How to Get Started with Kubernetes

A beginner's guide to Kubernetes

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Photo by Gesina Kunkel on Unsplash

Kubernetes is an open-source container orchestration engine for automating deployment, scaling, and management of containerized applications. In this post, we will go through the architecture of Kubernetes for beginners and what are the different options to get started for beginners.

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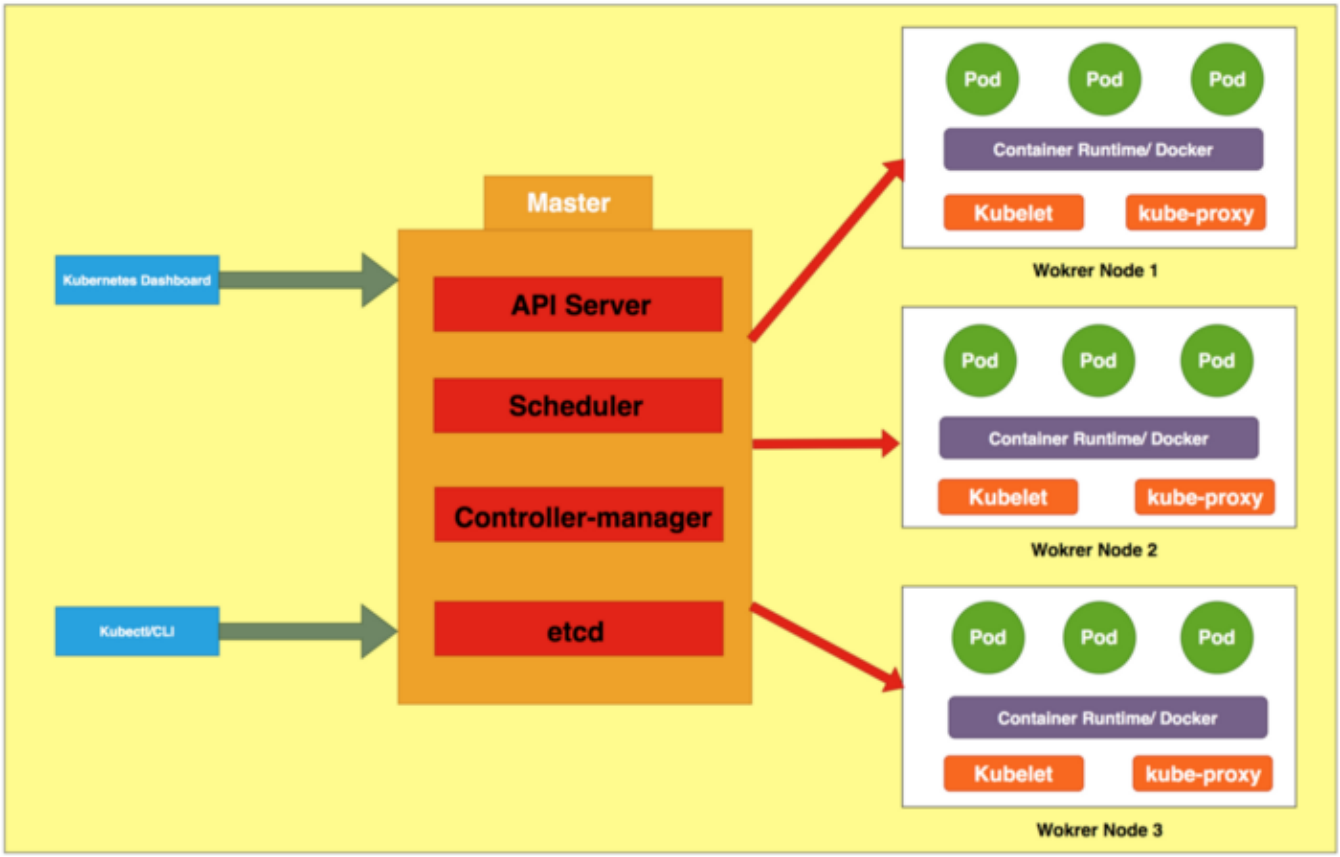
Kubernetes Architecture

Kubernetes is the orchestration platform for the containerized applications. It follows the declarative configuration which defines the desired state of the applications and Kubernetes work hard to maintain that state throughout the lifecycle.

It's very important for anyone to understand the architecture of the Kubernetes before getting started. Let's dive into the architecture principles of this tool.



Kubernetes Architecture

If you look at the above diagram, we have master nodes and worker nodes. Worker nodes are managed by the master. The worker node has the following services to be able to run the container applications in the pods.

- Kubelet
- Kube-proxy
- container runtime

Kubelet

This is the most important service in the Kubernetes which is responsible for the execution of the container execution layer. Without kubelet, Kubernetes is just REST API backed by key-value store. Kubernetes executes isolated container application by default. containers are not only isolated from each other and they are also isolated from the underlying host system. This is critical to decoupling the management of individual applications from each other and from management of the underlying cluster physical/virtual infrastructure.

API admission control may reject pods or add additional scheduling constraints to them, but Kubelet is the final arbiter of what pods can and cannot run on a given node, not the schedulers or DaemonSets.

Kube-proxy

This provides an abstraction layer for the group of pods in the node under a common access policy, for example, load balancer. Every node implements Kube-proxy which provides the virtual IP address for the clients to access the dynamic set of pods. This provides a highly available load balancing solution with low-performance overhead.

container runtime

This is responsible for running the container such as Docker, rkt, containerd

The main components of the master nodes are as follows

- API Server
- Scheduler
- Controller-manager
- etcd

API Server

This is the basis for all the communication in the cluster. All the components in the cluster communicate through this. It exposes the kubernetes API.

Scheduler

The scheduler is responsible for assigning applications or kubernetes objects to the worker node. It is responsible for placing the pods on the nodes based on the resource requirements.

Controller-manager

This maintains the cluster such as node failures, maintaining the correct amount of pods, for example, if you deploy the application with 3 replicas, it makes sure that there are three pods running at any particular point of time.

etcd

This is the key value store that stores the cluster configuration. If you want to back up the cluster, all you need to save is this key value distributed store.

Different Options To Get Started

Once you understand the basic principles and architecture of kubernetes there are different options to get started or start practicing kubernetes. We can build a single node cluster and multi-node cluster. Here are these options.

Minikube

Minikube is a tool that runs a single-node Kubernetes cluster in a virtual machine on your personal computer. If you want to practice and deploy kubernetes objects on your laptop, this is a great tool. The only problem with this is that it has only one node which is master. You don't get to experience the multi-node deployments of kubernetes. But, this is a great starting tool to get used to kubernetes. Here are the instructions on how to install it on your laptop.

Install Minikube Edit This Page To check if virtualization is supported on Linux, run the following command and verify that the output… kubernetes.io	

katacoda

You can actually run kubernetes scenarios right out of the box in the interactive browser-based terminal. You can just sign in and start working on these scenarios.

> Learn Kubernetes using Interactive Browser-Based Labs | Katacoda
>
> This set of hands-on labs covers the foundations of Kubernetes.
>
> www.katacoda.com

Google Kubernetes Engine

Google Kubernetes Engine provides a managed environment for deploying, managing, and scaling your containerized applications using Google infrastructure. You can create a free tier account and you can start a multi-node cluster right away and start working on it.

> GKE Overview | Kubernetes Engine Documentation | Google Cloud
>
> Google Kubernetes Engine provides a managed environment for deploying, managing, and scaling your containerized...
>
> cloud.google.com

Microsoft Azure Kubernetes Service

The fully managed Azure Kubernetes Service (AKS) makes deploying and managing containerized applications easy. It offers serverless Kubernetes, an integrated continuous integration and continuous delivery (CI/CD) experience, and enterprise-grade security and governance. You can create a free tier account and start with this right away.

> Azure Kubernetes Service (AKS) | Microsoft Azure
>
> Use Kubernetes to migrate your existing application to the cloud, build a complex application that uses machine...
>
> azure.microsoft.com

Amazon Elastic Kubernetes Service

Amazon Elastic Kubernetes Service (Amazon EKS) makes it easy to deploy, manage, and scale containerized applications using Kubernetes on AWS. You can create a free

tier account with AWS and start working.

> Amazon EKS - Managed Kubernetes Service
>
> Highly available, scalable, and secure Kubernetes service Amazon Elastic Kubernetes Service (Amazon EKS) makes it easy...
>
> aws.amazon.com

Minikube

Minikube is a tool that runs a single-node Kubernetes cluster in a virtual machine on your personal computer. In this Section, we install Minikube, any other prerequisites and test some commands with **kubectl**.

These are all the required things to run Minikube on your laptop.

- Set up Kubectl
- Install VirtualBox
- Install Minikube

The first thing we need is to install and set up kubectl. Here are the instructions from Kubernetes official docs. Once you install that one based on your OS check the version with the YAML format with this command `kubectl version --client -o yaml`. Since we didn't install minikube yet we are checking only client version. If you are seeing this you are good to go.

kubectl version

VirtualBox is the next thing we need to install. When we start minikube, it actually runs in the VirtualBox. You can follow the Installing VirtualBox section of the below article or you can follow official docs here.

Now it's time to install Minikube on your laptop. Follow these instructions.

Once installed, test the version and start it with these commands `minikube version` and `minikube start`

Minikube

You can check the version of kubectl to get the server version along with the client. Let's test with some commands.

```
// get component status
kubectl get componentstatus

// get nodes. you get only master node since minikube is single node
// cluster
kubectl get nodes

kubectl get pods
```

Kubernetes Dashboard

Kubernetes dashboard is a web-based UI that can be used to deploy containerized applications into Kubernetes cluster, troubleshoot applications and manage resources in the cluster. You can also get the complete view of resources or objects deployed in the cluster. You can also create the deployment using the deployment wizard.

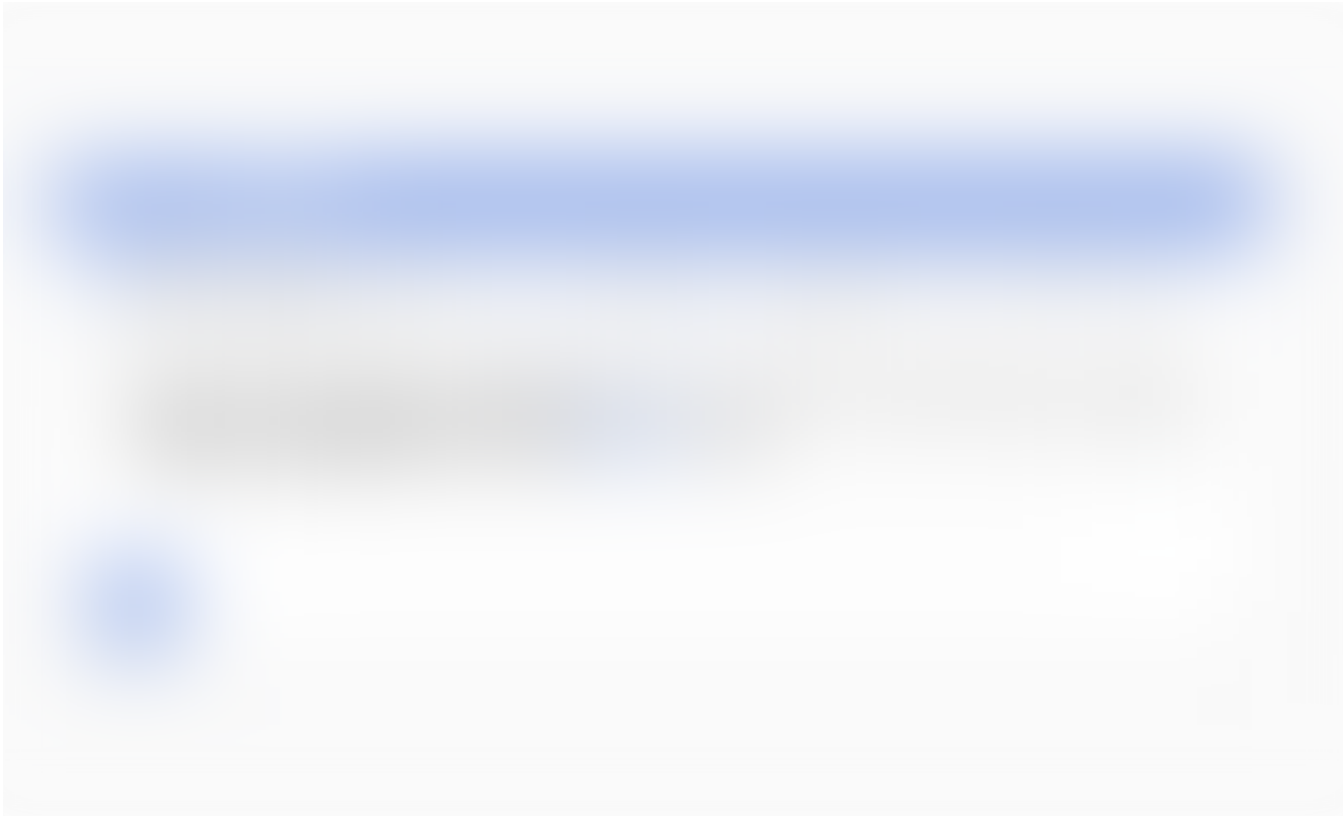
Kubernetes Dashboard UI is not installed by default. We have to use the following command to install it.

```
kubectl apply -f
https://raw.githubusercontent.com/kubernetes/dashboard/v2.0.0-
beta1/aio/deploy/recommended.yaml
```

Dashboard Installation

Once installed, we need to run this command `kubectl proxy` so that the dashboard is available at this location. When you first hit this URL, you will see the below screen.

http://localhost:8001/api/v1/namespaces/kubernetes-dashboard/services/https:kubernetes-dashboard:/proxy/



There are two ways to access the dashboard one is to create a service account and another way is to use a kubeconfig file. Let's use the token to sign into the dashboard.

You need to follow the documentation here to create a token. Once you create the token, you can sign in with the token. Here is the dashboard view. I have some objects already in the cluster. Here is the Kubernetes dashboard to view all the objects in the cluster in the UI.

Kubernetes Dashboard

The token expires after a certain amount of time. When it does, generate the token again with the below command and sign in again.

```
kubectl -n kubernetes-dashboard describe secret $(kubectl -n
kubernetes-dashboard get secret | grep admin-user | awk '{print
$1}')
```

How To Deploy In Cluster

You create objects in the cluster by feeding YAML or JSON file into the API server. The YAML file is converted to JSON format before submitted to the API server.

We use kubectl to create and update objects in the cluster. ***Kubectl create*** just creates the object in the cluster and ***kubectl apply*** creates and updates the objects in the cluster. This is the recommended way of managing Kubernetes applications on production.

Here is an example of Kubernetes object pod creating and updating with the YAML file.

nginx-pod.yaml

```
// raw file of the above
kubectl create -f
https://gist.githubusercontent.com/bbachi/bcdcfaab157d6461b64cd64d50
d9890a/raw/2062d7c17f6c07473309fa7508f8fba46d16944d/nginx-pod.yaml

// verify the pod is created
kubectl get po
```

You can create the same nginx pod with the **kubectl run** command. This command is limited and you can't pass all the specifications with this command.

```
kubectl run nginx --image=nginx --restart=Never
```

Here is the complete cheat sheet of the kubectl.

Some Examples

Let's create some objects in the cluster.

Pods

In the above section, we have created a pod. If you notice the Kubernetes dashboard, you can actually see this pod in the pod section of the workloads.

nginx pod

Deployments

Let's create a deployment of Nginx with 10 replicas. Here is the file

nginx-web.yaml

```
// create this object
kubectl apply -f
https://gist.githubusercontent.com/bbachi/4eef188f8687e82fb8e570e6ae
1ca405/raw/e1eae137150ff713c02ddd66db4acde7b5ffff69/nginx-web.yaml

// get deploy, replicasets and pods
kubectl get deploy
kubectl get rs
kubectl get po
```

Services

Let's create a service for this deployment. A Service is n abstract way to expose an application running on a set of pods as a network service.

```
kubectl expose deploy nginx-web --port=80

// get service
kubectl get svc
```

CronJob

Cron jobs are useful for creating periodic and recurring tasks, like running backups or sending emails. Cron jobs can also schedule individual tasks for a specific time, such as if you want to schedule a job for a low activity period.

Let' s create one from the official doc here.

```
kubectl create -f
https://k8s.io/examples/application/job/cronjob.yaml

kubectl get cj
```

Let's look again at the kubernetes dashboard to see all these objects.

Deployed Objects in the Kubernetes dashboard

Let's clean up the cluster by deleting all the objects in the cluster.

```
kubectl delete cj hello
kubectl delete deploy nginx-web
kubectl delete svc nginx-web
kubectl delete po nginx
```

Summary

- Kubernetes is an open-source container orchestration engine for automating deployment, scaling, and management of containerized applications.
- It's very important to get to know the Kubernetes architecture before diving into actual deployment with it
- We have master nodes and worker nodes in the cluster.
- Every master node contains these components: API server, Scheduler, controller-manager and etc.
- Every worker node contains these components: Kube-proxy, kubelet, and container runtime
- You can run multiple master nodes for the high available cluster
- There are different options to get hands-on with Kubernetes: katacoda. minikube, managed Kubernetes services from the major cloud providers
- Kubernetes dashboard is the web interface where you can view, edit and, delete objects in the cluster.
- Kubernetes dashboard is not installed by default.
- Kubectl apply is the recommended way to create/deploy objects in the production cluster
- You create objects in the cluster by feeding the YAML or JSON file into the API server. The YAML file is converted to JSON format before submitted to the API server.
- Kubectl run is another way to create objects but it is limited because we can't specify all the specs as options.

Conclusion

Kubernetes is the future of deployment. A lot of fortune 500 companies have already moved and some are transitioning now. So, it is here to stay. I would recommend start using this and get familiar as soon as possible.