
AWS
re:Invent
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CON326

# Are you ready? Essential Strategies for Kubernetes Adoption

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Director, EKS Service Team
AWS Kubernetes

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Principal Engineer
AWS Kubernetes

# Agenda

- Optimizing organizations for success
- EKS and Kubernetes
  - How systems work and fail and what to do about it

# Optimizing organizations for success

# Culture:

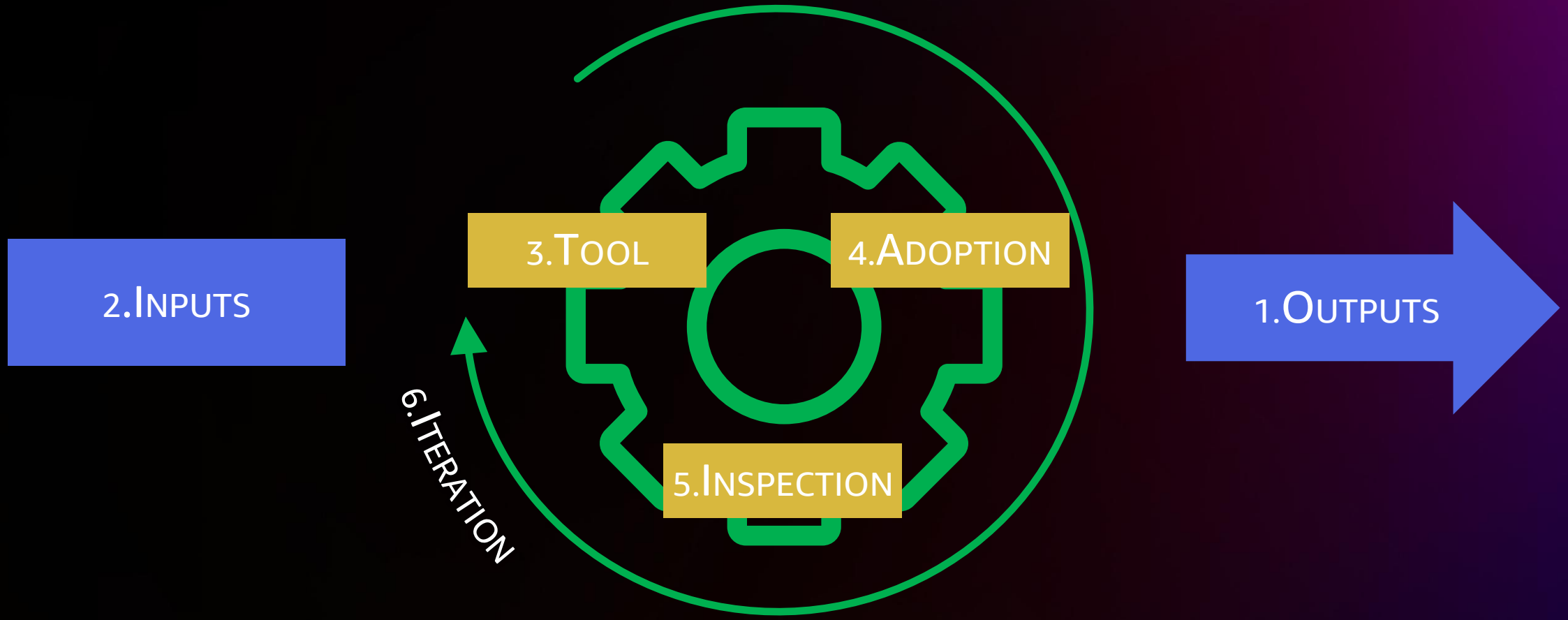
A set of beliefs, morals, methods, institutions and a collection of human knowledge that is dependent on the transmission of these characteristics to younger generations

Merriam-Webster’s Dictionary

# Mechanisms

- Recurring problems
- Solutions – sustain and scale
- Sustain  culture
- Examples inside Amazon
  - Operational reviews
  - Correction of Errors
  - Product development

# Mechanisms – In practice

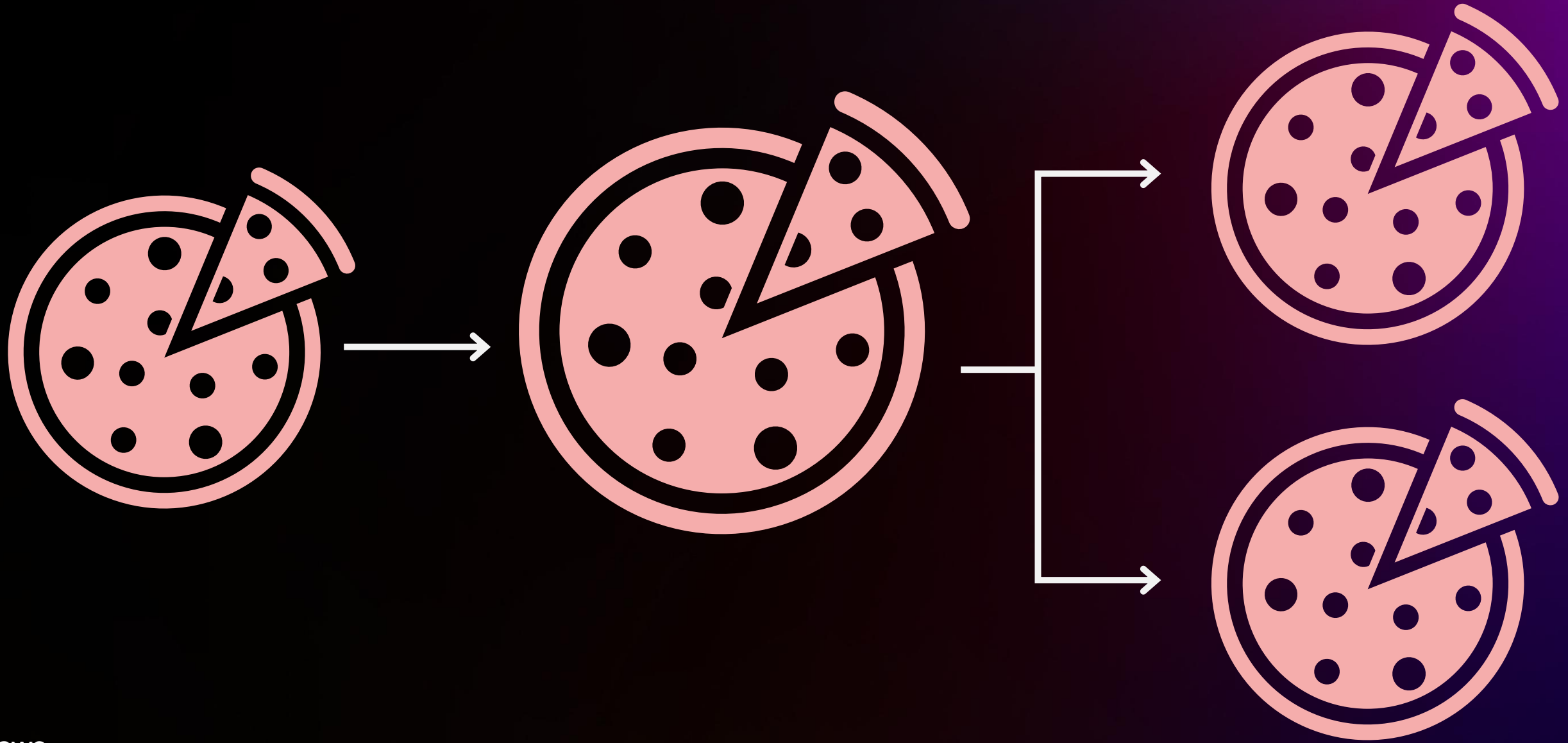


# Mechanisms – Organizational levers

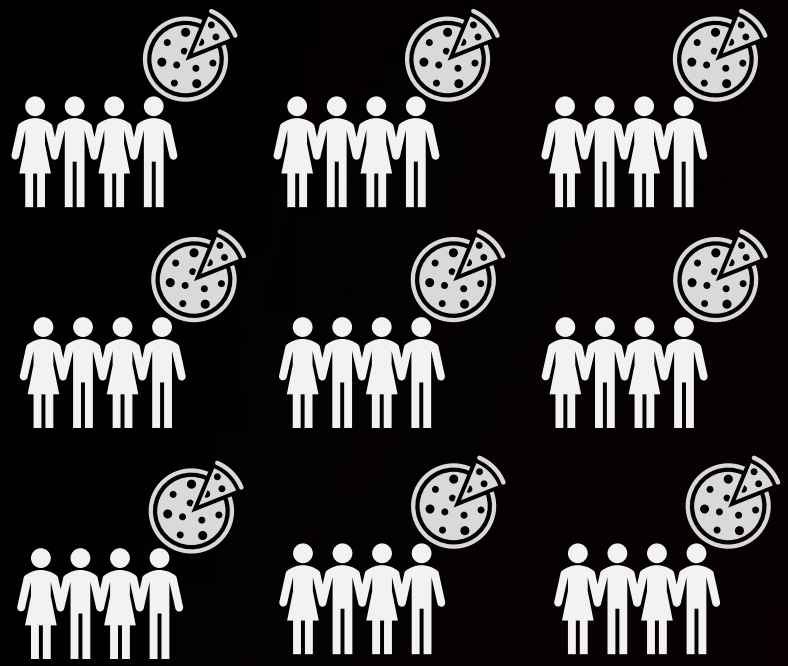
# Organizational structure

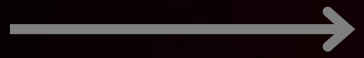
- Small (two-pizza) teams
- Ownership  (decentralized) / autonomy
- Local decisions
- Lowers cost of experimentation and failure

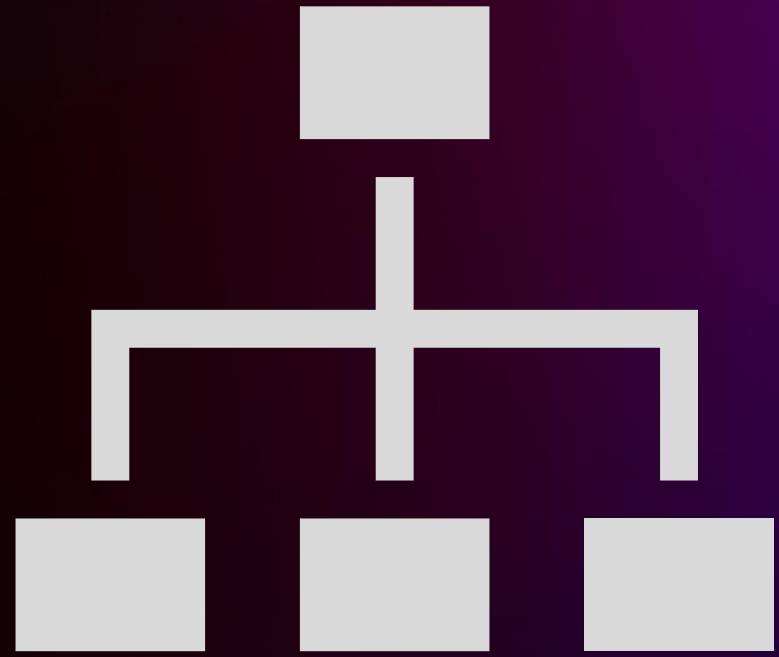
# Two-pizza team growth



# Two-pizza teams at scale



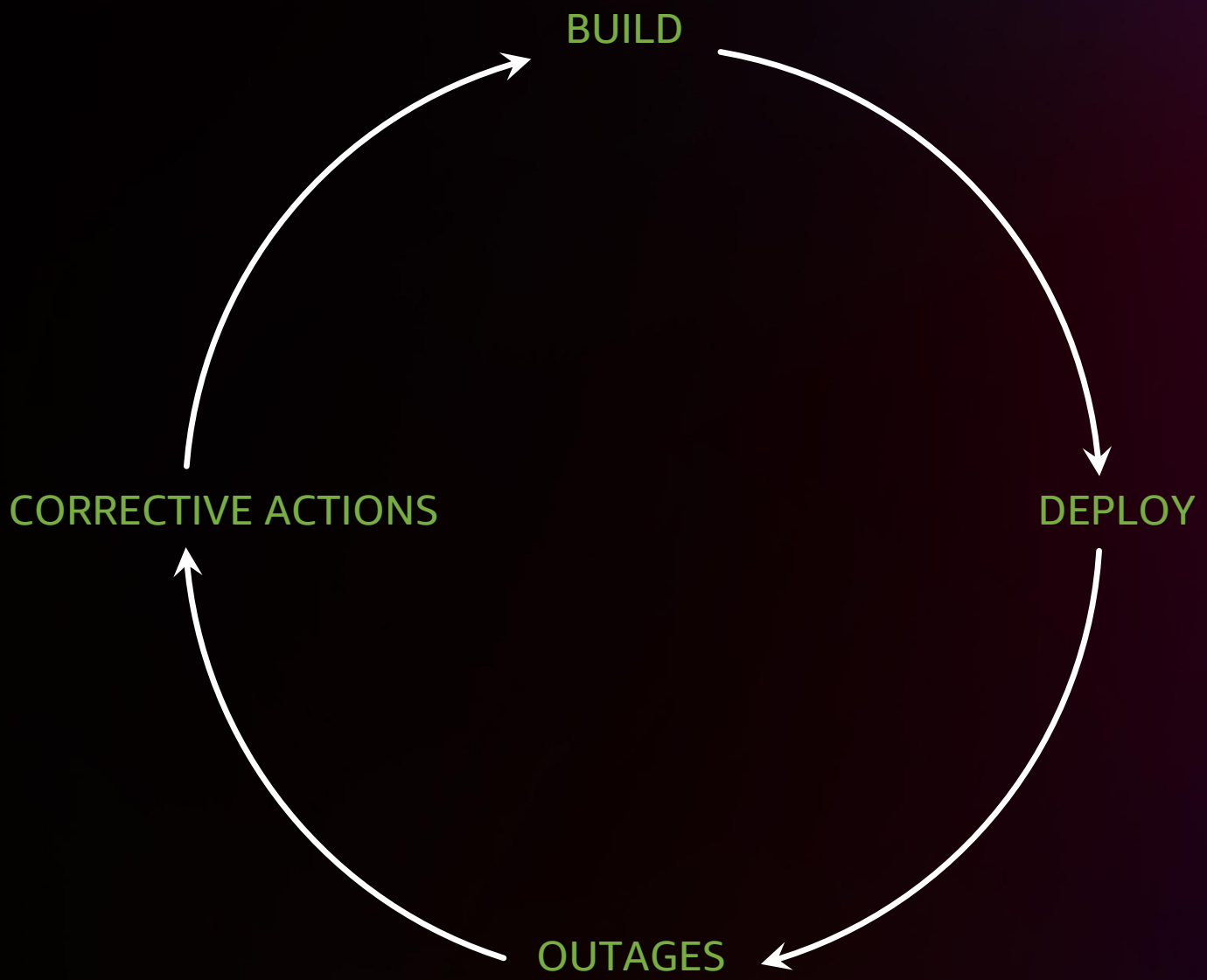




# AWS operational culture

- You Build, You Operate
- Broad operational responsibility
- Learn from failures

# Correction of Errors (COE)



# COE – In practice

- Best practices
- Tool improvements
- COE contents
  - Customer Impact
  - Metrics and Data
  - Root Cause Analysis – 5 Whys
  - Detection and Mitigation
  - Lessons Learned
  - Action Items

# Operational Readiness Reviews (ORR)

- Recognize failure patterns and avoid repetition
- Best operational practices
- Learn and correct before production
- Achieve and maintain operational excellence

# ORR – In practice

- Checklist of questions
- Derived from past failures
- Structure
  - Architecture
  - Release quality
  - Event management
- Multiple variations – service/feature/enhancement

# Deployment consistency

# Deployment consistency – Best practices

- Integration / pre-prod testing
- Canary / Fractional deployments
- Rollback alarms
- Metrics anomaly detection

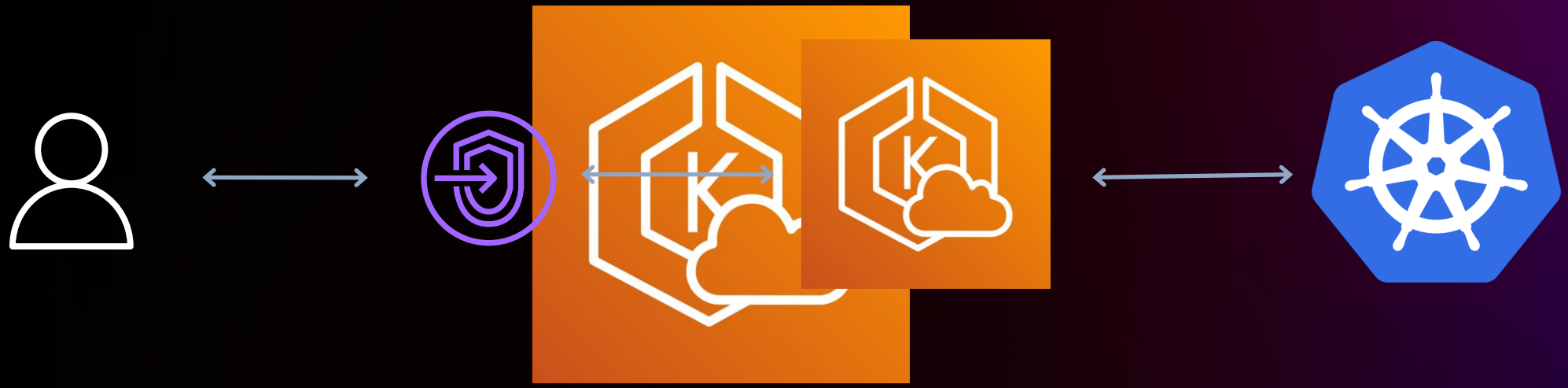
# EKS and Kubernetes

“A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable.”

**Leslie Lamport, 2013 Turing Award**

Computer Scientist and Mathematician, MIT

# EKS and Kubernetes overview



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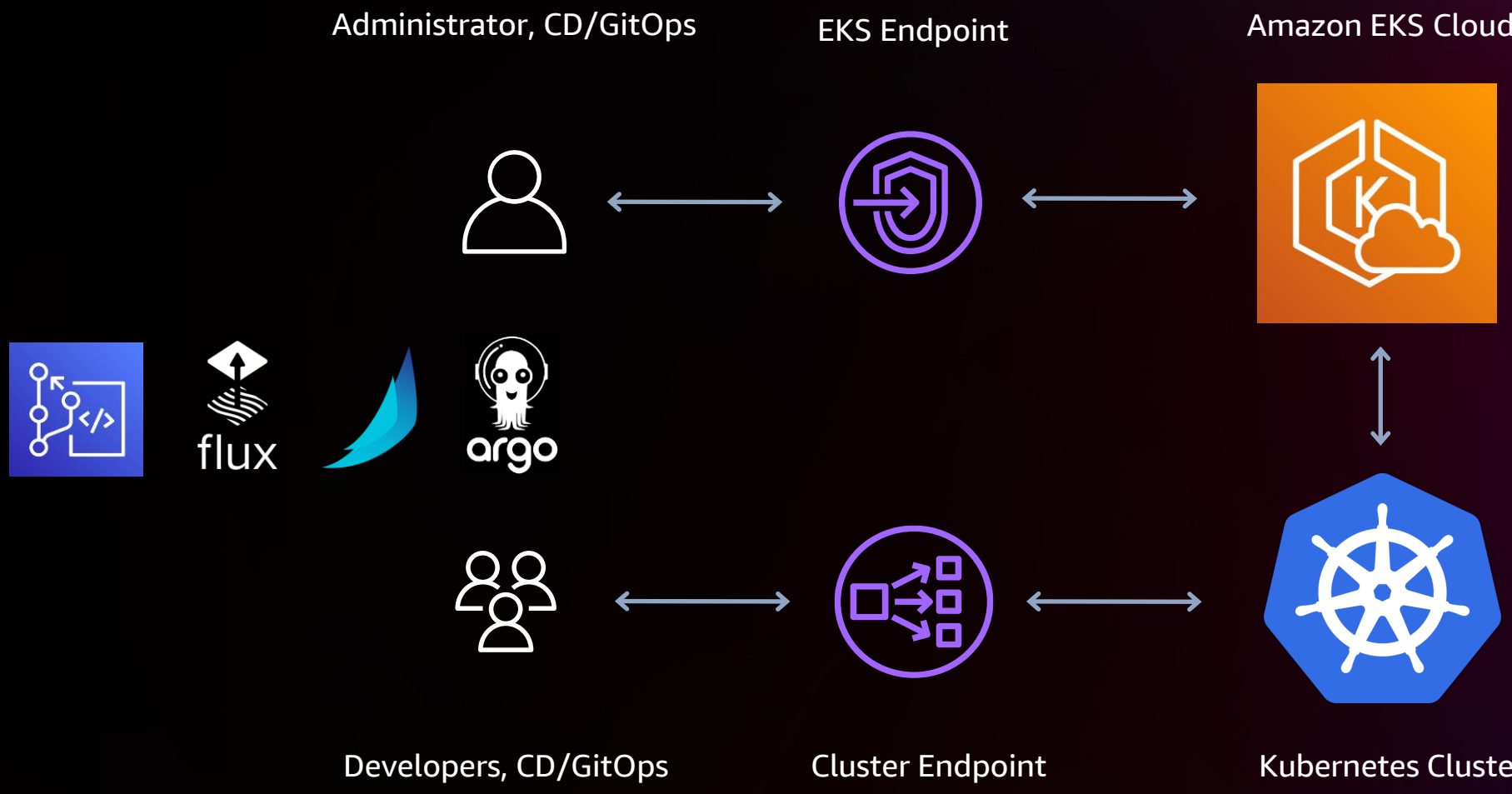

# EKS and Kubernetes overview

EKS Regional Endpoint
eks.us-west-2.amazonaws.com

```
$ aws eks list-clusters

$ aws eks create-cluster --name prod <…>

$ aws eks describe-cluster --name prod

$ aws eks get-token --cluster-name prod

$ aws eks create-nodegroup --cluster-name prod
      --nodegroup-name frontend <…>
```

Single Cluster API Server NLB Endpoint
https://1122334455667788OOAABB.gr7.us-west-2.eks.amazonaws.com

```
$ kubectl apply -f my_application.yml

$ kubectl describe nodes my-node

$ kubectl get pods --all-namespaces

$ kubectl exec --stdin --tty my-pod -- /bin/sh

$ kubectl create deployment nginx --image=nginx

$ kubectl rollout restart deployment/frontend
```

# How systems work

# Kubernetes high-level overview

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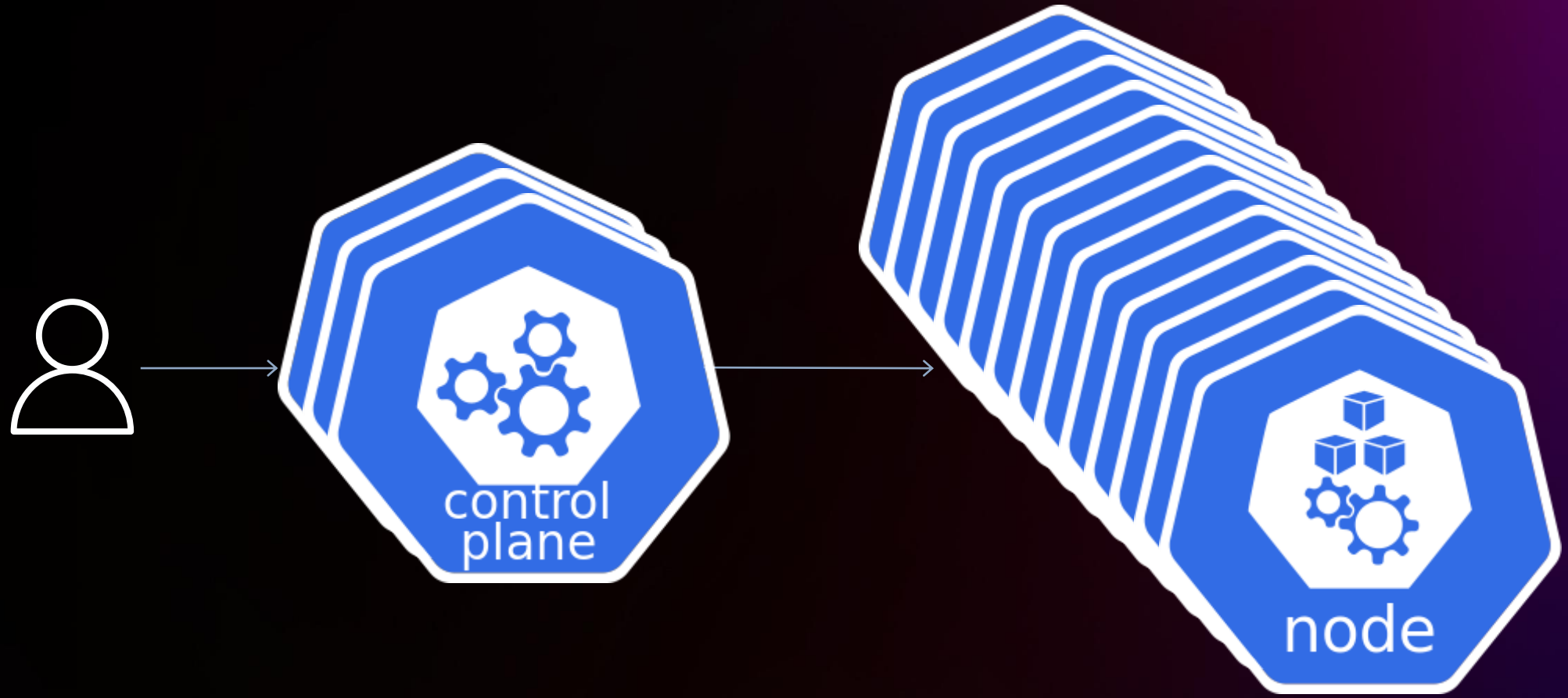

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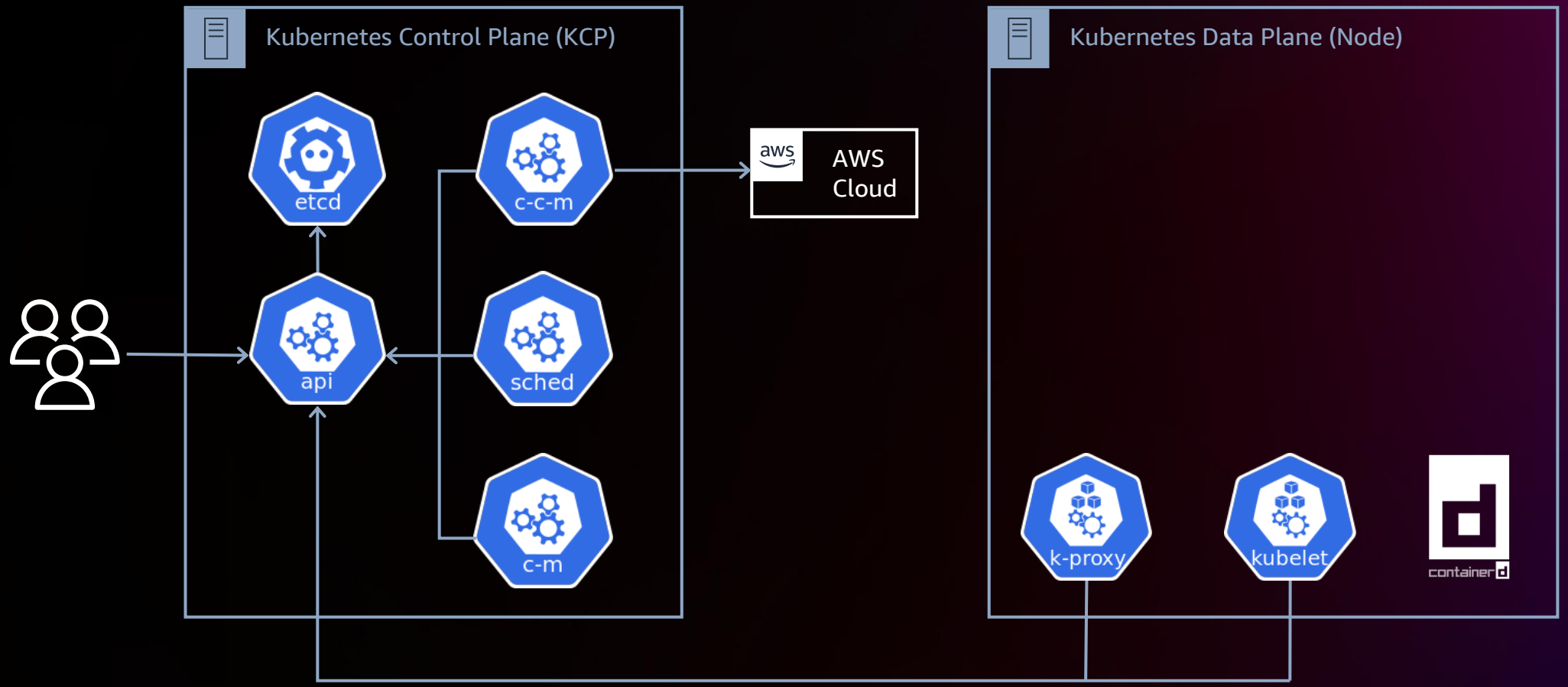

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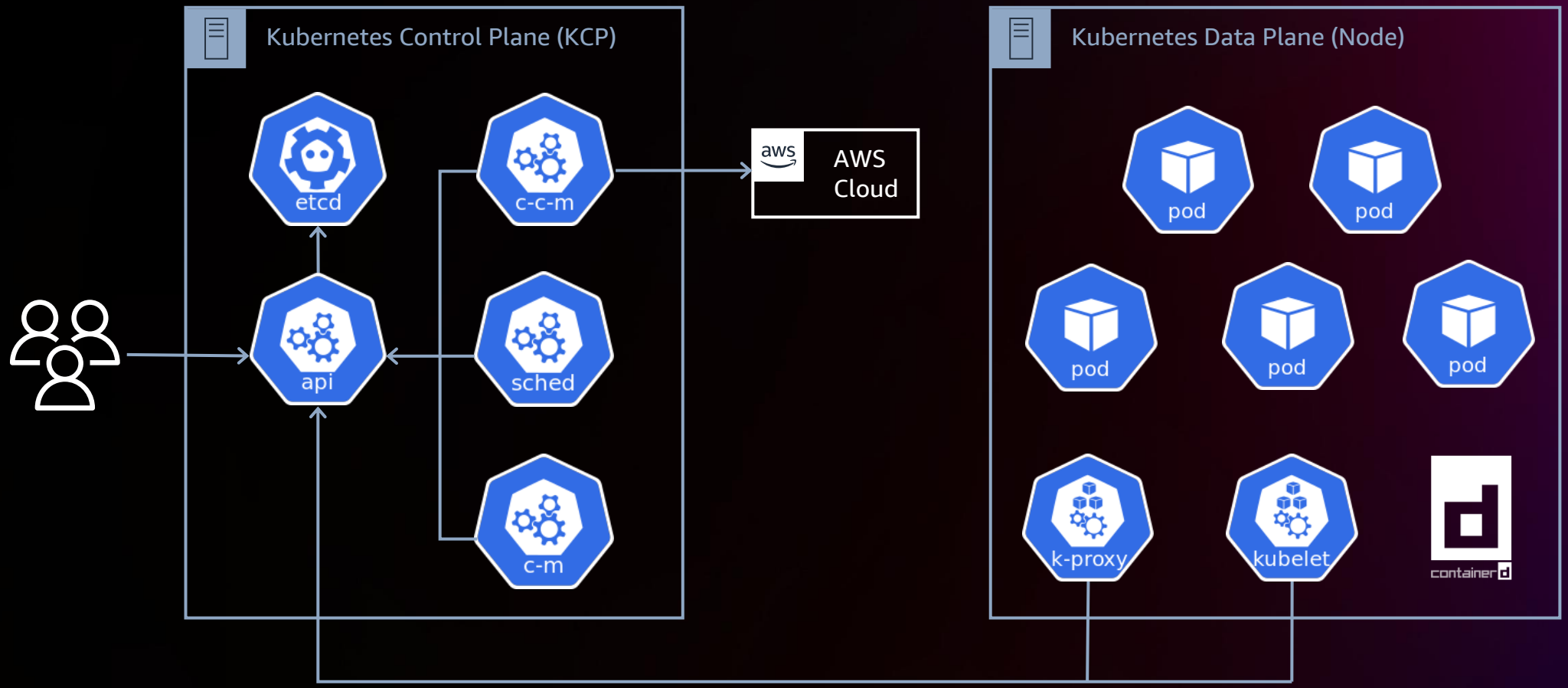

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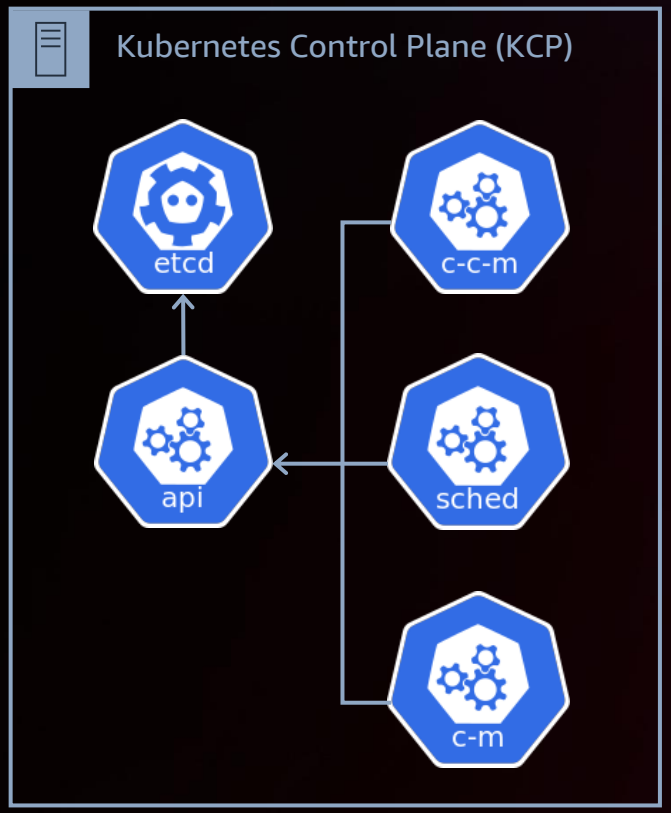

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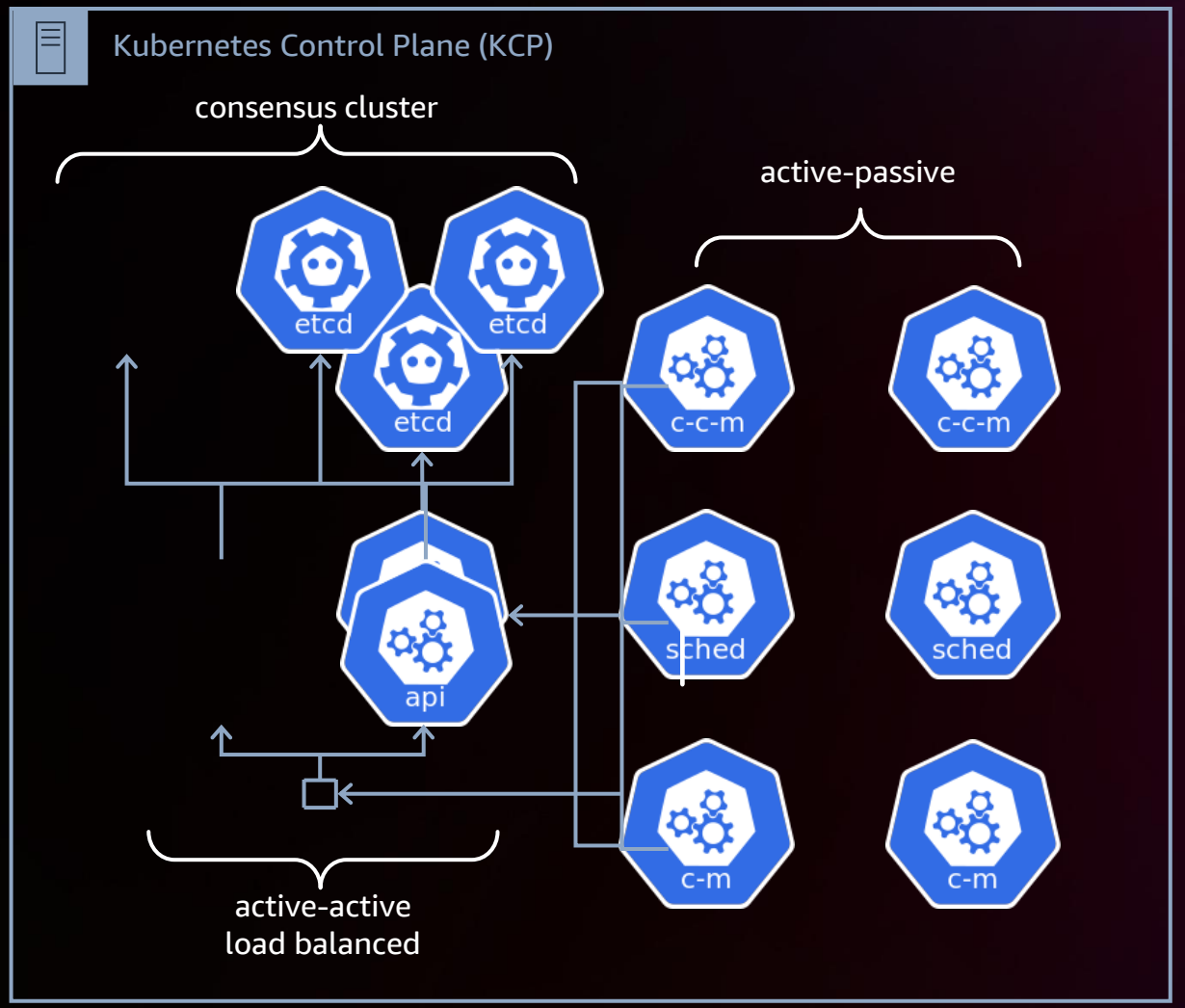
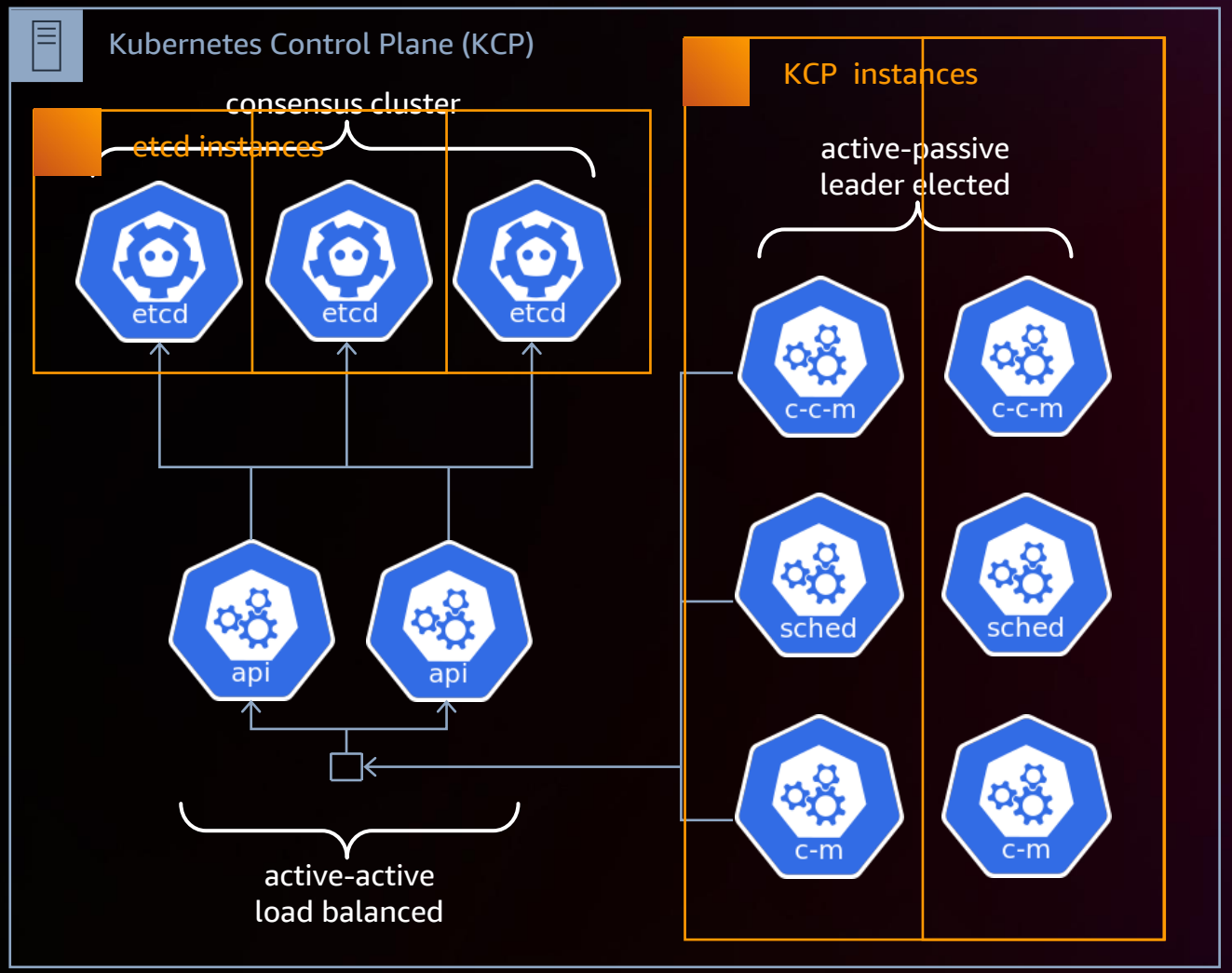
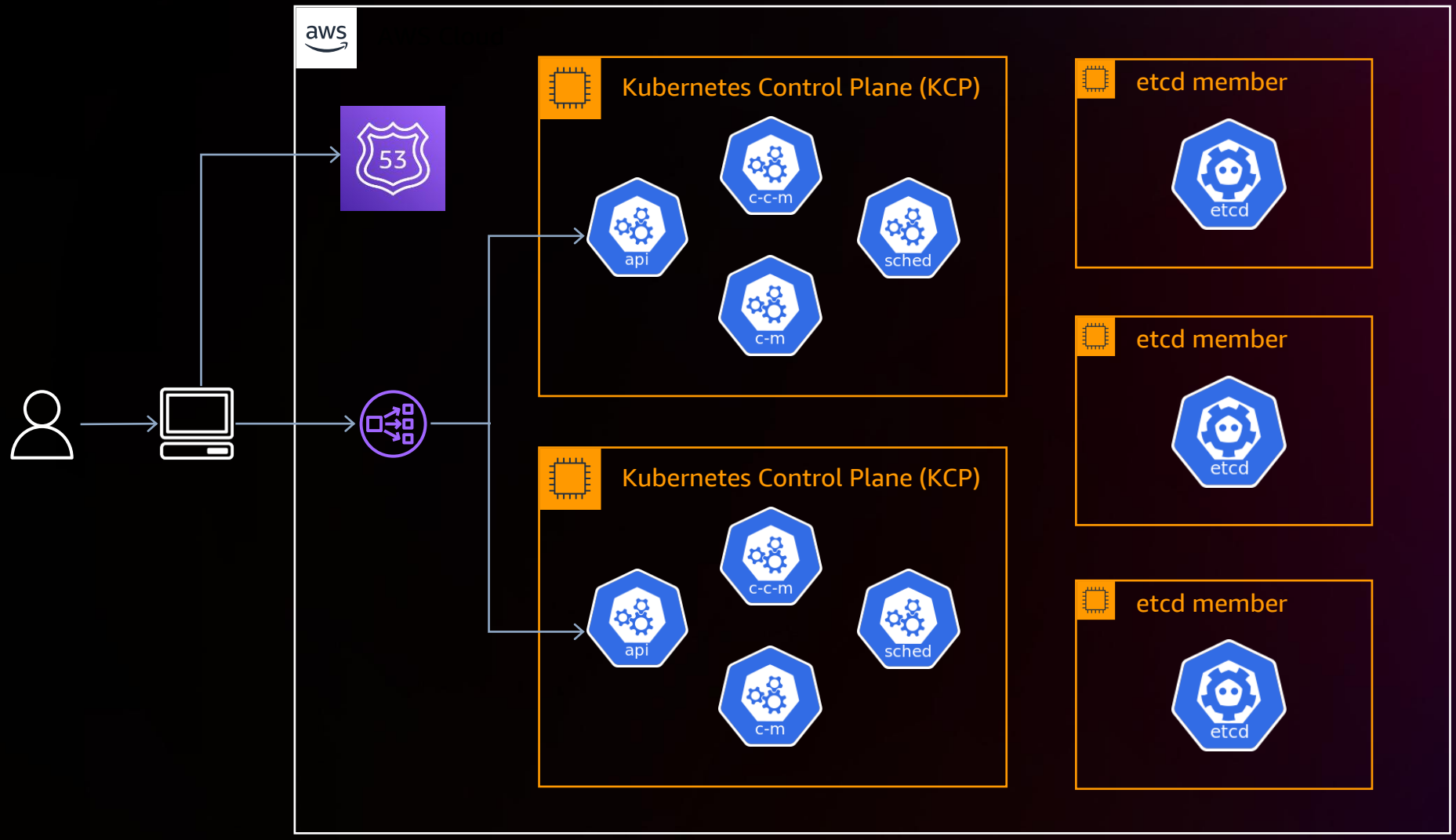


# Kubernetes high-level architecture in EKS



# EKS high-level architecture – Control Plane



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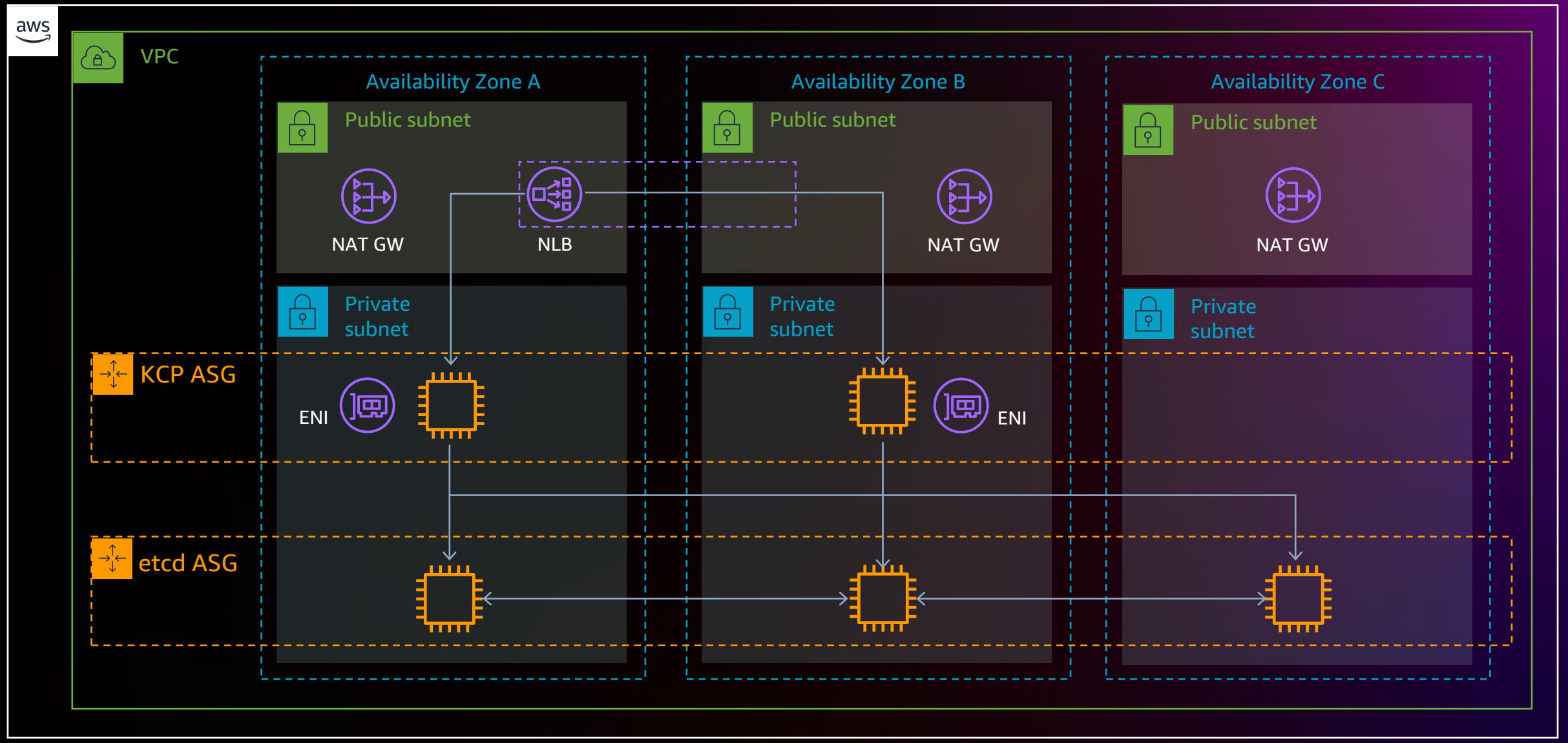

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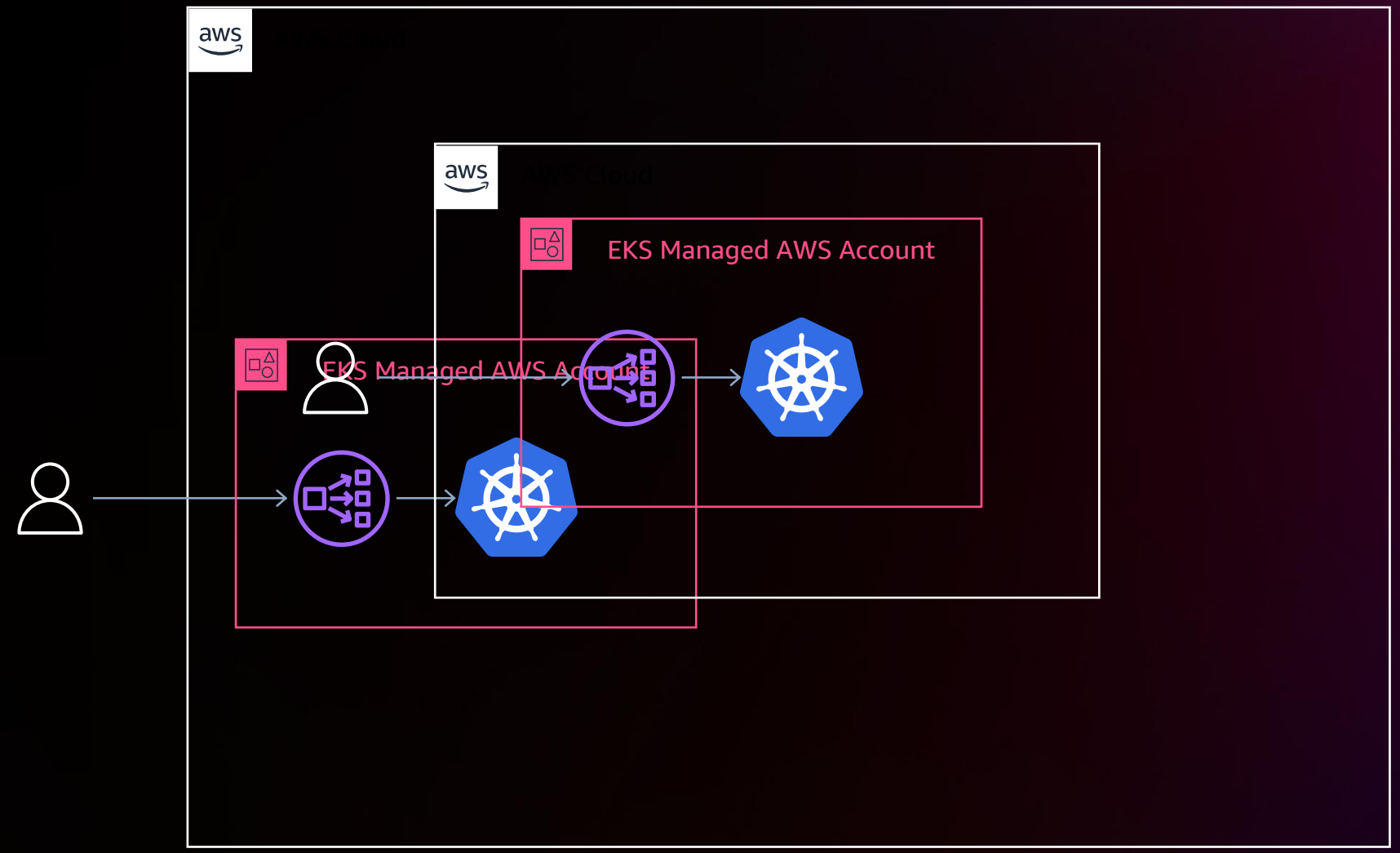

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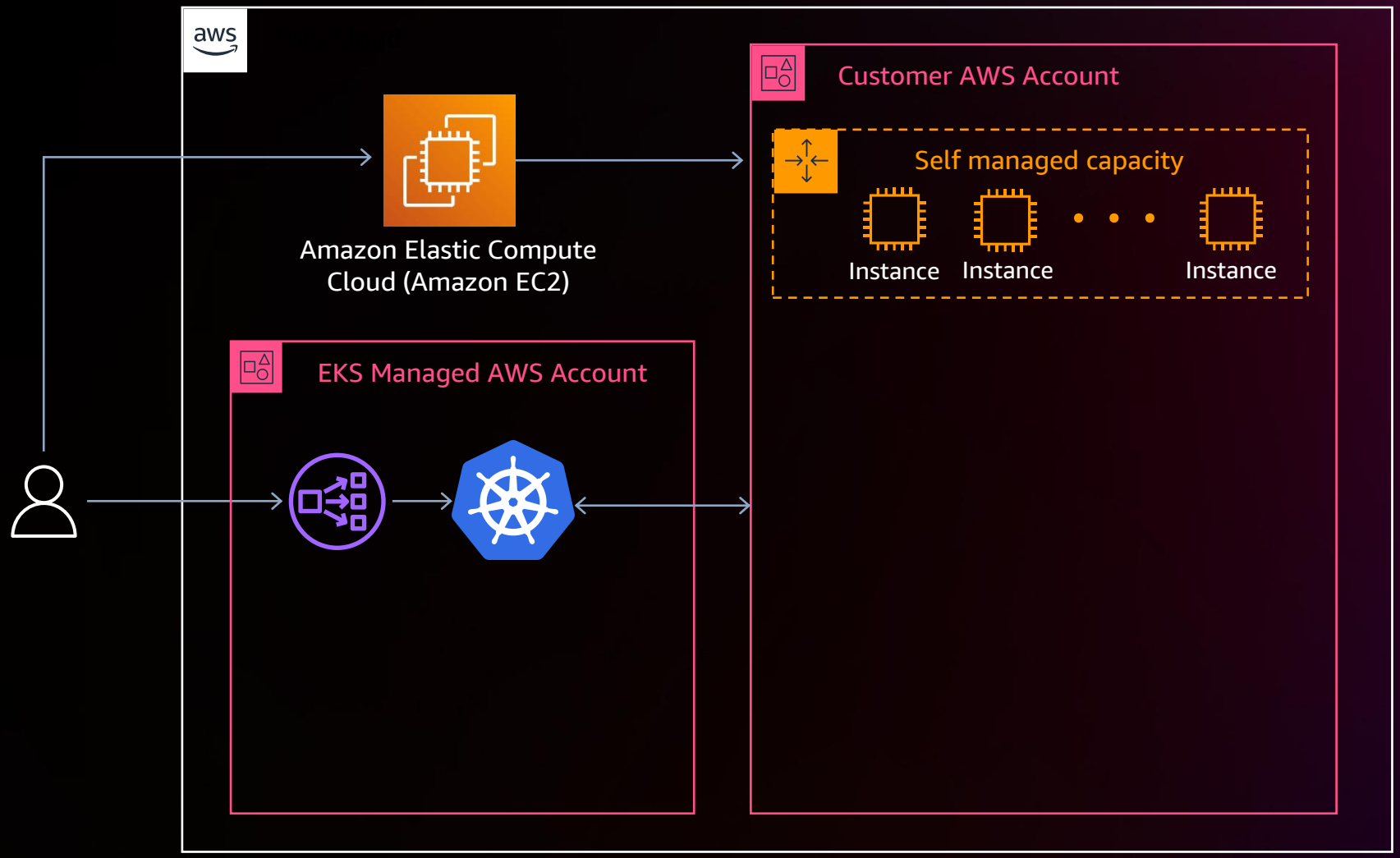

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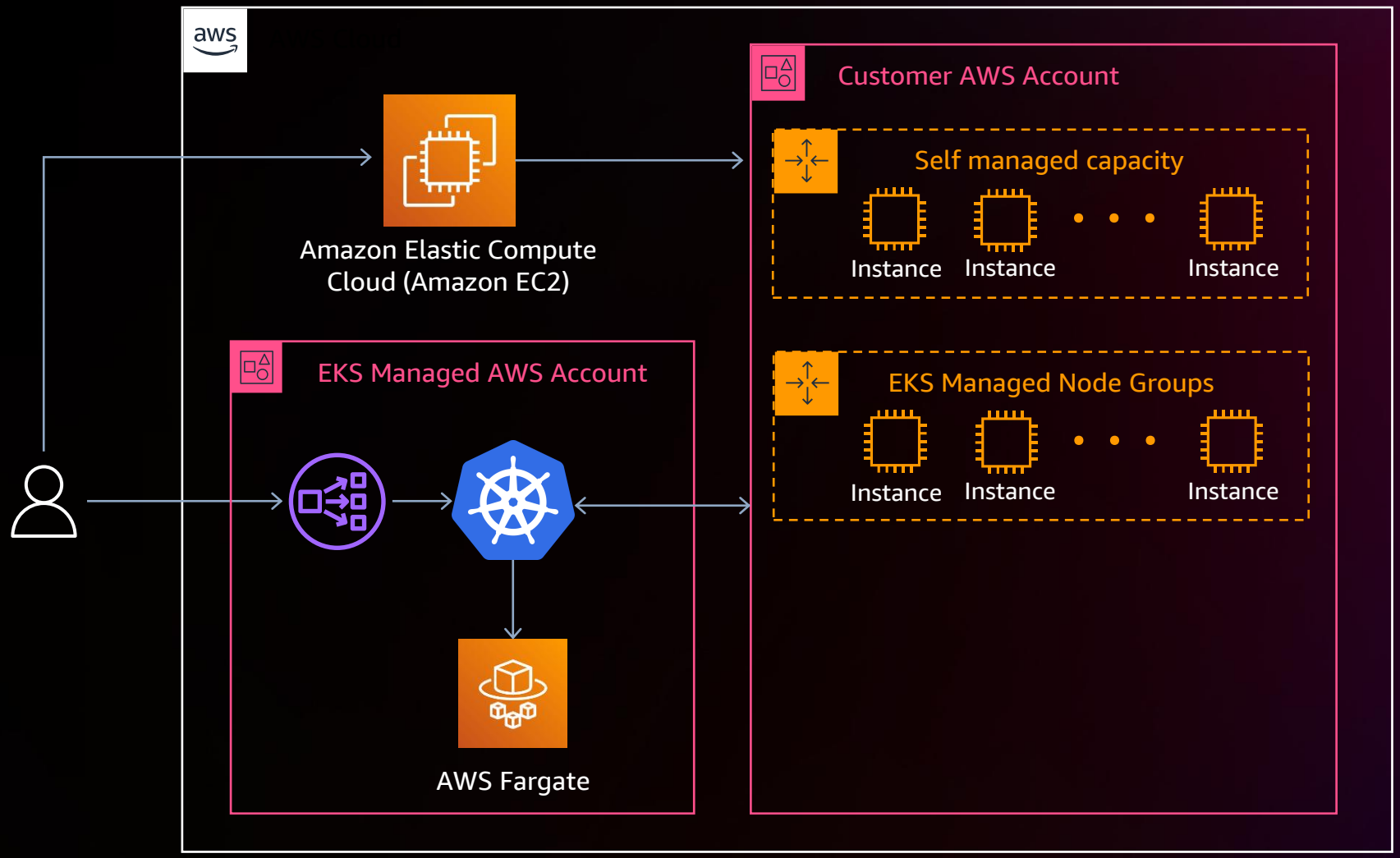

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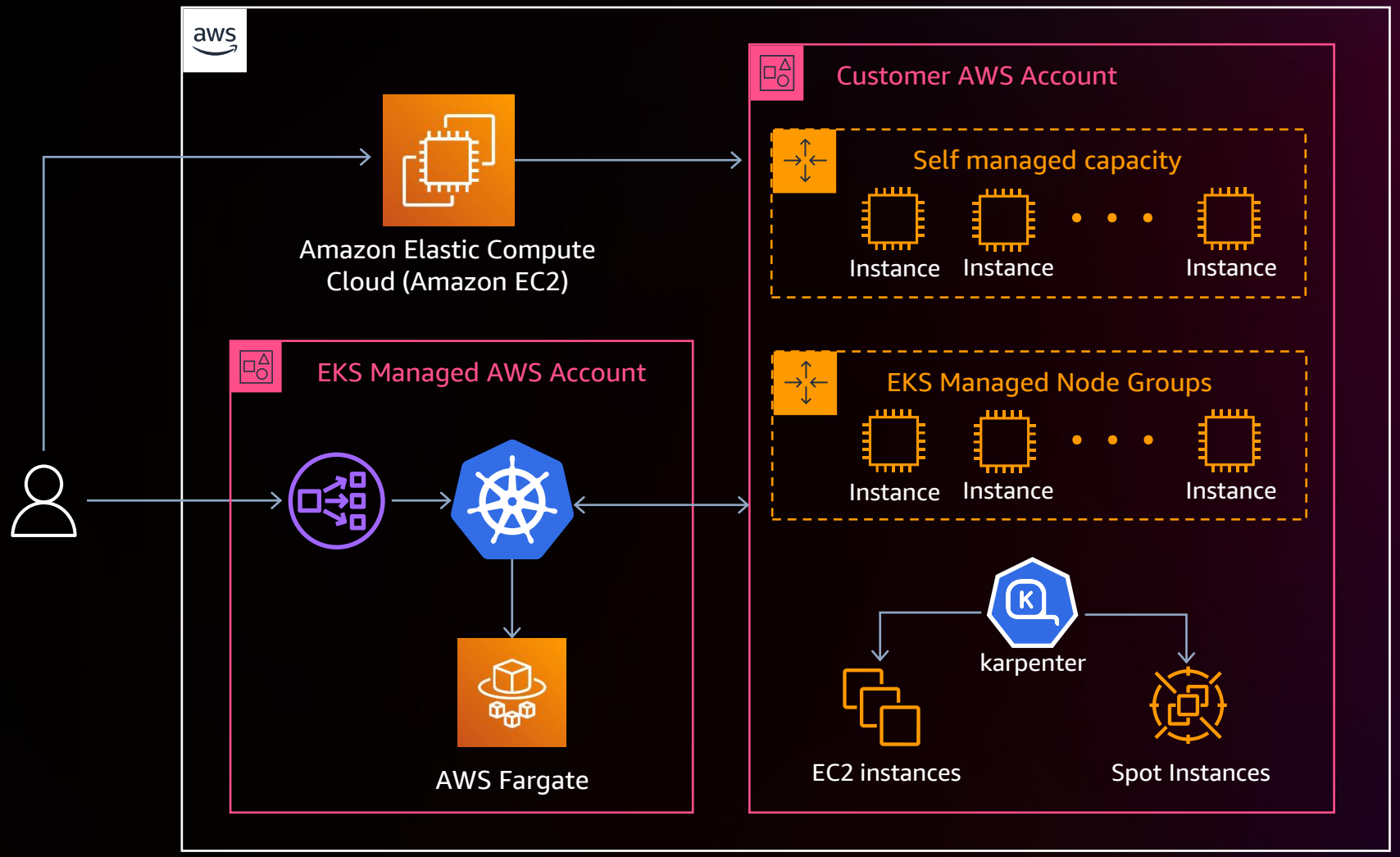
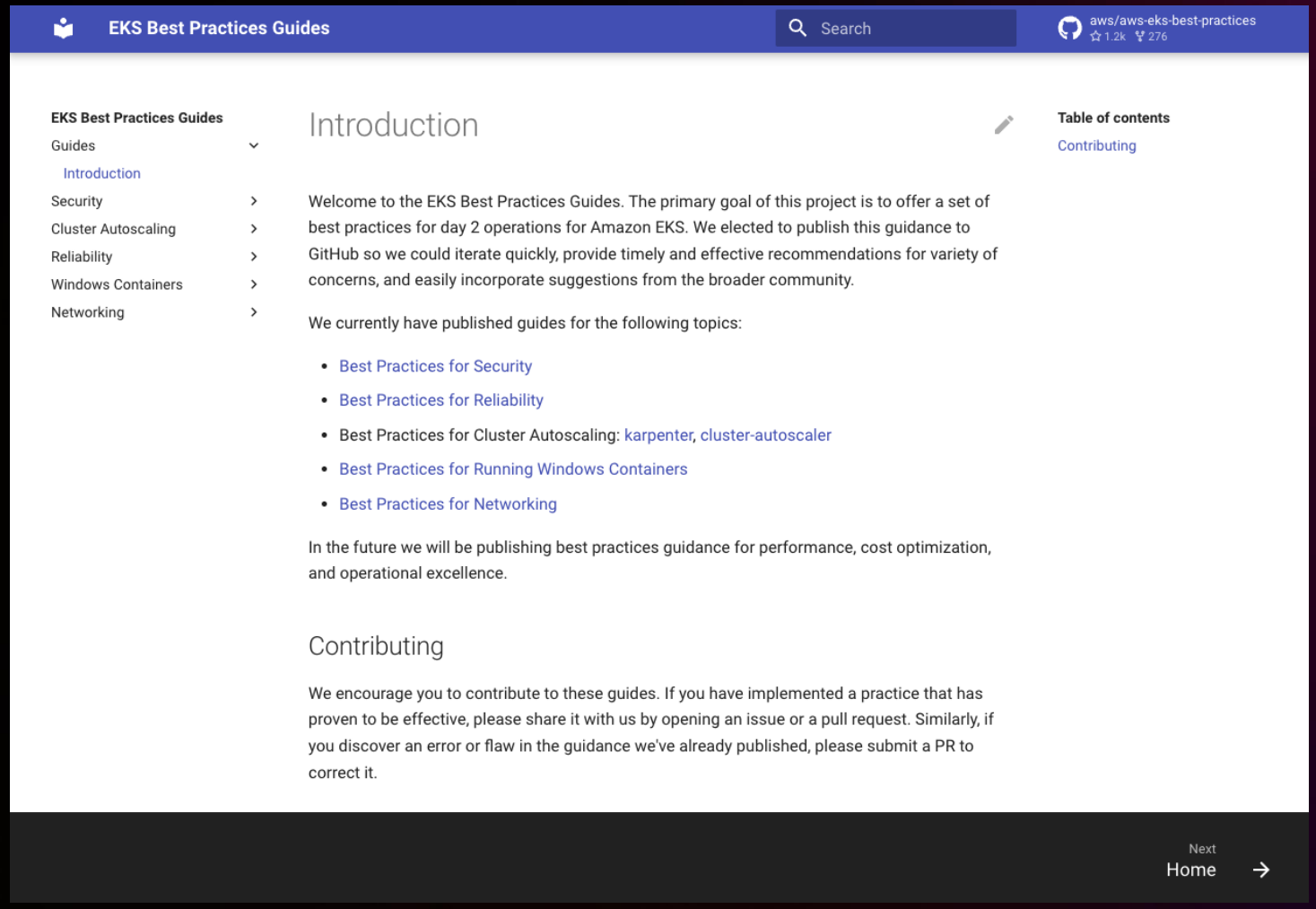


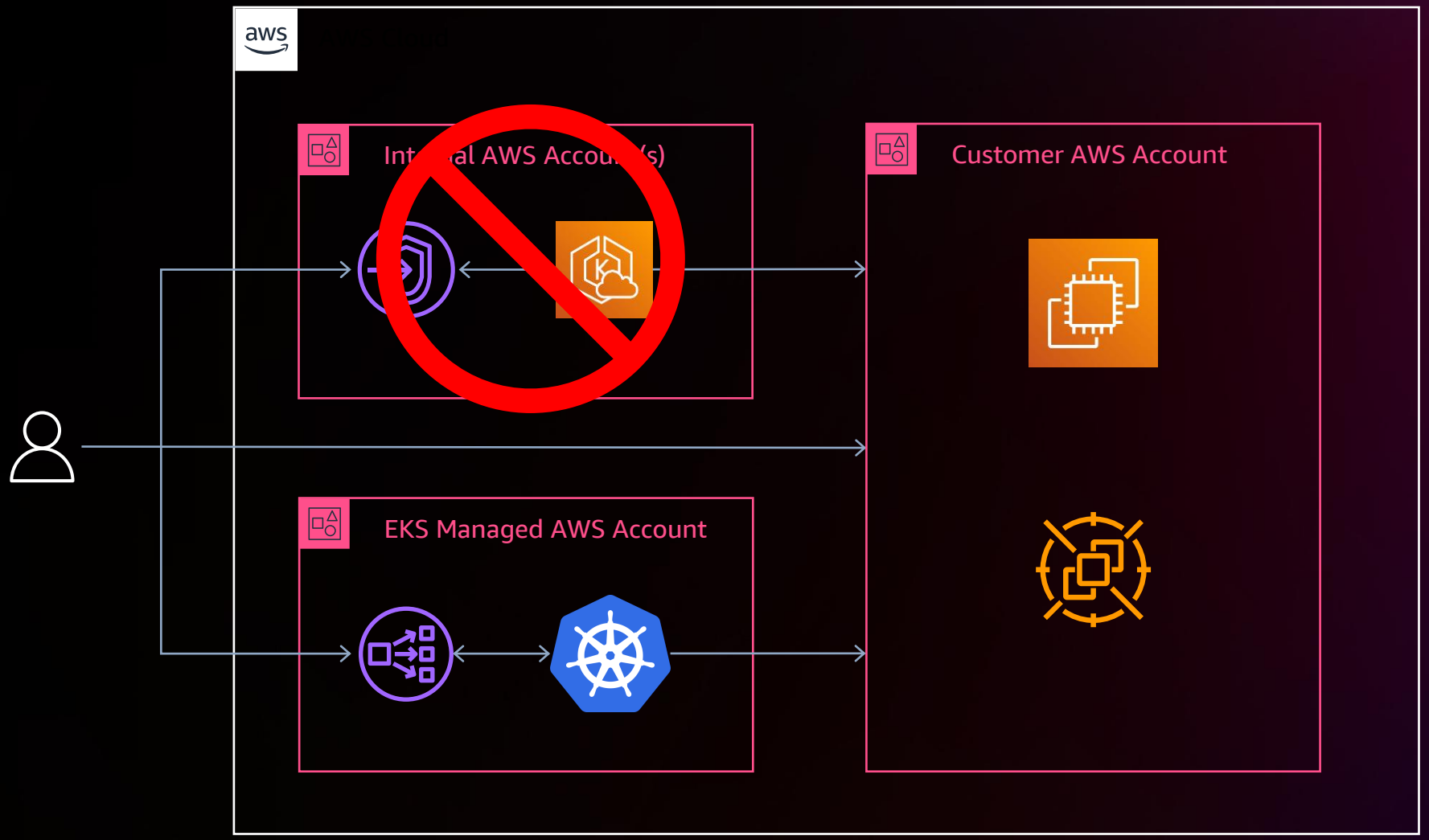
# EKS Best Practices Guides

Visit: https://aws.github.io/aws-eks-best-practices/



# How systems fail

# Independent failure domains



# EKS and Kubernetes interactions

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$ aws eks create-cluster --name prod <...>

$ aws eks describe-cluster --name prod

$ aws eks get-token --cluster-name prod

$ aws eks create-nodegroup --cluster-name prod
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```

```
$ kubectl apply -f my_application.yml

$ kubectl describe nodes my-node

$ kubectl get pods --all-namespaces

$ kubectl exec --stdin --tty my-pod -- /bin/sh

$ kubectl create deployment nginx --image=nginx

$ kubectl rollout restart deployment/frontend
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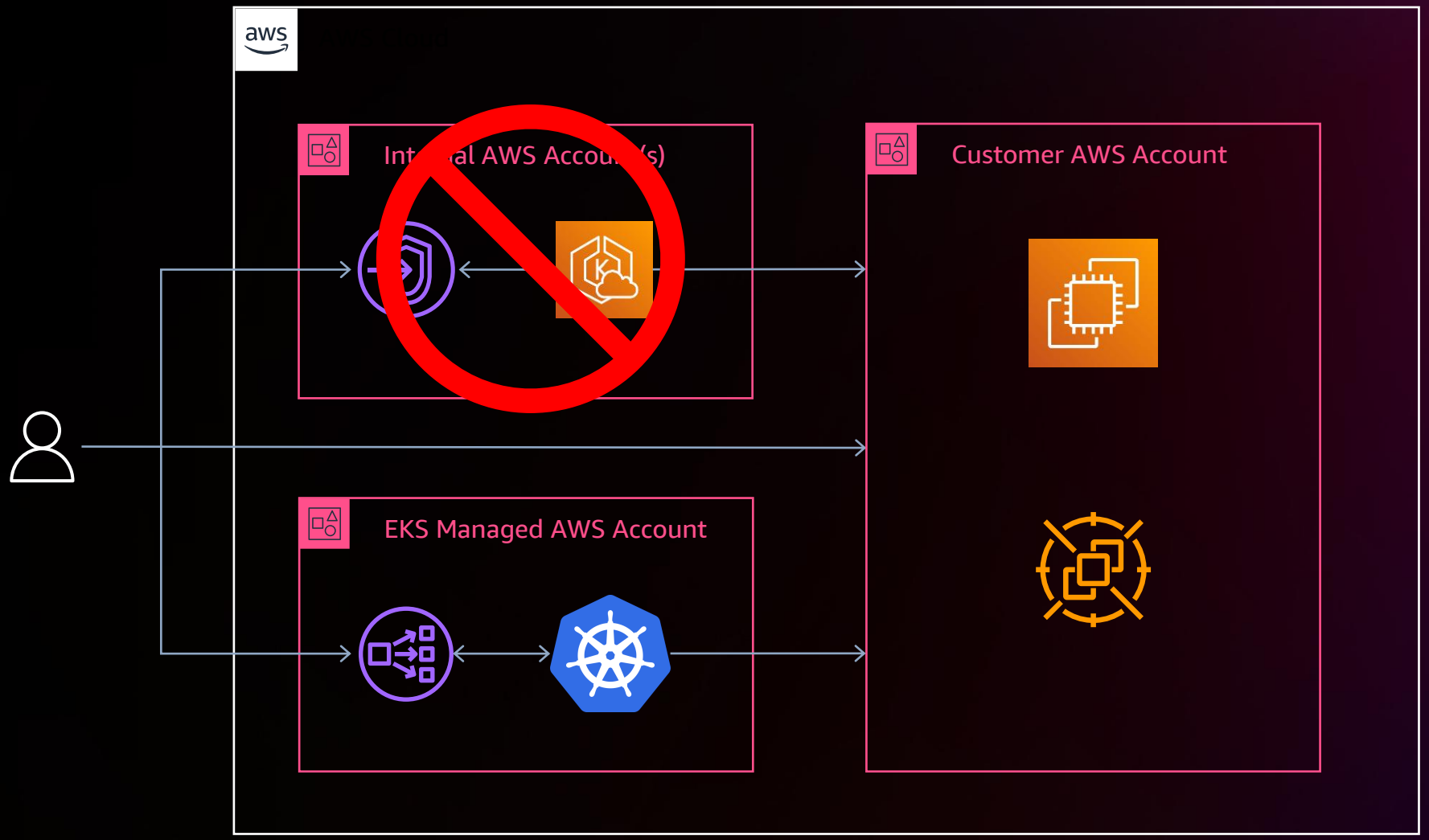
# Independent failure domains



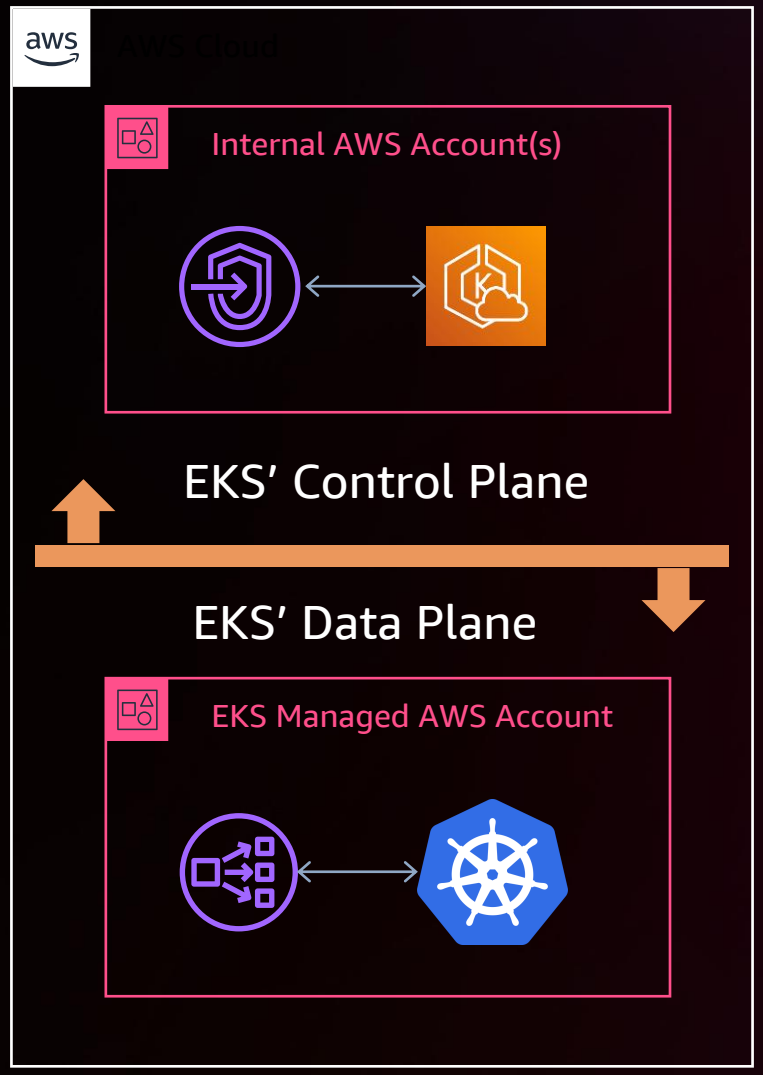
“In a statically stable design, the overall system keeps working when a dependency becomes impaired. Perhaps the system doesn’t see any updated information… However, everything it was doing before the dependency became impaired continues to work.”

**Becky Weiss and Mike Furr**

AWS Sr. Principal Engineers

**The Amazon Builders' Library: Static stability using Availability Zones**

# EKS Control Plane and Data Plane



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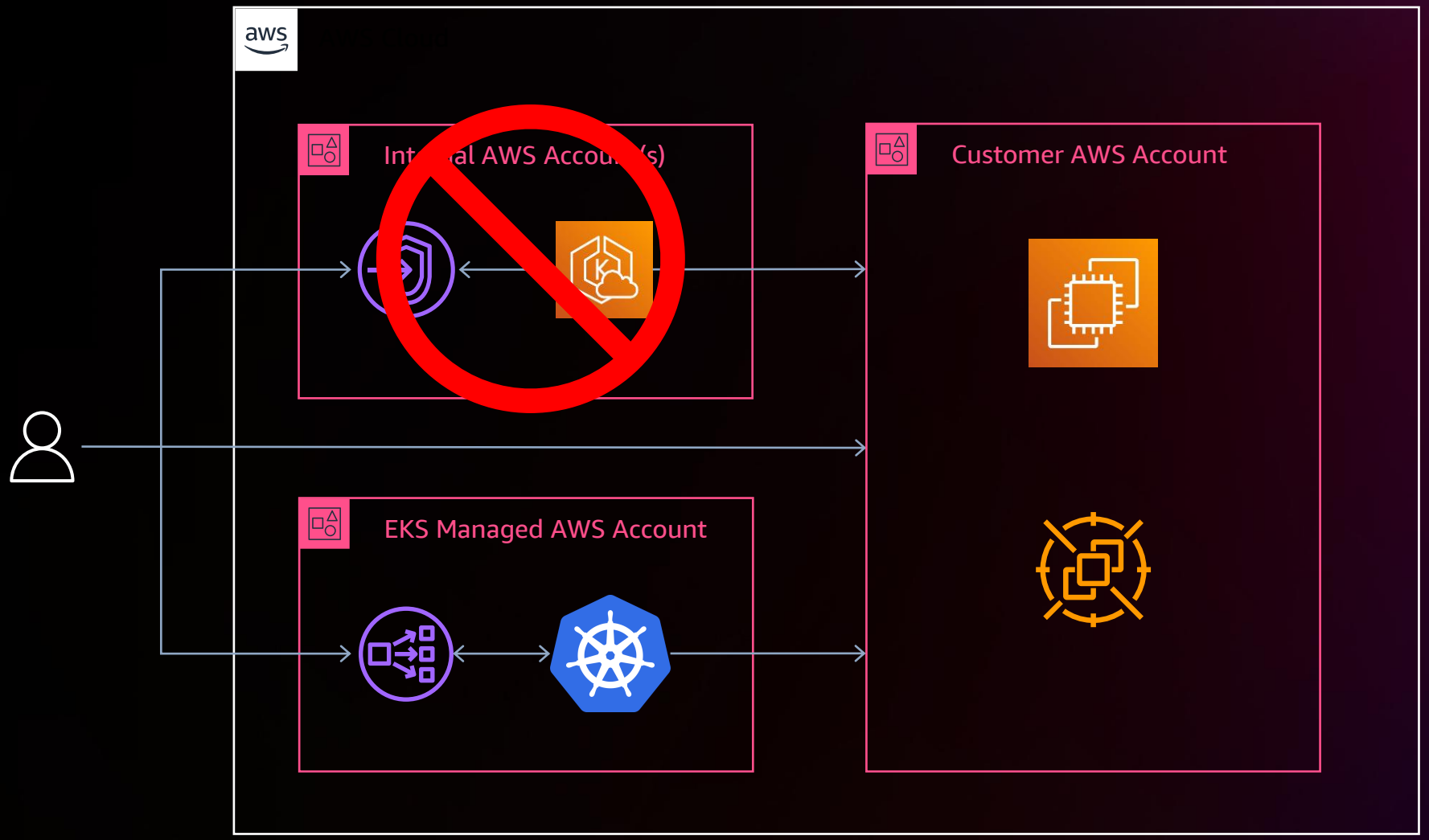

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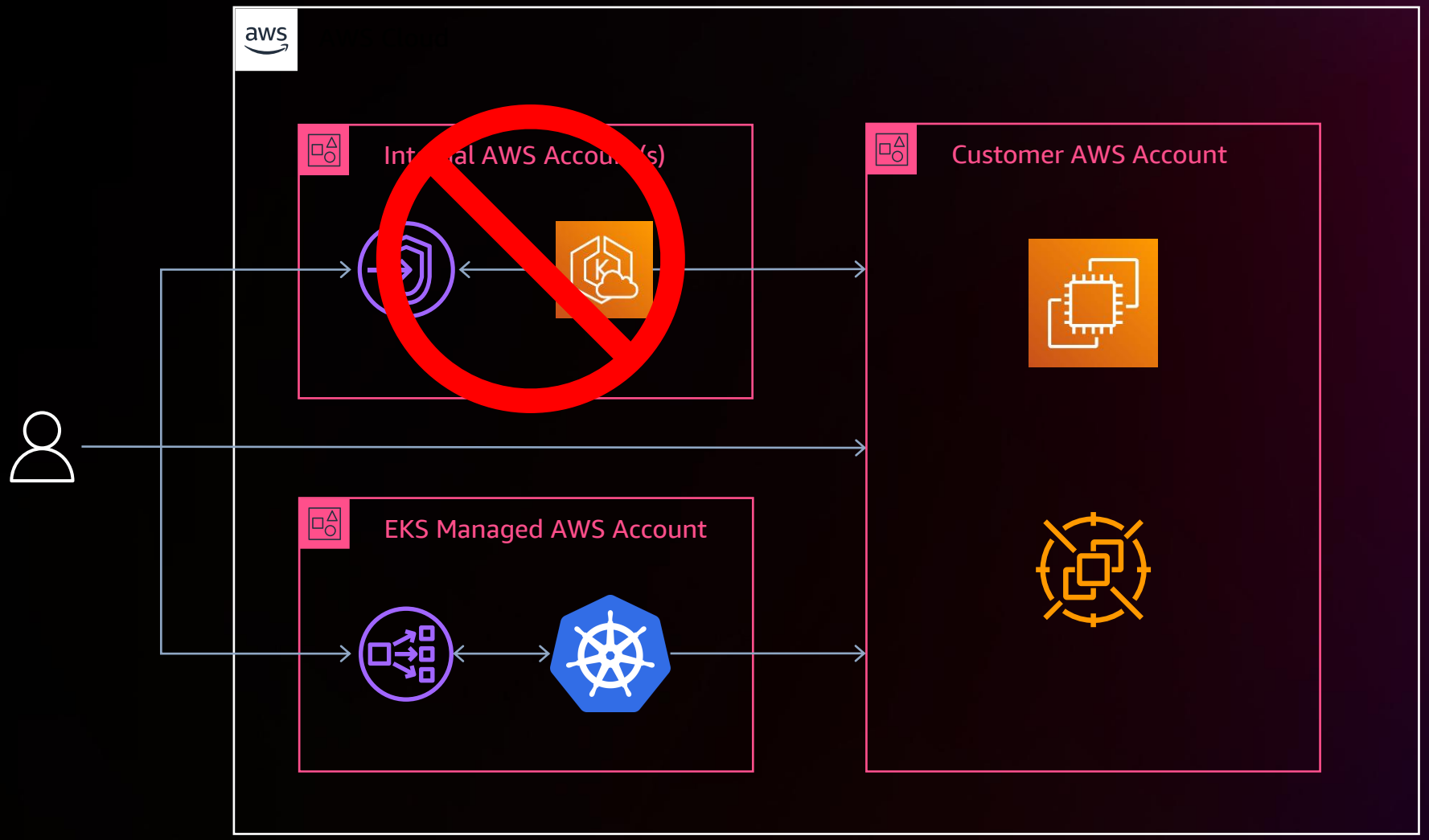

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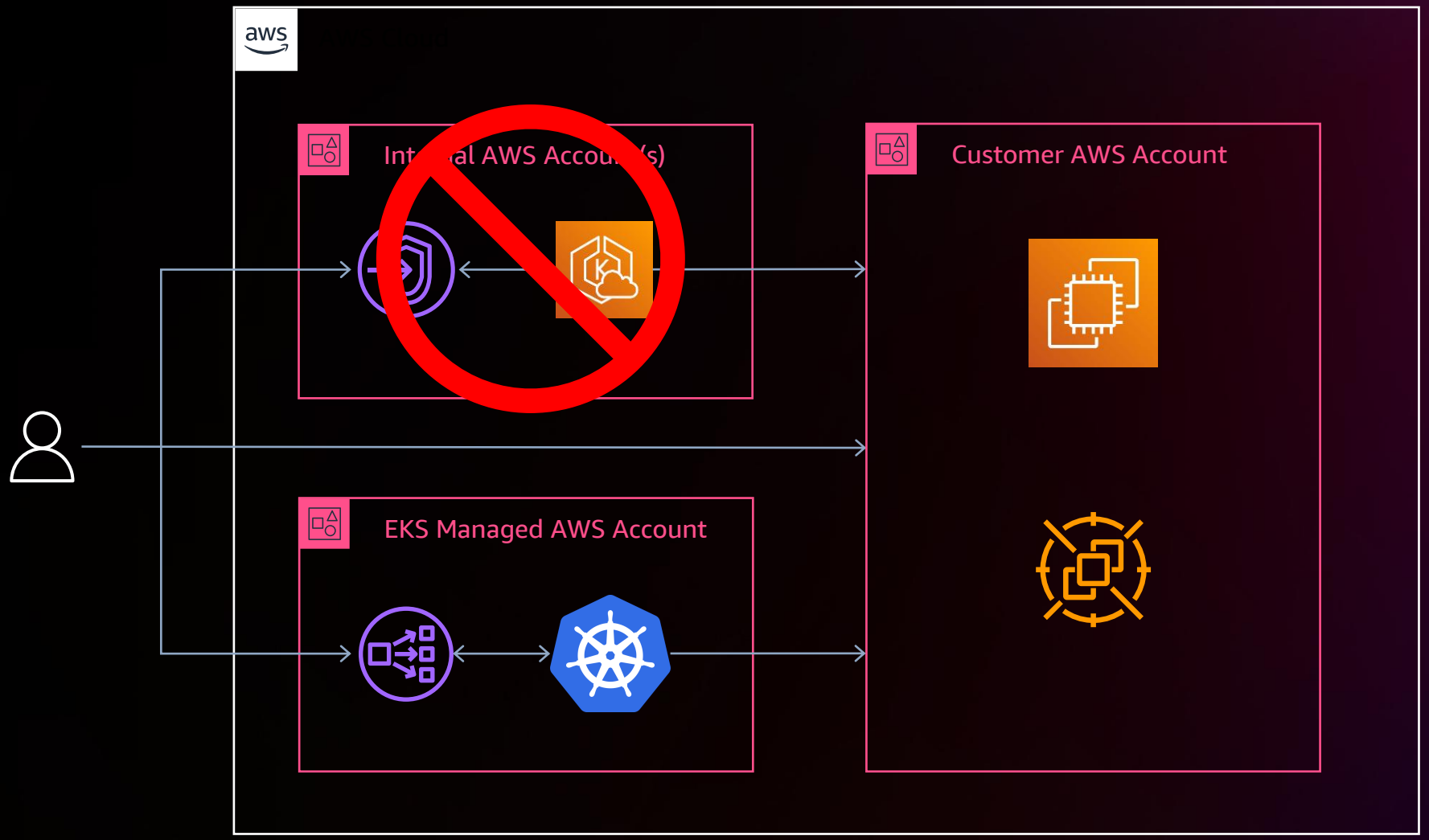


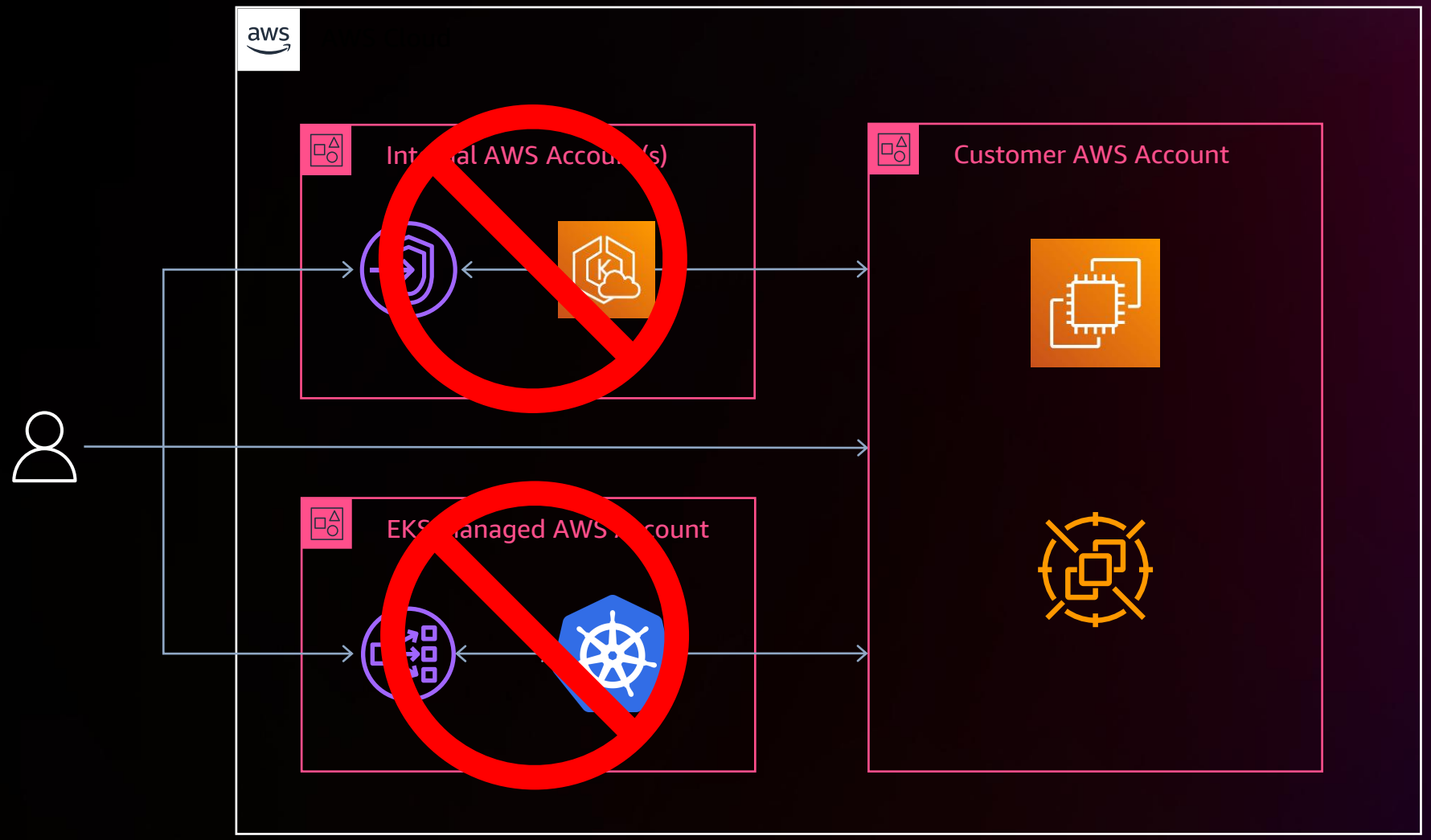
The Amazon Builders' Library

# Timeouts, retries, and backoff with jitter

**Marc Brooker**

AWS Sr. Principal Engineer

# Kubernetes Control Plane failures



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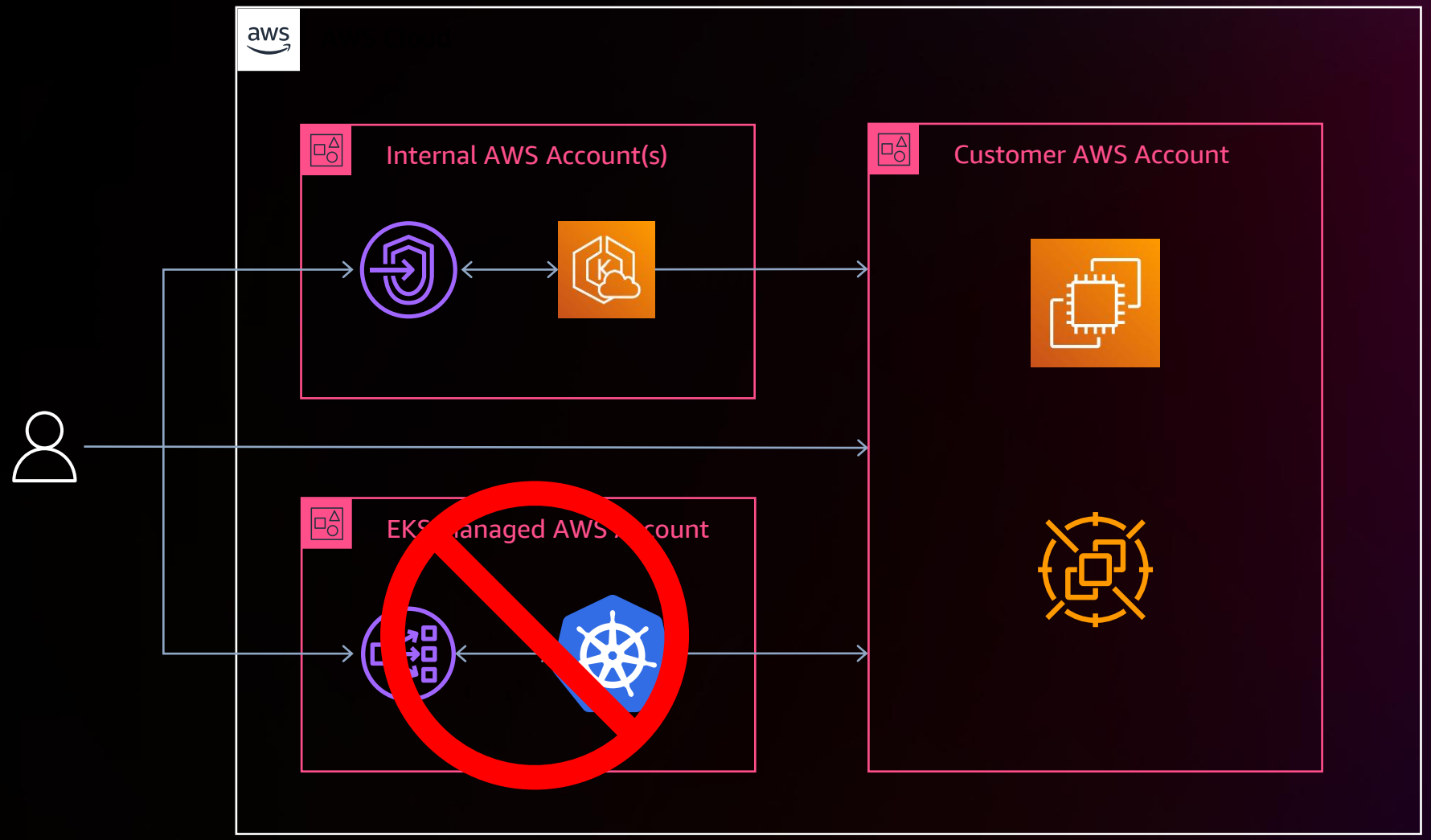

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$ kubectl    eate deployment n    x    mage=nginx

$ kubectl roll    restart d    yment/frontend
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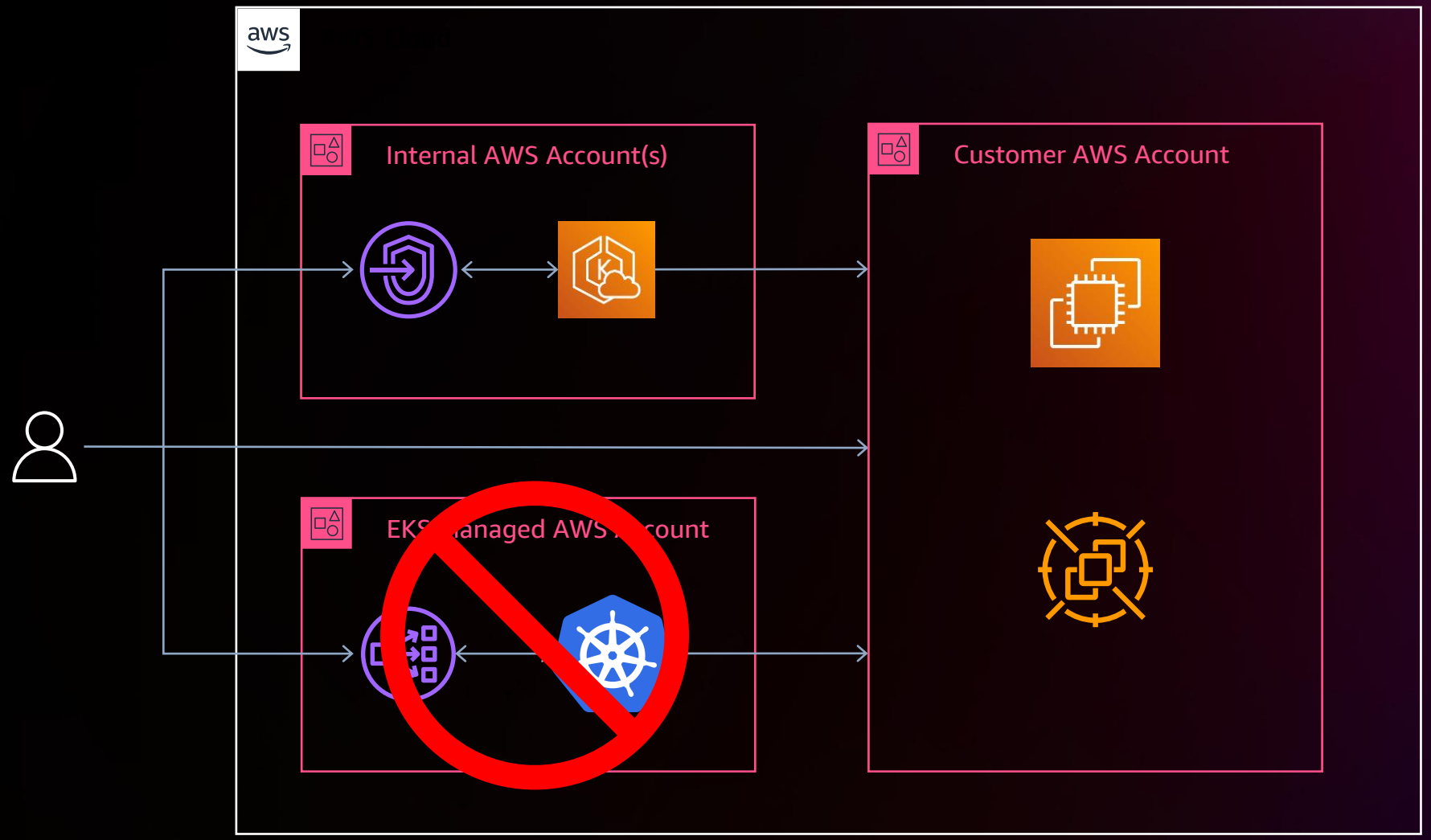
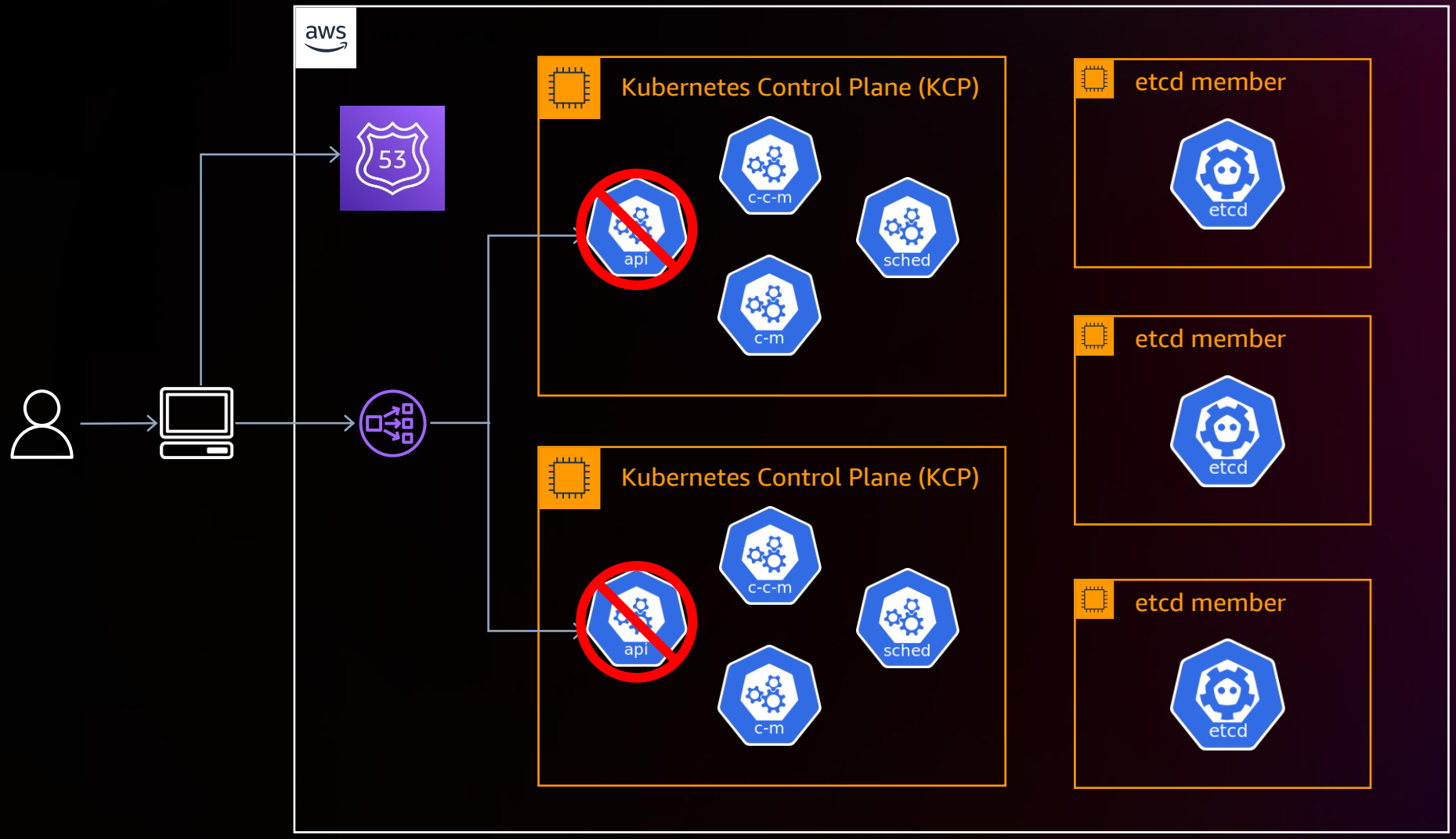


# Control Plane and shared fate



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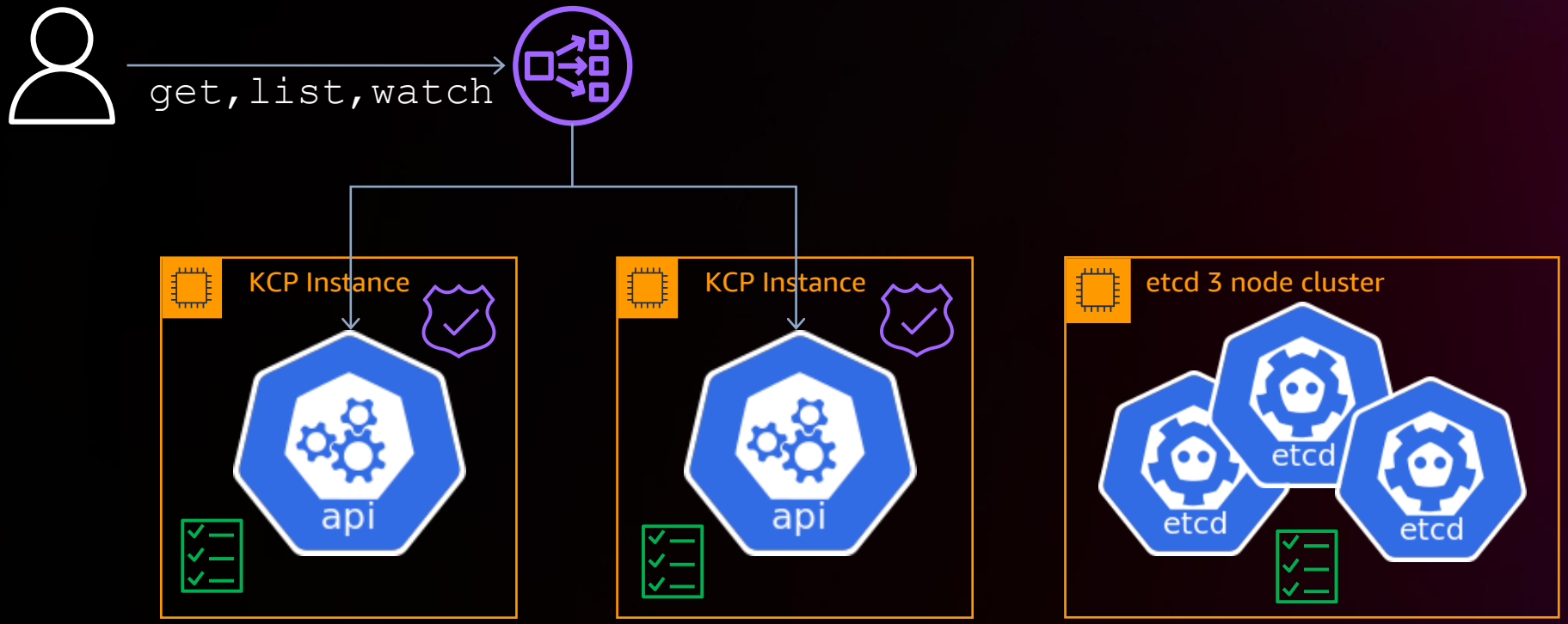
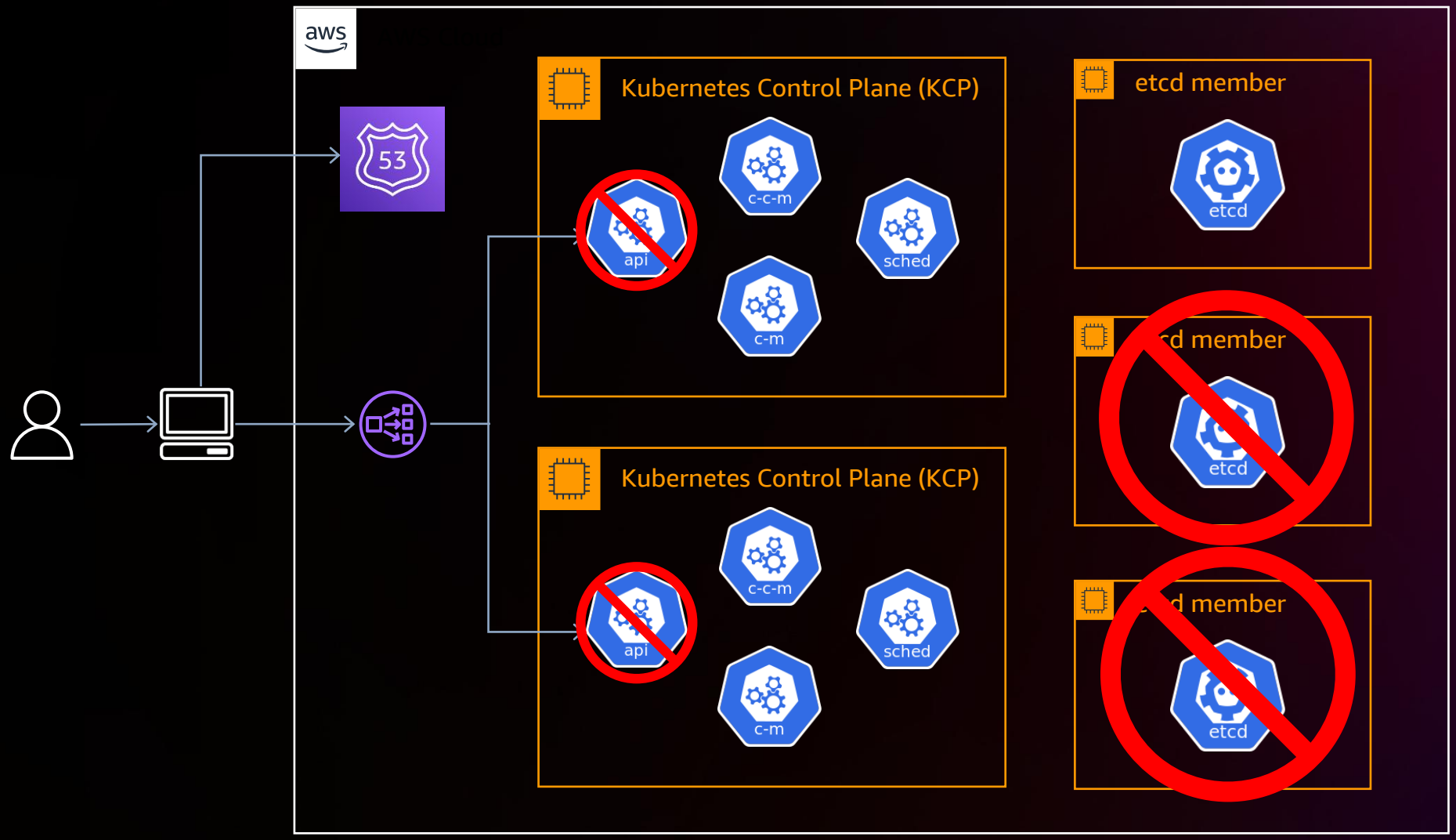



EKS Internal dashboards

# Kubernetes Persistent Data (etcd)



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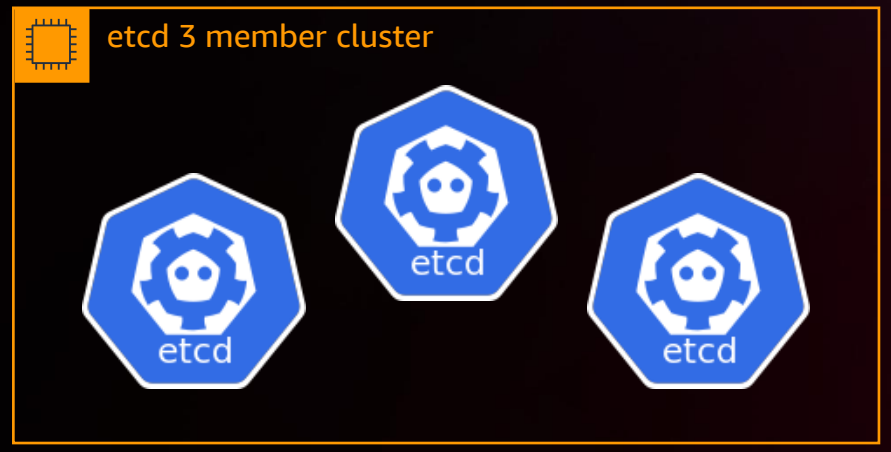


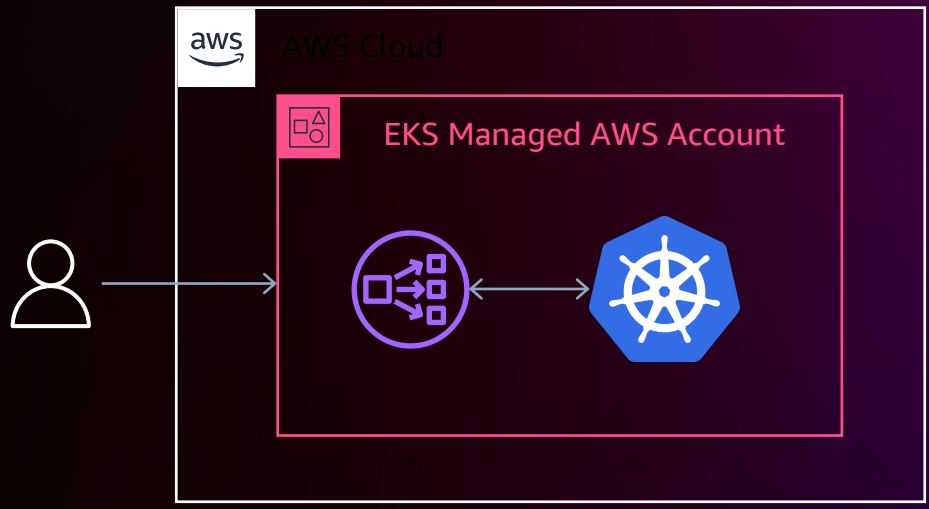

Track the etcd used storage size: `etcd_db_total_size_in_bytes`

# Kubernetes Cluster backup, restore, migration

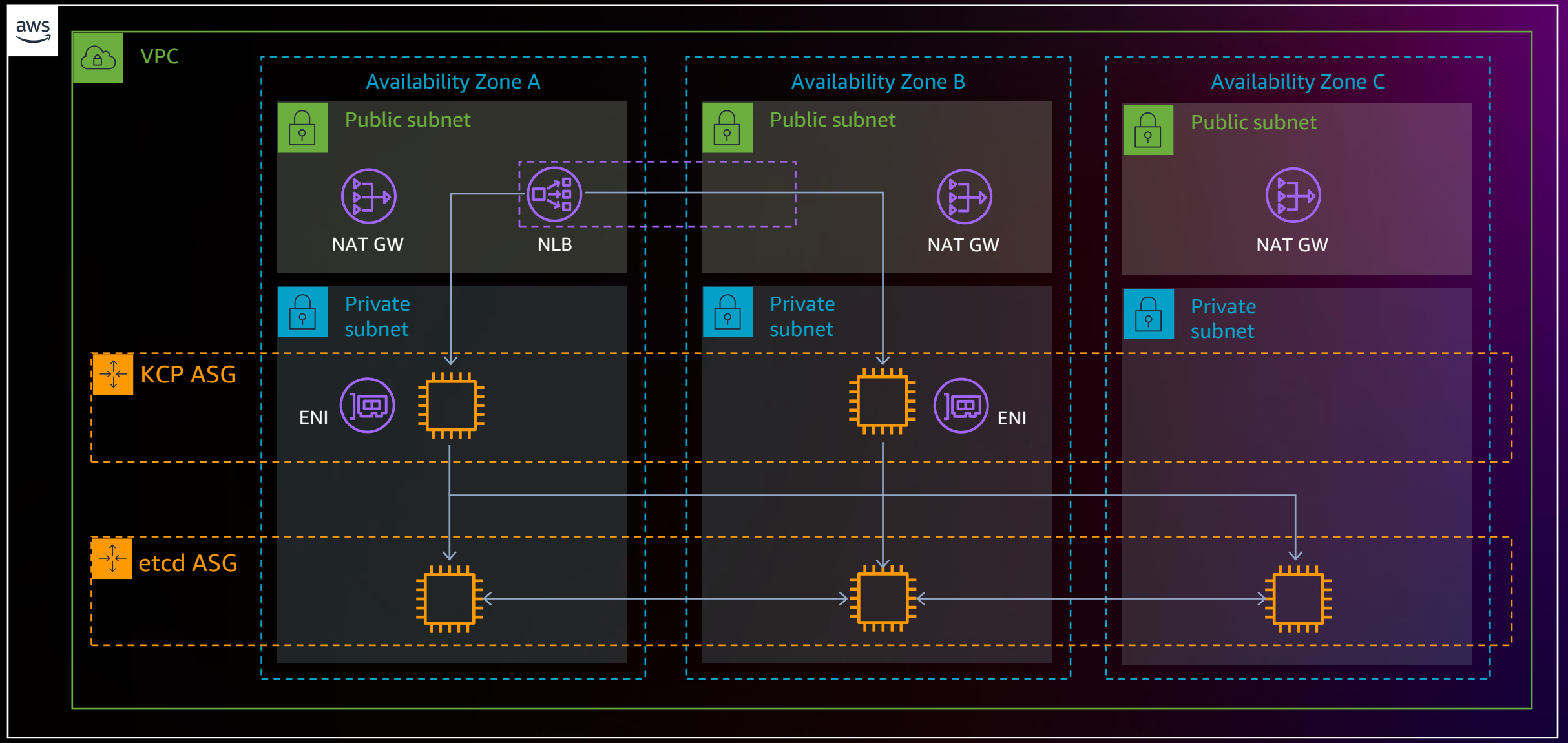
AWS Solutions

Open source solutions

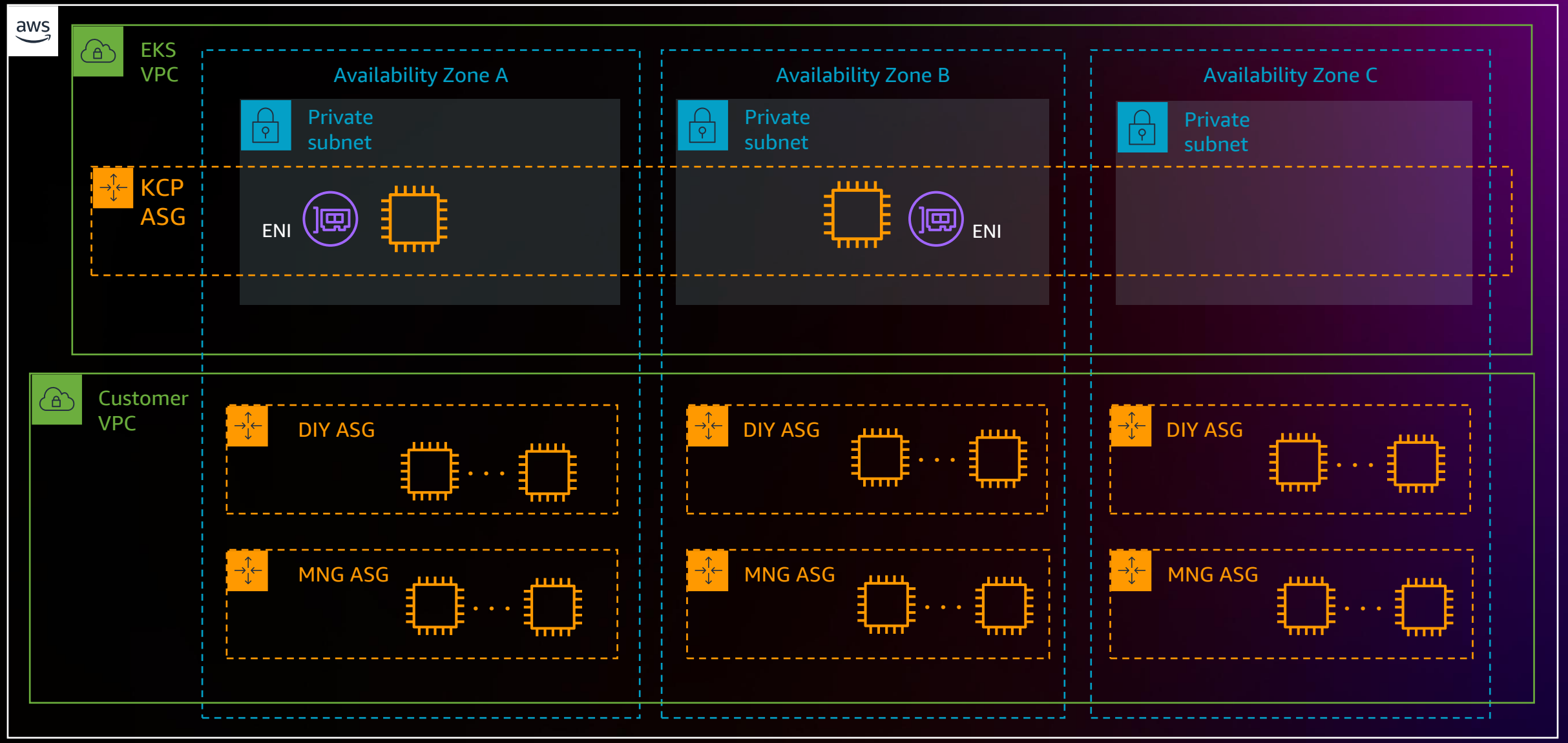

Commercial third-party solutions



# EKS Architecture – Control Plane



# EKS Control Plane – Data Plane communication



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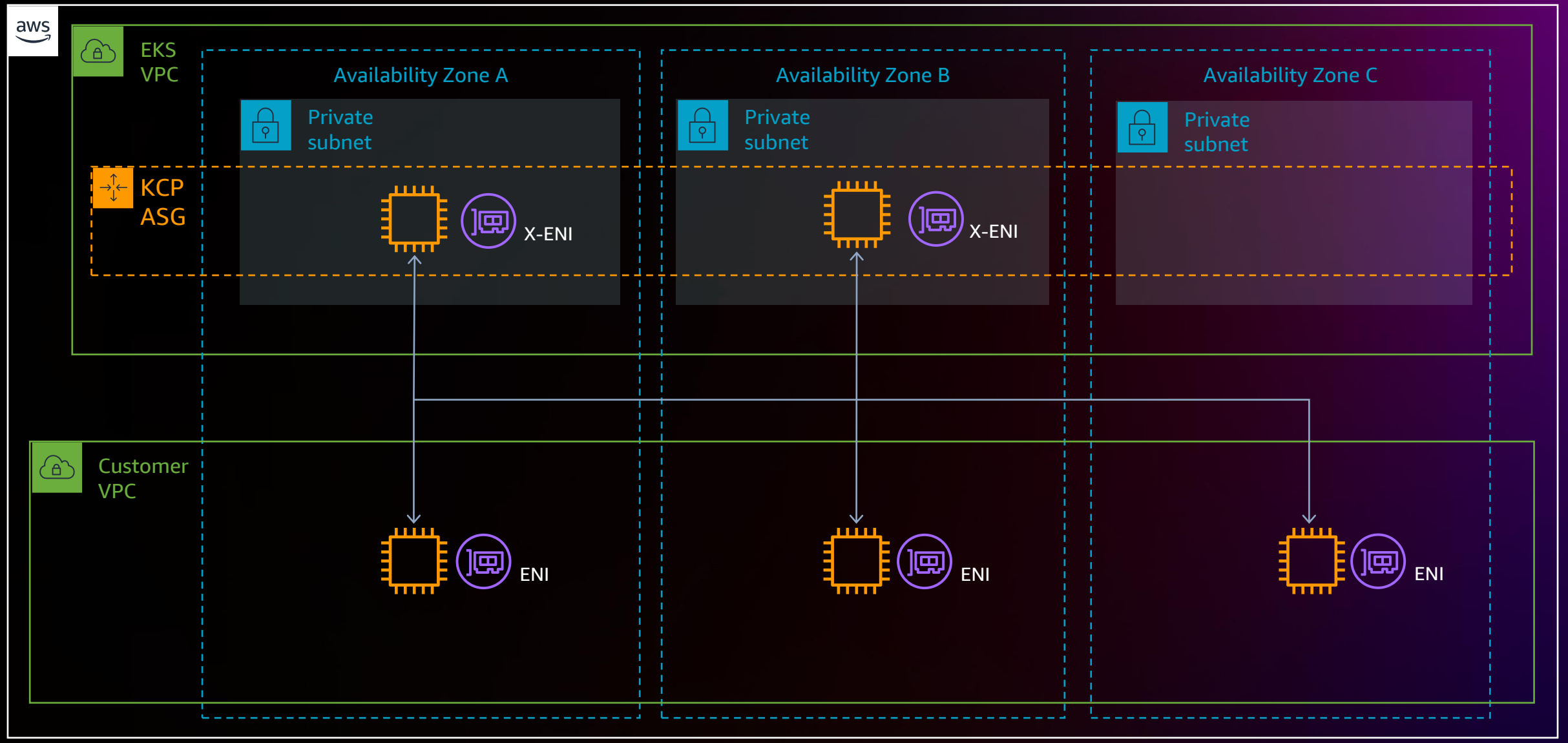
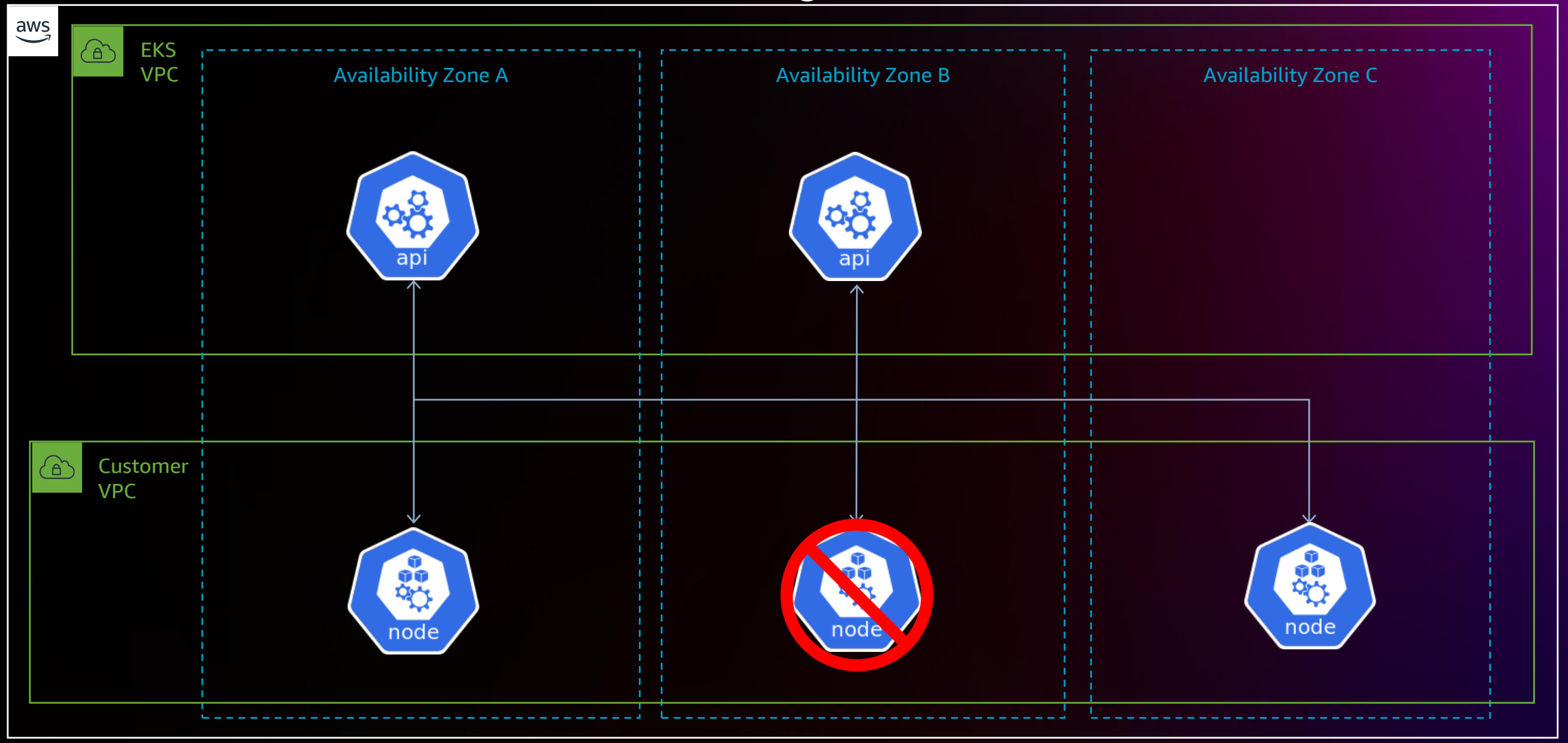
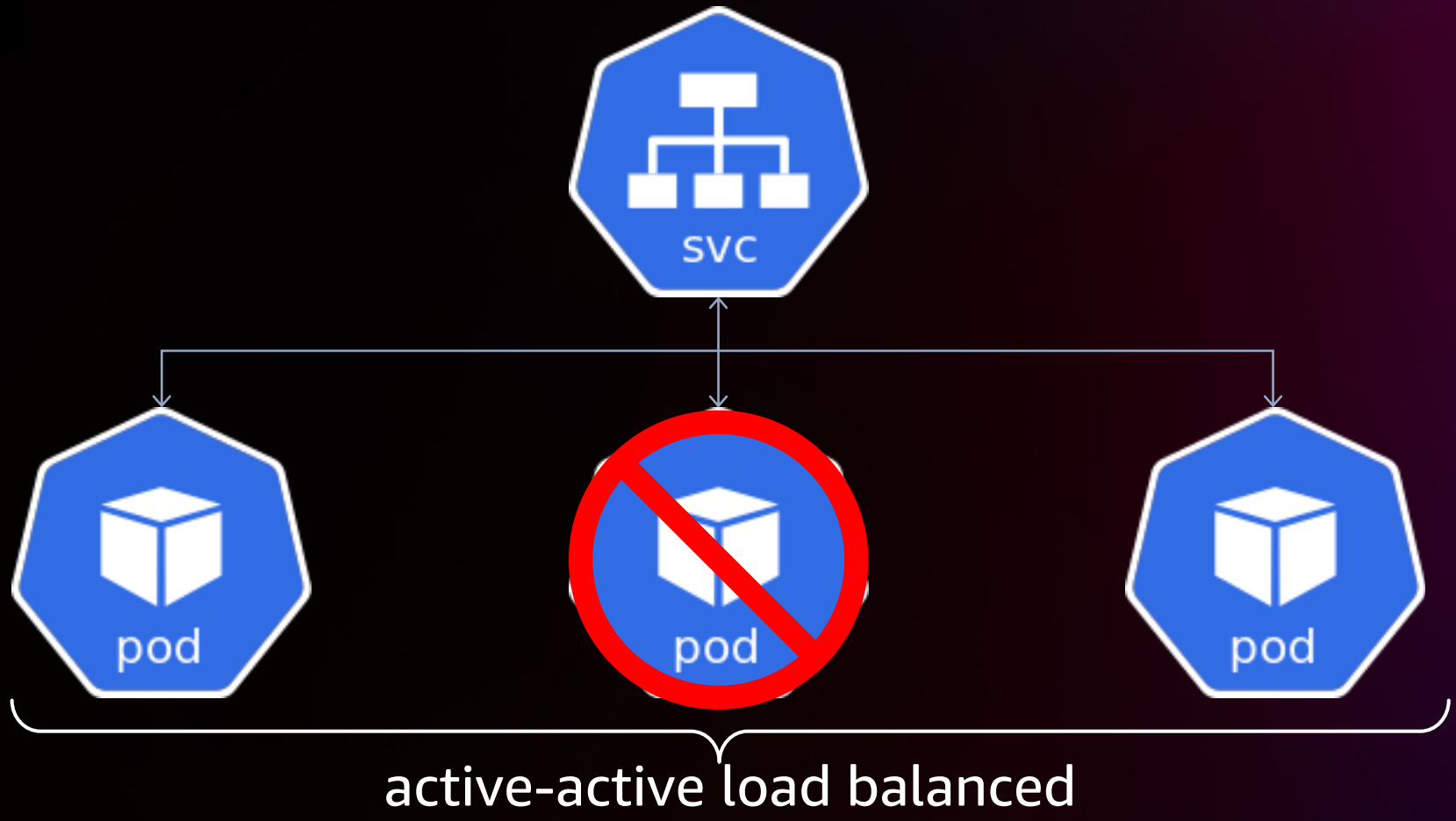


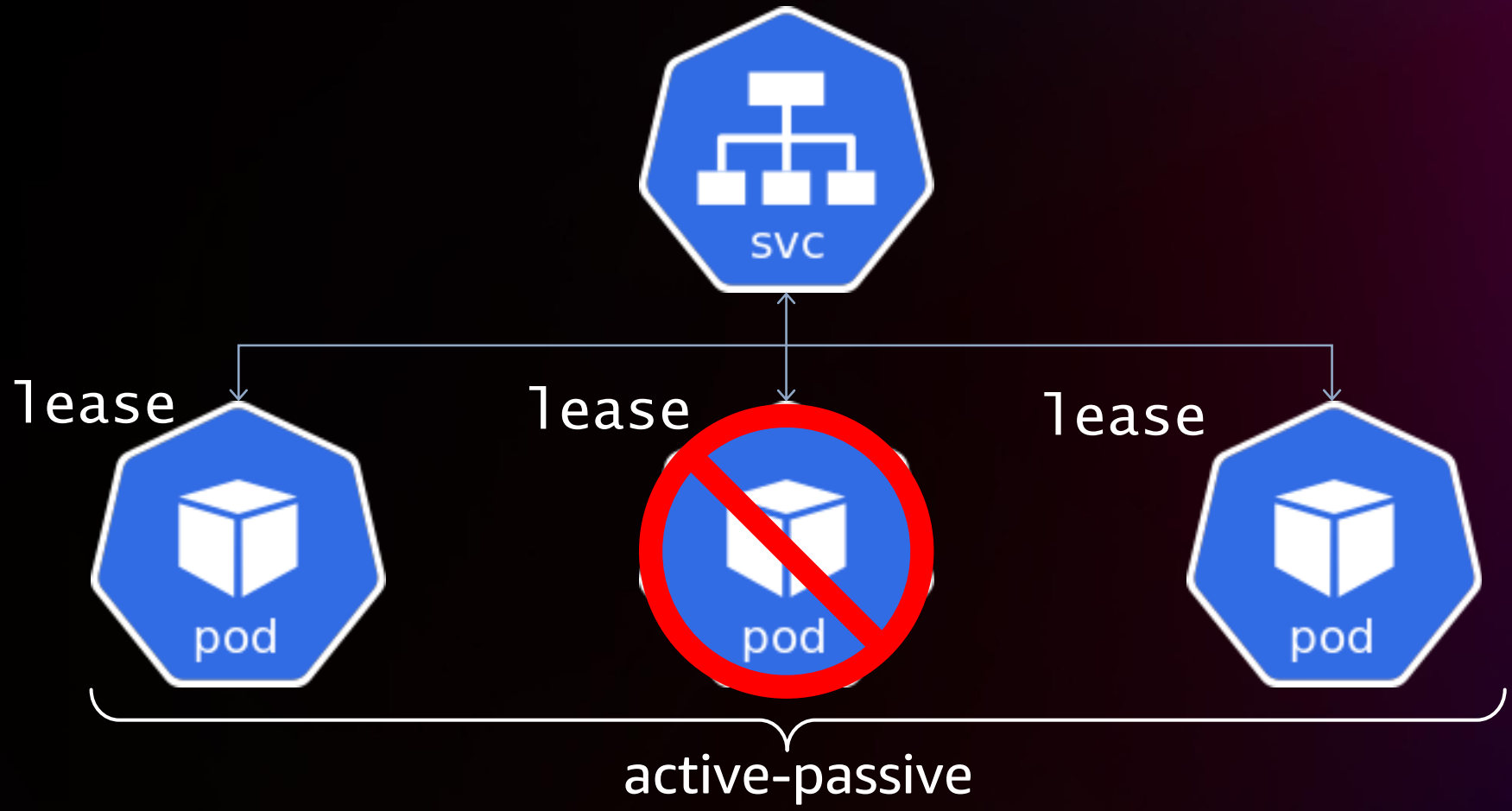
# Data Plane static stability



# Application resilience



# Application resilience



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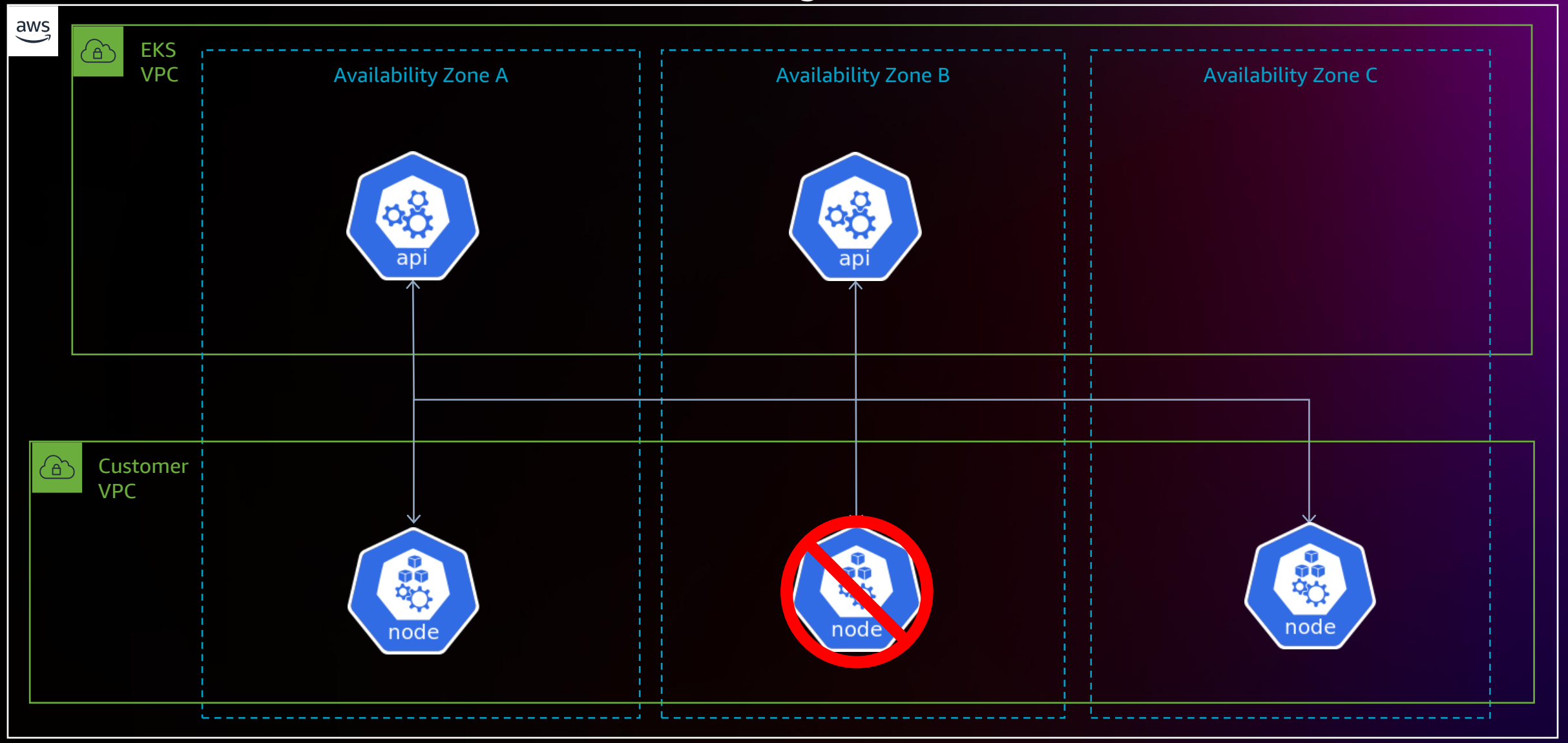

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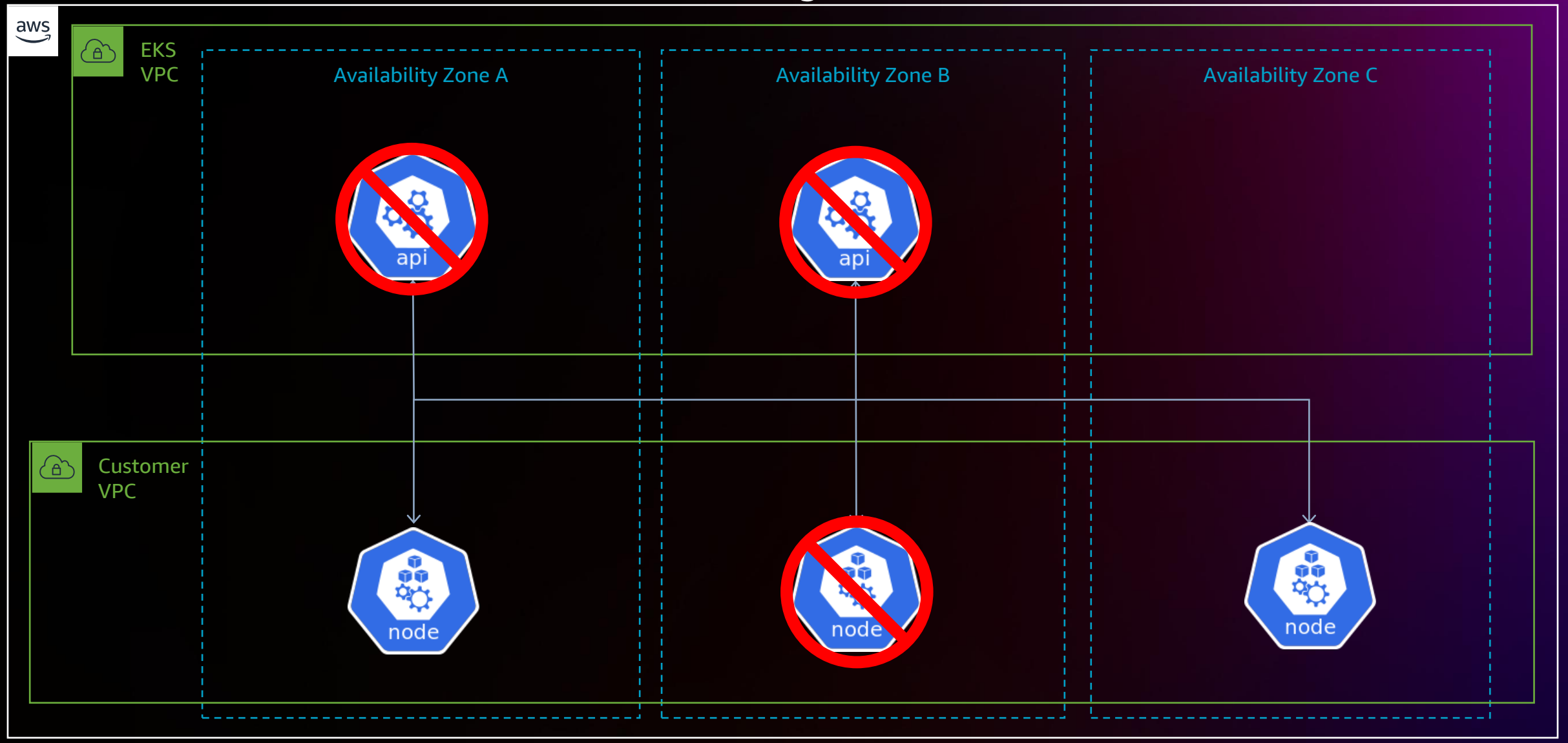

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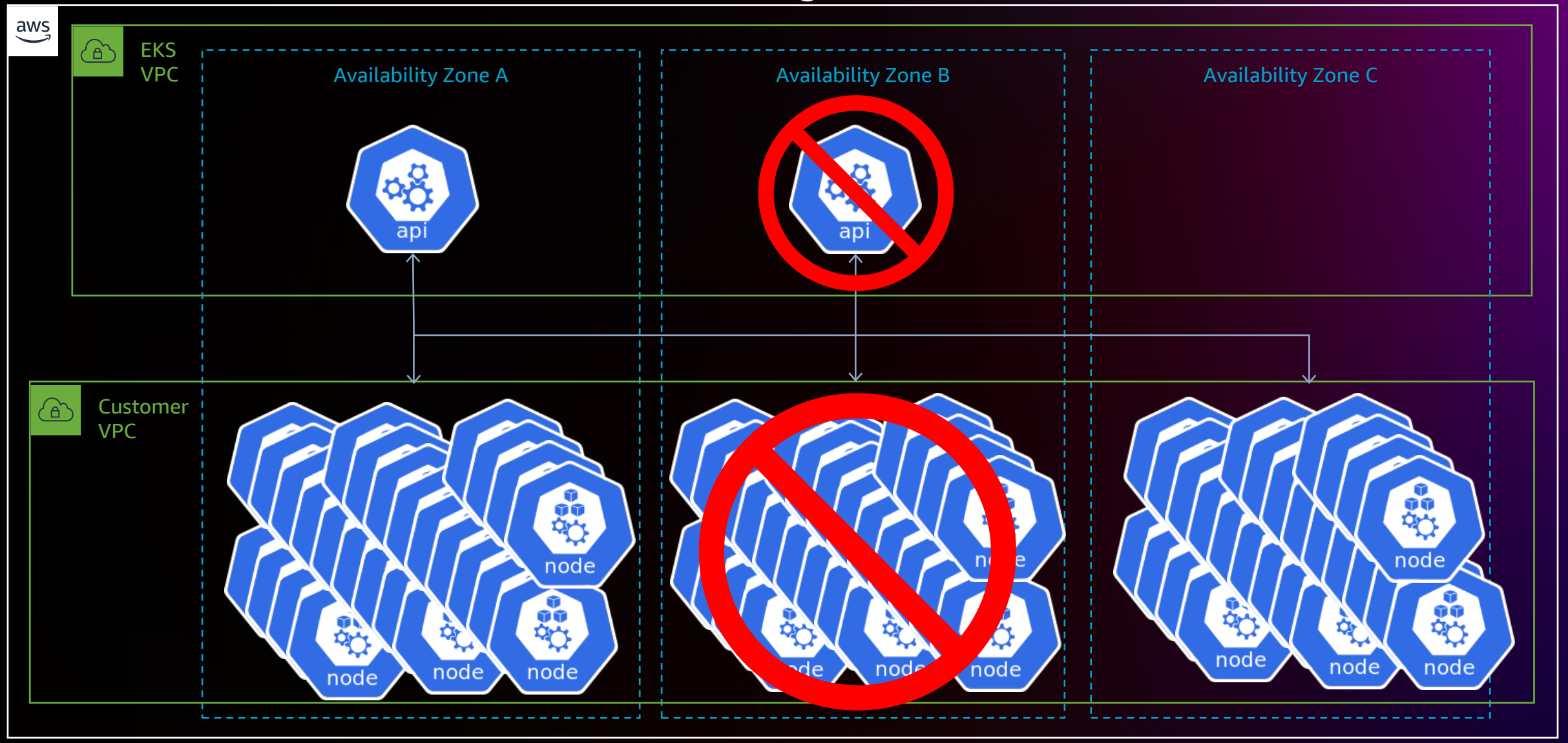

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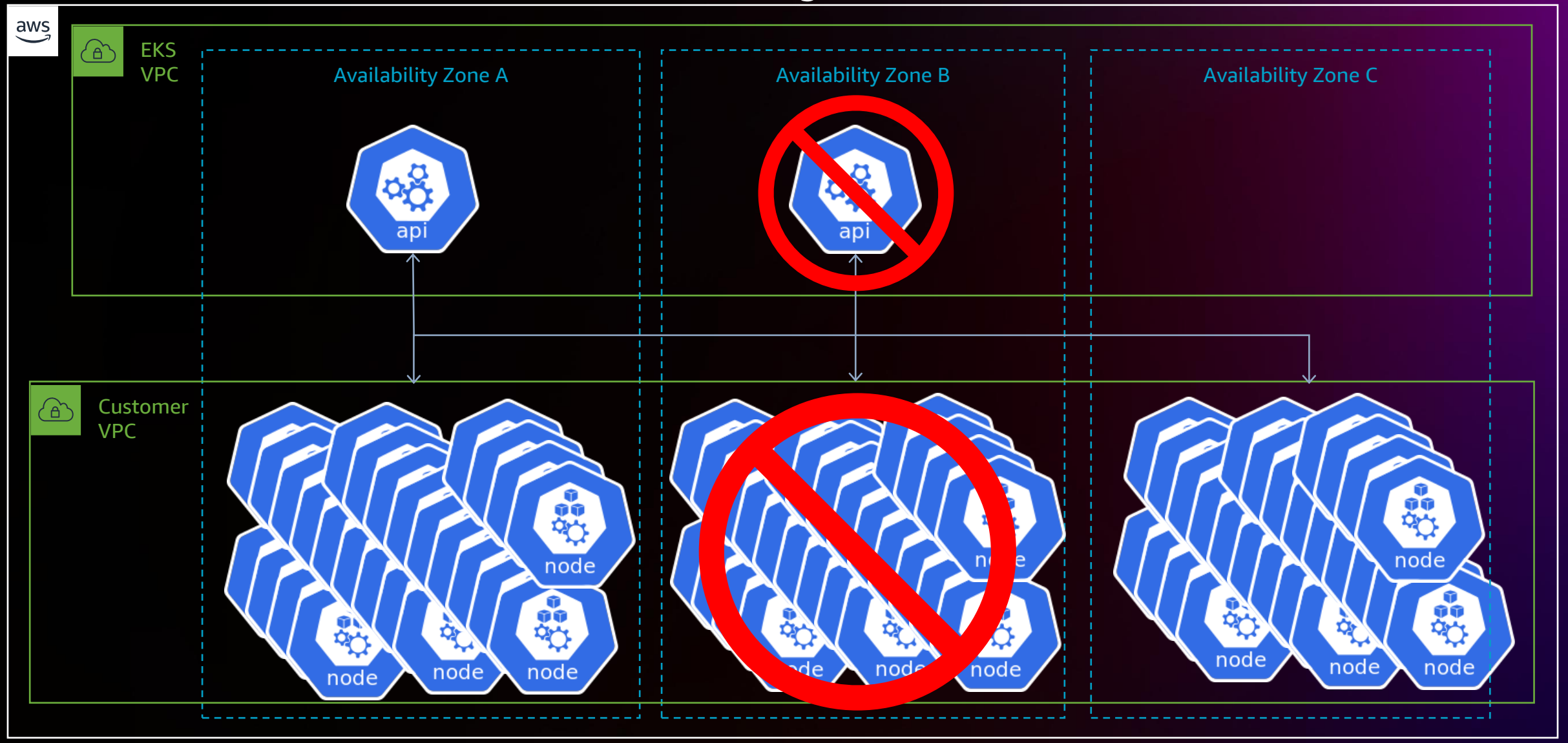

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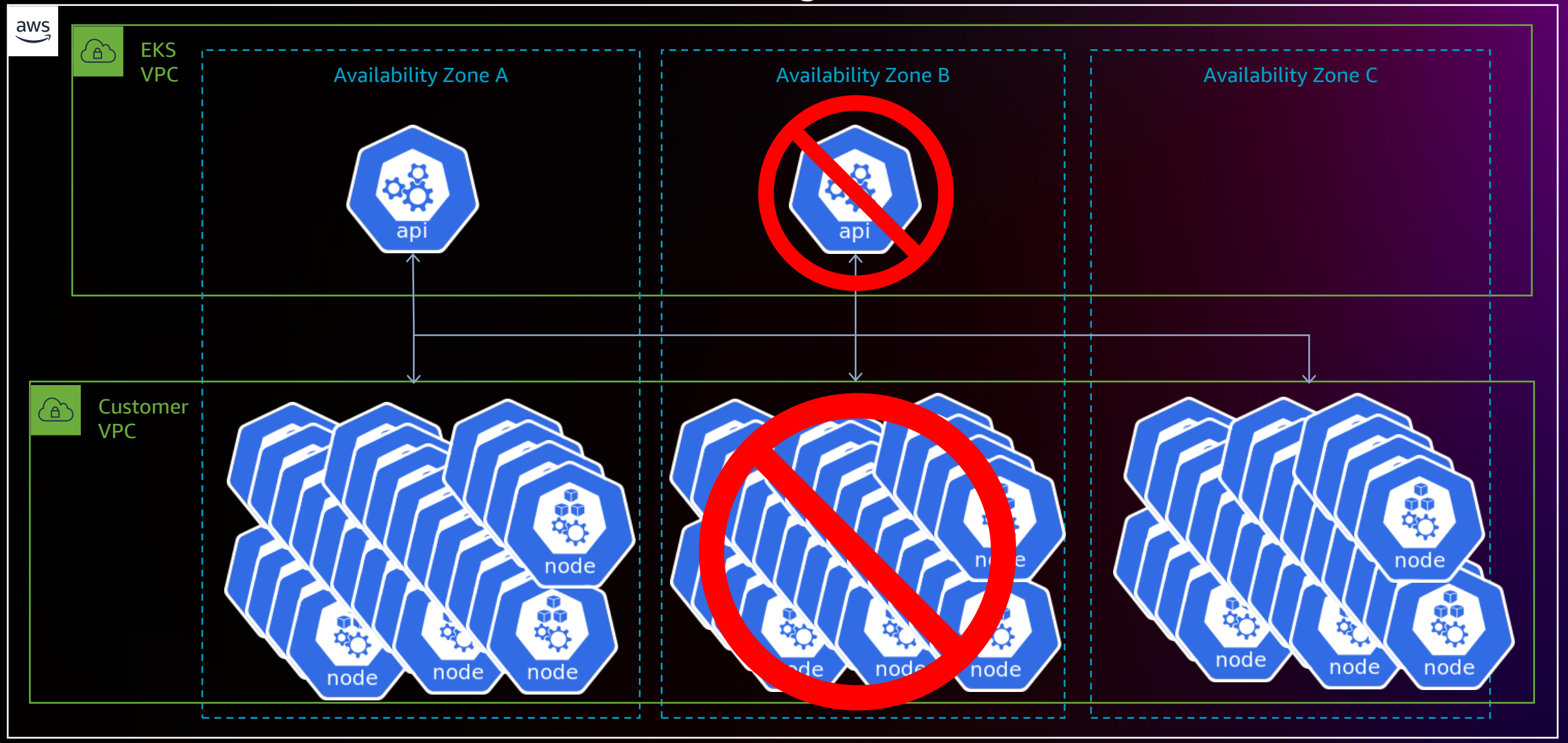

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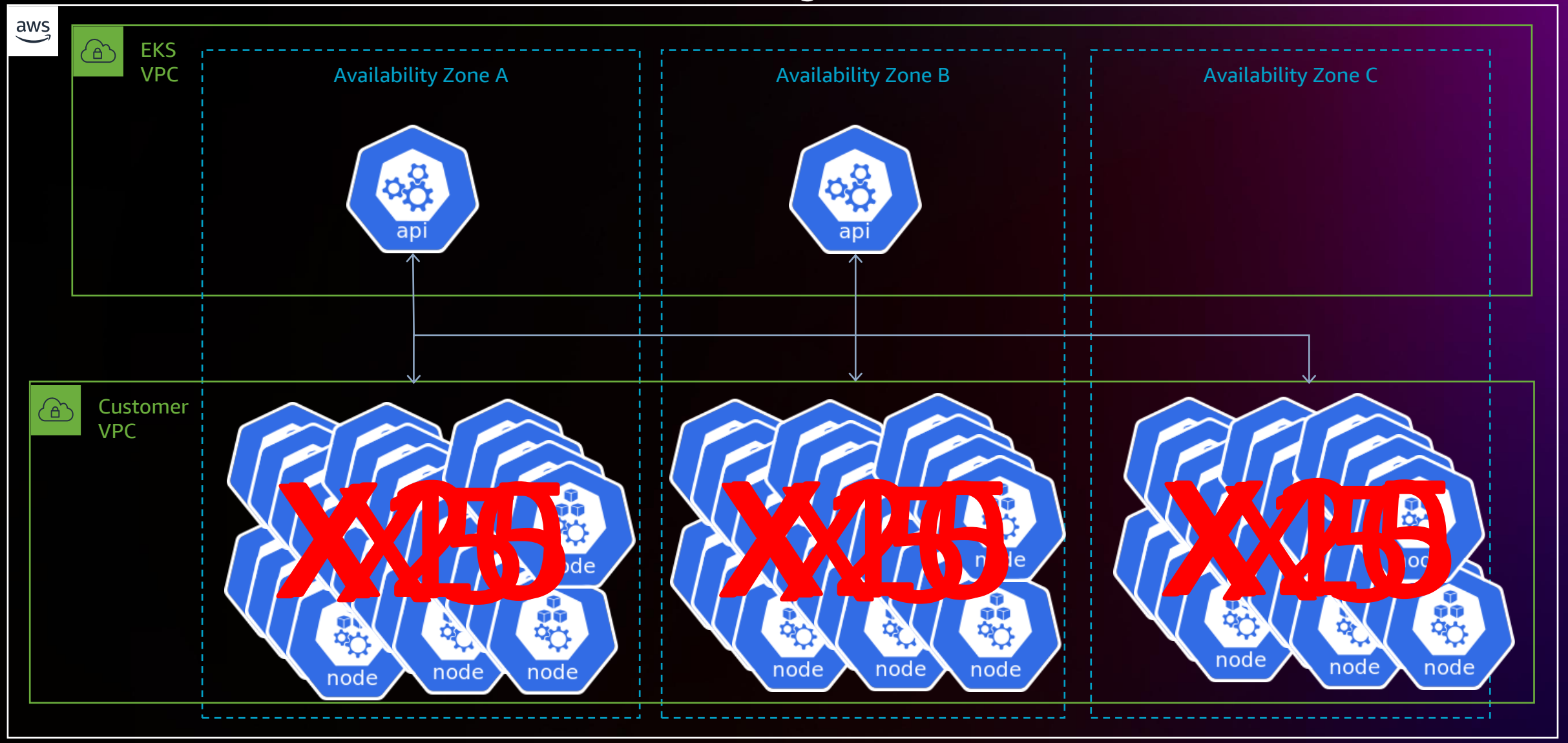

The Amazon Builders' Library

# Avoiding overload in distributed systems by putting the smaller service in control

**Joe Magerramov**

AWS Sr. Principal Engineer

# Further Reading

Amazon Builders' Library

EKS Best Practices

COE

ORR

# Thank you!

Eswar Bala
beswar@amazon.com

Rick Sostheim
sostheim@amazon.com

Please complete the session survey in the **mobile app**