axcess.io

MLOPS Pipeline Runbook

Version History

Sr No	Version ID	Date	Author	Remark
1	1.0	21-07-2025	Manoj P	First Version

TABLE OF CONTENT

OVERVIEW

The MLOps Pipeline Asset Runbook provides comprehensive guidance for Creating, implementing, and managing machine learning operations pipelines in AWS environments. This document serves as the primary reference for MLops pipeline implementation.

The pipeline encompasses the complete ML workflow from data ingestion and model training to deployment, monitoring, and continuous improvement. It implements industry best practices for scalability and reliability while ensuring efficient resource utilization and cost optimization.

PURPOSE

The primary purpose of this runbook is to:

- Standardize MLOps Processes: Establish consistent procedures for machine learning model development, deployment, and lifecycle maintenance.
- Enable Automation: Provide guidelines for implementing CI/CD pipelines tailored for ML workloads.
- Ensure Reliability: Define best practices for monitoring model quality, monitoring data quality and retraining model.

OUTCOME

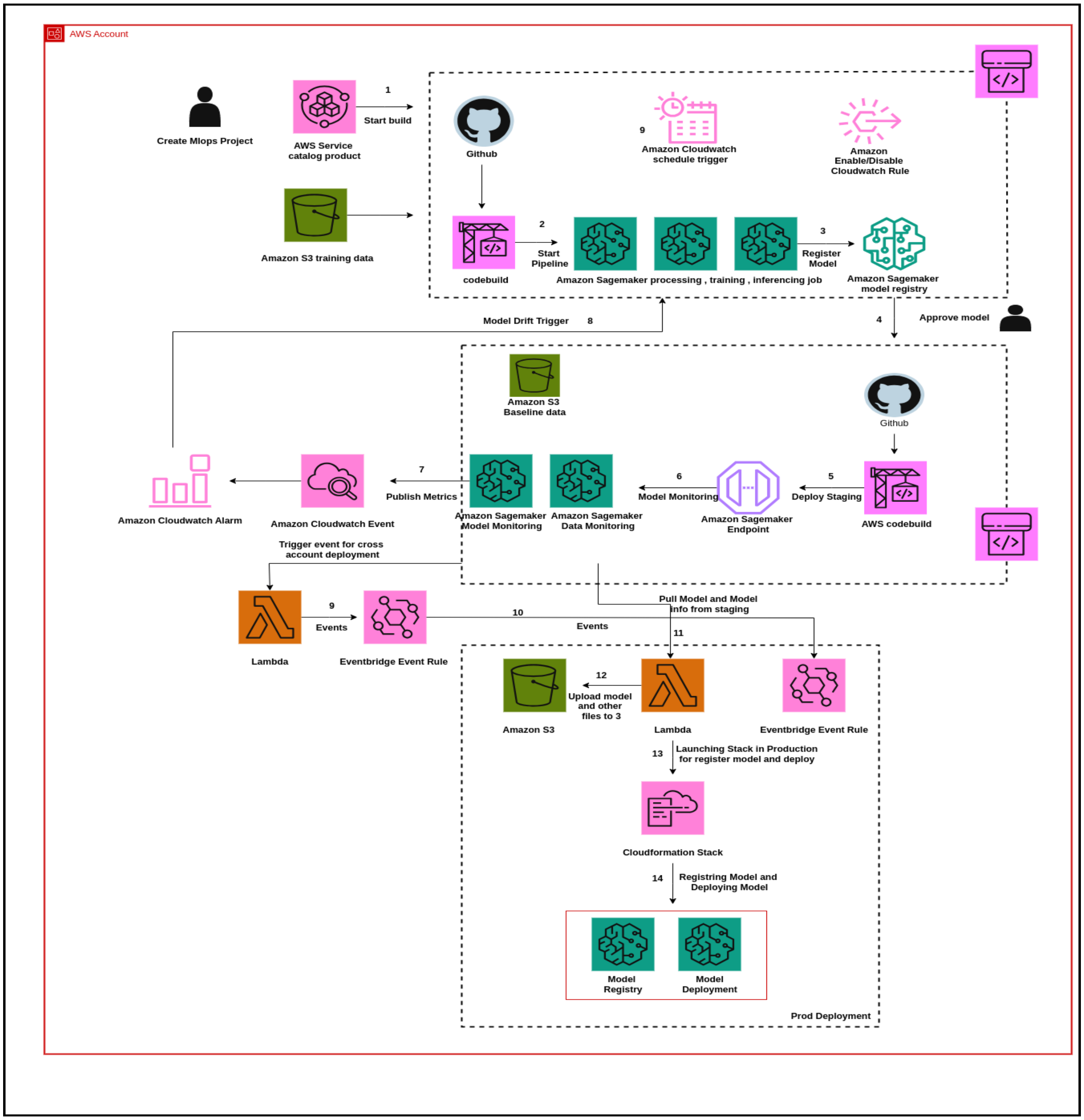
Upon successful implementation of this asset, the user will be able to create the complete infrastructure required for an MLOps pipeline.

TECHNICAL OUTCOMES

- Orchestrated model training using Amazon SageMaker Pipelines.
- Model version control and lifecycle management via SageMaker Model Registry.
- Deployment of models to Staging and Production environments configured for batch inference workloads.
- Automated ML Pipeline: Seamless automation from data ingestion to model deployment.
- Continuous Integration/Deployment: Automated testing, validation, and release of ML models.

- Real-time Monitoring: Integrated monitoring of model performance, including data drift detection.
- Version Control: Comprehensive versioning of both model artifacts and code.

ARCHITECTURE DIAGRAM


AWS Account
Create Mlops Project
1
Start build
AWS Service catalog product
Github
9
Amazon Cloudwatch schedule trigger
Amazon Enable/Disable Cloudwatch Rule
Amazon S3 training data
codebuild
2
Start Pipeline
Amazon Sagemaker processing , training , inferencing job
3
Register Model
Amazon Sagemaker model registry
Model Drift Trigger
8
4
Approve model
Amazon S3 Baseline data
Github
7
Publish Metrics
Amazon Sagemaker Model Monitoring
Amazon Sagemaker Data Monitoring
6
Model Monitoring
Amazon Sagemaker Endpoint
5
Deploy Staging
AWS codebuild
Amazon Cloudwatch Alarm
Amazon Cloudwatch Event
Trigger event for cross account deployment
9
Events
Lambda
Eventbridge Event Rule
10
Events
Pull Model and Model info from staging
11
Amazon S3
12
Upload model and other files to 3
Lambda
Eventbridge Event Rule
13
Launching Stack in Production for register model and deploy
Cloudformation Stack
14
Registring Model and Deploying Model
Model Registry
Model Deployment
Prod Deployment

PIPELINE COMPONENTS

- Source: GitHub repository
- CodePipeline: Full orchestration
- CodeBuild: Build phase
- SageMaker: Pipelines, Model Registry, Custom Project
- Lambda Functions
- Eventbridge Rules
- Amazon S3
- Amazon ECR
- AWS Service Catalog
- IAM Roles and Policies
- AWS Cloudformation
- SNS Topics
- API Gateways

DEPLOYMENT PROCESS

CREATE AND ORGANIZE GITHUB REPOSITORY

1. Create a new GitHub repository in your GitHub account (if it does not already exist).
2. Once the repository is created, add "axcess-Mlops" folder to it.

RUNBOOK: CREATE GITHUB CONNECTION USING CLOUDFORMATION

GOAL

Set up a GitHub connection in AWS using a CloudFormation template, then complete the GitHub authorization process to make the connection usable in services like CodePipeline using a console.

DEPLOYMENT STEPS

1. **Install AWS CLI**
    a. Installation Guide

2. Configure AWS CLI (One-Time Setup)/Launch using Cloud shell in AWS environment.

a. Launch resources from local.

i. Before deploying the CloudFormation stack, ensure your AWS CLI is configured with the necessary credentials and region.

ii. Type bash command given below.
aws configure

iii. You will be prompted to enter:

1. **AWS Access Key ID**
2. **AWS Secret Access Key**
3. **Default region name** (e.g., us-west-2)
4. **Default output format** (you can press Enter to leave it as None or type json)

iv. Make sure the credentials have sufficient permissions to deploy CloudFormation stacks and manage CodeStar Connections.

v. Run CLI command given below.

```
aws cloudformation create-stack\
  --template-url https://mlops-pipeline-template-files.s3.us-east-1.amazonaws.com/create-github-connection.yaml \
  --stack-name github-connection-stack \
  --parameters \

ParameterKey=GitHubConnectionName,ParameterValue=mlops-pipeline-github-connection  \
  --capabilities CAPABILITY_NAMED_IAM
```

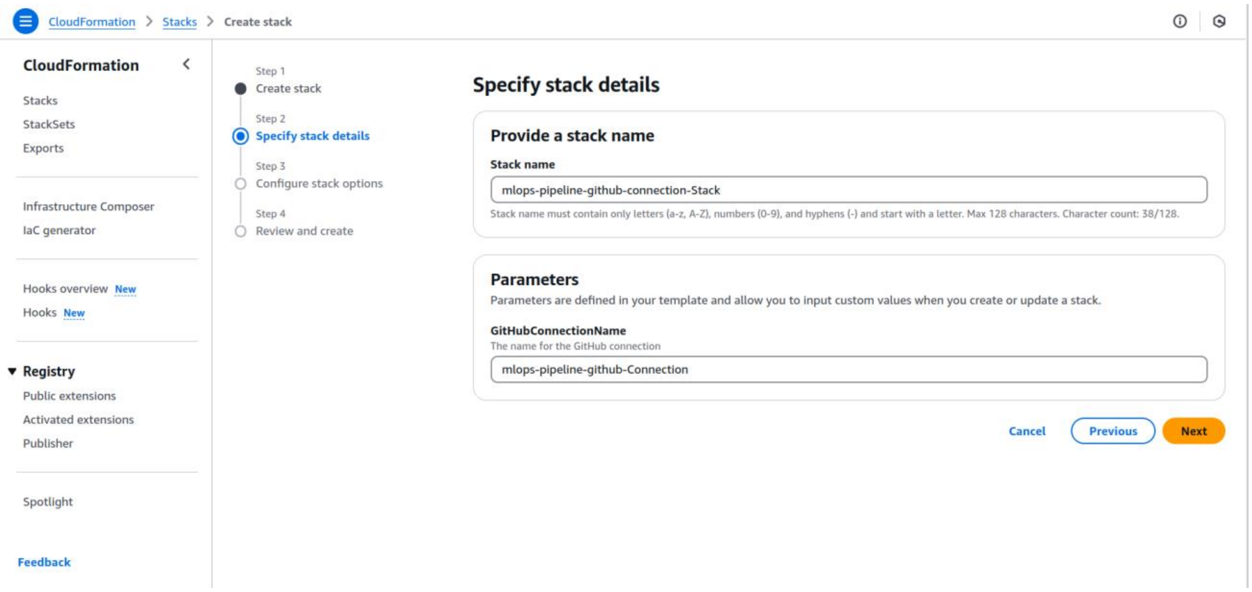
i. In template-url: add url of create-github-connection.yaml template which present in S3 bucket.

b. Launch resources from Cloudshell in AWS account, then directly run the command given below in the Cloudshell.

```
aws cloudformation create-stack\
  --template-url https://mlops-pipeline-template-files.s3.us-east-1.amazonaws.com/create-github-connection.yaml \
  --stack-name github-connection-stack \
  --parameters \
     ParameterKey=GitHubConnectionName,ParameterValue=mlops-pipeline-github-connection  \
  --capabilities CAPABILITY_NAMED_IAM
```

i. In template-url: add url of create-github-connection.yaml template which present in S3 bucket.

4. **Launch resources using AWS Console (**Note: Step 4-6: Launching resources using AWS Console)
    a. Open AWS CloudFormation Console.
    b. Upload the template you created (create-github-connection.yaml).
    c. When prompted, provide a value for stack name and GitHubConnectionName (e.g., mlops-pipeline-github-connection) and click **Next**.



Specify stack details

Provide a stack name

Stack name

mlops-pipeline-github-connection-Stack

Stack name must contain only letters (a-z, A-Z), numbers (0-9), and hyphens (-) and start with a letter. Max 128 characters. Character count: 38/128.

Parameters

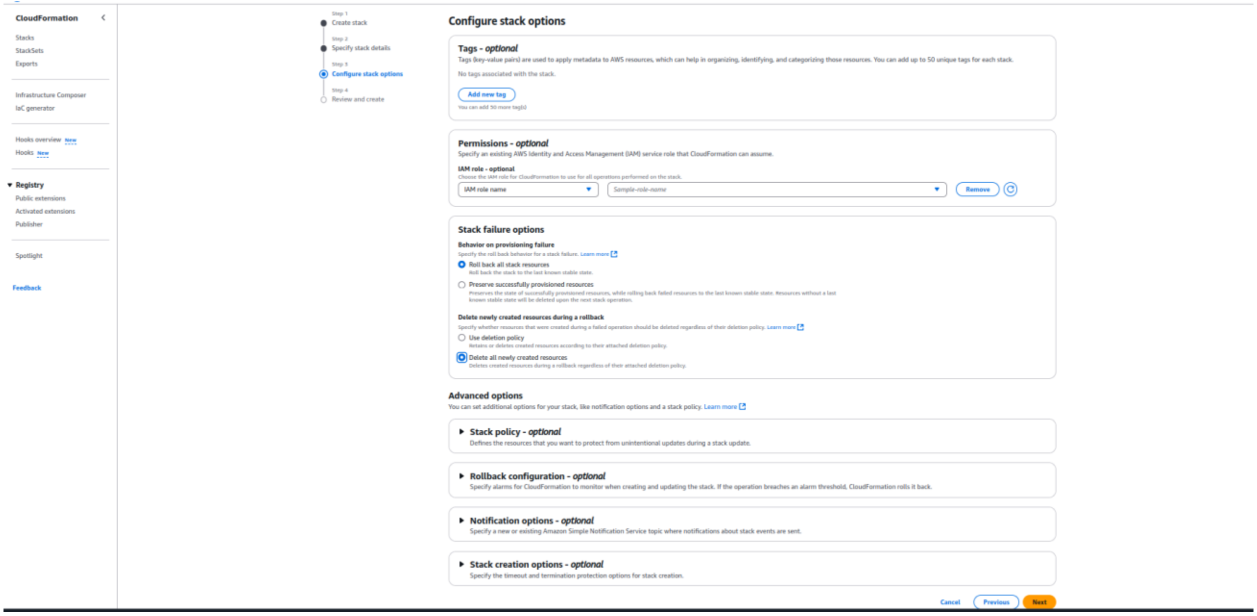
Parameters are defined in your template and allow you to input custom values when you create or update a stack.

GitHubConnectionName

The name for the GitHub connection

mlops-pipeline-github-Connection

5. **Configure Stack Options**



Configure stack options

Tags - *optional*

Tags (key-value pairs) are used to apply metadata to AWS resources, which can help in organizing, identifying, and categorizing those resources. You can add up to 50 unique tags for each stack.

No tags associated with the stack.

You can add 50 more tag(s)

Permissions - *optional*

Specify an existing AWS Identity and Access Management (IAM) service role that CloudFormation can assume.

IAM role - optional

Choose the IAM role for CloudFormation to use for all operations performed on the stack.

IAM role name | Sample-role-name

Stack failure options

Behavior on provisioning failure

Specify the roll back behavior for a stack failure.

● Roll back all stack resources
Roll back the stack to the last known stable state.

○ Preserve successfully provisioned resources
Preserves the state of successfully provisioned resources, while rolling back failed resources to the last known stable state. Resources without a last known stable state will be deleted upon the next stack operation.

Delete newly created resources during a rollback

Specify whether resources that were created during a failed operation should be deleted regardless of their deletion policy.

○ Use deletion policy
Retains or deletes created resources according to their attached deletion policy.

● Delete all newly created resources
Deletes created resources during a rollback regardless of their attached deletion policy.

Advanced options

You can set additional options for your stack, like notification options and a stack policy.

▸ Stack policy - *optional*
Defines the resources that you want to protect from unintentional updates during a stack update.

▸ Rollback configuration - *optional*
Specify alarms for CloudFormation to monitor when creating and updating the stack. If the operation breaches an alarm threshold, CloudFormation rolls it back.

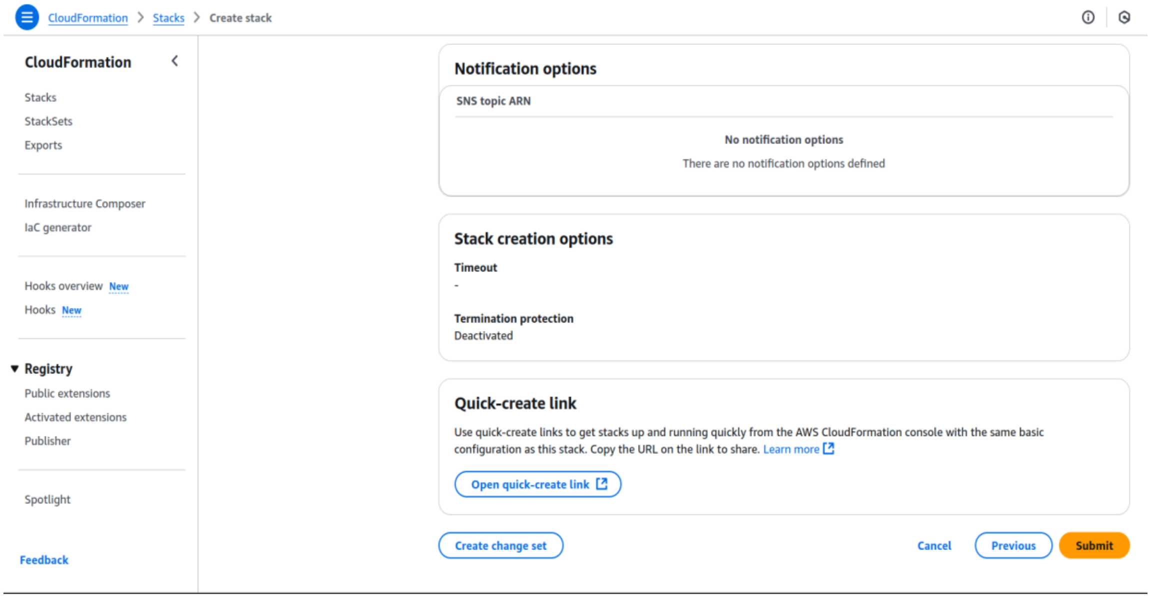
▸ Notification options - *optional*
Specify a new or existing Amazon Simple Notification Service topic where notifications about stack events are sent.

▸ Stack creation options - *optional*
Specify the timeout and termination protection options for stack creation.

a. Leave the default options or add tags if required.

   b. Click **Next**.

6. **Review and Submit**



Notification options

SNS topic ARN

No notification options

There are no notification options defined

Stack creation options

Timeout

-

Termination protection

Deactivated

Quick-create link

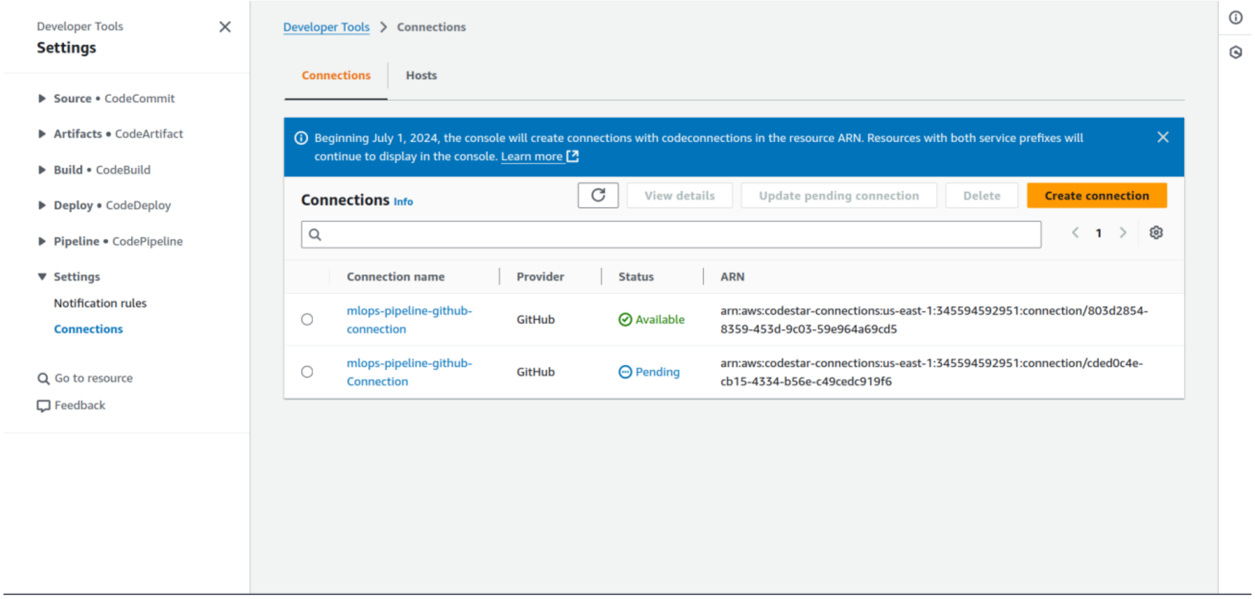
Use quick-create links to get stacks up and running quickly from the AWS CloudFormation console with the same basic configuration as this stack. Copy the URL on the link to share. Learn more

   a. Review the stack configuration.
   b. Click **Submit** to launch the stack.

7. **Navigate to CodePipeline Settings**
   a. After the stack is created, go to the AWS Console.
   b. Open the **CodePipeline** service.
   c. Go to the **Settings** tab on the left.

8. **Access Connection Settings**
   a. In the settings panel, click on the **Connections** section.

9. **Check Connection State**



Developer Tools
Settings

- Source • CodeCommit
- Artifacts • CodeArtifact
- Build • CodeBuild
- Deploy • CodeDeploy
- Pipeline • CodePipeline
- Settings
  - Notification rules
  - Connections

Go to resource
Feedback

Developer Tools > Connections

Connections | Hosts

Beginning July 1, 2024, the console will create connections with codeconnections in the resource ARN. Resources with both service prefixes will continue to display in the console. Learn more

Connections Info

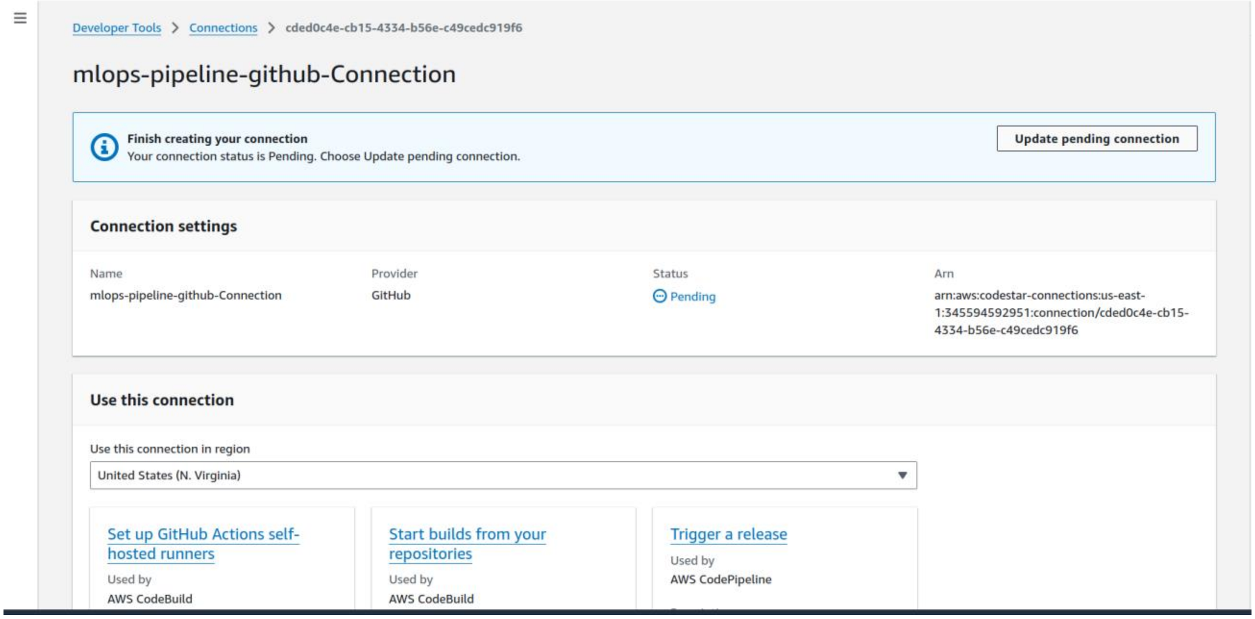
View details | Update pending connection | Delete | Create connection

	Connection name	Provider	Status	ARN
○	mlops-pipeline-github-connection	GitHub	Available	arn:aws:codestar-connections:us-east-1:345594592951:connection/803d2854-8359-453d-9c03-59e964a69cd5
○	mlops-pipeline-github-Connection	GitHub	Pending	arn:aws:codestar-connections:us-east-1:345594592951:connection/cded0c4e-cb15-4334-b56e-c49cedc919f6

a. You will see the newly created connection listed.

b. Its status will be **Pending**.

10. Update Pending Connection



Developer Tools > Connections > cded0c4e-cb15-4334-b56e-c49cedc919f6

mlops-pipeline-github-Connection

Finish creating your connection
Your connection status is Pending. Choose Update pending connection.

Update pending connection

Connection settings

Name	Provider	Status	Arn
mlops-pipeline-github-Connection	GitHub	Pending	arn:aws:codestar-connections:us-east-1:345594592951:connection/cded0c4e-cb15-4334-b56e-c49cedc919f6

Use this connection

Use this connection in region
United States (N. Virginia)

Set up GitHub Actions self-hosted runners
Used by
AWS CodeBuild

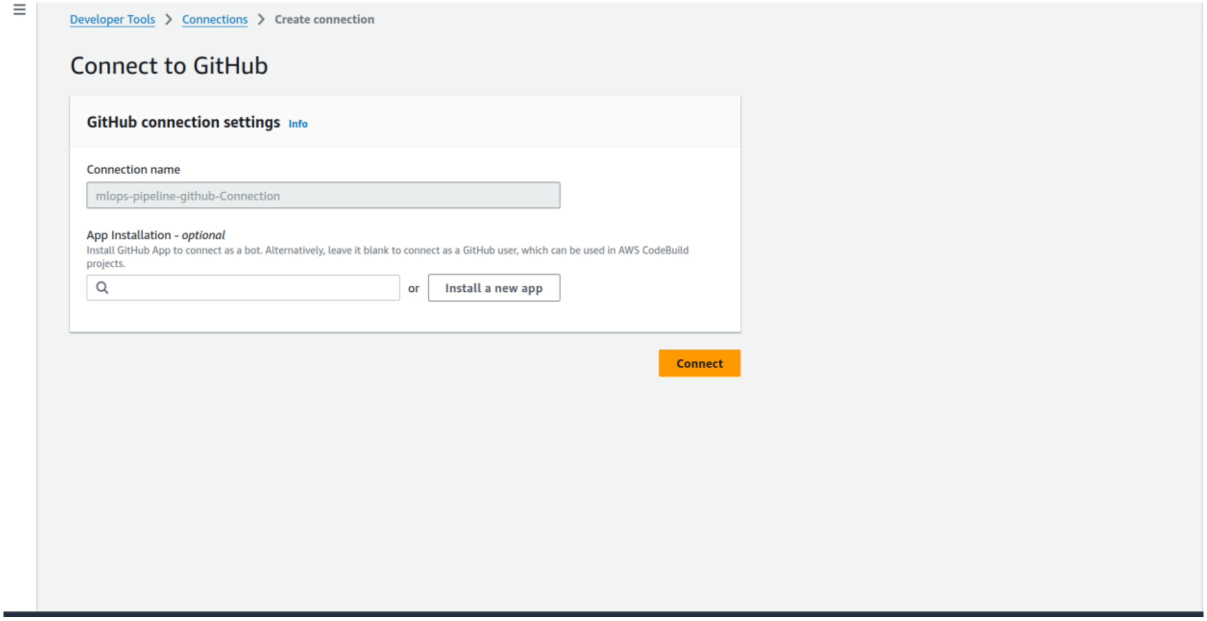
Start builds from your repositories
Used by
AWS CodeBuild

Trigger a release
Used by
AWS CodePipeline

a. Click on the connection name.

b. Then click on the **Update pending connection** button.

11. Install GitHub App



Connect to GitHub

GitHub connection settings Info

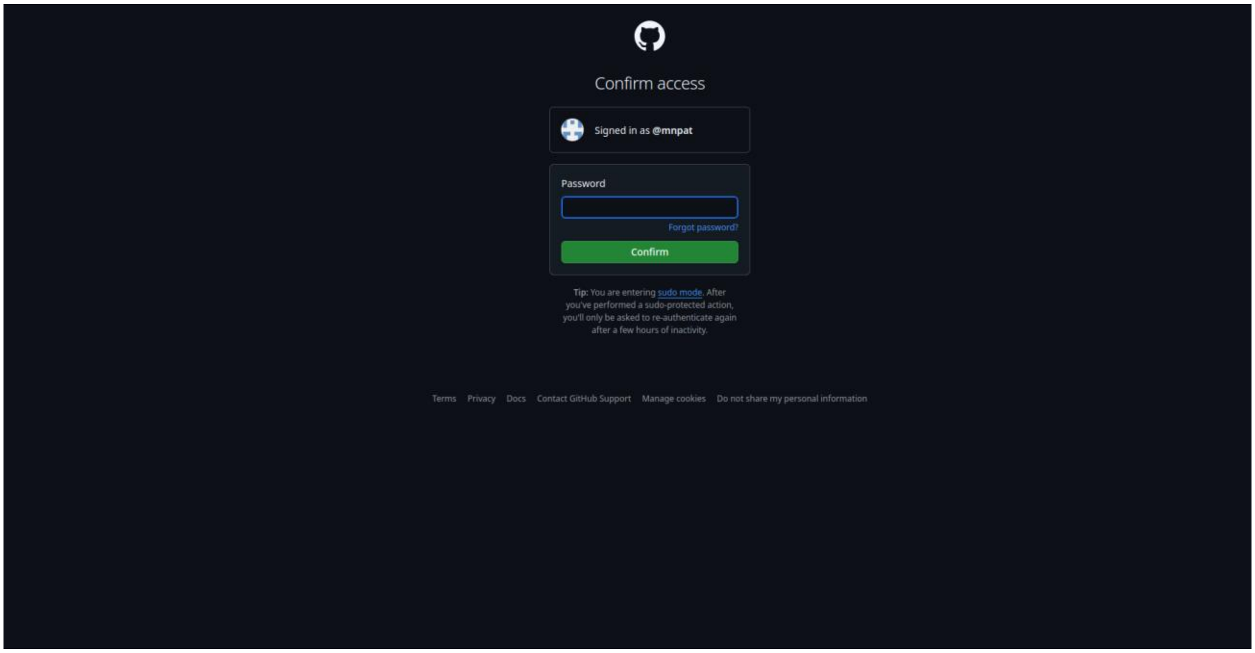
Connection name: mlops-pipeline-github-Connection

App Installation - *optional*

Install GitHub App to connect as a bot. Alternatively, leave it blank to connect as a GitHub user, which can be used in AWS CodeBuild projects.

a. In the popup, select **Install a new app**.

12. Authenticate with GitHub



Confirm access

Signed in as **@mnpat**

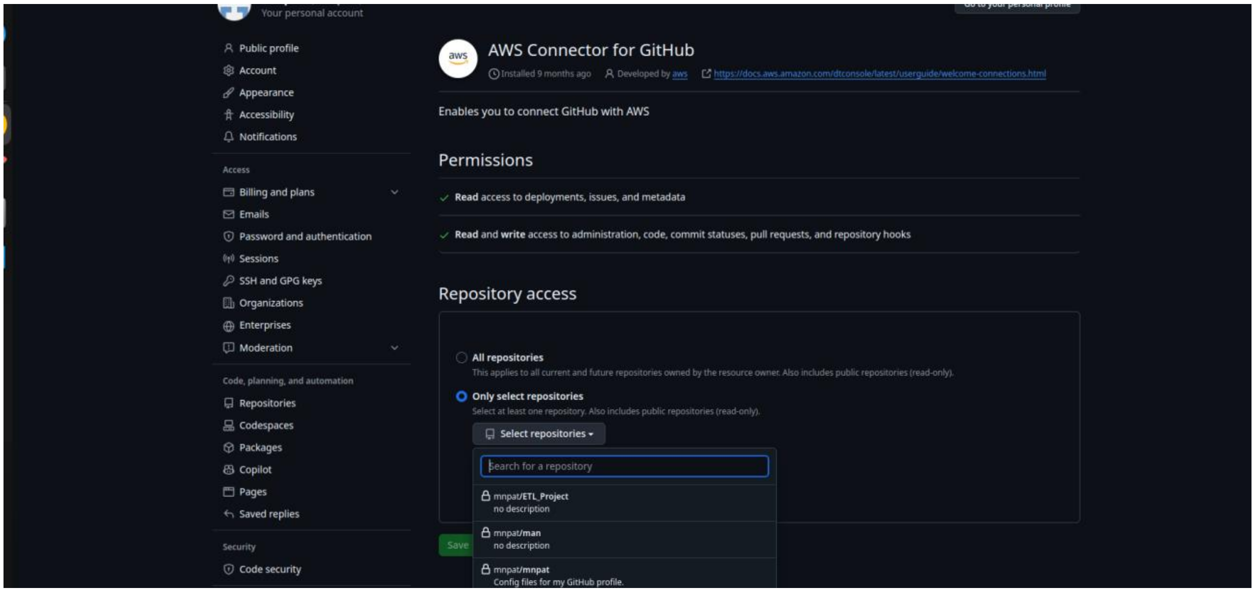
Password

Tip: You are entering sudo mode. After you've performed a sudo-protected action, you'll only be asked to re-authenticate again after a few hours of inactivity.

a. A GitHub login window will open.

b. Enter your **GitHub username and password**.

13. Authorize Repository Access



AWS Connector for GitHub

Installed 9 months ago · Developed by aws · https://docs.aws.amazon.com/dtconsole/latest/userguide/welcome-connections.html

Enables you to connect GitHub with AWS

Permissions

✓ **Read** access to deployments, issues, and metadata

✓ **Read** and **write** access to administration, code, commit statuses, pull requests, and repository hooks

Repository access

○ **All repositories**
This applies to all current and future repositories owned by the resource owner. Also includes public repositories (read-only).

● **Only select repositories**
Select at least one repository. Also includes public repositories (read-only).

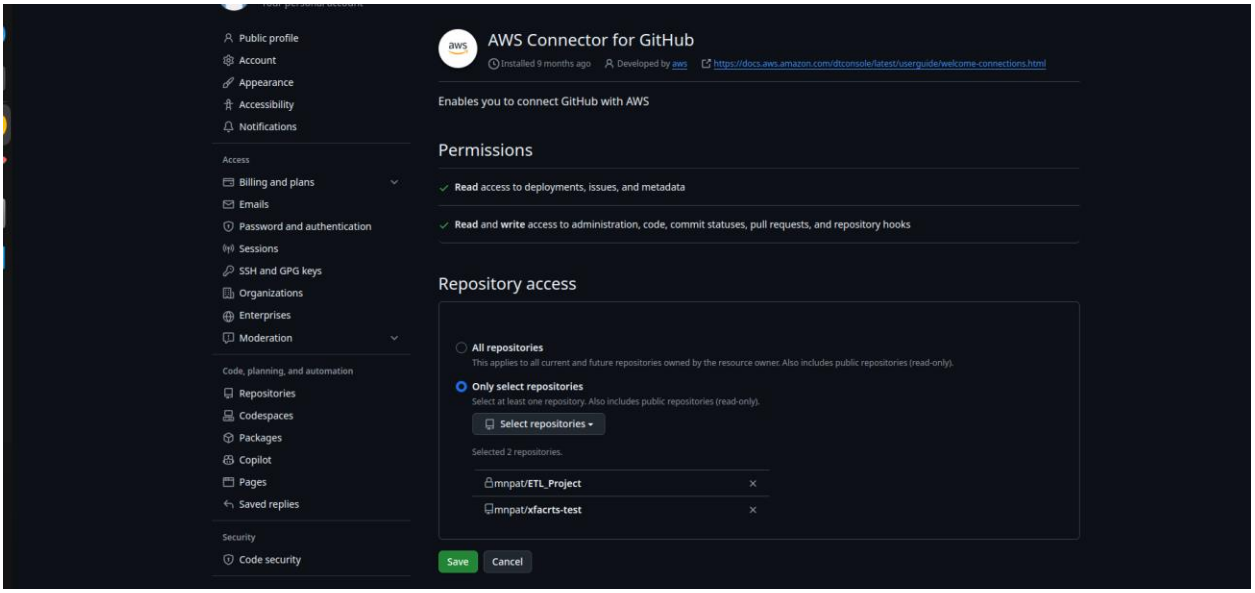
Select repositories ▾

Search for a repository

mnpat/**ETL_Project**
no description

mnpat/**man**
no description

mnpat/**mnpat**
Config files for my GitHub profile.



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Repository access

○ **All repositories**
This applies to all current and future repositories owned by the resource owner. Also includes public repositories (read-only).

● **Only select repositories**
Select at least one repository. Also includes public repositories (read-only).

Select repositories ▾

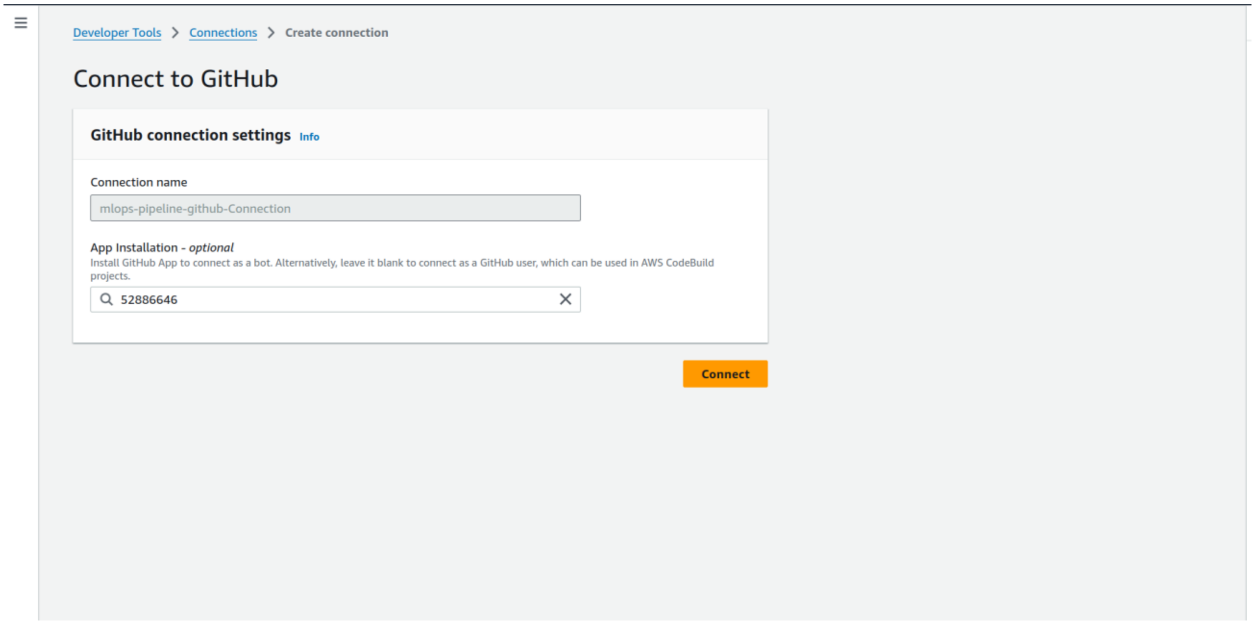
Selected 2 repositories.

mnpat/**ETL_Project** ×

mnpat/**xfacrts-test** ×

a. Choose the **GitHub repository** you want to allow access to.
b. Click **Save**.

14. Connect and Finalize

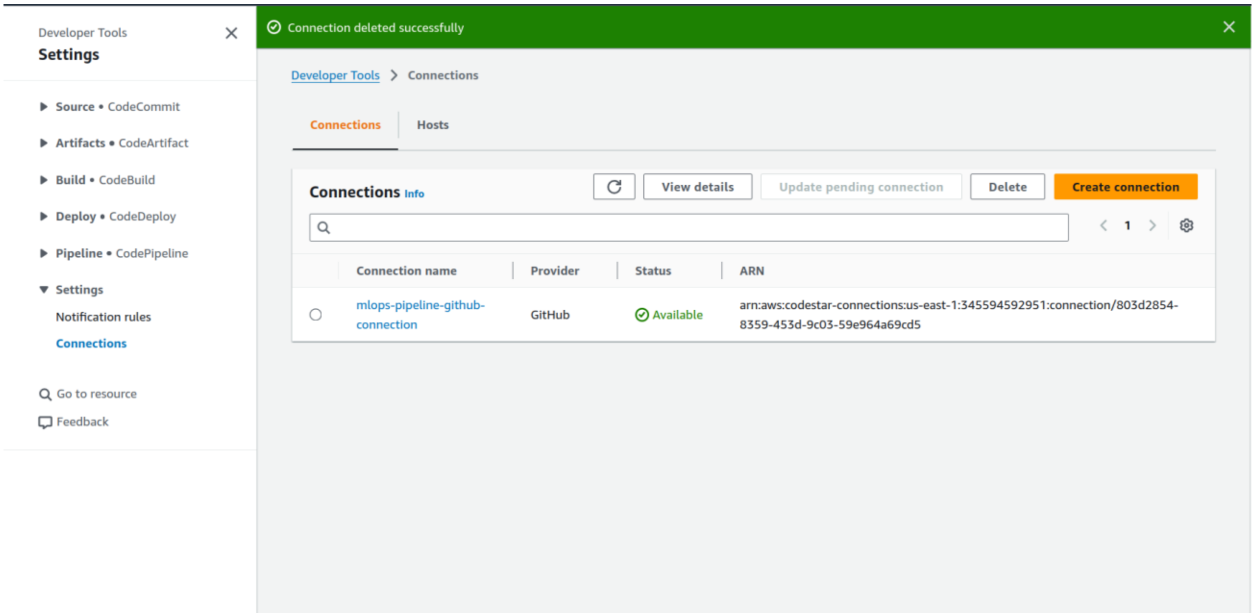


Connect to GitHub

GitHub connection settings

Connection name: mlops-pipeline-github-Connection

App Installation - *optional*
Install GitHub App to connect as a bot. Alternatively, leave it blank to connect as a GitHub user, which can be used in AWS CodeBuild projects.
52886646



Connection deleted successfully

Connections

	Connection name	Provider	Status	ARN
○	mlops-pipeline-github-connection	GitHub	✓ Available	arn:aws:codestar-connections:us-east-1:345594592951:connection/803d2854-8359-453d-9c03-59e964a69cd5

a. Back in the AWS Console, click **Connect**.

b. The connection will now move to **Available** state.

RUNBOOK: CREATE AWS SERVICE CATALOG PORTFOLIO, AWS SERVICE CATALOG PRODUCT AND SAGEMAKER CUSTOM PROJECT, INFRASTRUCTURE FOR SWITCH BASED RETRAINING OF MODEL AND STOP INITIAL EXECUTION OF CODEPIPELINE USING SINGLE CLOUDFORMATION TEMPLATE.

GOAL

This runbook provisions a Service Catalog Portfolio, Product, SageMaker custom project, and infrastructure for switch-based model retraining, while preventing initial CodePipeline execution — all via a single CloudFormation template.

DEPLOYMENT STEPS

1. **Install AWS CLI**
   a. Installation Guide
   b. Skip this step if you have already installed the AWS CLI.
2. **Configure AWS CLI (One-Time Setup)/Launch using Cloudshell in AWS environment.**
   a. Steps for Configure AWS CLI already given in above step.
   b. Launch resources from local/from cloudshell in an AWS account.

```
aws cloudformation create-stack \
  --template-url https://axcess-devst-sagemaker.s3.us-east-1.amazonaws.com/mlops-pipeline-resource-templates/Complete_Mlops_Package.yaml \
  --stack-name complete-mlops-resources-stack \
  --parameters \
     ParameterKey=PortfolioName,ParameterValue=mlops-service-catalog-portfolio \

ParameterKey=SageMakerExecutionRoleArn,ParameterValue=arn:aws:iam::345951:role/service-role/AmazonSageMaker-ExecutionRole-20250325T120134 \

ParameterKey=PrincipalArn,ParameterValue=arn:aws:iam::345951:role/aws-reserved/sso.amazonaws.com/AWSReservedSSO_AWSAdministratorAccess_834ce3a515a6f00d \
     ParameterKey=ProductName,ParameterValue=mlops-service-catalog-product \

ParameterKey=GithubUrl,ParameterValue="https://github.com/<user-name>/<repo-name>" \
ParameterKey=ZipUrlGithubRepo,ParameterValue="https://github.com/<user-name>/<repo-name>/archive/refs/heads/<brach-name>.zip" \
      ParameterKey=RepoBranchName,ParameterValue="<repo-name>-<branch-name>" \
      ParameterKey=MainFolderName,ParameterValue="<main-folder-name-from-repo>" \

          ParameterKey=ServiceCatalogPortfolioTemplateURL,ParameterValue=https://axcess-devst-sagemaker.s3.us-east-1.amazonaws.com/mlops-pipeline-resource-templates/create-service-catalog-portfolio.yaml \

ParameterKey=ServiceCatalogProductTemplateURL,ParameterValue=https://axcess-devst-sagemaker.s3.us-east-1.amazonaws.com/mlops-pipeline-resource-templates/create-product.yaml \

ParameterKey=StopPipelineTemplateURL,ParameterValue=https://axcess-devst-sagemaker.s3.us-east-1.amazonaws.com/mlops-pipeline-resource-templates/Stop-specific-codepipeline-executions.yaml \

ParameterKey=SageMakerProjectName,ParameterValue="axcess-sagemaker-project-8" \
      ParameterKey=GitHubOwner,ParameterValue="<github-user-name>" \
      ParameterKey=GitHubRepo,ParameterValue="<github-repo-name>" \
      ParameterKey=GitHubBranch,ParameterValue="<branch-name>" \

ParameterKey=GithubConnArn,ParameterValue="arn:aws:codeconnections:us-east-1:345951:connection/0cdb21f1-6062-433b-bdea-f4bde8ea6f07" \
      ParameterKey=UseCase,ParameterValue="trip-prediction" \
      ParameterKey=S3Prefix,ParameterValue="NA" \

ParameterKey=ProcessingInstanceType,ParameterValue="ml.t3.large" \

ParameterKey=TrainingInstanceType,ParameterValue="ml.m5.large" \

ParameterKey=ProcessingInstanceCount,ParameterValue="1" \
      ParameterKey=TrainingInstanceCount,ParameterValue="1" \
            ParameterKey=ModelPackageGroupName,ParameterValue="tri
            p-prediction" \
                  ParameterKey=ModelVersion,ParameterValue="1" \
        ParameterKey=
  Approveremail,ParameterValue="approver@example.com" \
        ParameterKey=
  Executoremail,ParameterValue="executor@example.com" \

        ParameterKey=DeployStackName,ParameterValue="trip-
  prediction-1-deploy-staging" \
        ParameterKey=S3Bucket,ParameterValue="axcess-devst-
  sagemaker-bucket-1" \
    --capabilities CAPABILITY_NAMED_IAM \
    --region us-east-1
```

i. In template-url: add url of Complete_Mlops_Package.yaml template which present in S3 bucket. (using this template will launch all resources)
ii. In SageMakerExecutionRoleArn: add arn of sagemaker domain execution role.
iii. In PrincipalArn: add arn of user or sso user role.
iv. In ZipUrlGithubRepo: add url of zipped repo.
v. In RepoBranchName: add "RepoName"-"BrachName"
vi. In ServiceCatalogPortfolioTemplateURL: add url of create-service-catalog-portfolio.yaml template present in S3 bucket.
vii. In ServiceCatalogProductTemplateURL: add url of create-product.yaml template which present in S3 bucket.
viii. In GithubConnArn: add arn of github connection which created first step.
ix. In StopPipelineTemplateURL: add url of Stop-specific-codepipeline-executions.yaml template which present in S3 bucket.
x. In Approveremail: add email id of Approver/Administrator
xi. In Executoremail: add email id of Pipeline Executor/Engineer

3. Manual Configuration Steps After Stack Launch
   1. Update processing.py with the S3 Bucket Name
      - Add or update the S3 bucket name in the processing.py file to ensure it points to the correct data location.
   2. Build and Push Updated Docker Image for Processing
      - Make the required changes to your local environment.
      - Build a new Docker image for the processing step.
      - Push the updated image to your container registry with a new version tag.
   3. Update pipeline.py with the New Image Version

  - Update the pipeline.py file in your GitHub repository to reference the new version of the processing image.
  - Commit and push the changes to your GitHub repository.
4. Upload Required Dataset to S3 for Pipeline Execution
   - Upload the data.csv file to the following S3 location so it can be used in the processing step of the pipeline
   - s3://<bucket-name>/taxi-duration/original_raw_data/
5. S3 Configuration for Pipeline Execution
   - Add the S3 bucket name and the training pipeline name in the model_manifest.json file.
   - Upload the following configuration files to their respective S3 locations:
     - model_manifest.json to "s3://<bucket-name>/taxi-duration/data/config/"
     - monitoring_config.json to "s3://<bucket-name>/taxi-duration/data/config/"
     - Upload the batch inference input file(inference_data.csv) to "s3://<bucket-name>/taxi-duration/batch_input/"
     - Upload the model monitoring dataset(monitoring_dataset.csv) to "s3://<bucket-name>/taxi-duration/model_monitor/input/"
6. Update IAM Role ARNs in Scripts for Stack Integration
   - In data_quality_monitor.py, update the IAM role ARNs within the initialize_resources function as per your environment configuration.
   - In retraining.py, update the role using the PrincipalArn provided in the CloudFormation stack parameters during stack launch, ensuring the correct IAM role is assumed during pipeline execution.

RUNBOOK: IF YOU WANT TO CREATE AN AWS SERVICE CATALOG PORTFOLIO SEPARATELY FOR SAGEMAKER MLOPS

GOAL

This runbook helps you deploy a Service Catalog Portfolio using CloudFormation to support Amazon SageMaker MLOps workflows.

PREREQUISITES

- AWS CLI installed and configured
- Required IAM permissions to create Service Catalog resources

DEPLOYMENT STEPS

Step 1: Deployment Using AWS Console

1. **Open AWS CloudFormation Console**
   a. CloudFormation Console
2. **Create Stack**
   a. Click **"Create stack" → "With new resources (standard)"**
3. **Specify Template**
   a. Choose your template file (.yaml or .json)
   b. If the template is in S3, select **Amazon S3 URL** and paste the full path (e.g., https://s3.amazonaws.com/your-bucket/template.yaml)
4. **Provide Parameters**
   a. Fill out values as per the parameter.
5. **Stack Options**
   a. Leave default or add tags if needed
6. **Permissions**
   a. Ensure the deploying IAM user/role has access to servicecatalog:* and cloudformation:*
7. **Review and Submit**
   a. Click **Create stack**

Step 2: Deploy CloudFormation Stack

- Run below command to create Service Catalog Portfolio

```
aws cloudformation create-stack \
--template-url https://mlops-pipeline-template-files.s3.us-east-
1.amazonaws.com/create-service-catalog-portfolio.yaml \
--stack-name mlops-service-catalog-portfolio-stack \
--parameters \
   ParameterKey=AllowDirectUserAccessParameter,ParameterValue=false \

ParameterKey=MakePorfolioAccessibleFromSageMakerStudioParameter,ParameterVa
lue=true \
   ParameterKey=PortfolioDescriptionParameter,ParameterValue="Custom project
templates for MLOps" \

ParameterKey=PortfolioNameParameter,ParameterValue=mlops_pipeline_service_cat
alog_portfolio \
  ParameterKey=PortfolioOwnerParameter,ParameterValue=owner
\   ParameterKey=SageMakerStudioExecutionRoleParameter,ParameterValue=arn:aws
```

```
:iam::317046:role/service-role/AmazonSageMaker-ExecutionRole-20240228T142935
\
   ParameterKey=UserAccessPrincipalsParameter,ParameterValue= \
--capabilities CAPABILITY_NAMED_IAM \
--region us-east-1
```

i. In SageMakerStudioExecutionRoleParameter section add role of Sagemaker Domain.
ii. Keep UserAccessPrincipalsParameter section blank.
iii. In PortfolioNameParameter section, add the name for Service Catalog Portfolio.

Step 3: Post Deployment

After successful deployment:

1. Navigate to **AWS Console > Service Catalog > Portfolios**
2. You will find a new portfolio named mlops_pipeline_service_catalog_portfolio
3. Confirm:
   a. The execution role is associated
   b. In tag section sagemaker:studio-visibility should be true

RUNBOOK: IF YOU WANT TO CREATE SERVICE CATALOG PRODUCT SEPARATELY FOR MULTI-MODEL TRAINING AND BATCH INFERENCE PIPELINE

GOAL

This CloudFormation template deploys a **Service Catalog product** that can be used from within **Amazon SageMaker Studio** to launch a custom project for MLOps pipelines.

PREREQUISITES

- An existing **Service Catalog Portfolio**
- Portfolio ID (from CloudFormation stack output if you used a template to create it)
- AWS CLI configured (or use the AWS Console)

DEPLOYMENT STEPS

Step 1: Deployment Using AWS Console

1. **Open AWS CloudFormation Console**
    a. CloudFormation Console
2. **Create Stack**
    a. Click **"Create stack" → "With new resources (standard)"**
3. **Specify Template**
    a. Choose your template file (.yaml or .json)
    b. f the template is in S3, select **Amazon S3 URL** and paste the full path (e.g., https://s3.amazonaws.com/your-bucket/template.yaml)
4. **Provide Parameters**
    a. Fill out values as per the parameter.
5. **Stack Options**
    a. Leave default or add tags if needed
6. **Permissions**
    a. Ensure the deploying IAM user/role has access to servicecatalog:* and cloudformation:*
7. **Review and Submit**
    a. Click **Create stack**

Step 2: AWS CLI Deployment

- Run below command to create Service Catalog Portfolio

```
aws cloudformation create-stack \
--template-url https://mlops-pipeline-template-files.s3.us-east-
1.amazonaws.com/create-product.yaml \
--stack-name mlops-service-catalog-product-stack \
--parameters \
   ParameterKey=PortfolioIDParameter,ParameterValue=port-474rj4x4tzpw2 \
   ParameterKey=ProductNameParameter,ParameterValue=mlops-pipeline-service-
catalog-product \
   ParameterKey=ProductDescriptionParameter,ParameterValue="A pipeline project
for training and batch inference" \
   ParameterKey=ProductOwnerParameter,ParameterValue="Product Owner" \
   ParameterKey=ProductDistributorParameter,ParameterValue="Product Distributor"
\
   ParameterKey=ProductSupportDescriptionParameter,ParameterValue="Support
Description" \

ParameterKey=ProductSupportEmailParameter,ParameterValue="support@example.c
om" \
ParameterKey=ProductSupportURLParameter,ParameterValue="https://github.com/<u
ser-name>/<repo-name>" \
ParameterKey=SageMakerProjectRepoZipParameter,ParameterValue="https://github.c
om/mnpat/axcess-test/archive/refs/heads/main.zip" \

ParameterKey=SageMakerProjectRepoNameBranchParameter,ParameterValue="<rep
o-name>-<branch-name>" \
 ParameterKey=SageMakerProjectsProjectNameParameter,ParameterValue="<main-
folder-name-from-repo>" \
--capabilities CAPABILITY_NAMED_IAM \
--region us-east-1
```

i. In PortfolioIDParameter add Service Catalog Portfolio ID in which we have to create Service Catalog Product.
ii. In ProductNameParameter add name for Product.
iii. In ProductSupportURLParameter add url of Github Repo where custom project template is present.
iv. In SageMakerProjectRepoZipParameter url should like ProductSupportURLParameter/archive/refs/heads/main.zip
v. In SageMakerProjectRepoNameBranchParameter add Name/Branch of the SageMaker Projects Examples GitHub Repo. (should like RepoName-Branch)
vi. In SageMakerProjectsProjectNameParameter add Project folder inside of the GitHub repo for this project.

Validation Steps

1. Go to **Service Catalog > Products**
2. We should see a new product with the name provided.
3. Open **Amazon SageMaker Studio**
4. Go to **Projects > Create project**
5. We should see the custom project listed in the Organization Template section.

RUNBOOK: IF YOU WANT TO CREATE SAGEMAKER ML PROJECT SEPARATELY.

GOAL

This CloudFormation template provisions all required infrastructure for managing a CI/CD pipeline in **Amazon SageMaker**, targeting batch inference jobs. It uses GitHub as the source, SageMaker Pipelines for training, and Model Registry for model versioning and deployment.

PREREQUISITES

Ensure the following are in place before deployment:

- **GitHub connection** is created via *AWS CodeStar Connections*.
- AWS CLI configured:

- IAM role has permissions to deploy CloudFormation stacks and access SageMaker, S3, and CodePipeline.

TEMPLATE DESCRIPTION

This template:

- Sets up CodePipeline for CI/CD
- Uses SageMaker Pipelines for training
- Registers models in Model Registry
- Automates deployment to **staging** environments for **batch inference**
- Setup infrastructure for switch-based retraining

DEPLOYMENT STEPS

Step 1: Deploy Step (AWS CLI)

1. **Run AWS CLI Command**

```
aws sagemaker create-project     --project-name "sm-project"     --service-catalog-provisioning-details '{
    "ProductId": "prod-rcp2tgmmj32ck",
    "ProvisioningParameters": [

        {
          "Key": "GitHubOwner",
          "Value": "<github-user-name>"
        },
        {
          "Key": "GitHubRepo",
          "Value": "<github-remo-name>"
        },
        {
          "Key": "GitHubBranch",
          "Value": "<github-branch-name>"
        },
        {
          "Key": "GithubConnArn",
          "Value": "<github-connection-arn-created_in_first_step>"
        },
        {
          "Key": "UseCase",
          "Value": "<usecase-name-which_is_folder_in_repo_includes_all_codes_like_processing_training_and_other>"
        },
        {
          "Key": "s3Prefix",
          "Value": "NA"
        },
        {
          "Key": "ProcessingInstanceType",
          "Value": "<Processing-Instance-Type>"
        },
        {
          "Key": "TrainingInstanceType",
          "Value": "<Training-Instance-Type>"
        },
        {
          "Key": "ProcessingInstanceCount",
          "Value": "<Processing-Instance-Count>"
        },
        {
          "Key": "TrainingInstanceCount",
          "Value": "<Training-Instance-Count>"
        },
        {
          "Key": "ModelPackageGroupnameInput",
          "Value": "<Model-Package-Groupname-Input>"
        },
        {
          "Key": "ModelVersionInput",
          "Value": "<Model-Version-Input>"
        },
        {
          "Key": "StackName",
          "Value": "<stack-name-while_deploying_model_at_staging>"
        },
        {
          "Key": "mls3bucket",
          "Value": "<name-of-s3-bucket-using_for_mlops_pipeline>"
        },
        {
           "Key": "ApproverEmail",
           "Value": "<email-id-of-Approver>"
         },
         {
           "Key": "ExecutorEmail",
           "Value": "<email-id-of-Executor>"
     }
  ]
}'
```

i. In the project name add name of sagemaker project which want to create.
ii. In ProductId add id of product which created in above steps.
iii. In ProvisioningParameters add required values for given keys.

Validation Steps

After stack creation:

- Go to **AWS CodePipeline** → Validate the pipeline stages
- Confirm **Source** connects to GitHub
- Go to **AWS Sagemaker > Domain > User Profile > Sagemaker Studio > Deployments > Project** where custom projects have been launched.

RUNBOOK: DEPLOYING LAMBDA + EVENTBRIDGE RULE FOR CROSS ACCOUNT MODEL DEPLOYMENT (PRODUCTION).

GOAL

This CloudFormation template provisions:

- A **Lambda function** is designed to handle specific production tasks.
- An **Amazon EventBridge rule** that triggers the Lambda function based on predefined events.

This is designed for deployment in the **Production account** as part of the overall MLOps toolchain.

PREREQUISITES

Ensure the following before deployment:

- You are operating in the **Production AWS account**.
- You have **deployment permissions** for AWS Lambda, IAM, and EventBridge.
- AWS CLI or CloudFormation console access is available.
- IAM execution role for Lambda has necessary permissions.

DEPLOYMENT STEPS

Step 1: Using AWS CLI

1. **Execute the CloudFormation deployment**:

```
        aws cloudformation deploy \
          --template-url https://axcess-devst-sagemaker.s3.us-east-1.amazonaws.com/mlops-pipeline-resource-templates/Production-account-setup.yaml \
          --stack-name mlops-pipeline-prod-account-setup \
--parameters \
   ParameterKey= SageMakerProjectName,ParameterValue= <sagemaker-proje>
--capabilities CAPABILITY_NAMED_IAM
```

Validation Checklist

After deployment:

- Go to **AWS Lambda Console** and confirm the Lambda function has been created.
- Validate the **IAM Role** associated with the Lambda (includes logs, event access, etc.).
- Navigate to **Amazon EventBridge > Rules**, and verify the rule exists and is targeting the Lambda.
- Check the **event pattern** to confirm it matches your production trigger (e.g., SageMaker job status).

CREATE ONE ROLE FOR SAGEMAKER TASKS IN PRODUCTION ACCOUNT

- Role name: AmazonSageMakerServiceCatalogProductsUseRoleMultiModelTB
- Policies:
    - AWS managed:
        - AmazonS3FullAccess
        - AmazonSageMakerFullAccess
    - Customer managed:
        - access_ecr_stage_policy   {

          ```
          "Version": "2012-10-17",
          "Statement": [
            {
              "Effect": "Allow",
              "Action": [
                "ecr:GetAuthorizationToken"
              ],
              "Resource": "*"
            },
          ```

```
        {
          "Effect": "Allow",
          "Action": [
            "ecr:BatchGetImage",
            "ecr:GetDownloadUrlForLayer",
            "ecr:BatchCheckLayerAvailability"
          ],
          "Resource": "arn:aws:ecr:us-east-1:345594592951:repository/sagemaker-inference"
        }
      ]
    }
```

- Below is trust relationship: {

```
      "Version": "2012-10-17",
      "Statement": [
        {
          "Sid": "",
          "Effect": "Allow",
          "Principal": {
            "Service": "sagemaker.amazonaws.com"
          },
          "Action": "sts:AssumeRole"
        }
      ]
    }
```

RUNBOOK: PERMISSIONS FOR CROSS ACCOUNT SAGEMAKER MODEL DEPLOYMENT.

- User Guide
- In staging and prod account add select create role for eventbridge event while cross account setup.