Docker , Container and Kubernetes

Docker is an open-source platform that enables developers to build, deploy, run, update and manage containers.

We can run containers using Docker Desktop.

Containers are standardized, executable components that combine application source code with the operating system (OS) libraries and dependencies required to run that code in any environment.

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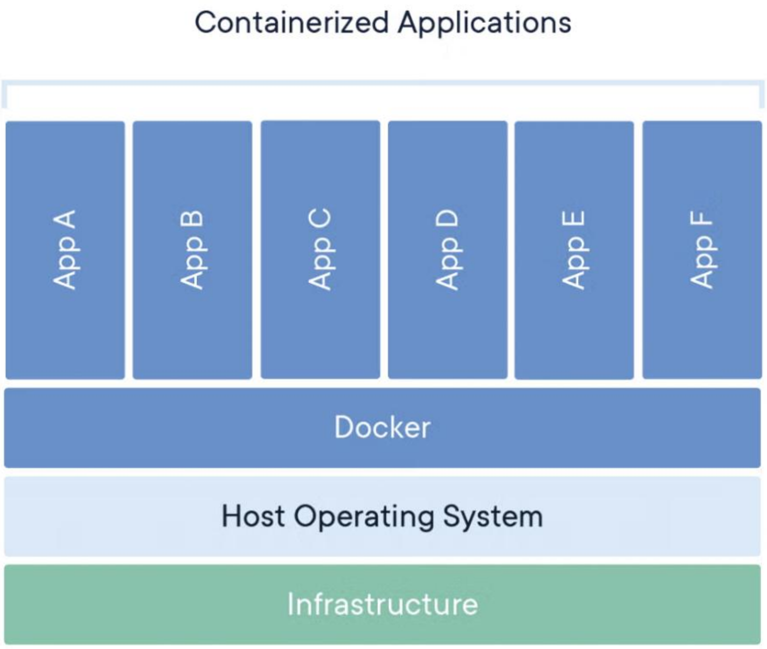
A Docker container **image** is a lightweight, standalone, executable package of software that includes everything needed to run an application: code, runtime, system tools, system libraries and settings.

Container **images** become **containers** at runtime and in the case of Docker containers – images become containers when they run on Docker Engine. Available for both Linux and Windows-based applications, containerized software will always run the same, regardless of the infrastructure.

Containers isolate software from its environment and ensure that it works uniformly despite differences for instance between development and staging.



Docker containers that run on Docker Engine:

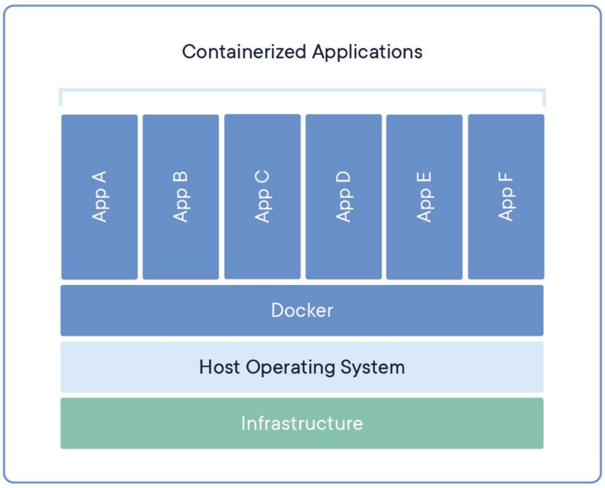
Standard: Docker created the industry standard for containers, so they could be portable anywhere.

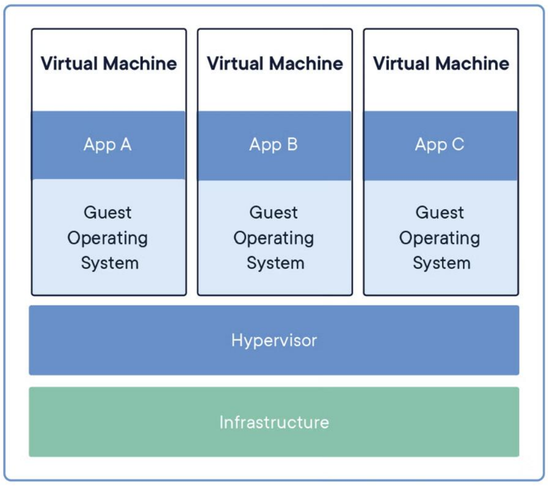
Lightweight: Containers share the machine's OS system kernel and therefore do not require an OS per application, driving higher server efficiencies and reducing server and licensing costs.

Secure: Applications are safer in containers and Docker provides the strongest default isolation capabilities in the industry.

Comparing Containers and Virtual Machines

Containers and virtual machines have similar resource isolation and allocation benefits, but function differently because containers virtualize the operating system instead of hardware. Containers are more portable and efficient.



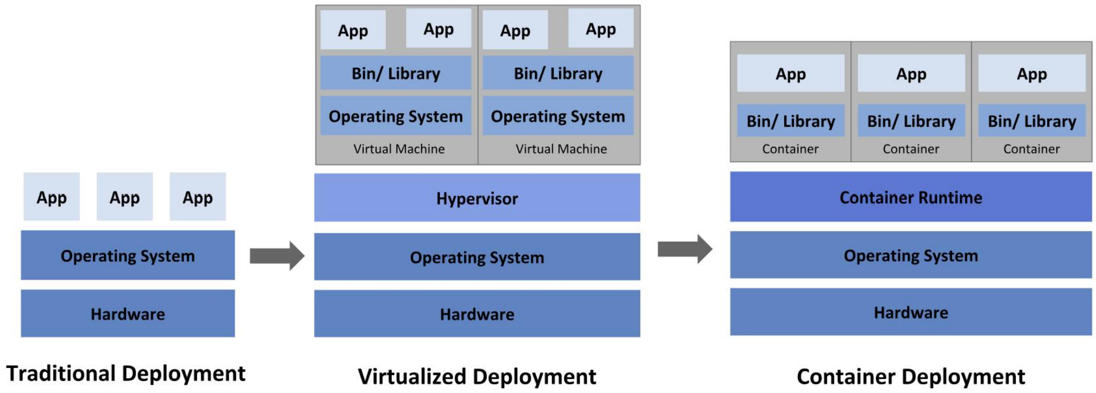


CONTAINERS

Containers are an abstraction at the app layer that packages code and dependencies together. Multiple containers can run on the **same machine and share the OS kernel** with other containers, each running as isolated processes in user space. Containers take up less space than VMs (container images are typically tens of MBs in size), can handle more applications and require fewer VMs and Operating systems.

VIRTUAL MACHINES

Virtual machines (VMs) are an abstraction of physical hardware turning one server into many servers. The hypervisor allows multiple VMs to run on a single machine. Each VM includes a **full copy of an operating system**, the application, necessary binaries and libraries – taking up tens of GBs. VMs can also be slow to boot.



Kubernetes

Kubernetes is a portable, extensible, open source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation. It has a large, rapidly growing ecosystem. Kubernetes services, support, and tools are widely available

Why you need Kubernetes and what it can do

Containers are a good way to bundle and run your applications. In a production environment, you need to manage the containers that run the applications and ensure that there is no downtime. For example, if a container goes down, another container needs to start. Wouldn't it be easier if this behavior was handled by a system?

That's how Kubernetes comes to the rescue! Kubernetes provides you with a framework to run distributed systems resiliently. It takes care of scaling and failover for your application, provides deployment patterns, and more. For example: Kubernetes can easily manage a canary deployment for your system.

Kubernetes provides you with:

- **Service discovery and load balancing** Kubernetes can expose a container using the DNS name or using their own IP address. If traffic to a container is high, Kubernetes is able to load balance and distribute the network traffic so that the deployment is stable.

- **Storage orchestration** Kubernetes allows you to automatically mount a storage system of your choice, such as local storages, public cloud providers, and more.
- **Automated rollouts and rollbacks** You can describe the desired state for your deployed containers using Kubernetes, and it can change the actual state to the desired state at a controlled rate. For example, you can automate Kubernetes to create new containers for your deployment, remove existing containers and adopt all their resources to the new container.
- **Automatic bin packing** You provide Kubernetes with a cluster of nodes that it can use to run containerized tasks. You tell Kubernetes how much CPU and memory (RAM) each container needs. Kubernetes can fit containers onto your nodes to make the best use of your resources.
- **Self-healing** Kubernetes restarts containers that fail, replaces containers, kills containers that don't respond to your user-defined health check, and doesn't advertise them to clients until they are ready to serve.
- **Secret and configuration management** Kubernetes lets you store and manage sensitive information, such as passwords, OAuth tokens, and SSH keys. You can deploy and update secrets and application configuration without rebuilding your container images, and without exposing secrets in your stack configuration.
- **Batch execution** In addition to services, Kubernetes can manage your batch and CI workloads, replacing containers that fail, if desired.
- **Horizontal scaling** Scale your application up and down with a simple command, with a UI, or automatically based on CPU usage.
- **IPv4/IPv6 dual-stack** Allocation of IPv4 and IPv6 addresses to Pods and Services
- **Designed for extensibility** Add features to your Kubernetes cluster without changing upstream source code.