Deployment Automation using AWS Codedeploy, Jenkins and Code Commit

Continuous Integration: is a software development practice where continuous changes and updates in code base are integrated and verified by an automated build scripts using various tools.

Continuous Deployment: is also a software development practice whose role is to automatically deploy the code to the application folder of specified server

Scenario: Suppose we have set up an architecture of www.xyz.com application the server is setup on Amazon Web Services. As a part of the architecture , Our server is featured with AWS Auto Scaling service which is used to help scale our servers depending on the metrics and policies we specified. So every time a new feature will develop, we have to manually run the test cases before the code was integrated and deployed, later pull the latest code to all the environment servers.

Challenges :

1. Centralised repository for pulling and pushing code for deployment
2. Manually work to run test cases and pull the latest code on all the servers.
3. How to deploy code on new instance which are configured in AWS autoscaling
4. Since the servers were auto scaled we had to pull the latest code on one server, take image of that server, re configure it with Auto Scaling.
5. How to automatically deploy build on instances timely manner
6. How to Revert back to previous build

The above challenges requires lots of time and human resources. So we have to find a technique that must save high amount of time and make our life easy with automating all the process from CI to CD.

We are going to use **Jenkins** as CI tool and **AWS Code Deploy** as CD tool and **AWS Code Commit** as Application Repo.

Let's just walk through the flow, how it's going to work and what are the advantages before we implement it all.

When a new code is pushed to a particular GIT repo/AWS Code Commit branch.

1. Jenkins will run the test cases, (Jenkins listening to a particular branch through git web hooks)

2. If the test cases fail. It will notify us and stop the further after build actions.

3. If the test cases are successful, it will go to post build action and trigger aws code deploy.

4. Jenkins will push the latest code in the zip file format to AWS S3 on the account we specify.

5. AWS Code Deploy will pull the zip file in all the Auto Scaled servers that have been mentioned.

6. For autoscaling server we can choose that ami which by default have the AWS Codedeploy Agent running on it cause these ami launch faster and pull the latest revision automatically.

7. Once the latest code is copied to the application folder , it will once again run the test cases.

8. If the test cases fail it will roll back the deployment to previous successful revision.

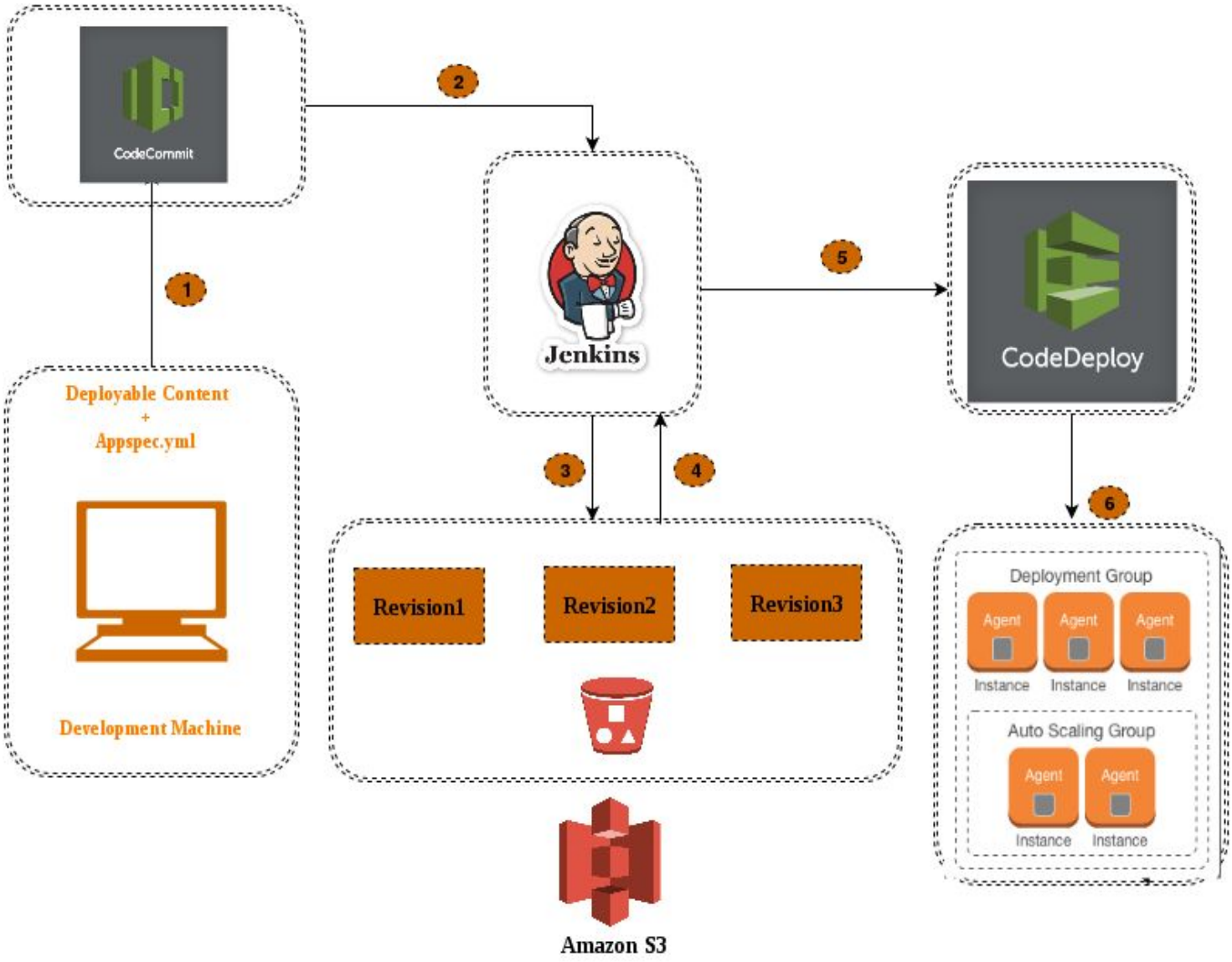
9. If it is successful , it will run post deployment build commands on server and ensure that latest deployment does not fail.

10. If we want to go back to previous revision then also we can roll back easily

So this way of automation makes the Deployment of application smooth, error tolerant, and faster.

Deployment of Application via CodeDeploy using Jenkins and CodeCommit (Implementation Steps)

Architecture :



Workflow:

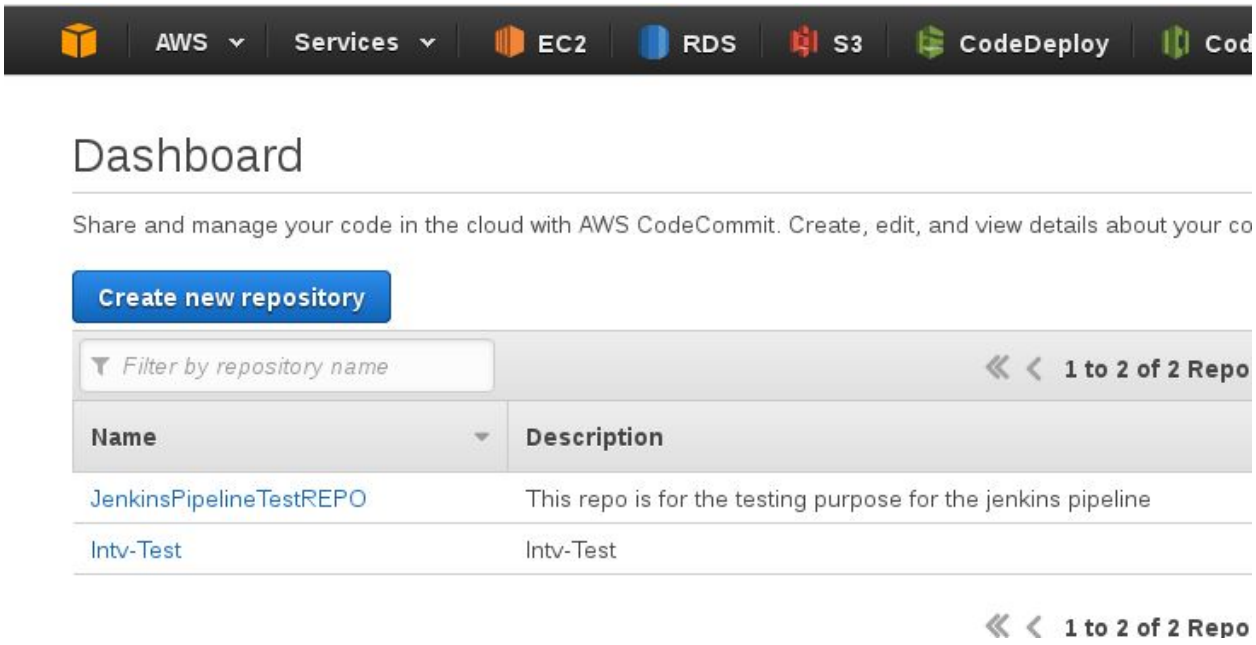
Below are the workflow steps of the above architecture

1. The application code with the Appspec.yml file will be pushed to the AWS code Commit. The Appspec.yml file includes the necessary scripts path and command which will help the AWS code deploy to run the application successfully
2. As the Application and Appspec.yml file will get committed in the AWS codeCommit, jenkins will automatically will get triggered by poll SCM function.
3. Now Jenkins will pull the code from CodeCommit into its workspace (Path in Jenkins where all the artifacts is placed) and archive it and push it to the AWS S3 bucket. So this is considered as Job1. If the Job 1 will execute successfully then email will be sent to the Admin with the console output. And if the Job 1 get fail then email will be triggered with message of Job Failure and at that point only Jenkins stops working rather than executing the 2nd Job.
4. If Job 1 will execute successfully then it will trigger the Job2 which is responsible to pull the successful build version of code from S3 bucket and then trigger the Job3. If Job 2 will get fail, then again email will be triggered with message of Job Failure.
5. When Job 3 get triggered, the archive file (Application code along with appspec.yml) will be pushed to aws codedeploy.
6. Now AWS codedeploy is the deployment service which will run the Codedeploy agent in the instance and run the Appspec.yml file which will help the application to get up and running.
7. If at any place the Job will get fail then the application will be deployed will the previous build.

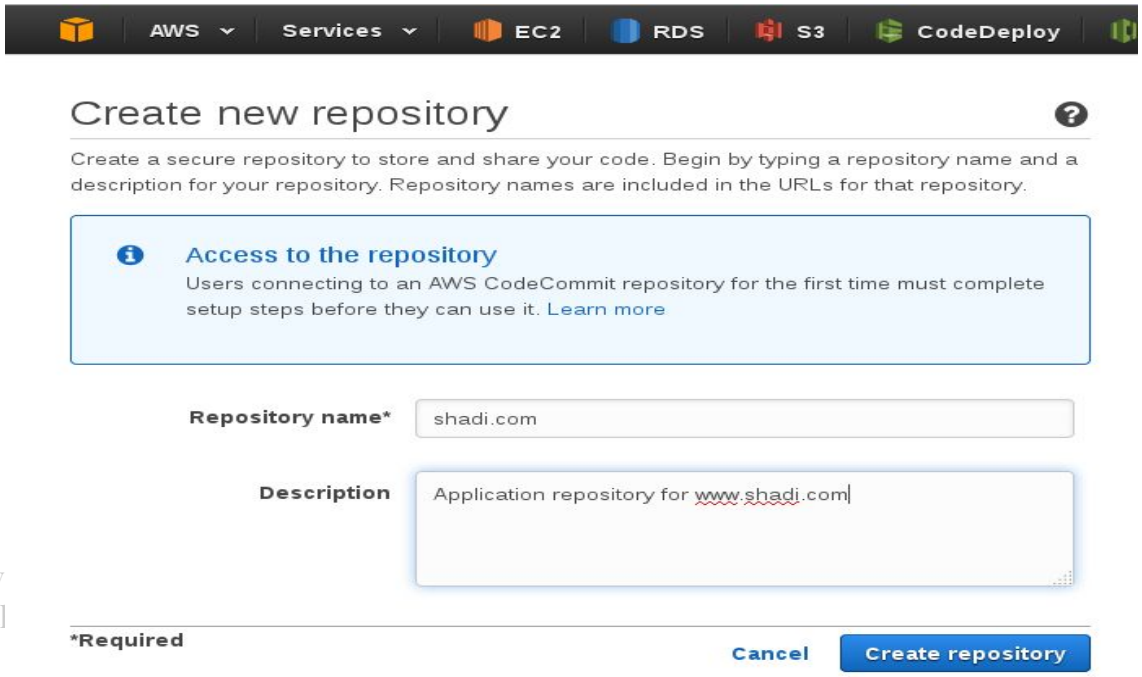
Step1. Setting Up CodeCommit in Development Environment.

Create an AWS CodeCommit Repository

a. Open the AWS CodeCommit console at https://console.aws.amazon.com/codecommit.
b. On the welcome page, choose Get Started Now. (If a Dashboard page appears instead of the welcome page, choose Create new repository.)



c. On the Create new repository page, in the Repository name box, type **shadi.com**
d. In the Description box, type **Application repository of www.shadi.com**



e. Choose Create repository to create an empty AWS CodeCommit repository named shadi.com

Create a Local Repo

In this step, we will set up a local repo on our local machine to connect to our repository. To do this, we will select a directory on our local machine that will represent the local repo. we will use Git to clone and initialize a copy of our empty AWS CodeCommit repository inside of that directory. Then we will specify the username and email address that will be used to annotate your commits.

a. Generate ssh-keys in your local machine ***#ssh-keygen*** **without any passphrase.**

```
$ ssh-keygen

Generating public/private rsa key pair.
Enter file in which to save the key (/home/u

Enter passphrase (empty for no passphrase):
Enter same passphrase again: <Type the passp

Your identification has been saved in /home/
Your public key has been saved in /home/user
The key fingerprint is:
45:63:d5:99:0e:99:73:50:5e:d4:b3:2d:86:4a:2c
The key's randomart image is:
+--[ RSA 2048]----+
|        E.+.o*.++|
|        .o .=.=o.|
|       . ..  *. +|
|        ..o . +..|
|        So . . . |
|          .      |
|                 |
|                 |
|                 |
+-----------------+
```

b. Cat **id_rsa.pub** and paste it into the **IAM User->Security Credentials-> Upload SSH Keys** Box. And Note Down the **SSH-KeyID**

```
$ cat /.ssh/id_rsa.pub
```

Copy this value. It will look similar to the following:

```
ssh-rsa EXAMPLE-AfICCQD6m7oRw0uXOjANBgkqhkiG9w0BAQUFADCBiDELMAkGA1UEBhMCVVMxCzAJB
gNVBAgTAldBMRAwDgYDVQQHEwdTZWF0dGxlMQ8wDQYDVQQKEwZBbWF6b24xFDASBgNVBAsTC0lBTSBDb2
5zb2xlMRIwEAYDVQQDEwlUZXN0Q2lsYWMxHzAdBgkqhkiG9w0BCQEWEG5vb25lQGFtYXpvbi5jb20wHhc
NMTEwNDI1MjA0NTIxWhcNMTIwNDI0MjA0NTIxWjCBiDELMAkGA1UEBhMCVVMxCzAJBgNVBAgTAldBMRAw
DgYDVQQHEwdTZWF0dGxlMQ8wDQYDVQQKEwZBbWF6b24xFDAS=EXAMPLE user-name@ip-192-0-2-137
```

c. Click on Create Access keys and Download the Credentials having Access Key and Secret Key.

d. Set the Environment Variables in BASHRC File at the end.

```
# vi /etc/bashrc

export AWS_ACCESS_KEY_ID=AKIAINTxxxxxxxxxxxSAQ
export AWS_SECRET_ACCESS_KEY=9oqM2L2YbxxxxxxxxxxxxzSDFVA
```

e. Set the config file inside .ssh folder

```
# vi ~/.ssh/config

Host git-codecommit.us-east-1.amazonaws.com
   User APKAxxxxxxxxxxT5RDFGV
   IdentityFile ~/.ssh/id_rsa            ---> Private Key
# chmod 400 config
```

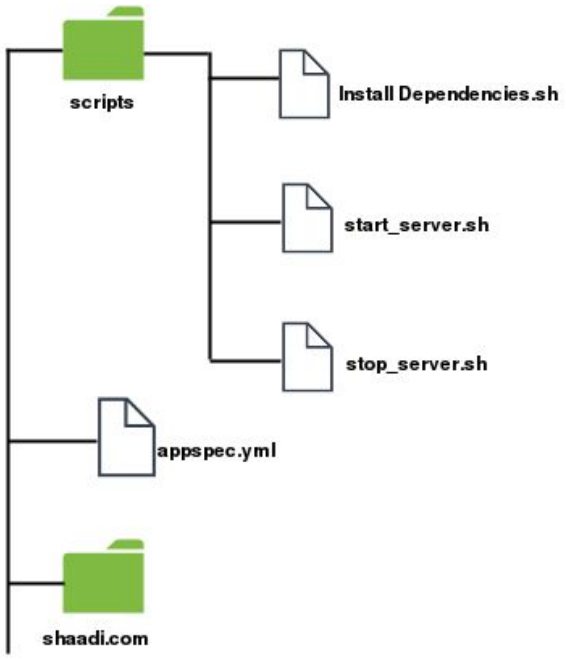
f. Configure the Global Email and Username

```
#git config --global user.name "username"
#git config --global user.email "emailID"
```

G. Copy the SSH URL to use when connecting to the repository and clone it

```
#git clone ssh://git-codecommit.us-east-1.amazonaws.com/shadi.com
```

Now Put the Application/Code inside the cloned directory and also write the appspec.yml file and you are ready to push it.



`Install_dependencies.sh` includes.

```
#!/bin/bash
yum groupinstall -y "PHP Support"
yum install -y php-mysql
yum install -y httpd
yum install -y php-fpm
```

`Start_server.sh` includes

```
#!/bin/bash
service httpd start
service php-fpm start
```

`Stop_server.sh` includes

```
#!/bin/bash
isExistApp=`pgrep httpd`
if [[ -n  \$isExistApp ]]; then
   service httpd stop
fi
isExistApp=`pgrep php-fpm`
if [[ -n  \$isExistApp ]]; then
    service php-fpm stop
Fi
```

`Appspec.yml` includes

```
version: 0.0
os: linux
files:
  - source: /
    destination: /var/www/shadi.com
hooks:
  BeforeInstall:
    - location: .scripts/install_dependencies.sh
      timeout: 300
      runas: root
  ApplicationStart:
    - location: .scripts/start_server.sh
      timeout: 300
      runas: root
  ApplicationStop:
    - location: .scripts/stop_server.sh
      timeout: 300
      runas: root
```

H. Now push the code to the CodeCommit

```
# git add .
# git commit -m “1st push”
# git push
```

Now we can see that the code will be pushed to the codecommit .

Step2. Setting Up Jenkins Server in EC2-Instance.

Launch the EC2 instance (CentOS7/RHEL7) and perform the following operations

```
# yum update -y
# yum install java-1.8.0-openjdk
```

Verify the java

```
# java –version
```

```
# wget -O /etc/yum.repos.d/jenkins.repo
http://pkg.jenkins-ci.org/redhat/jenkins.repo
# rpm --import http://pkg.jenkins-ci.org/redhat/jenkins-ci.org.key
```

Install Jenkins:

```
# yum install Jenkins
```

Add Jenkins to system boot:

```
# chkconfig jenkins on
```

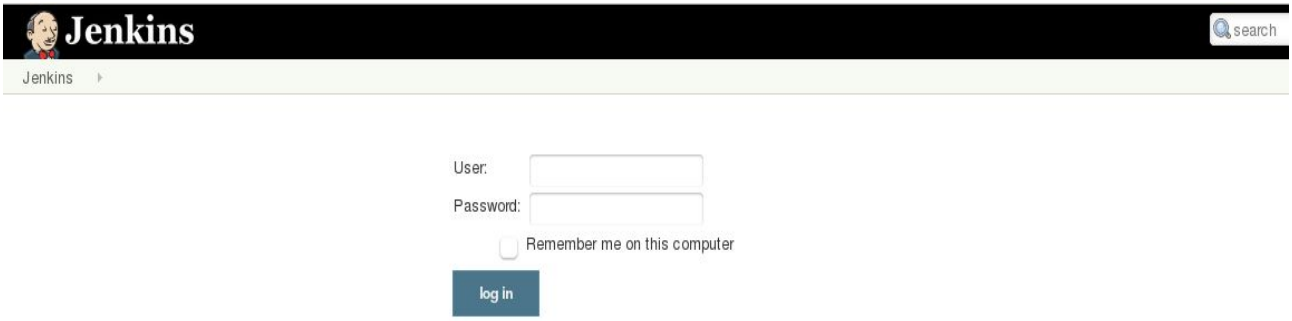
Start Jenkins:

```
# service jenkins start
```

By default Jenkins will start on Port 8080, this can be verified via

```
# netstat -tnlp | grep 8080
```

Go to browser and navigate to **http://<Elastic/Public-IP>:8080**. You will see jenkins dashboard.

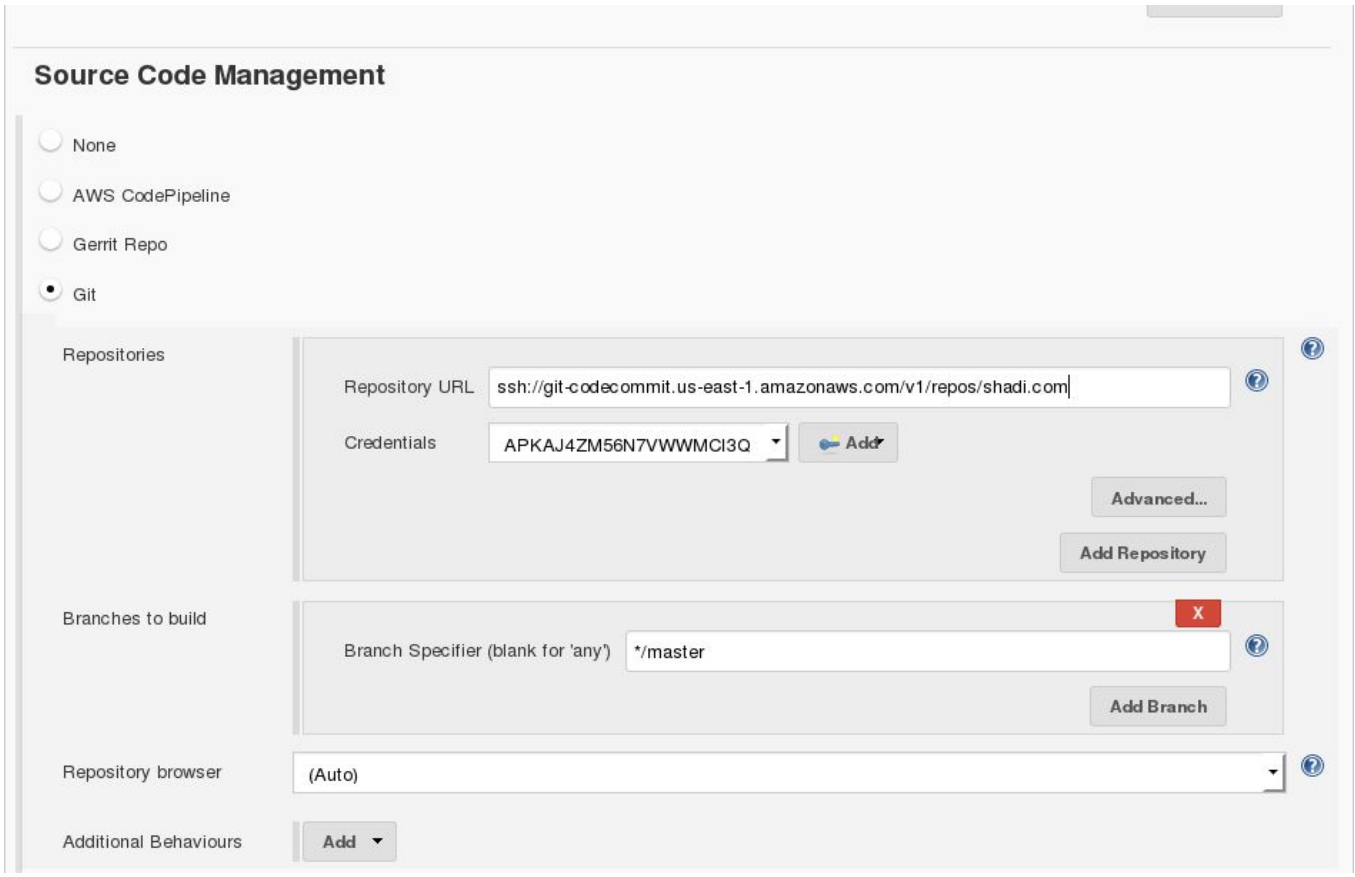


Configure The Jenkins Username and password and Install the Aws and Git related Plugins.

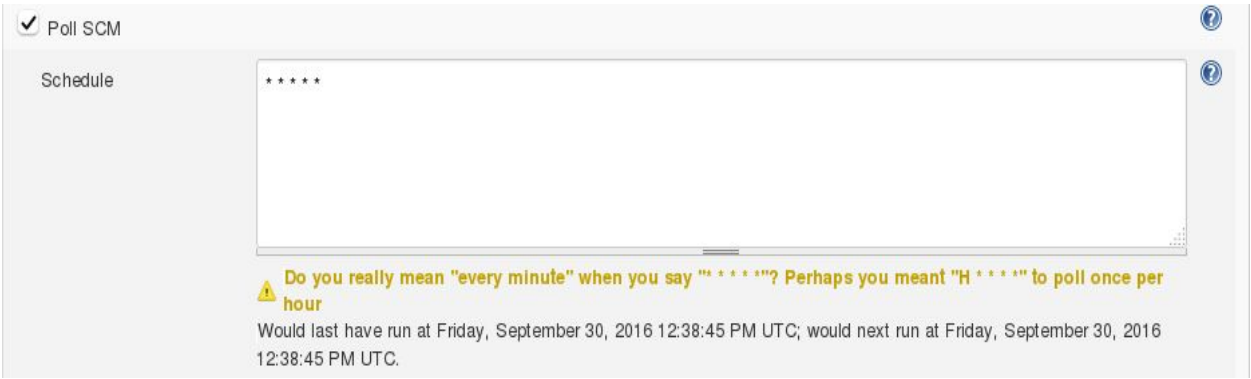
Setup a Jenkins Pipeline Job.

In Source Control Management click on GIT.

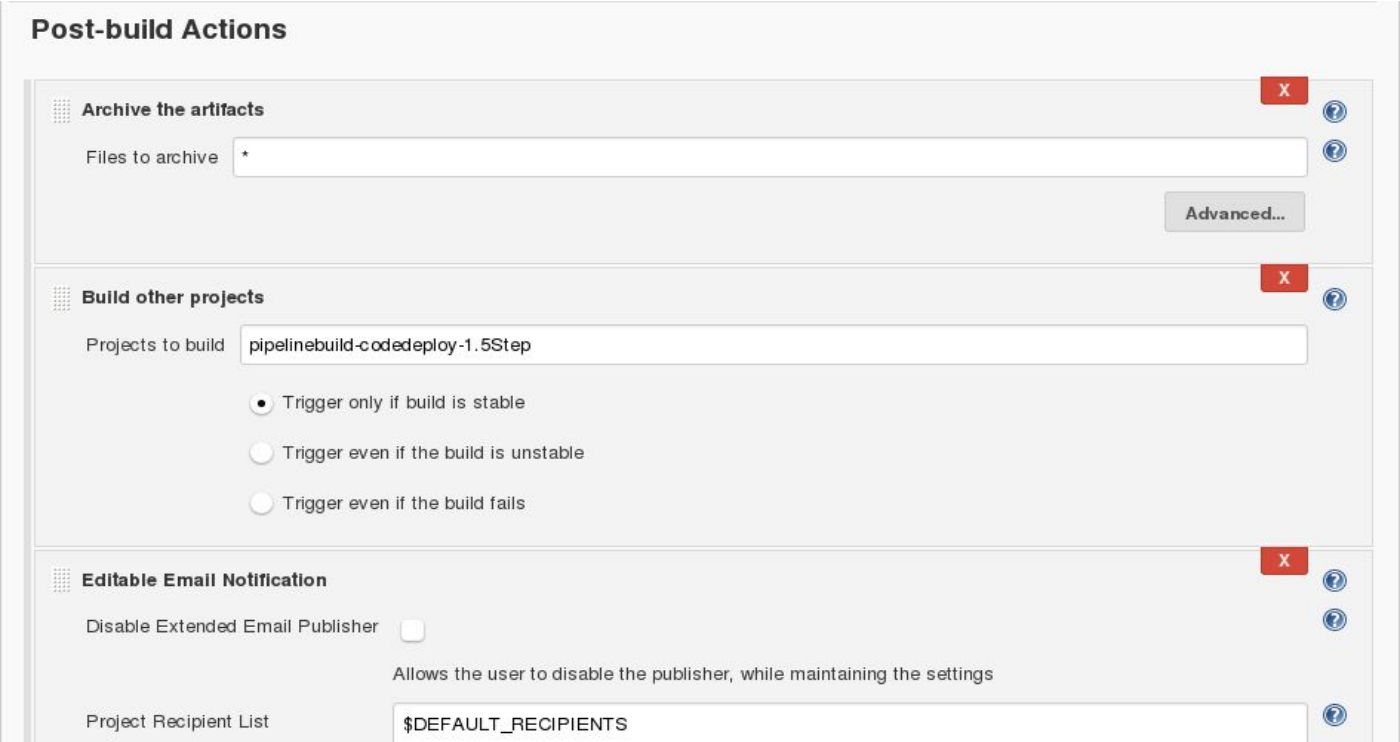
Pass the git ssh URL and In credentials, Click on ADD and then in kind option click SSH username with PrivateKey. Username will be same as mentioned in the config file of development machine where repo was initiated and we have to cat the private key of development machine and paste it here.



In Build Trigger click on Poll SCM and mention the time whenever you want to start the build.

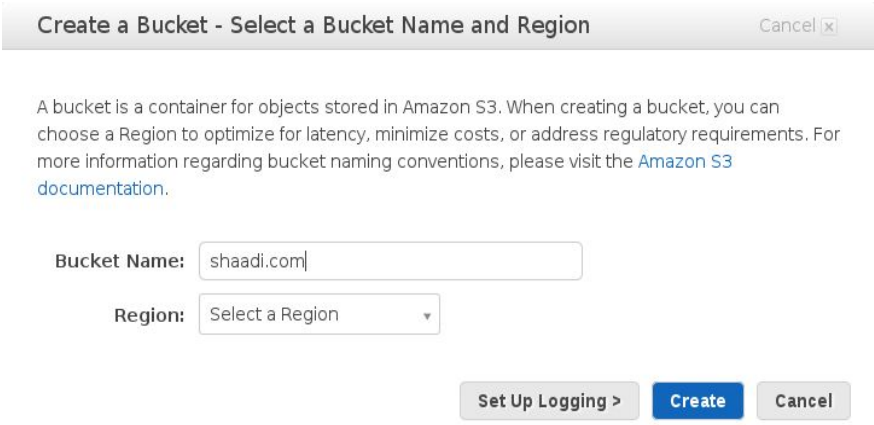


For the Post Build Action we have to archive the files and provide the name of job 2, if the job 1 will get successful build after then it should trigger the email.



Now For the time being we can start Building the Job and we have to verify that when the code is committed, the Jenkins should start building automatically and weather it is able to pull the code into its workspace folder but before that we have to create S3 bucket and pass credentials (Access key and Secret key) in jenkins so that when the jenkins pull code from codecommit and after archiving it can push build in the s3 bucket

Step3. Create S3 Bucket.



After creating S3 bucket, provide the details into jenkins with the AWS credentials.

Amazon S3 profiles

S3 profiles

Profile name: shadi.com

Use IAM Role

Access key: AKIAINTX2I4PI5G67OHQ

Check passed!

Secret key: ••

Advanced...

Delete

Add

Profiles for publishing to S3 buckets

Now when we run job 1 of Jenkins it will pull the code from code commit and after archiving, it will keep into the workspace folder of job1.

Console Output

```
Started by user Nikit Swaraj
Building in workspace /var/lib/jenkins/workspace/pipelinebuild-codedeploy-1stStep
 > git rev-parse --is-inside-work-tree # timeout=10
Fetching changes from the remote Git repository
 > git config remote.origin.url ssh://git-codecommit.us-east-1.amazonaws.com/v1/repos/JenkinsPipe
Fetching upstream changes from ssh://git-codecommit.us-east-1.amazonaws.com/v1/repos/JenkinsPipel
 > git --version # timeout=10
using GIT_SSH to set credentials
 > git fetch --tags --progress ssh://git-codecommit.us-east-1.amazonaws.com/v1/repos/JenkinsPipel
/remotes/origin/*
 > git rev-parse refs/remotes/origin/master^{commit} # timeout=10
 > git rev-parse refs/remotes/origin/origin/master^{commit} # timeout=10
Checking out Revision 3c7e516141f8a95e5bd1cd3e39f0bd7aa994dfde (refs/remotes/origin/master)
 > git config core.sparsecheckout # timeout=10
 > git checkout -f 3c7e516141f8a95e5bd1cd3e39f0bd7aa994dfde
 > git rev-list 3c7e516141f8a95e5bd1cd3e39f0bd7aa994dfde # timeout=10
Checking for pre-build
Executing pre-build step
Checking if email needs to be generated
No emails were triggered.
Archiving artifacts
Checking for post-build
Performing post-build step
Checking if email needs to be generated
Email was triggered for: Always
Sending email for trigger: Always
messageContentType = text/plain; charset=UTF-8
Request made to attach build log
Adding recipients from project recipient list
Adding recipients from trigger recipient list
Successfully created MimeMessage
Sending email to: nikit.swaraj@minjar.com
```

```
downstream builds to be triggered
Triggering a new build of pipelinebuild-codedeploy-1.5Step
Finished: SUCCESS
```

From the above Console output we can see that it is pulling the code from codecommit and after archiving, it is triggering the email and after then it calls for the next job 2

Job 2 is responsible for pushing the archive code to S3 bucket and then after successful push it will trigger the email with console output and call job3.

Console Output

```
Started by upstream project "pipelinebuild-codedeploy-1stStep" build number 44
originally caused by:
 Started by user Nikit Swaraj
Building in workspace /var/lib/jenkins/workspace/pipelinebuild-codedeploy-1.5Step
Copied 10 artifacts from "pipelinebuild-codedeploy-1stStep" build number 44
Publish artifacts to S3 Bucket Build is still running
Publish artifacts to S3 Bucket Using S3 profile: jenkinspipelinecodepackage
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=Always-37.txt region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=Always-38.txt region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=Always-39.txt region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=Always-40.txt region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=Always-41.txt region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=Always-42.txt region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=Always-43.txt region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=appspec.yml region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=hello.sh region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Publish artifacts to S3 Bucket bucket=jenkinspipelinecodepackage/32, file=index.html region=sa-east-1, will be uploaded from
slave=false managed=false , server encryption false
Warning: you have no plugins providing access control for builds, so falling back to legacy behavior of permitting any
downstream builds to be triggered
Triggering a new build of pipelinebuild-codedeploy-2ndStep
Finished: SUCCESS
```

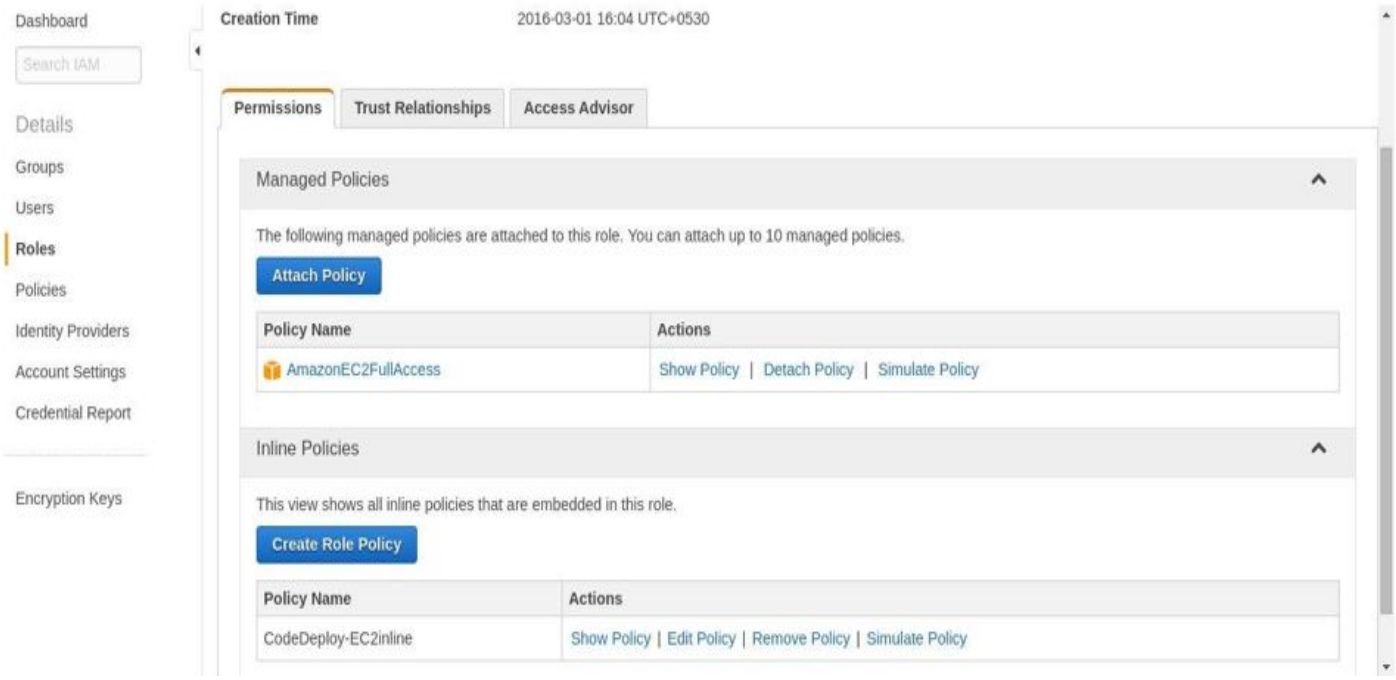
The above image shows that after building Job2, the Job3 will also get triggered. Now before triggering Job3, we need to setup AWS codedeploy environment.

Step4. Now launch the AWS codedeploy application.

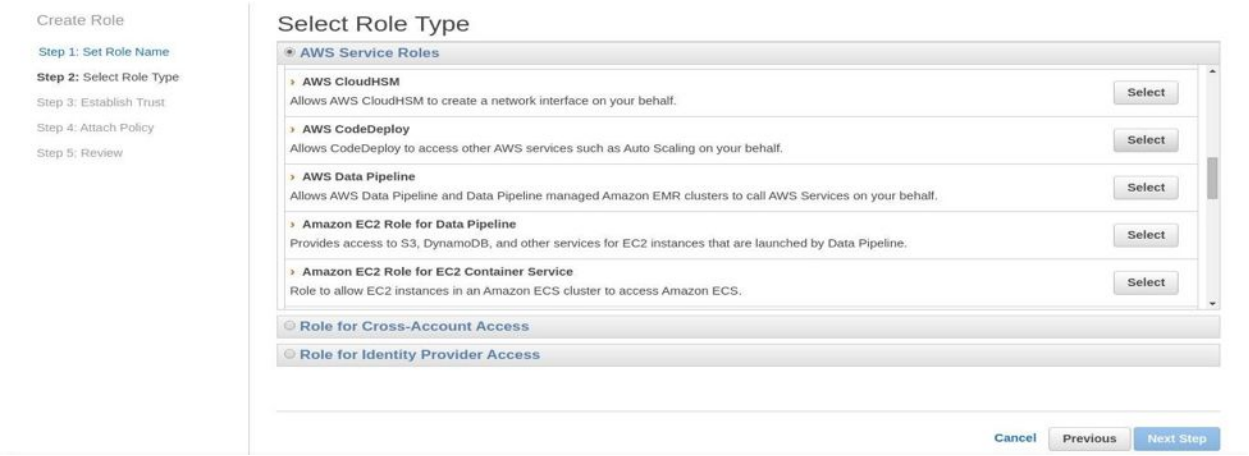
Creating IAM Roles

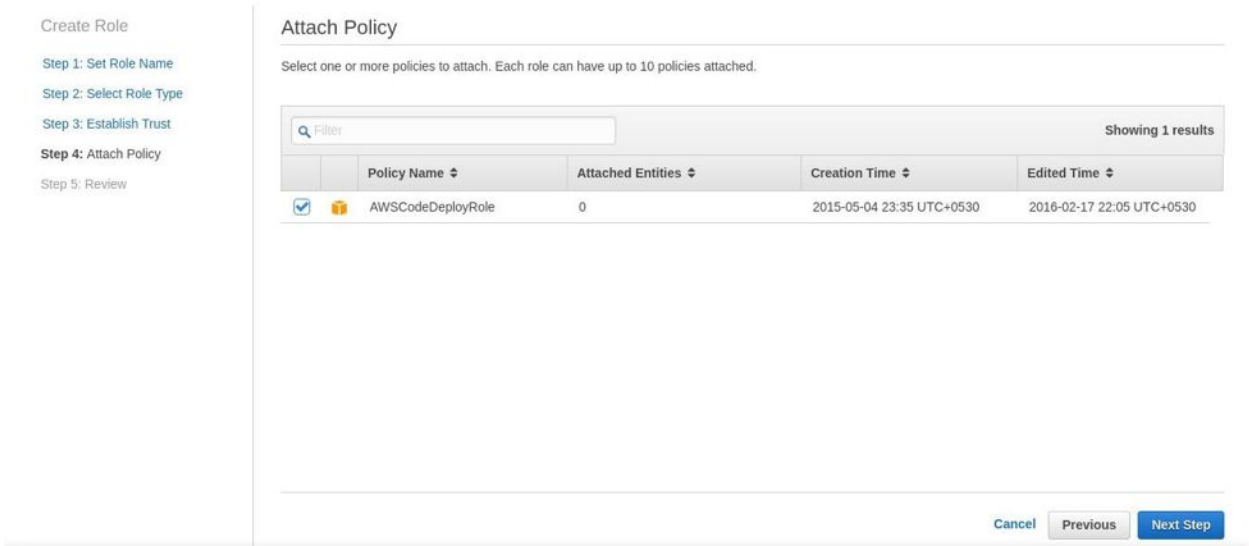
Create an iam instance profile and attach AmazonEC2FullAccess policy and also attach the following inline policy:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": [
                "s3:Get*",
                "s3:List*"
            ],
            "Effect": "Allow",
            "Resource": "*"
        }
    ]
}
```



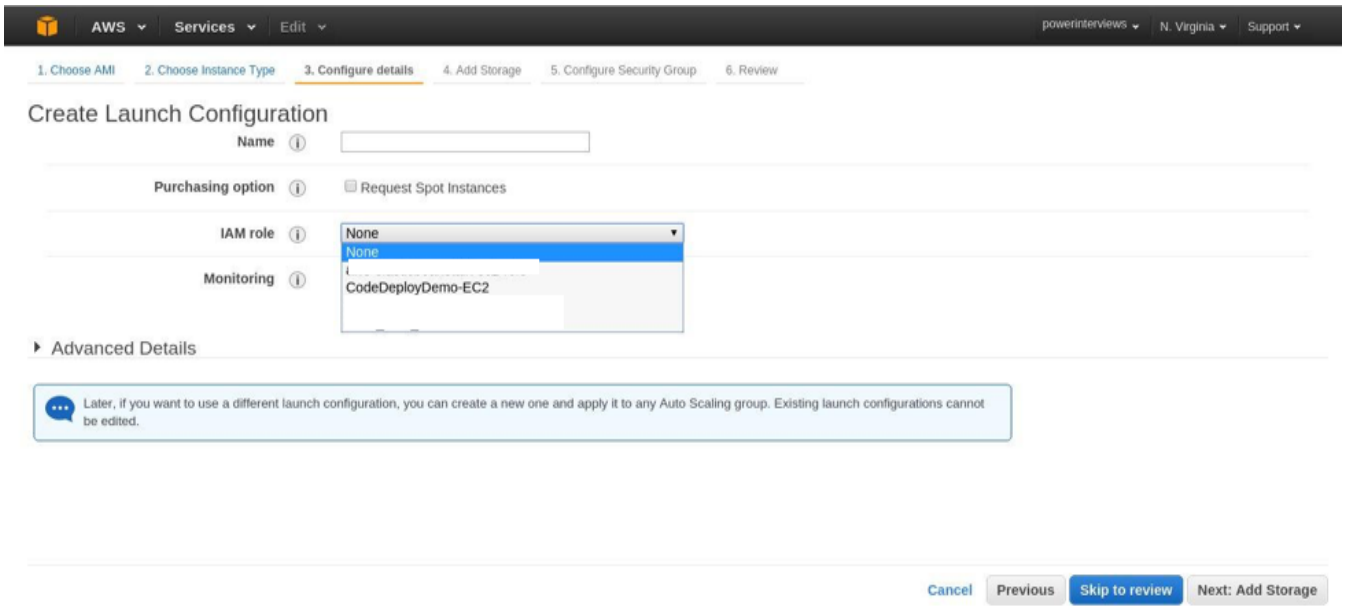
Create a service role `CodeDeployServiceRole`. Select Role type AWS CodeDeploy. Attach the Policy `AWSCodeDeployRole` as shown in the below screenshots:





Create an autoscaling group for a scalable environment. Steps below:

Choose an ami and select an instance type for it and Attach the iam instance profile which we created in the earlier step



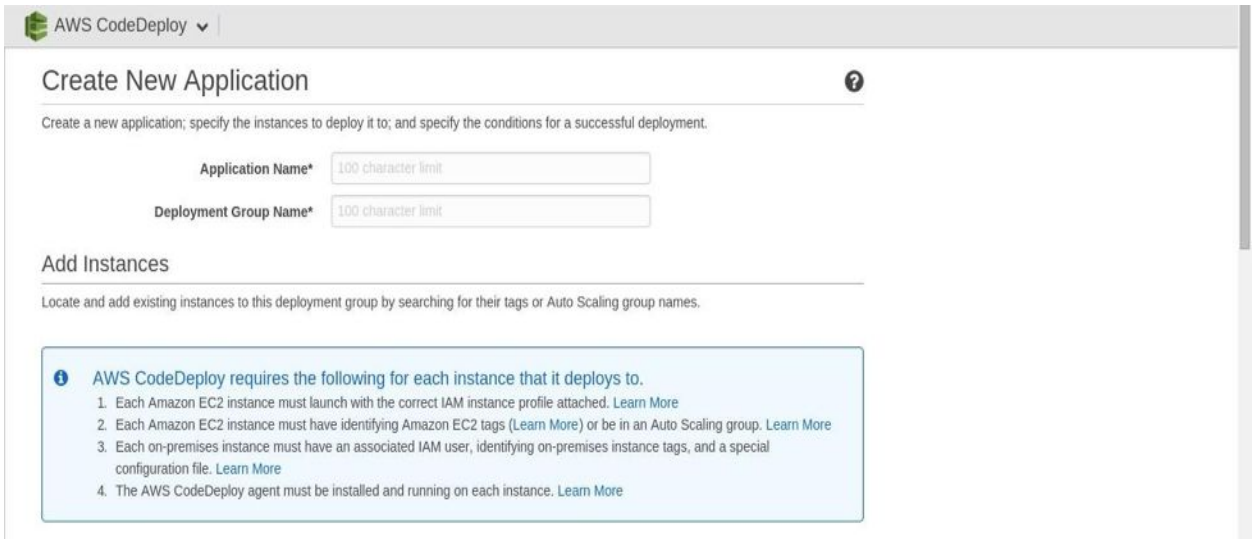
Now go to Advanced Settings and type the following commands in "User Data" field to install codedeploy agent on your machine (if it's not already installed on your ami)

```
#!/bin/bash
yum -y update
yum install -y ruby
yum install -y aws-cli
sudo su -
aws s3 cp s3://aws-codedeploy-us-east-1/latest/install . --region
us-east-1
chmod +x ./install
./install auto
```

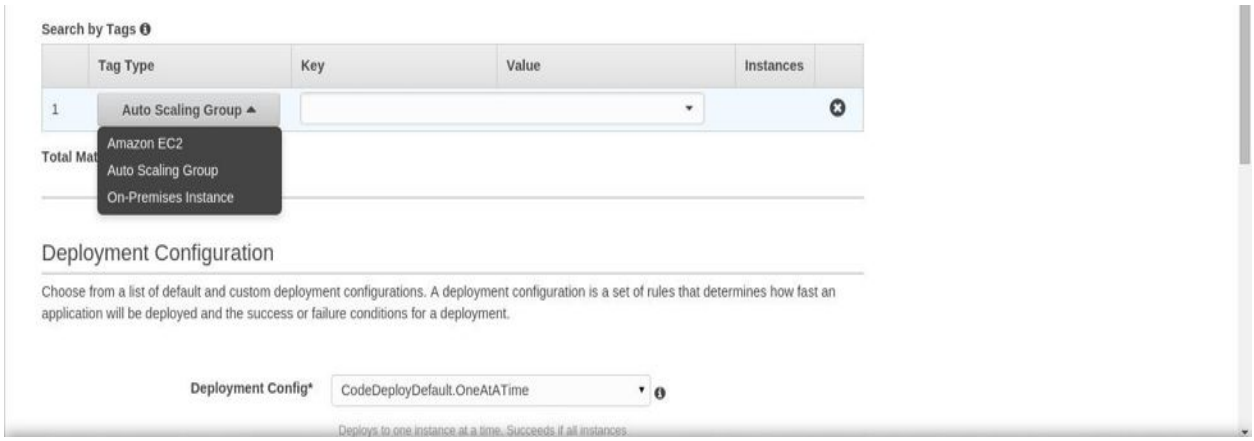
Select Security Group in the next step and create the launch configuration for the autoscaling group. Now using the launch configuration created in the above step, create an Autoscaling group.

Now after creating Autoscaling group its time to create Deployment Group

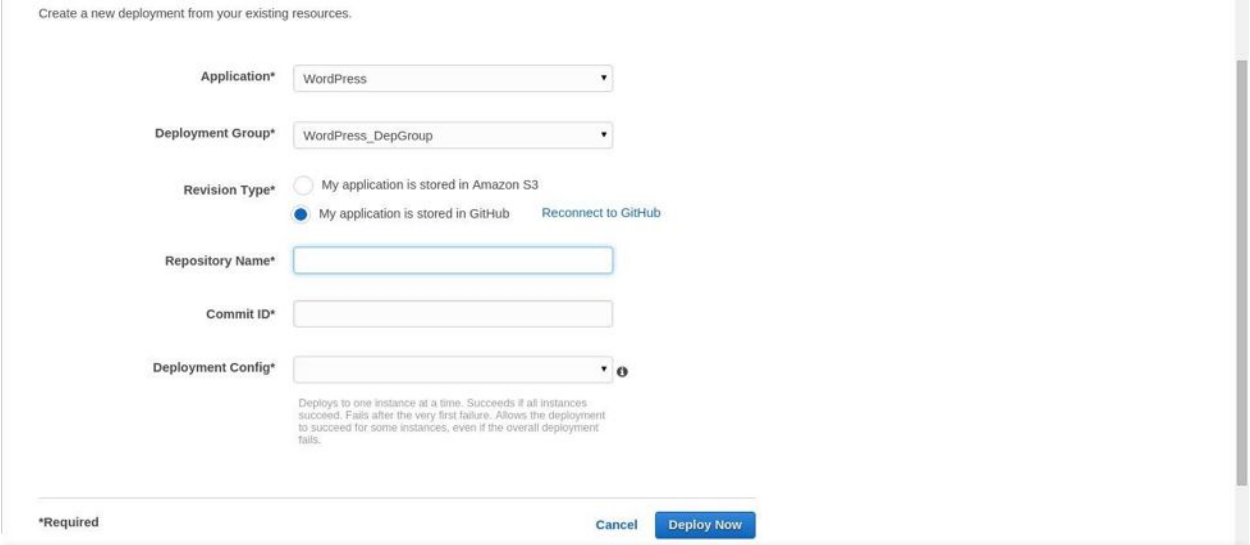
Click on AWS codedeploy and click on create application and Mention the application name and Deployment Group Name



In tag type click on either EC2 instance or AWS AutoScale Group. And mention the Name of ec2 instance or AWS autoscale Group.



Select ServiceRoleARN for the service role which we created in the “Creating IAM Roles” section of this post. Go to Deployments and choose Create New Deployment. Select Application and Deployment Group and select the revision type for your source code



Note: The IAM role associated with the instance or autoscale group should be same as codedeploy and the arn name must have the codedeploy policy associated with it.

Step5. Fill Codedeploy Info in jenkins and Build it

Now go back to jenkins job 3 and click on “Add PostBuild Action” and select “Deploy the application using AWS codedeploy. Fill the details of

AWS CodeDeploy Application Name , AWS CodeDeploy Deployment Group, AWS CodeDeploy Deployment Config, AWS Region S3 Bucket, Include Files ** and click on Access/secret to fill the Keys for the Authentication. Click on save and Build the project. After few min or sec the application will deployed on the Autoscale instances.

Deploy an application to AWS CodeDeploy

AWS CodeDeploy Application Name	ShadiApp
AWS CodeDeploy Deployment Group	ShadiGN
AWS CodeDeploy Deployment Config	CodeDeployDefault.OneAtATime
AWS Region	SA_EAST_1
S3 Bucket	shadi.com
S3 Prefix	
Subdirectory	
Include Files	**
Exclude Files	
Proxy Host	
Proxy Port	0
Version File	
Appspec.yml per Deployment Group	

- Register Revision
- Deploy Revision
- Use Access/Secret keys

If these keys are left blank, the plugin will attempt to use credentials from the default provider chain. That is: Environment Variables, Java System properties, credentials profile file, and finally, EC2 Instance profile.

AKIAINTX2I4PI5G67OHQ

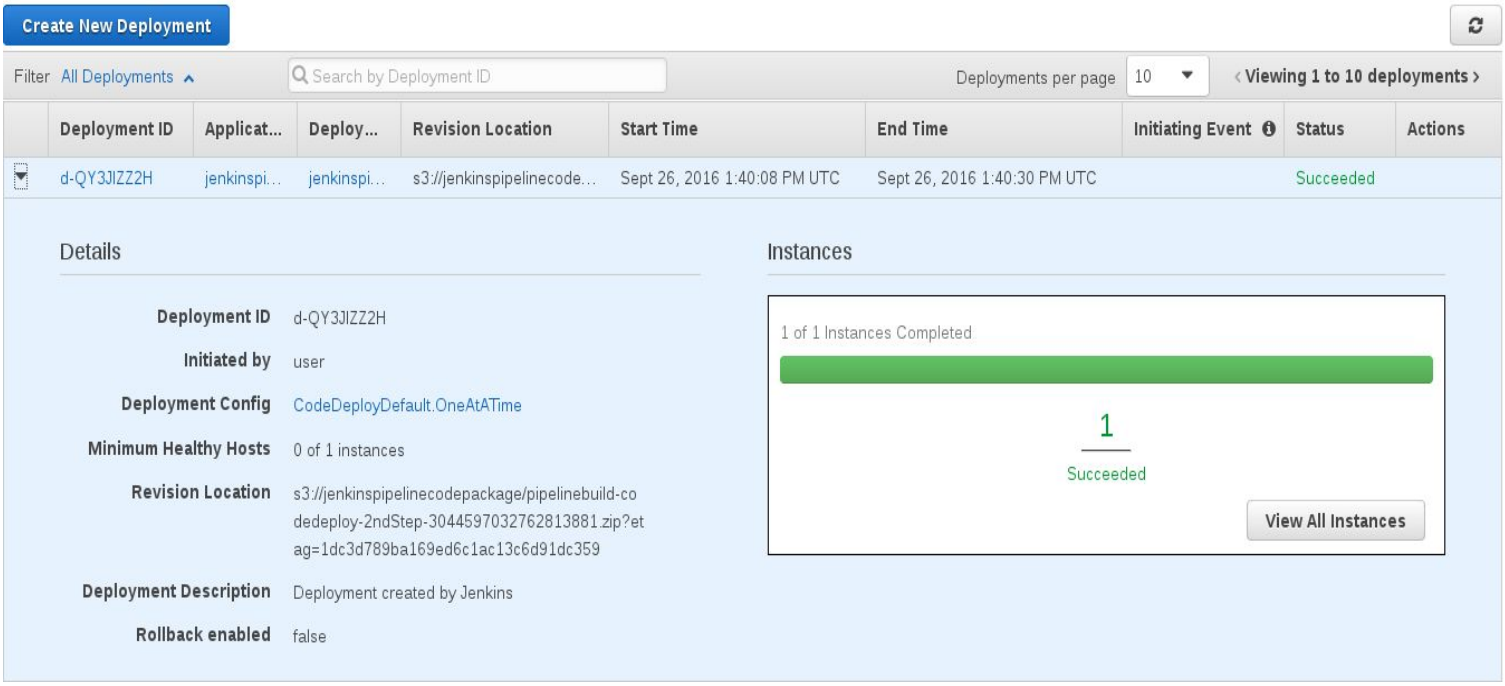
Save Apply

When this Job3 will get build successfully then we will get the console output as below

Console Output

```
Started by upstream project "pipelinebuild-codedeploy-1.5Step" build number 32
originally caused by:
 Started by upstream project "pipelinebuild-codedeploy-1stStep" build number 44
 originally caused by:
  Started by user Nikit Swaraj
Building in workspace /var/lib/jenkins/workspace/pipelinebuild-codedeploy-2ndStep
[pipelinebuild-codedeploy-2ndStep] $ /bin/sh -xe /tmp/hudson6241934088690401524.sh
Zipping files into /tmp/pipelinebuild-codedeploy-2ndStep-3044597032762813881.zip
Uploading zip to s3://jenkinspipelinecodepackage/pipelinebuild-codedeploy-2ndStep-3044597032762813881.zip
Registering revision for application 'jenkinspipelinetestApp'
Creating deployment with revision at {RevisionType: S3,S3Location: {Bucket: jenkinspipelinecodepackage,Key: pipelinebuild-codedeploy-
2ndStep-3044597032762813881.zip,BundleType: zip,ETag: 1dc3d789ba169ed6c1ac13c6d91dc359},}
Finished: SUCCESS
```

After this Build, there will be changes takes place in AWS codedeploy group



After then when you will hit the dns of the instance you will get your Application up and running.

Build Pipeline

Jenkins pipeline (previously workflow) refers to the job flow in a specific manner. Building Pipeline means breaking the big Job into small individual jobs, relying on which, if first job get failed then it will trigger the email to the admin and stop the building process at that step only and will not move to the second job.
To achieve the pipeline, one should need to install the pipeline plugin in Jenkins.

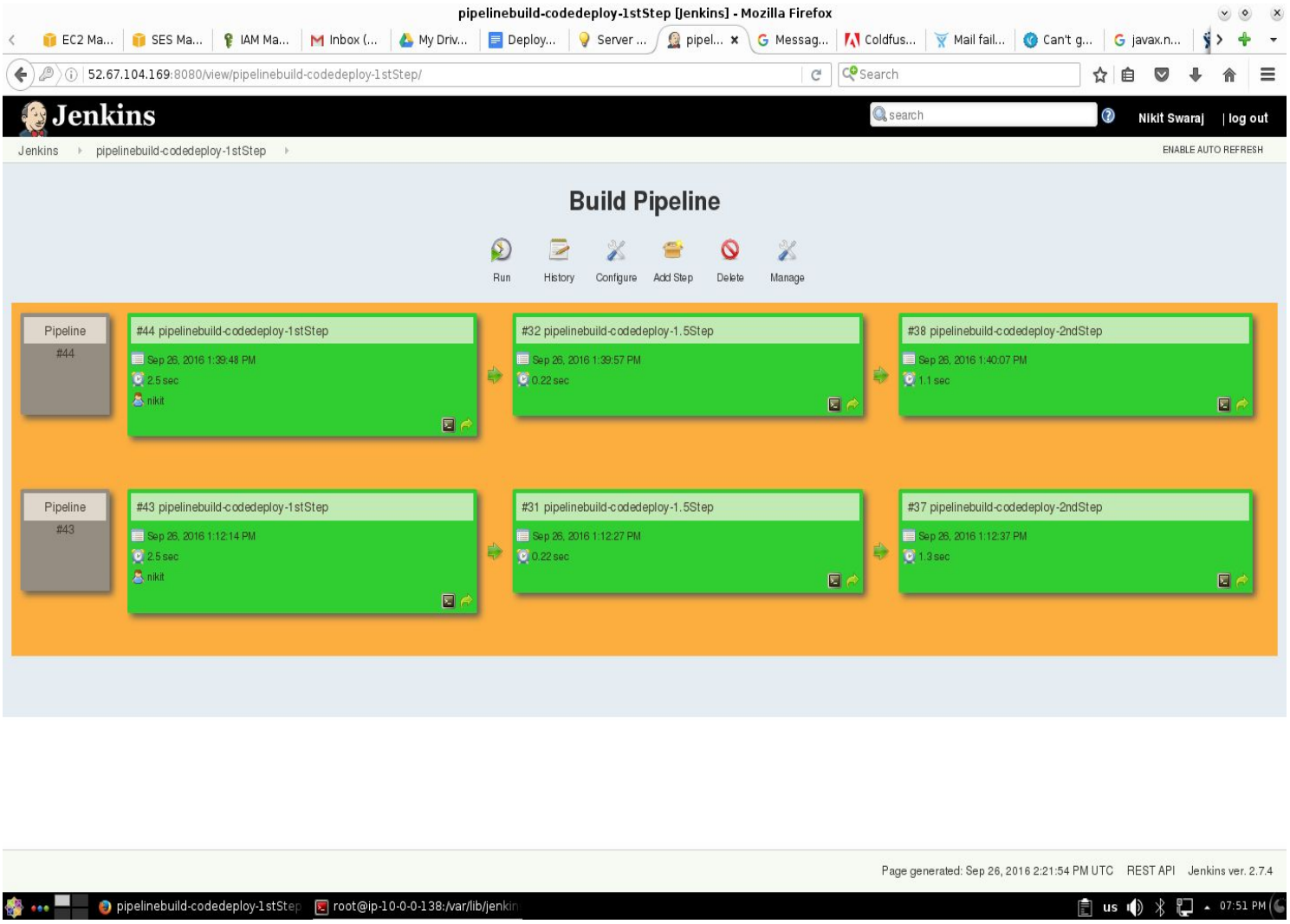
According to the above scenario, the Jobs will be broken into three individual Jobs

Job 1: When the code code commit, the Job 1 will run and it will pull the latest code from the CodeCommit repository, and it will archive the artifact and email about the status of Job1, weather it got successful build or got failed altogether with the console output. If the Job1 got build successfully then it will trigger to Job 2.

Job2: This Job will get run only when the Job 1 will be stable and run successfully. In Job2, the artifacts from Job1 will be copied to workspace 2 and will be pushed to AWS S3 bucket. Post to that if the artifacts will be send to S3 bucket, the email will be send to the admin. And then it will trigger the Job3.

Job3: This Job is responsible to invoke the AWS codedeploy and pull the code from S3 and push it either running ec2 instance or AWS auto scaling instances. When it will be done

The below image shows the structure of pipeline.


pipelinebuild-codedeploy-1stStep [Jenkins] - Mozilla Firefox
52.67.104.169:8080/view/pipelinebuild-codedeploy-1stStep/
Jenkins
Nikit Swaraj | log out
Jenkins pipelinebuild-codedeploy-1stStep
ENABLE AUTO REFRESH
Build Pipeline
Run
History
Configure
Add Step
Delete
Manage
Pipeline #44
#44 pipelinebuild-codedeploy-1stStep
Sep 26, 2016 1:39:48 PM
2.5 sec
nikit
#32 pipelinebuild-codedeploy-1.5Step
Sep 26, 2016 1:39:57 PM
0.22 sec
#38 pipelinebuild-codedeploy-2ndStep
Sep 26, 2016 1:40:07 PM
1.1 sec
Pipeline #43
#43 pipelinebuild-codedeploy-1stStep
Sep 26, 2016 1:12:14 PM
2.5 sec
nikit
#31 pipelinebuild-codedeploy-1.5Step
Sep 26, 2016 1:12:27 PM
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#37 pipelinebuild-codedeploy-2ndStep
Sep 26, 2016 1:12:37 PM
1.3 sec
Page generated: Sep 26, 2016 2:21:54 PM UTC REST API Jenkins ver. 2.7.4
pipelinebuild-codedeploy-1stStep
root@ip-10-0-0-138:/var/lib/jenkin
us
07:51 PM