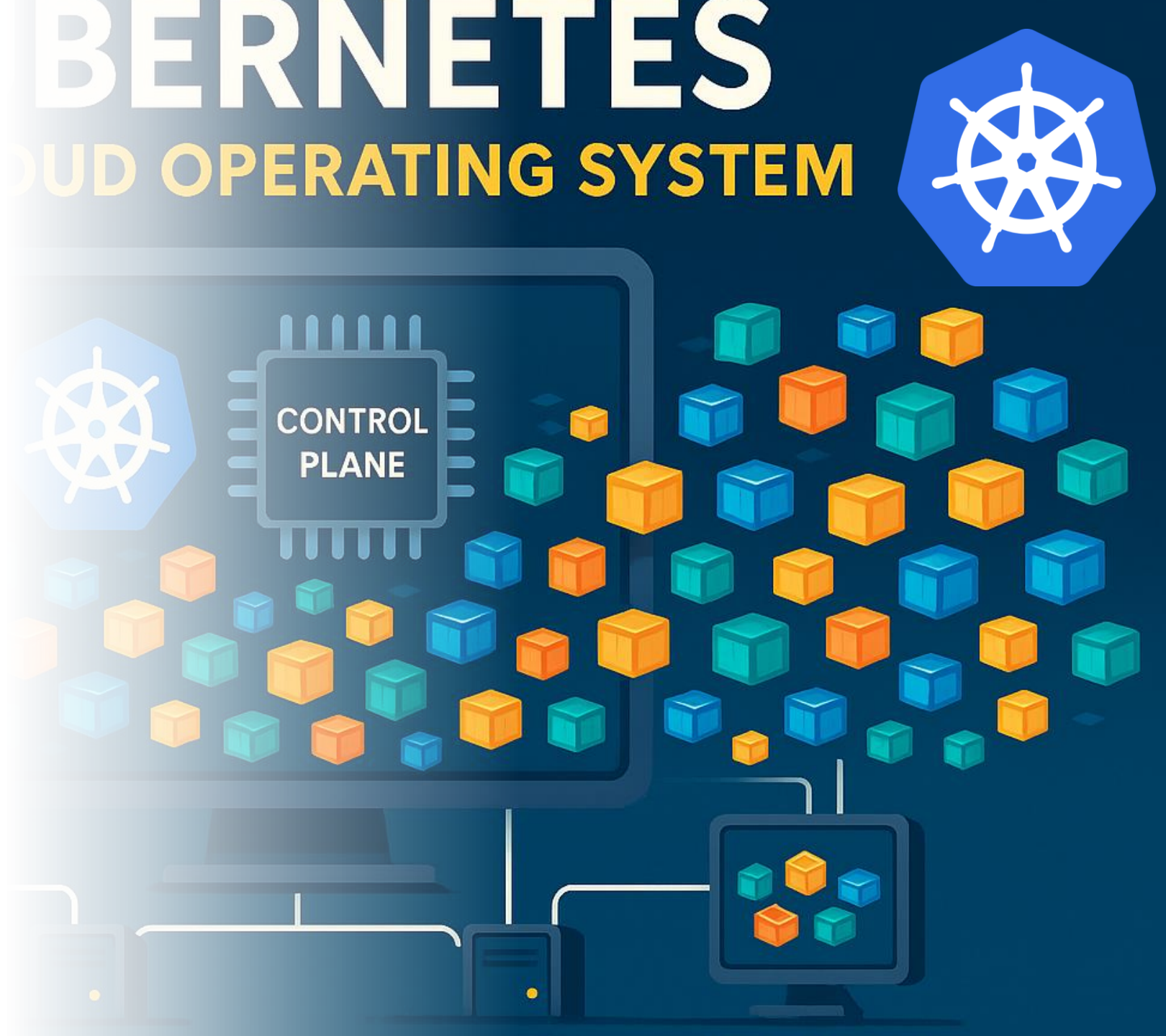


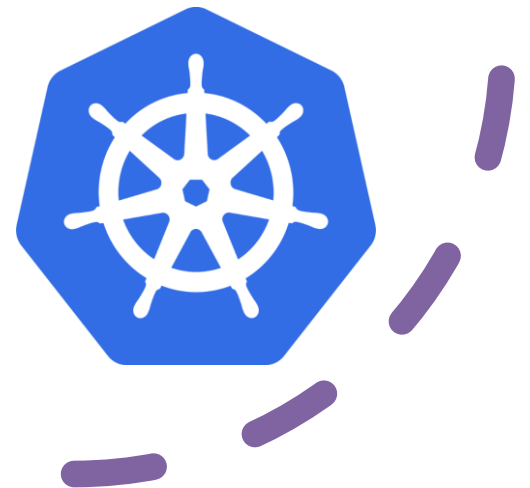
# Kubernetes Fundamentals

Instructor: Magdy Salem



# Agenda

- Why Kubernetes?
- Deep dive Kubernetes architecture
- Kubernetes CLI (kubectl) introduction
- Installing Minikube vsKIND



# Why Kubernetes?

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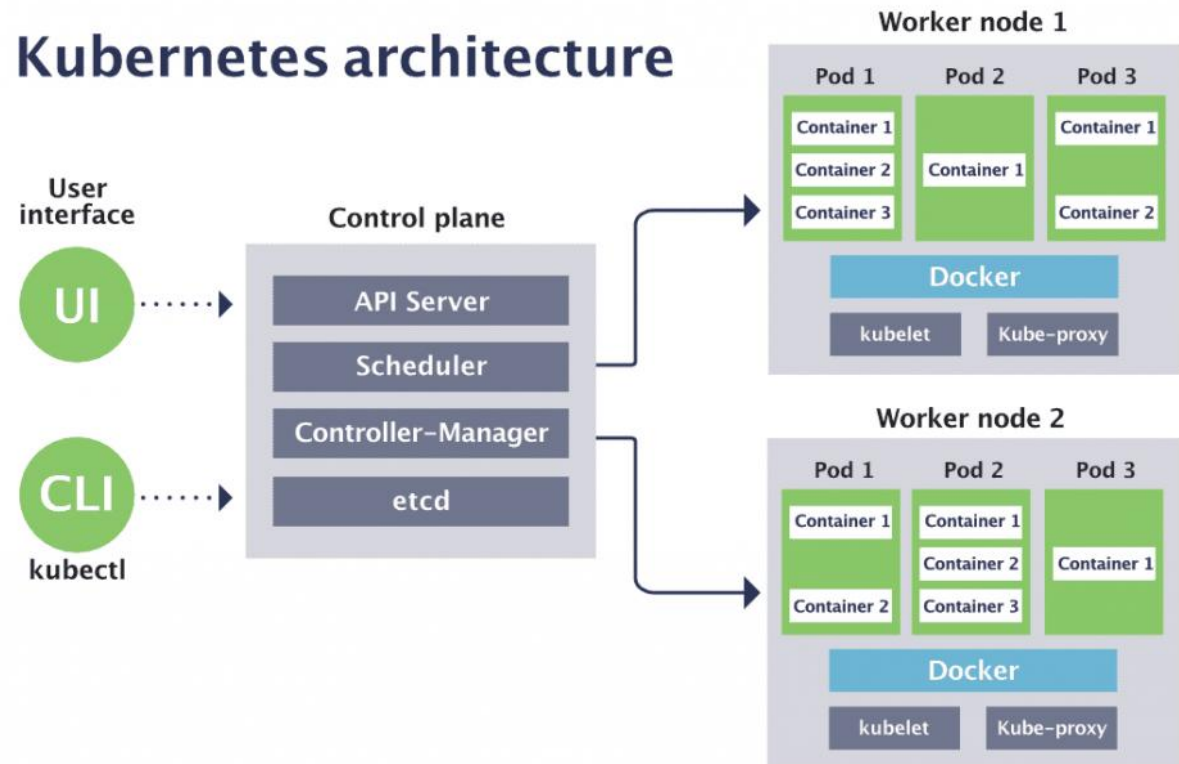
- Manual container orchestration doesn't scale
- Microservices increase complexity
- Kubernetes provides:
  - Automated deployment & scaling
  - Healing & service discovery
  - Config and secret management



# Core Concepts & Architecture

- Cluster = control plane + worker nodes
- Pod = smallest deployable unit )
- Deployment = manages desired state of apps
- Service = stable networking endpoint for Pods
- ETCD, Scheduler, Controller Manager, Kubelet

## Kubernetes architecture



# API Server

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- Acts as the front-end for the Kubernetes control plane
- Accepts RESTful calls from kubectl and other clients
- Validates requests and updates the cluster state in ETCD
- Communicates with all other components (scheduler, controller manager)



# Scheduler

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- Watches for newly created Pods without assigned nodes
- Selects the best available node based on resource requirements and constraints
- Factors: CPU, memory, affinity rules, taints/tolerations, custom policies
- Binds the Pod to a Node (but does not actually launch it)



# Controller Manager

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- Runs controllers that regulate the state of the cluster
- Examples: ReplicationController, NodeController, JobController, EndpointsController
- Continuously monitors cluster state and performs reconciliation to match the desired state
- Communicates with the API Server to watch resources and submit updates



# ETCD

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- Consistent and highly-available key-value store
- Stores all cluster configuration data, state, and metadata
- Acts as the single source of truth for Kubernetes
- Used by API Server to read/write cluster information



# Kubernetes CLI (kubectl)

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- kubectl version
- kubectl cluster-info
- kubectl get nodes
- kubectl get pods
- kubectl apply -f <file.yaml>
- kubectl describe, delete, logs



# Installing Minikube

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- Minikube = Single-node Kubernetes cluster for local use
- Use VirtualBox, Docker, or Hyperkit as VM driver
- Compatible with kubectl



# Installing KIND

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- KIND = Kubernetes IN Docker
- Runs K8s clusters in Docker containers
- Good for CI/CD and lightweight testing





# Demo





# Lab

