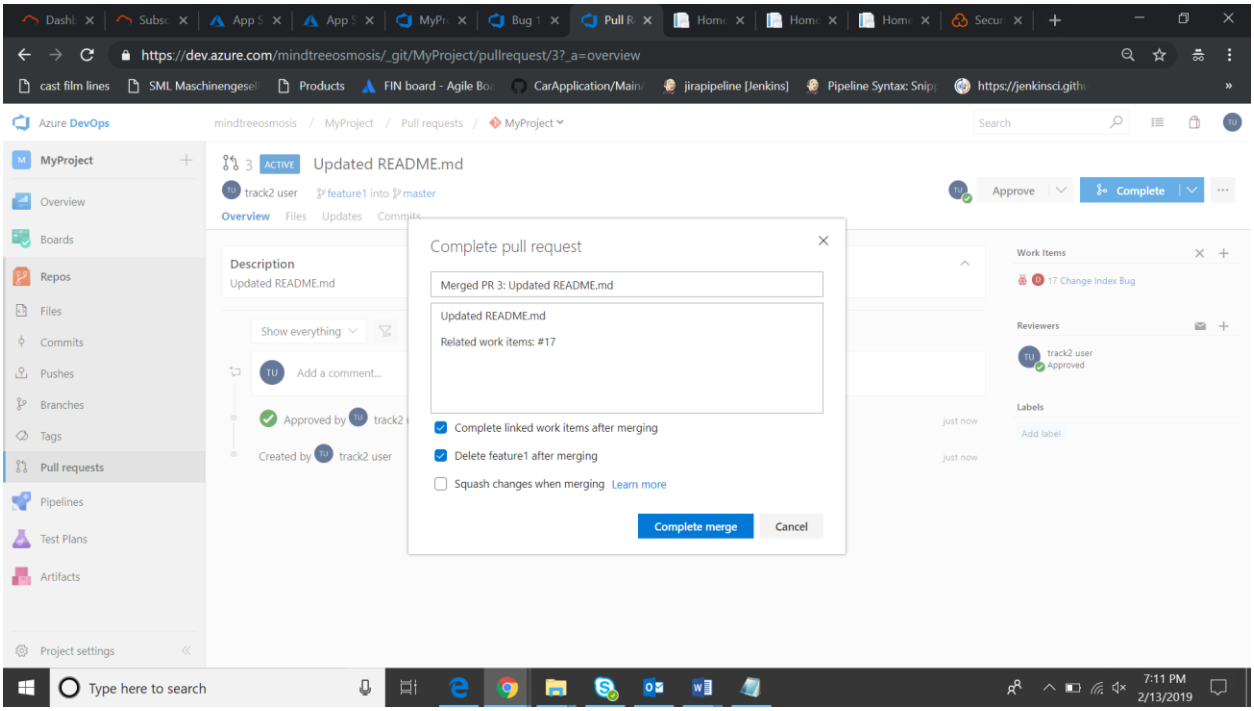




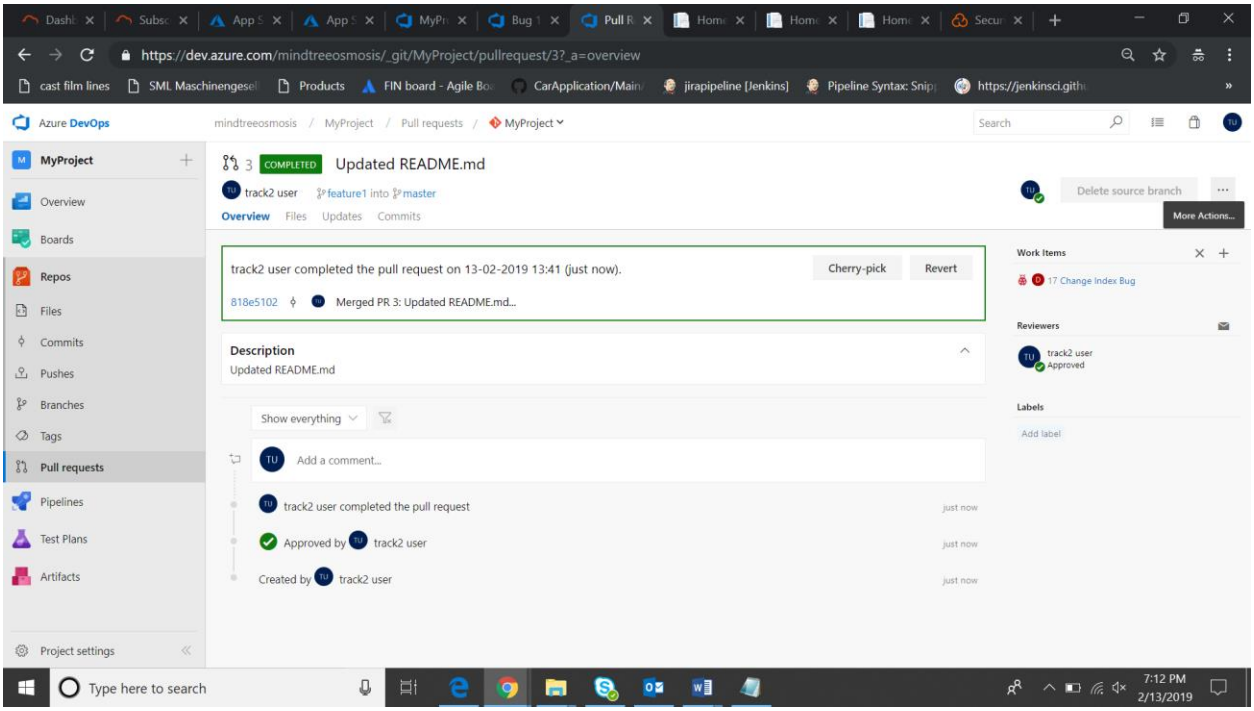
91. Click on "Create a pull request" → Add a title → Add a description → Select Reviewers (The people you want to review your work and give their approval for merging with the master) → Click "Create".



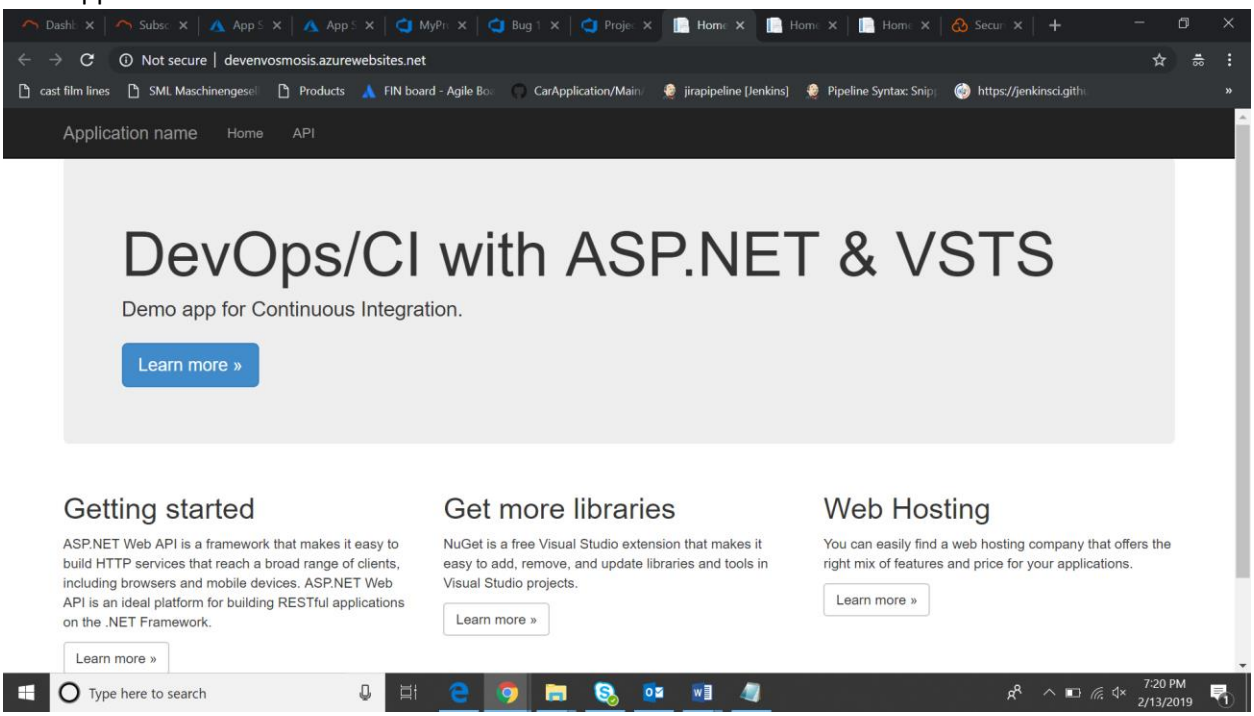
92. The approver can check form his account and Click "Approve" if he is satisfied with the work → Click "Complete" (to do the final merge with the master) → Click "Complete Merge" (This will go ahead and merger your branch "Feature 1" with the master and delete the branch "Feature 1" as it's purpose has been fulfilled, but you can also choose to keep the branch).



93. The merge has been completed.



94. A new "Build" has been queued automatically as soon as it gets over the releases will also get queued automatically. Deployment to Dev Deployment will happen but deployment to further stages will only happen after approvals.



Thank You