Project: Lab - Automating Infrastructure Deployment with AWS CloudFormation

Deploying infrastructure in a consistent, reliable manner is difficult. It requires people to follow documented procedures without taking any undocumented shortcuts. It can also be difficult to deploy infrastructure out-of-hours when fewer staff are available. AWS CloudFormation changes this situation by defining infrastructure in a template that can be automatically deployed even on an automated schedule.

How to deploy multiple layers of infrastructure with AWS CloudFormation, update a CloudFormation stack, and delete a stack.

Task 1: Deploying a networking layer

It is a best practice to deploy infrastructure in layers. Common layers are:

- Network (Amazon VPC)
- Database
- Application

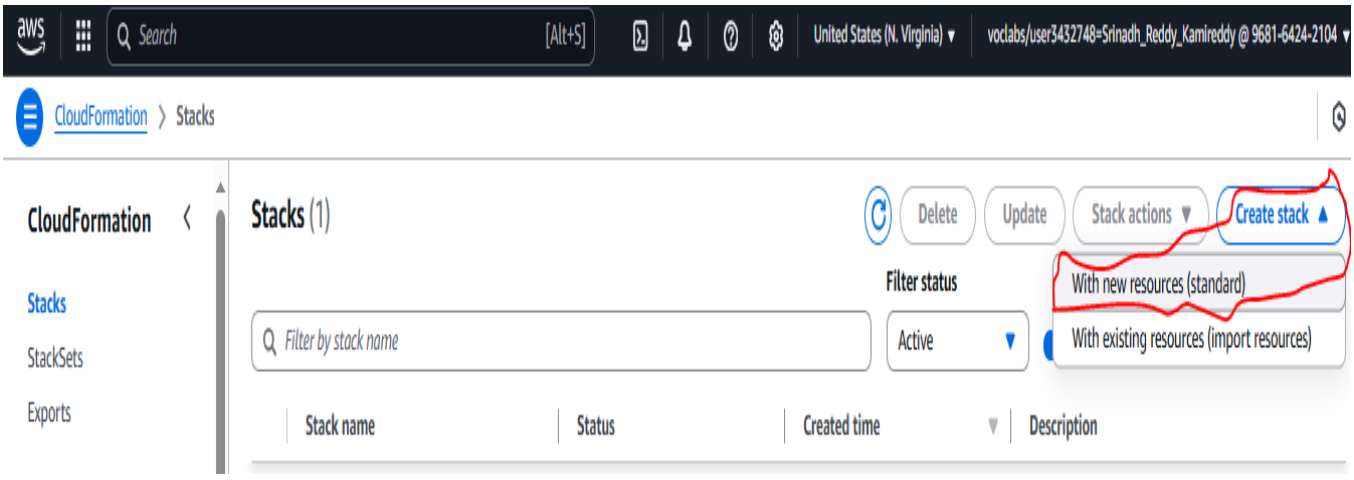
This way, templates can be reused between systems. For example, you can deploy a common network topology between development, test, and production environments, or deploy a standard database for multiple applications.

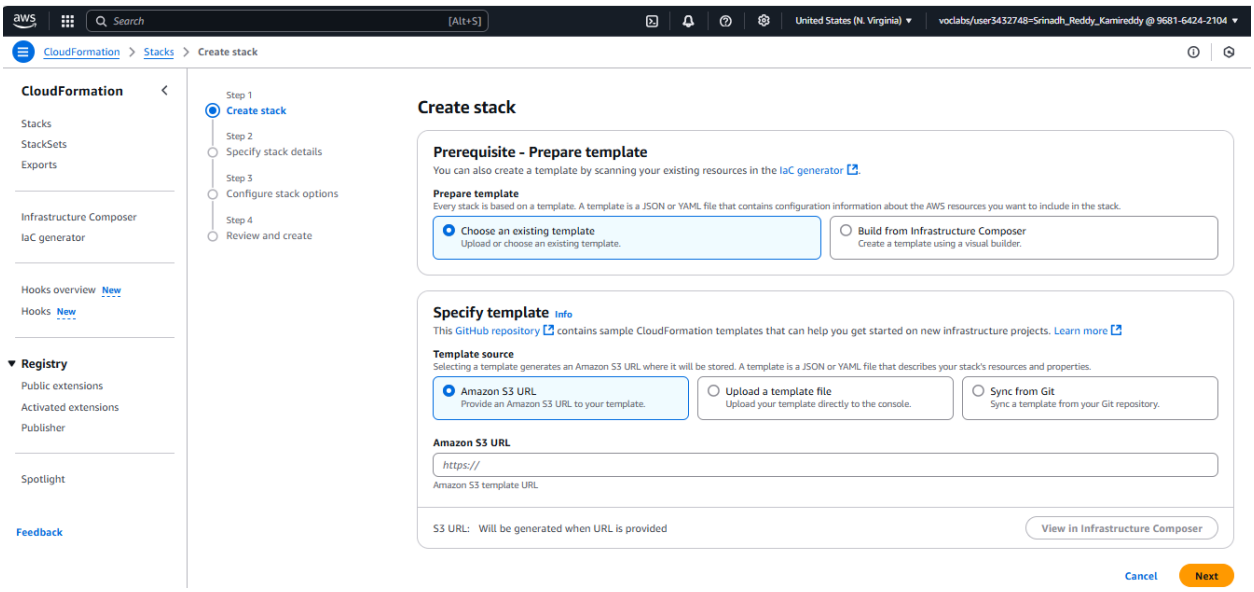
Templates can be written in JavaScript Object Notation (JSON) or YAML Ain't Markup Language (YAML). YAML is a markup language that is similar to JSON, but it is easier to read and edit.

In this task, I will deploy an AWS CloudFormation template that creates a networking layer by using Amazon VPC.

-1. In the AWS Management Console, from the Services menu, choose **CloudFormation**.

Choose Create stack (with new resources - Standard) and configure these settings.



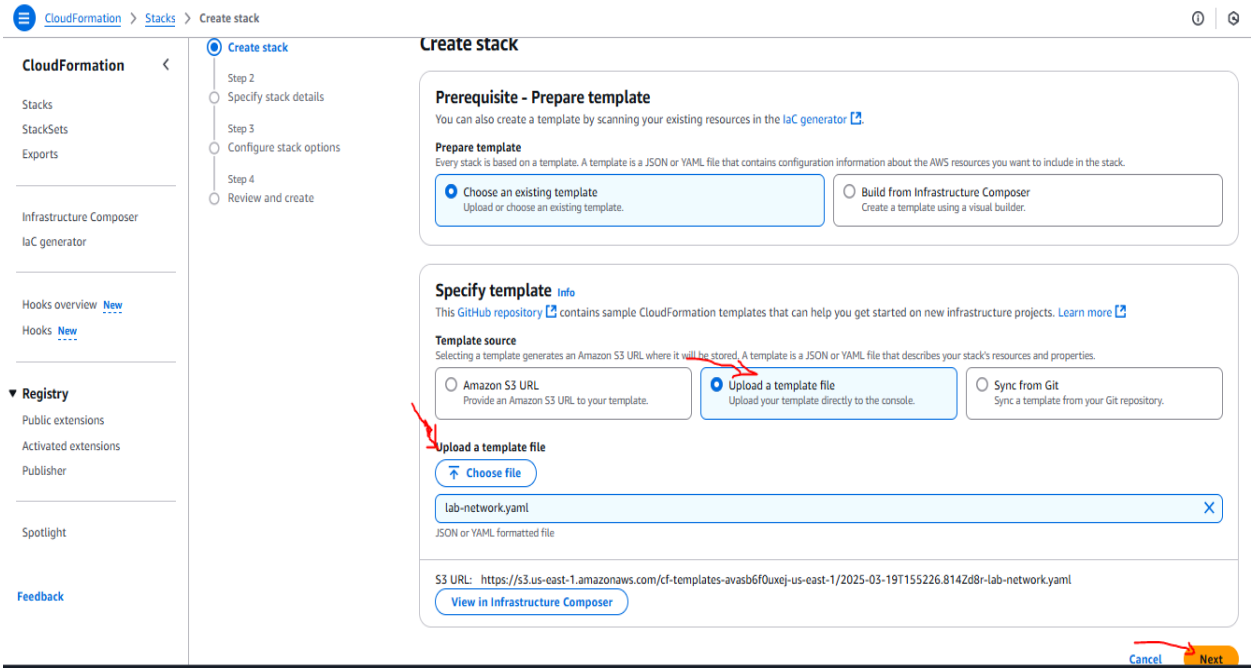


Step 1: Specify template

Template source: Choose - Upload a template file

Upload a template file: Click Choose file then select the lab-network.yaml file from the attachments.

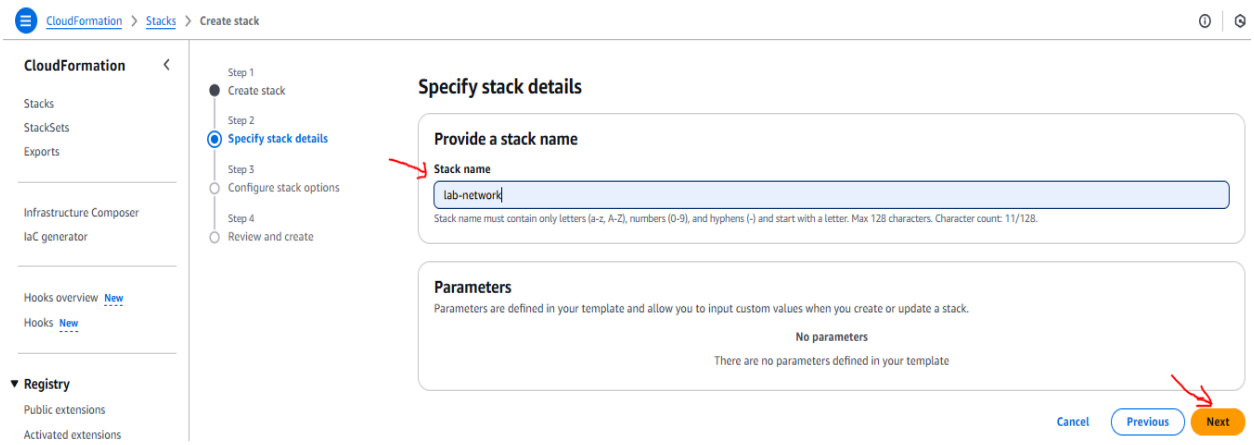
Choose Next



Step 2: Create Stack

Stack name: lab-network

Choose Next



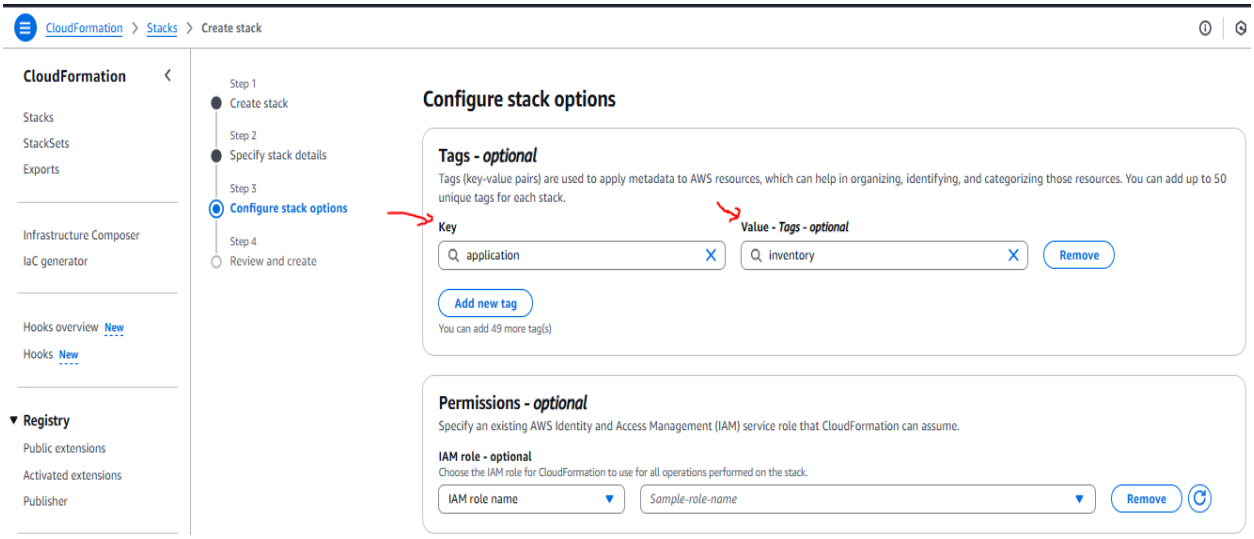
Step 3: Configure stack options

In the Tags section, click on Add new tag and then enter below values.

Key: application

Value: inventory

Choose Next at the right-side bottom



Step 4: Review lab-network

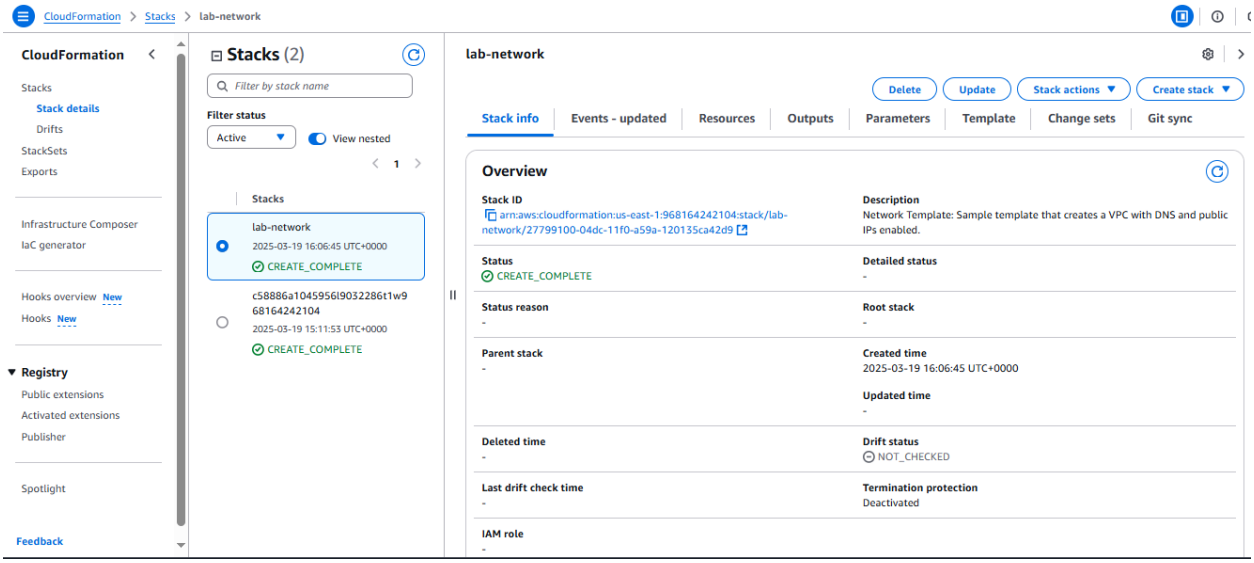
Choose Submit at right-side bottom

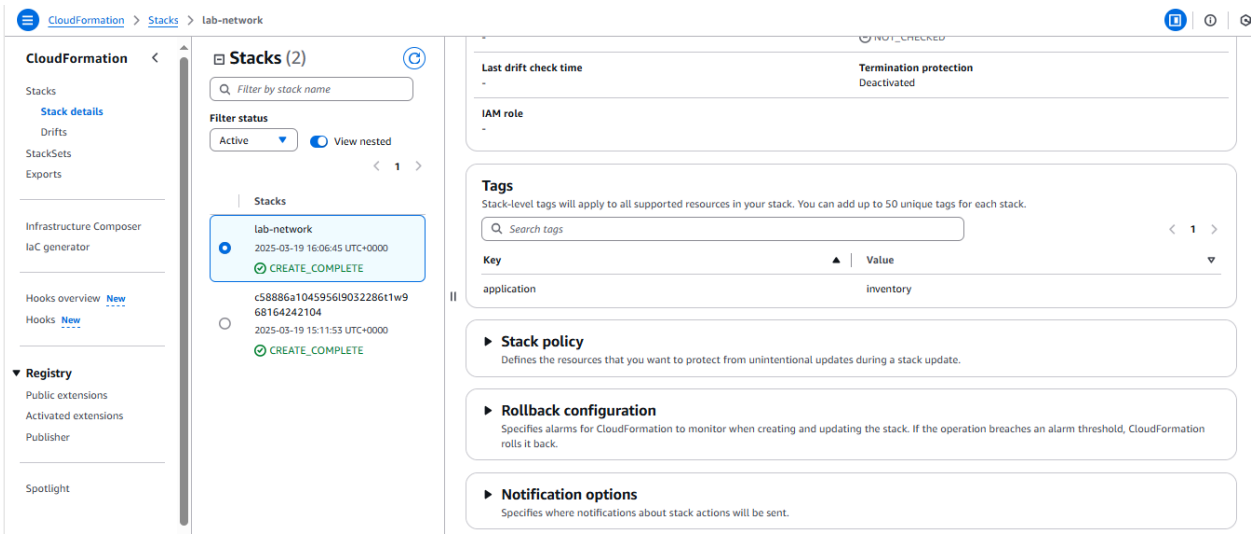
The template will now be used by AWS CloudFormation to generate a stack of resources in the AWS account.

The specified tags are automatically propagated to the resources that are created, which makes it easier to identify resources that are used by particular applications.

-2. Choose the Stack info tab.

Wait for the Status to change to CREATE_COMPLETE.



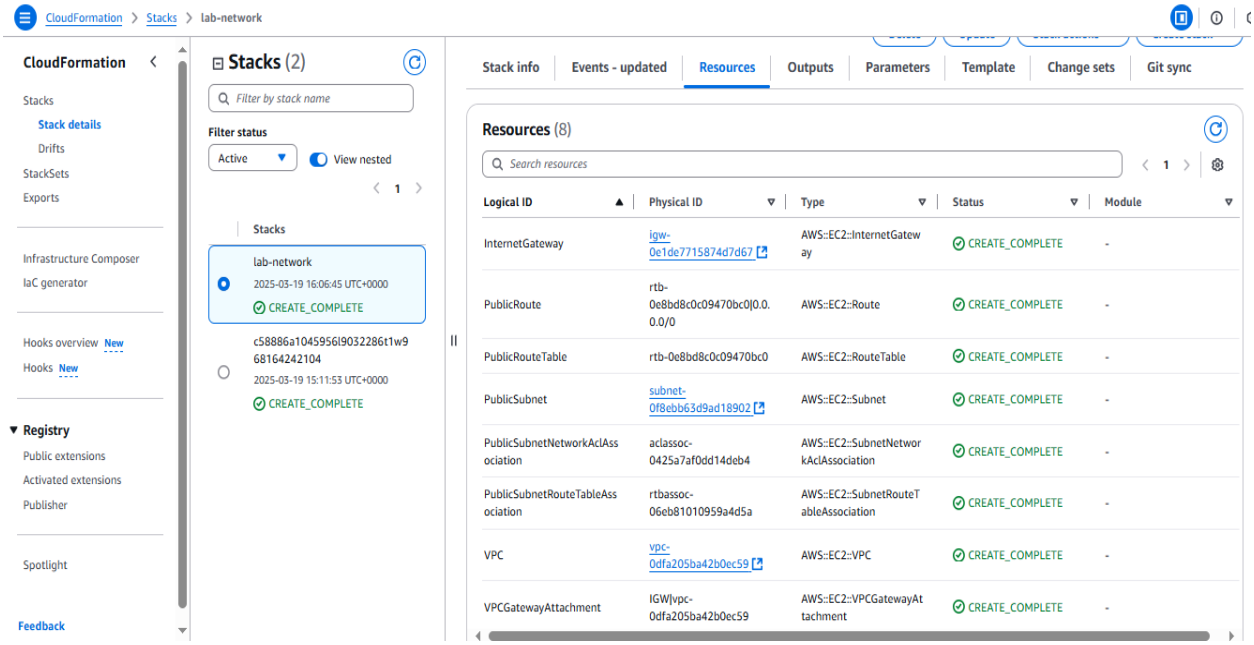


-3. Choose Refresh every 15 seconds to update the display, if necessary.

You can now examine the resources that were created.

-4. Choose the Resources tab.

You will see a list of the resources that were created by the template. If the list is empty, update the list by choosing Refresh.



-5. Choose the Events-updated tab and scroll through the events log.

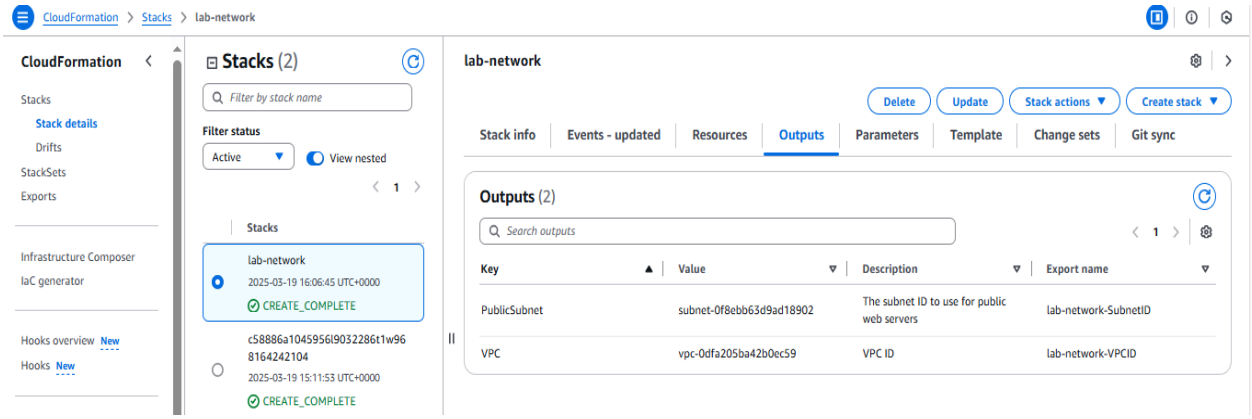
The events updated log shows (from more recent to less recent) the activities that were performed by AWS CloudFormation.

-6. Choose the Outputs tab.

A CloudFormation stack can provide output information, such as the ID of specific resources and links to resources. Two outputs are listed.

PublicSubnet: The ID of the public subnet that was created (Here: subnet-0f8ebb63d9ad18902)

VPC: The ID of the VPC that was created (Here vpc-0dfa205ba42b0ec59)



-7. Choose the Template tab.

This tab shows the template that was used to create the stack—that is, the template that I uploaded while creating the stack.

Task 2: Deploying an application layer

Now I will deploy an application layer that contains an Amazon EC2 instance and a security group.

The AWS CloudFormation template will import the VPC and subnet IDs from the Outputs of the existing CloudFormation stack. It will then use this information to create the security group in the VPC and the EC2 instance in the subnet.

-1. From the Service menu, choose CloudFormation.

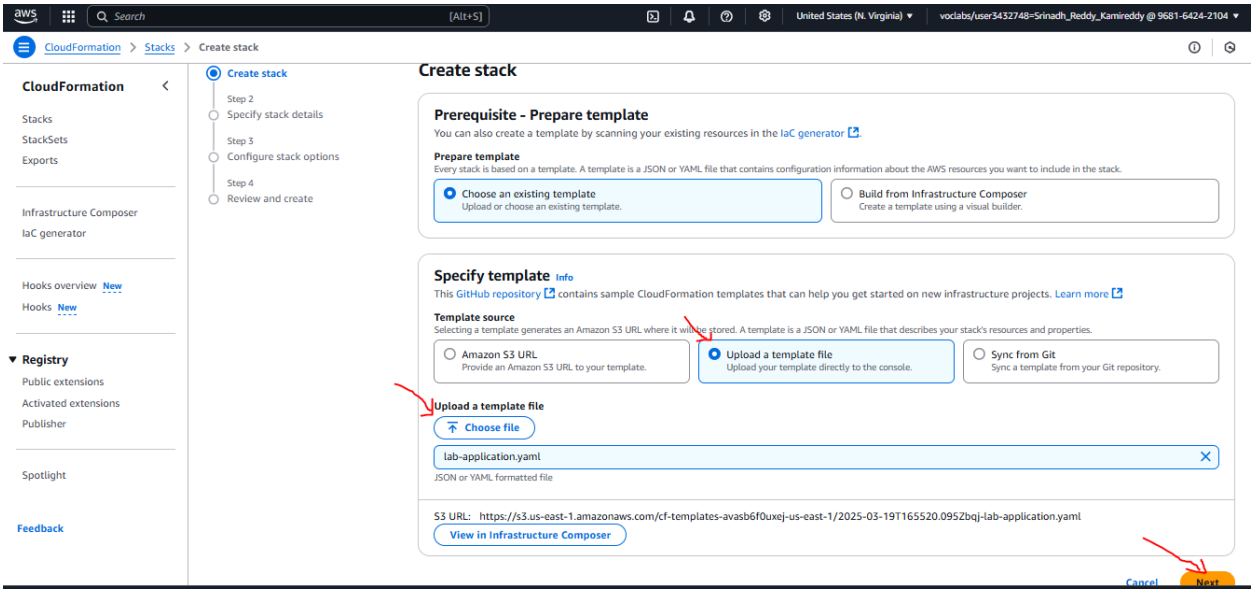
Select Create stack > With new resources (standard), and then configure below settings.

Step 1: Specify template

Template source: Upload a template file

Upload a template file: Click Choose file then select the lab-application.yaml file the attachments.

Choose Next



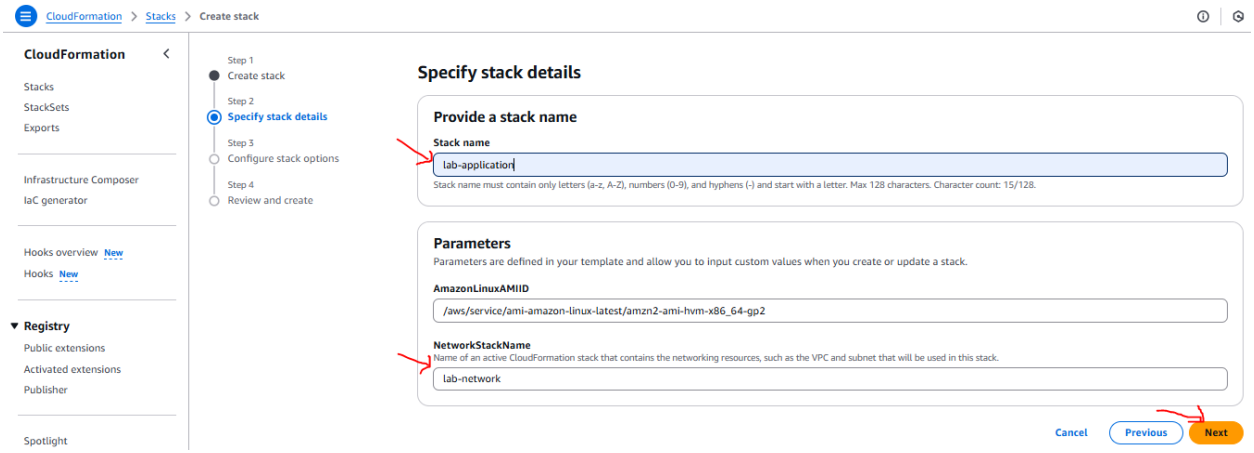
Step 2: Create Stack

Stack name: lab-application

NetworkStackName: lab-network

Choose Next

The Network Stack Name parameter tells the template the name of the first stack that I created (lab-network), so it can retrieve values from the Outputs.



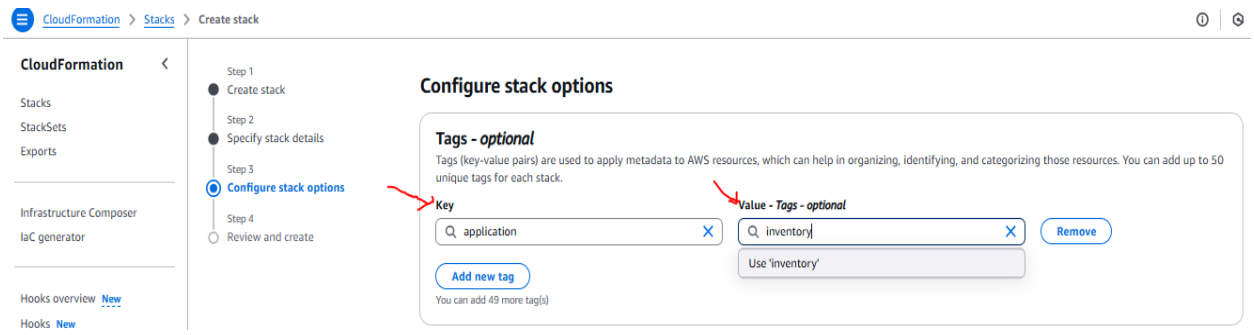
Step 3: Configure stack options

In the Tags section, click on Add new tag and then enter below values.

Key: application

Value: inventory

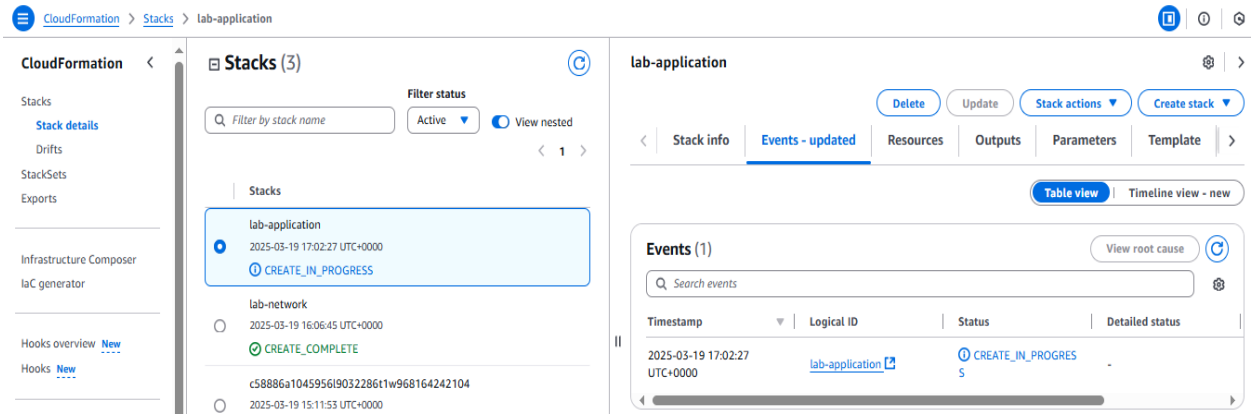
Choose Next at the bottom



Step 4: Review and create of lab-application

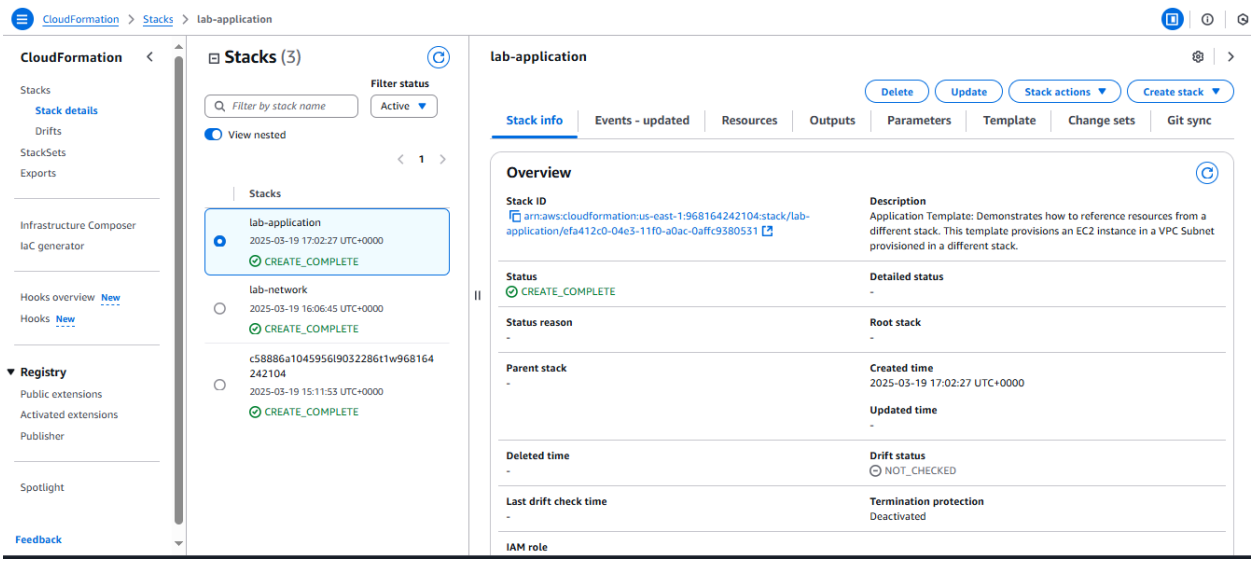
Choose Submit at the bottom

While the stack is being created, examine the details in the Events tab and the Resources tab. You can monitor the progress of the resource-creation process and the resource status.

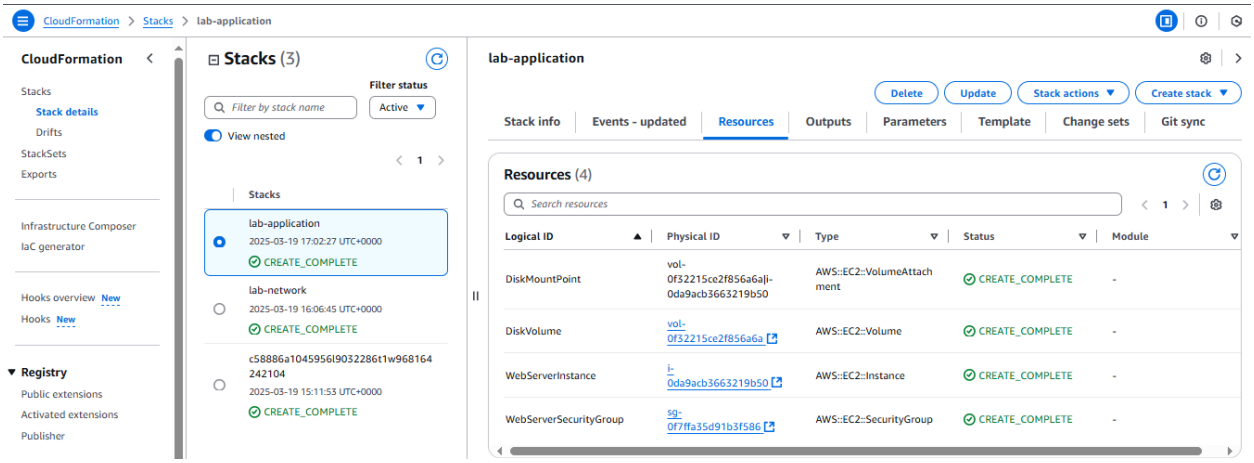


-2. Choose the Stack info tab, wait for the Status to change to CREATE_COMPLETE.

Your application is now ready!



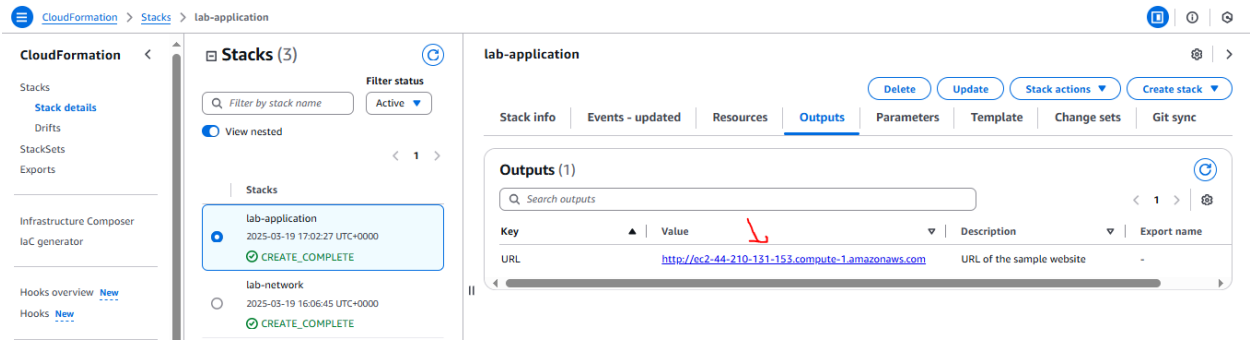
From the Resource tab



-3. Choose the Outputs tab.

Copy the URL that is displayed, open a new web browser tab, paste the URL, and press ENTER.

The browser tab will open the application, which is running on the web server that this new CloudFormation stack created.



A CloudFormation stack can use reference values from another CloudFormation stack. For example, this portion of the lab-application template references the lab-network template:

```
WebServerSecurityGroup:
  Type: AWS::EC2::SecurityGroup
  Properties:
    GroupDescription: Enable HTTP ingress
    VpcId:
      Fn::ImportValue:
        !Sub ${NetworkStackName}-VPCID
```

The last line uses the network stack name that you provided (lab-network) when the stack was created. It imports the value of lab-network-VPCID from the Outputs of the first stack. It then inserts the value into the VPC ID field of the security group definition. The result is that the security group is created in the VPC that was created by the first stack.

Here is another example, which is in the CloudFormation template that you just used to create the application stack. This template code places the EC2 instance into the subnet that was created by the network stack:

```
SubnetId:
  Fn::ImportValue:
  !Sub ${NetworkStackName}-SubnetID
```

It takes the subnet ID from the lab-network stack and uses it in the lab-application stack to launch the instance into the public subnet, which was created by the first stack.

Task 3: Updating a Stack

AWS CloudFormation can also update a stack that has been deployed. When I update a stack, AWS CloudFormation will only modify or replace the resources that are being changed. Any resources that are not being changed will be left as it is.

In this task, I will update the lab-application stack to modify a setting in the security group.

First, Check the current settings for the security group.

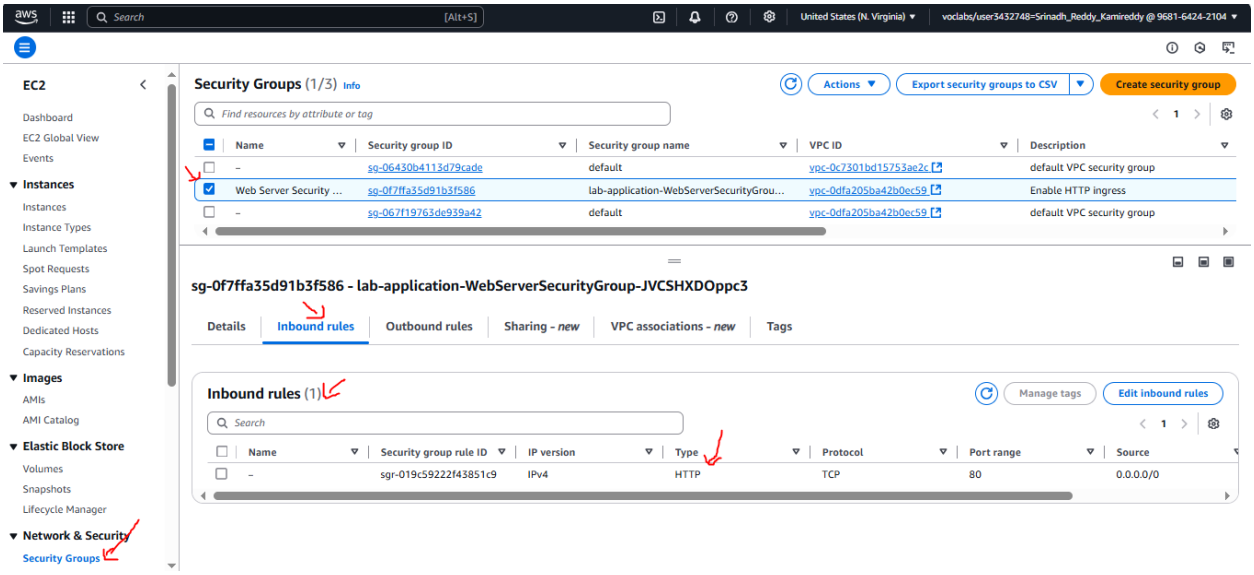
-1. In the AWS Management Console, from the Services menu, choose EC2.

In the left navigation pane, choose Security Groups.

Select the check box for lab-application-WebServerSecurityGroup....

Choose the Inbound rules tab.

Currently, only one rule is in the security group. The rule permits HTTP traffic.



-2. Now return to AWS CloudFormation to update the stack.

From the Services menu, choose CloudFormation.

Get the updated template lab-application2.yaml from the attachments

This template has an additional configuration to permit inbound Secure Shell (SSH) traffic on port 22:

```
- IpProtocol: tcp
  FromPort: 22
  ToPort: 22
  CidrIp: 0.0.0.0/0
```

-3. In the Stacks list of the AWS CloudFormation console, select lab-application.

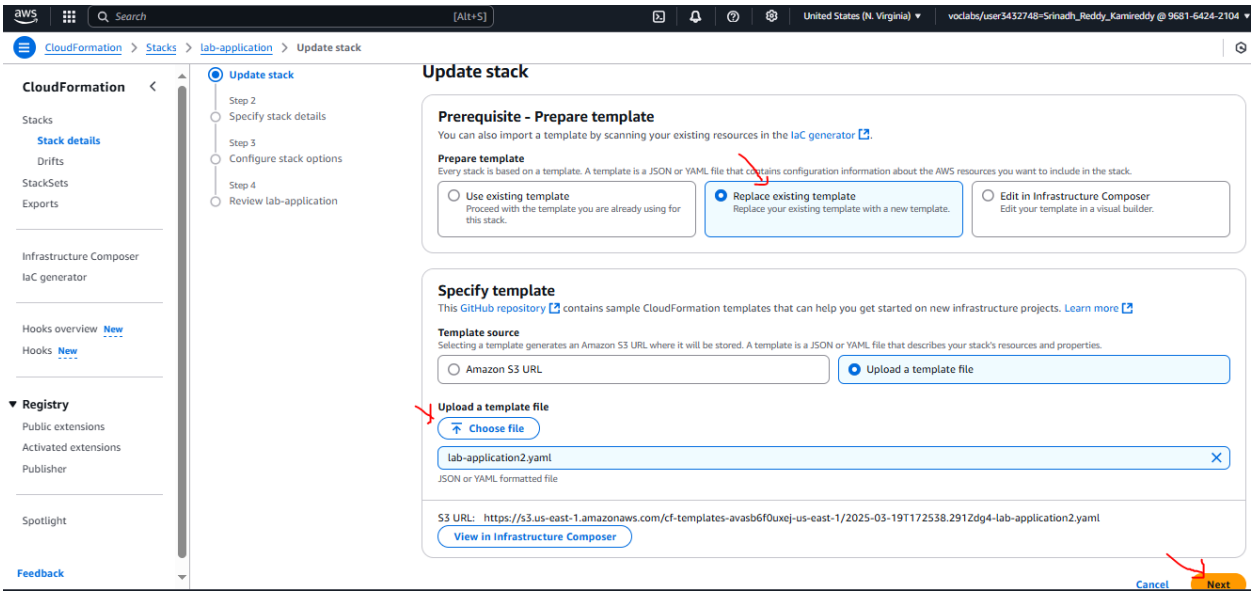
Choose Update and configure below settings.

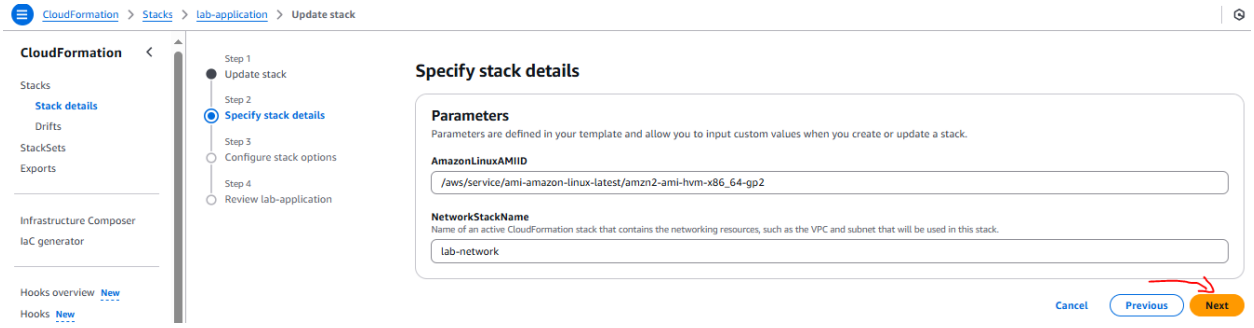
Choose Replace existing template

Template source: Upload a template file

Upload a template file: Click Choose file then select the lab-application2.yaml file from the attachments.

Choose Next in each of the next three screens to advance to the Review lab-application page.





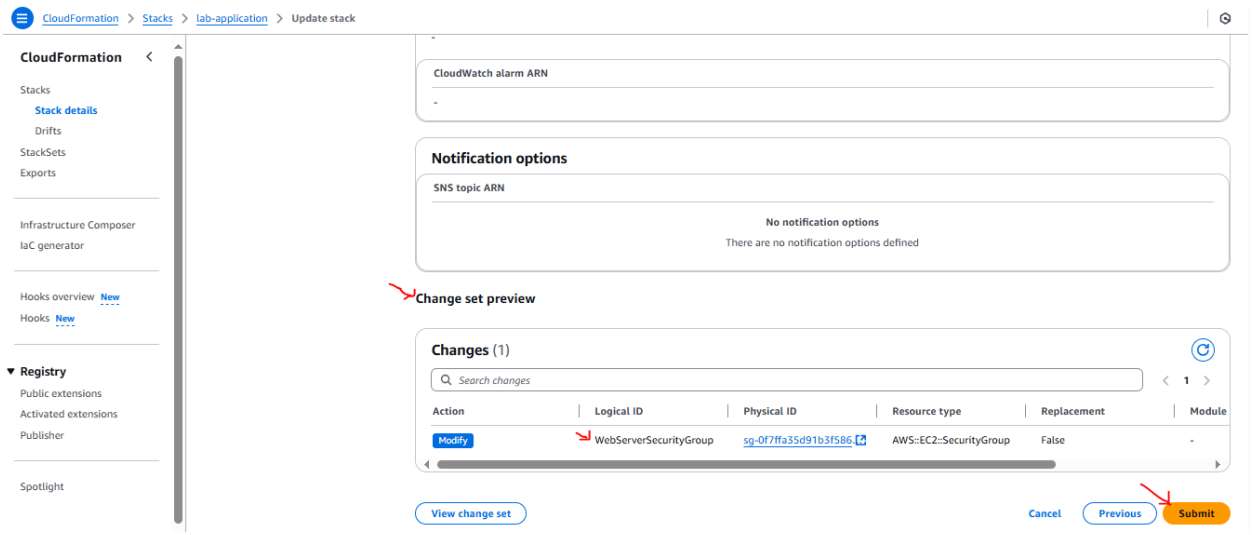
In the Configure stack options screen - Click Next

Review lab-application

In the Change set preview section at the bottom of the page, AWS CloudFormation displays the resources that will be updated:

Change set preview

This change set preview indicates that AWS CloudFormation will Modify the WebServerSecurityGroup without needing to replace it (Replacement = False). This change set means that the security group will have a minor change applied to it, and no references to the security group will need to change.

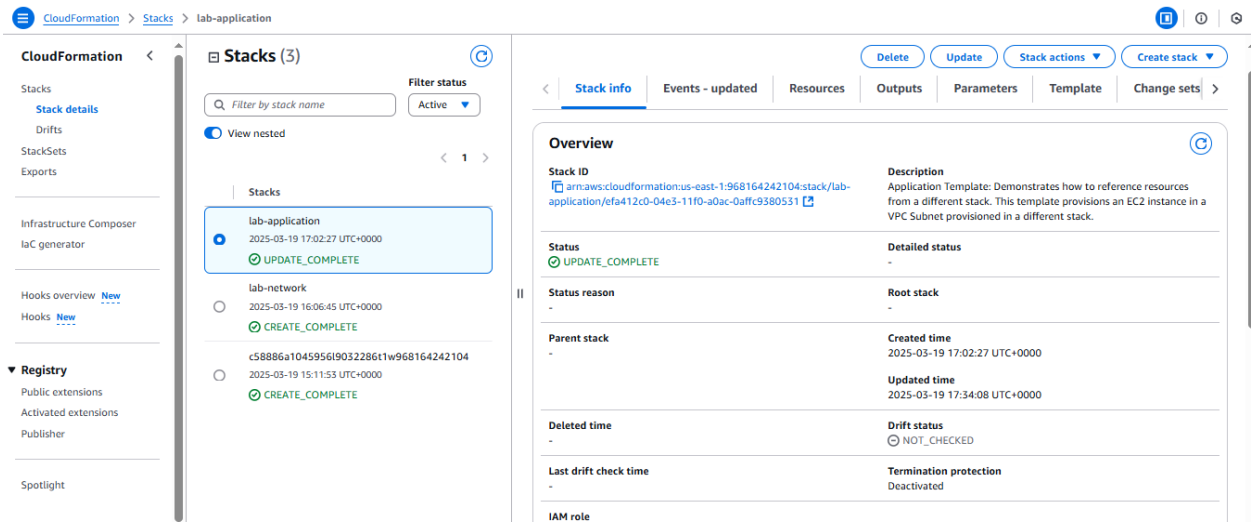


Click on Submit

-4. In the Stack info tab, wait for the Status to change to UPDATE_COMPLETE.

Update the status by choosing Refresh every 15 seconds, if necessary.

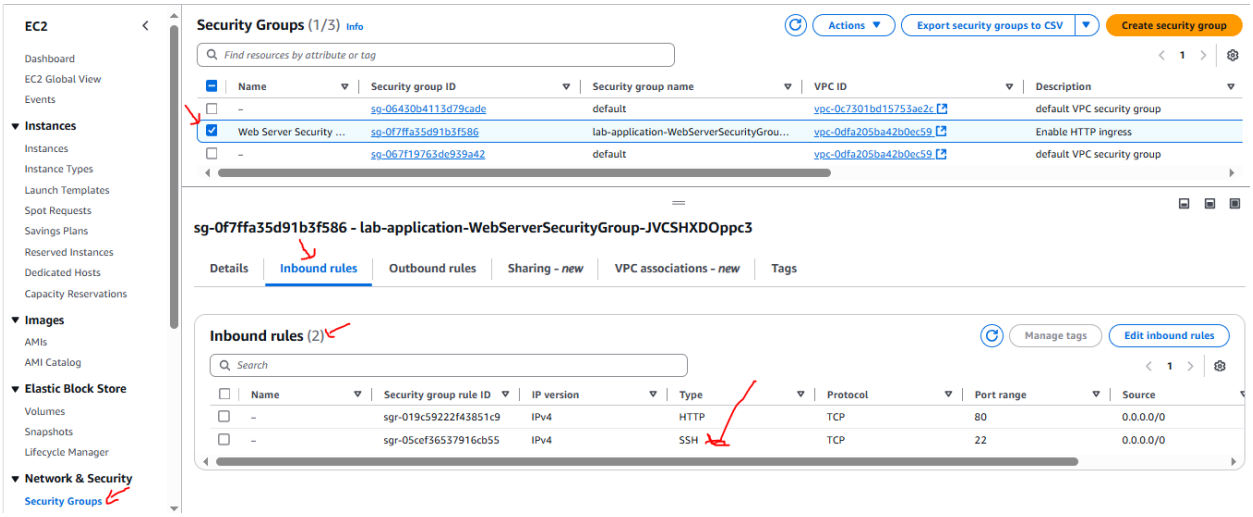
We can now verify the change.



-5. Return to the Amazon EC2 console and from the left navigation pane, choose Security Groups.

In the Security Groups list, select lab-application-WebServerSecurityGroup.

The Inbound rules tab should display an additional rule that allows SSH traffic over TCP port 22.



This task demonstrates how changes can be deployed in a repeatable, documented process. The AWS CloudFormation templates can be stored in a source code repository (such as AWS CodeCommit). This way, we can maintain versions and a history of the templates and the infrastructure that was deployed.

Task 4: Exploring templates with AWS CloudFormation Infrastructure Composer

AWS CloudFormation Infrastructure Composer is a graphic tool for creating, viewing, and modifying AWS CloudFormation templates. With Infrastructure Composer, we can diagram our template resources by using a drag-and-drop interface, and then edit their details through the integrated JSON and YAML editor.

Whether we are a new to AWS CloudFormation or an experienced AWS CloudFormation user, Infrastructure Composer can help us quickly see the interrelationship between a template's resources. It also enables us to easily modify templates.

In this task, we will gain some hands-on experience with Designer.

From the Services menu, choose CloudFormation.

In the left navigation pane, choose Infrastructure Composer.

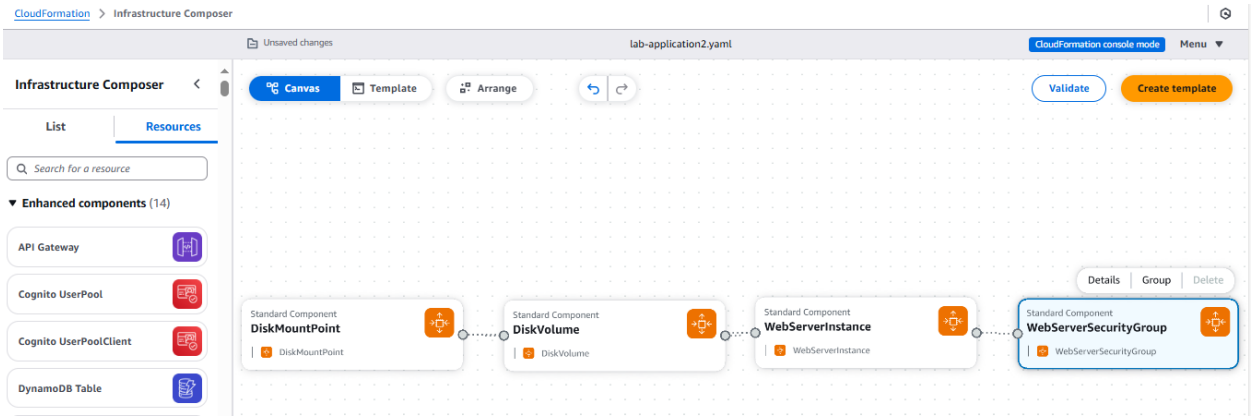
Tip: You might need to expand the left navigation pane by choosing the menu icon.

Choose the File menu, select Open > Local file, and select the lab-application2.yaml template that you downloaded previously.

Infrastructure Composer will display a graphical representation of the template:

Instead of drawing a typical architecture diagram, Infrastructure Composer is a visual editor for AWS CloudFormation templates. It draws the resources that are defined in a template and their relationship to each other.

CloudFormation Infrastructure Composer

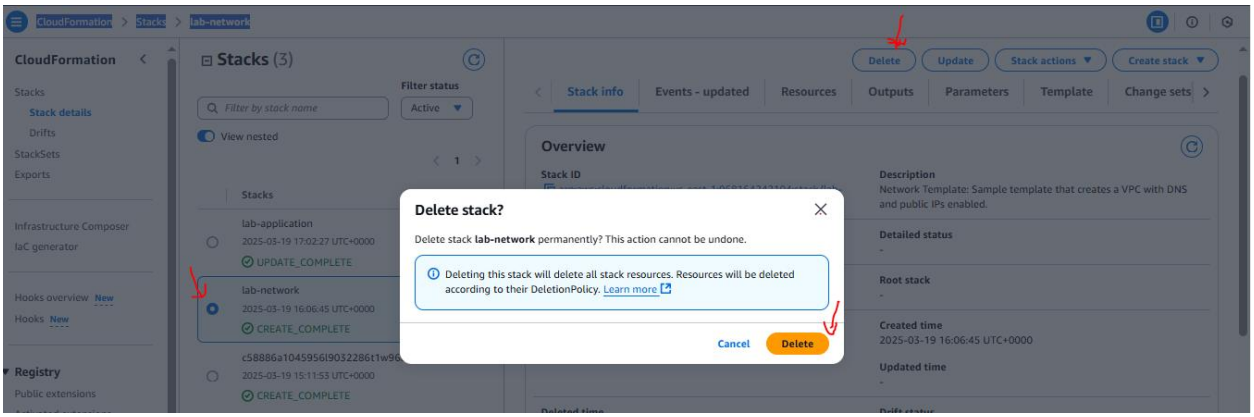


Task 5: Deleting the stack

When resources are no longer required, AWS CloudFormation can delete the resources built for the stack.

A deletion policy can also be specified against resources. It can preserve or (in some cases) back up a resource when its stack is deleted. This feature is useful for retaining databases, disk volumes, or any resource that might be needed after the stack is deleted.

The lab-application stack was configured to take a snapshot of an Amazon Elastic Block Store (Amazon EBS) disk volume before it is deleted. AWS CloudFormation to create a snapshot of the disk volume before it is deleted.



We can monitor the deletion process in the Events tab and update the screen by choosing Refresh occasionally. We might also see an events log entry that indicates that the EBS snapshot is being created.

Wait for the stack to be deleted. It will disappear from the stacks list.

We will now verify that a snapshot of the EBS volume was created before the EBS volume was deleted.

From the Services menu, choose EC2.

In the left navigation pane, choose Snapshots.

We should see a snapshot with a Started time in the last few minutes.

==========End==========