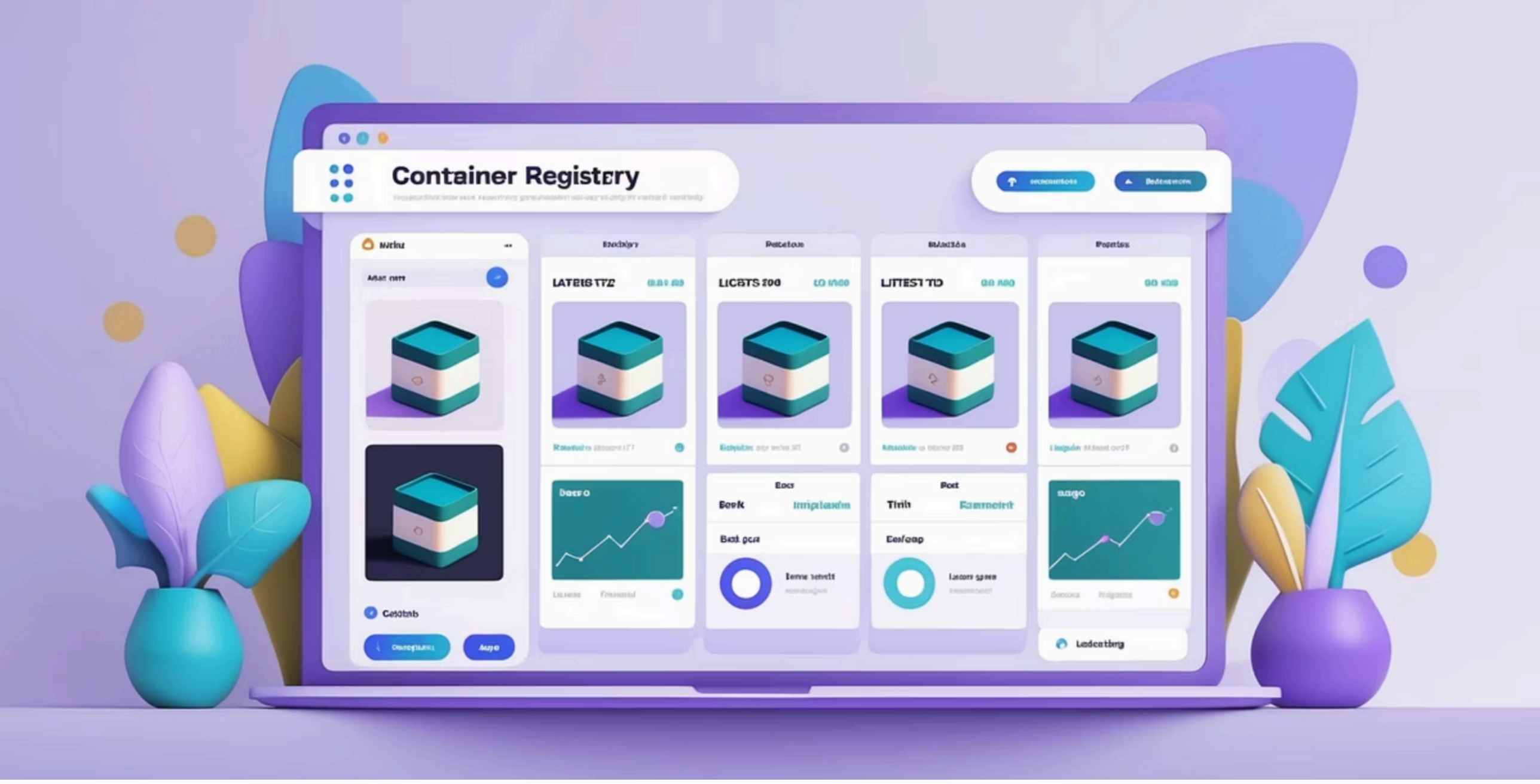
10 Kubernetes Design Errors You're Making (And How to Fix Them!)

Swipe to avoid the most common mistakes that are crashing your cluster!

RANGARAJ BALAKRISHNAN

@RAJCLOUDX



The "Latest" Tag

What's the problem?

Using `:latest` tag causes unpredictable rollbacks and upgrades

Why it's dangerous

Pulls different versions and breaks deployment repeatability

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Fix: Use Specific Version

Pin Exact Tags

Always use specific tags like `myapp:v1.3.0`

Example YAML

image: myapp:v1.3.0 in your Deployment manifest

Best Practice

Update image tag with every code release

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Missing Health

Dead Pods Stay in Service

Without probes, Kubernetes can't detect unhealthy pods

Slow Startups Cause Failures

Initializing pods receive traffic before they're ready

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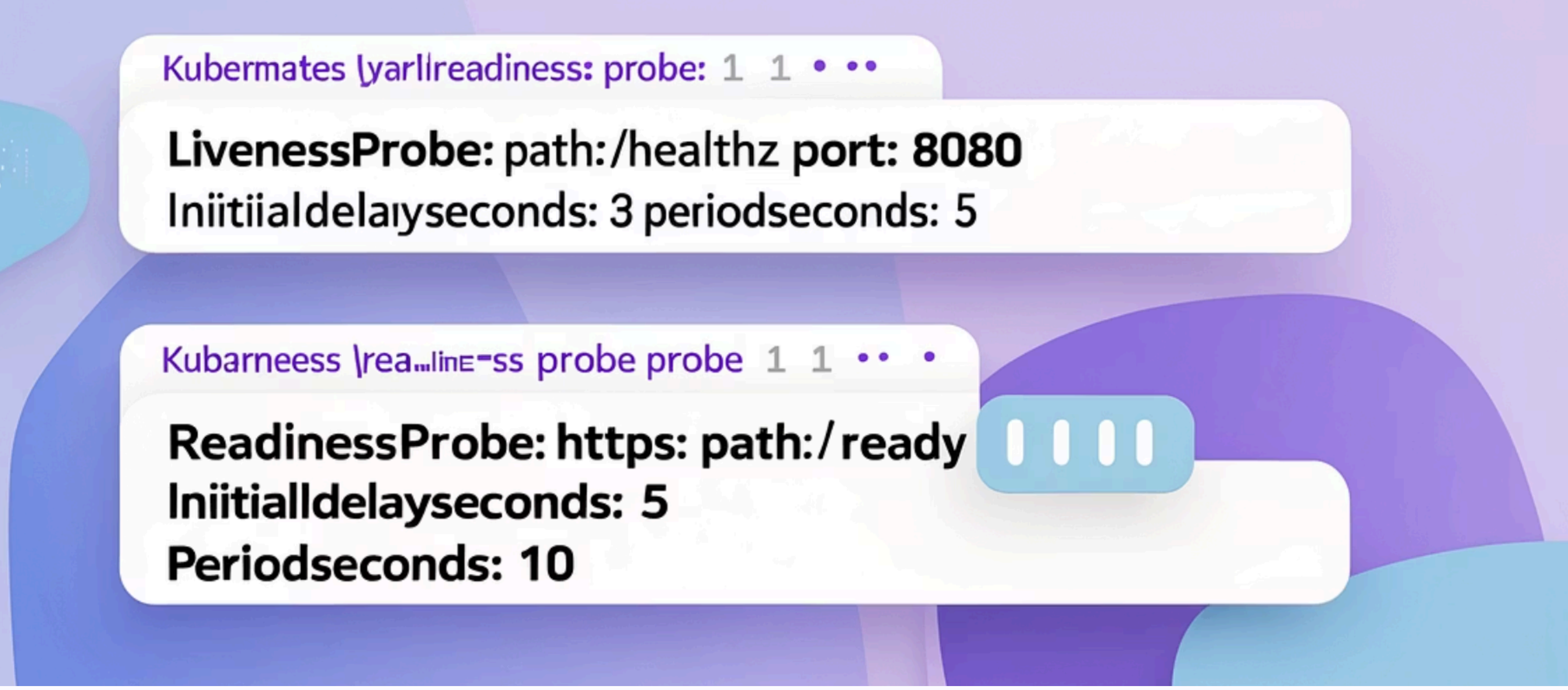

Fix: Implement Both Types of Probes

Liveness Probe

Detects if your pod is running but deadlocked

Readiness Probe

Checks if your pod is ready to receive traffic

Use HTTP or Exec

GET /health or command-line checks work best

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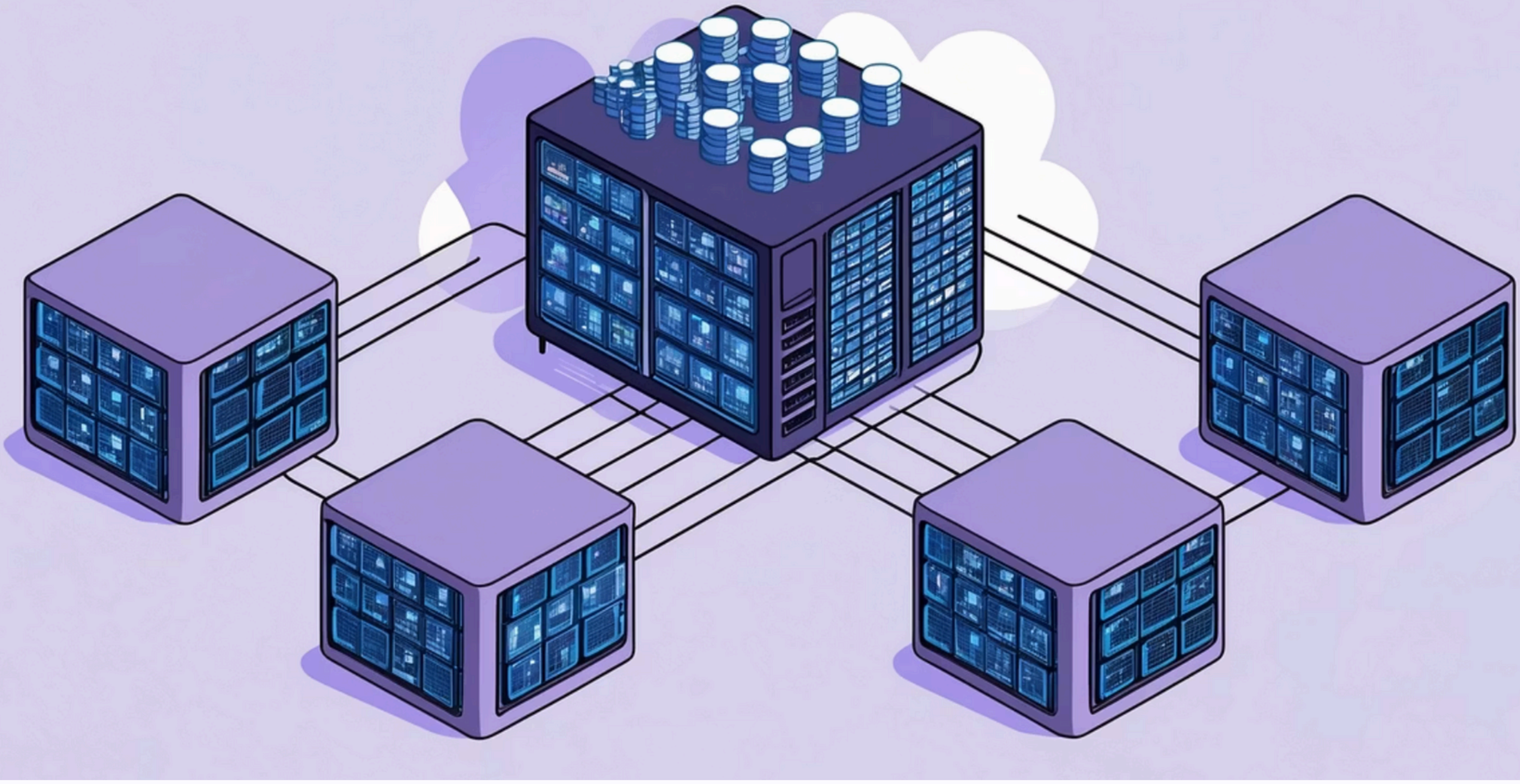

Pods Piling Up on One

Poor Scheduling Rules

Without affinity settings, pods cluster on single nodes

Availability Risk

If that node fails, multiple services go down simultaneously

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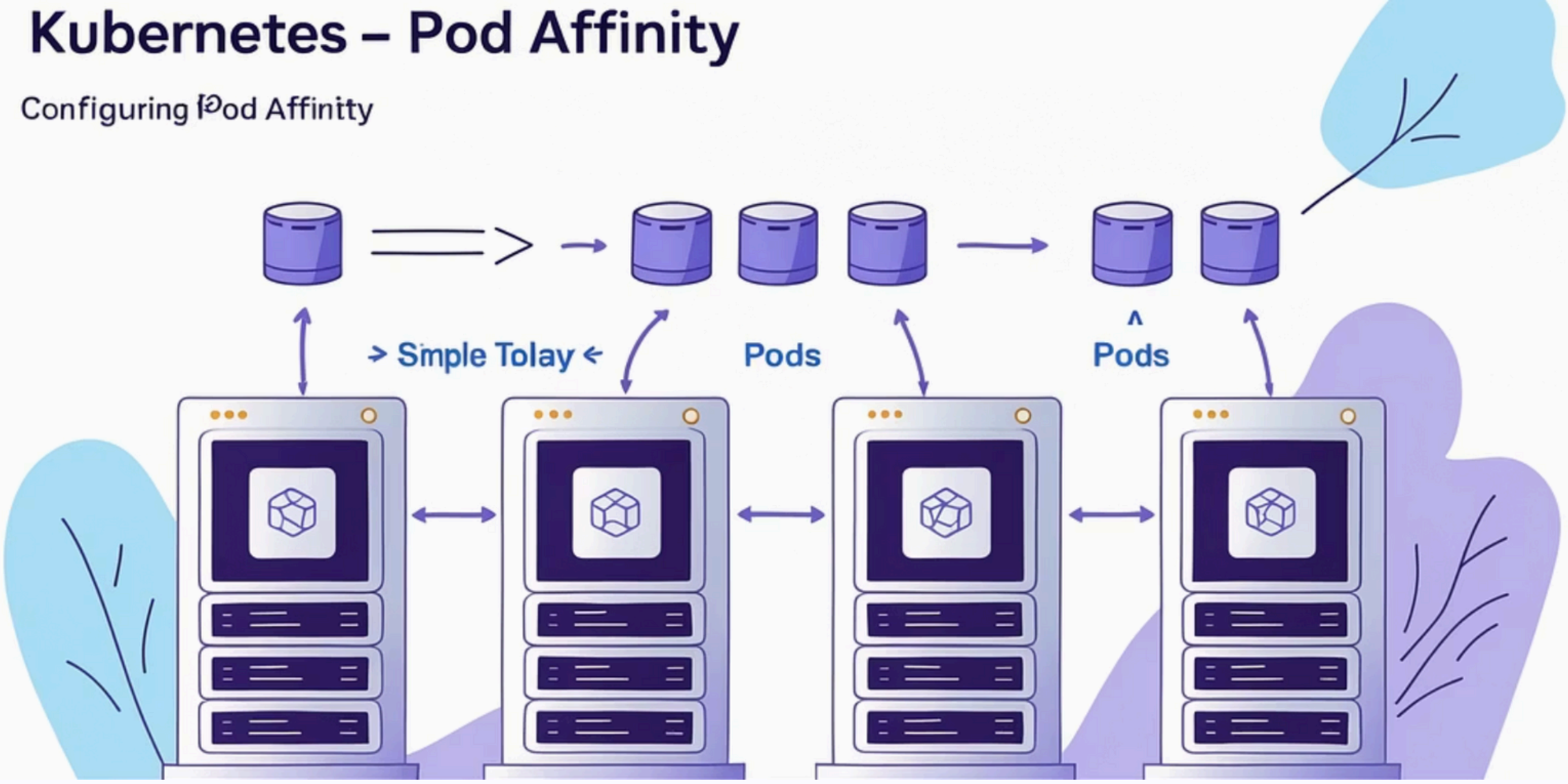

Fix: Set Pod Affinity

Balanced Scheduling

Use podAntiAffinity to spread replicas across nodes

Example YAML

requiredDuringSchedulingIgnoredDuringExecution with matching labels

Result

Pods evenly distributed for better resilience

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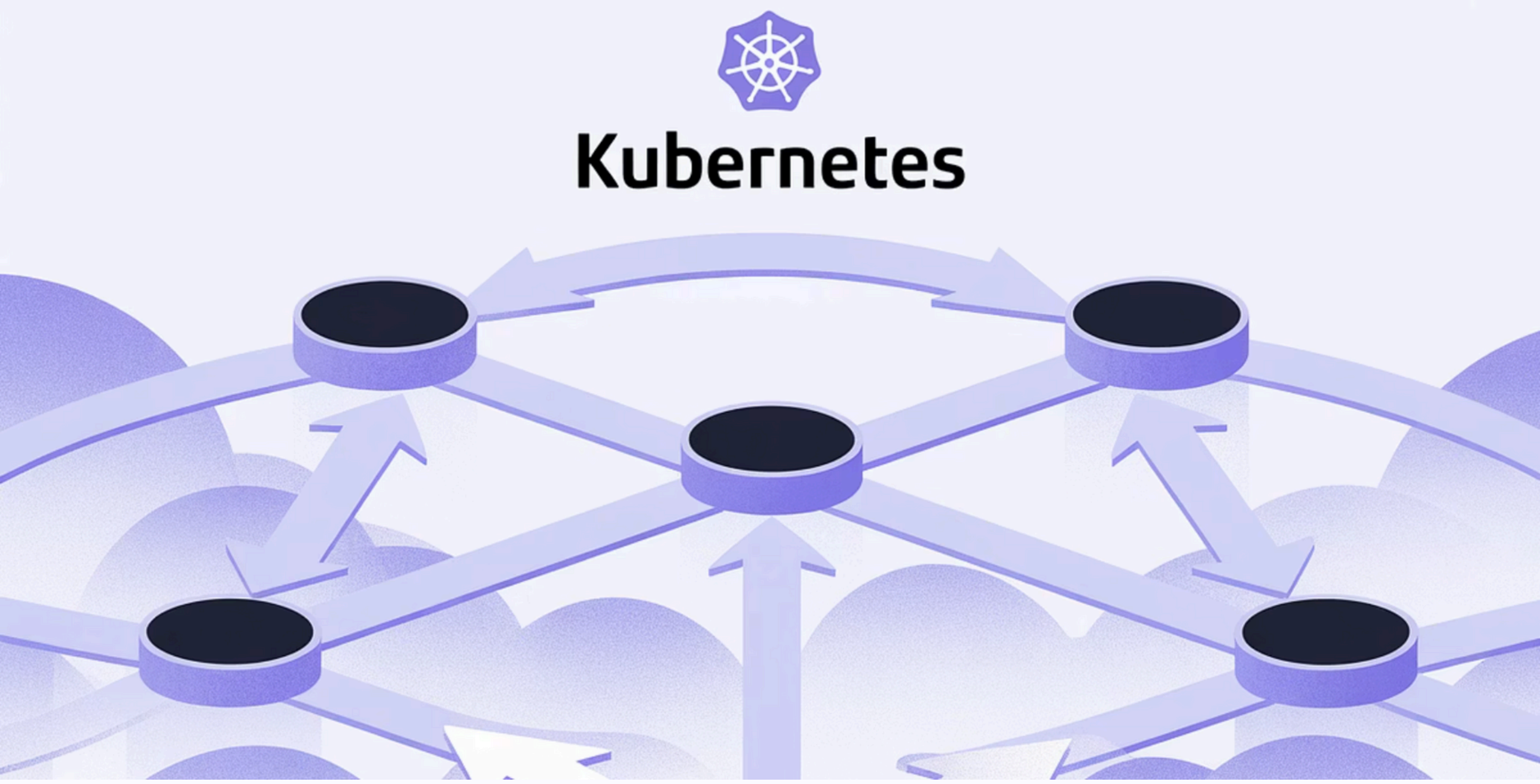

No Network Policies = Security Risk

Default: Allow All

Every pod can communicate with every other pod

Zero Segmentation

Compromised pod becomes entry point to entire cluster

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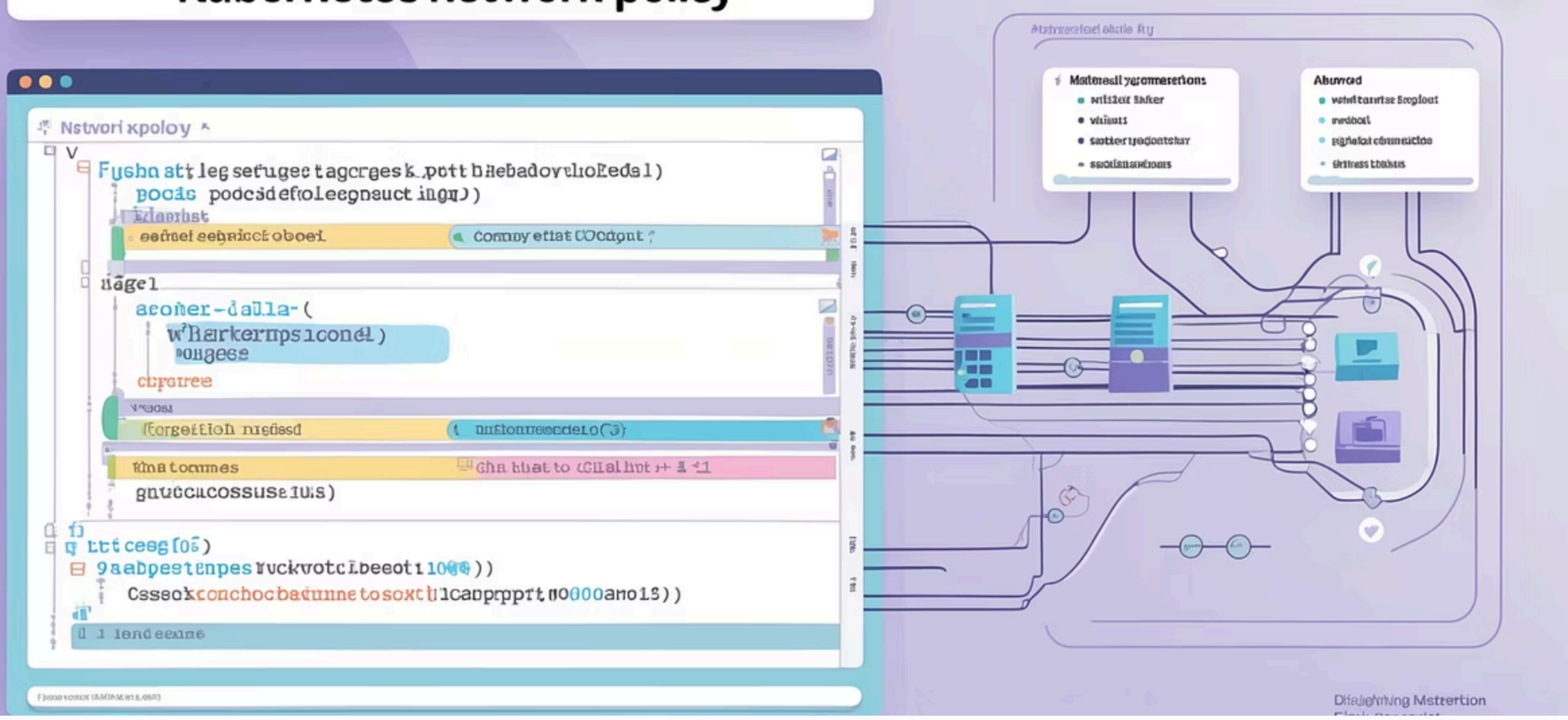

Fix: Apply Network

Restrict

Only allow necessary communication paths

Example

Frontend only accepts web traffic; backend only accepts frontend

Verification

Test with kubectl exec curl commands between pods

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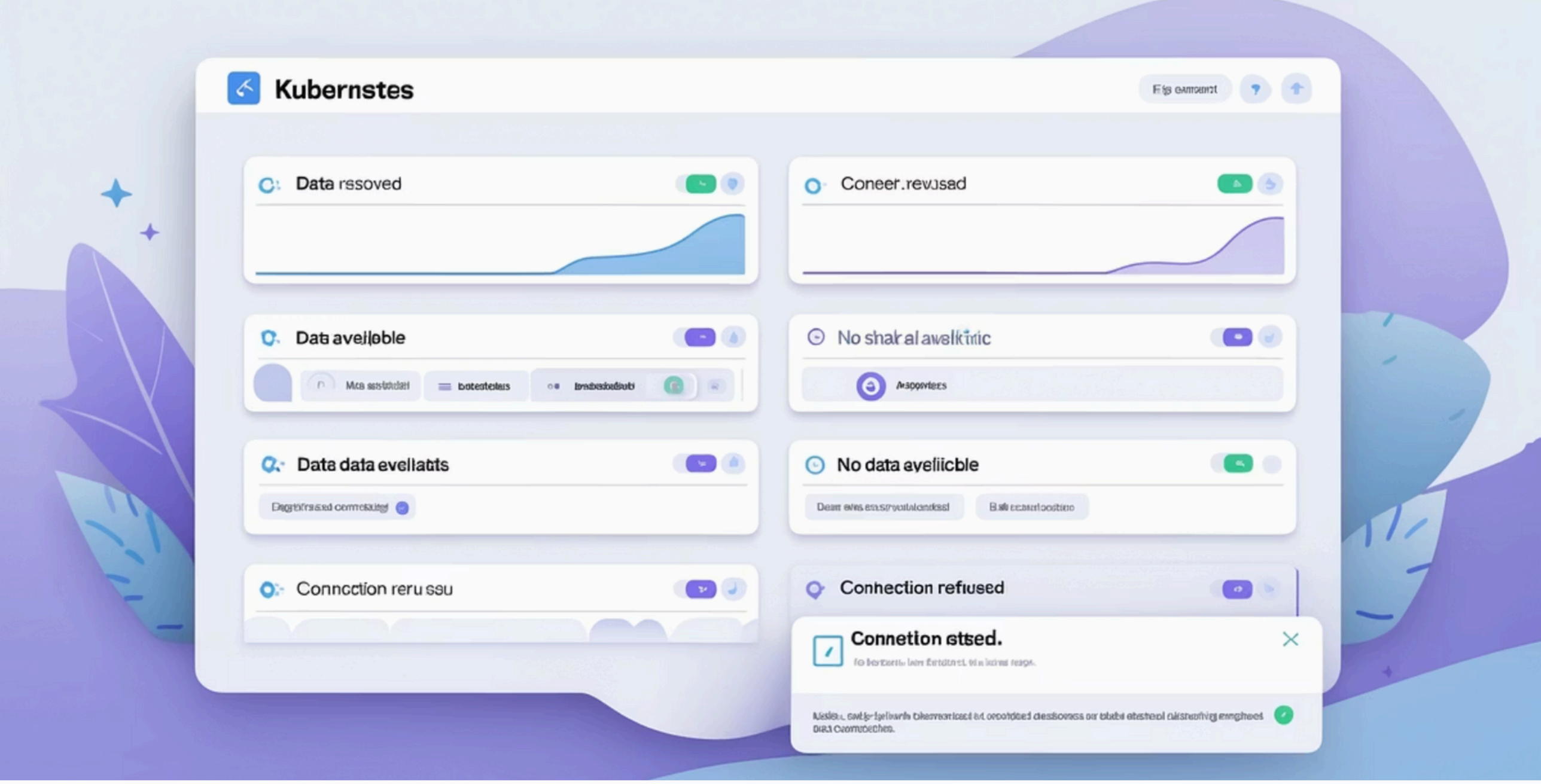

Flying Blind Without Monitoring

No Performance Metrics

Can't detect resource bottlenecks before they cause outages

Missing Log Aggregation

Debugging requires manual pod-by-pod log inspection

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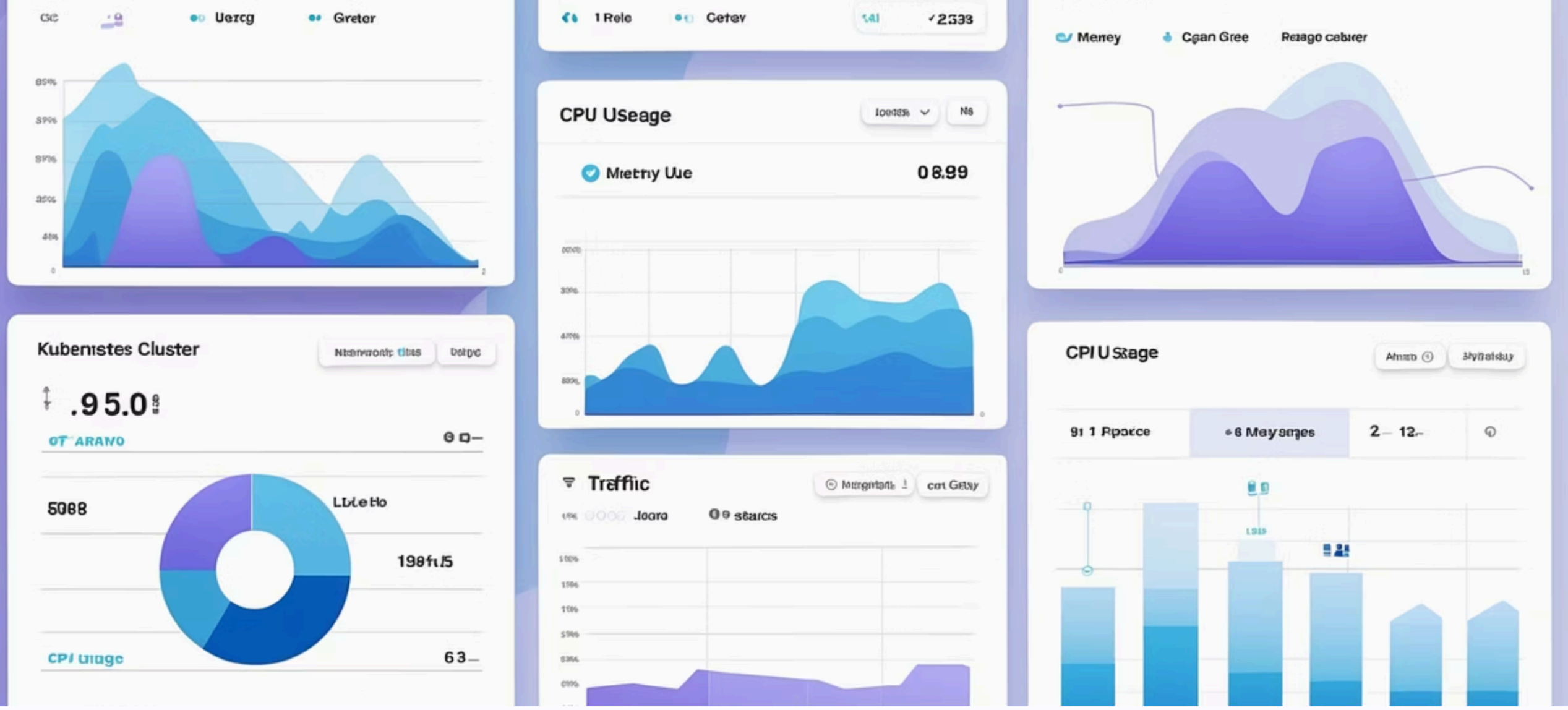

Fix: Setup Monitoring Stack

Metrics

Implement Prometheus/Grafana for resource visualization

Logging

Deploy ELK or EFK stack for centralized log collection

Configuration

Add prometheus.io/scrape: "true" annotations to pods

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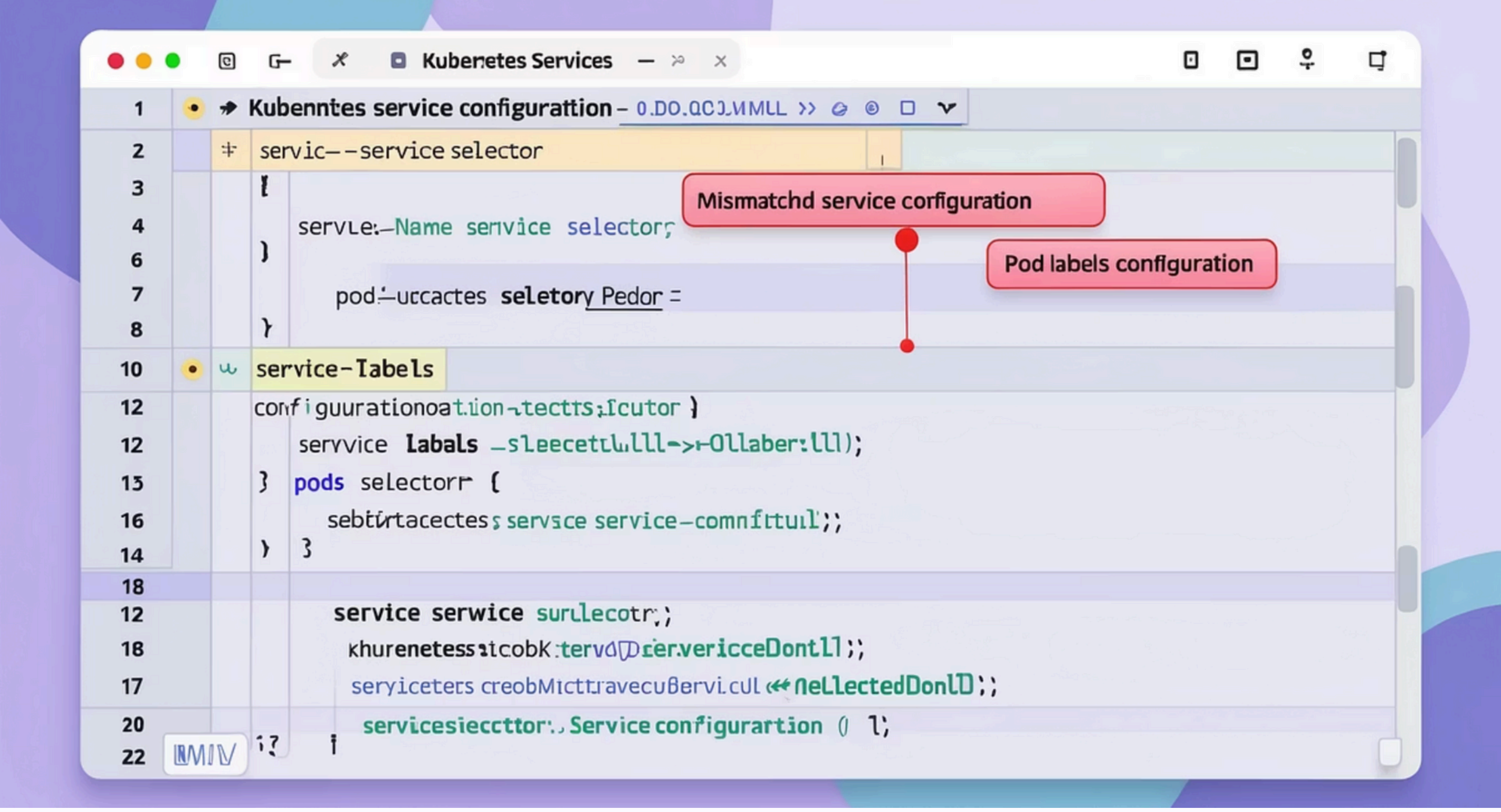

Label Selector Mismatches

Mislabeled Resources

Services can't find pods due to typos or inconsistent labels

Broken Connections

Traffic routes to nowhere despite running pods

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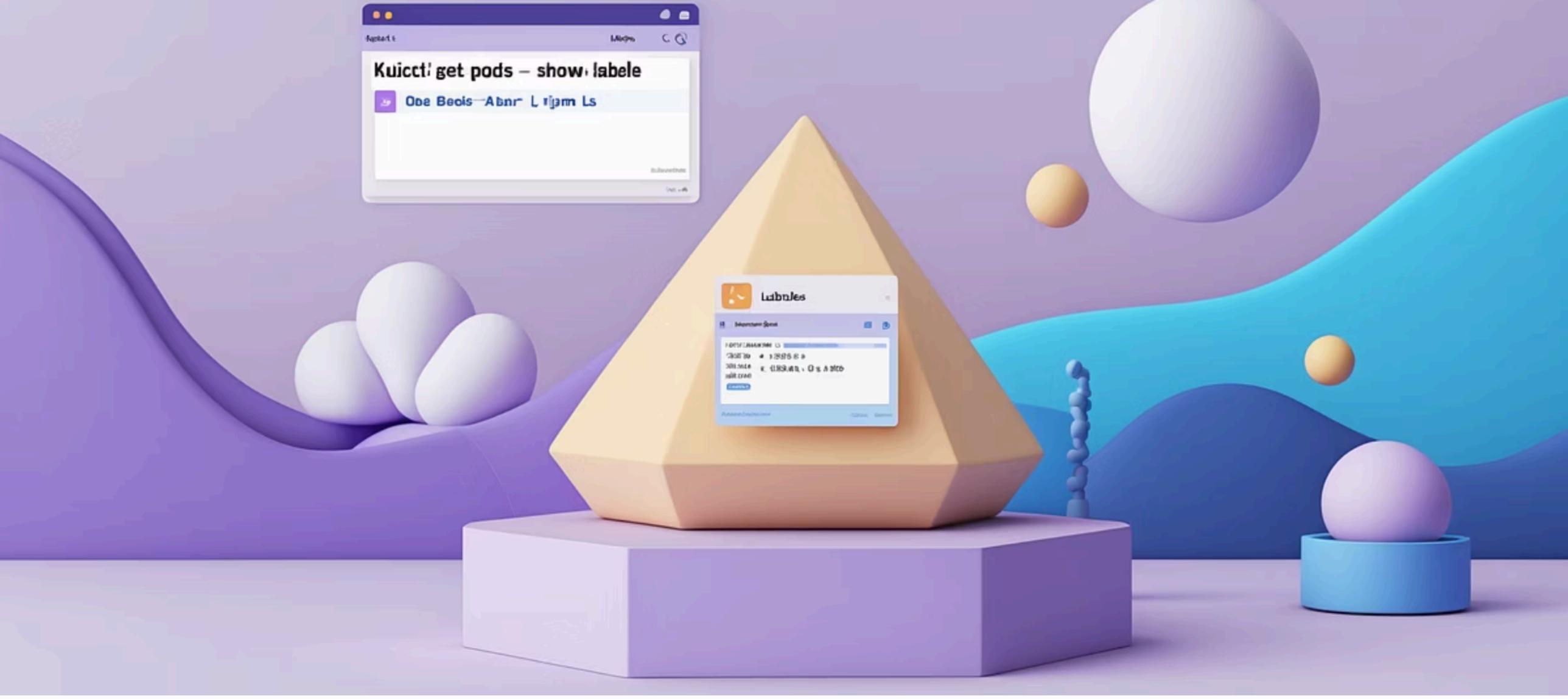

Fix: Align Labels and Selectors

Match Exactly

Ensure app: myapp on both pod template and service selector

Verification

Use kubectl get pods --show-labels to confirm labels

Best Practice

Use consistent labeling scheme across all resources

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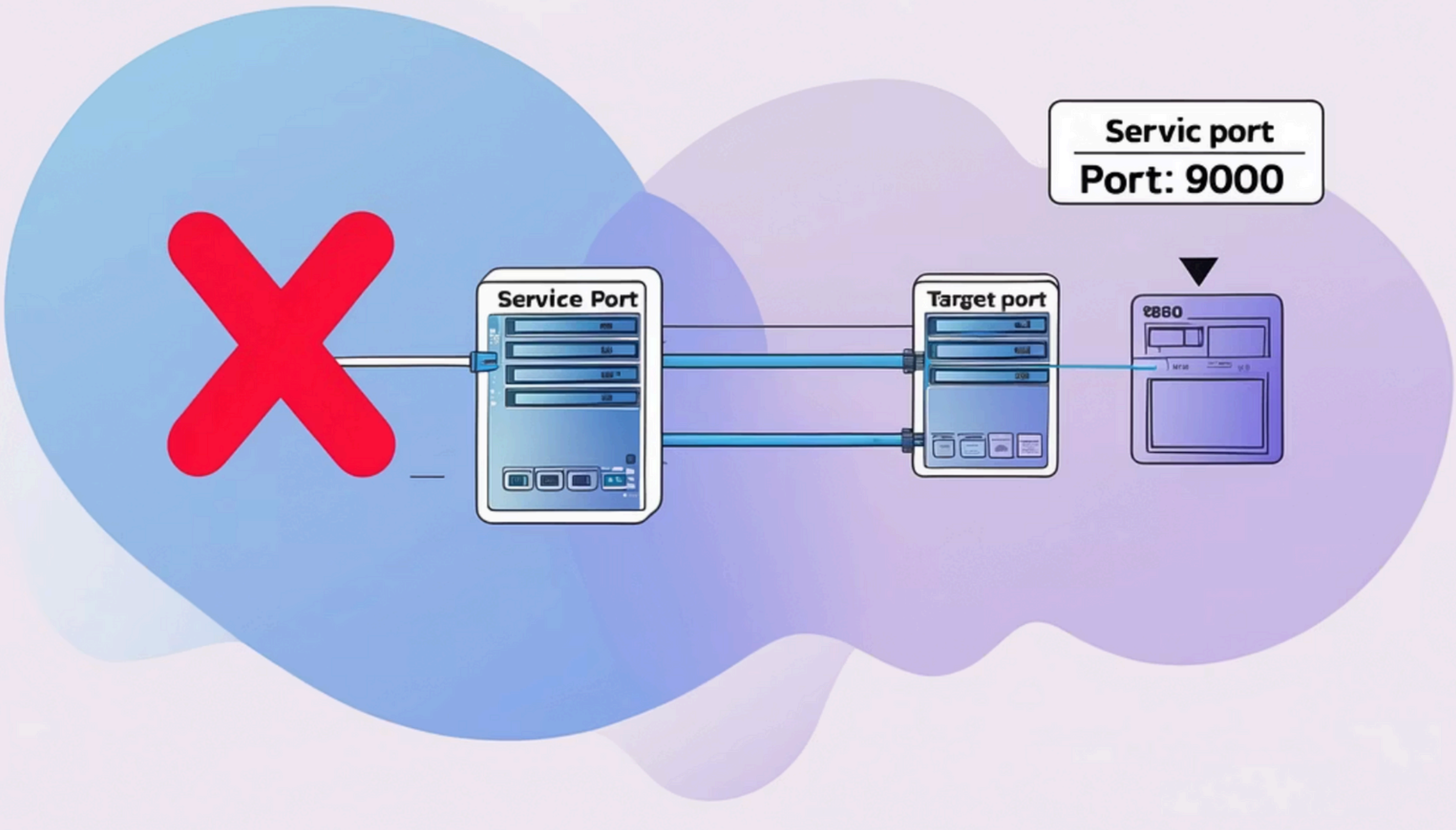

Service Port

Port Mismapping

Service port doesn't match container's listening port

Connection Failures

Traffic arrives but application doesn't respond

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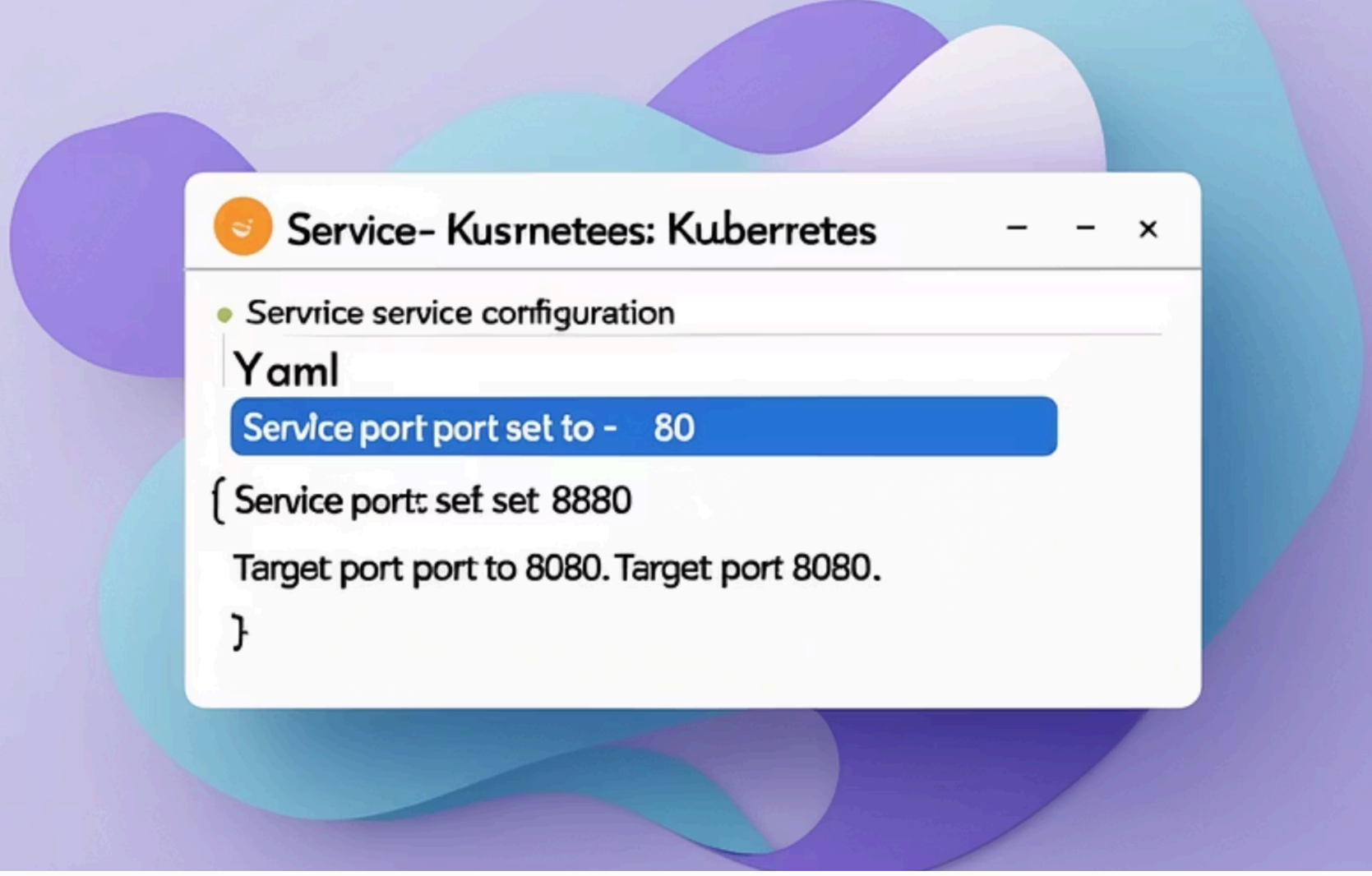

Fix: Align Service and Container Ports

Port vs TargetPort

Service port is what clients connect to

Example

Service exposes port 80, targets container port 8080

Verification

Test connectivity with kubectl port-forward

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Load Balancer Overuse

Cost Impact

Each LoadBalancer service incurs cloud provider charges

DNS Confusion

Multiple public endpoints for one app cause routing complexity

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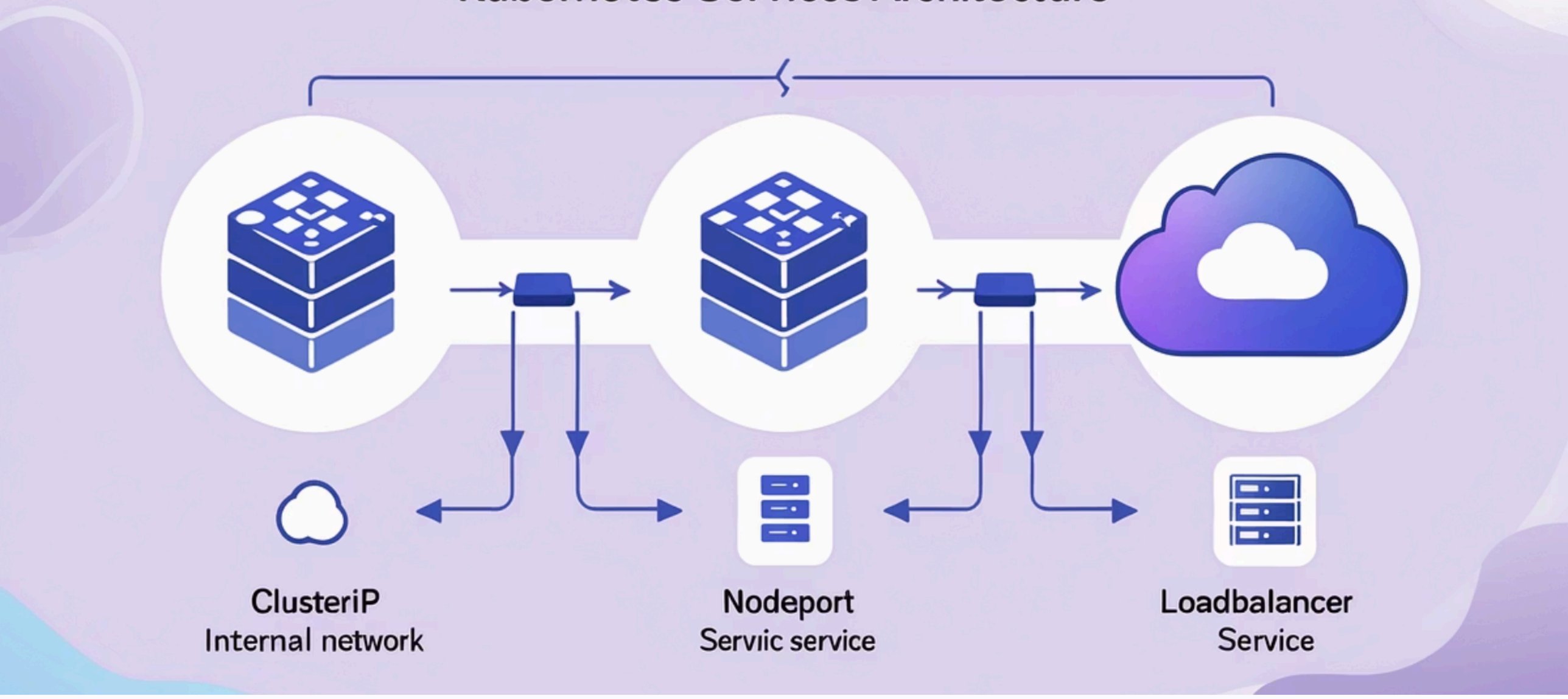

Fix: Use Load Balancers Strategically

Internal: ClusterIP

For pod-to-pod communication within cluster

Semi-Public:

For dev/test or behind another LB

Public: LoadBalancer

Only for external-facing endpoints

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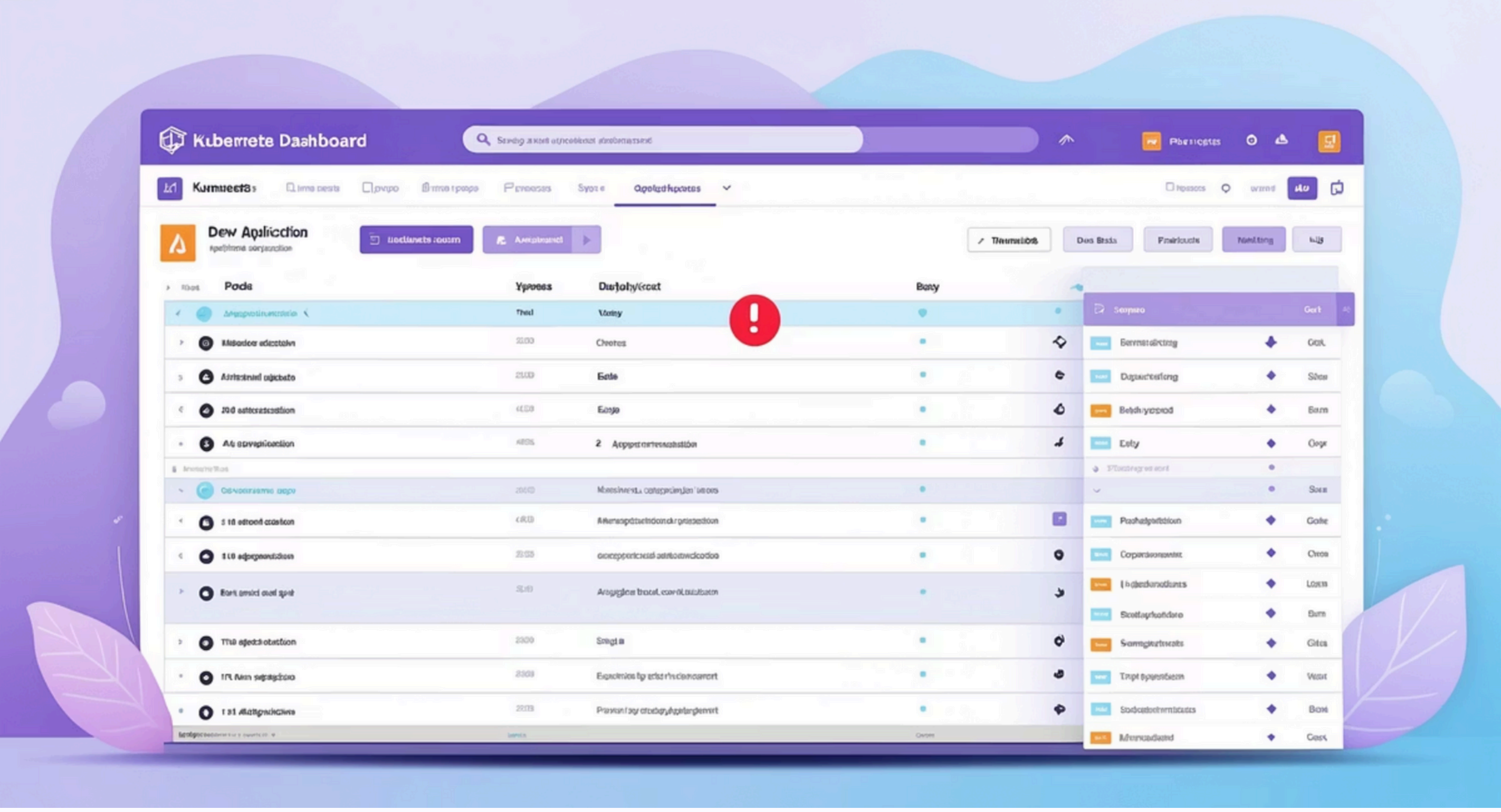

Wrong Namespace Deployments

Environment Mixups

Test apps deployed to production or vice versa

Secret Exposure

Apps access secrets from wrong environment

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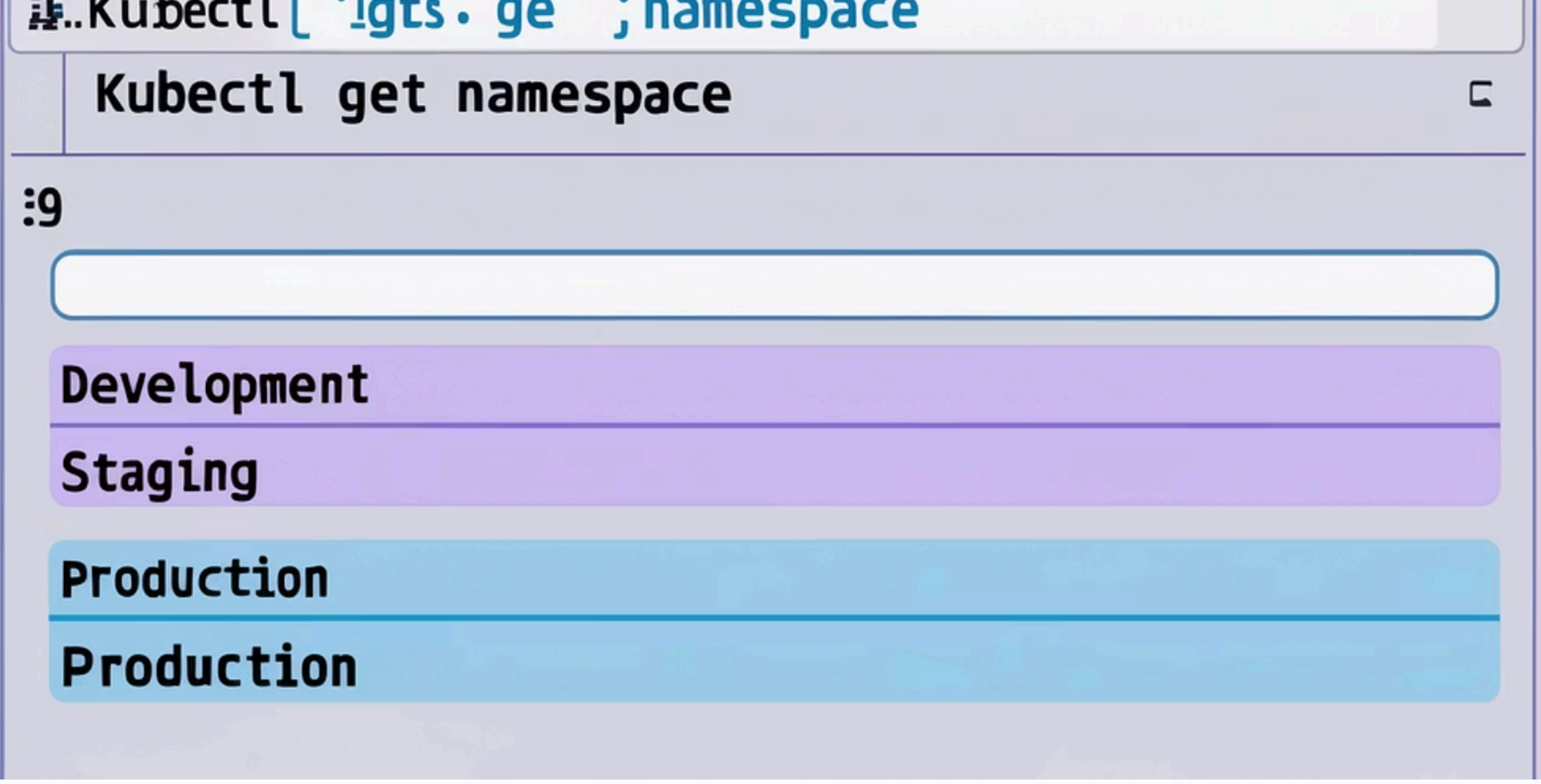

Fix: Explicit Namespace Management

In YAML

Always include namespace: prod in resource definitions

Command Line

Use kubectl config set-context to set default namespace

Verification

Double-check with kubectl get pods -n staging

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Unlimited Resource Consumption

Resource Hogging

One pod can consume all CPU/memory on a node

Eviction Risk

Pods killed when nodes run out of resources

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Fix: Define Resource Boundaries

Requests

Minimum resources pod needs: CPU: 100m, memory: 256Mi

Limits

Maximum resources pod can use: CPU: 500m, memory: 1Gi

Benefits

Better scheduling, predictable performance, reliable autoscaling

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Maintenance Downtime Risk

Node Maintenance

Cluster upgrades can kill all replicas simultaneously

No Safety Net

Without PDB, kubectl drain can cause outages

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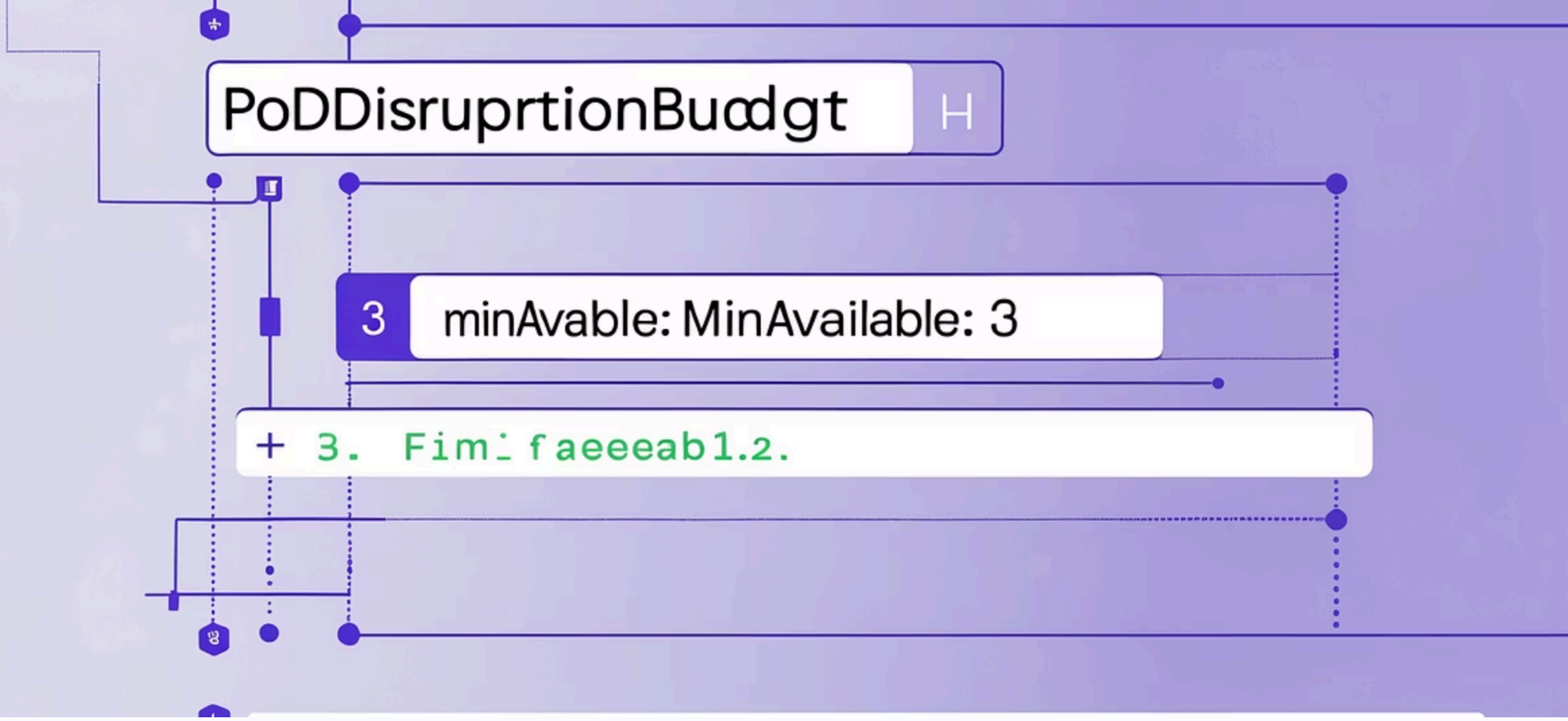

Fix: Add PodDisruptionBudget

MinAvailable

Set to keep at least 2 replicas running during maintenance

MaxUnavailable

Alternative: specify maximum pods that can be down

Implementation

Create PDB YAML that matches your deployment selector

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Image Pull Errors

ErrImagePull / ImagePullBackOff

Pod can't download container image

Common Causes

Typos in image name, missing tags, or registry auth issues

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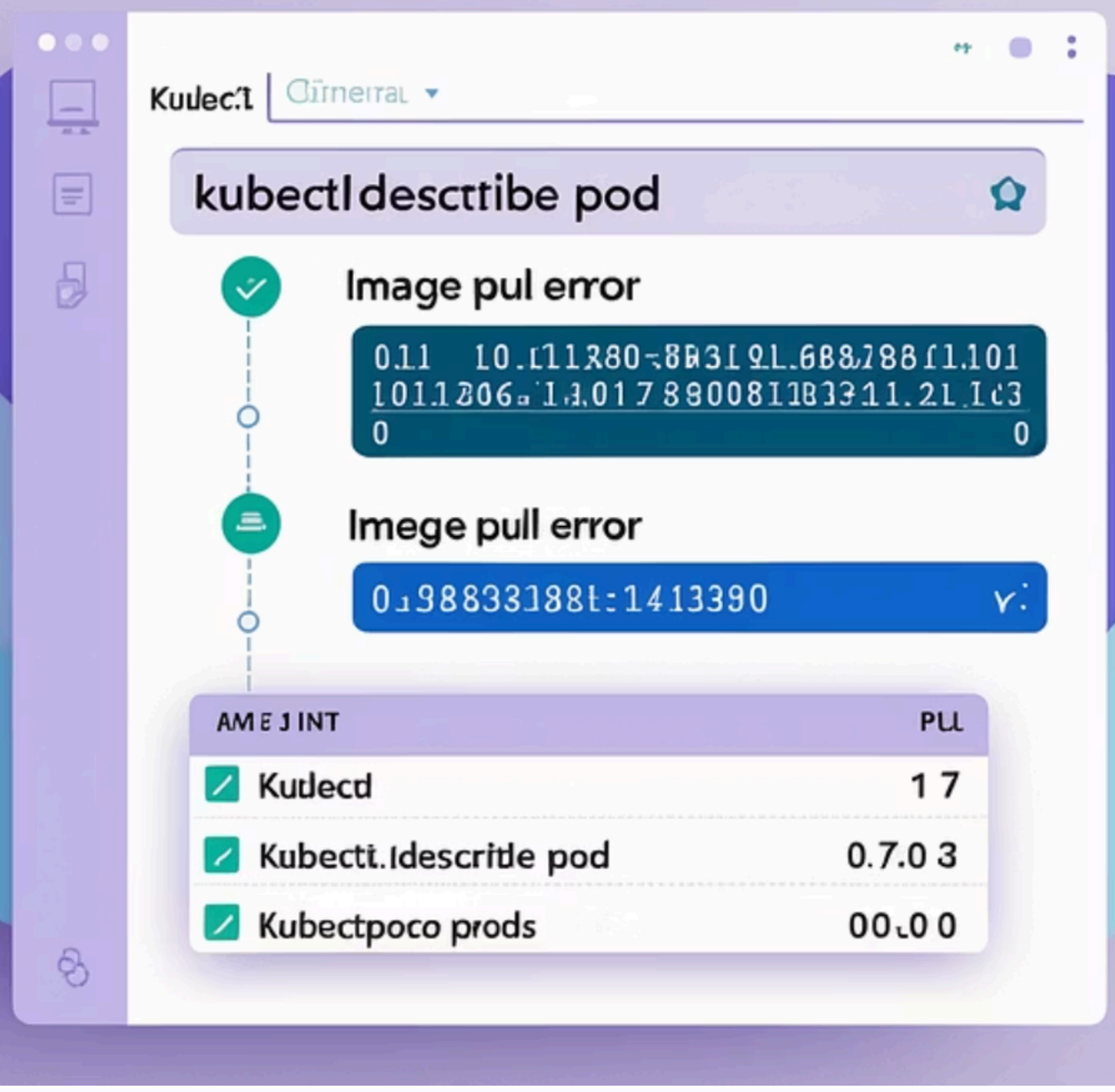

Fix: Resolve Image

Verify Image

Double-check spelling and tag existence in registry

Check Credentials

Ensure imagePullSecrets are correct

Investigate

Run kubectl describe pod for detailed error message

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CreateContainerConfigError

Config Problems

Pod fails to start due to specification errors

Common Causes

Missing environment variables, invalid mounts, or secret references

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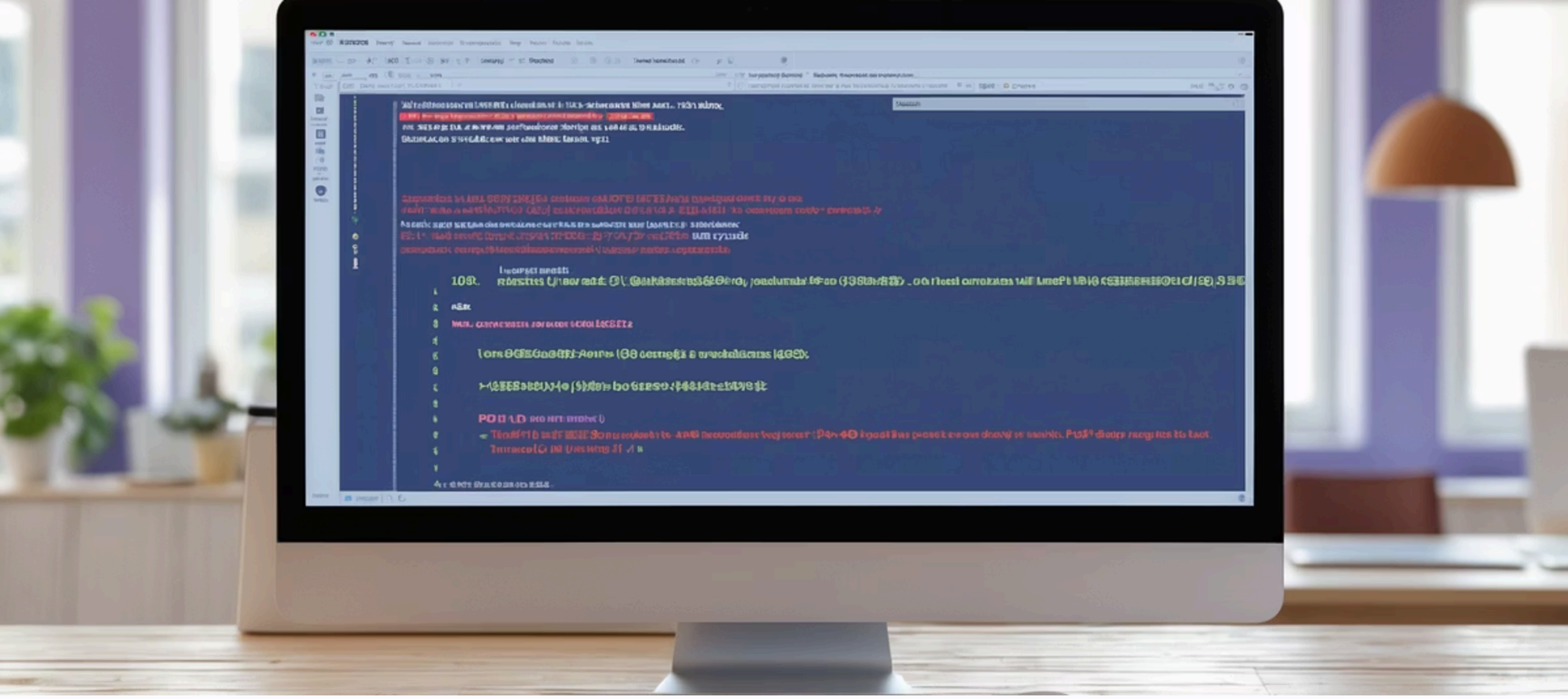

Fix: Correct Pod Configuration

API Validation

Use kubectl --validate to check manifest against schema

Inspect Errors

kubectl describe pod shows detailed configuration issues

Test Resources

Verify referenced ConfigMaps and Secrets exist

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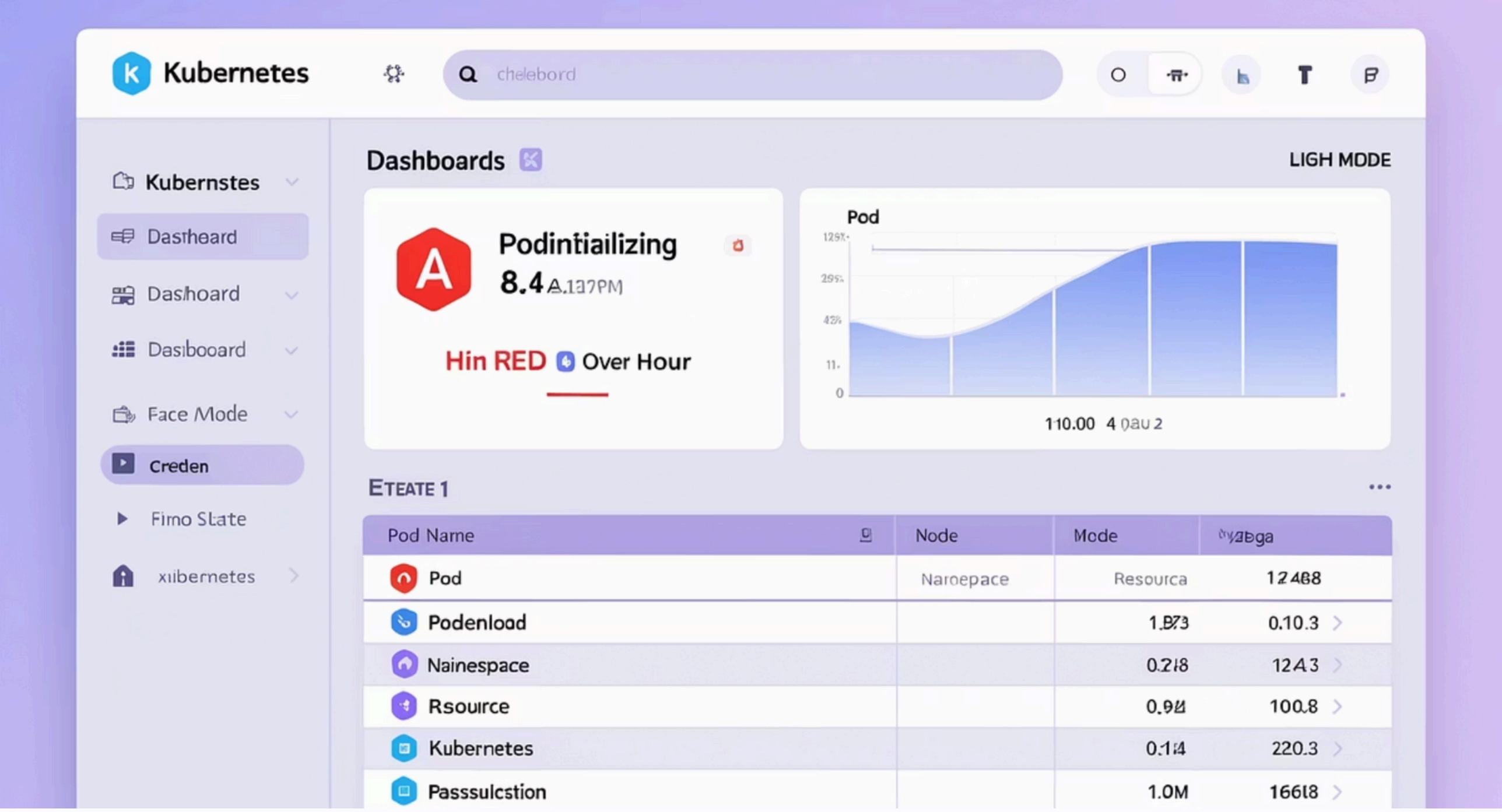

Stuck in

Initialization Freeze

Pod never progresses past init phase

Common Causes

Failed init containers, missing volumes, or resource constraints

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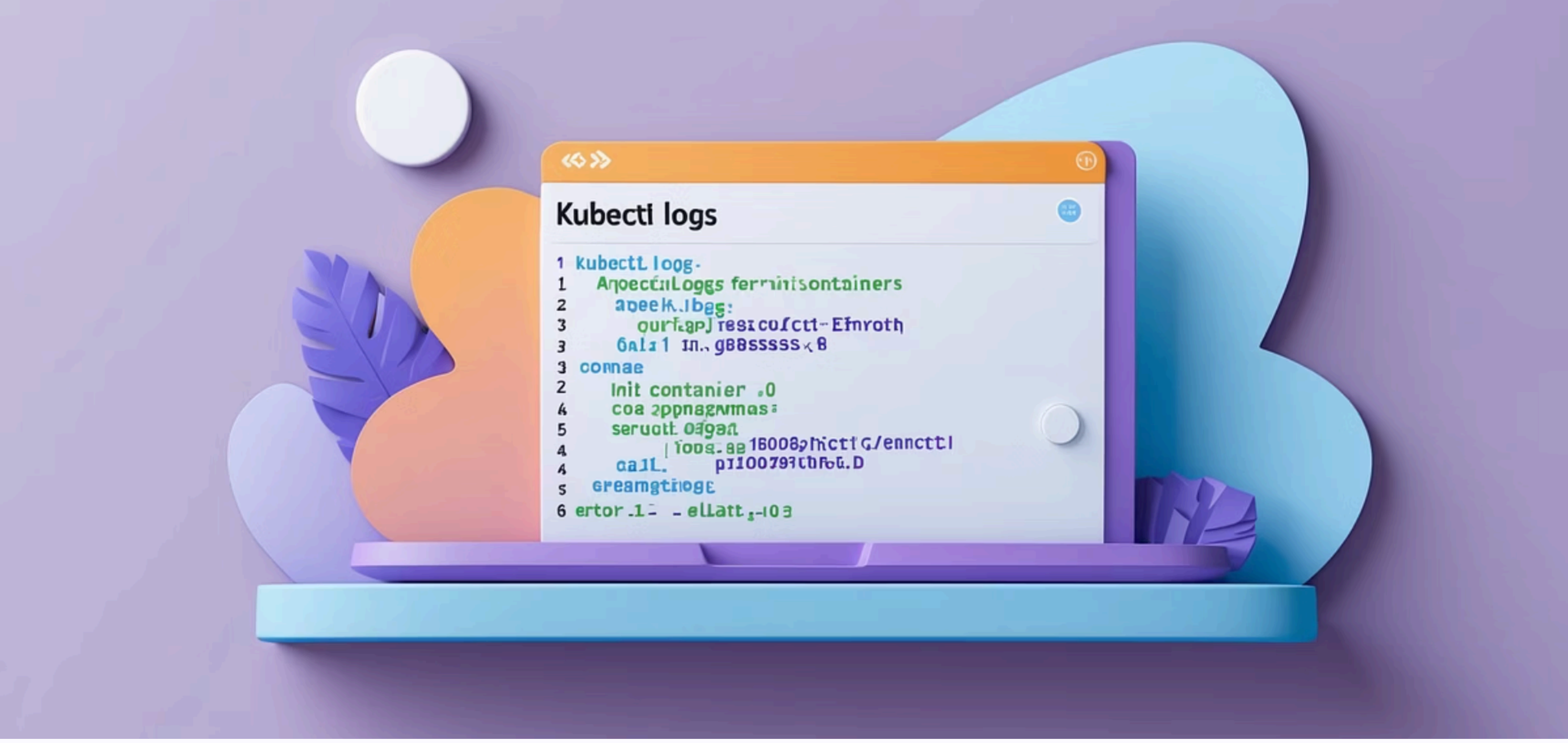

Fix: Investigate Init Failures

Check Init Logs

kubectl logs pod-name -c init-container-name

Verify Volumes

Ensure PVCs are bound and readable

Review Resources

Check if init containers have sufficient CPU/memory

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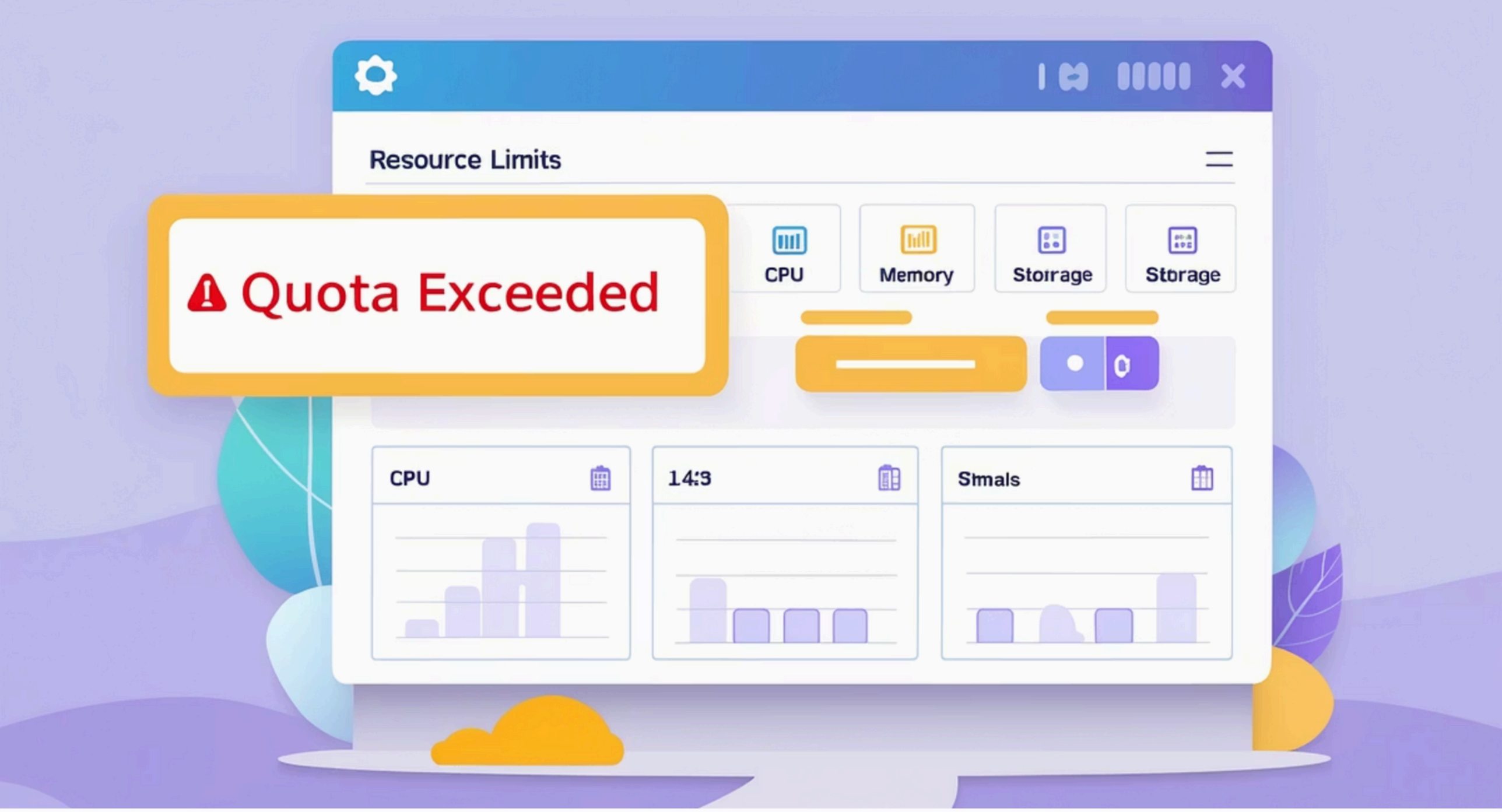

Resource Quota

Hitting Namespace Limits

Prevented from creating new resources

Common Quota

Pod count, CPU, memory, storage, or custom resources

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Fix: Manage Resource Quotas

Check Current

Run kubectl get resourcequota -n namespace

Adjust Usage

Reduce replica count or size resource requests

Request Increase

Ask cluster admin to raise quota limits if needed

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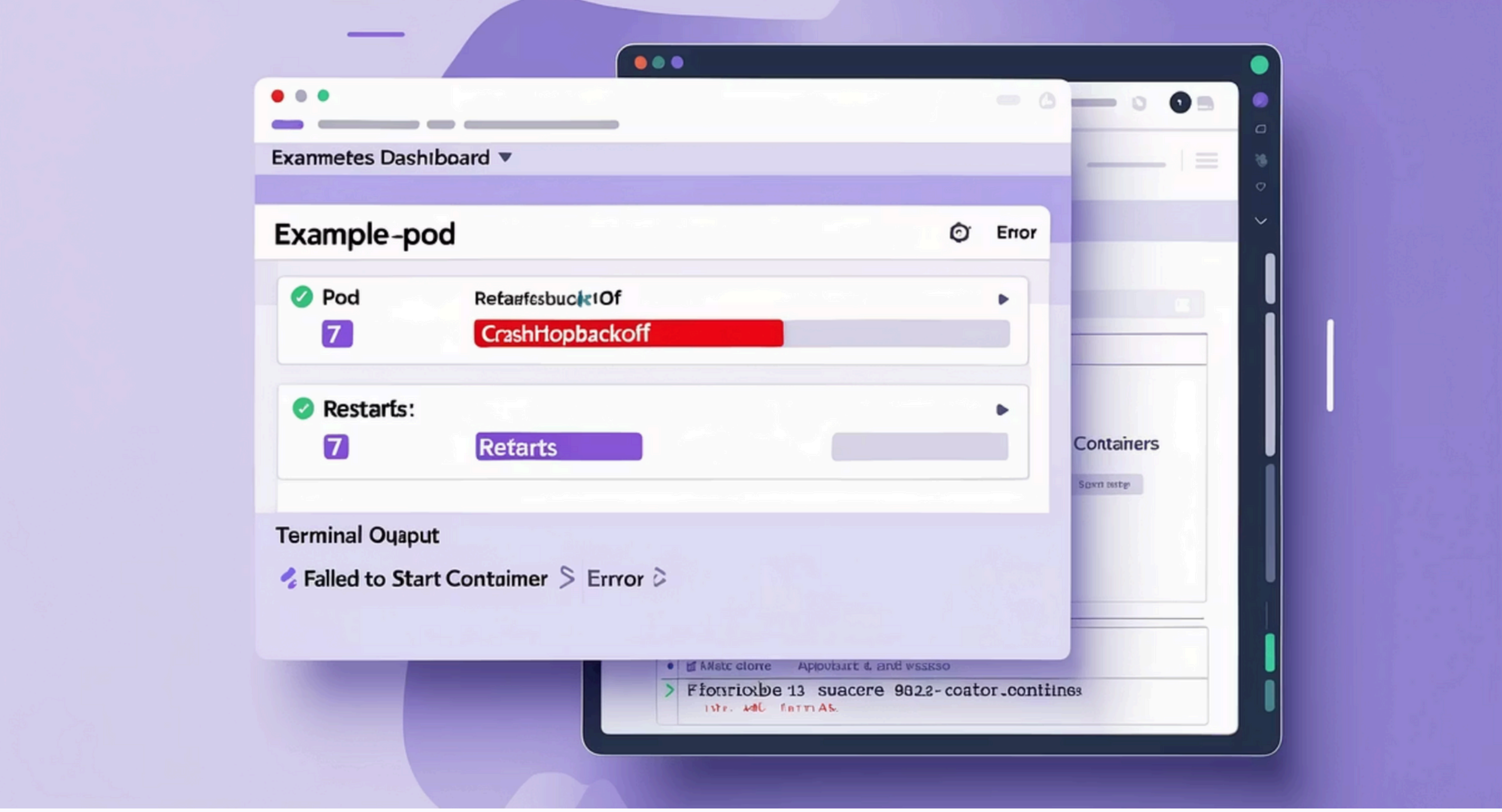

CrashLoopBackOff

Endless Restarts

Container keeps failing and Kubernetes keeps restarting it

Common Causes

Missing files, bad commands, or configuration issues

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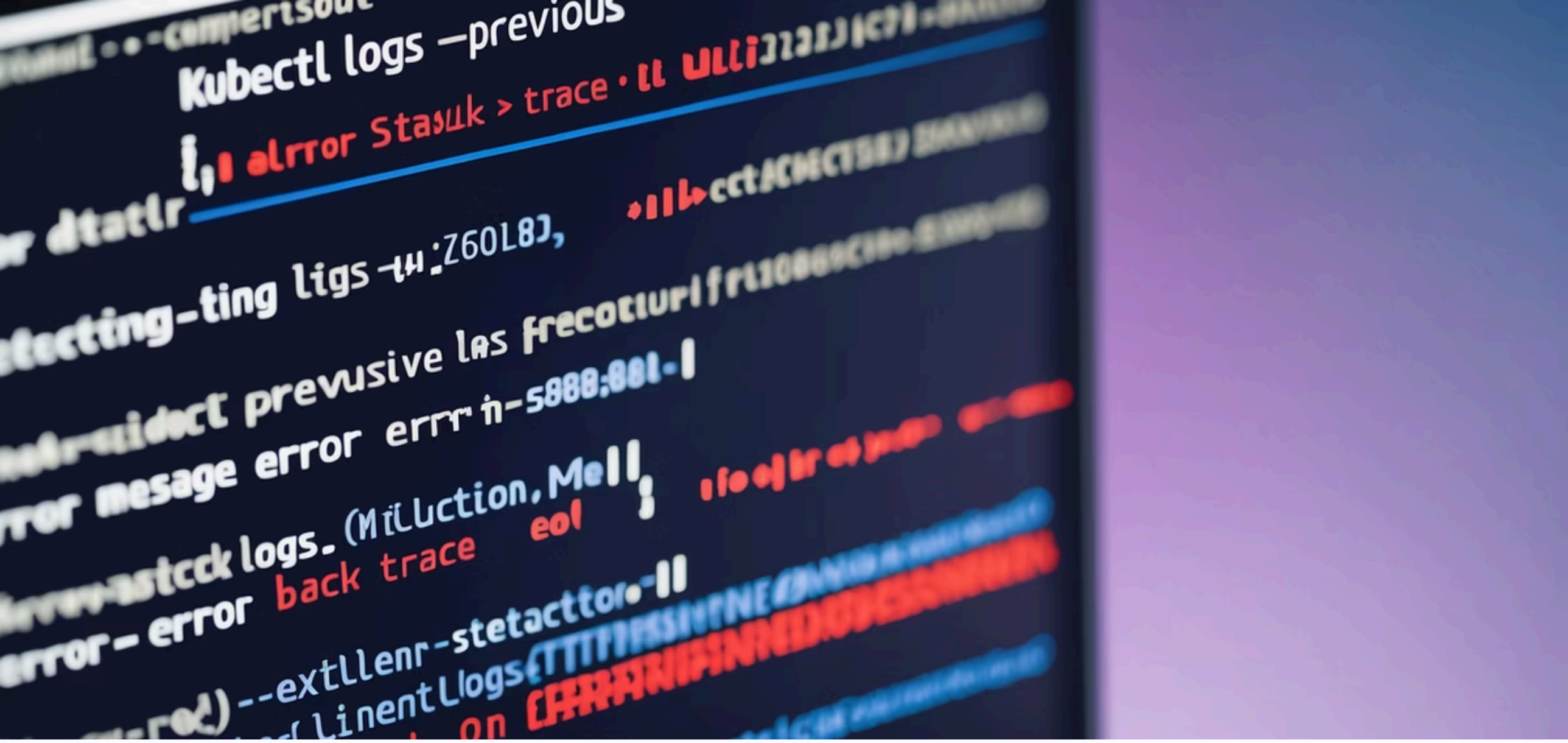

Fix: Break the Crash Loop

Get Crash Logs

kubectl logs pod-name --previous to see failure reason

Debug Command

Check command and args in pod spec

Update Config

Fix the root cause and redeploy with corrected YAML

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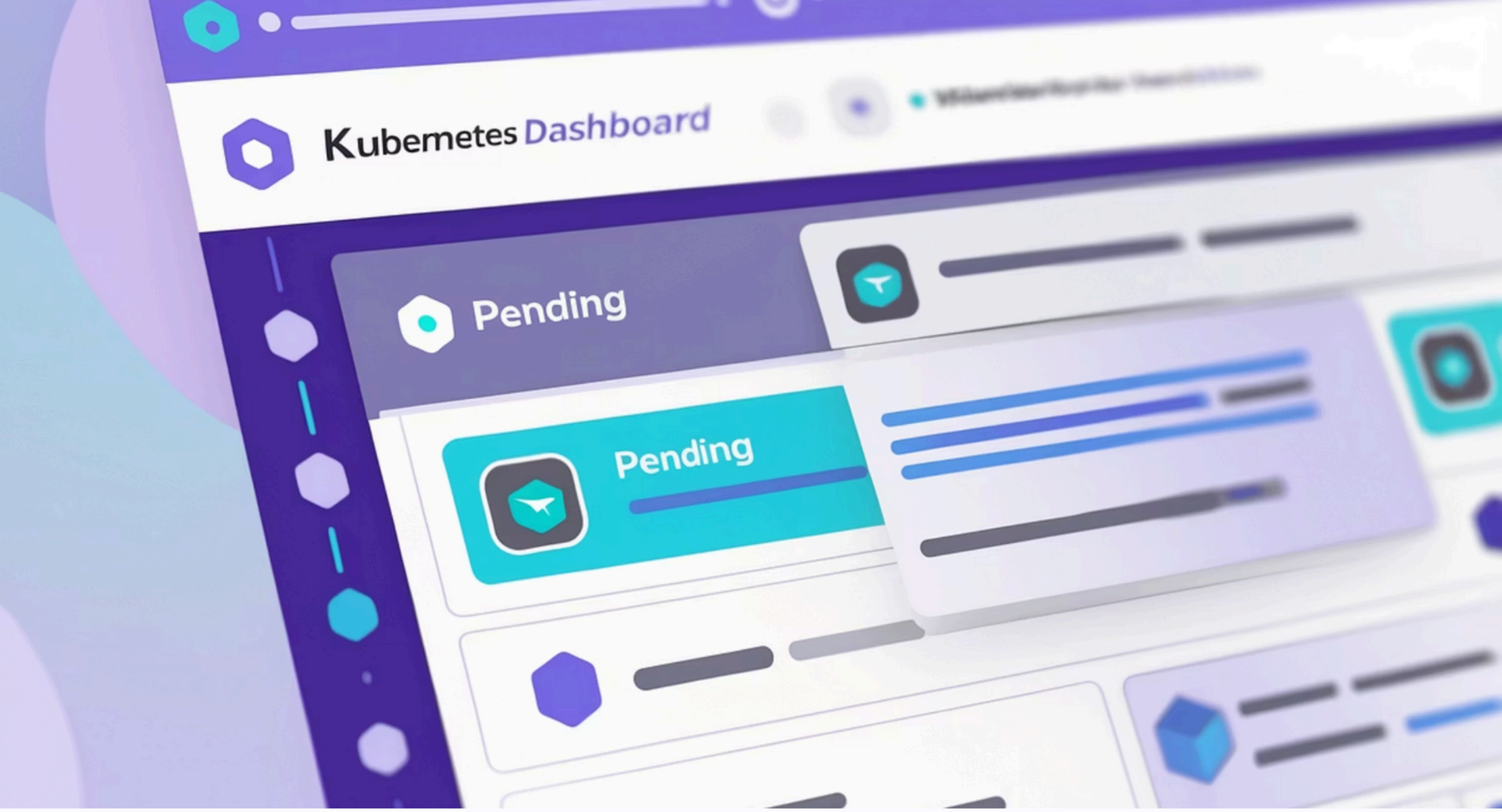

Scheduling

Pods Stuck in Pending

Never get assigned to a node

Common Causes

Insufficient resources, node selectors, or taints/tolerations

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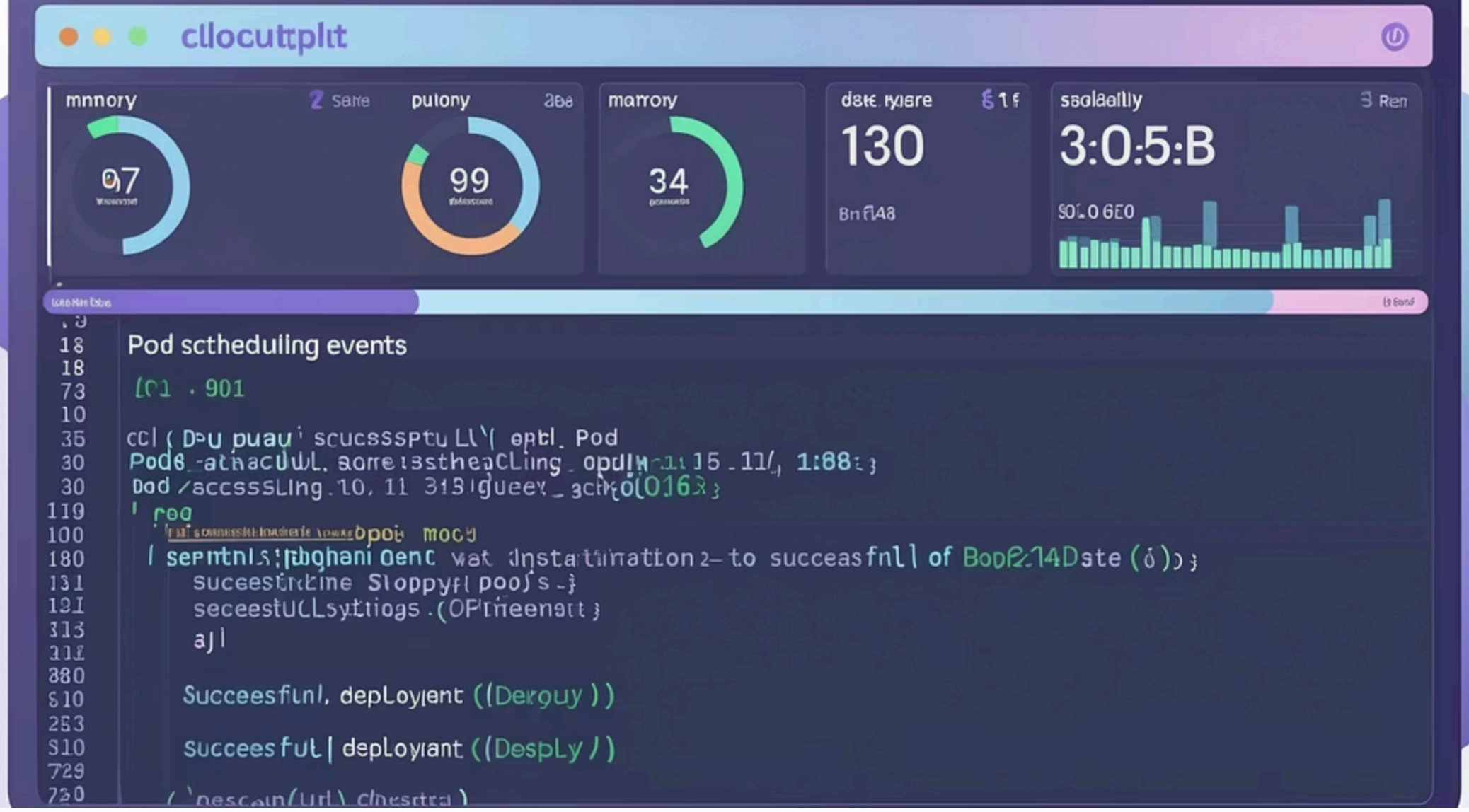

Fix: Address Scheduling Issues

Check Node Status

kubectl get nodes -o wide to see available resources

Review Pod Spec

Examine nodeSelector, affinity rules, and tolerations

Investigate Events

kubectl describe pod shows scheduler decisions

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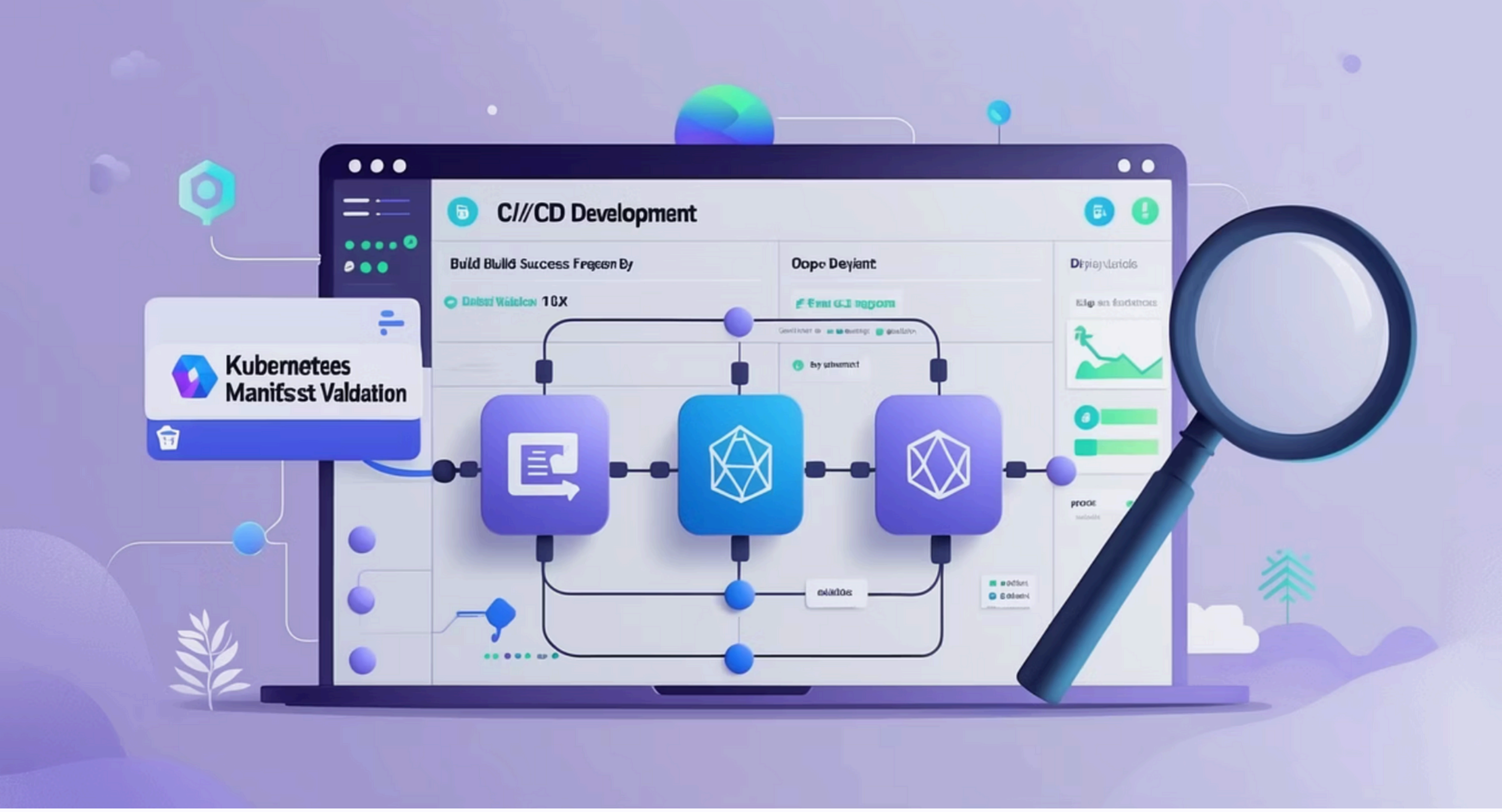

Prevention: Automate YAML Validation

Pre-deployment Checks

Catch configuration issues before they hit the cluster

Tools

Use kubeval, datree, or conftest in CI/CD pipelines

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Prevention: Secure Default Configurations

RBAC

Apply least-privilege role-based access control to all resources

Pod Security

Disable privileged containers and root access by default

Network Policy

Start with default-deny and add specific allow rules

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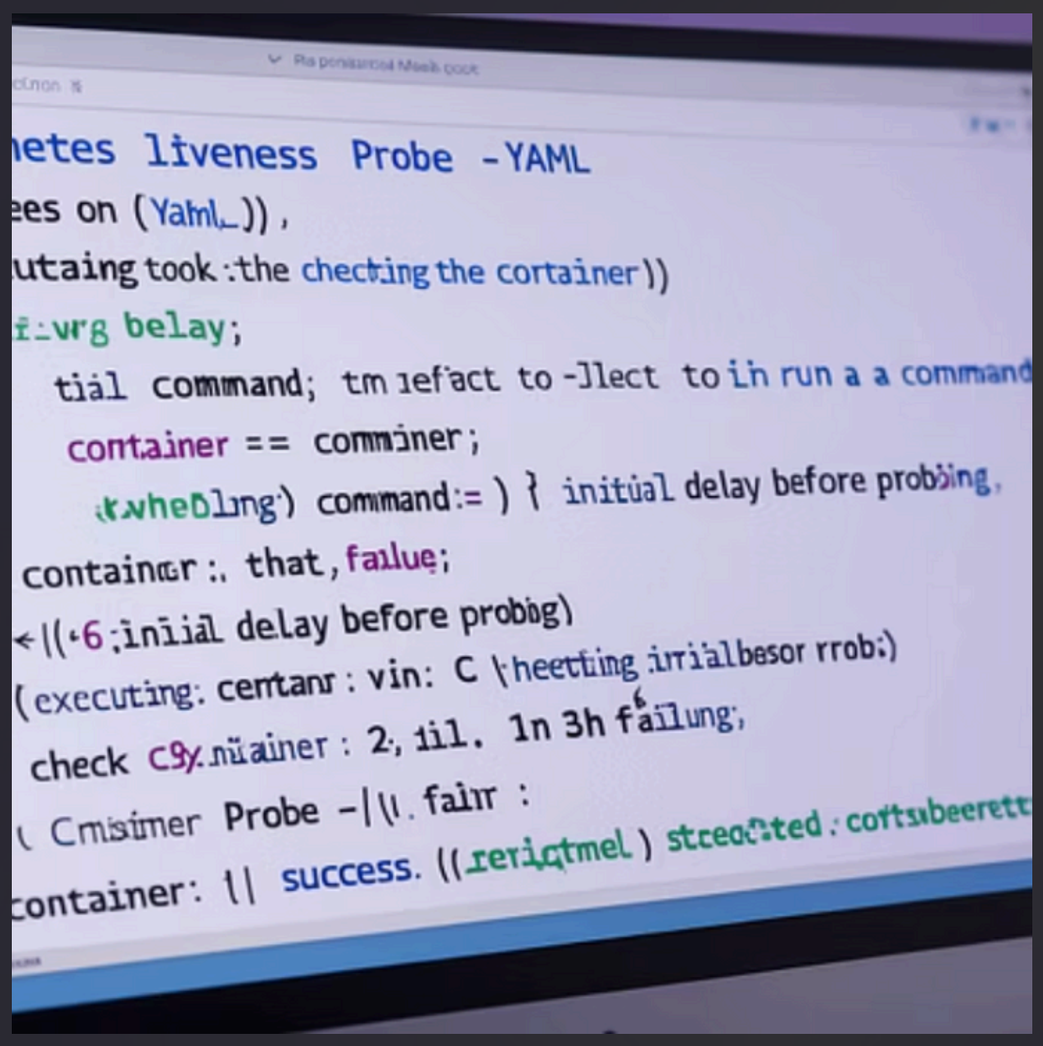
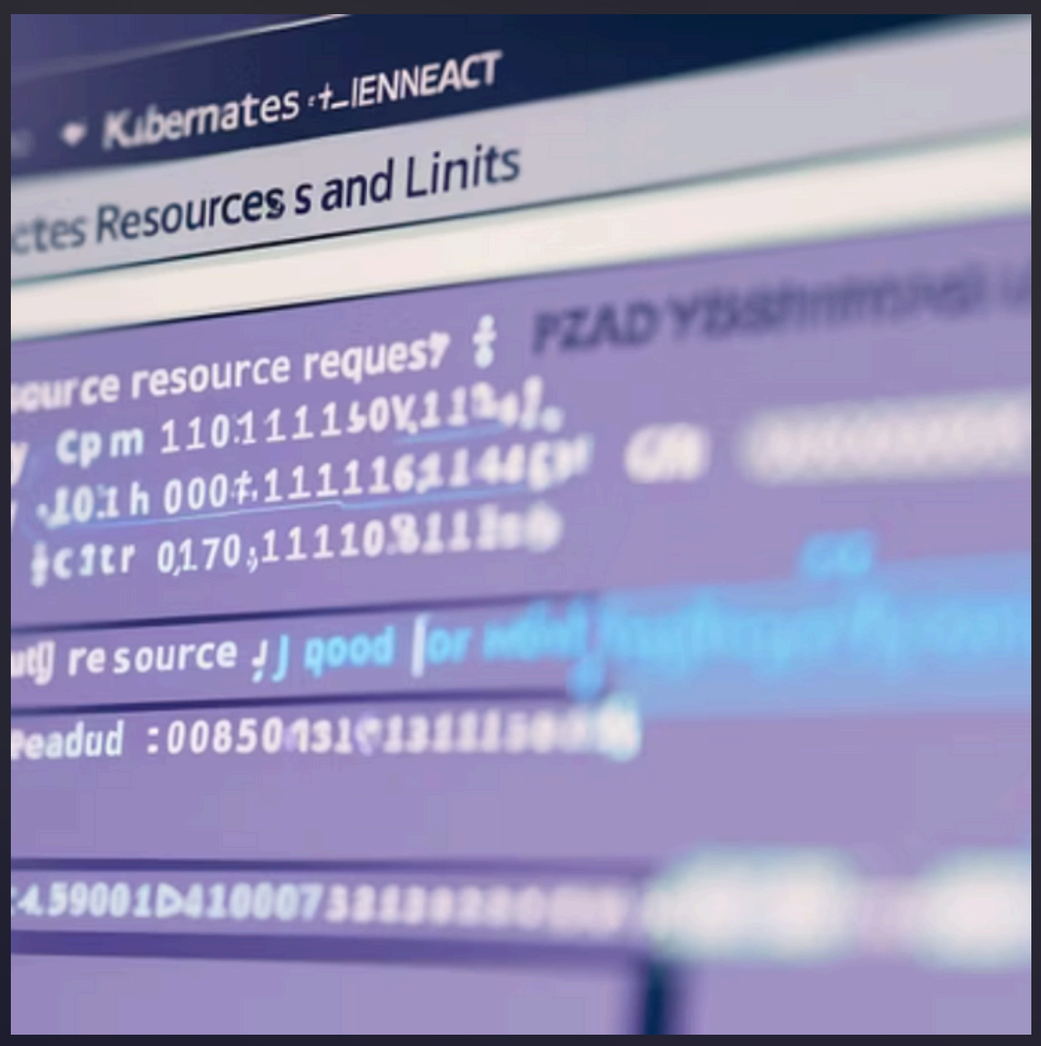
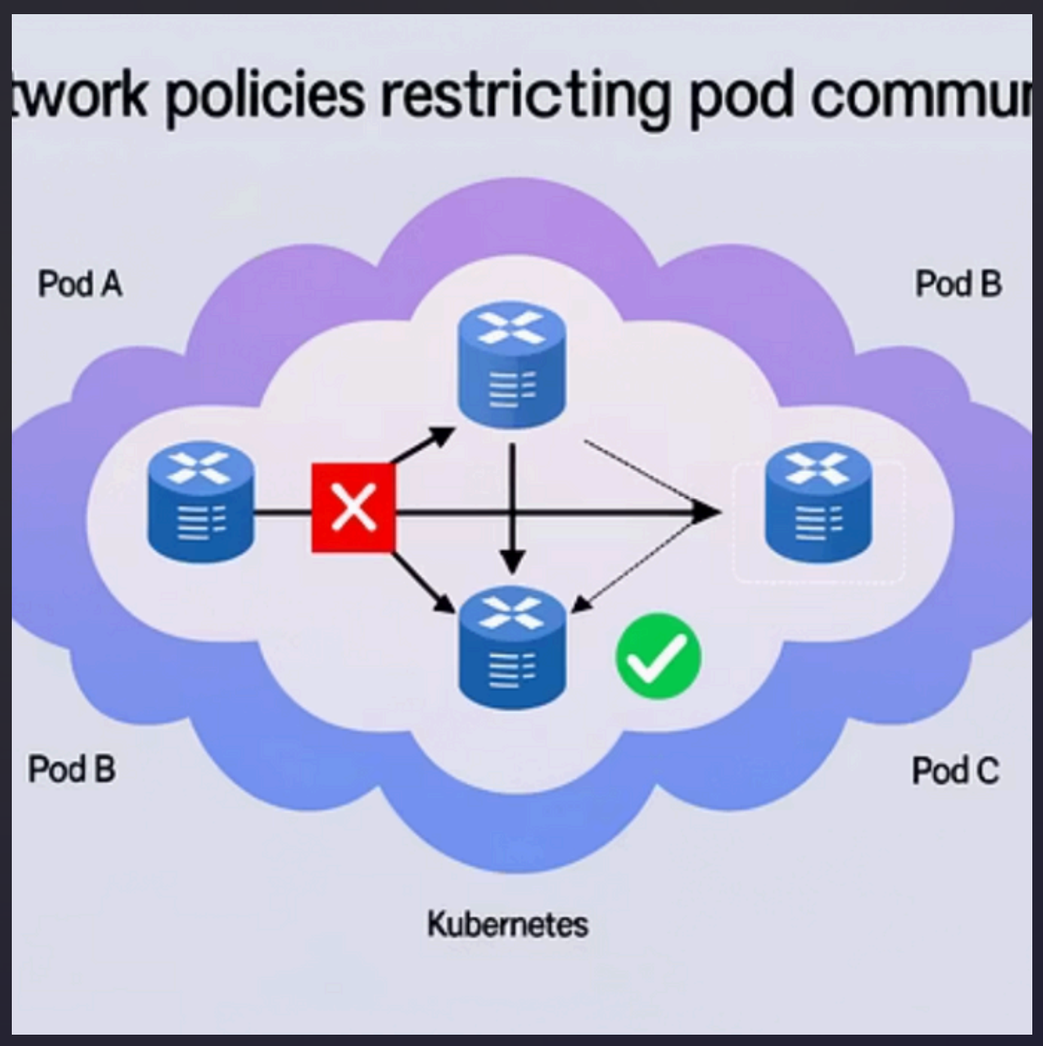
Quick Recap: Top Errors to







Always pin image versions, implement health checks, set resource boundaries, and restrict network access for a production-ready cluster.

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Essential Troubleshooting

kubectl describe

Get detailed info and events for any resource

kubectl logs

View container output with --previous for crashed pods

kubectl get -o wide

See additional details including node assignments

kubectl exec -it

Run commands inside containers for live debugging

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Build Reliable Kubernetes Clusters Today!

These fixes will help you avoid the most common Kubernetes design errors. Tag a fellow engineer who needs this guide, and share your own K8s troubleshooting tips in the comments!

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