

QATIPv3 AWS Lab6

Jenkins Terraform Pipelining

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Lab Objectives

In this lab you will:

- Deploy a network and an EC2 instance with Jenkins installed via a script.
- Configure an S3 remote backend
- Configure and test terraform pipelining using Jenkins to deploy, modify and destroy AWS resources

Teaching Points

This lab introduces the concept of Terraform pipelining with Jenkins, demonstrating how infrastructure as code (IaC) can be automated for consistent and repeatable deployments in AWS. You will gain hands-on experience in setting up a Jenkins pipeline to execute Terraform configurations, allowing them to deploy, modify, and destroy AWS resources efficiently. By integrating Terraform with Jenkins, users can enforce version control, automate approvals, and implement CI/CD best practices for infrastructure management.

Key concepts covered include provisioning infrastructure with Terraform, configuring Jenkins to automate deployments, and managing Terraform state remotely using an S3 backend. Additionally, you will explore how Jenkins integrates with GitHub for source control, manage AWS credentials within Jenkins securely, and implement automated triggers using GitHub Webhooks. By the end of the lab, you should understand how to structure Terraform pipelines in Jenkins, troubleshoot deployment issues, and automate resource lifecycle management, ensuring scalable and reliable infrastructure provisioning in AWS.

Solution

Given the nature of this lab, there is no solution section. Please reach out to your instructor if you encounter any issues

Before you begin

1. Ensure you have completed Lab0 before attempting this lab.
2. In the IDE terminal pane, enter the following commands...
`cd ~/environment/awslabs/06`
3. This shifts your current working directory to awslabs/labs/06. ***Ensure all IDE commands are executed in this directory***

Task1 Create a Jenkins EC2 instance

1. Examine the script file create_ec2.sh in awslabs/06. This will create network resources and an EC2 instance in us-east-1 into which Jenkins is installed. Make the script executable...
`chmod +x create_ec2.sh`
2. Run the script
`./create_ec2.sh`
3. You can continue with the next task whilst the script runs.

Task2 Create an S3 Bucket for Remote State

1. Switch to the AWS Console.
2. Search for and then navigate to the **S3** service. Click on **Create bucket**
3. Ensure you are focussed on the **(us-east-1)** region

4. Name your bucket **jenkins-state-<your-name>**. Every bucket name must be globally unique; therefore you may get a message indicating that a bucket already exists with your chosen name. If so, then simply append a random number after your name. Record the name of this bucket in your session-info file against **Jenkins-state-bucket**
5. Leaving all settings at their default values, scroll down and select Create bucket.

Task3 Configure Jenkins

1. Open Jenkins in a new browser tab using the url displayed in your IDE. (Your IP address will differ)

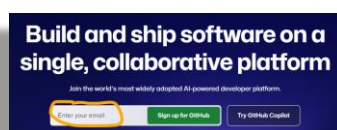
```
Waiting 5 mins for Jenkins to initialize...
Retrieving the Jenkins initial admin password...
Warning: Permanently added '34.220.233.115' (ED25519) to the list of known hosts.
Jenkins setup complete!
Access Jenkins at: http://34.220.233.115:8080
Initial Admin Password: 96e10c1fbc794ede910ff98e1793fd0e
awsstudent:~/environment/awslabs/06 (main) $
```

2. Copy and paste the admin password from the IDE into the **Unlock Jenkins** screen the click on Continue
3. Select “Install suggested plugins”
4. On the “Create First Admin User” screen; Select “Skip and continue as admin”
5. Click “Save and Finish” to complete the Jenkins configuration.
6. Click “Start using Jenkins”

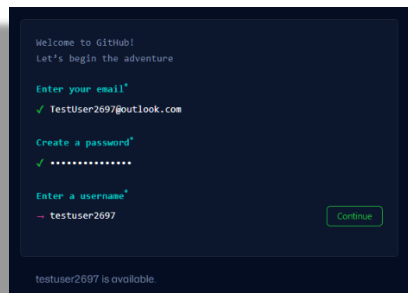
Task4 Create a Github account and repository

Note: The process that follows was correct at time of writing. Github enrolment steps may change over time, so apply your own logic as you work through the process if it does not exactly match the steps that follow.

1. Sign up to Github using a personal email address that is not currently associated with Github...
 - a. Navigate to <https://github.com/>
 - b. Enter a personal email address and select “Sign up for Github”...



- c. Enter a password and a unique username of your choice..



Welcome to GitHub!
Let's begin the adventure

Enter your email*

✓ TestUser2697@outlook.com

Create a password*

✓

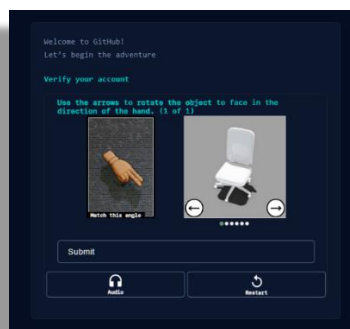
Enter a username*

- testuser2697

Continue

testuser2697 is available

- d. Record and save your chosen **username** and **password** in your session-info file for safekeeping.
- e. Complete the challenge to prove you are a human...



Welcome to GitHub!
Let's begin the adventure

Verify your account

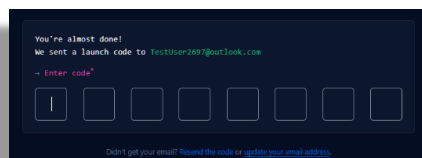
Use the arrows to rotate the object to face in the direction of the hand. (1 of 2)

Watch this angle

Submit

Audio Restart

- f. An email will sent containing your launch code. Retrieve this and enter it..



You're almost done!

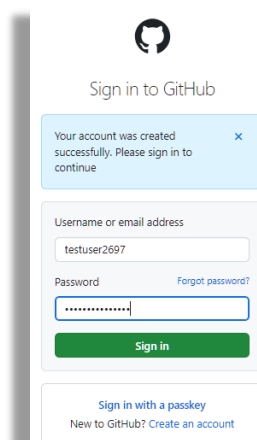
We sent a launch code to testuser2697@outlook.com

- Enter code*

1 [] [] [] [] [] [] []

Didn't get your email? [Resend the code](#) or [update your email address](#)

- g. You will then be prompted to log into github using your new account..



Sign in to GitHub

Your account was created successfully. Please sign in to continue

Username or email address

testuser2697

Password

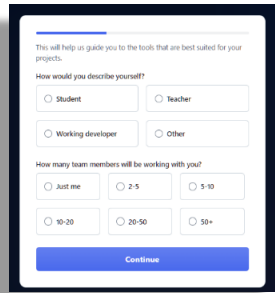
Forgot password?

Sign in

Sign in with a passkey

New to GitHub? [Create an account](#)

- h. Complete the questionnaire...



This will help us guide you to the tools that are best suited for your projects.

How would you describe yourself?

☐ Student ☐ Teacher

☐ Working developer ☐ Other

How many team members will be working with you?

☐ Just me ☐ 2-5 ☐ 5-10

☐ 10-20 ☐ 20-50 ☐ 50+

[Continue](#)

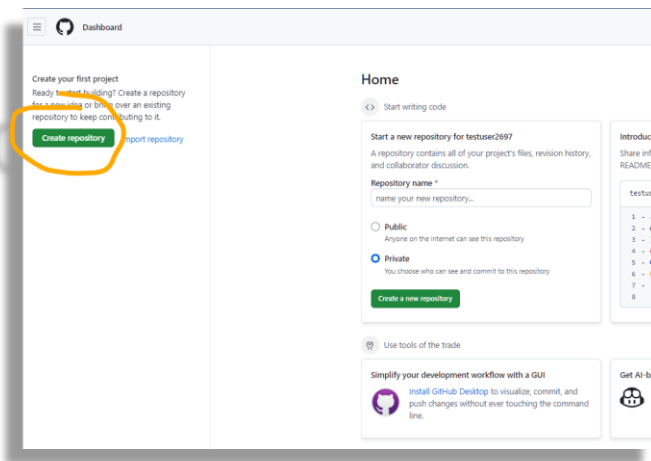
- i. When asked to select a subscription, select “**Continue for free**”..



[Continue for free](#)

2. Create a public repository ...

- a. Click on New ...



Dashboard

Create your first project

Ready to start building? Create a repository for a new idea or bring over an existing repository to keep contributing to it.

[Create repository](#) [Import repository](#)

Home

Start writing code

Start a new repository for testuser2697

A repository contains all of your project's files, revision history, and collaborator discussion.

Repository name *

name your new repository...

☐ Public
Anyone on the Internet can see this repository

☒ Private
You choose who can see and commit to this repository

[Create a new repository](#)

Introduce your repository

Share information, README, and more

testuser

1 - 2 - 3 - 4 - 5 - 6 - 7 - 8

Use tools of the trade

Simplify your development workflow with a GUI

Install GitHub Desktop to visualize, commit, and push changes without ever touching the command line.

Get AI-based suggestions

- b. Enter a Repository name of your choice. Ensure **Public** is selected and check the ‘**Add a README file**’ option. Then click on **Create repository**...

Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository](#).

Required fields are marked with an asterisk (*).

Owner * testuser2697 Repository name * jenkins-lab
 jenkins-lab is available.

Great repository names are short and memorable. Need inspiration? How about [potential-octo-telegram](#)?

Description (optional)

☒ **Public**
Anyone on the internet can see this repository. You choose who can commit.

☐ **Private**
You choose who can see and commit to this repository.

Initialize this repository with:

☒ **Add a README file**
This is where you can write a long description for your project. [Learn more about READMEs](#).

Add .gitignore
 .gitignore template: None
 Choose which files not to track from a list of templates. [Learn more about ignoring files](#).

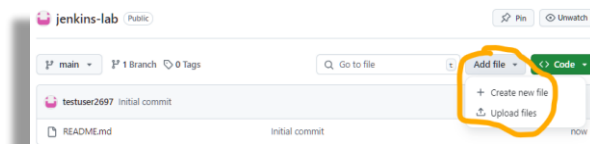
Choose a license
 License: None
 A license tells others what they can and can't do with your code. [Learn more about licenses](#).

This will set [main](#) as the default branch. Change the default name in your [settings](#).

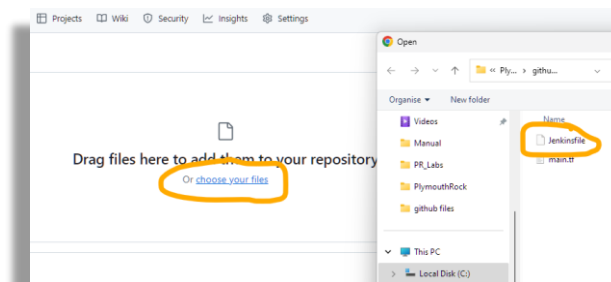
① You are creating a public repository in your personal account.

Create repository

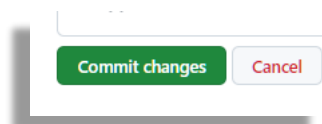
c. Click on **Add file, Upload file..**



d. Select the file **Jenkinsfile** from the **awslabs\Lab Instructions\lab6** folder of your student bundle files that you downloaded at the start of the course

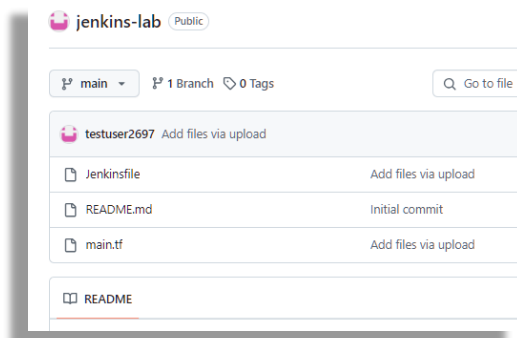


e. Click on Commit changes..

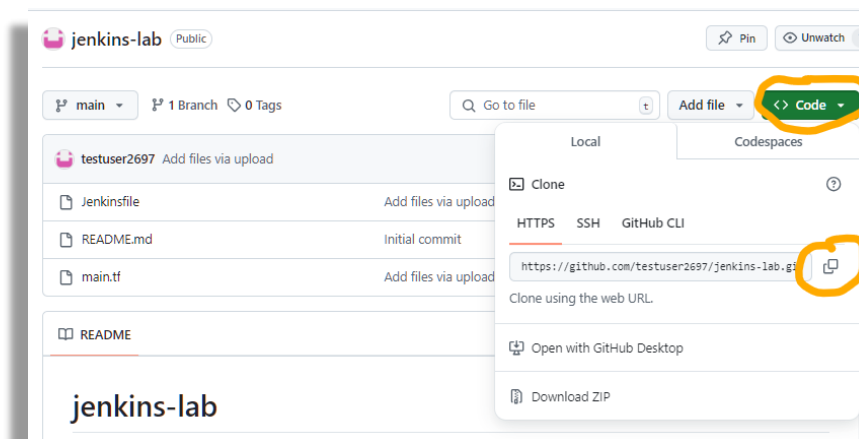


f. Repeat the previous 2 steps to upload the **main.tf** file

g. The 2 files should now be listed..



h. Copy the URL of your repository to your clipboard..

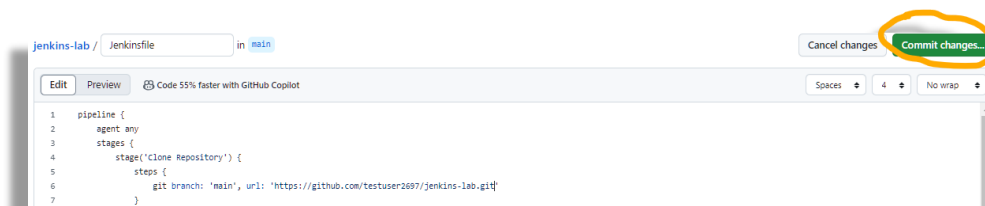


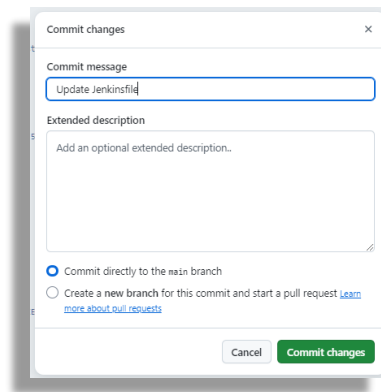
i. Record this URL in your **session-info** file against **Repo-URL**

j. Click on the file **Jenkinsfile** and then click on the **edit** icon to open the file for editing...

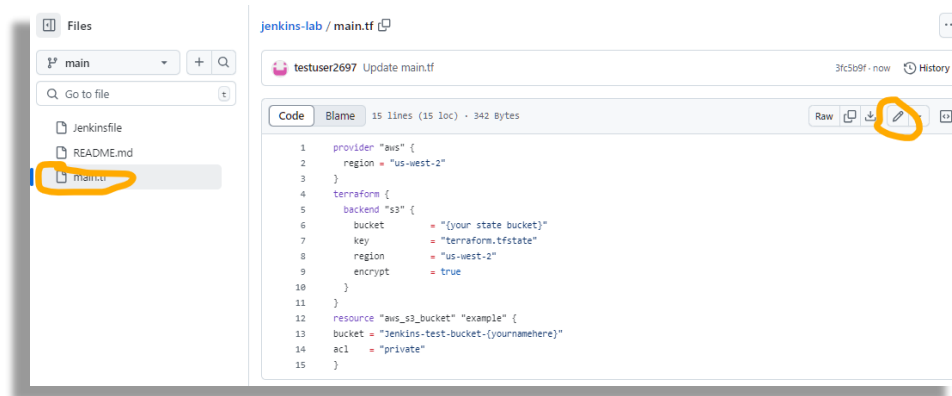


k. On line 6, replace **{your github repo url here}**, including the braces, with your **Repo-URL** and then click on **Commit changes** twice...





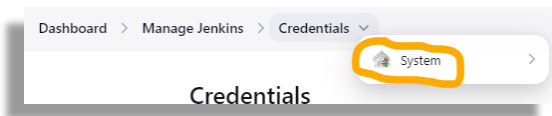
l. Click on **main.tf** and then open it for edits...



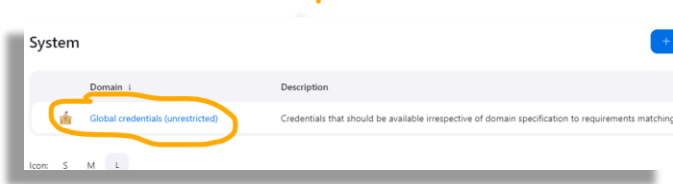
- m. On line 6, replace **{your state bucket}**, including the braces, with the name of the bucket you created in Task1 (recorded as **Jenkins-state-bucket** in your session-info file). This is where your statefile will be created when you initialize Terraform
- n. On line 13, replace **{yournamehere}**, including the braces, with your name followed by 2 random digits (to guarantee uniqueness). This will be the name of the bucket that Terraform will create when we run a Jenkins pipeline.
- o. Commit these changes as before.
- p. Leave the Github tab open as we will return to it later.

Task5 Add AWS Credentials to Jenkins

1. In order to use Terraform on Jenkins to interact with AWS, we must supply it with credentials to use. In your **Jenkins** browser session; Navigate to **Manage Jenkins > Credentials**.
2. On the breadcrumb menu; click on the **Credentials** dropdown and then select **System ...**



3. Click on “**Global credentials (unrestricted)**” ...



4. Click on “**Add Credentials**”

5. For Username: Enter the **Access key ID** generated for your lab user. (This and the Secret Access key required next, can be found in your **session-info** file)

6. For Password: Enter the **Secret Access key** generated for your lab user

7. For ID: enter **aws_user**

8. Select “**Create**”

Task6 Configure Pipeline Job

1. Select “**+ New Item**” from the Jenkins **dashboard**

2. Enter “**Terraform Pipeline**” as the item name

3. Select **"Pipeline"** as the item type
4. Click **"OK"**
5. On the **General** page displayed next, scroll down to the **Pipeline** section. Use the dropdown list to change the **Definition** from **"Pipeline script"** to **"Pipeline script from SCM"**
6. Select **"Git"** from the **SCM** dropdown list
7. In the **Repository URL**: Enter **your** Github repository URL, recorded in your session-info file as **Repo-URL**
8. In **"Branches to build," "Branch Specifier;"** change from ***/master** to ***/main**

The image contains two screenshots of the Jenkins Pipeline configuration page. The top screenshot shows the 'Definition' dropdown set to 'Pipeline script from SCM', the 'SCM' dropdown set to 'Git', and the 'Repository URL' field containing 'https://github.com/qatip/jenkins-demo.git'. The bottom screenshot shows the 'Branches to build' section with the 'Branch Specifier (blank for \'any\')' field set to '*/main'. Both fields are circled in orange.

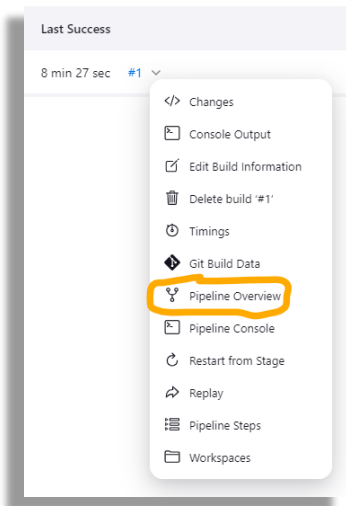
9. Click **"Save"**
10. Click **"Build Now"**

Task7 Verify pipeline run and explore Jenkins

1. In Jenkins, return to the Dashboard. A record of the pipeline will be displayed showing run success and failure. Refresh the page until a result of the pipeline run is displayed...

S	W	Name ↓	Last Success	Last Failure	Last Duration
✓	☀	Terraform Pipeline	1 min 30 sec #1	N/A	38 sec

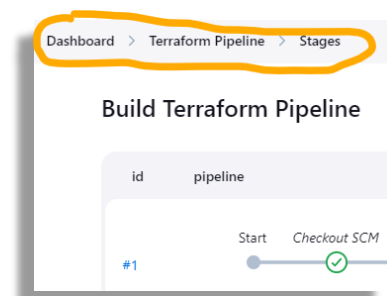
2. Select the drop-down menu against **#1** and choose Pipeline Overview..



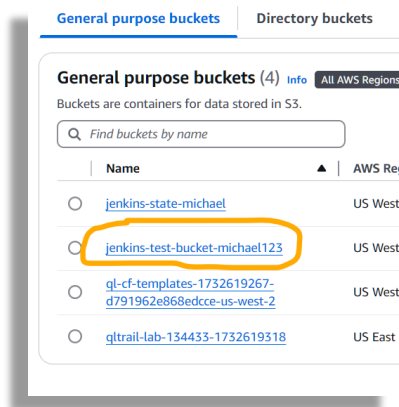
3. The stages of the pipeline are shown, with ticks (or crosses) indicating success or failure at that stage...



4. Spend a little time exploring the Jenkins interface, using the bread-crumb menu to navigate around, and finally return to the main Dashboard...



5. In the AWS console, navigate to the S3 service and verify the existence of your new storage bucket..

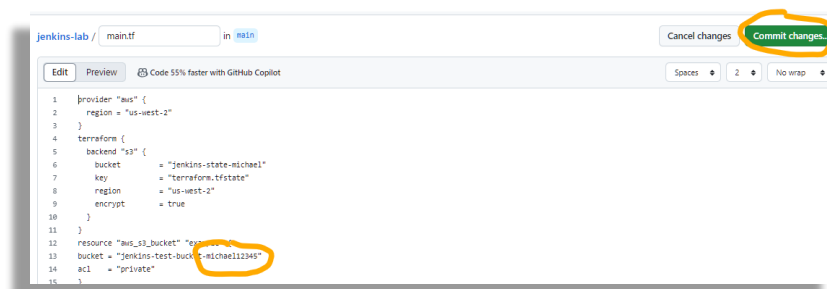


Task8 Updating the transformation pipeline

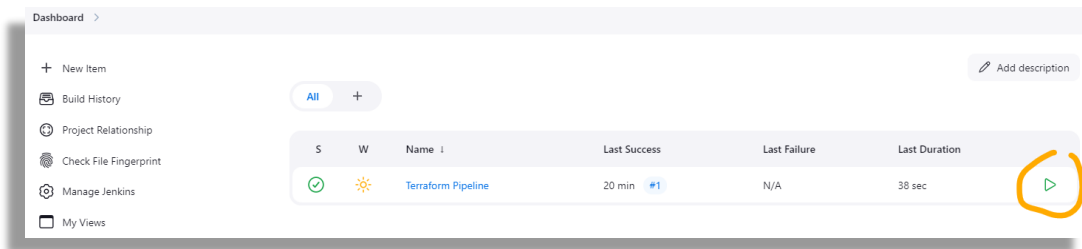
In a production environment, developers would now check-out the contents of the Github repo to their local machine, make updates to the terraform files and then check them back into the repo for approval. Once approved these changes would be merged with the current files and deployed by triggering a new pipeline run. This can be done manually in Jenkins or automatically using Webhooks, whereby Github notifies Jenkins of the changed files, and the pipeline run starts automatically to deploy these changes.

In this task we will modify the terraform files directly in Github before manually triggering a new pipeline run in Jenkins. We will then set up Webhooks to show how changes in Github can automatically trigger the pipeline run.

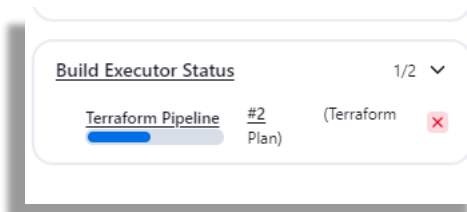
1. Return to your Github repository, logging back in if necessary.
2. Open **main.tf** for editing
3. Change the name of the bucket to be created by adding addition digits to the existing name. This will cause the original bucket to be deleted and a new one to be created. Commit this change..



4. Switch to Jenkins and click on the play icon to schedule a manual running of the pipeline..

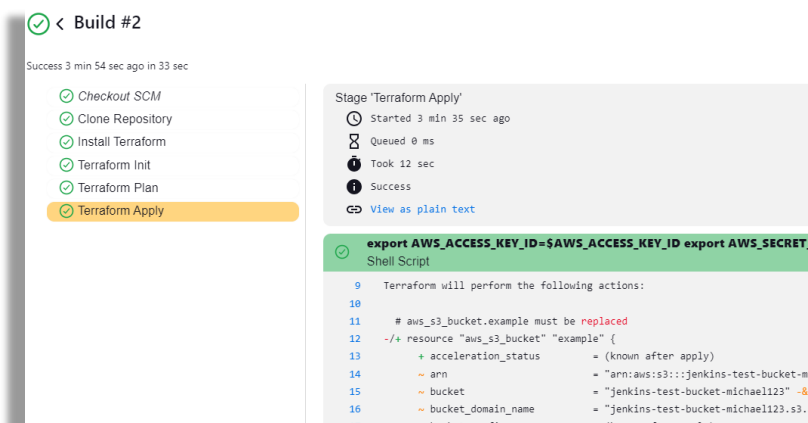


5. The build Executor Status will show the progress of the run..

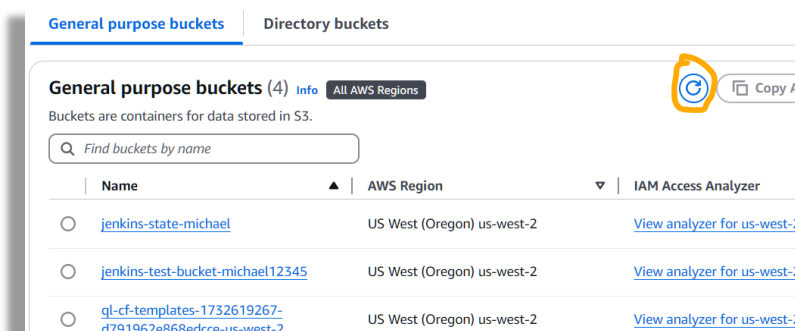


6. The success runs count should increase to #2 indicating successful manual running of the pipeline. (You may need to refresh the page)

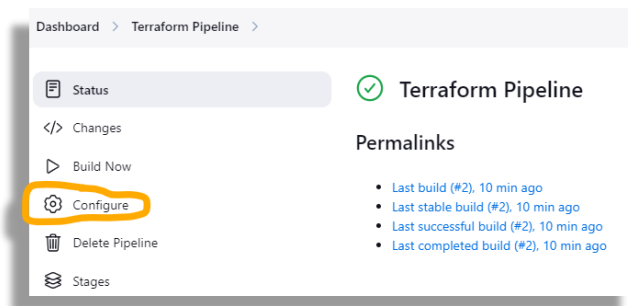
7. Looking at the logs for the **Terraform Apply** phase we see that the old bucket was replaced as bucket names are immutable and cannot be changed...



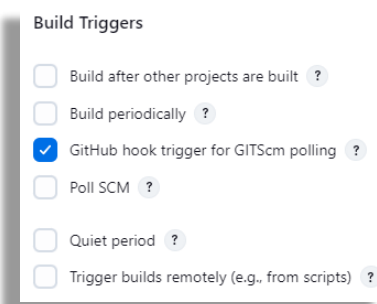
8. Switch to your console and, in S3, verify the deletion of the old bucket and the creation of a new one, refreshing the display if necessary..



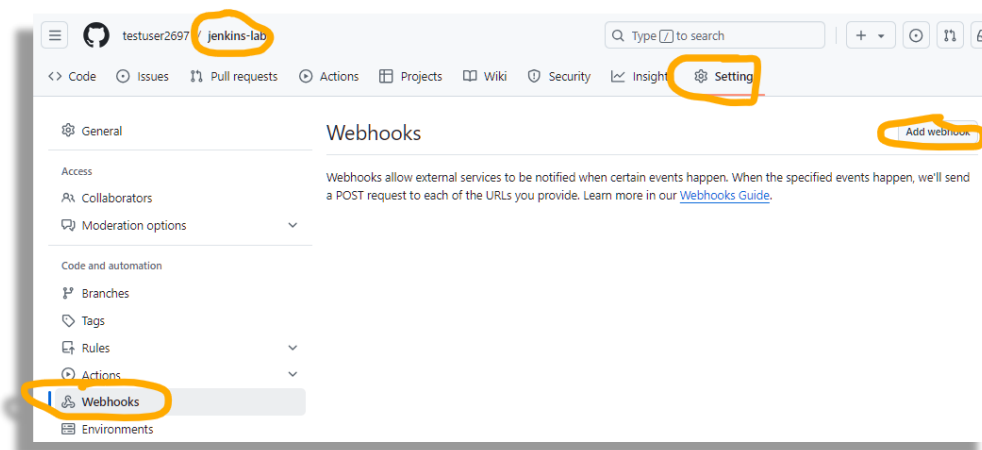
9. To configure automatic pipeline running; **In Jenkins**, configure the pipeline by first selecting it on the main dashboard and then choosing the **“Configure”** option..



10. Scroll down to the Build Triggers section, select **“Github hook trigger for GITScm polling”** and click on Save ...



11. **Switch to Github**. Select the **Settings** for your repo. Scroll down and select **Webhooks**. Click on **Add webhook** (you may be prompted to re-authenticate at this point)...



12. For **Payload URL**; enter **http://{Jenkins Public IP}:8080/github-webhook/** replacing **{Jenkins Public IP}** with the Public IP address of your Jenkins instance
13. For Content type; select **application/json**
14. Select to disable **SSL verification** for this lab environment.

15. Verify your settings as shown in example below (your IP will differ) before clicking on **Add webhook**..

Settings Recent Deliveries

We'll send a post request to the URL below with details of any subscribed events. You can also specify which data format you'd like to receive (JSON, x-www-form-urlencoded, etc). More information can be found in [our developer documentation](#).

Payload URL *

http://54.187.113.98:8080/github-webhook/

Content type *

application/json

Secret

SSL verification

☐ By default, we verify SSL certificates when delivering payloads.

☐ Enable SSL verification ☒ Disable (not recommended)

16. Make another change to the name of your bucket in **main.tf** and commit the changes (refer to steps 2 and 3 above if you need guidance)

17. Re-visit your Webhooks setting and you should see confirmation that there was a successful push of the changes to Jenkins...

Projects Wiki Security Insights Settings

General Webhooks Add webhook

Access

Collaborators

Moderation options

Code and automation

Branches

Tags

Rules

Actions

Webhooks

Webhooks allow external services to be notified when certain events happen. When the specified events happen, we'll send a POST request to each of the URLs you provide. Learn more in our [Webhooks Guide](#).

✓ http://54.187.113.98:8080/github-w... (push) Edit Delete

Last delivery was successful.

18. Switch to Jenkins. Return to the Dashboard and check that there is now a record of a third successful running of the pipeline...

Dashboard

New Item Build History Project Relationship Check File Fingerprint Manage Jenkins My Views

All + Add description

S	W	Name	Last Success	Last Failure	Last Duration
✓	☀	Terraform Pipeline	7 min 52 sec <u>#3</u>	N/A	35 sec

19. Switch to your AWS console, navigate to S3, refresh the display if necessary and verify the new bucket has been created.

Task9 (Time permitting). Configure Destroy Pipeline Job

1. Select “+ New Item” from the Jenkins **dashboard**
2. Use “**Terraform Pipeline Destroy**” as the item name
3. Select “**Pipeline**” as the item type
4. Click “**OK**”
5. On the **General** page displayed next, scroll down to the **Pipeline** section. Use the dropdown list to change the **Definition** from “**Pipeline script**” to “**Pipeline script from SCM**”
6. Select “**Git**” from the **SCM** dropdown list
7. In the **Repository URL**: Enter **your** Github repository URL, recorded in your session-info file as **Repo-URL**
8. In “**Branches to build**,” “**Branch Specifier**,” change from ***/master** to ***/main**

Pipeline

Definition

Pipeline script from SCM

SCM ?

Git

Repositories ?

Repository URL ?

<https://github.com/qatip/jenkins-demo.git>

Credentials ?

- none -

Add Repository

Branches to build ?

Branch Specifier (blank for 'any') ?

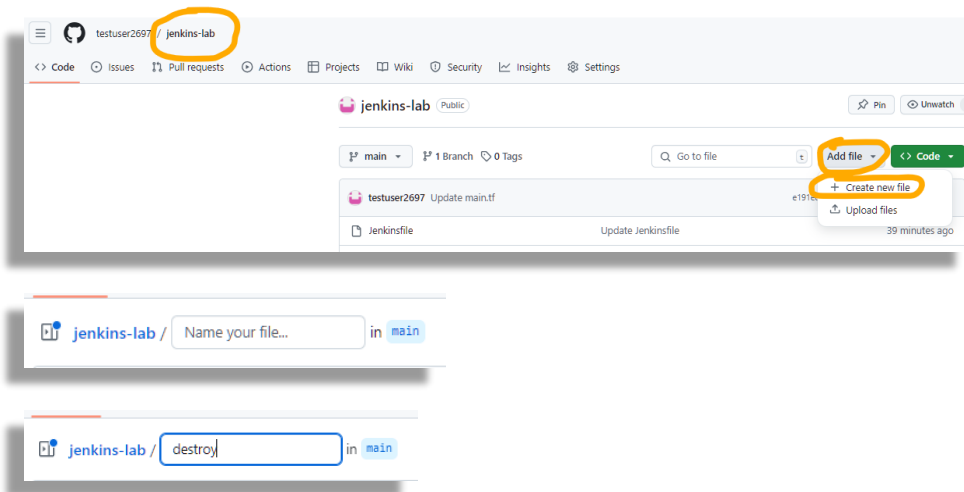
*/main

9. Change the Script Path to **destroy/Jenkinsfile**

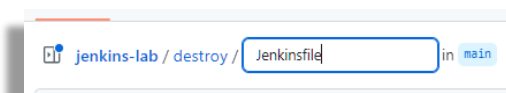
Script Path ?

destroy/Jenkinsfile

10. Save the new pipeline but do not build it yet
11. Switch to your Github account
12. Create a new empty Jenkinsfile in a new folder “destroy”...



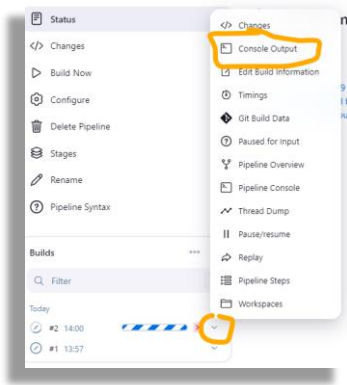
Note: Entering **destroy/** will create the **destroy** folder



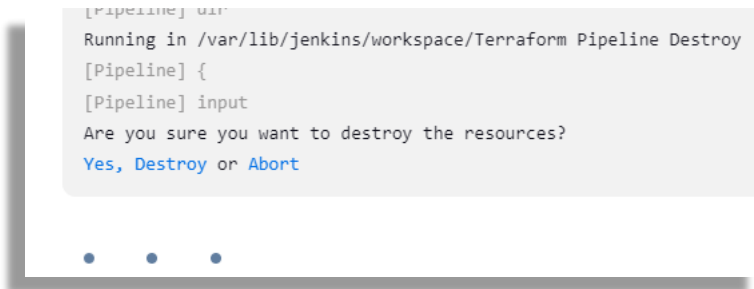
13. In your IDE, navigate to and to open **Jenkinsfile.txt** in your **Lab Instructions/lab6_Files/destroy** folder and copy the contents into your new github file. Then commit the changes..



14. Switch back to Jenkins and **Build** the pipeline
15. This Jenkinsfile mandates that approval must be granted for the deletion to proceed.
16. Click on the pipeline and under **Builds**, select the running Terraform Pipeline Destroy job and select **Console Output**..



17. The run is waiting for approval to continue...



18. Click on **Yes** to confirm the deletion

19. The destruction should now proceed. Switch to **S3** to verify the deletion of your test bucket.

***** Congratulations, you have completed the final lab of the course. If you wish to attempt optional lab06a then please do so now. Your instructor will end your lab environment for you at course end, which will destroy all AWS resources created. Destroy your Github repository at your own discretion or retain it for future use *****