Simple AWS EKS Architecture for deploying a Node.js application:

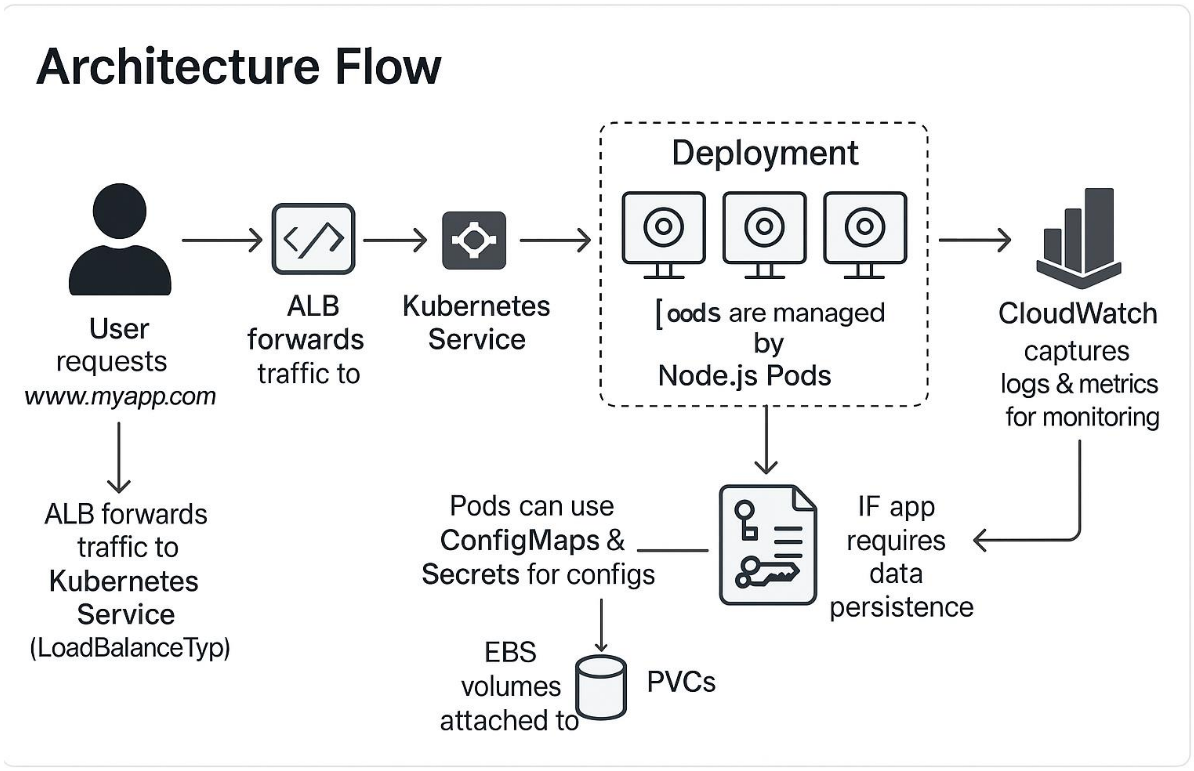
AWS EKS Project Architecture for Node.js App

Components Involved:

1. **VPC**
   - Private & Public Subnets
   - Internet Gateway, NAT Gateway
   - Route Tables
2. **EKS Cluster**
   - Control Plane (managed by AWS)
3. **EKS Worker Nodes (EC2 or Fargate)**
   - Runs Kubernetes Pods (Node.js app)
4. **Kubernetes Objects**
   - **Deployment** → Manages Pods for Node.js app
   - **Service (LoadBalancer)** → Exposes app to the Internet
   - **ConfigMap/Secrets** → For environment variables & sensitive data
   - **Ingress Controller (Optional)** → For domain-based routing (e.g., ALB Ingress)
5. **IAM Roles**
   - EKS Cluster Role
   - Worker Node Role
   - Service Account Roles (for app access to AWS resources)
6. **EBS/EFS** (Optional)
   - Persistent storage for data (if needed)
7. **Route53 (Optional)**
   - Custom domain management (e.g., www.myapp.com)
8. **CloudWatch**
   - Logs and Monitoring

Architecture Flow:

1. **User requests www.myapp.com → ALB (Ingress/Service LoadBalancer)**
2. **ALB forwards traffic to Kubernetes Service (LoadBalancer Type)**
3. **Service routes to Node.js Pods running on EKS Worker Nodes**
4. **Pods are managed by Deployment (ensures desired replicas)**
5. **Pods can use ConfigMaps & Secrets for configs**
6. **CloudWatch captures logs & metrics for monitoring**
7. **If app requires data persistence → EBS volumes attached to Pods via PVCs**


Architecture Flow
User requests www.myapp.com
ALB forwards traffic to
Kubernetes Service
Deployment
[oods are managed by Node.js Pods
CloudWatch captures logs & metrics for monitoring
ALB forwards traffic to Kubernetes Service (LoadBalanceTyp)
Pods can use ConfigMaps & Secrets for configs
IF app requires data persistence
EBS volumes attached to
PVCs

step-by-step guide to create an EKS Cluster using AWS Console & AWS CLI to deploy a **Node.js app** with the full architecture you outlined:

🔗 PART 1: Networking Setup via AWS Console

Step 1: Create VPC

- Go to **VPC Console** → **Your VPCs** → **Create VPC**
- Name: eks-vpc
- IPv4: e.g., 10.0.0.0/16
- Enable DNS hostnames: ✅ Yes

Step 2: Create Subnets

Create **4 Subnets**:

- 2 **Public** (e.g., 10.0.1.0/24, 10.0.2.0/24)
- 2 **Private** (e.g., 10.0.3.0/24, 10.0.4.0/24)
- Attach them to **2 different AZs** (e.g., us-east-1a, us-east-1b)

Step 3: Internet Gateway & NAT Gateway

- **Create Internet Gateway**, attach to VPC
- **Create Elastic IPs** for NAT Gateway
- **Create NAT Gateway** in one public subnet

Step 4: Route Tables

- **Public Route Table** → route 0.0.0.0/0 to Internet Gateway → associate to public subnets
- **Private Route Table** → route 0.0.0.0/0 to NAT Gateway → associate to private subnets

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☸ PART 2: IAM Setup

Step 5: IAM Roles

- **EKS Cluster Role**: AmazonEKSClusterPolicy
- **Node Group Role**:
  - AmazonEKSWorkerNodePolicy
  - AmazonEC2ContainerRegistryReadOnly
  - AmazonEKS_CNI_Policy

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Step-6: Create IAM Node Role for EKS Worker Nodes

This role allows EC2 instances (worker nodes) to connect to the EKS cluster and pull container images from ECR.

✅ Option 1: Create Using AWS Console

1. Go to **IAM** → **Roles** → **Create Role**
2. **Trusted Entity**: Select **AWS Service**
   - Use Case: **EC2**
   - Click **Next**
3. **Attach Permissions Policies**:
   ✅ Select these 3 policies:
   - AmazonEKSWorkerNodePolicy

    - AmazonEKS_CNI_Policy
    - AmazonEC2ContainerRegistryReadOnly
4. **Name**: eks-node-group-role
5. **Tags** (Optional), then click **Create Role**
6. Copy the **Role ARN** — you'll use it while creating the node group.

✅ Option 2: Create Node Role via AWS CLI

bash

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```
aws iam create-role \
  --role-name eks-node-group-role \
  --assume-role-policy-document file://trust-policy.json
```

trust-policy.json

json

CopyEdit

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "ec2.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

✅ Attach Permissions to the Role

bash

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```
aws iam attach-role-policy \
  --role-name eks-node-group-role \
  --policy-arn arn:aws:iam::aws:policy/AmazonEKSWorkerNodePolicy

aws iam attach-role-policy \
  --role-name eks-node-group-role \
  --policy-arn arn:aws:iam::aws:policy/AmazonEKS_CNI_Policy

aws iam attach-role-policy \
  --role-name eks-node-group-role \
  --policy-arn arn:aws:iam::aws:policy/AmazonEC2ContainerRegistryReadOnly
```

🔄 Reattempt Node Group Creation

Now that the **Node Role is created**, retry your **node group creation** via:

- AWS Console: Select the role eks-node-group-role
- AWS CLI:

bash

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```
aws eks create-nodegroup \
  --cluster-name my-eks-cluster \
  --nodegroup-name my-node-group \
  --scaling-config minSize=1,maxSize=3,desiredSize=2 \
  --subnets subnet-abc subnet-def \
  --instance-types t3.medium \
  --ami-type AL2_x86_64 \
  --node-role arn:aws:iam::<your-account-id>:role/eks-node-group-role \
  --region us-east-1
```

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☁️ PART 3: Create EKS Cluster (Console or AWS CLI)

Option 1: AWS Console

1. Go to **EKS → Clusters → Create**
2. Name: my-eks-cluster
3. Kubernetes Version: Choose latest
4. Role: Choose EKS Role created earlier
5. Networking:
    - Choose the VPC and private subnets
    - Enable public endpoint (for now)
6. Create the cluster (takes 10-15 mins)

Option 2: AWS CLI

bash

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```
aws eks create-cluster \
  --name my-eks-cluster \
  --role-arn arn:aws:iam::<account-id>:role/eks-cluster-role \
  --resources-vpc-config subnetIds=subnet-abc,subnet-def,securityGroupIds=sg-123 \
  --region us-east-1
```

⚙️ PART 4: Create Node Group (Console or CLI)

Option 1: Console

1. Go to **EKS → Node groups → Add Node Group**
2. Name: node-group-1
3. Role: Node group role created earlier
4. Instance Type: t3.medium

5. Subnets: Choose **private subnets**
6. Create

Option 2: AWS CLI

bash

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```
aws eks create-nodegroup \
  --cluster-name my-eks-cluster \
  --nodegroup-name my-node-group \
  --scaling-config minSize=1,maxSize=3,desiredSize=2 \
  --subnets subnet-abc subnet-def \
  --instance-types t3.medium \
  --ami-type AL2_x86_64 \
  --node-role arn:aws:iam::<account-id>:role/eks-node-group-role \
  --region us-east-1
```

PART 5: Connect with kubectl

Step 1: Update kubeconfig

```
aws eks update-kubeconfig --region us-east-1 --name my-eks-cluster
```

Step 2: Verify Connection

```
kubectl get nodes
```

You should see nodes listed.

🚀 PART 6: Deploy Node.js App to EKS

Step 1: Dockerize Node.js app

Create Dockerfile:

Dockerfile

```
FROM node:18
WORKDIR /app
COPY . .
```

RUN npm install

CMD ["node", "index.js"]

Step 2: Push to ECR

Step 3: Kubernetes YAML

Create:

- deployment.yaml (Node.js deployment)
- service.yaml (LoadBalancer or ClusterIP)
- configmap.yaml (optional)
- secret.yaml (optional)

Apply:

bash

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kubectl apply -f deployment.yaml

kubectl apply -f service.yaml

🔒 Optional: Ingress, Route53, EBS, CloudWatch

Ingress Controller (ALB)

Use Helm to install ALB Ingress Controller and create Ingress resource.

Route53

Point a domain (e.g., www.myapp.com) to your ALB DNS.

EBS/EFS

Use PersistentVolume and PersistentVolumeClaim for stateful data.

CloudWatch

- Automatically enabled for EKS
- You can configure fluent-bit or cloudwatch-agent for more detailed logs.

▯ Optional: Monitoring with Prometheus + Grafana

Let me know if you want this as the next step, and I'll walk you through it.