Docker Fundamentals

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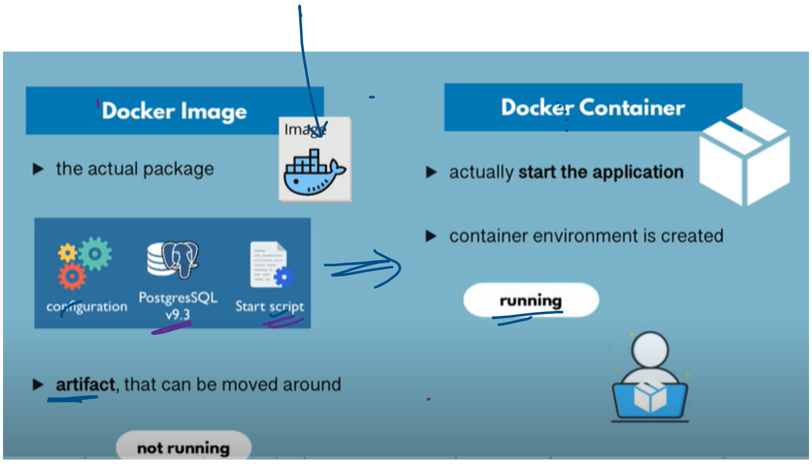
set instruction ? artifacts → final . prod ready →



Docker Image

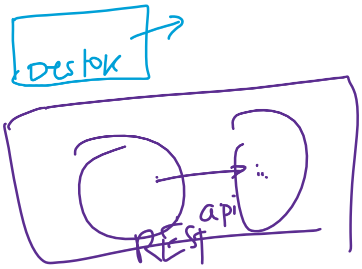
- the actual package
- **artifact**, that can be moved around

Docker Container

- actually **start the application**
- container environment is created

What can I use Docker for?

Fast, consistent delivery of your applications



Docker architecture

Docker uses a client-server architecture. The Docker *client* talks to the Docker *daemon*, which does the heavy lifting of building, running, and distributing your Docker containers. The Docker client and daemon *can* run on the same system, or you can connect a Docker client to a remote Docker daemon. The Docker client and daemon communicate using a REST API, over UNIX sockets or a network interface. Another Docker client is Docker Compose, that lets you work with applications consisting of a set of containers.

The Docker daemon

The Docker daemon (dockerd) listens for Docker API requests and manages Docker objects such as images, containers, networks, and volumes. A daemon can also communicate with other daemons to manage Docker services.

The Docker client

The Docker client (docker) is the primary way that many Docker users interact with Docker. When you use commands such as docker run, the client sends these commands to dockerd, which carries them out. The docker command uses the Docker API. The Docker client can communicate with more than one daemon.

Docker registries

A Docker *registry* stores Docker images. Docker Hub is a public registry that anyone can use, and Docker is configured to look for images on Docker Hub by default. You can even run your own private registry.

When you use the docker pull or docker run commands, the required images are pulled from your configured registry. When you use the docker push command, your image is pushed to your configured registry.

Docker objects

When you use Docker, you are creating and using images, containers, networks, volumes, plugins, and other objects. This section is a brief overview of some of those objects.

Images

An *image* is a read-only template with instructions for creating a Docker container. Often, an image is *based on* another image, with some additional customization.

https://hub.docker.com/search?category=base&source=verified&type=image

For example, you may build an image which is based on the ubuntu image, but installs the Apache web server and your application, as well as the configuration details needed to make your application run.

You might create your own images or you might only use those created by others and published in a registry. To build your own image, you create a *Dockerfile* with a simple syntax for defining the steps needed to create the image and run it.

Each instruction in a Dockerfile creates a layer in the image. When you change the Dockerfile and rebuild the image, only those layers which have changed are rebuilt.

This is part of what makes images so lightweight, small, and fast, when compared to other virtualization technologies.

Containers

A container is a runnable instance of an image.

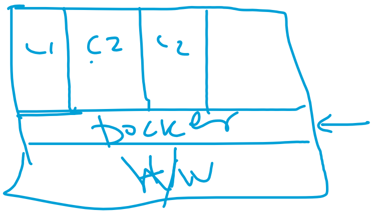
You can create, start, stop, move, or delete a container using the Docker API or CLI.

You can connect a container to one or more networks, attach storage to it, or even create a new image based on its current state.

By default, a container is relatively well isolated from other containers and its host machine.

You can control how isolated a container's network, storage, or other underlying subsystems are from other containers or from the host machine.

A container is defined by its image as well as any configuration options you provide to it when you create or start it. When a container is removed, any changes to its state that are not stored in persistent storage disappear.



to create contairs

https://docs.docker.com/engine/install/centos/

1. sudo apt update 2. sudo apt install docker.io -y

Example docker run command

The following command runs an ubuntu container, attaches interactively to your local command-line session, and runs /bin/bash.

```
$ docker run -it  ubuntu /bin/bash
```

docker run hello-world

The underlying technology

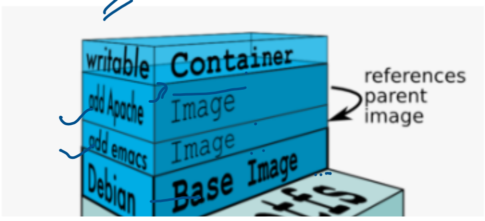
Docker is written in the Go programming language and takes advantage of several features of the Linux kernel to deliver its functionality. Docker uses a technology called namespaces to provide the isolated workspace called the *container*.

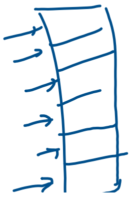
What is an image?

bare

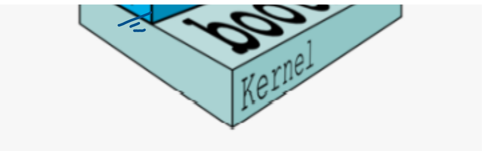
- An image is a collection of files + some meta data. (Technically: those files form the root filesystem of a container.)
- Images are made of *layers*, conceptually stacked on top of each other.
- Each layer can add, change, and remove files.
- Images can share layers to optimize disk usage, transfer times, and memory use.

final image





wall

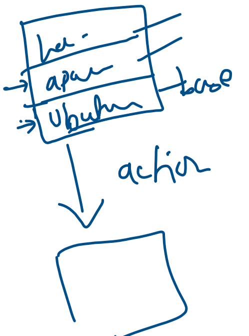


Ubuntu.

Differences between containers and images

- An image is a read-only filesystem.
- A container is an encapsulated set of processes running in a read-write copy of that filesystem.
- To optimize container boot time, *copy-on-write* is used instead of regular copy.
- `docker run` starts a container from a given image.

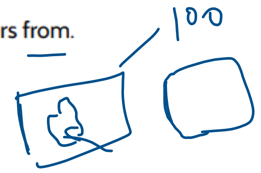
s give a couple of metaphors to illustrate those concepts.



→docker run ubuntu

Image as stencils

Images are like templates or stencils that you can create containers from.



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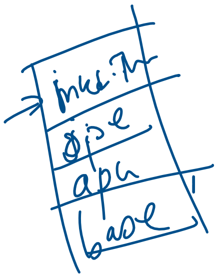
Object-oriented programming

- Images are conceptually similar to *classes*.
- Layers are conceptually similar to *inheritance*.
- Containers are conceptually similar to *instances*.

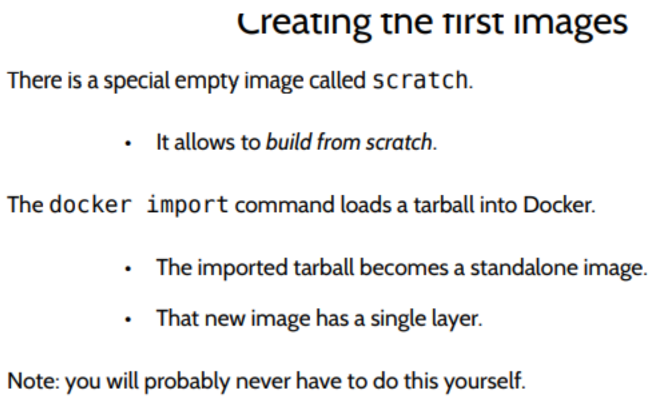
Wait a minute...

1) If an image is read-only, how do we change it?

- We don't.
- We create a new container from that image.
- Then we make changes to that container.
- When we are satisfied with those changes, we transform them into a new layer.
- A new image is created by stacking the new layer on top of the old image.



Creating the first images



Creating the first images

There is a special empty image called `scratch`.

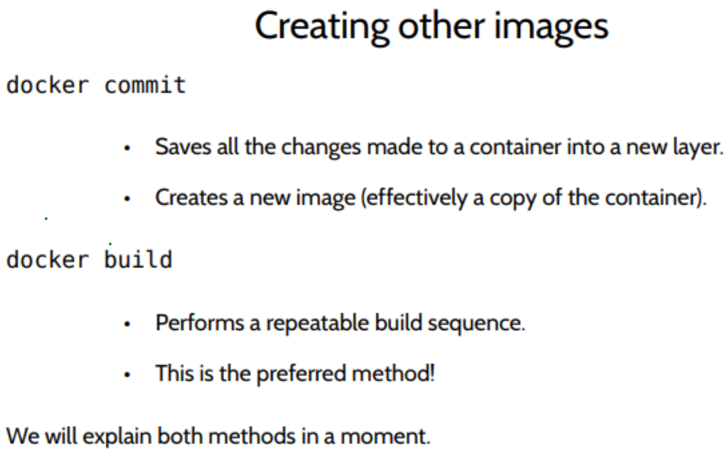
- It allows to *build from scratch*.

The `docker import` command loads a tarball into Docker.

- The imported tarball becomes a standalone image.
- That new image has a single layer.

Note: you will probably never have to do this yourself.

git repo



Creating other images

`docker commit`

- Saves all the changes made to a container into a new layer.
- Creates a new image (effectively a copy of the container).

`docker build`

- Performs a repeatable build sequence.
- This is the preferred method!

We will explain both methods in a moment.

```
docker build -f dockerfiles/Dockerfile.debug -t myapp_debug .
docker build -f dockerfiles/Dockerfile.prod  -t myapp_prod .
```