# Kubernetes

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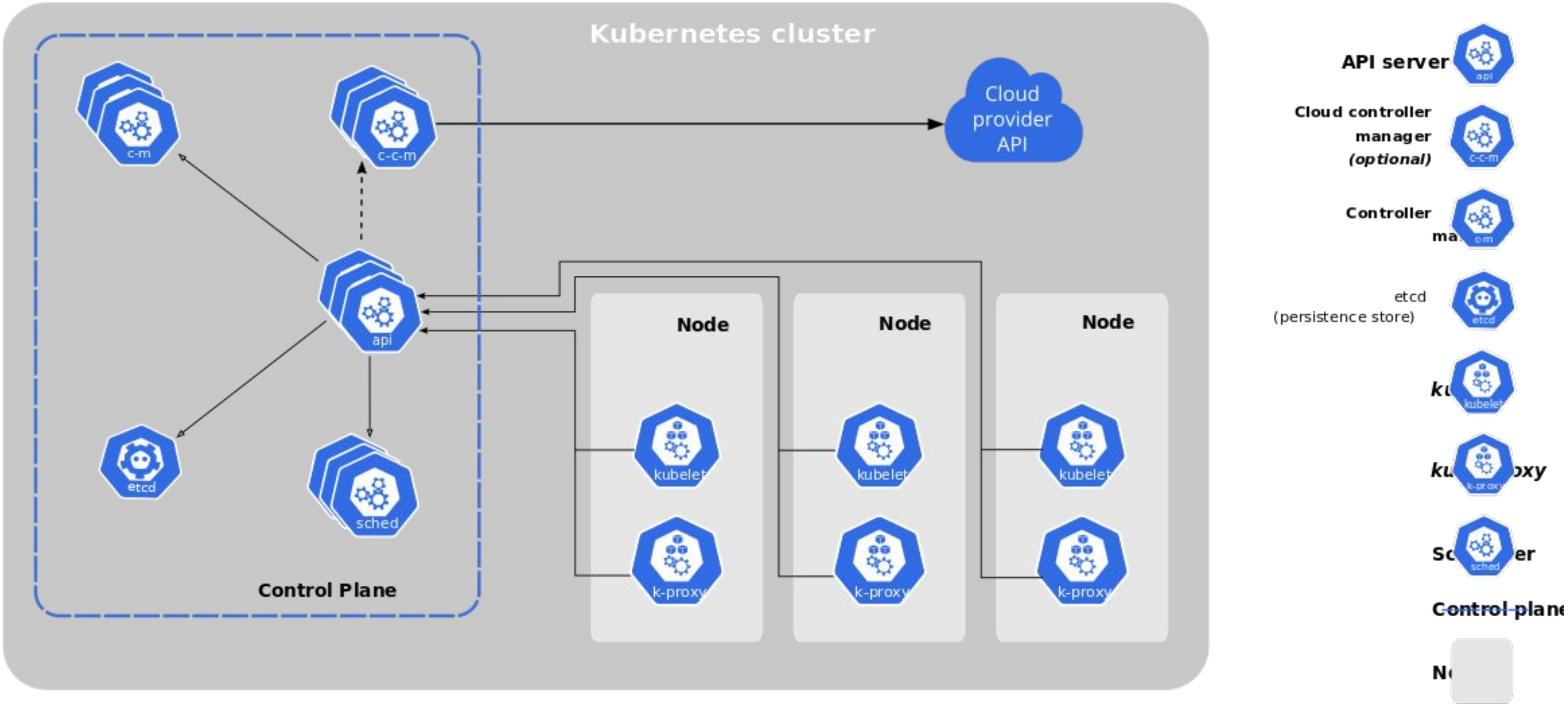
# What is Kubernetes?

- Container Orchestration Platform
    - OCI Compliant Images
- Standardized Development and Deployment
    - Virtualizes them to look same
- Allows fast deployment
    - Tools for allow quick & “invisible” updates

# High Level Features

- Allow for scalability
  - Deploy many containers of the same image
- Allow for logical grouping
  - Load Balancing for containers
- Self-healing and auto scaling
  - How does Kubernetes self-repair services?

# High Level Architecture



# Basic Components

- Pod → Smallest unit in Kubernetes
  - Represents a container in Kubernetes
- Deployment → Grouping of Pods
  - Used to start/update all pods originating from a specific image

# Basic Components

- Persistent Volume → Define persistent storage for Deployment
  - Allows you to store data that outlives Deployment
- Persistent Volume Claim → Defines persistent storage mapping for cloud resources
  - Allows you to link to the same volume after every restart

# Basic Components

- Secrets → Define any sort of “secret” information
    - Used to specific registry secrets to pull images
- ConfigMaps → Application level configuration
    - Key-value store that applications can read from and write to

# Networking in Kubernetes

- Namespaces
    - Allow “logical” clusters of pods. Can communicate within themselves (Private Network)
- Service
    - Allow to expose a Deployment “externally”

# Why Kubernetes?

- Portable Configuration
  - Can change cloud providers to any Kubernete Complaint Cloud
- Allow for containerization deployment
  - What is the advantage of this?
- Resource allocation is done optimally (Why?)

# Common Use Cases

- Microservice Orchestration
  - Deploy Microservices effectively with namespaces
- Multi-Cloud Deployment
  - Abstract Cloud Resources, so Multi-Cloud is very possible
- AI/ML Deployment
  - Dynamic Resource Allocation → Very important for AI

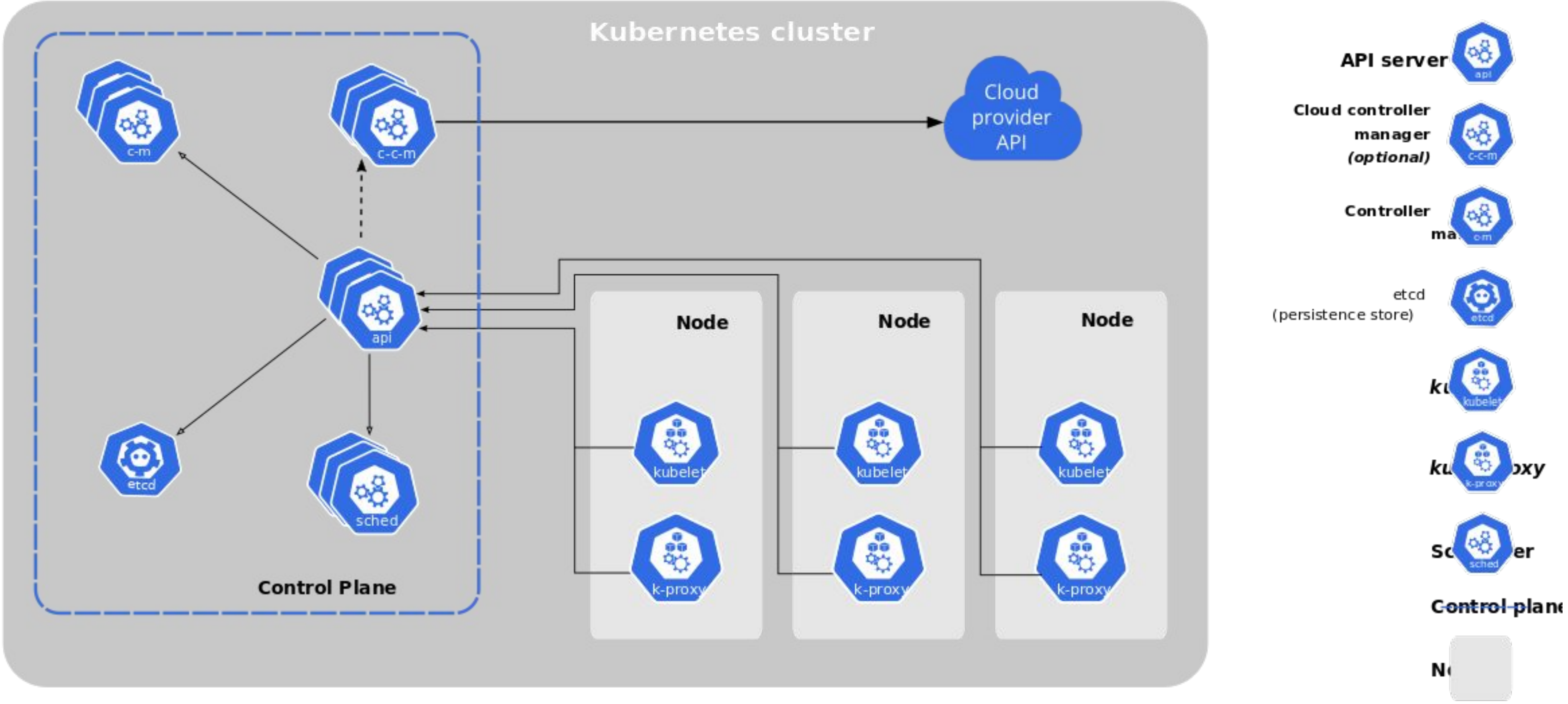
# Challenges of Kubernetes

- Very complex to set up
    - Explicitly configure every detail
- kompose → Tool for converting Docker Compose configuration to Kubernetes Configuration
    - Requires very little modification after!

# Important Kubernetes Tools

- Kubectl → CLI Client for Kubernetes
  - Interacts with Control Plane for you
- Usually some custom tools are used
  - Automated deployment using Kubernetes API at the end of CI/CD pipelines

# Tying back everything



# Thank You!

Next Time: Intro to Structured Development