Report: Deploying a 2040 game Application using Amazon EKS with Fargate and ALB Controller

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Topic: 2040 game Deployment on AWS EKS (with Fargate and ALB Controller)

1. Introduction

Kubernetes is the leading platform for orchestrating containerized applications. Amazon Elastic Kubernetes Service (EKS) provides a fully managed Kubernetes control plane on AWS, allowing developers to focus on deploying and managing workloads rather than managing infrastructure.

This report outlines the process of deploying a sample application using Amazon EKS with AWS Fargate, which allows serverless pod execution, and the AWS Load Balancer Controller to manage application traffic through an Application Load Balancer (ALB).

2. Objectives

- Set up an EKS cluster using eksctl with Fargate as the compute backend.
- Deploy a sample application in a Kubernetes namespace.
- Configure IAM and security to support ALB integration.
- Set up the AWS Load Balancer Controller.
- Expose the application using an ALB Ingress and validate deployment.

3. Prerequisites

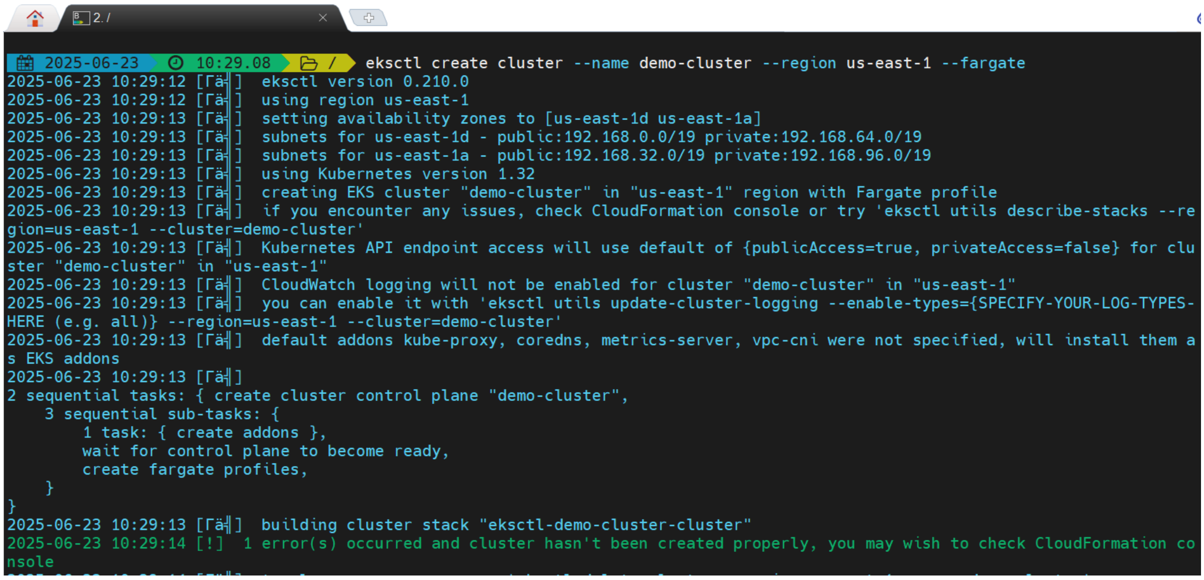
- AWS CLI installed and configured with required credentials.
- kubectl and eksctl installed and added to system path.
- IAM user with sufficient privileges to create EKS clusters, IAM roles, and policies.
- Basic understanding of Kubernetes, AWS networking, and container deployment.

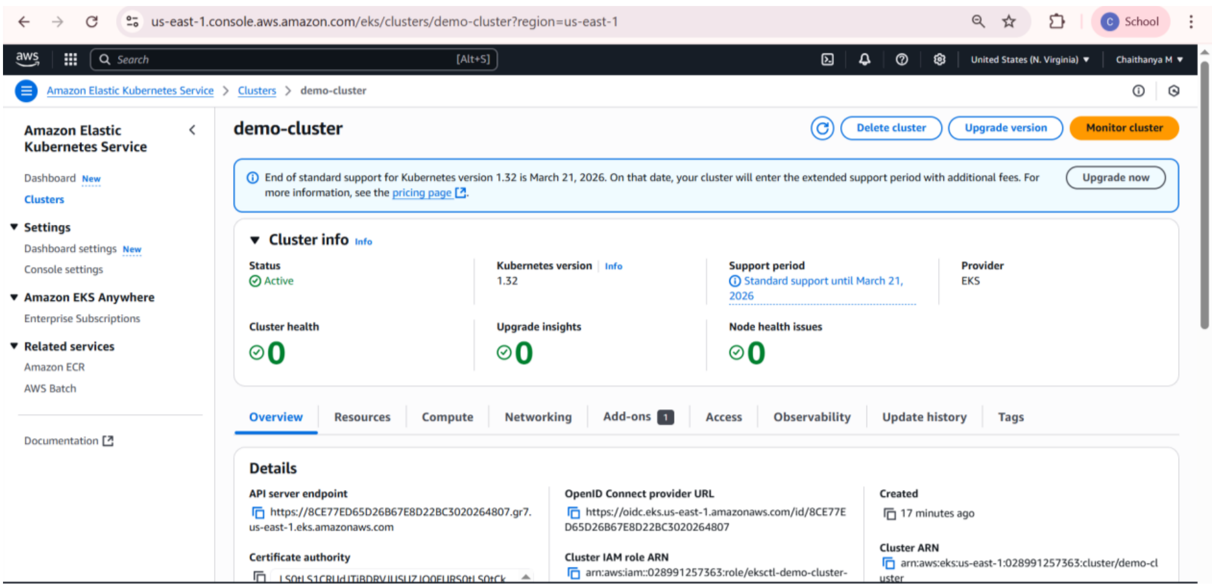
4. Step-by-Step Deployment Process

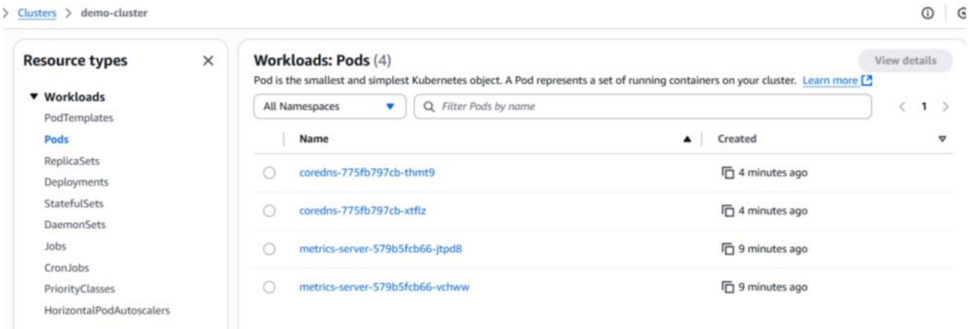
Step 1: Create the EKS Cluster Using Fargate

$ eksctl create cluster --name demo-cluster --region us-east-1 --fargate

This command creates an EKS cluster named demo-cluster in the us-east-1 region using AWS Fargate, allowing pods to run serverlessly without provisioning EC2 worker nodes.







Step 2: Create a Fargate Profile

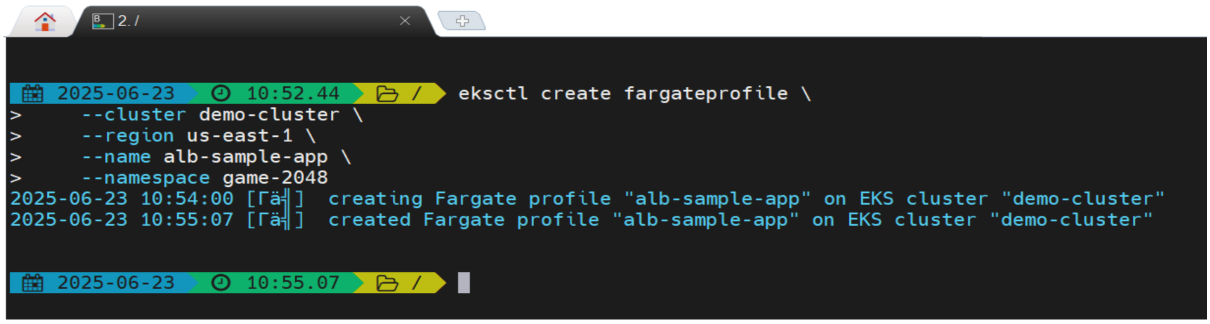
$ eksctl create fargateprofile \

  --cluster demo-cluster \

  --region us-east-1 \

  --name alb-sample-app \

  --namespace game-2048

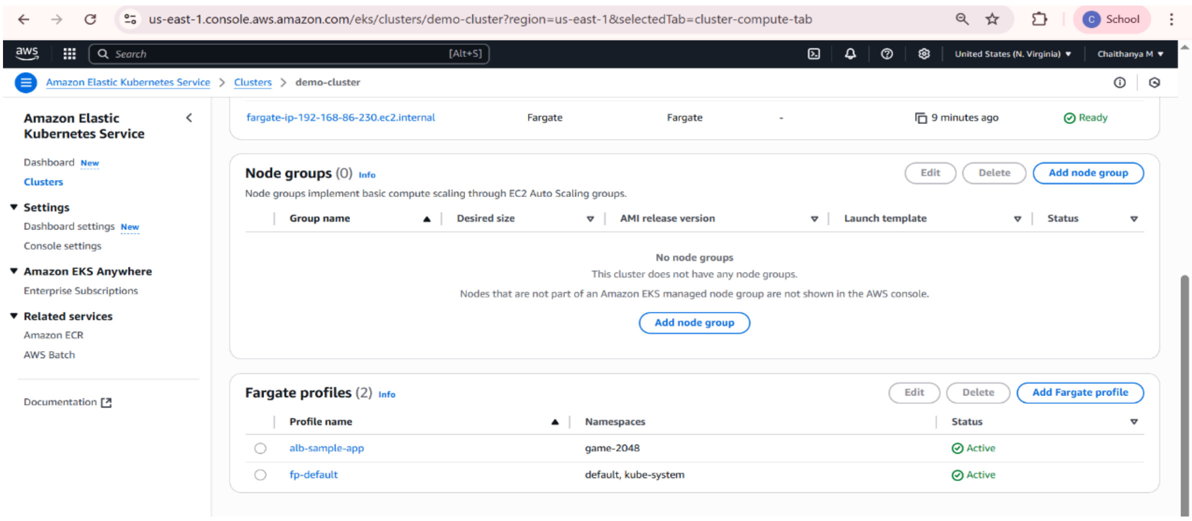


A Fargate profile enables Kubernetes pods in the game-2048 namespace to run on Fargate.

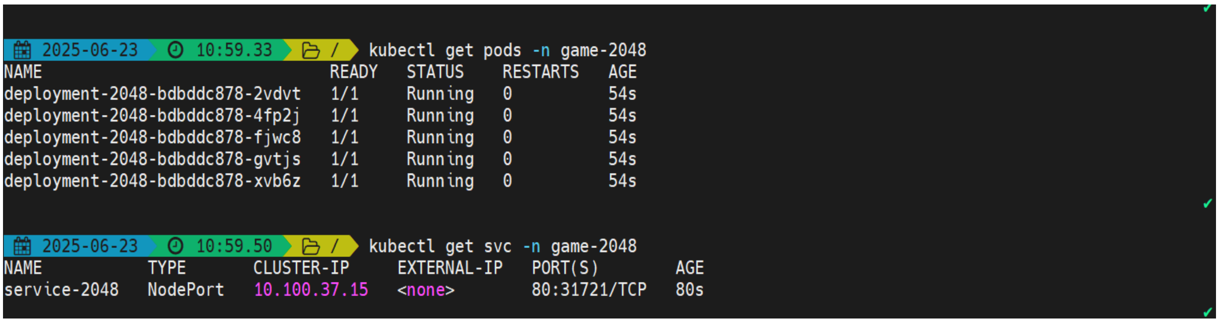
Step 3: Deploy the Sample Application

$ kubectl apply -f https://raw.githubusercontent.com/kubernetes-sigs/aws-load-balancer-controller/v2.5.4/docs/examples/2048/2048_full.yaml

This command applies all necessary Kubernetes manifests (deployment, service, ingress) for the 2048 game application.



```
2025-06-23  10:56.40  / kubectl apply -f https://raw.githubusercontent.com/kubernetes-sigs/aws-load-balancer-controller/v2.5.4/docs/examples/2048/2048_full.yaml
namespace/game-2048 created
deployment.apps/deployment-2048 created
service/service-2048 created
ingress.networking.k8s.io/ingress-2048 created
```



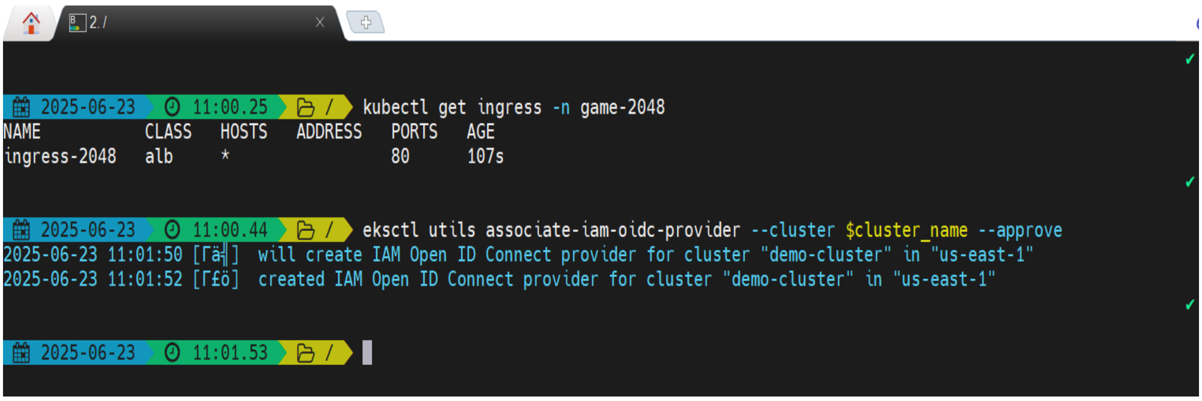
```
2025-06-23  10:59.33  / kubectl get pods -n game-2048
NAME                              READY   STATUS    RESTARTS   AGE
deployment-2048-bdbddc878-2vdvt   1/1     Running   0          54s
deployment-2048-bdbddc878-4fp2j   1/1     Running   0          54s
deployment-2048-bdbddc878-fjwc8   1/1     Running   0          54s
deployment-2048-bdbddc878-gvtjs   1/1     Running   0          54s
deployment-2048-bdbddc878-xvb6z   1/1     Running   0          54s

2025-06-23  10:59.50  / kubectl get svc -n game-2048
NAME           TYPE       CLUSTER-IP      EXTERNAL-IP   PORT(S)        AGE
service-2048   NodePort   10.100.37.15    <none>        80:31721/TCP   80s
```

Step 4: Associate IAM OIDC Provider

$ eksctl utils associate-iam-oidc-provider --cluster demo-cluster --approve

This step ensures that the EKS cluster is associated with an OIDC provider for secure IAM role assumption by Kubernetes service accounts.



```
2.  /
2025-06-23  11:00.25  / kubectl get ingress -n game-2048
NAME           CLASS   HOSTS   ADDRESS   PORTS   AGE
ingress-2048   alb     *                 80      107s

2025-06-23  11:00.44  / eksctl utils associate-iam-oidc-provider --cluster $cluster_name --approve
2025-06-23 11:01:50 [Γä╣]  will create IAM Open ID Connect provider for cluster "demo-cluster" in "us-east-1"
2025-06-23 11:01:52 [Γ£ö]  created IAM Open ID Connect provider for cluster "demo-cluster" in "us-east-1"

2025-06-23  11:01.53  /
```

Step 5: Set Up IAM for ALB Controller

- **Download the IAM Policy:**

$ curl -O https://raw.githubusercontent.com/kubernetes-sigs/aws-load-balancer-controller/v2.11.0/docs/install/iam_policy.json

- **Create IAM Policy**

$ aws iam create-policy \
  --policy-name AWSLoadBalancerControllerIAMPolicy \
  --policy-document file://iam_policy.json

```
2025-06-23  11:01.53  / curl -O https://raw.githubusercontent.com/kubernetes-sigs/aws-load-balancer-controller/v2.11.0/docs/install/iam_policy.json
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  8759  100  8759    0     0  16823      0 --:--:-- --:--:-- --:--:-- 16941

2025-06-23  11:02.38  / aws iam create-policy \
>     --policy-name AWSLoadBalancerControllerIAMPolicy \
>     --policy-document file://iam_policy.json
{
    "Policy": {
        "PolicyName": "AWSLoadBalancerControllerIAMPolicy",
        "PolicyId": "ANPAQNQADPMJ2GXS5DHBV",
        "Arn": "arn:aws:iam::028991257363:policy/AWSLoadBalancerControllerIAMPolicy",
        "Path": "/",
        "DefaultVersionId": "v1",
        "AttachmentCount": 0,
        "PermissionsBoundaryUsageCount": 0,
        "IsAttachable": true,
        "CreateDate": "2025-06-23T05:32:56+00:00",
        "UpdateDate": "2025-06-23T05:32:56+00:00"
    }
}

2025-06-23  11:02.56  /
```

- **Create IAM Role with Service Account**

$ eksctl create iamserviceaccount \

--cluster=demo-cluster \

--namespace=kube-system \

--name=aws-load-balancer-controller \

--role-name AmazonEKSLoadBalancerControllerRole \

--attach-policy-arn=arn:aws:iam::<your-account id>:policy/AWSLoadBalancerControllerIAMPolicy \

--approve

```
2025-06-23  11:04.01  / eksctl create iamserviceaccount \
>   --cluster=demo-cluster\
>   --namespace=kube-system \
>   --name=aws-load-balancer-controller \
>   --role-name AmazonEKSLoadBalancerControllerRole \
>   --attach-policy-arn=arn:aws:iam::028991257363:policy/AWSLoadBalancerControllerIAMPolicy \
>   --approve
2025-06-23 11:06:04 [Гä╢]  1 iamserviceaccount (kube-system/aws-load-balancer-controller) was included (based on the include/exclude rules)
2025-06-23 11:06:04 [!]  serviceaccounts that exist in Kubernetes will be excluded, use --override-existing-serviceaccounts to override
2025-06-23 11:06:04 [Гä╢]  1 task: {
    2 sequential sub-tasks: {
        create IAM role for serviceaccount "kube-system/aws-load-balancer-controller",
        create serviceaccount "kube-system/aws-load-balancer-controller",
    } }2025-06-23 11:06:04 [Гä╢]  building iamserviceaccount stack "eksctl-demo-cluster-addon-iamserviceaccount-kube-system-aws-load-balancer-controller"
2025-06-23 11:06:04 [Гä╢]  deploying stack "eksctl-demo-cluster-addon-iamserviceaccount-kube-system-aws-load-balancer-controller"
2025-06-23 11:06:04 [Гä╢]  waiting for CloudFormation stack "eksctl-demo-cluster-addon-iamserviceaccount-kube-system-aws-load-balancer-controller"
2025-06-23 11:06:36 [Гä╢]  waiting for CloudFormation stack "eksctl-demo-cluster-addon-iamserviceaccount-kube-system-aws-load-balancer-controller"
2025-06-23 11:06:38 [Гä╢]  created serviceaccount "kube-system/aws-load-balancer-controller"

2025-06-23  11:06.38  /
```

Step 6: Deploy AWS Load Balancer Controller

- **Add Helm Repository**

$ helm repo add eks https://aws.github.io/eks-charts

- **Install the Controller**

$ helm install aws-load-balancer-controller eks/aws-load-balancer-controller \

-n kube-system \

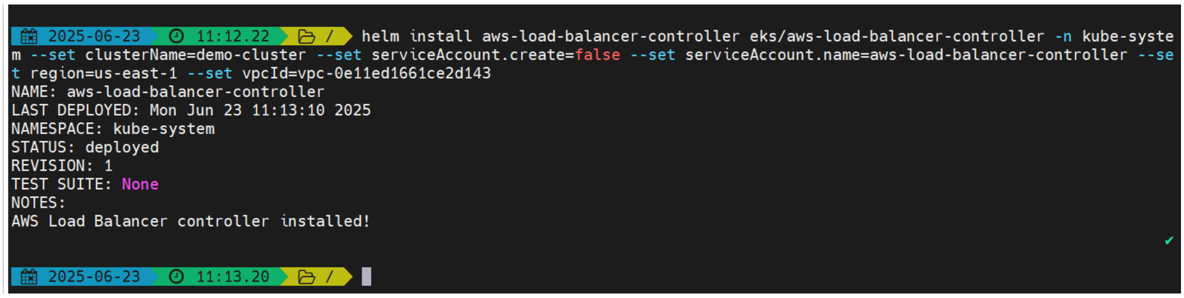
--set clusterName=demo-cluster \

--set serviceAccount.create=false \

--set serviceAccount.name=aws-load-balancer-controller \

--set region=us-east-1 \

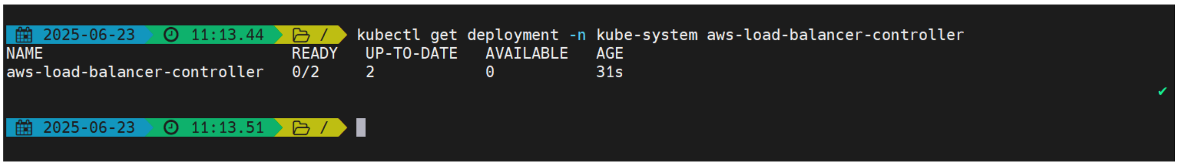
--set vpcId=<your-vpc-id>

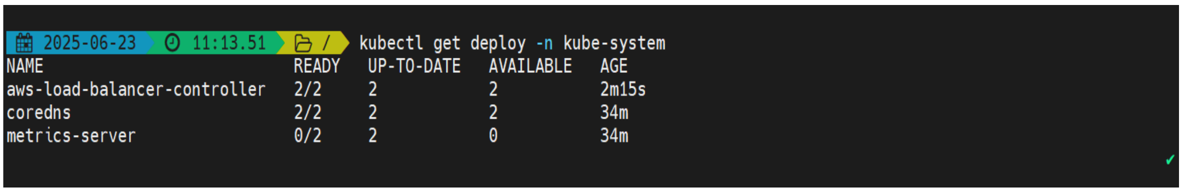


Step 7: Verify the Controller Deployment

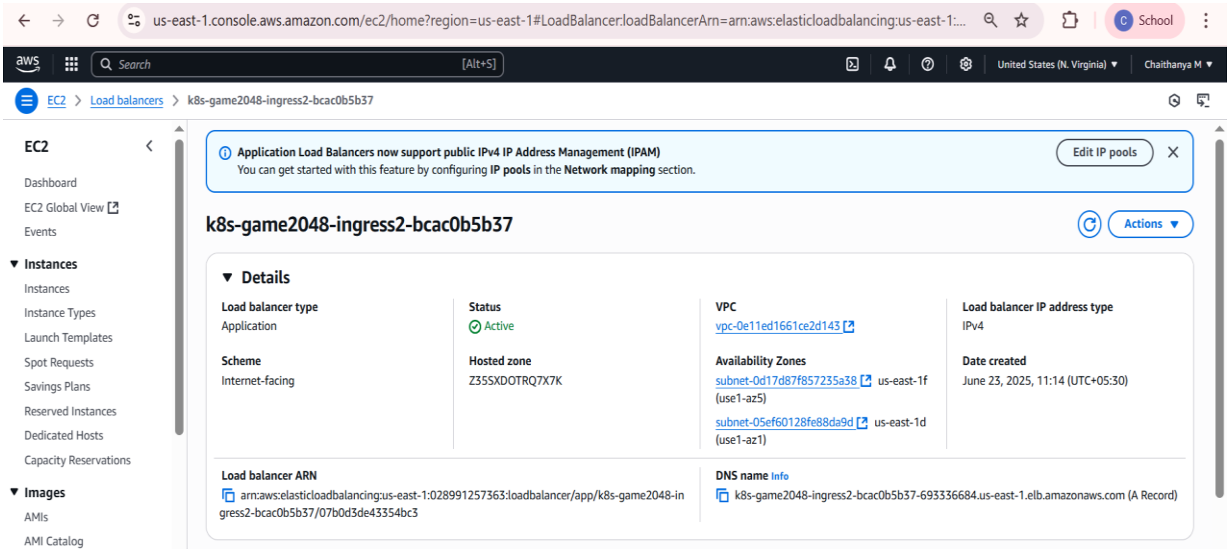
$ kubectl get deployment -n kube-system aws-load-balancer-controller

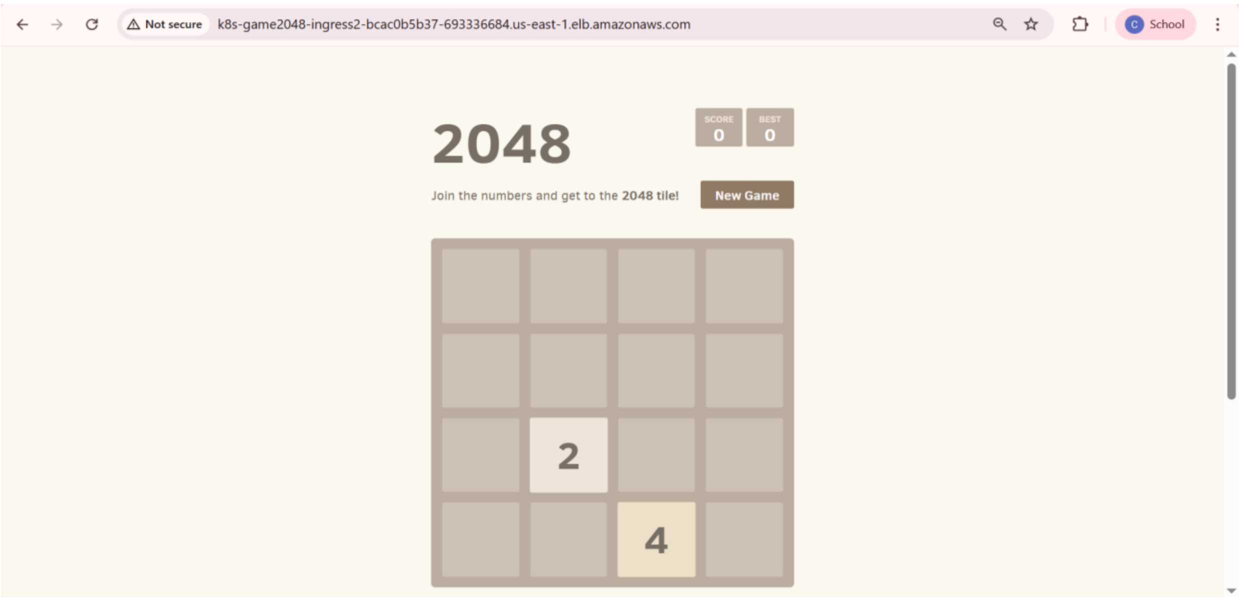
Ensure the deployment is running successfully without any errors.

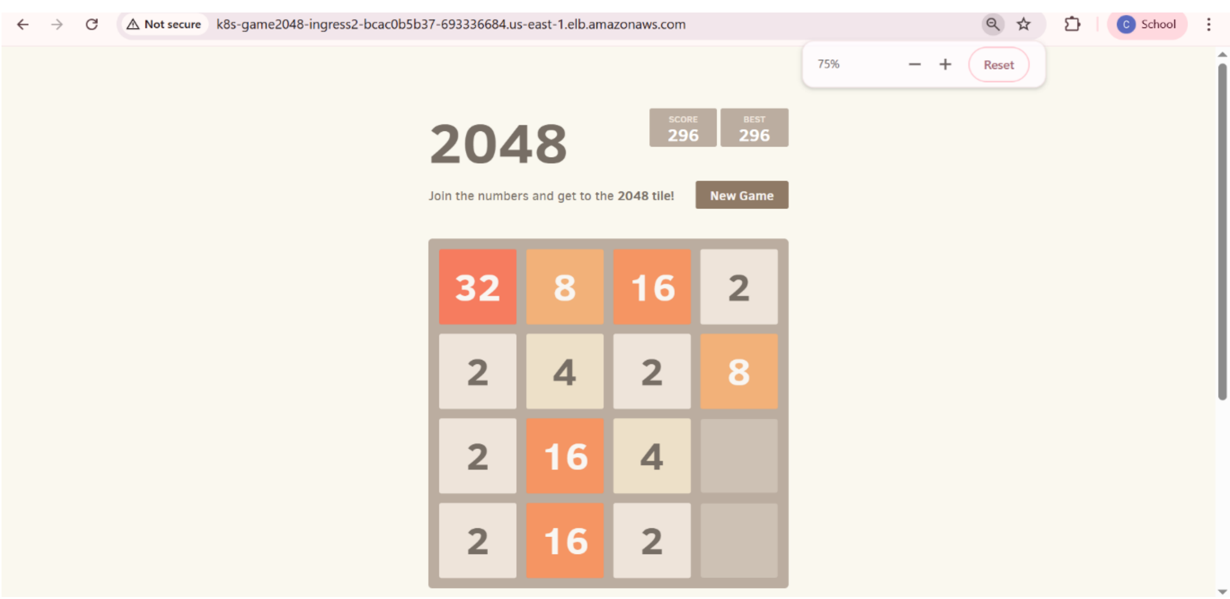




Deployed 2048 game Application Screenshot







5. Conclusion

This project provided comprehensive hands-on experience with deploying a containerized application using Amazon Elastic Kubernetes Service (EKS) backed by AWS Fargate. By following a step-by-step approach to cluster provisioning, Fargate profile creation, application deployment, and load balancer integration, I was able to gain a deeper understanding of Kubernetes operations in a cloud-native environment.

Using Fargate significantly simplified the infrastructure layer by eliminating the need to manage EC2 instances. This allowed me to focus purely on deploying and managing the application rather than configuring and maintaining the underlying compute resources. The integration of AWS Load Balancer Controller demonstrated how Kubernetes Ingress can be used in conjunction with AWS ALB to provide scalable, secure, and resilient access to services.

Key takeaways from this experience include:

- Proficiency in using eksctl, kubectl, and helm for EKS and Kubernetes management.
- Understanding the role of **IAM policies**, **OIDC providers**, and **service accounts** in securely granting access to AWS services from within Kubernetes.
- The importance of namespace-based resource isolation, especially when using Fargate profiles.
- Real-world exposure to deploying applications using declarative Kubernetes manifests.

This project also highlighted the **serverless nature of Fargate**, showing how it can help reduce operational complexity and scale containerized workloads efficiently. In a production environment, this approach can lower infrastructure overhead, improve security posture, and speed up deployment cycles.