Kubernetes Fundmentals

.NET CORE

Kubernetes is a portable, extensible, open-source platform for managing containerized workloads and services. It facilitates both declarative configuration and automation.

HTTPS://KUBERNETES.IO/DOCS/CONCEPTS/OVERVIEW/WHAT-IS-KUBERNETES/

What is Kubernetes?

https://developer.ibm.com/technologies/microservices/articles/why-should-we-use-microservices-and-containers/
https://kubernetes.io/docs/concepts/overview/what-is-kubernetes/
https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/architecture.md#kubernetes-design-and-architecture

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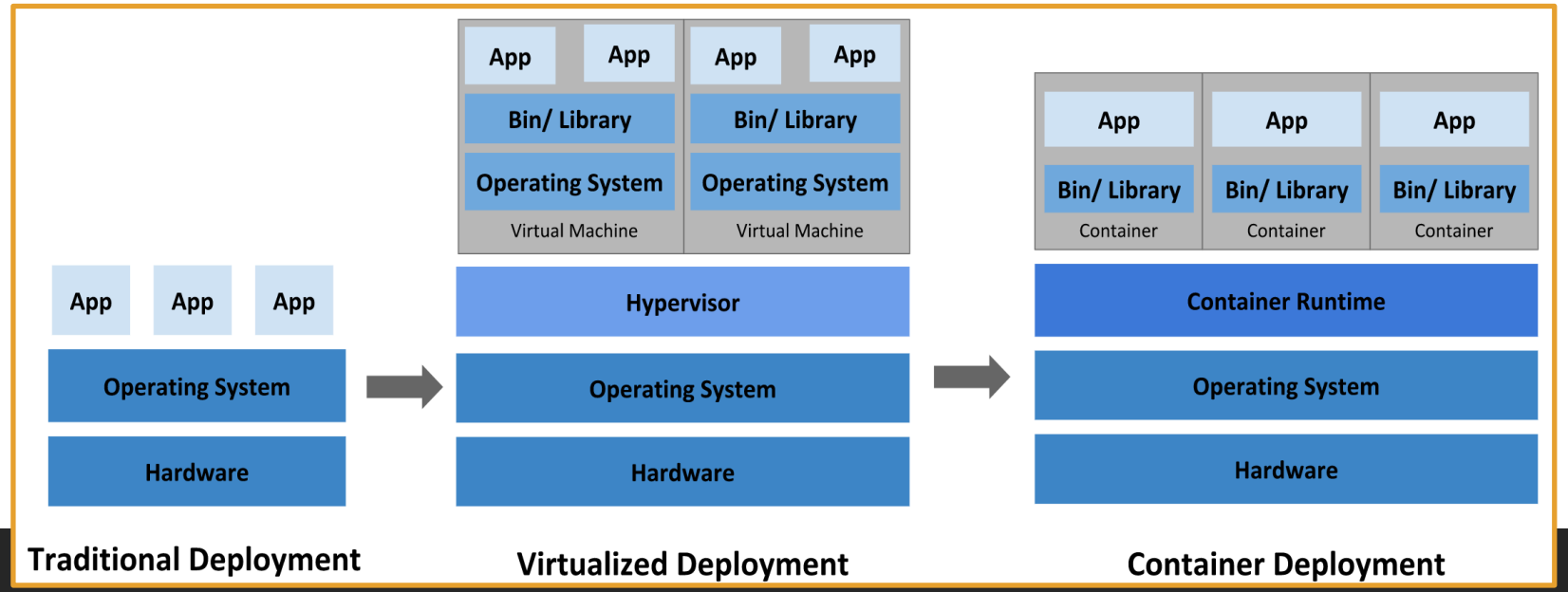
Kubernetes is a production-grade, open-source infrastructure for the deployment, scaling, management, and composition of application containers across clusters of hosts. It is inspired by previous work at Google ***Kubernetes project***. The name ***Kubernetes*** originates from Greek, meaning helmsman or pilot.

Kubernetes provides you with a framework to run distributed systems resiliently. It takes care of scaling and failover and provides deployment patterns. It allows you to automate the deployment of your containerized microservices. This makes it easier to manage all of the components and microservices in your application.

Kubernetes containers allow you to:

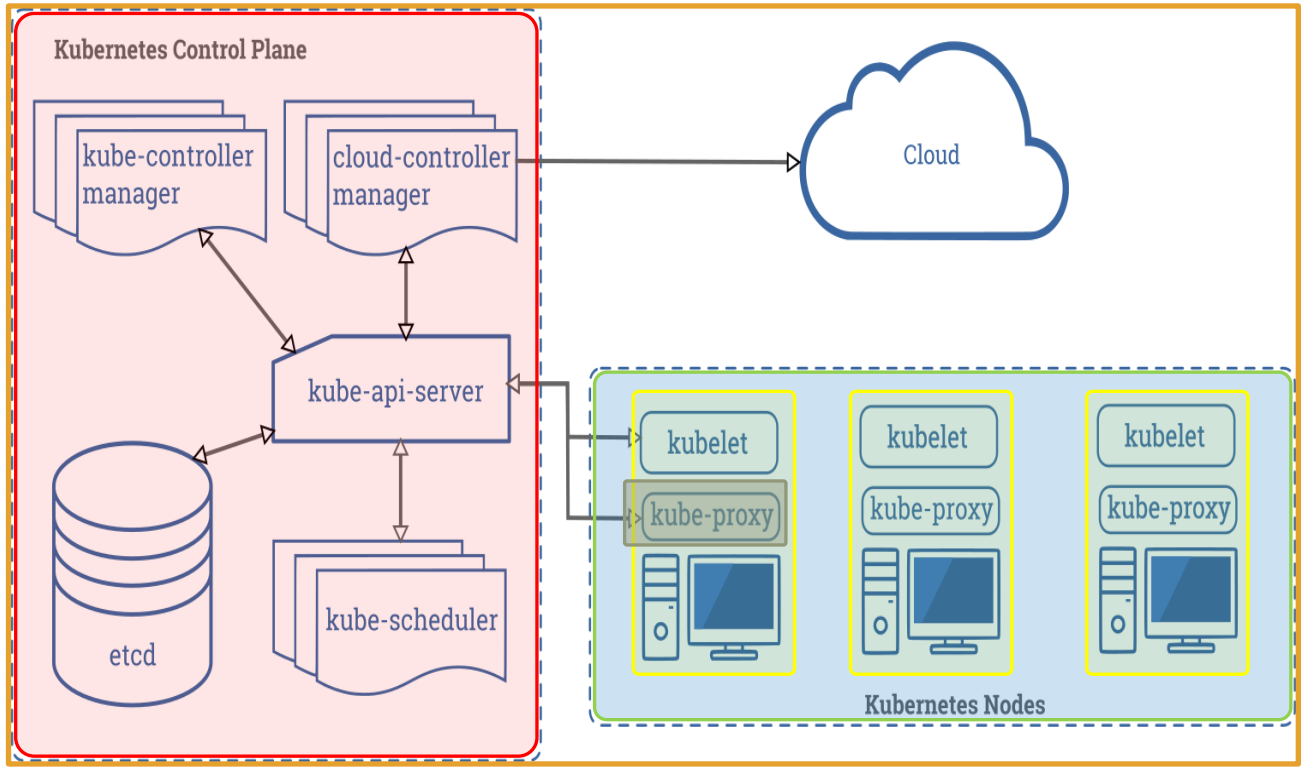
- Deploy images quickly
- Maintain continuous deployment
- Enhance Separation of Concerns
- Run your (portable) application anywhere, on any platform
- Have an elastic, scalable MSA
- Isolate resources
- Utilize resources more effectively



Kubernetes Architecture – Overview (1/2)

https://kubernetes.io/docs/concepts/overview/components/

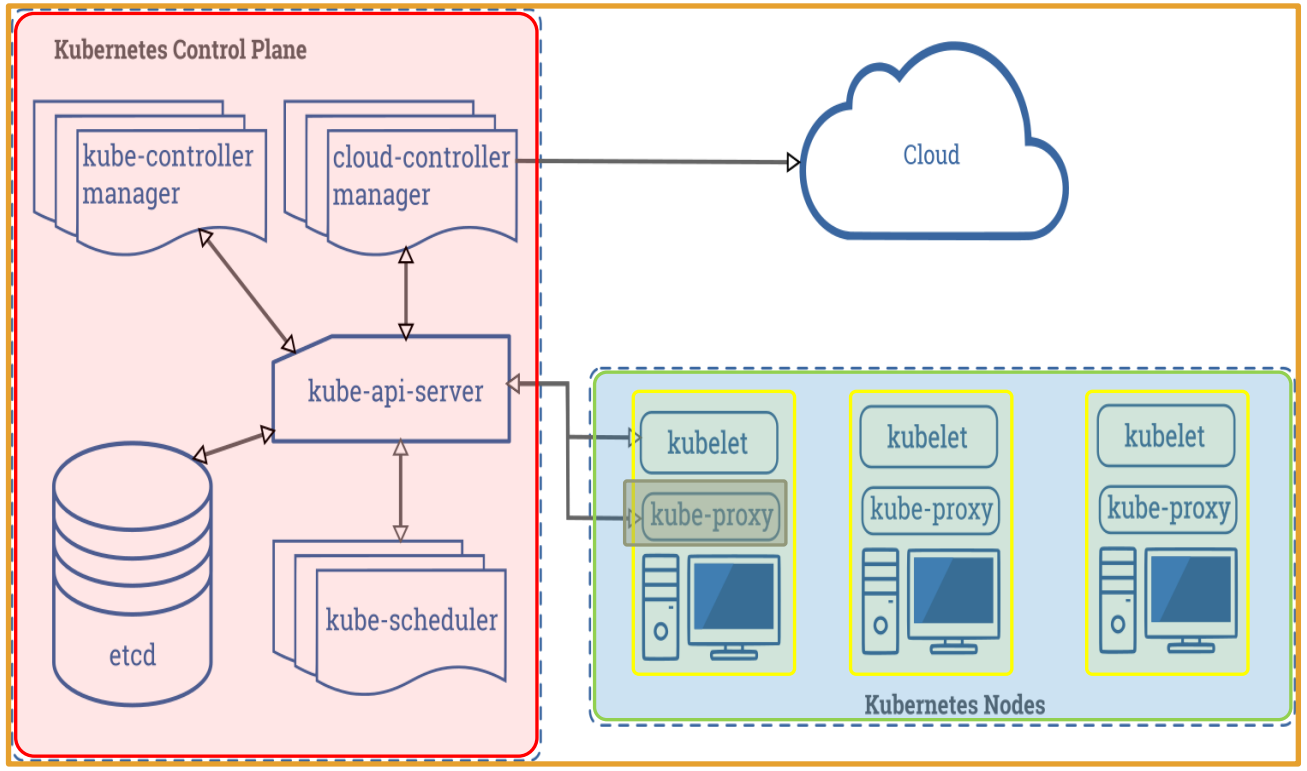
- ***Kubernetes*** is not a traditional, all-inclusive PaaS (Platform as a Service) system. ***Kubernetes*** operates at the container level rather than at the hardware level.
- When you deploy ***Kubernetes***, you get a cluster.
- A Cluster consists of worker machines (nodes), that run ***containerized*** applications.



Kubernetes Architecture – Overview (2/2)

https://kubernetes.io/docs/concepts/overview/components/

- The worker node(s) host the Pods that are the components of the application workload.
- The control plane manages the worker nodes and the Pods in the cluster.
- In production environments, the control plane usually operates across multiple computers and a cluster usually runs multiple nodes. This provides fault-tolerance and high availability.

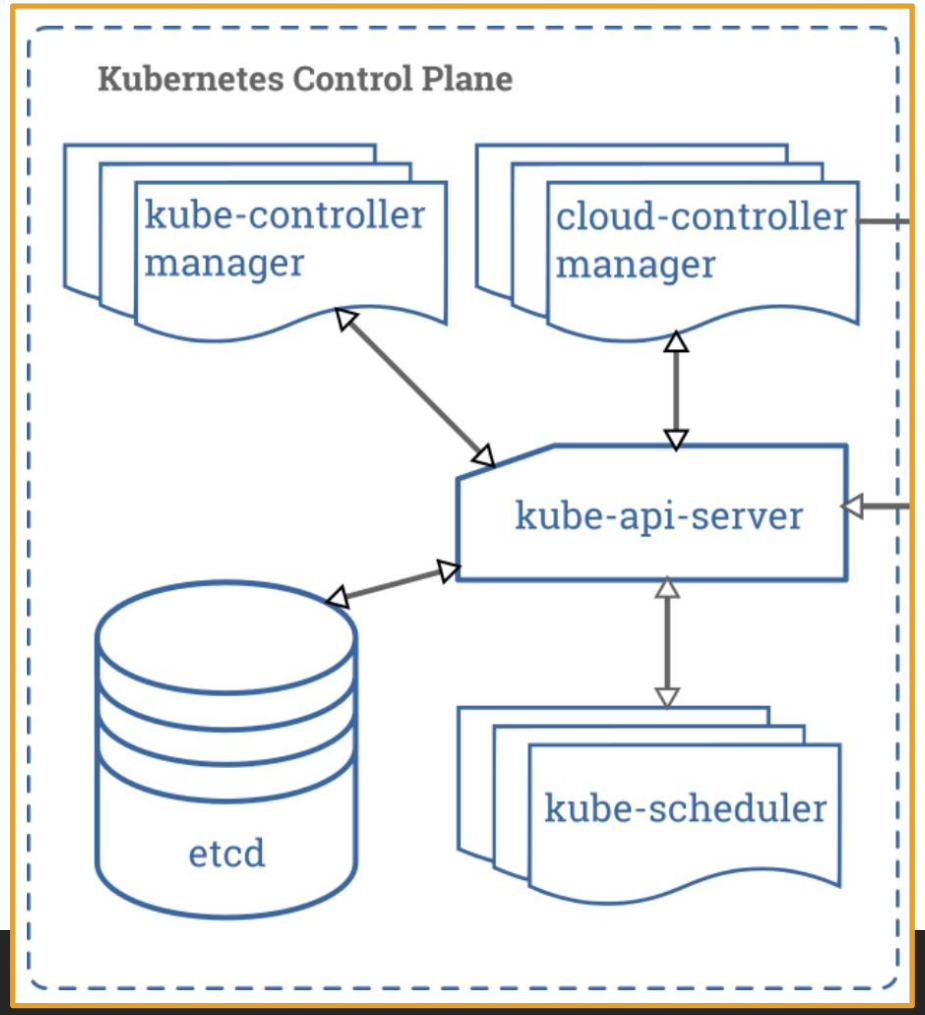


Kubernetes Control Plane (Master)

https://kubernetes.io/docs/concepts/overview/components/#control-plane-components

The ***control plane's*** components make global decisions about the cluster, as well as detecting and responding to ***cluster*** events (for example, starting up a new pod when a deployment's 'replicas' field is unsatisfied).

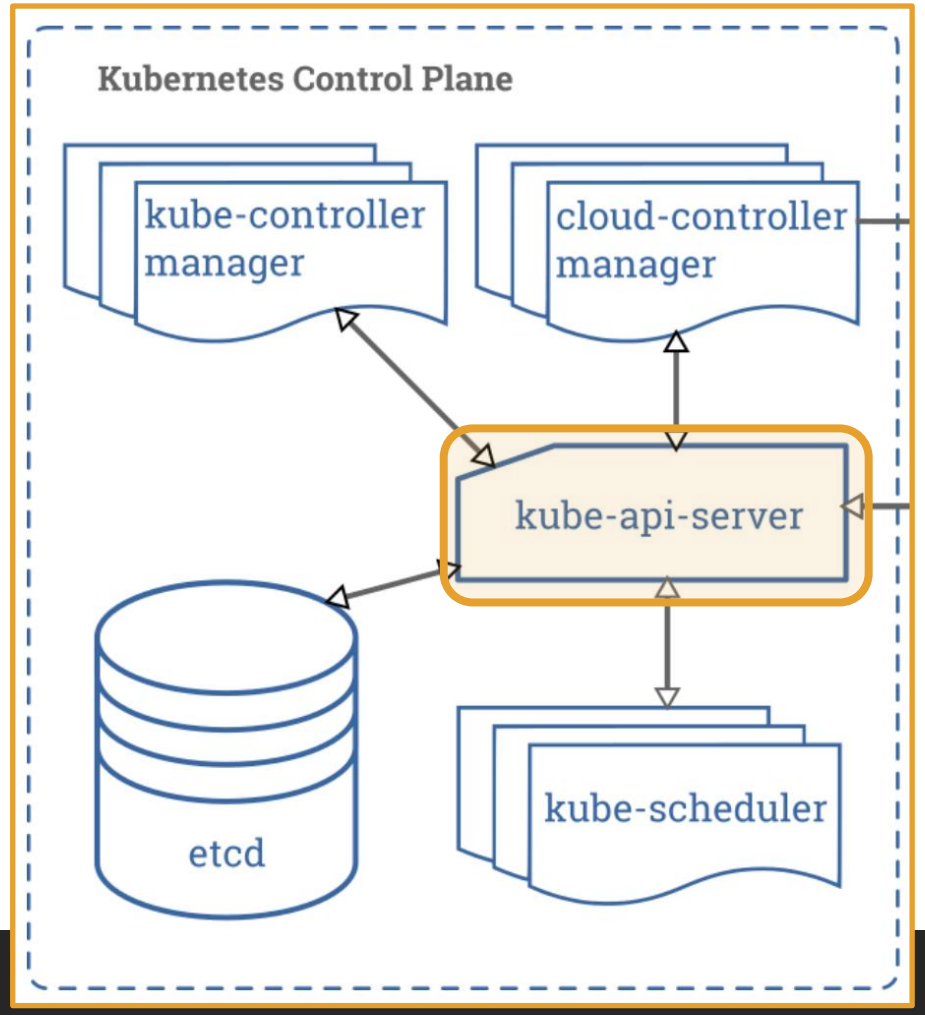
Control plane components can be run on any machine in the cluster, but typically set-up scripts start all ***control plane*** components on the same machine, and do not run user containers on that machine.



Control Plane – kube-apiserver

https://kubernetes.io/docs/concepts/overview/components/#kube-apiserver

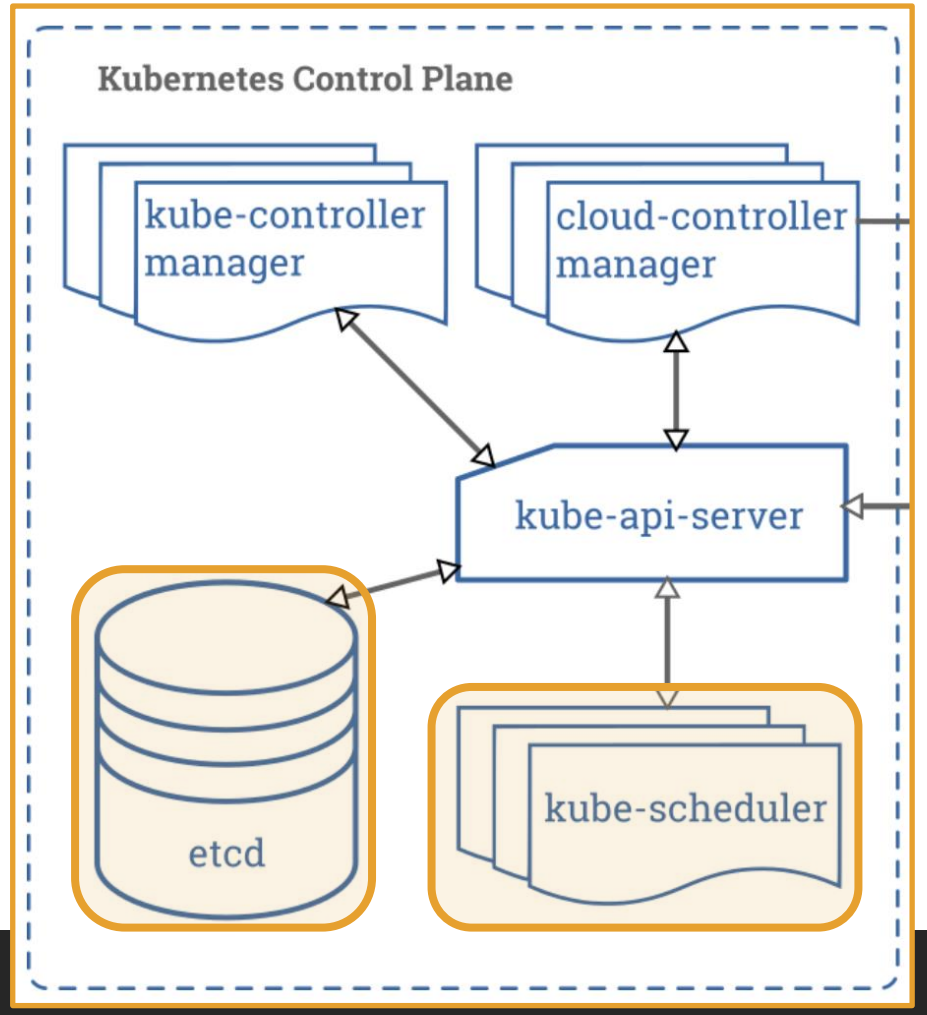
- The ***API server*** exposes the Kubernetes API. The API server is the front end for the Kubernetes ***control plane***.
- The main implementation of a Kubernetes API server is ***kube-apiserver***.
- ***kube-apiserver*** is designed to scale horizontally (deploying more instances).
- You can run several instances of ***kube-apiserver*** and balance traffic between those instances.



Control Plane – etcd and kube-scheduler

https://kubernetes.io/docs/concepts/overview/components/#etcd
https://kubernetes.io/docs/concepts/overview/components/#kube-scheduler
https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/architecture.md#scheduler

- ***Etcd*** is a key-value store. It maintains all the ***clusters'*** data.
- ***kube-scheduler*** watches for new ***Pods*** and assigns a ***node*** to them to run on based on predetermined requirements like:
  - hardware constraints,
  - affinity/anti-affinity specifications,
  - deadlines, and many more.

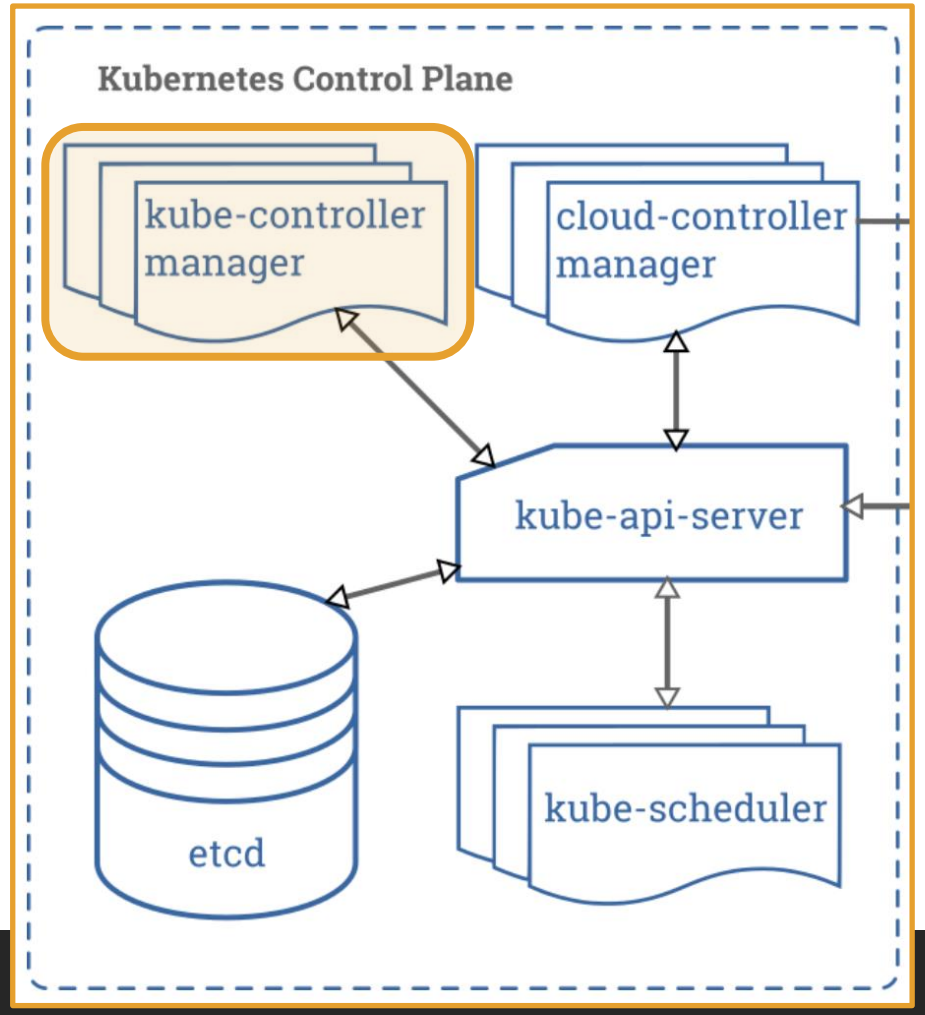


Control Plane – kube-controller-manager

https://kubernetes.io/docs/concepts/overview/components/#kube-controller-manager

Kube-manager-controller runs the ***controller processes***. There are 4 ***controllers***:

- Node controller: notices and responds when nodes go down.
- Replication controller: maintains the correct number of pods for every replication controller object in the system.
- Endpoints controller: Populates the Endpoints object (joins Services & Pods).
- Service Account & Token controllers: Create default accounts and API access tokens for new namespaces.

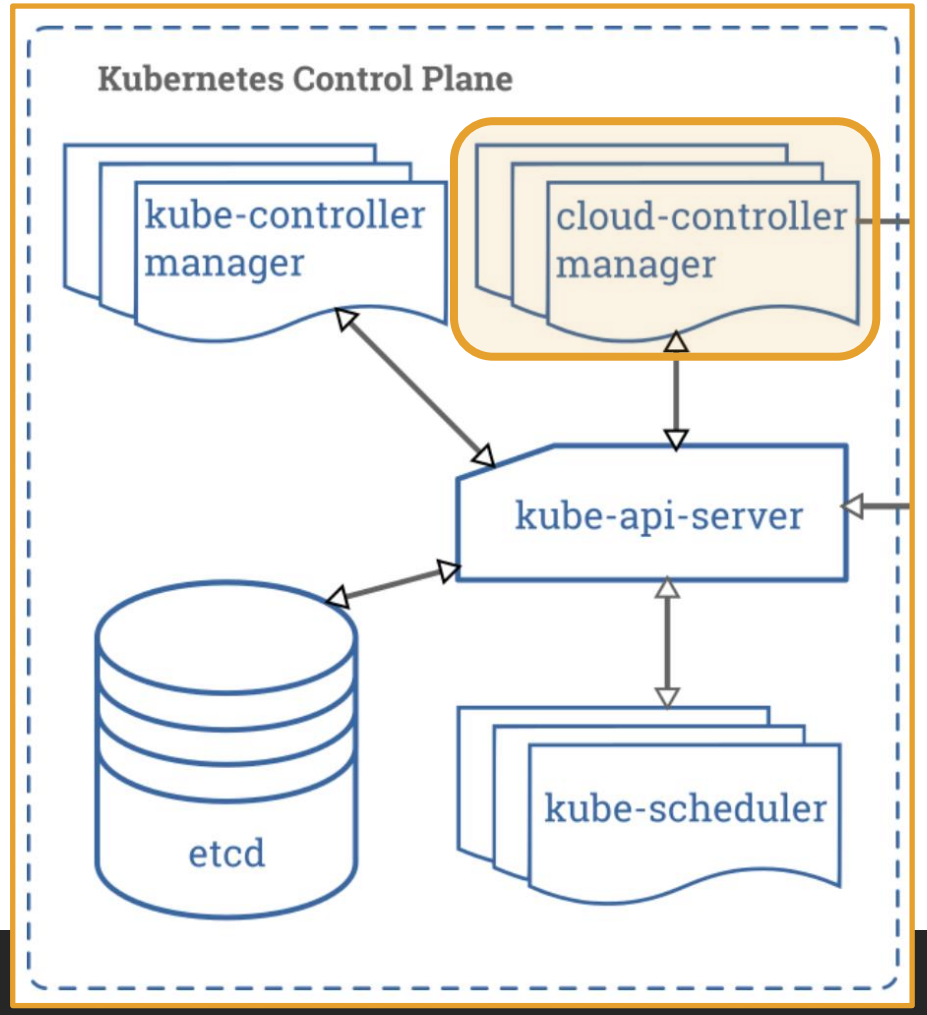


Control Plane – cloud-controller-manager

https://kubernetes.io/docs/concepts/overview/components/#cloud-controller-manager

The ***cloud-controller-manager*** allows linking a cluster into the cloud providers API. It will separate the components that interact with the cloud platform from components that only interact with the cluster.

cloud-controller-manager combines several logically independent control loops into a single binary that are run as a single process. Horizontal scaling (running more instances) allows for improved performance or help with failure tolerance.

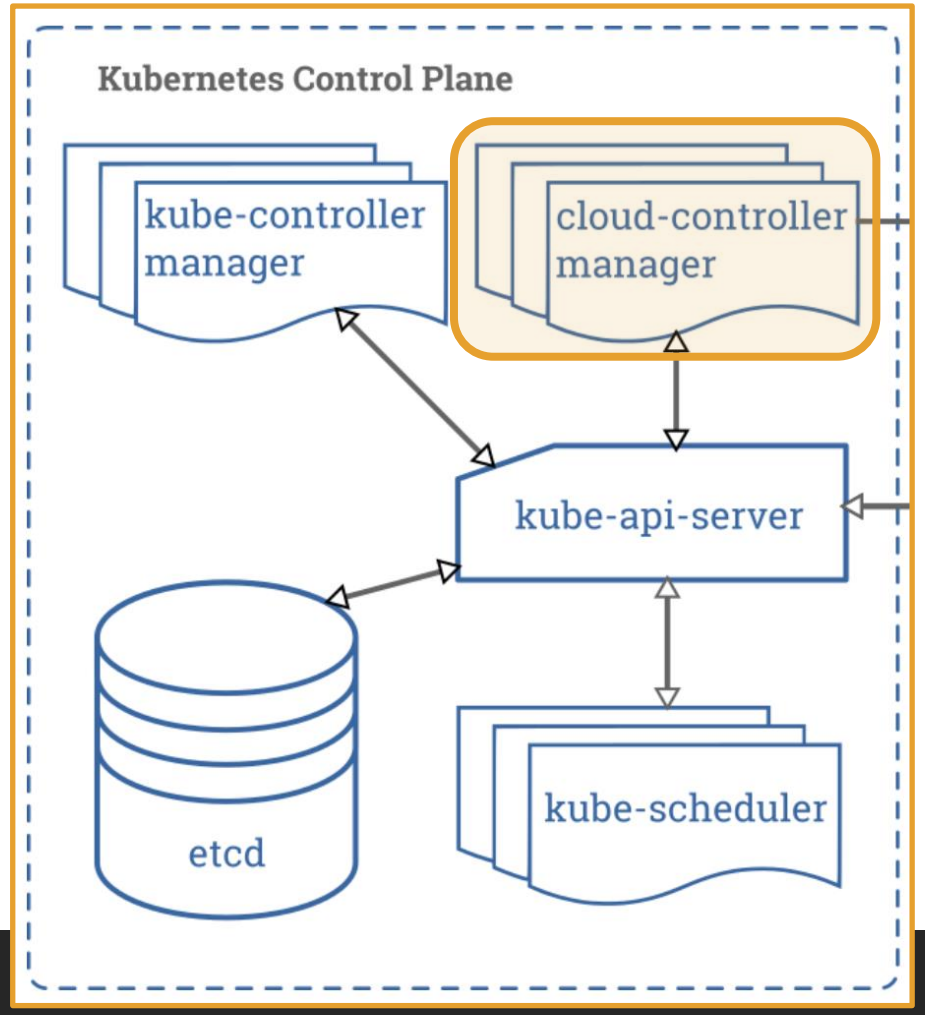


Control Plane – cloud-controller-manager

https://kubernetes.io/docs/concepts/overview/components/#cloud-controller-manager

The following controllers can have cloud provider dependencies:

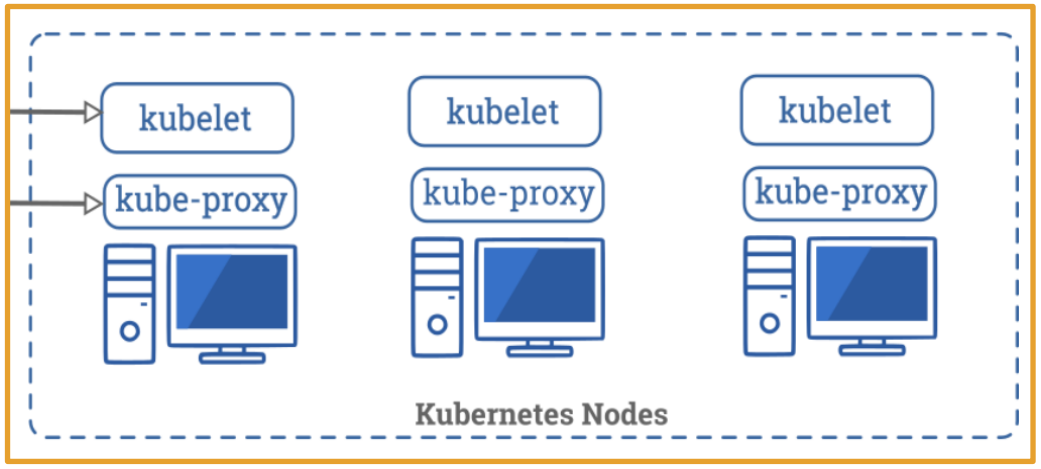
- Node controller: For checking the cloud provider to determine if a node has been deleted in the cloud after it stops responding
- Route controller: For setting up routes in the underlying cloud infrastructure
- Service controller: For creating, updating and deleting cloud provider load balancers.



Node Components - Kubelet

https://kubernetes.io/docs/concepts/overview/components/#node-components
https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/architecture.md#kubelet
https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/architecture.md#kube-proxy

A ***Kubelet*** agent runs on each ***node*** in the cluster. It is the primary implementer of the ***Pod*** and Node APIs that drive the container execution layer. The ***Kubelet*** uses ***PodSpecs*** to verify that containers described in those ***PodSpecs*** are running in the ***Pods***. The ***kubelet*** doesn't manage containers which were not created by ***Kubernetes***.



Node components run on every ***node***, maintain running ***pods***, and providing the Kubernetes runtime environment.

Node Components – kube-proxy

https://kubernetes.io/docs/concepts/overview/components/#node-components
https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/architecture.md#kubelet
https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/architecture.md#kube-proxy

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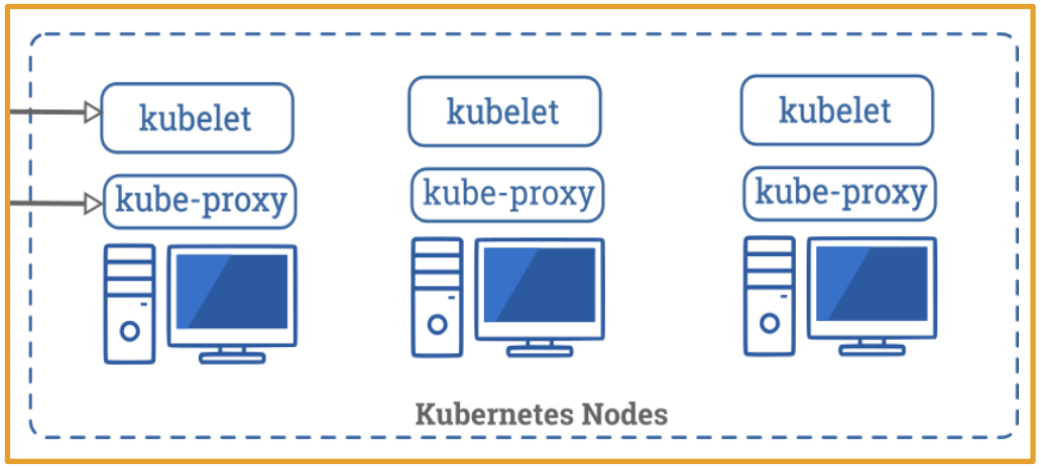
A ***kube-proxy*** is a network proxy that runs on each ***node*** in your cluster. ***kube-proxy*** provides a way to group pods under a common access policy (e.g., ***load-balanced***). This creates a virtual IP which clients can access, and which is transparently proxied (forwarded) to the ***pods*** in a Service. Every ***node*** runs a ***kube-proxy*** process. ***Kube-proxy*** programs IpTables rules to trap access to service IPs and redirect them to the correct backends.



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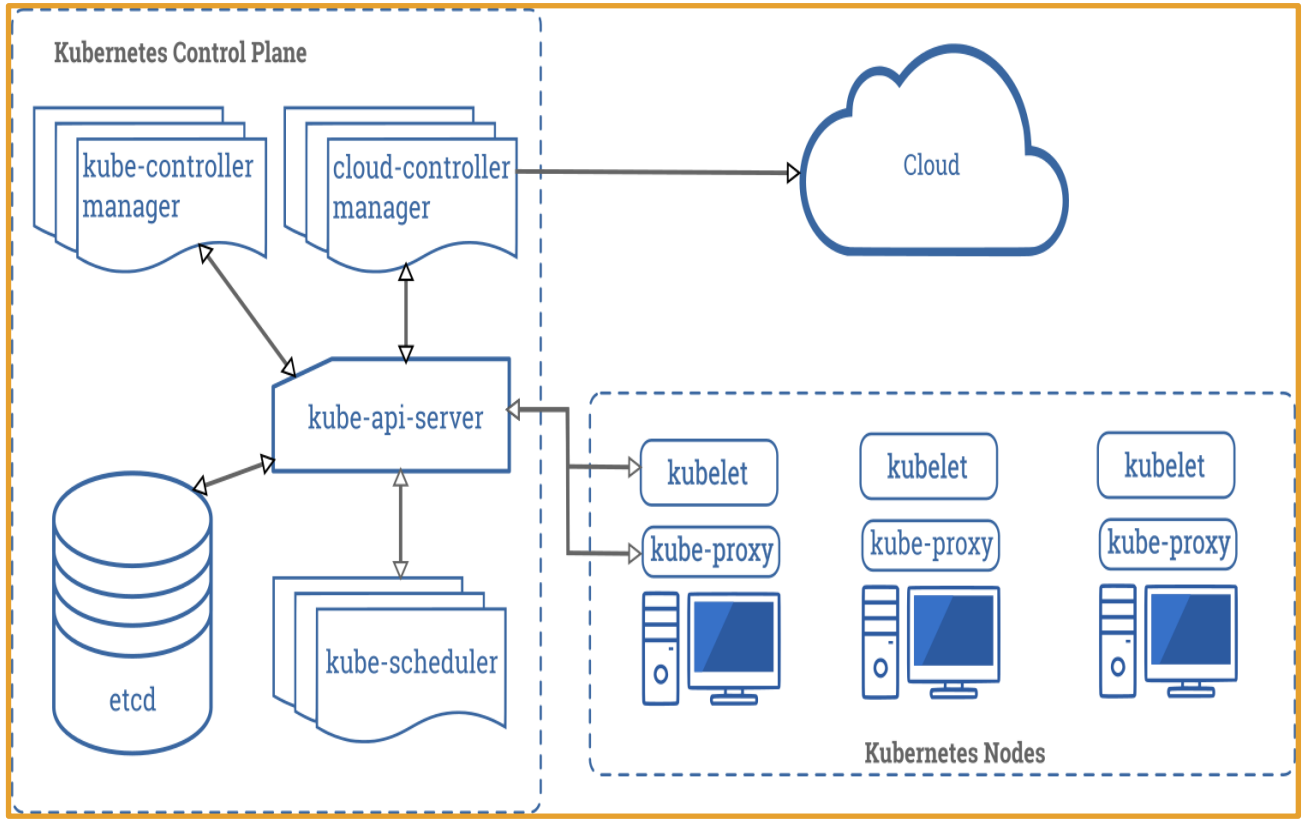
Node – Components

https://kubernetes.io/docs/concepts/overview/components/#node-components
https://kubernetes.io/docs/concepts/architecture/nodes/#management

The ***container runtime*** is the software that is responsible for running containers.

Kubernetes supports several container runtimes.

- Kubernetes Container Runtime Interface (CRI
- Docker
- containerd
- CRI-O

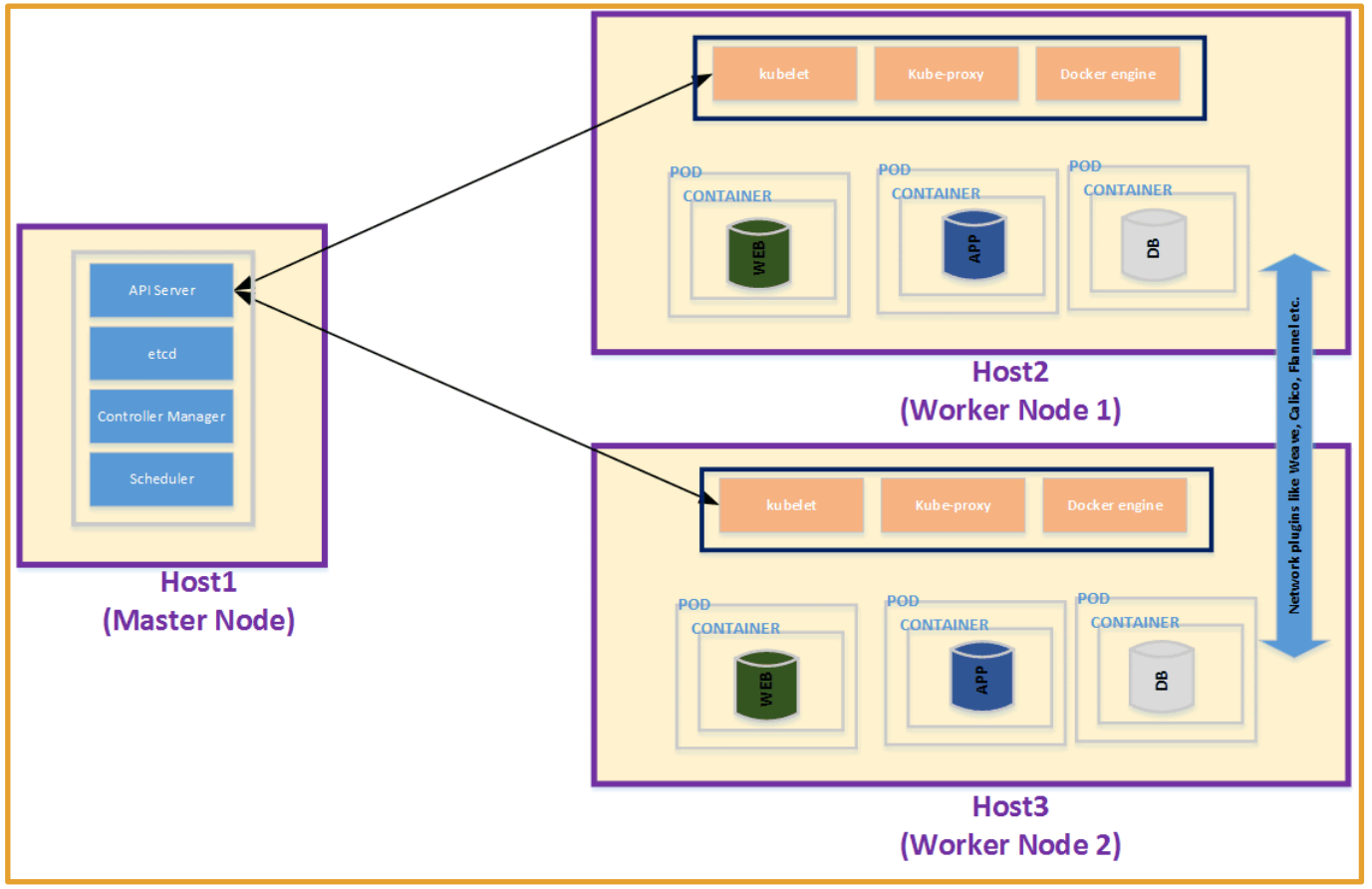


Node Structure

https://kubernetes.io/docs/concepts/architecture/nodes/

Each ***node*** contains the services necessary to run the ***Pods*** on it, which are managed by the ***control plane***.

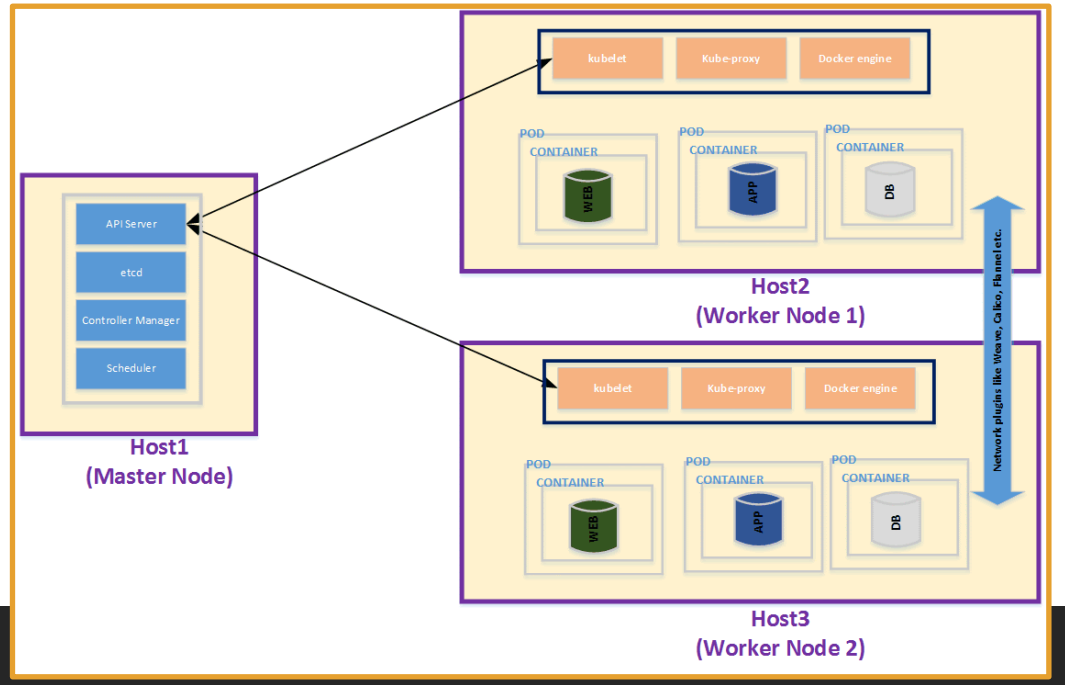
A ***node*** may be a virtual or physical machine.



Node Structure

https://kubernetes.io/docs/concepts/architecture/nodes/

A ***container*** represents a containerized application → The ***container*** is placed into a ***Pod***. → A ***Pod*** runs on a ***Node***. → One or more ***Nodes*** make up a ***Cluster***. → The ***Cluster*** is the ***Kubernetes Workload***.



FOR ME ONLY - https://github.com/RevatureGentry/ERS-V2