AWS CICD

Configuration and Setup

- Create an IAM user and configure aws cli on git bash using aws configure command.
- Launch an EC2 instance with Amazon Linux AMI.
- Attach IAM Role to this EC2 with `S3 Access,CodeDeploy Access`, as CodeDeploy Agent should have access to list/get Objects from S3
  - Add below shell commands to install CodeDeploy Agent on the EC2 using EC2 UserData.

```
#!/bin/bash
sudo yum update -y
sudo yum install -y ruby wget
wget https://aws-codedeploy-eu-west-1.s3.eu-west-1.amazonaws.com/latest/install
chmod +x ./install
sudo ./install auto
sudo service codedeploy-agent status
sudo service codedeploy-agent enable
```

- Tag the EC2 instance with Name and Environment Values as
  - `Name` : `Webserver`
  - `Environment` : `Dev`

> Alternatively, a CF template to launch an EC2 instance with above commands as Userdata.

Creating a CodeDeploy Application

- Go to `CodeDeploy Service` > `Create Application` > Select Compute Platform as `"EC2/On-Premises"`
- Create a Deployment Group with name `DevEC2DeploymentGroup`
- Create a IAM Role for CodeDeploy Service that will have access to EC2 service.
  - CodeDeploy service needs to read EC2 instance tags
- The `Deployment type` selected by default is `in-place deployment`:
- Under `Environment configuration`, select `Amazon EC2 Instances`
  - Specify the right Tag Group `Key:Value` that is set on the EC2 instance.
- For Deployment Configuration, select the `CodeDeployDefault.OneAtATime`
- Deployment configuration
  - `CodeDeployDefault.AllAtOnce` :
    - Status is **Succeeded** if the application revision is deployed to one or more of the instances.
    - Status is **Failed** if the application revision is not deployed to any of the instances.
  - `CodeDeployDefault.HalfAtATime` :
    - Status is **Succeeded** if the application revision is deployed to at least half of the instances.
  - `CodeDeployDefault.OneAtATime` :
    - Status is **Succeeded** if the application revision is deployed to all of the instances. The exception to this rule is that if deployment to the last instance fails, the overall deployment still succeeds.
    - Status is **Failed** if the application revision fails to be deployed to any but the last instance.

CodeDeploy with S3 having Source Code

- Create a new or use existing S3 bucket and `enable versioning`, replace below `<S3BUCKETNAME>` with your bucket name.

- Upload your existing `app.zip` file into the bucket, this file is called as `Revision File` that contains application specification code i.e `appspec.yml` and required source code for application that needs to be deployed on EC2.

- The deployment can be started using the **AWS CodeDeploy Service UI** or by using **AWS CLI command**, replace appropriate content in the command below as per your account.

  #### Start Deployment using AWS Console

  - Navigate to **CodeDeploy Application** > Click on specific **Deployment Group** > Click on **Create Deployment**.
    - Under **Revision location**, specify the S3 `app.zip` revision file from S3 Bucket Path that was previously uploaded.

- Once Deployment Group is created, we can click **Create deployment**, and specify the S3 path of the package code and the deployment of the artifact on your EC2 instances will begin.

  #### Create Revision and Start Deployment using aws cli

- To upload the source code from local machine to S3 bucket, run the `deploy push` command within the directory where your `appspec.yml` is present

  ```
  aws deploy push --application-name CICD-Test --s3-location
  s3://<S3BUCKETNAME>/CICD-Test/app.zip --ignore-hidden-files
  ```

- To deploy with this revision, run:

  ```
  aws deploy create-deployment --application-name CICD-Test --s3-location
  bucket=<S3BUCKETNAME>,key=codedeploy-
  demo/app.zip,bundleType=zip,eTag=3e960dd6842eea91c61843157946259d,versi
  on=1oHw_ZABTFVWAvcXb7PrFft08pB4JW1T --deployment-group-name
  <deployment-group-name> --deployment-config-name <deployment-config-
  name> --description <description>
  ```

- Once the Deployment will start, there will be a `Deployment ID` created like `d-GC3B88ROA`
- Click on Deployment Id to see the event details executed on specific EC2 instance.
- On View Events on a specific EC2 instance ARN is displayed : `arn:aws:ec2:ap-south-1:<ACCOUNT_ID>:instance/i-0789556ecdf884653`
  - Details under this Page shows all the Event Hooks that are executed by the `CodeDeploy Agent` on the EC2.

Viewing the CodeDeploy Agent Logs and Deployment logs on the EC2 instance.

- The folder where related `revisions`, `deployment history`, and `deployment scripts` on the instance are stored.

  ```
  tree /opt/codedeploy-agent
  tree /opt/codedeploy-agent/deployment-root
  ```

  - Output of above command is below directory structure.

  ```
      /opt/codedeploy-agent/deployment-root
  ├── deployment-instructions
  │   ├── fb00c799-7826-4e8a-834b-98e83c278506-cleanup
  │   ├── fb00c799-7826-4e8a-834b-98e83c278506-install.json
  │   ├── fb00c799-7826-4e8a-834b-98e83c278506_last_successful_install
  │   └── fb00c799-7826-4e8a-834b-98e83c278506_most_recent_install
  ├── deployment-logs
  │   └── codedeploy-agent-deployments.log
  ├── fb00c799-7826-4e8a-834b-98e83c278506
  │   └── d-0TY70HROA
  ```

```
│         ├── bundle.tar
│         ├── deployment-archive
│         │   ├── appspec.yml
│         │   ├── buildspec.yml
│         │   ├── index.html
│         │   └── scripts
│         │       ├── after_install.sh
│         │       ├── install_dependencies.sh
│         │       ├── start_server.sh
│         │       ├── stop_server.sh
│         │       └── validate_service.sh
│         └── logs
│             └── scripts.log
└── ongoing-deployment
```

- `Deployment Group ID` : This is the deployment group directory's name having an ID like `fb00c799-7826-4e8a-834b-98e83c278506`.
  - Each deployment group directory contains one subdirectory for each attempted deployment in that deployment group.
- `Deployment ID` directory represent each deployment in a deployment group with directory's name is its ID `d-0TY70HROA`. Each directory contains:
  - `bundle.tar` : a compressed file with the contents of the deployment's revision. Use a zip decompression utility if you want to view the revision.
  - `deployment-archive` : contains the contents of the deployment's revision.
  - `logs` :contains a `scripts.log` file that lists the output of all scripts specified in the deployment's AppSpec file.

- The folder on the instance where log files related to CodeDeploy agent operations are stored.

```
cat /var/log/aws/codedeploy-agent/codedeploy-agent.log
```

- To determine the location of the last successfully deployed application revision

```
cat /opt/codedeploy-agent/deployment-root/deployment-instructions
```

Lifecycle Event hooks in appspec.yml file

- **ApplicationStop** – This deployment lifecycle event occurs even before the application revision is downloaded.
- **DownloadBundle**- During this deployment lifecycle event, the CodeDeploy agent copies the application revision files to a temporary location.
- **BeforeInstall**– You can use this deployment lifecycle event for preinstall tasks, such as decrypting files and creating a backup of the current version.

- **Install** – During this deployment lifecycle event, the CodeDeploy agent copies the revision files from the temporary location to the final destination folder.
- **AfterInstall** – You can use this deployment lifecycle event for tasks such as configuring your application or changing file permissions.
- **ApplicationStart** – You typically use this deployment lifecycle event to restart services that were stopped during ApplicationStop.
- **ValidateService** – This is the last deployment lifecycle event. It is used to verify that the deployment was completed successfully.
- Structure of 'hooks' Section

```
hooks:
   deployment-lifecycle-event-name:
     - location: script-location
       timeout: timeout-in-seconds
       runas: user-name
```

Environment variables in CodeDeploy

```
APPLICATION_NAME
DEPLOYMENT_ID
DEPLOYMENT_GROUP_NAME
DEPLOYMENT_GROUP_ID
LIFECYCLE_EVENT
```

Troubleshooting Scenarios

- InstanceAgent::Plugins::CodeDeployPlugin::CommandPoller: Missing credentials - please check if this instance was started with an IAM instance profile
- Make Sure instance is started with IAM role attached,if you attach IAM Role to EC2 after the instance is already running, the Instance needs to be restarted. If codedeploy agent is installed and later IAM Role is attached, make sure Codedeploy agent is restarted or EC2 is restarted.

Orchestrate pipeline using CodeCommit,Codebuild,CodeDeploy and CodePipeline

Launching Dev and Prod EC2 instances

> Use CF template to create AWS Infra as per SDLC Environment.

- Launch more two EC2 instances with CodeDeploy Agent installation Script in the UserData during Launch.
- Make sure new instances are having Tags as `SDLC_ENVIRONMENT` : `prod`

- Go to the same CodeDeploy Application -> Create a new Deployment Group with name `ProdEC2DeploymentGroup` for the newly launched EC2 instances Tag Key:Value pair as `SDLC_ENVIRONMENT` : `prod` Tag.

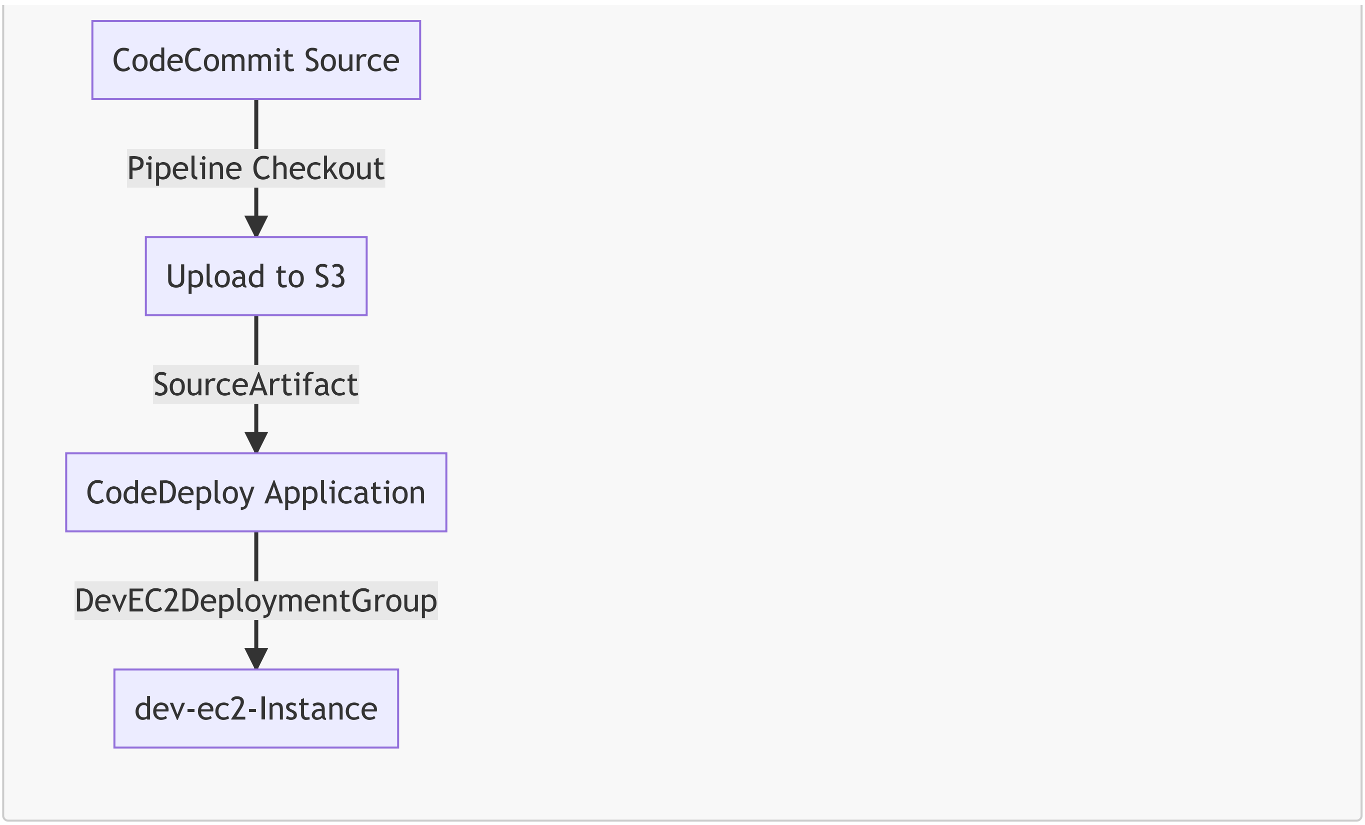
Creating CICD Resources (Continuous Deployment)

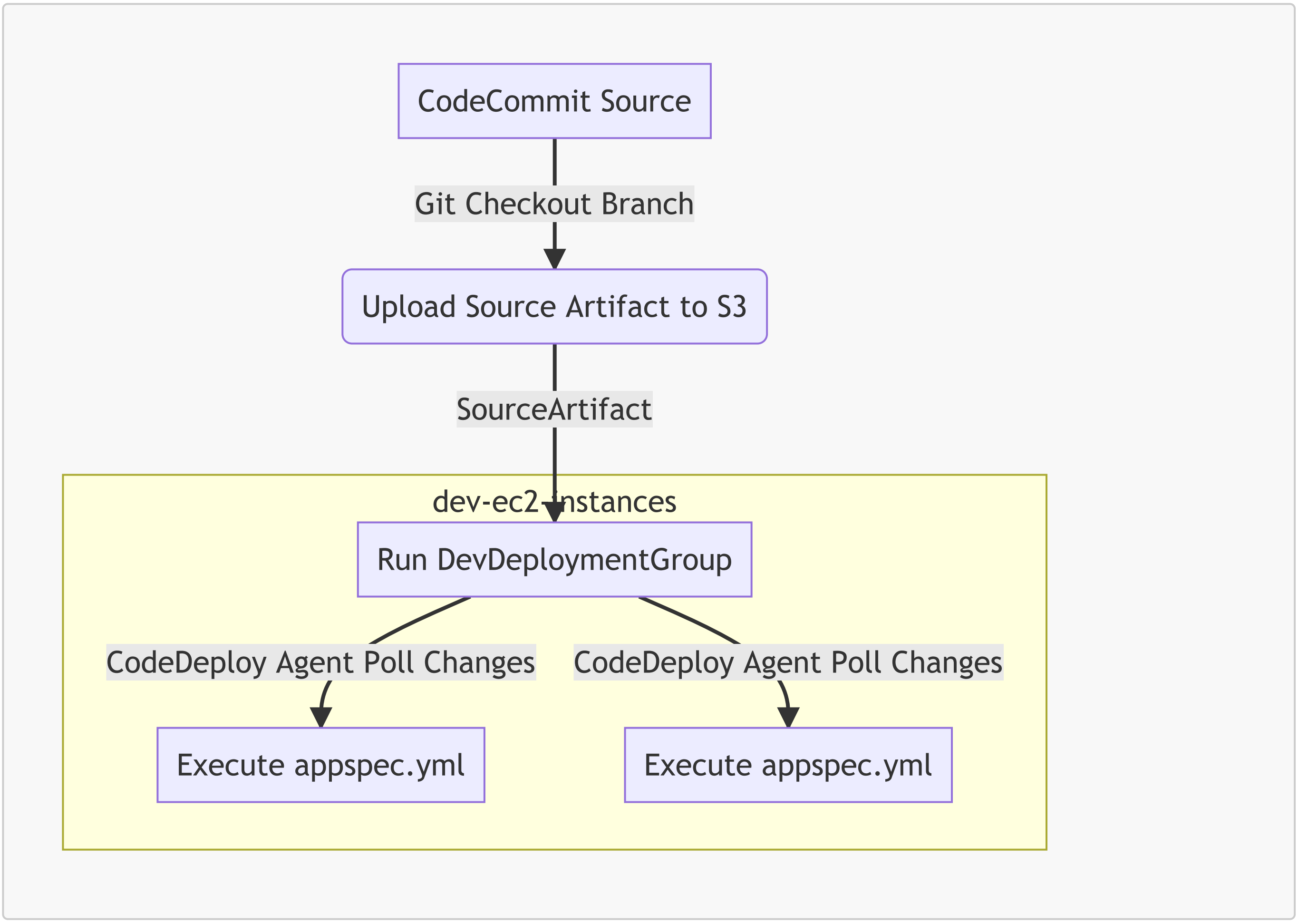
Creating Dev Deployment Pipeline

- Create below resources:
    - Configure CodeCommit IAM `https` credentials.
    - Create/Use exising CodeCommit Repo, push the source code to Codecommit Repo into master branch.
    - First for above setup, using CodeDeploy, we will first have our Code in CodeCommit.
    - Create a new AWS CodePipeline:
        - Navigate to `AWS CodePipeline` > `Pipeline` and click `Create pipeline` > `dev-deployment-pipeline`
        - Input the name for the service for CodePipeline and the S3 bucket that holds the artifacts for this pipeline.
        - Add a source stage such as `CodeCommit repository` and `branch` on which code version you want to deploy.
        - For `dev` pipeline, `develop` branch can be used.
    - Skip the CodeBuild as of now.
    - Add a deploy stage using `AWS CodeDeploy`. Select the CodeDeploy Application name that we have already created, and select the `DevEC2DeploymentGroup`
    - Review the Stages and Create the Pipeline.
    - A **Cloudwatch Event Rule** with similar name `codepipeline-awscod-develo-497863-rule` is created in the background that will trigger the CodePipeline automatically when there is any change in specified branch of CodeCommit Repo. - Navigate and view the CloudWatch Event.
        - Event Pattern will be as below:

```
{
  "source": ["aws.codecommit"],
  "detail-type": ["CodeCommit Repository State Change"],
  "resources": ["arn:aws:codecommit:ap-south-
1:ACCOUNT_ID:CODECOMMIT_REPO"],
  "detail": {
    "event": ["referenceCreated", "referenceUpdated"],
    "referenceType": ["branch"],
    "referenceName": ["develop"]
  }
}
```

    - If you make changes in the branch that is configured in cloudwatch event, the codepipeline will automatically start.





Testing the Pipeline Executions

- Change some content in the source code file in the branch configured above, and push the changes in the CodeCommit Repo.

- This will trigger the CodePipeline with (Codecommit and CodeDeploy stage).
- Above CodePipeline Project will directly deploy anything that is pushed to Repo in the specified branch that is configured in CloudWatch Event Rule.
- Once Pipeline is executed successfully for stages configured, validate all the steps from commits made in repo to application code that is deployed on WebServers.
- Validate the CodeDeploy Agent Execution Logs on any of the Webserver.

Creating Prod Deployment Pipeline

- Create another Pipeline/Clone above pipeline, with similar above stages to configure the same for prod environment deployment i.e `prod-deployment-pipeline`.
- Configure the Source Stage for CodeCommit Repository with `main/master` branch.
- Configure the Deploy Stage with CodeDeploy Applicaton with `ProdEC2DeploymentGroup`.
- Raise a PR to merge changes from `develop` into `master/main`.
- Once Changes are present in `master/main` branch, `prod-deployment-pipeline` should get started automatically due to CloudWatch Event Rule.

Continuous Delivery Pipeline

- A Pipeline can have manual approval stage to make sure , any changes that deployed in `prod` environment are approved.
- Existing Pipeline can be cloned into a new one and below stages can be added.
- Adding necessary stages in the CodePipeline as below flow

Syntax error in graph
mermaid version 8.13.3

- Create a **Manual Approval** Action group after CodeDeploy to dev in the Same Stage

- Provide URL of the Dev Instance to test the webpage, `this will be sequential`.

- Provide appropriate comments, so that this will be a message sent to user who will approve the stage

- Add a CodeDeploy stage and action group **ProdDeployStage** after the **Manual Approval** Stage with Action Provider as CodeDeploy and Deployment Group as `ProdDeploymentGroup`

- Release a change or make some changes in the source files for above configured branch in codecommit.

- Once Pipeline is Running, the deployment to dev environment will happen with above stage, and pipeline will be in `Pending` state on the `ManualApprovalStage`.

- The SNS Topic Subscriber will receive approval notification with CodePipeline and Stage Details to `Approve/Reject` the same.

- Once User has Approved the same, Pipeline will continue to execute the next deployment stage.

Adding Build Stage in CodePipeline

- Create/Use Existing CodeBuild Project, and specify default configuration, and enter the `buildspec.yml` file path into CodeBuild Project.
- To Add Build Stage, edit one of the CodePipeline.
- When you add CodeBuild Stage , specify value in Output Artifact that will be used by next stage.
- Add a stage in CodePipeline by selecting the CodeBuild Project.
- Modify the `InputArtifacts` and `OutputArtifacts` as necessary for CodeBuild and CodeDeploy.
- **CodeBuild** Stage should have `InputArtifact as SourceArtifact` and **CodeDeploy** Stage should have `Input Artifacts as BuildArtifact`.
- Release Change in Pipeline to validate the Build Artifacts and Deployment using the CodePipeline.

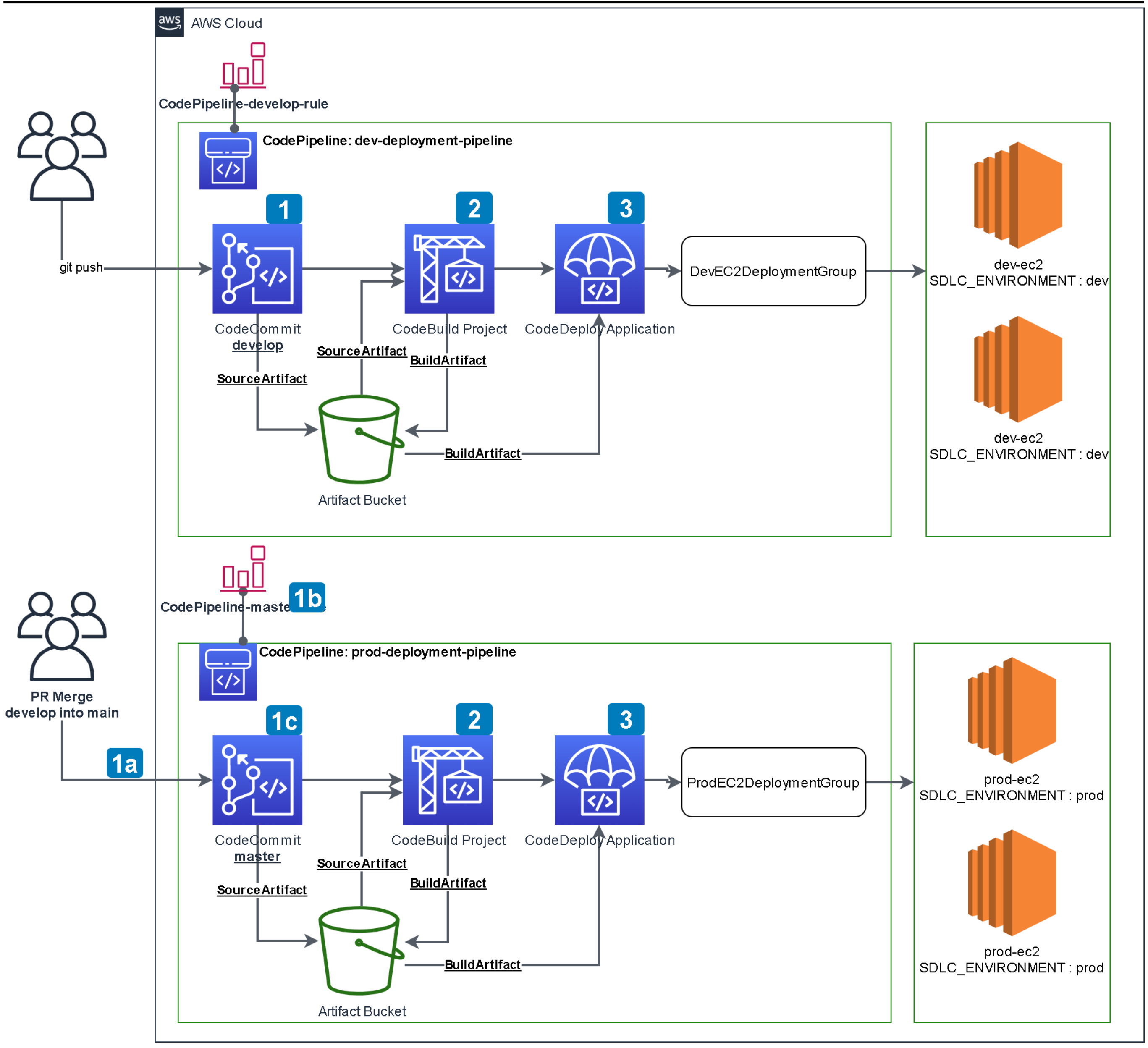
Pipeline Execution and verify the webpage on EC2 instances.

- Once Pipeline is successfully executed, verify the status of Deployments and test the Webpage the is available.

AWS CICD Setup

AWS CodePipeline

CodeCommit -> CodeBuild -> CodeDeploy



AWS CICD Notification Rules

- Create a Notification Rule for CodeBuild,CodeDeploy and CodePipeline. Specify the SNS Topic to get Notified on Execution Status.

Notes

- **Standard DevOps Approach to be followed:**
  - Make sure `DevCodePipeline` is triggered with `DevDeploymentGroup` only when there are code changes in `develop` branch, Also `ProdCodePipeline` is triggered with `ProdDeploymentGroup` only when there are code changes in `master` branch.
  - Changes will be made in child/feature branches, and once changes are merged into `develop` branch, the `DevCodePipeline` should trigger automatically to deploy changes done in `develop` branch.
  - Once the application is tested using `develop` and changes are deployment into Dev Environment, raise a Pull Request to merge from `develop` branch into `master`.

- In a Continuous Delivery scenario,once code changes reviewed by requested Team Member, the `ProdCodePipeline` is automatically triggered.