

Amrita Vishwa Vidyapeetham

Amritapuri Campus



22AIE305: CLOUD COMPUTING



Create DockerHub free account

<https://www.docker.com/products/docker-desktop/>

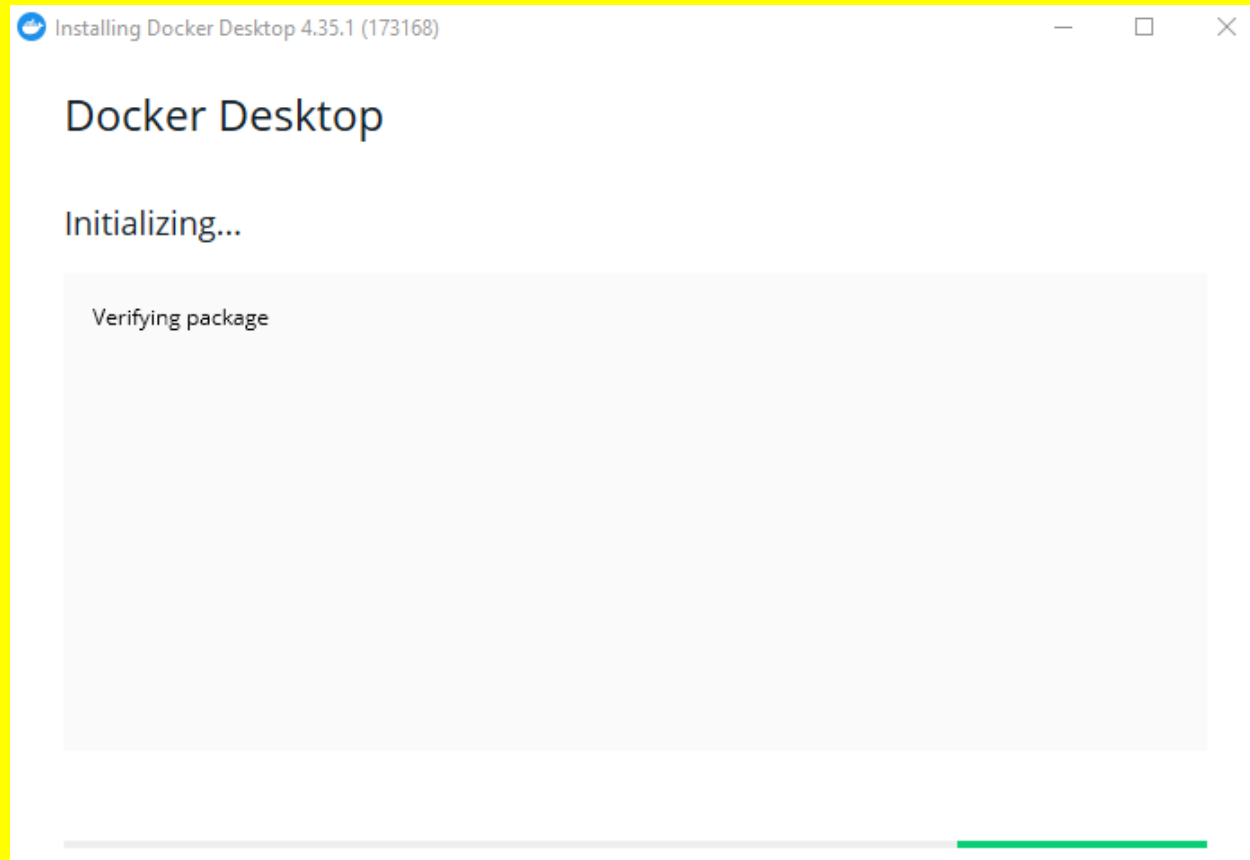
The options for Daemon are stored in a json file

C:\Program Files\Docker\Docker\resources\windows-daemon-options.json

Docker containers are a way to build a self-contained environment that includes software, libraries, and other dependent tools. Name and Tag of an Image are two different things. Name identifies each image uniquely, and tag identifies different versions (when software is released in various versions as Python 3.0, 3.2, 3.9, etc).

Several free base images are available at DockerHub.com

Docker icon added to desktop



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Organization

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Rajan C

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Apt, suite, etc. (optional)

City

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<https://console.cloud.google.com/home/dashboard>



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Aneka 5.0 (also known as Aneka 5G) Cloud Application Platform Software






- ▶ [Aneka 5G Release Notes](#)
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- ▶ [Aneka 5.0 Installation Guide](#) 
- ▶ [Another Installation Guide in Brief](#)
- ▶ [Video on Installing Aneka Master](#)
- ▶ [Video on Installing Aneka Worker](#)
- ▶ [Refer to Blog for Aneka Cloud](#) for latest user information.

NOTE: This evaluation version supports limited features with 1 master and 2 workers.. Those interested in long-term license with all features and support (including installation and training), please contact Manjrasoft (for pricing details).

A Book for Teaching Cloud Computing with Aneka

Check out [Mastering Cloud Computing](#) published by McGraw Hill, China Machine Press, and Elsevier/Morgan Kaufmann for Indian, Chinese and international markets respectively. The book has many example programs of Cloud Application Programming. Some useful documents and examples are noted below:

Aneka User Documents

- ▶ [Task Model Programming Tutorial](#) 
- ▶ [Thread Model Programming Tutorial](#) 
- ▶ [Map Reduce Programming Tutorial](#) 
- ▶ [Aneka Task Submission Web Service](#) 
- ▶ [Aneka Dynamic Provisioning](#) 

Programming Models - Example Code

- ▶ [README.txt](#)
- ▶ [Thread and Task Model Examples Code](#)
- ▶ [Parallel Programming with Aneka Thread Model](#)
- ▶ [MapReduce Model and Other Examples](#)

Running **AWS** Docker Containers

Docker provides simple commands to help you build, start, or run containers. There are various services to run and manage Docker containers at scale. These include:

Amazon Fargate

Amazon Elastic Beanstalk (EB)

The difference between these services is the degree of control regarding scheduling, capacity, and scaling of applications.

AWS Fargate allows you to run AWS Docker containers without any EC2 instances. You can run containers without provisioning, clustering, or managing virtual machine clusters because it acts as the sole compute engine for all workloads.

The process of running Docker containers include:

- Building container image

- Defining computer resources and memory required

- Running and managing applications

AWS Fargate allows you to focus entirely on the application by removing the need to run and manage compute infrastructure.

Kubernetes

Kubernetes was launched in September 2014

Kubernetes is a container orchestration platform that facilitates the deployment and management of containerized applications in any environment. It allows cluster administrators to define the desired state of their deployments using declarative manifests that configure all aspects of the application's lifecycle, such as storage, networking, load balancing, health checks, updates, etc.

Kubernetes is a cluster management system that **uses containers as its fundamental unit**.

K8s is a **container orchestrator platform** capable of running different workloads in different environments with great flexibility.

A **pod** is an abstraction (as in a pod of whales or pea pod) which is a **group of one or more containers** with shared storage, network resources, and namespaces and a specification for how to run the containers (**Pod literally means shell, case or husk**).

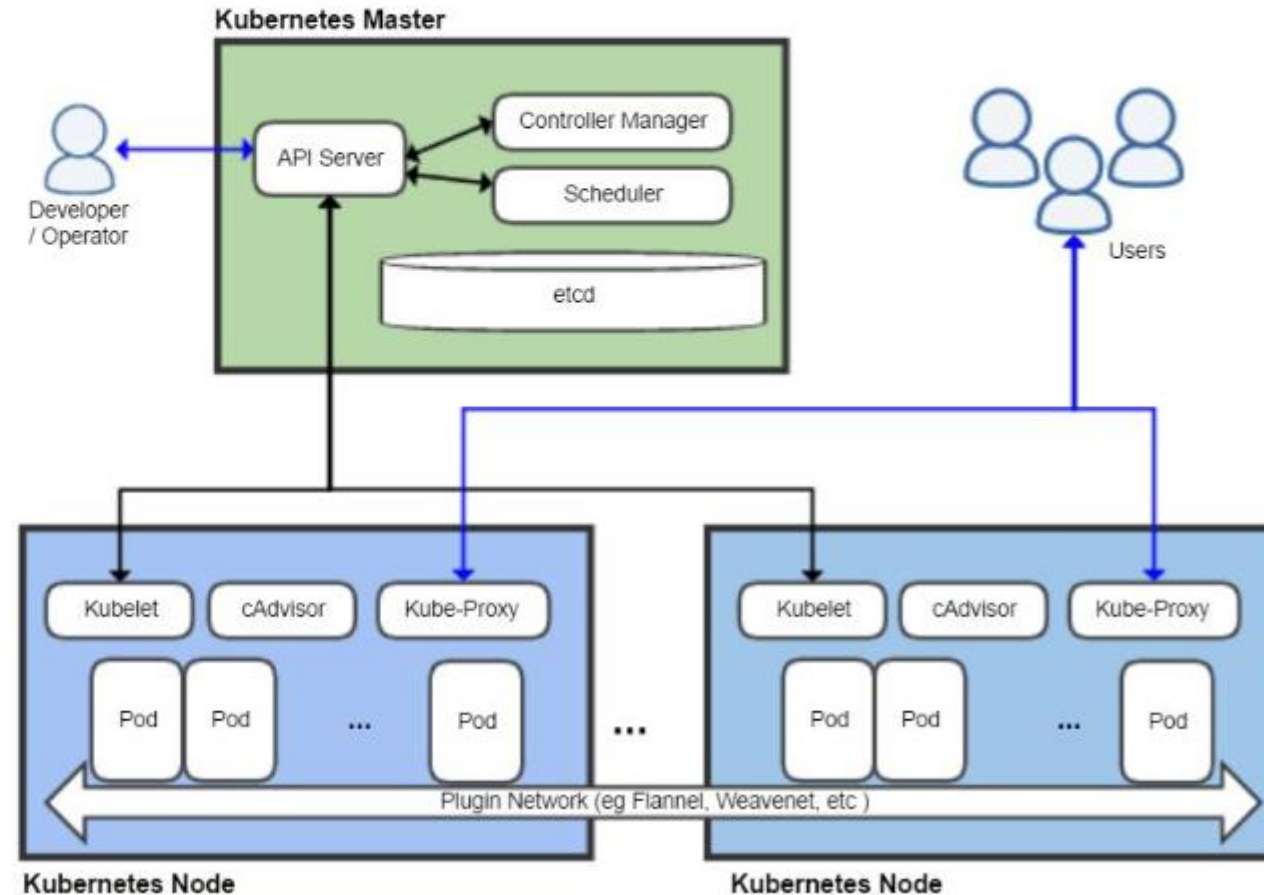
Kubernetes deals with resources and allocate resources to pods. Kubernetes takes pods, put them on machines, and then allocate the resources of that machine to the pods.

This means that **Kubernetes doesn't deal with containers directly but instead deals with pods**.

You need to install a **container runtime** on each node in the cluster so that Pods can be run there.

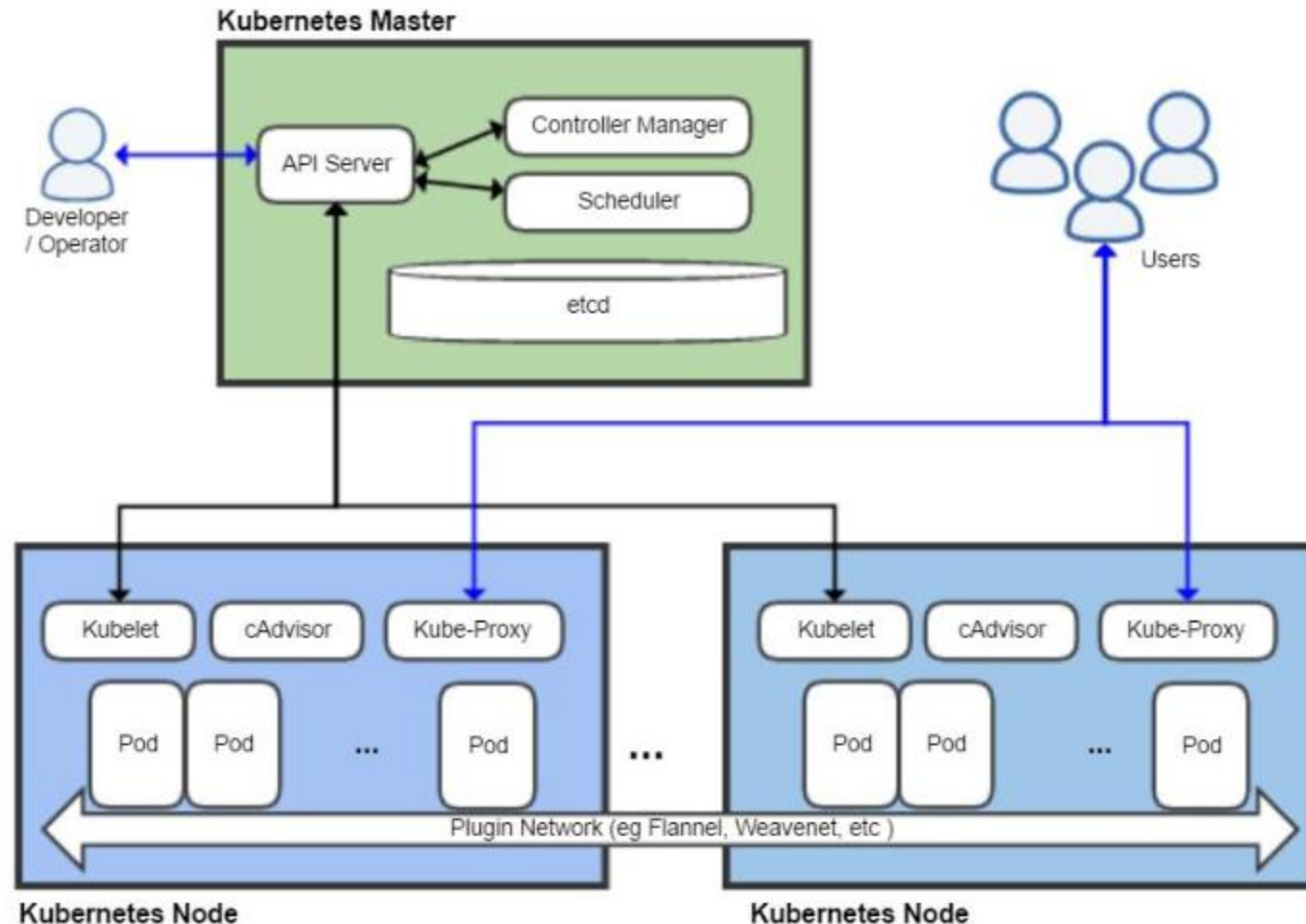
Master Node

- API Server
- Controller Manager
- Scheduler



Worker Nodes

- Kubelet Daemon
- Kube-Proxy

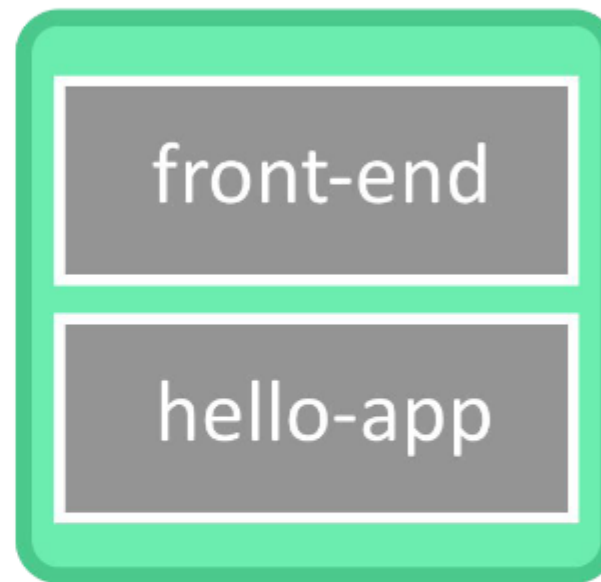


SAMPLE KUBERNETES YAML FILE

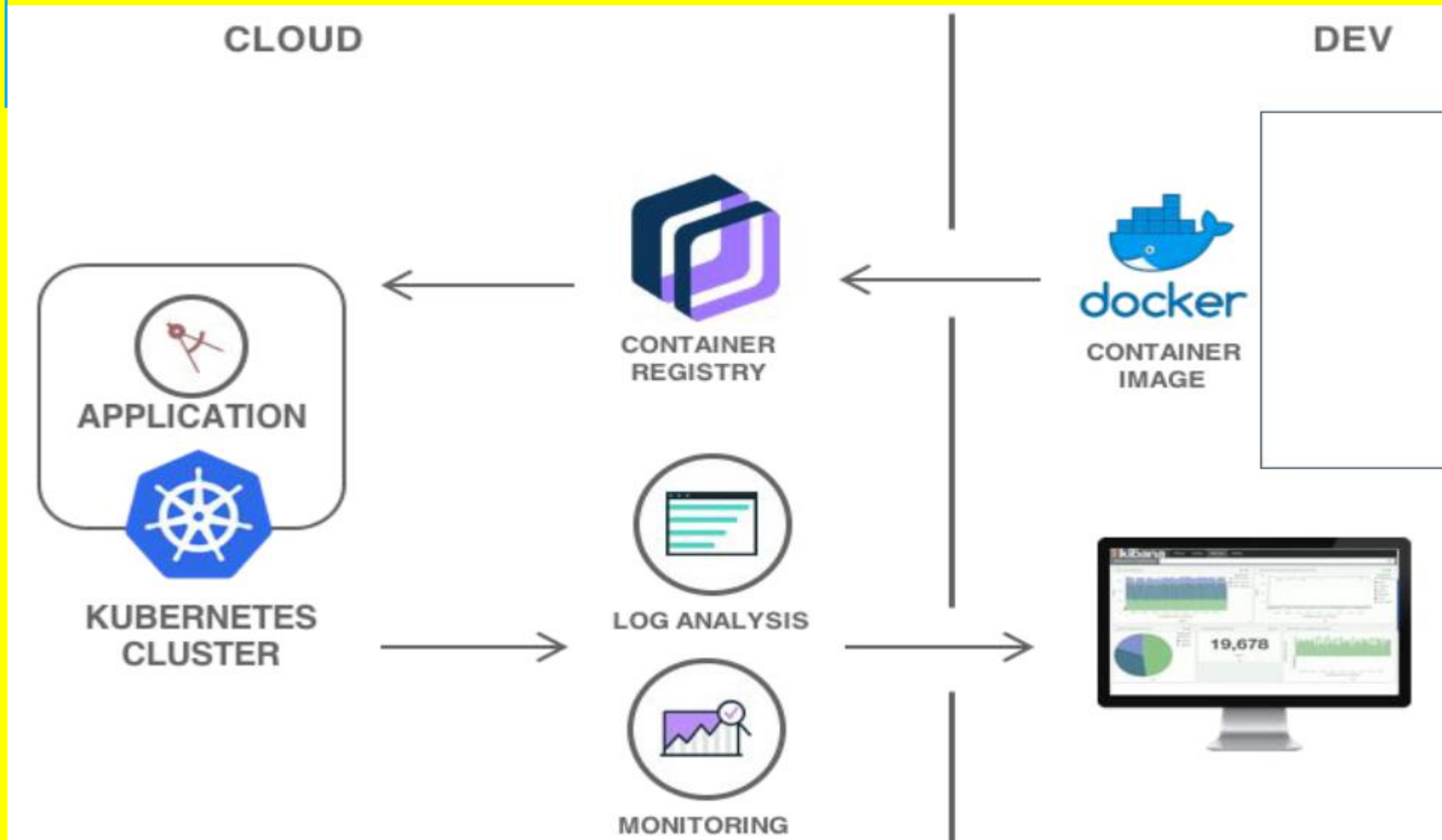
```
apiVersion: apps/v1beta1
kind: Pod
metadata:
  name: Sample-Pod
  labels:
    app: web
spec:
  containers:
    - name: front-end
      image:
gcr.io/samples/hello-frontend:1.0
      ports:
        - containerPort: 80
    - name: hello-app
      image:
gcr.io/samples/hello-app:1.0
      ports:
        - containerPort: 8080
```



Sample-Pod



DOCKER, KUBERNETES WORKFLOW



Components of Kubernetes

- API Objects
 - Pods - Collection of Containers
 - Deployment - Manages Pods
 - Service - Network Endpoint
- Desired State Management
 - YAML (YAML Ain't a Markdown Language)
- Kubectl - CLI for Kubernetes
 - `kubectl create config.yaml`

Pods can be replicated

Pods are the smallest deployable units of Cloud computing that you can create and manage in Kubernetes.

Pods can be replicated as well.

For example, to run 3 instances of a web server, put a single instance inside a pod, then replicate this pod 3 times.

This creates 3 exact replicas that can be run in parallel.

How different components are put inside a pod is a design choice.

As well as application containers, a Pod can contain **init containers** (to initialise Cloud setup) that are run during Pod startup. You can also inject ephemeral containers for debugging a running Pod.

More about Pods

Pods are ephemeral resources, meaning that Pods can be terminated at any point and then restarted on another node within our Kubernetes cluster.

They **acts as a wrapper around the container(s)**, and they live and die. Pod containers will share the name network namespace and interface.

Container processes need to bind to different ports within a Pod and ports can be reused by containers in separate containers.

Kubernetes can expose pods to the outside world by giving them a **public IP address** through which clients like web browsers can interact with them.

How to create Pods in Kubernetes?

We can define Pods in Kubernetes using YAML files.

Using these YAML files, we can create objects that interact with the Kubernetes API (Pods, Namespace, Deployments etc.).

Under the hood, **kubectl** converts the information that we have defined in our **YAML file to JSON format**, that makes the request to the Kubernetes API.

YAML can be created using any editor, or Visual Studio extension.

Creating Kubernetes using yaml

After creating the yaml file, give

`kubectl apply -f yamlfilename` as follows:

```
kubectl apply -f
```

<https://k8s.io/examples/pods/simple-pod.yaml>

You can implement TLS security on your ports to tighten things up if needed.

YAML Editors

YAML, or “Yet Another Markup Language,” is a simple and human-readable data serialization format

There are also YAML editors to work exclusively with YAML.

marketplace.visualstudio.com/items?itemName=aaubry.YAMLEditor

[Codebeautify.org/yaml-editor-online](https://codebeautify.org/yaml-editor-online)

[Drupal.org/project/yaml_editor](https://drupal.org/project/yaml_editor)



Windows and Linux K8S Containers

Kubernetes is [one of the most popular](#) open-source projects on [GitHub](#).

Kubernetes has DNS ability so that it can manage multiple containers and redirect the load among multiple containers (called container load balancing).

Windows container images have a much larger file size than container images in Linux.

The smallest Windows Docker container image size (after installation) is currently 2.63 GB using a Windows Server Core Insider v1903. In comparison, a purpose-built Kubernetes Linux distribution, k3S, can be used with a binary size of less than 100MB.

An example of a Pod which consists of a container running the image nginx:1.14.2.

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
  - name: nginx
    image: nginx:1.14.2
    ports:
    - containerPort: 80
resources:
  requests:
    memory: "64Mi"
    cpu: "250m"
  limits:
    memory: "128Mi"
```

Until spring 2020, a lack of OS support from Microsoft rendered Linux container images as the only viable option for Kubernetes container deployment.

Today, Windows containers are available and officially supported on the Azure Kubernetes Service.

Containers can now be created on the [Azure Kubernetes Service \(AKS\)](#), the [Google Kubernetes Engine \(GKE\)](#), or the [Amazon Elastic Kubernetes Service \(EKS\)](#).

Distributed applications and services usually consist of multiple containerised components across multiple tiers.

Different programming languages and database technologies can be used for different microservices

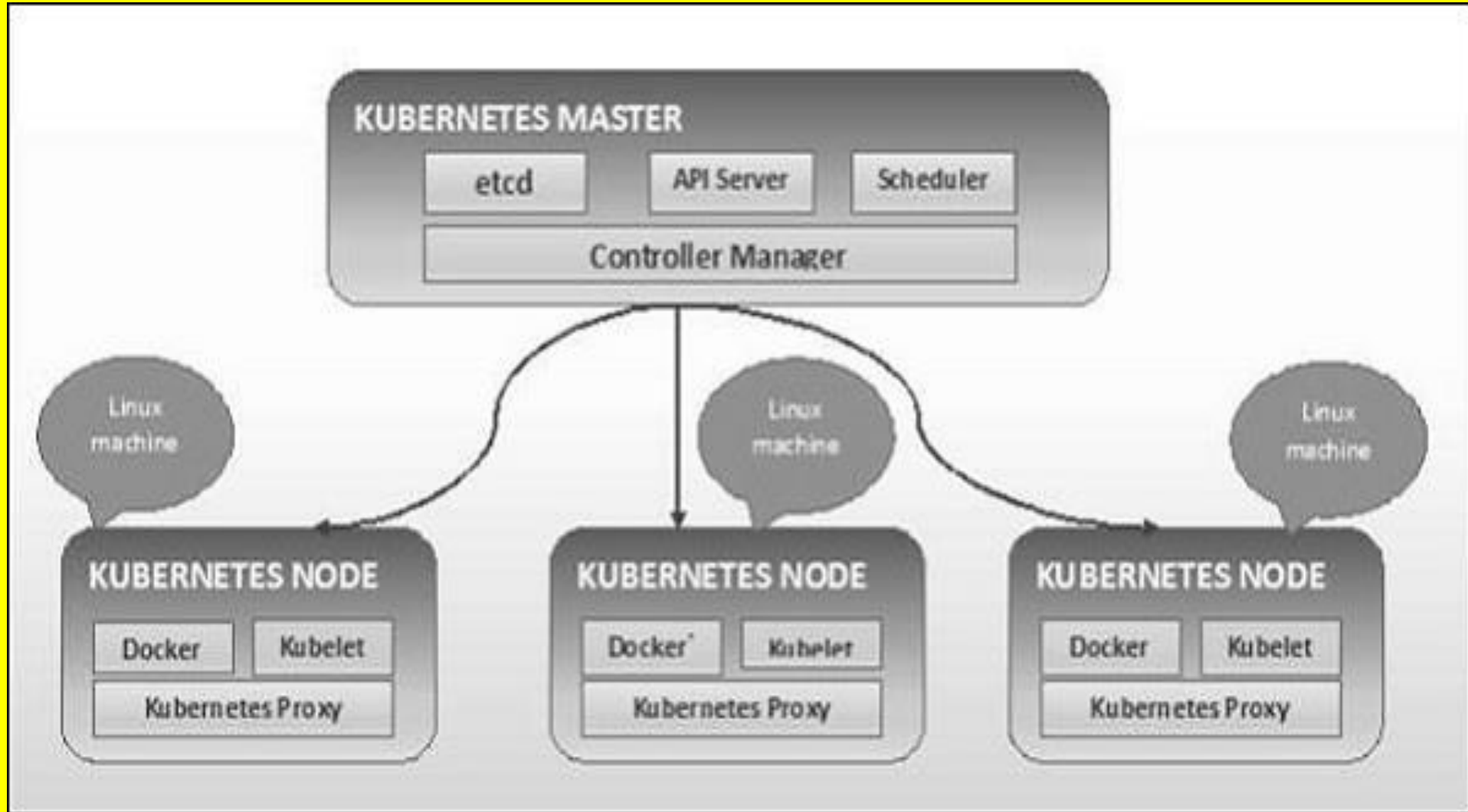
Kubernetes has emerged as the de-facto standard to deploy and manage these containerised applications

Some applications may have to be dynamically scaled depending on user traffic (incoming requests)

Kubernetes helps you make sure those containerized applications run where and when you want, and helps them find the resources and tools they need to work.

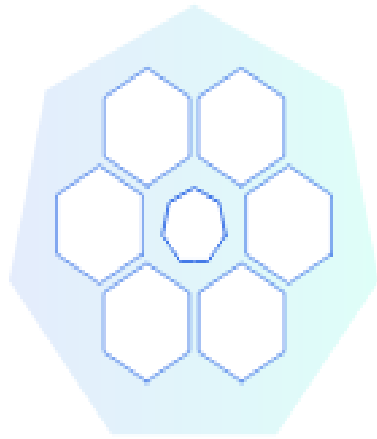
Kubernetes is a production-ready, open source platform designed with Google's accumulated experience in container orchestration, combined with best-of-breed ideas from the community.

Kubernetes uses Master/Slave architecture

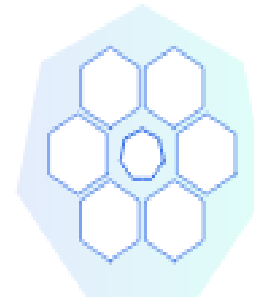


Features of kubernetes

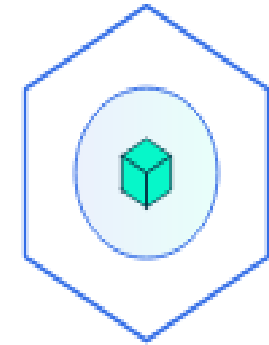
- Continues development, integration and deployment
- Containerized infrastructure
- Application-centric management
- Auto-scalable infrastructure
- Environment consistency across development testing and production
- Loosely coupled infrastructure, where each component can act as a separate unit
- Higher density of resource utilization
- Predictable infrastructure which is going to be created



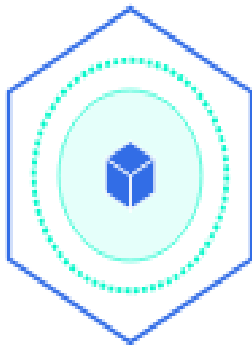
1. Create a Kubernetes cluster



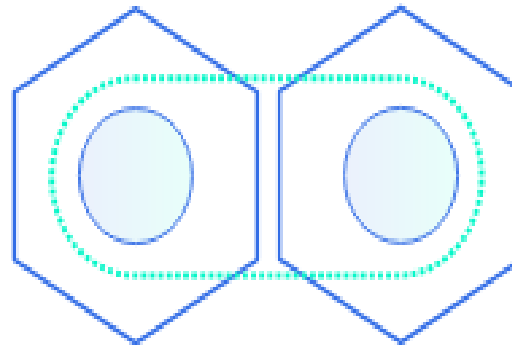
2. Deploy an app



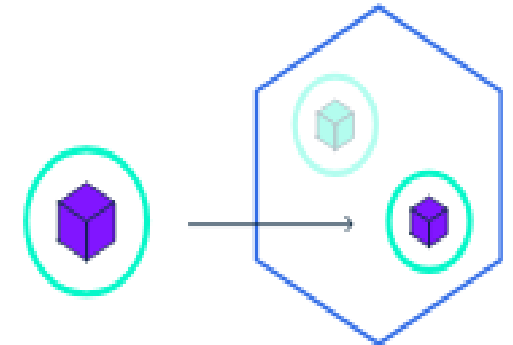
3. Explore your app



4. Expose your app publicly



5. Scale up your app



6. Update your app