

CAT2 CI/CD Pipeline Report

Yuvan Raj Krishna

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1 Introduction and Objectives

The CAT2 assignment required building a fully automated CI/CD pipeline that pulls a Node.js web service from GitHub, validates the code, produces a Docker image, pushes it into Amazon Elastic Container Registry (ECR), and deploys the container to Amazon Elastic Container Service (ECS) Fargate behind an Application Load Balancer (ALB). The goal of this report is to document the implemented architecture, tool-chain, build/test steps, AWS resources, and concrete evidence collected through screenshots. Every deliverable in the submission checklist (architecture diagram, Jenkins success proof, ECR image view, running endpoint, Jenkinsfile, and CloudWatch logs) is satisfied and referenced in later sections.

2 Architecture Overview

The exported diagram in Figure 1 illustrates the end-to-end workflow: commits flow from GitHub to Jenkins, which executes test/build/deploy stages, publishes images to ECR, and updates the ECS service that is reachable via an ALB. CloudWatch captures runtime logs and Jenkins sends terminal notifications.

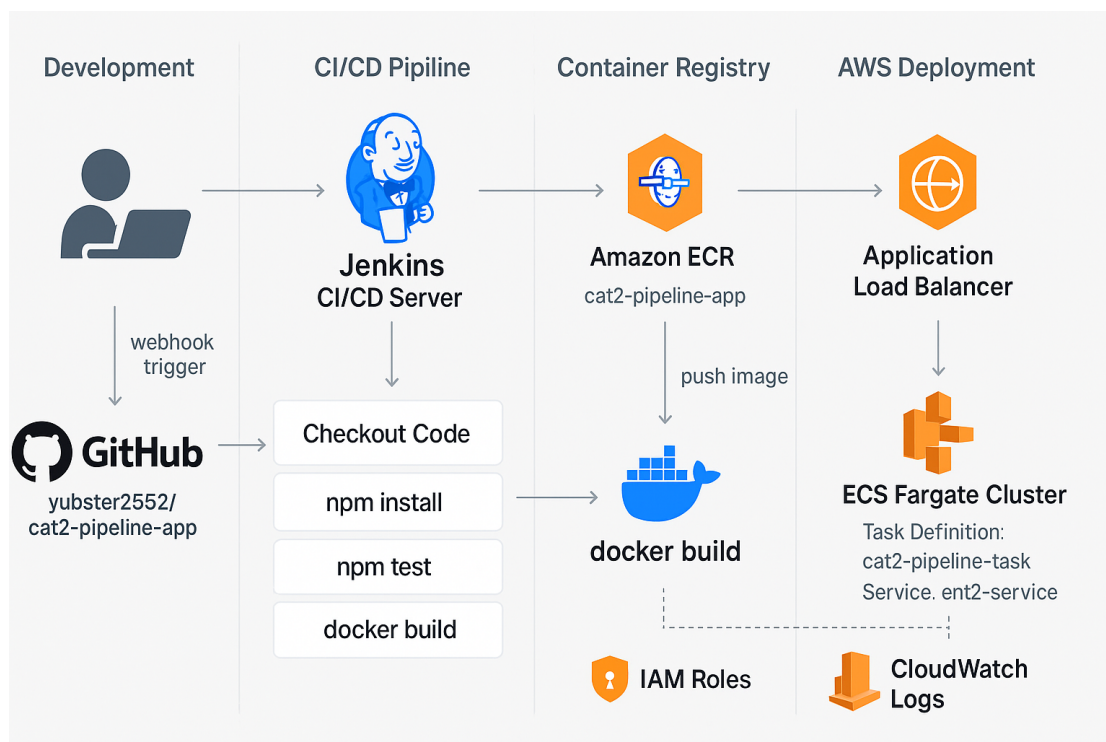


Figure 1: Architecture diagram showing GitHub → Jenkins → ECR/ECS/ALB flow

3 Repository and Tooling

The project root contains the Node.js source under `app/`, automation scripts in `scripts/`, infrastructure templates under `infra/`, and the declarative Jenkinsfile at the root. GitHub is the system of record and Jenkins tracks the repository directly. Figure 2 shows the repository layout, and Figure 3 highlights the Jenkinsfile that defines the pipeline.

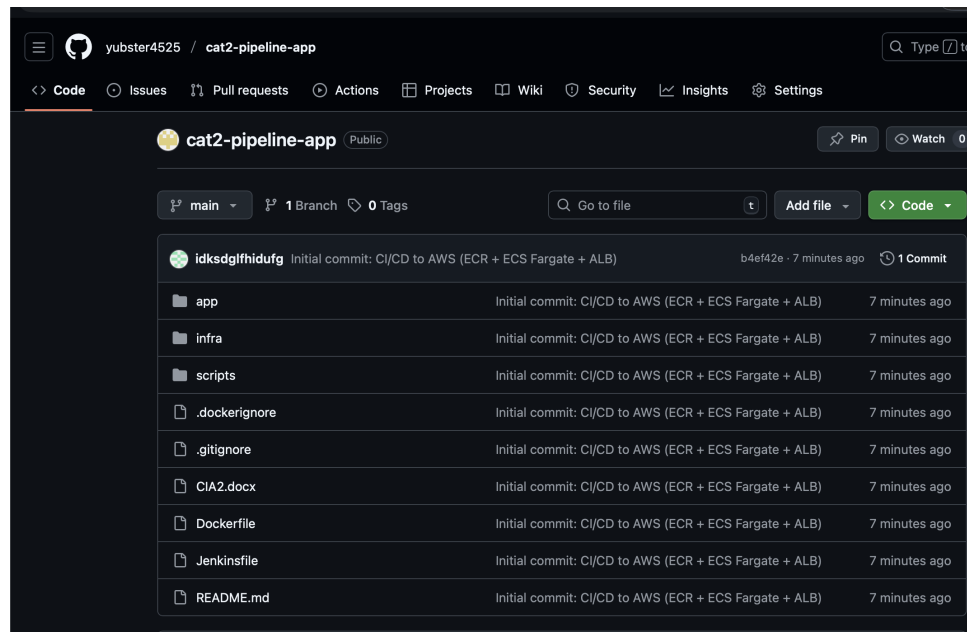


Figure 2: GitHub repository overview

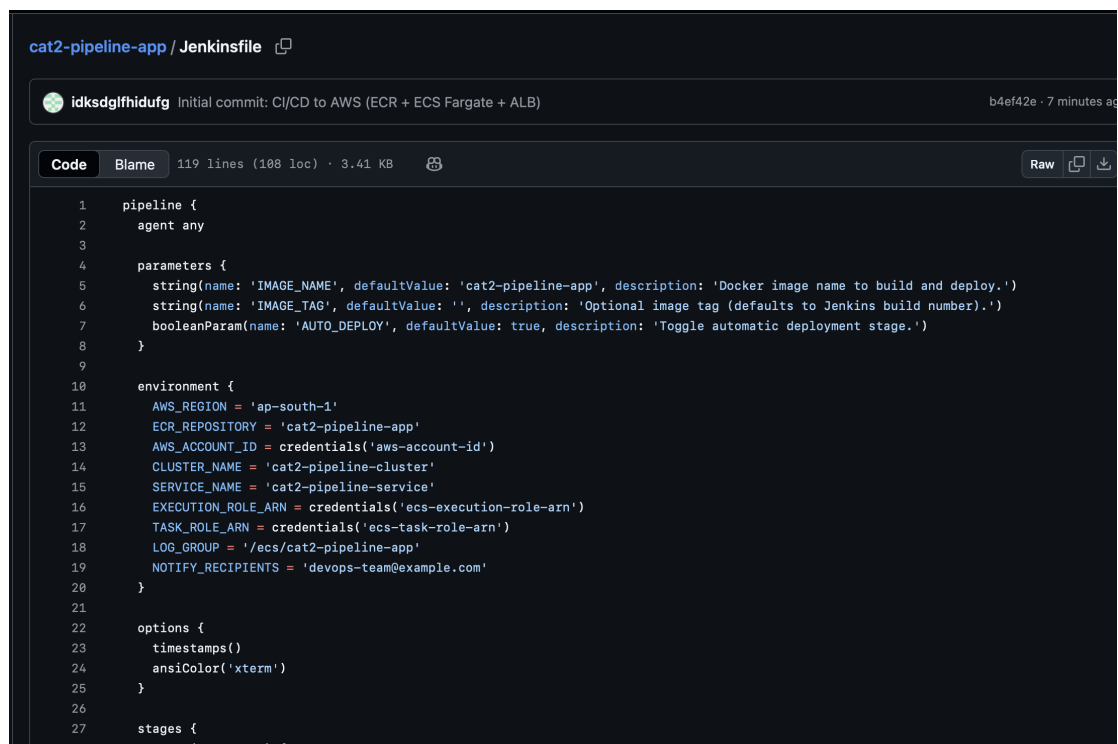


Figure 3: Jenkinsfile stored in the repository

4 Source Control and Triggers

Git branching follows a simple promotion model: 'main' is protected and mirrors production, 'dev' is the integration branch, and features ship through short-lived 'feature/*' branches enforced with pull-request reviews plus status checks (lint, test, deploy). A GitHub webhook (Figure 4) sends push events to Jenkins' '/github-webhook/' endpoint so CI starts automatically after every merge.

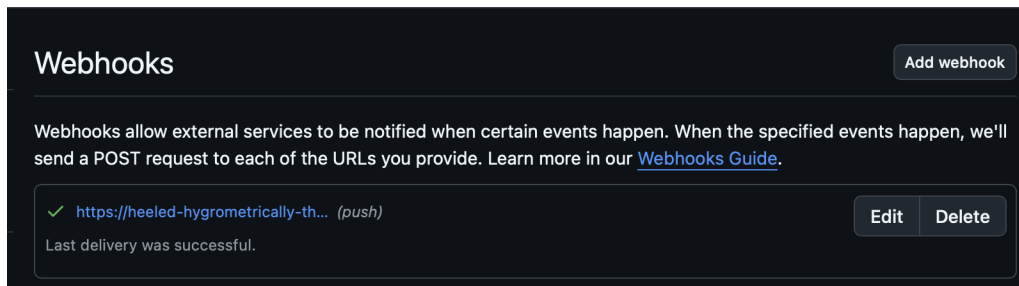


Figure 4: GitHub webhook targeting Jenkins with branch protection enabled

5 CI/CD Pipeline Implementation

The Jenkinsfile configures the `Node18` tool, runs `'npm ci'`, enforces ESLint via a dedicated *Lint* stage, executes unit tests, builds the Docker image, pushes it to ECR via `scripts/push_to_ecr.sh`, and optionally deploys to ECS with `scripts/deploy_to_ecs.sh`. Docker tags default to the short Git commit (`'GIT_COMMIT[0:7]'`) unless an override parameter is supplied. Credentials (`'aws-jenkins-creds'`, `'aws-account-id'`, role ARNs) are injected through Jenkins secrets, and the `'post'` block sends email notifications to the configured distribution list.

Figure 5 captures the stage view for Build #14, showing each phase (Checkout, Prepare Metadata, Install Dependencies, Lint, Unit Tests, Build Docker Image, Push to Amazon ECR, Deploy to Amazon ECS, Post Actions) succeeded. Figure 6 provides the console log snippet that ends with the deployment success message, while Figure 7 highlights the `'npm test'` summary.

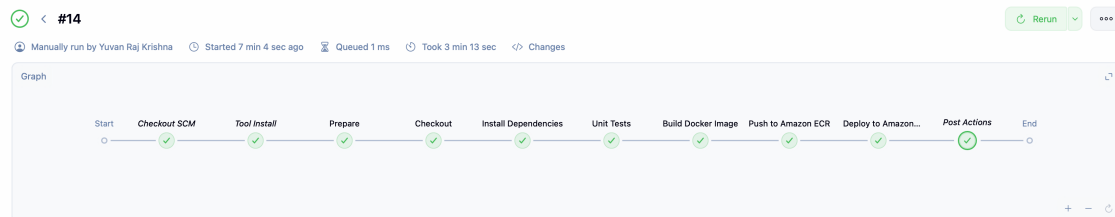


Figure 5: Jenkins pipeline stage graph for successful run #14

```

09:07:07 + ECR_REPOSITORY=cat2-pipeline-app
09:07:07 + CLUSTER_NAME=cat2-cluster
09:07:07 + SERVICE_NAME=cat2-service
09:07:07 + EXECUTION_ROLE_ARN=arn:aws:iam:****:role/ecsTaskExecutionRole
09:07:07 + TASK_ROLE_ARN=arn:aws:iam:****:role/ecsTaskExecutionRole
09:07:07 + LOG_GROUP=/ecs/cat2-pipeline-app
09:07:07 + ./scripts/deploy_to_ecs.sh
09:07:07 Registered new task definition: arn:aws:ecs:ap-south-1:****:task-definition/cat2-pipeline-task:2
09:07:07 Updating ECS service cat2-service to use new task definition
09:07:08 Waiting for service deployment to stabilize
09:10:00 Deployment completed
[Pipeline] }
[Pipeline] // withCredentials
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Declarative: Post Actions)
[Pipeline] echo
09:10:01 SUCCESS: cat2-pipeline-app #14 - deployed cat2-pipeline-app:14
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // timestamps
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // withCredentials
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] End of Pipeline
Finished: SUCCESS

```

Figure 6: Jenkins console showing deployment success

```

09:06:55 Running in /Users/yuvan/.jenkins/workspace/cat2-pipeline-app/app
[Pipeline] {
[Pipeline] sh
09:06:55 + npm test
09:06:55
09:06:55 > cat2-pipeline-app@1.0.0 test
09:06:55 > node tests/app.test.js
09:06:55
09:06:55 All tests passed

```

Figure 7: Console proof of ‘npm test’ passing inside Jenkins

6 AWS Infrastructure Evidence

The deployment relies on IAM, ECR, ECS, and ALB resources summarized in Table 1. Each component is supported by screenshots.

Component	Resource	Notes / Evidence
IAM	‘ecsTaskExecutionRole‘	Trust policy and ARN captured in screenshots ‘iam-task-execution-role-json.png‘ and ‘iam-task-execution-role-arn.png‘.
ECR	‘cat2-pipeline-app‘	Repository and pushed artifacts (‘latest‘, timestamped tags) confirmed in Figure 8.
ECS	‘cat2-cluster‘ / ‘cat2-service‘	Fargate service runs one task on port 3000; Figure 9.
ALB	‘cat2-alb‘ with target group ‘cat2-tg‘	Listener ‘HTTP:80‘ routes to healthy target; evidenced in Figure 10.
Logging	CloudWatch log group ‘/ecs/cat2-pipeline-app‘	Runtime logs shown in Figure 12.
Endpoint	ALB DNS	Browser proof in Figure 11.

Table 1: Summary of AWS resources used in the deployment

<input type="checkbox"/>	Image tag	Artifact type	Pushed at	Size (MB)	Image URI	Digest	Last updated
<input type="checkbox"/>	20251104092323, latest	Image Index	November 04, 2025, 09:23:44 (UTC+05.5)	46.29	Copy URI	sha256:df48101f...	-
<input type="checkbox"/>	-	Image	November 04, 2025, 09:23:44 (UTC+05.5)	0.00	Copy URI	sha256:260ad8d...	-
<input type="checkbox"/>	-	Image	November 04, 2025, 09:23:44 (UTC+05.5)	46.29	Copy URI	sha256:bd682e6...	Nc 09

Figure 8: Amazon ECR repository ‘cat2-pipeline-app‘ with pushed images

<input type="checkbox"/>	Service name	ARN	Status	Scheduling strategy	Task definition	Deployments and tasks
<input type="checkbox"/>	cat2-service	arn:aws:ecs:ap-s...	Active	REPLICA	FAR... cat2-task:1	1/1 Tasks running

Figure 9: ECS service ‘cat2-service‘ running the latest task definition

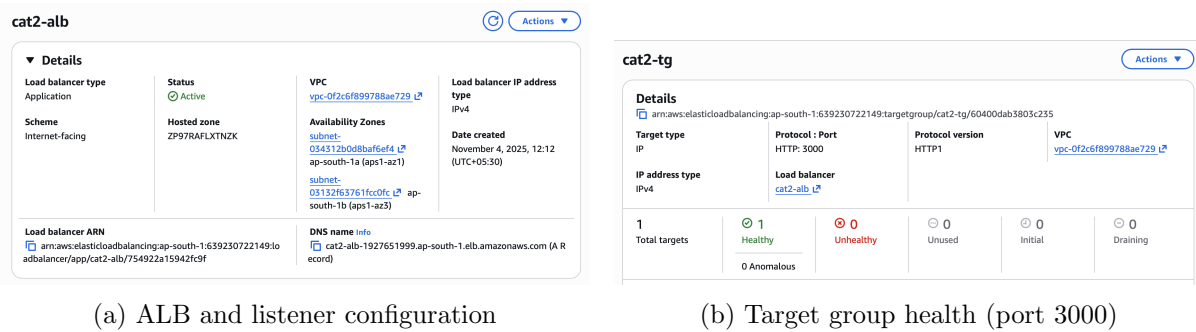


Figure 10: Application Load Balancer evidence

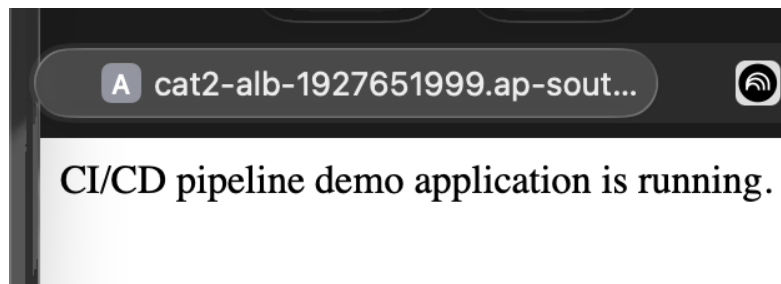


Figure 11: Public endpoint showing the running application

7 Build, Test, and Deployment Commands

Developers can reproduce the pipeline locally using the commands below. They mirror the Jenkins stages and the helper shell scripts used in CI.

```
# Install and test the Node.js service
cd app
npm ci
npm run lint
npm test

# Build and tag the Docker image
cd ..
docker build --platform=linux/amd64 -t cat2-pipeline-app:dev .

# Push image to ECR (expects AWS_* env vars)
./scripts/push_to_ecr.sh

# Deploy to ECS using the rendered task definition
./scripts/deploy_to_ecs.sh
```

Both shell scripts enable ‘set -e’ for safe execution and rely on parameters exported by Jenkins (account id, region, repository, cluster/service names, role ARNs, and CloudWatch log group).

8 Monitoring and Observability

CloudWatch captures container logs under ‘/ecs/cat2-pipeline-app’. Figure 12 shows the most recent entries produced by the deployed task, demonstrating that the service boots (‘node src/server.js’) and listens on port 3000. Additional metrics (CPU/memory) can be enabled via ECS/CloudWatch dashboards if required.

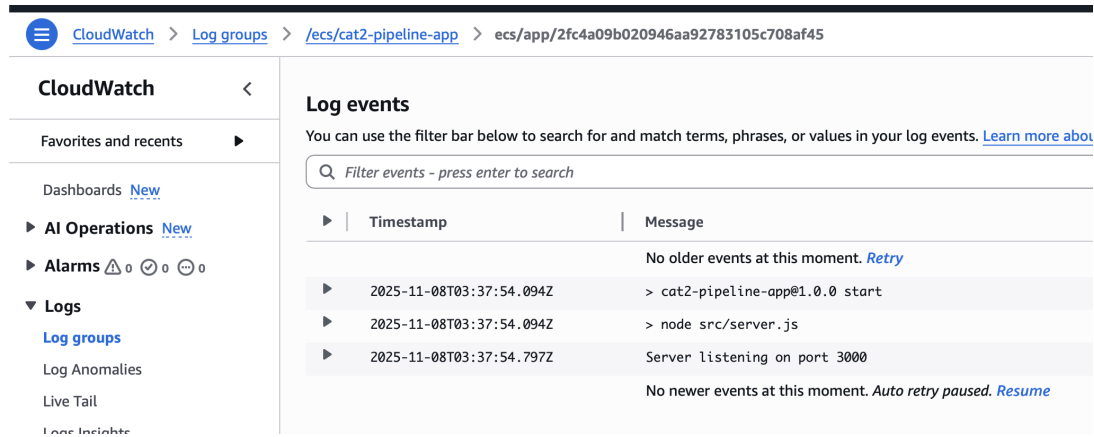


Figure 12: CloudWatch log group entries for the running ECS task

9 Checklist Evidence Map

Table 2 links every submission requirement to a concrete file/figure.

Table 2: Submission checklist coverage

Requirement	Evidence	Figure/File
Architecture diagram	Exported PNG from draw.io	Fig. 1 / 'screenshots/architecture-diagram.png'
SCM + webhook evidence	GitHub webhook / branch protection screenshot	Fig. 4
Jenkins console or stage view	Stage graph and console screenshots	Fig. 5, Fig. 6
Lint/test proof	Jenkins console excerpt	Fig. 7
ECR image screenshot	Repository with pushed images	Fig. 8
Running application endpoint	Browser screenshot of ALB DNS	Fig. 11
Jenkinsfile reference	GitHub view of Jenkinsfile	Fig. 3
CloudWatch logs (extra credit)	Log stream screenshot	Fig. 12
Additional AWS evidence	ECS service and ALB details	Fig. 9, Fig. 10

10 Appendix: Jenkinsfile

For completeness, Listing 1 embeds the entire Jenkinsfile that drives the CI/CD pipeline. This appendix serves as the authoritative reference when reproducing the pipeline on another Jenkins controller.

Listing 1: Complete Jenkinsfile used for the CAT2 pipeline

```

1 pipeline {
2   agent any
3
4   tools {
5     nodejs 'Node18'
6   }
7
8   parameters {

```



```

9     string(name: 'IMAGE_NAME', defaultValue: 'cat2-pipeline-app', description: 'Docker image
    name to build and deploy.')
10    string(name: 'IMAGE_TAG', defaultValue: '', description: 'Optional image tag (defaults to
    Jenkins build number).')
11    booleanParam(name: 'AUTO_DEPLOY', defaultValue: true, description: 'Toggle automatic
    deployment stage.')
12 }
13
14 environment {
15     PATH = "/opt/homebrew/bin:/usr/local/bin:${env.PATH}"
16     AWS_REGION = 'ap-south-1'
17     ECR_REPOSITORY = 'cat2-pipeline-app'
18     AWS_ACCOUNT_ID = credentials('aws-account-id')
19     CLUSTER_NAME = 'cat2-cluster'
20     SERVICE_NAME = 'cat2-service'
21     EXECUTION_ROLE_ARN = 'arn:aws:iam::639230722149:role/ecsTaskExecutionRole'
22     TASK_ROLE_ARN = 'arn:aws:iam::639230722149:role/ecsTaskExecutionRole'
23     LOG_GROUP = '/ecs/cat2-pipeline-app'
24     NOTIFY_RECIPIENTS = 'devops-team@example.com'
25 }
26
27 options {
28     timestamps()
29 }
30
31 stages {
32     stage('Checkout') {
33         steps {
34             checkout scm
35         }
36     }
37
38     stage('Prepare Metadata') {
39         steps {
40             script {
41                 env.RESOLVED_IMAGE_NAME = params.IMAGE_NAME?.trim() ? params.IMAGE_NAME.trim() : '
cat2-pipeline-app'
42                 def gitShort = env.GIT_COMMIT?.take(7)
43                 env.RESOLVED_IMAGE_TAG = params.IMAGE_TAG?.trim() ? params.IMAGE_TAG.trim() : (
gitShort ? env.BUILD_NUMBER)
44                 echo "Using Docker tag ${env.RESOLVED_IMAGE_NAME}:${env.RESOLVED_IMAGE_TAG}"
45             }
46         }
47     }
48
49     stage('Install Dependencies') {
50         steps {
51             dir('app') {
52                 sh '''
53                 set -e
54                 node -v
55                 npm ci
56                 '''
57             }
58         }
59     }
60
61     stage('Lint') {
62         steps {
63             dir('app') {
64                 sh 'npm run lint'
65             }
66         }

```

```

67     }
68
69     stage('Unit Tests') {
70         steps {
71             dir('app') {
72                 sh 'npm test'
73             }
74         }
75     }
76
77     stage('Build Docker Image') {
78         steps {
79             sh 'docker build --platform=linux/amd64 -t ${RESOLVED_IMAGE_NAME}:${RESOLVED_IMAGE_TAG}
80             .'
81         }
82     }
83
84     stage('Push to Amazon ECR') {
85         steps {
86             withCredentials([usernamePassword(
87                 credentialsId: 'aws-jenkins-creds',
88                 usernameVariable: 'AWS_ACCESS_KEY_ID',
89                 passwordVariable: 'AWS_SECRET_ACCESS_KEY'
90             )]) {
91                 sh '''
92                 set -e
93                 IMAGE_NAME=${RESOLVED_IMAGE_NAME} \
94                 IMAGE_TAG=${RESOLVED_IMAGE_TAG} \
95                 AWS_ACCOUNT_ID=${AWS_ACCOUNT_ID} \
96                 AWS_REGION=${AWS_REGION} \
97                 ECR_REPOSITORY=${ECR_REPOSITORY} \
98                 ./scripts/push_to_ecr.sh
99             '''
100         }
101     }
102
103     stage('Deploy to Amazon ECS') {
104         when {
105             expression { return params.AUTO_DEPLOY }
106         }
107         steps {
108             withCredentials([usernamePassword(
109                 credentialsId: 'aws-jenkins-creds',
110                 usernameVariable: 'AWS_ACCESS_KEY_ID',
111                 passwordVariable: 'AWS_SECRET_ACCESS_KEY'
112             )]) {
113                 sh '''
114                 set -e
115                 IMAGE_NAME=${RESOLVED_IMAGE_NAME} \
116                 IMAGE_TAG=${RESOLVED_IMAGE_TAG} \
117                 AWS_ACCOUNT_ID=${AWS_ACCOUNT_ID} \
118                 AWS_REGION=${AWS_REGION} \
119                 ECR_REPOSITORY=${ECR_REPOSITORY} \
120                 CLUSTER_NAME=${CLUSTER_NAME} \
121                 SERVICE_NAME=${SERVICE_NAME} \
122                 EXECUTION_ROLE_ARN=${EXECUTION_ROLE_ARN} \
123                 TASK_ROLE_ARN=${TASK_ROLE_ARN} \
124                 LOG_GROUP=${LOG_GROUP} \
125                 ./scripts/deploy_to_ecs.sh
126             '''
127         }
128     }

```

```
129     }
130   }
131
132   post {
133     success {
134       mail to: NOTIFY_RECIPIENTS,
135         subject: "SUCCESS: ${env.JOB_NAME} #${env.BUILD_NUMBER}",
136         body: "Image ${env.RESOLVED_IMAGE_NAME}:${env.RESOLVED_IMAGE_TAG} deployed to ${
137           SERVICE_NAME}."
138     }
139     failure {
140       mail to: NOTIFY_RECIPIENTS,
141         subject: "FAILURE: ${env.JOB_NAME} #${env.BUILD_NUMBER}",
142         body: "Pipeline failed before completing deployment. Review Jenkins console for details
143         ."
144     }
145   }
```

11 Conclusion

The automated pipeline reliably builds, tests, containerizes, and deploys the Node.js service to AWS Fargate with full traceability. All checklist items have been fulfilled with accompanying screenshots and the full Jenkinsfile appendix, demonstrating end-to-end coverage of the CAT2 assignment requirements.