

Final Capstone Project

Presented by

Satyam

DevOps Training (Batch-1)

Under the Guidance of

Mr. Murali Mohan

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Step 1: Jira Workflow

- Each candidate must assign themselves tasks in Jira.
- Track task progress using Jira board (To Do → In Progress → Done).
- Export the board as part of the final submission.

Step 2: GitHub Workflow

- Clone the GitHub repository: <https://github.com/akshu20791/Book-My-Show/>
- Create a feature branch and make changes.
- Push changes and raise a Pull Request (PR).
- Review peers' PRs and approve before merging into the main branch.
- Submit the final PR link as deliverable.

Step 3: Jenkins CI/CD Pipeline

Pipeline stages to implement:

1. Clean Workspace
2. Checkout Code from GitHub
3. SonarQube Analysis (Quality Gate)
4. Install Dependencies (NPM)
5. Trivy FS Scan (Optional)
6. OWASP Dependency Check (Optional)
7. Docker Build & Push to DockerHub (via Jenkins)
8. Deploy to Docker Container
9. (Optional) Deploy to Kubernetes (EKS)
10. Email Notification on build result

Step 4: Docker Deployment

- Candidates must write their own Dockerfile to build the BMS app image.
- Build Docker image and push to DockerHub via Jenkins.
- Run container locally and validate accessibility on port 3000.

Step 5: Kubernetes Deployment (EKS)

- Candidates must write their own Kubernetes manifests (`deployment.yaml`, `service.yaml`).

- Deploy the application on EKS cluster.
- Expose service using NodePort or LoadBalancer.
- Validate deployment using 'kubectl get pods' and 'kubectl get svc'.

Step 6: Monitoring & Observability

- Install Prometheus and Node Exporter to collect metrics.
- Integrate Jenkins metrics into Prometheus.
- Install Grafana, configure Prometheus as a data source.
- Add dashboards for Node health and Jenkins performance.
- Submit Grafana screenshots in deliverables.

Introduction

This capstone project simulates a real-world DevOps workflow for the Book-My-Show (BMS) application, covering the complete CI/CD lifecycle from code collaboration to deployment and monitoring. The project demonstrates how modern organizations implement automation, security, and observability into their software delivery process.

The workflow begins with project management in Jira, where tasks are created, assigned, and tracked using an Agile board. Version control and collaboration are handled through GitHub, where feature branches, pull requests, and code reviews ensure code quality.

A Jenkins pipeline orchestrates the CI/CD process, which includes:

- Code checkout and quality checks with SonarQube.
- Installing dependencies and performing security scans (Trivy, OWASP).
- Building and pushing Docker images to DockerHub.
- Deploying the application to a Docker container and optionally to an EKS cluster with Kubernetes manifests.

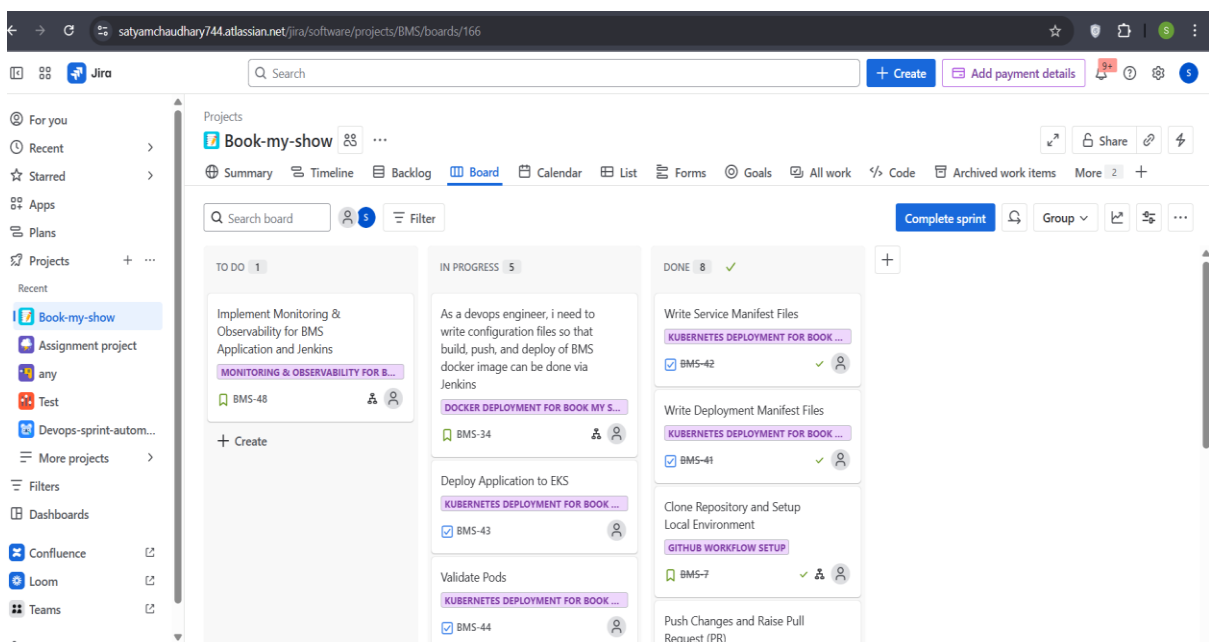
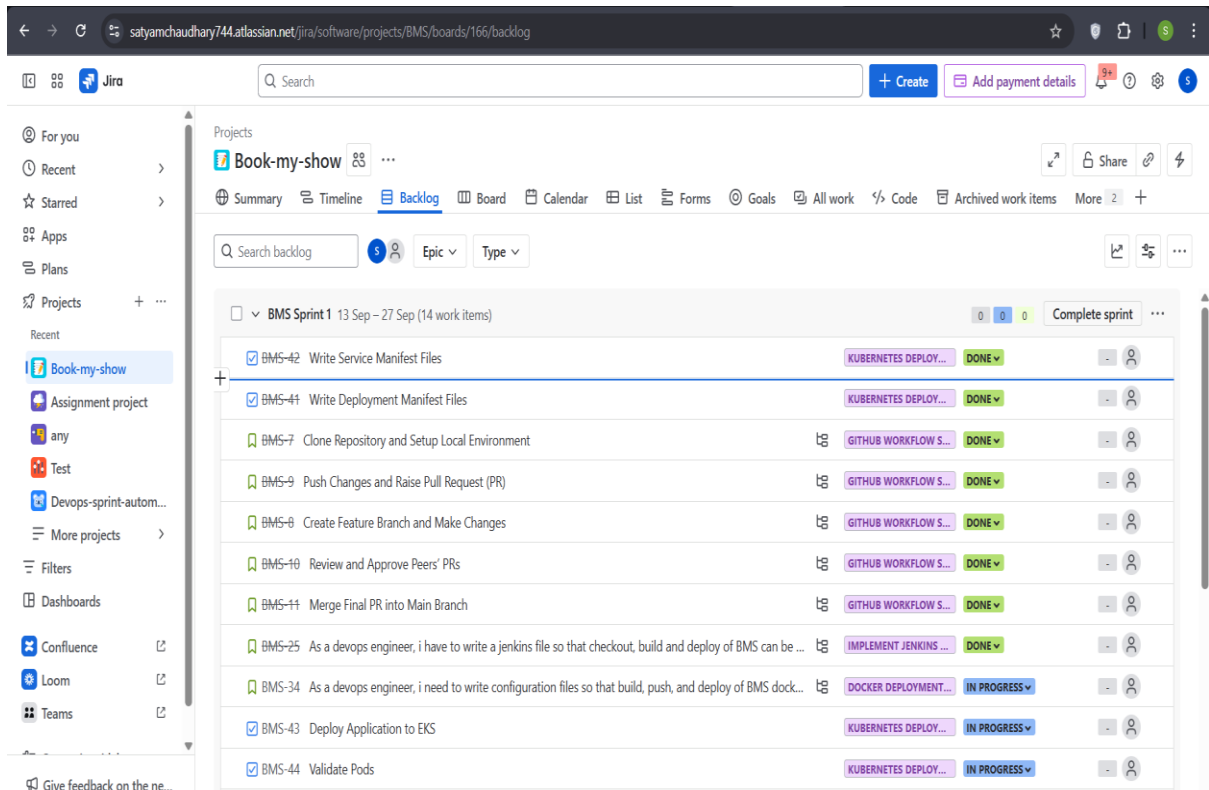
For deployment and scalability, Docker and Kubernetes ensure consistent runtime environments. Finally, Prometheus and Grafana provide monitoring and observability, enabling visibility into system performance, Jenkins pipelines, and infrastructure health.

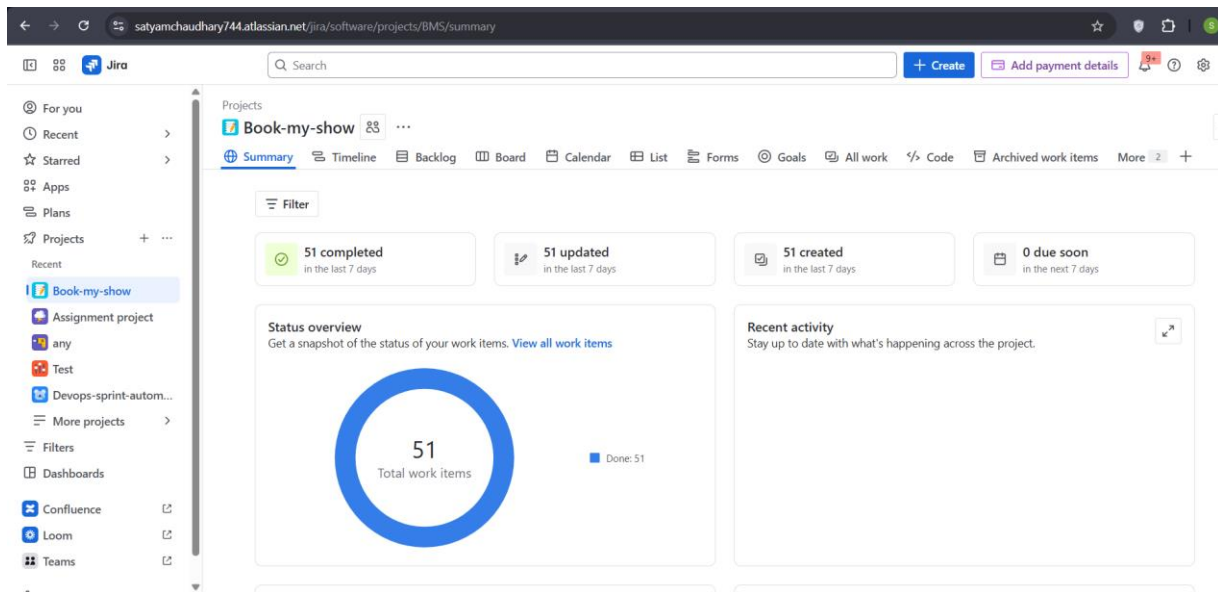
This end-to-end project integrates collaboration, automation, security, deployment, and monitoring, reflecting industry-standard DevOps practices.

Solution

Step 1

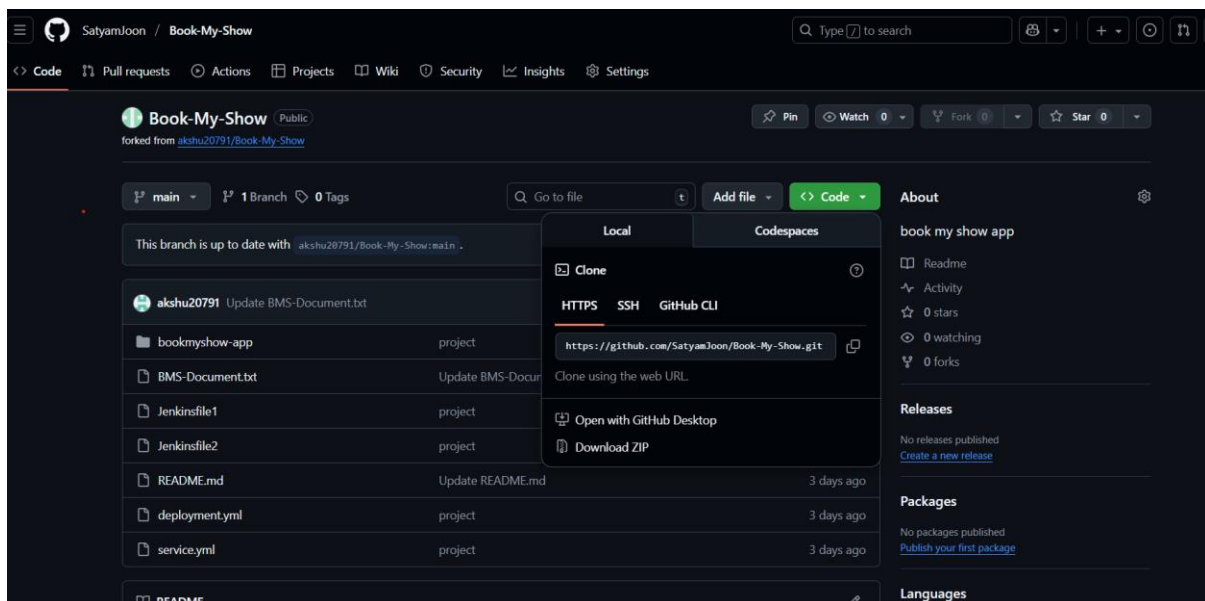
1. Jira was used to manage and track project tasks using an Agile board.
2. All activities required for the Book-My-Show (BMS) DevOps pipeline were broken down into tasks and assigned to myself.
3. The workflow followed the standard Jira board structure.





Step 2

1. Fork git repository



Clone repository <https://github.com/SatyamJoon/Book-My-Show.git>

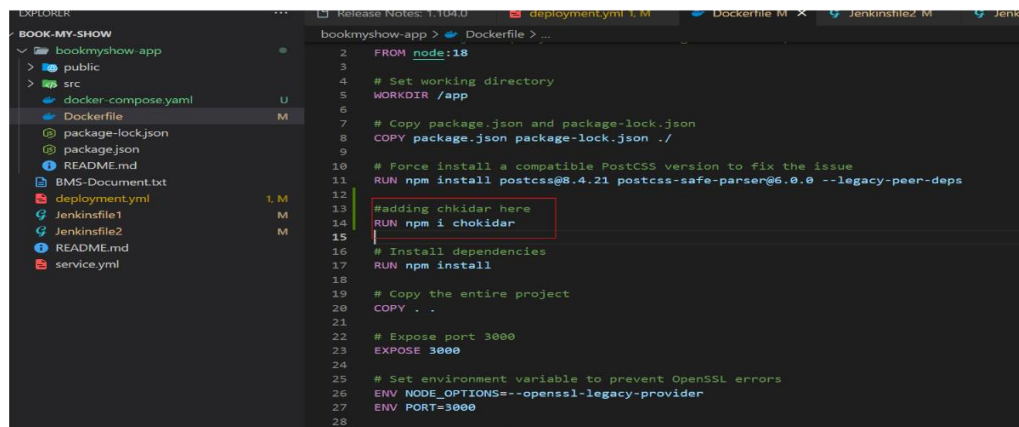
```
Command Prompt
Microsoft Windows [Version 10.0.22631.5768]
(c) Microsoft Corporation. All rights reserved.

C:\Users\HP>git clone https://github.com/SatyamJoon/Book-My-Show.git
fatal: destination path 'Book-My-Show' already exists and is not an empty directory.

C:\Users\HP>git clone https://github.com/SatyamJoon/Book-My-Show.git
Cloning into 'Book-My-Show'...
remote: Enumerating objects: 136, done.
remote: Counting objects: 100% (136/136), done.
remote: Compressing objects: 100% (114/114), done.
remote: Total 136 (delta 19), reused 129 (delta 16), pack-reused 0 (from 0)Receiving objects: 89% (122/136)
Receiving objects: 100% (136/136), 1.52 MiB | 3.87 MiB/s, done.
Resolving deltas: 100% (19/19), done.

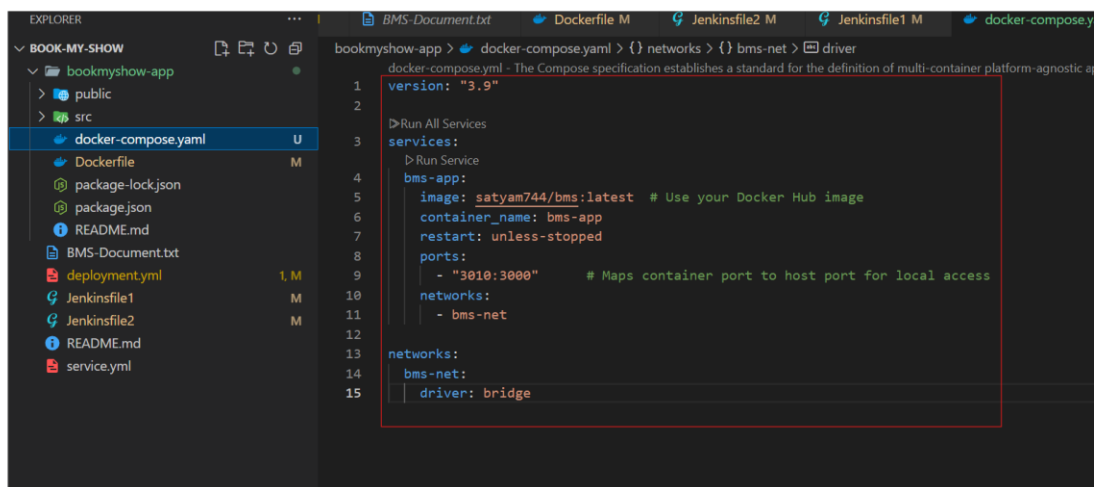
C:\Users\HP>
```

Editing Dockerfile



```
FROM node:18
# Set working directory
WORKDIR /app
# Copy package.json and package-lock.json
COPY package.json package-lock.json ./
# Force install a compatible PostCSS version to fix the issue
RUN npm install postcss@8.4.21 postcss-safe-parser@6.0.0 --legacy-peer-deps
#adding chokidar here
RUN npm i chokidar
# Install dependencies
RUN npm install
# Copy the entire project
COPY . .
# Expose port 3000
EXPOSE 3000
# Set environment variable to prevent OpenSSL errors
ENV NODE_OPTIONS=--openssl-legacy-provider
ENV PORT=3000
```

Creating docker-compose.yaml file



```
version: "3.9"
services:
  bms-app:
    image: satyam744/bms:latest # Use your Docker Hub image
    container_name: bms-app
    restart: unless-stopped
    ports:
      - "3010:3000" # Maps container port to host port for local access
    networks:
      - bms-net
networks:
  bms-net:
    driver: bridge
```

Now, I have open terminal move to git bash and use below commands

>> git branch feature

>> git checkout feature

>> git add .

>> git status

>> git commit -m "docker-compose file"

>> git push -u origin feature

Now go to github and click on compare and pull request

The screenshot shows the GitHub web interface for a repository named 'Book-My-Show' by user 'SatyamJoon'. The 'Comparing changes' section is active, comparing the 'base: master' branch with the 'compare: feature' branch. A green 'Create pull request' button is highlighted with a red rectangle. Below the comparison, it shows '1 commit', '1 file changed', and '1 contributor'. A commit titled 'adding docker compose file' by 'SatyamJoon' is listed, committed 10 minutes ago. At the bottom, it states 'Showing 1 changed file with 15 additions and 0 deletions.' and has 'Split' and 'Unified' view options.

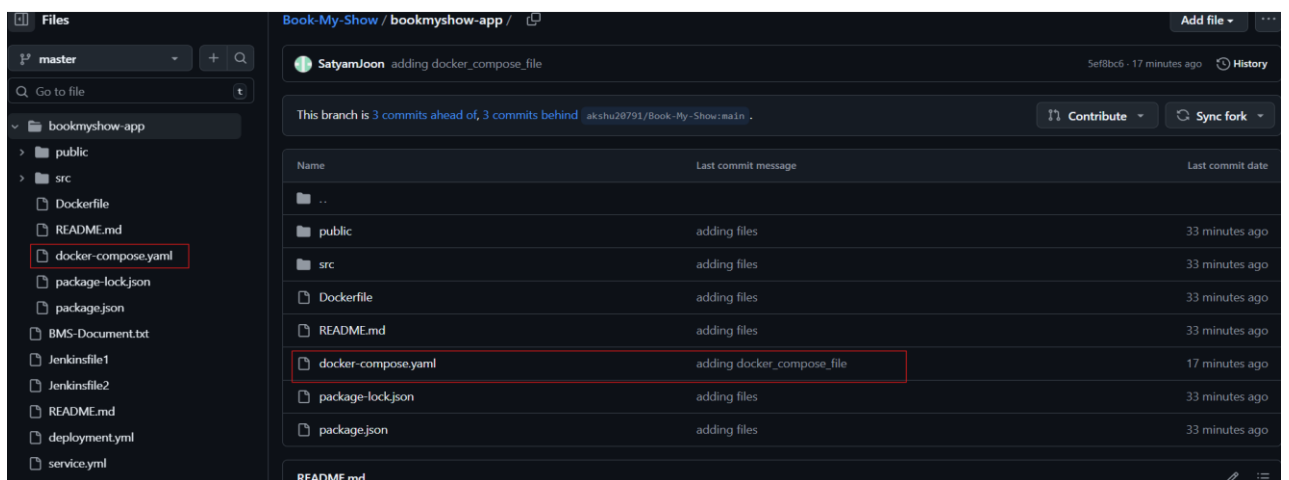
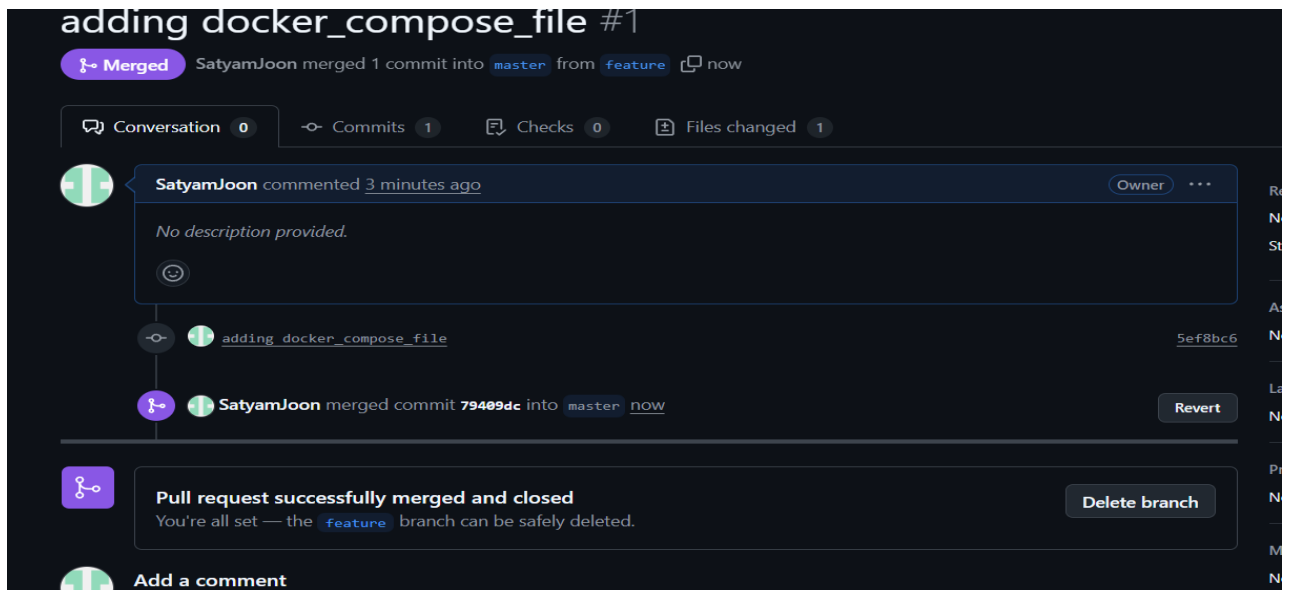
This screenshot shows the diff view for the commit 'adding docker compose file'. It displays the changes to the file 'bookmyshow-app/docker-compose.yaml'. The diff shows 15 additions and 0 deletions. The content of the file is as follows:

```
@@ -0,0 +1,15 @@
1 + version: "3.9"
2 +
3 + services:
4 +   bms-app:
5 +     image: satyam744/bms:latest # Use your Docker Hub image
6 +     container_name: bms-app
7 +     restart: unless-stopped
8 +     ports:
9 +       - "3010:3000" # Maps container port to host port for local access
10 +     networks:
11 +       - bms-net
12 +
13 + networks:
14 +   bms-net:
15 +     driver: bridge
```

The 'driver: bridge' line at the bottom is circled in red. The interface also shows the 'Create pull request' button and the commit details.

Merge pull request ▾ You can also merge this with the command line. [View command line instructions.](#)

Confirm merge



Link for the pull request → <https://github.com/SatyamJoon/Book-My-Show/pull/1>

Step 3

1. Launch the 2 ec2 server for t2.medium and storage upto 20gb. One for Jenkins and one for SonarQube.
2. Install Jenkins, Java and Docker on Jenkins server, and Java, Docker and Sonar on sonar server.
3. For launching SonarQube , I use command and `https://<public ip>:9000` .
4. `>> docker run -d --name sonarqube -p 9000:9000 sonarqube:community`
5. In Jenkins plugin, I have installed plugins for Docker, Pipeline and SonarQube.
6. Configure the Jenkins along with credentials of Docker-hub and SonarQube.
7. Writing the pipeline script and start build.

The screenshot displays the AWS Management Console interface for the 'eu-north-1' region. The top navigation bar shows the account ID '3513-7043-0610' and the user 'SatyamAWS'. The left sidebar contains navigation links for Dashboard, AWS Global View, Events, Instances, Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, and Capacity Reservations. The main content area shows the 'Instances (1/5)' page. A table lists five instances, with 'satyam-kuber...' (i-0b9fa32ec7c2ed0ed) selected. The details for this instance are shown below, including its status as 'Running', public IPv4 address, and private IPv4 addresses.

	Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4
<input type="checkbox"/>	Satyam-sonar1	i-0a41c2871bb7c550d	Stopped	t3.small	-	View alarms +	eu-north-1c	-
<input type="checkbox"/>	satyam-cluster...	i-0952813ab761e0372	Running	t3.small	3/3 checks passed	View alarms +	eu-north-1b	ec2-51-20-5
<input type="checkbox"/>	Satyam-jenkins	i-03fcc6fa5be4c4270	Running	t3.small	3/3 checks passed	View alarms +	eu-north-1a	ec2-16-171-
<input checked="" type="checkbox"/>	satyam-kuber...	i-0b9fa32ec7c2ed0ed	Running	t3.small	3/3 checks passed	View alarms +	eu-north-1a	ec2-13-53-1
<input type="checkbox"/>	satyam-cluster...	i-0094741d651434953	Running	t3.small	3/3 checks passed	View alarms +	eu-north-1a	ec2-16-16-2

i-0b9fa32ec7c2ed0ed (satyam-kubemetes)

Details	Status and alarms	Monitoring	Security	Networking	Storage	Tags
Instance summary Instance ID i-0b9fa32ec7c2ed0ed IPv6 address	Public IPv4 address 13.53.122.52 open address	Private IPv4 addresses 172.31.20.189 Public DNS 13.53.122.52.eu-north-1.compute.amazonaws.com	Instance state Running			

Manage Jenkins

Building on the built-in node can be a security issue. You should set up distributed builds. See [the documentation](#).

Warnings have been published for the following currently installed components:

docker-build-steps 2.12:
 CSRF vulnerability and missing permission check (no fix available)
 No fixes for these issues are available. It is recommended that you review the security advisory and apply mitigations if possible, or uninstall this plugin.

System Configuration

- System**
Configure global settings and paths.
- Tools**
Configure tools, their locations and automatic installers.
- Plugins**
Add, remove, disable or enable plugins that extend the functionality of Jenkins.
- Docker**
Plugin for launching build Agents as Docker containers
- Clouds**
Add, remove, and configure cloud instances to provision agents on-demand.
- Appearance**
Configure the look and feel of Jenkins

Security

- Security**
Secure Jenkins; define who is allowed to access/use the system.
- Credentials**
Configure credentials
- Credential Providers**
Configure the credential providers and types

Jenkins / pipeline-book-my-show

- Configure
- Delete Pipeline
- Full Stage View
- Stages
- Rename
- Pipeline Syntax
- Credentials

	Declarative: Tool Install	Clean Workspace	Checkout from Git	SonarQube Analysis	Quality Gate	Install Dependencies	Docker Build & Push	Deploy to Container
Average stage times:	105ms	256ms	1s	23s	250ms	73ms	71ms	73ms
#6 Sep 13 19:39 No Changes	106ms	215ms	1s	23s	176ms			
#7 Sep 13 19:38 No Changes								

Builds

...

	clean workspace	git checkout	sonarqube analysis	install dependencies	docker build and push	deploy to container	Declarative: Post Actions
Average stage times: (full run time: ~4min 43s)	1s	728ms	11s	39s	59s	201ms	1s
#5 Sep 14 14:35 1 commit	3s	618ms	11s	49s	3min 36s	564ms	1s
#4 Sep 14 14:22 1 commit	3s	Success Logs	10s	48s	18s failed	71ms failed	1s
#3 Sep 14 14:13 No Changes	101ms	746ms	9s	58s	2s failed	100ms failed	1s
#2 Sep 14 14:06 No Changes	77ms	940ms	14s	399ms failed	104ms failed	69ms failed	1s
#1 Sep 14 14:06 No Changes							

Not secure 54.153.88.49:9000/projects

Embedded database should be used for evaluation purposes only. It doesn't support scaling, upgrading to a new SonarQube Server version, or migration to another database engine. [Learn more](#)

SonarQube community Projects Issues Rules Quality Profiles Quality Gates Administration More

Search by project name or key

Search projects (minimum 2 characters) Perspective Overall Status Sort by Name 1 project(s)

Book-my-show Public Passed

Last analysis: 7 minutes ago • 5.8k Lines of Code • JavaScript, CSS, ...

C 2
D 167
A 275
E 0.0%
0.0%
1.4%

Security Reliability Maintainability Hotspots Reviewed Coverage Duplications

1 of 1 shown

SonarQube™ technology is powered by SonarSource SA

Community Build • v25.9.0.112764 • HQR MODE

LGPL v3 Community Documentation Plugins Web API

Instant: EC2 Inst Linux Jenkins Sign In System Linux Docker Hub

hub.docker.com/repositories/satyam744

New Building AI Agents is Now Easy

hub Explore My Hub Search Docker Hub CtrlK

satyam744
Docker Personal

Repositories Collaborations Settings Default privacy Notifications Billing Usage Pulls Storage

Repositories
All repositories within the satyam744 namespace.

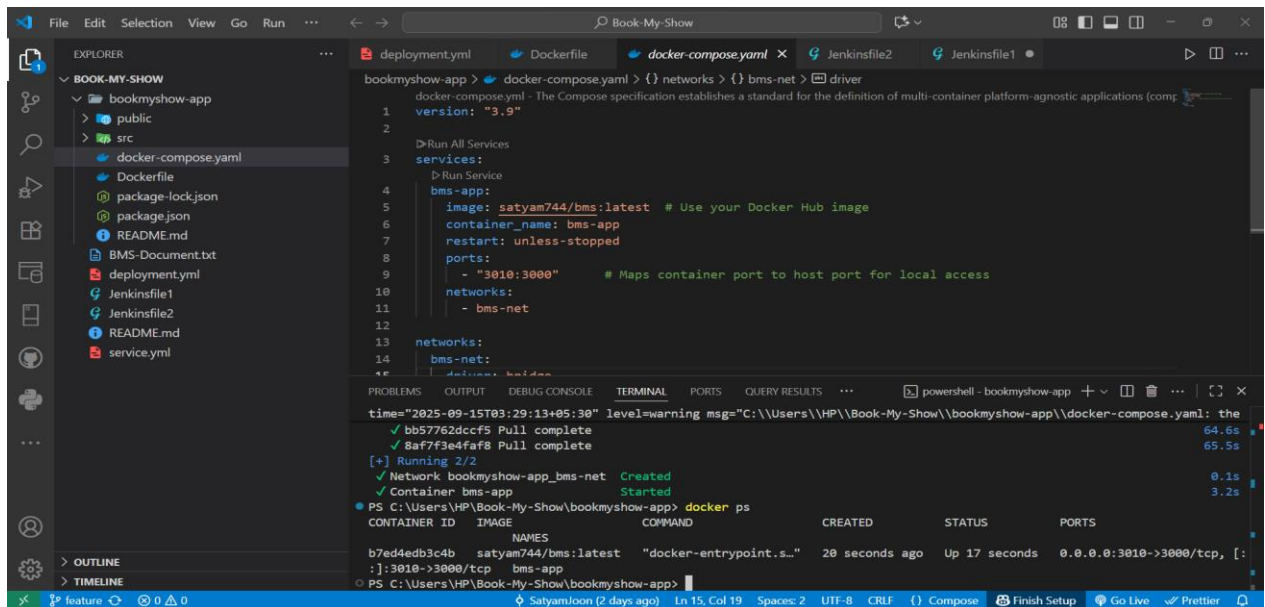
Search by repository name All content Create a repository

Name	Last Pushed	Contains	Visibility	Scout
satyam744/bms	3 minutes ago	IMAGE	Public	Inactive
satyam744/book	4 days ago	IMAGE	Public	Inactive
satyam744/th	6 days ago	IMAGE	Public	Inactive
satyam744/veg	9 days ago	IMAGE	Public	Inactive
satyam744/organic	9 days ago	IMAGE	Public	Inactive
satyam744/org	9 days ago	IMAGE	Public	Inactive
satyam744/retail-25	10 days ago	IMAGE	Public	Inactive

Stage 4

1. First I write the Dockerfile for building the docker image and pushed the image to the Docker-registry via Jenkins.
2. Using Docker desktop, run the container locally.

>> docker-compose up -d



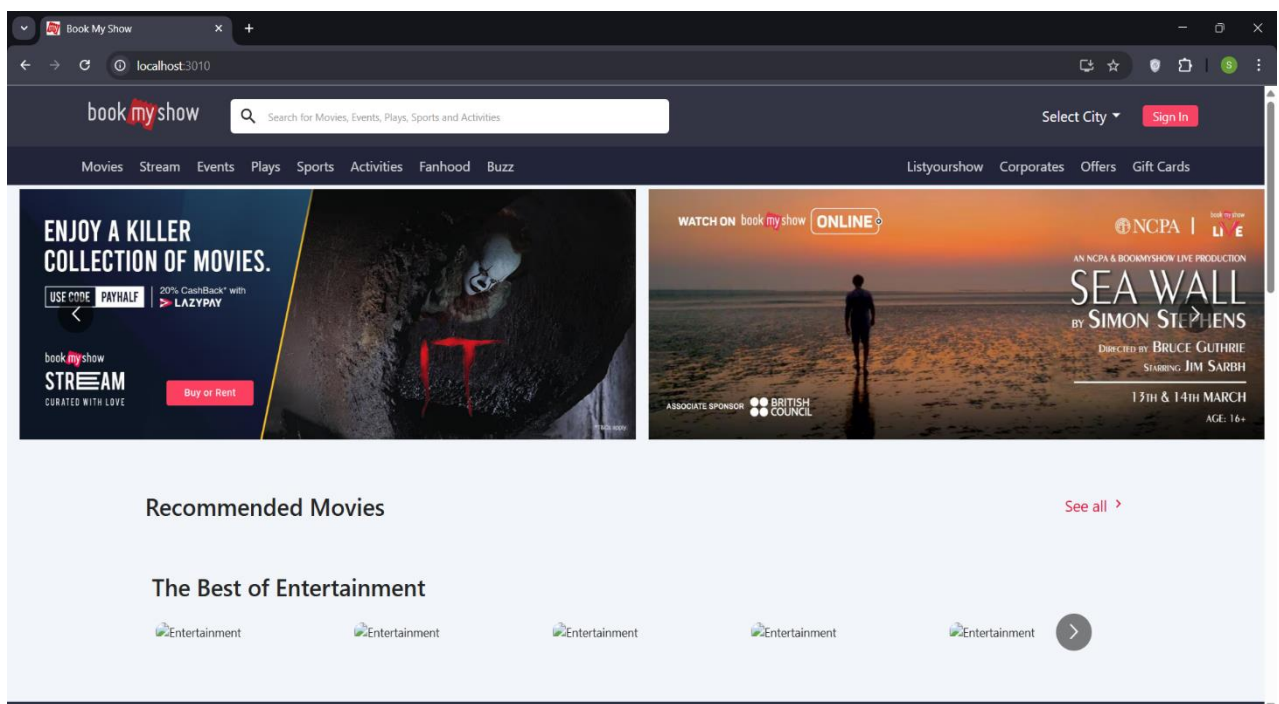
The screenshot shows the Visual Studio Code interface with the 'docker-compose.yml' file open. The file defines a service named 'bms-app' using the 'satyam744/bms:latest' image, mapped to port 3010. The terminal output shows the successful execution of 'docker-compose up -d', including pulling the image and starting the container. A table at the bottom lists the running containers.

```
version: "3.9"

services:
  bms-app:
    image: satyam744/bms:latest # Use your Docker Hub image
    container_name: bms-app
    restart: unless-stopped
    ports:
      - "3010:3000" # Maps container port to host port for local access
    networks:
      - bms-net

networks:
  bms-net:
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS
b7ed4edb3c4b	satyam744/bms:latest	"docker-entrypoint.s..."	20 seconds ago	Up 17 seconds	0.0.0.0:3010->3000/tcp, [:



Stage 5

1. First I have create a ec2 instance then install eksctl, kubectl and awscli.

2. Setup IAM user and role for cluster.
3. Attach the IAM role with the ec2 instance and configure the credentials, then using eksctl create command I have created the cluster.

```
>> eksctl create cluster \  
  
--name satyam-cluster \  
  
--region eu-north-1 \  
  
--nodegroup-name satyam-nodes \  
  
--node-type t3.small \  
  
--zones eu-north-1a,eu-north-1b \  
  
--nodes 2
```

4. First create namespace as satyam-ns then create the deployment.yaml and service.yaml file for deploying the application on EKS cluster using below commands.

```
>> kubectl create namespace satyam-ns  
  
>> kubectl apply -f deployment.yaml -n satyam-ns  
  
>> kubectl apply -f service.yaml -n satyam-ns  
  
>> kubectl get pods -n satyam-ns  
  
>> kubectl get svc -n satyam-ns
```

5. After these commands my command and service for application start running and I get the external ip address for access the application.
6. At last, I delete the cluster using below command.

```
>> eksctl delete cluster \  
  
--name satyam-cluster \  
  
--region eu-north-1
```

eu-north-1.console.aws.amazon.com/ec2/home?region=eu-north-1#Instances

EC2 > Instances

Instances (1/7) Info

Find Instance by attribute or tag (case-sensitive)

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4
Satyam-jenkins	i-03fcc6fa5be4c4270	Stopped	t3.small	-	View alarms +	eu-north-1a	-
satyam-kuber...	i-0b9fa32ec7c2ed0ed	Running	t3.small	3/3 checks passed	View alarms +	eu-north-1a	ec2-13-61-1
satyam-cluster...	i-0094741d651434953	Terminated	t3.small	-	View alarms +	eu-north-1a	-

i-0b9fa32ec7c2ed0ed (satyam-kubernetes)

Details Status and alarms Monitoring Security Networking Storage Tags

▼ Instance summary Info

Instance ID: i-0b9fa32ec7c2ed0ed

Public IPv4 address: 13.61.143.164 | open address

Private IPv4 addresses: 172.31.20.189

Instance state: Running

Public DNS: ec2-13-61-143-164.eu-north-1.compute.amazonaws.com | open address

Private IP DNS name (IPv4 only): i-0b9fa32ec7c2ed0ed.eu-north-1.compute.amazonaws.com

eu-north-1.console.aws.amazon.com/ec2-instance-connect/ssh/home?addressFamily=ipv4&connType=standard&instanceId=i-0b9fa32ec7c2ed0ed&osUser=ubuntu®ion=eu-n...

Search [Alt+S]

Europe (Stockholm)

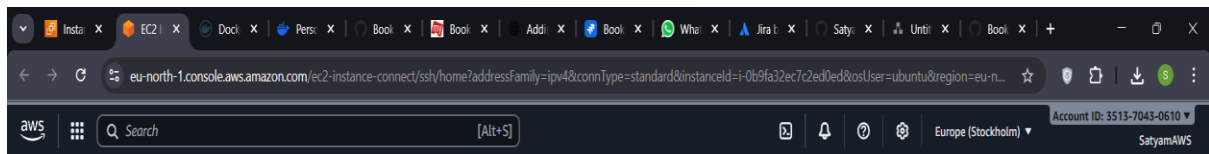
Account ID: 3513-7043-0610

SatyamAWS

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: hms-app
  namespace: satyam-ns
  labels:
    app: hms
spec:
  replicas: 1
  selector:
    matchLabels:
      app: hms
  template:
    metadata:
      labels:
        app: hms
    spec:
      containers:
        - name: hms-container
          image: satyam744/hms:latest # Replace with your Docker image
          ports:
            - containerPort: 3000
```

i-0b9fa32ec7c2ed0ed (satyam-kubernetes)

Public IPs: 13.61.143.164 Private IPs: 172.31.20.189

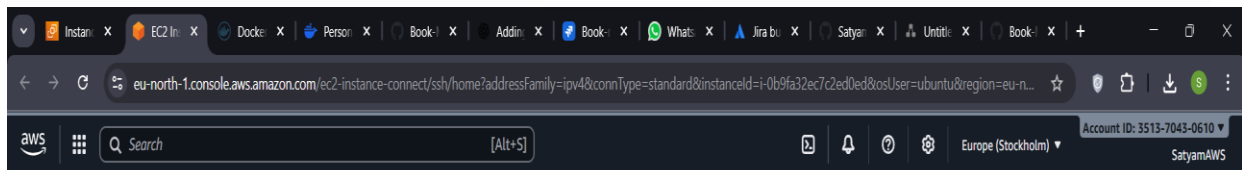


```
apiVersion: v1
kind: Service
metadata:
  name: bms-service
  namespace: satyam-ns
  labels:
    app: bms
spec:
  type: LoadBalancer
  ports:
    - port: 80
      targetPort: 3000 # Replace with the port your app runs on
  selector:
    app: bms
```

"service.yaml" 14L, 242B

i-0b9fa32ec7c2ed0ed (satyam-kubernetes)

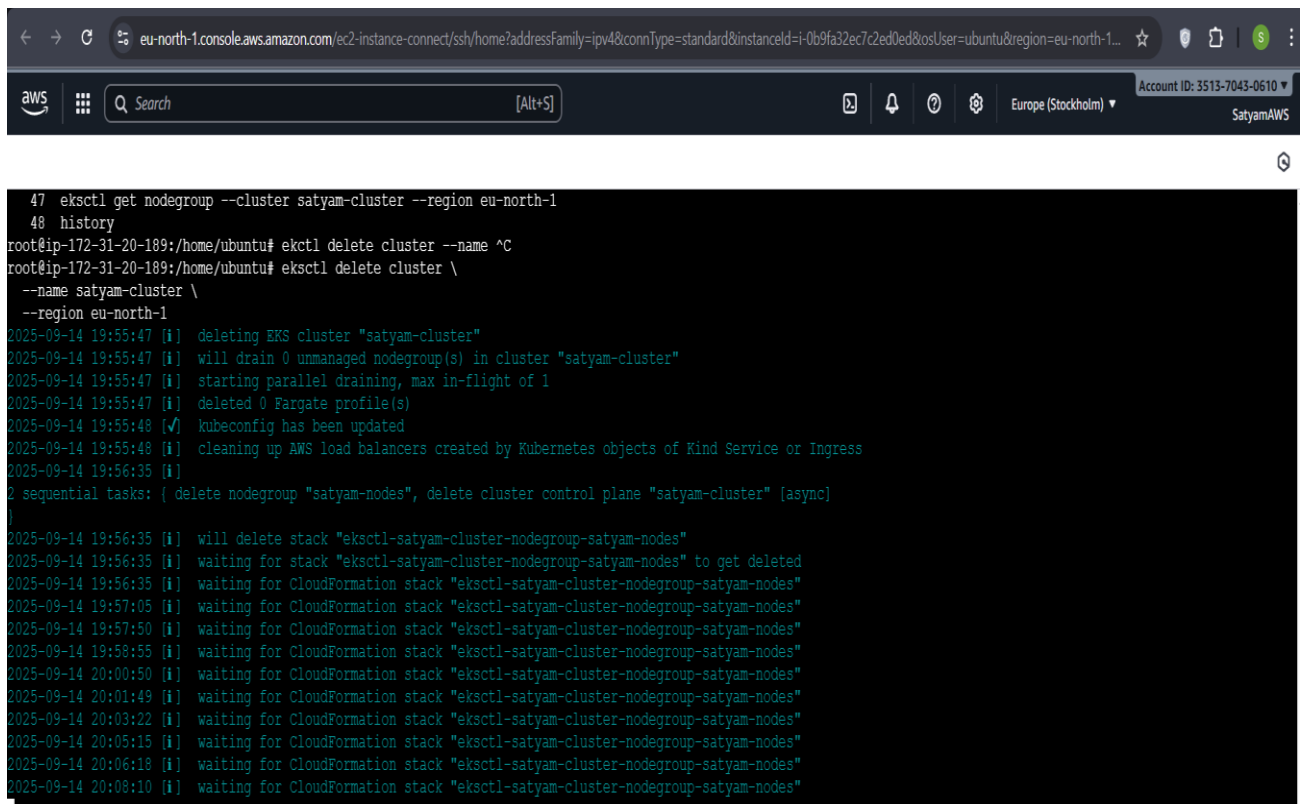
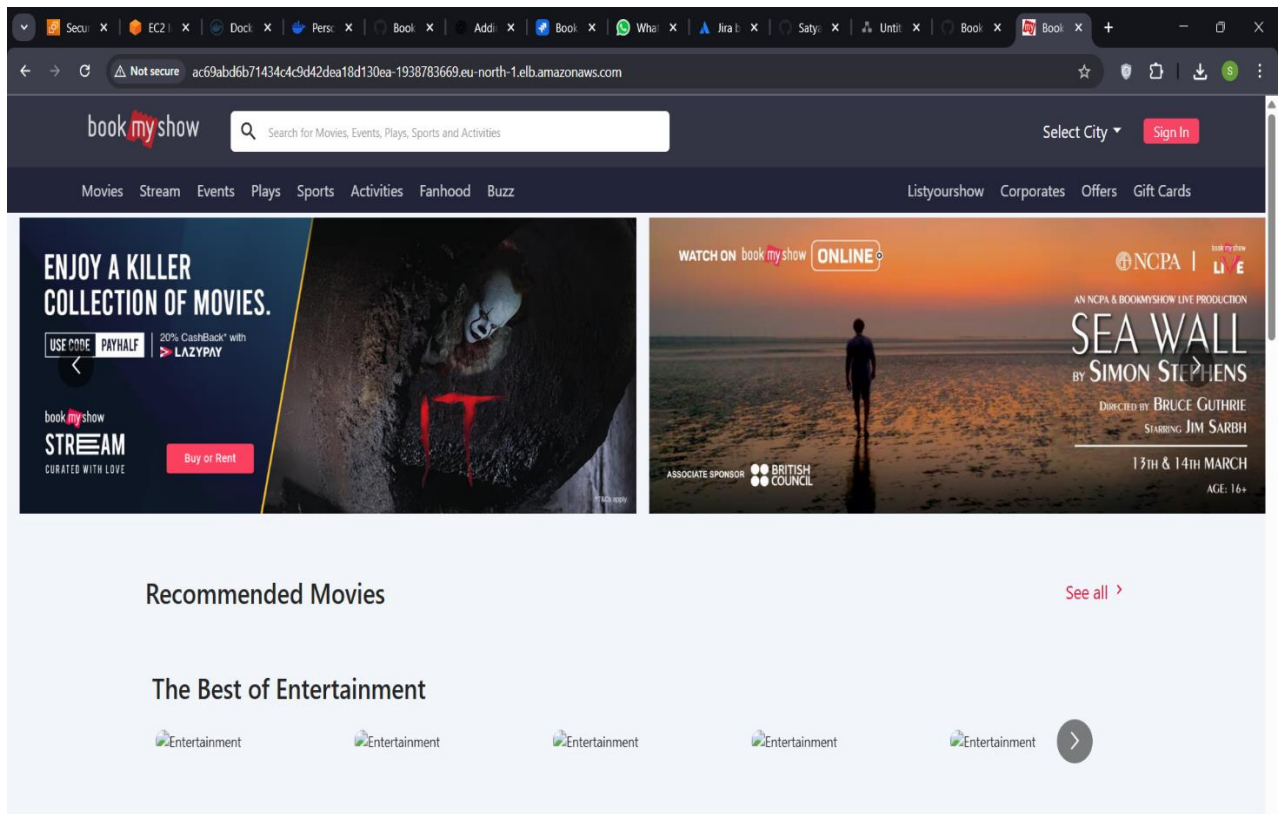
PublicIPs: 13.61.143.164 PrivateIPs: 172.31.20.189



```
root@ip-172-31-20-189:/home/ubuntu# cd satyam
root@ip-172-31-20-189:/home/ubuntu/satyam# ls
deployment.yaml service.yaml
root@ip-172-31-20-189:/home/ubuntu/satyam# kubectl get pods
No resources found in default namespace.
root@ip-172-31-20-189:/home/ubuntu/satyam# kubectl get pods -n satyam-ns
No resources found in satyam-ns namespace.
root@ip-172-31-20-189:/home/ubuntu/satyam# vi deployment.yaml
root@ip-172-31-20-189:/home/ubuntu/satyam# vi service.yaml
root@ip-172-31-20-189:/home/ubuntu/satyam# rm -rf deployment.yaml
root@ip-172-31-20-189:/home/ubuntu/satyam# ls
deployment.yaml service.yaml
root@ip-172-31-20-189:/home/ubuntu/satyam# vi deployment.yaml
root@ip-172-31-20-189:/home/ubuntu/satyam# ls
deployment.yaml service.yaml
root@ip-172-31-20-189:/home/ubuntu/satyam# kubectl apply -f satyam-ns
error: the path "satyam-ns" does not exist
root@ip-172-31-20-189:/home/ubuntu/satyam# kubectl apply -f deployment.yaml -n satyam-ns
deployment.apps/bms-app created
root@ip-172-31-20-189:/home/ubuntu/satyam# kubectl apply -f service.yaml -n satyam-ns
service/bms-service created
root@ip-172-31-20-189:/home/ubuntu/satyam# kubectl get svc -n satyam-ns
NAME      TYPE          CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
bms-service  LoadBalancer  10.100.110.8     ac69abd6b71434c4c9d42de18d130ea-1938783669.eu-north-1.elb.amazonaws.com  80:30840/TCP    22s
root@ip-172-31-20-189:/home/ubuntu/satyam# kubectl get pods -n satyam-ns
NAME      READY   STATUS    RESTARTS   AGE
bms-app-5cf86654d9-9x2qs  1/1     Running   0          4m53s
root@ip-172-31-20-189:/home/ubuntu/satyam#
```

i-0b9fa32ec7c2ed0ed (satyam-kubernetes)

PublicIPs: 13.61.143.164 PrivateIPs: 172.31.20.189



Stage 6

1. Host the application using EKS cluster, then install Prometheus and Grafana.
2. Install plugins for Prometheus.
3. Create a data source, contact point along with alerting rules.
4. Go dashboard section and create the dashboard for the application.

The image shows two screenshots from a cloud environment. The top screenshot is the Jenkins 'Manage Jenkins' > 'Plugins' page. A search for 'promet' has been performed, showing three available plugins: 'Prometheus metrics' (checked for installation), 'Otel agent host metrics monitoring', and 'Cortex Metrics'. The bottom screenshot is the Prometheus 'Status > Target health' page. It shows two scrape targets for the 'serviceMonitor/monitoring/prometheus-kube-prometheus-alertmanager' service, both with a state of 'UP'.

Jenkins Plugins Page

Install	Name	Released	Health
<input checked="" type="checkbox"/>	Prometheus metrics 819.v50953a_c560dd <i>monitoring Miscellaneous</i> Jenkins Prometheus Plugin expose an endpoint (default /prometheus) with metrics where a Prometheus Server can scrape.	6 mo 27 days ago	96
<input type="checkbox"/>	Otel agent host metrics monitoring 1.5.1 <i>monitoring observability</i> This plugin allows monitoring of Jenkins agents by deploying Prometheus node exporters and Otel collectors to them and linking to a Grafana dashboard displaying those gathered metrics.	4 days 19 hr ago	100
<input type="checkbox"/>	Cortex Metrics 1.0.1 Adds the ability to publish run results to Cortex directly using the Prometheus push endpoint.	4 yr 6 mo ago	91

Prometheus Target Health Page

1 / 1 up

Endpoint	Labels	Last scrape	State
http://192.168.55.144:9093/metrics	container="alertmanager" endpoint="http-web" instance="192.168.55.144:9093" job="prometheus-kube-prometheus-alertmanager" namespace="monitoring" pod="alertmanager-prometheus-kube-prometheus-alertmanager-0" service="prometheus-kube-prometheus-alertmanager"	1.891s ago 4ms	UP
http://192.168.55.144:8080/metrics	container="config-reloader" endpoint="reloader-web" instance="192.168.55.144:8080" job="prometheus-kube-prometheus-alertmanager" namespace="monitoring" pod="alertmanager-prometheus-kube-prometheus-alertmanager-0" service="prometheus-kube-prometheus-alertmanager"	8.53s ago 4ms	UP

