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Kubernetes Architecture

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Agenda

- A quick introduction to Kubernetes
- Architecture
- Kubernetes components
- Kubernetes terminology
- Networking
- Demo

Introduction

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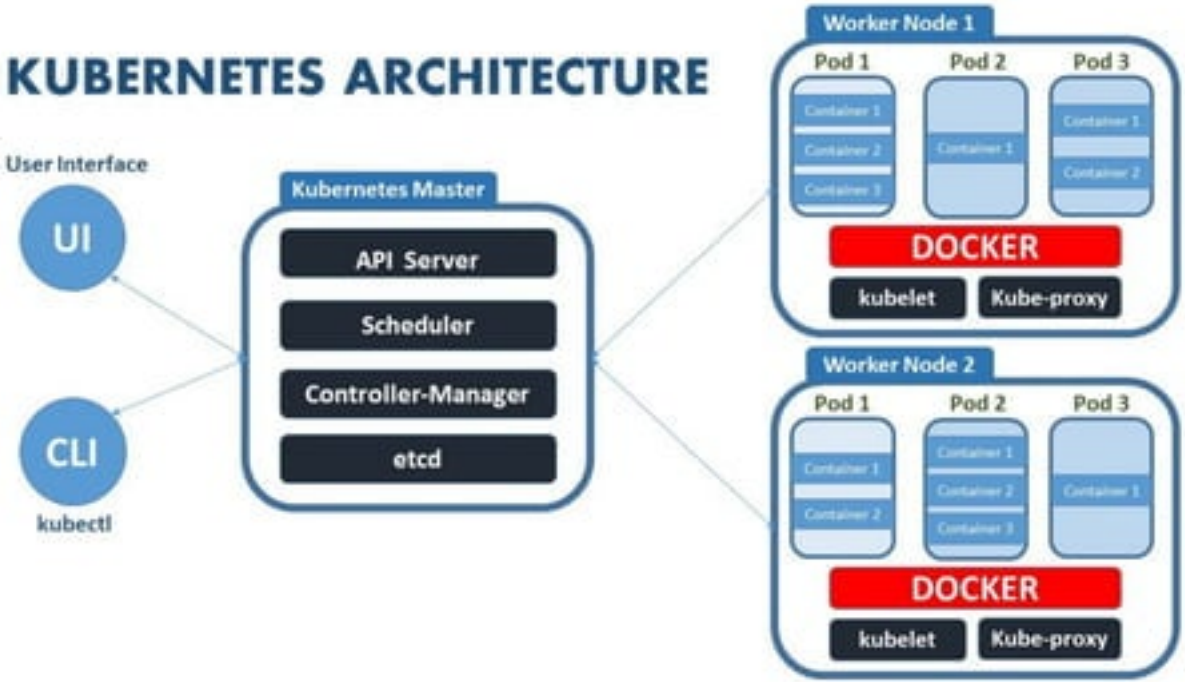
- An open-source Container Management tool which automates container deployment, container (de)scaling & container load balancing.
- Written on Golang, it has a huge community because it was first developed by Google & later donated to **CNCF.**
- Based on learnings from Borg Project, which Google uses to deploy and scale their internal applications (e.g: GMail, YouTube etc).
- Gives you the freedom to take advantage of on-premises, hybrid, or public cloud infrastructure, letting you move workloads to anywhere you want.

Components

01	Master Components	• Kube-api server • Kube-scheduler • Kube-controller-manager • Etcd
02	Node Components	• Kube-proxy • Container Runtime • Kubelet
03	Addons	• Web UI (Dashboard)

Architecture



Master Components

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➢ **Kube-api server**

- Performs all the administrative tasks through the API server within the master node.
- In this REST commands are sent to the API server which validates and processes the requests.
- After requesting, the resulting state of the cluster is stored in the distributed key-value store.

➢ **kube-controller-manager**

- Component on the master that runs controllers.
- Logically, each controller is a separate process, but to reduce complexity, they are all compiled into a single binary and run in a single process.
- Controllers such as Node controller, Replication controller, Endpoints controller etc.

Master Components

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➢ **Kube-scheduler:**

- The scheduler schedules the tasks to slave nodes. It stores the resource usage information for each slave node.
- It schedules the work in the form of Pods.

➢ **Eted**

- etcd is a distributed key-value store which stores the cluster state.
- It can be part of the Kubernetes Master, or, it can be configured externally.
- etcd is written in the Go programming language. In Kubernetes, besides storing the cluster state. It is also used to store configuration details such as subnets, ConfigMaps, Secrets, etc.

Node Components

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➢**Container runtime:**

- To run and manage a container's lifecycle, we need a **container runtime** on the worker node such as Docker, rkt etc

➢**Kubelet:**

- It is an agent which communicates with the Master node and executes on nodes or the worker nodes. It gets the Pod specifications through the API server and executes the containers associated with the Pod and ensures that the containers described in those Pod are running and healthy.

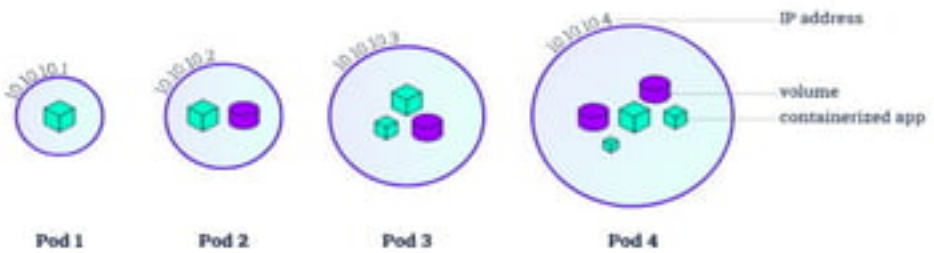
Node Components

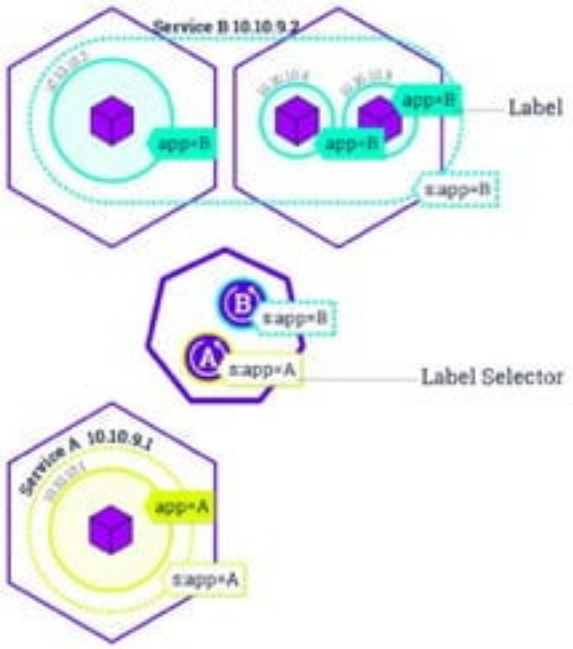
➢ **Kube-proxy**

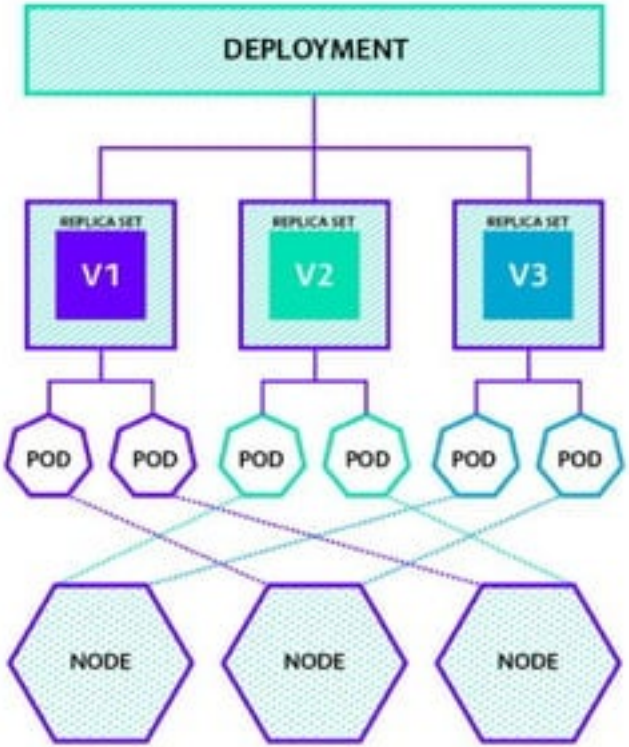
- Kube-proxy runs on each node to deal with individual host sub-netting and ensure that the services are available to external parties.
- It is the network proxy which runs on each worker node and listens to the API server for each Service endpoint creation/deletion.
- For each Service endpoint, kube-proxy sets up the routes so that it can reach to it

Terminology

- **Pods**
  - Collection of containers. Smallest unit of deployment.
- **Services**
  - Collection of pods. Exposed as an endpoint.
- **Replicasets**
  - Ensure scalability and availability
- **Deployment**
  - Creates replica sets and pods for you
- **Node**
  - Machine which run workloads

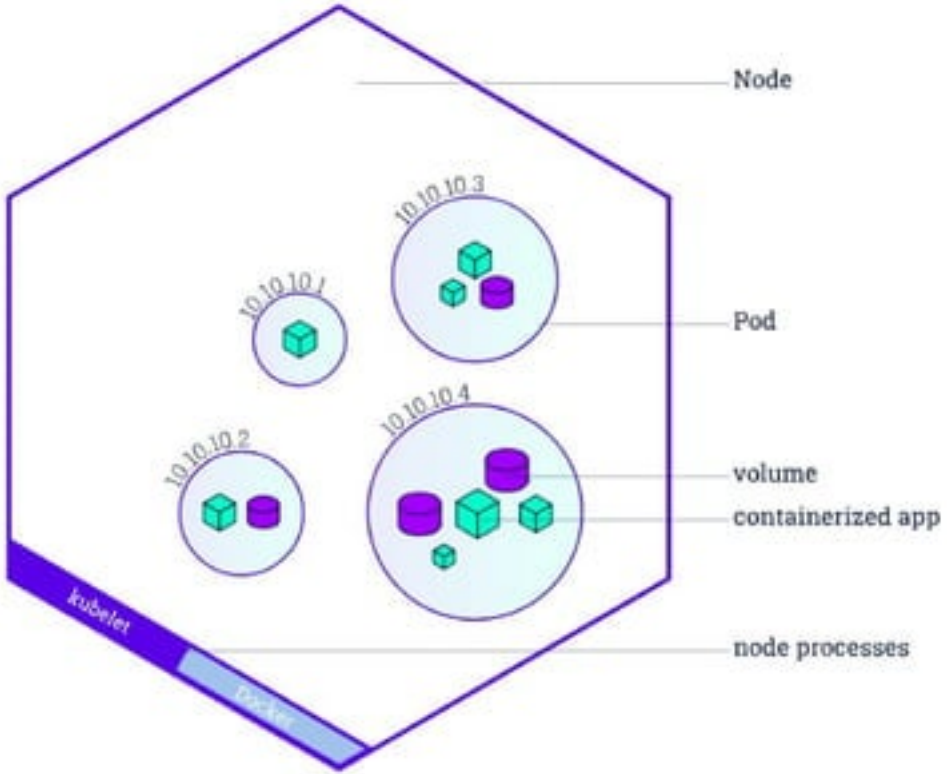



Service B 10.10.9.2
app=B
app=B
app=B
Label
s:app=B
B
s:app=B
A
s:app=A
Label Selector
Service A 10.10.9.1
app=A
s:app=A


DEPLOYMENT
REPLICA SET
V1
REPLICA SET
V2
REPLICA SET
V3
POD
POD
POD
POD
POD
POD
NODE
NODE
NODE

Networking

- There are 4 distinct networking problems to solve:
  - Highly-coupled container-to-container communications
  - Pod-to-Pod communications
  - Pod-to-Service communications
  - External-to-Service communications


Node
10.10.10.3
10.10.10.1
Pod
10.10.10.4
10.10.10.2
volume
containerized app
kubelet
Docker
node processes

Installation options

- Local-machine solutions
  - Minikube
  - Minishift
  - Vagrant
- Hosted solutions
  - Amazon Elastic Container Service for Kubernetes
  - DigitalOcean Kubernetes
  - Google Kubernetes Engine
  - OpenShift Online
  - ...many more
- Baremetal solutions
  - Kubespray
  - Kubeadm
  - Kops with AWS

References

- https://kubernetes.io/docs/home/
- https://www.youtube.com/user/janakirammsv/featured
- https://github.com/kelseyhightower/kubernetes-the-hard-way

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Thank You !