



Docker Basics

Learn what Docker is, how to run, and where it is used

Menu



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What is Docker?



Comparison to virtual machine

A virtual machine uses a full guest OS and hypervisor (Hyper-V on Windows) to run the guest on a host OS.

The layers of separation via other means (e.g. firewall) sandbox the guest OS.

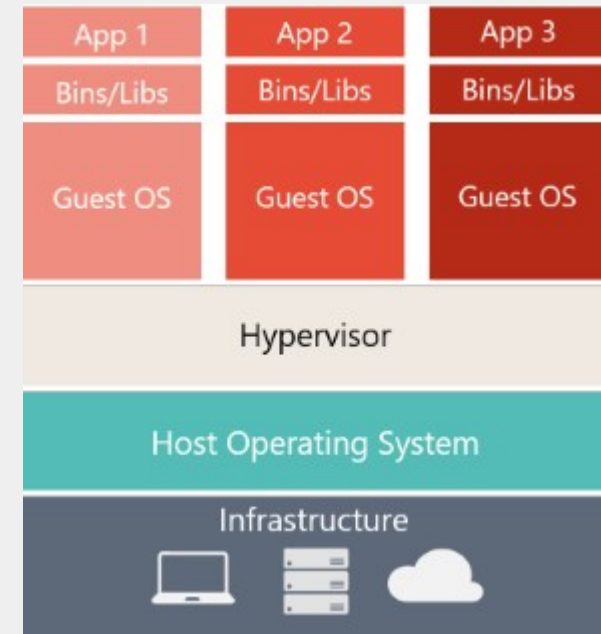
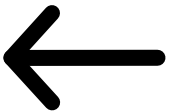


Image from
<https://docs.microsoft.com/en-us/dotnet/architecture/microservices/container-docker-introduction/media/docker-defined/virtual-machine-hardware-software.png>



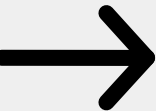
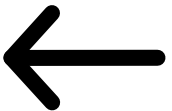
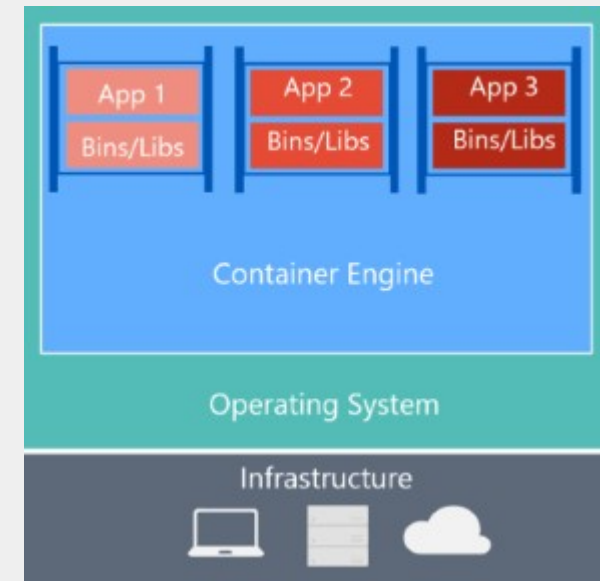
What is Docker?



Docker is a container, not a vm

Docker uses a container engine to run on the host's operating system without needing
* hypervisor * guest OS

The docker image is constructed by layers in a Dockerfile.



Common Docker Commands - Hello!

```
$ docker pull hello-world
```

```
Using default tag: latest
```

```
latest: Pulling from library/hello-world
```

```
2db29710123e: Pull complete
```

```
Digest:
```

```
sha256:cc15c5b292d8525effc0f89cb29
```

```
9f1804f3a725c8d05e158653a563f15e4
```

```
f685
```

```
Status: Downloaded newer image for
```

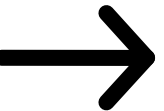
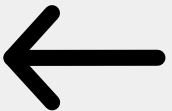
```
hello-world:latest
```

```
docker.io/library/hello-world:latest~
```

docker pull <image> retrieves the latest* tag version of the named image from docker hub.

docker pull <image>:<tag>

* recommended practice to specify image tag



Common Docker Commands – Hello!

```
$ docker run --name hola-mundo hello-world
```

Hello from Docker!

This message shows that your installation appears to be working correctly.

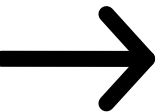
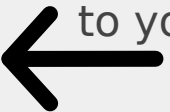
To generate this message, Docker took the following steps:

1. The Docker client contacted the Docker daemon.
2. The Docker daemon pulled the "hello-world" image from the Docker Hub. (amd64)
3. The Docker daemon created a new container from that image which runs the executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it to your terminal. ...

docker run --name <container>
<image> runs the image using given name.

This container starts, prints out text --
...

For more examples and ideas, visit:
<https://docs.docker.com/get-started/>
-- and exits.

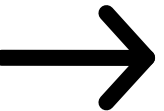
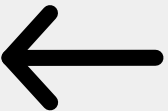


Common Docker Commands – Interact

```
$ docker run -it ubuntu bash  
root@9a565811a38e:/#
```

docker run -it <image> <exe> runs the image providing bash as terminal to interact with the container.

Notice ‘root’ and ‘#’; take appropriate precautions – ‘with great power comes great responsibility.’



Common Docker Commands – Manage

\$ docker ps

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
9a565811a38e	ubuntu	"bash"	7 minutes ago	Up 7 minutes		determined_blackburn

\$ docker stop 9a565811a38e

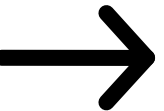
9a565811a38e

\$ docker ps

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
--------------	-------	---------	---------	--------	-------	-------

docker ps provides info about running containers.

docker stop <container-id> stops a running container.



Working Knowledge - Dockerfile



Base Image

**Alpine linux or
project-based**

Often projects, like node,
provide their own images
to build on top of

FROM <image>
MAINTAINER <author>

Layers

**Install needed
components, setup**

Each component
command adds a layer
RUN <commandline>
WORKDIR <working dir>
COPY <src> <dest>

Final Item

**CMD command not
executed during build**

A parameter list is used
for CMD command, so
CMD ["node", "index.js"]
CMD [<parm1>, <parm2>]



Working Knowledge - Dockerfile

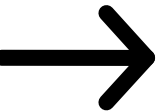
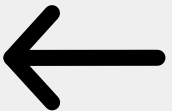


```
# syntax=docker/dockerfile:1
FROM node:12-alpine
RUN apk add --no-cache python3 g++ make
WORKDIR /app
COPY . .
RUN yarn install --production
CMD ["node", "src/index.js"]
```

```
# comment
FROM <image>:<tag>
RUN <commandline>
WORKDIR <working directory>
COPY <src> <dest>
CMD <list of parameters>
```

CMD executes **after** the container has been created.

TIP: there can be **only one CMD** – if multiple CMDs, last one used.



Working Knowledge - Compose



```
version: "3.7"
```

```
services:
```

```
  app:
```

```
    image: node:12-alpine
```

```
    command: sh -c "yarn install && yarn run dev"
```

```
    ports:
```

```
      - 3000:3000
```

```
    working_dir: /app
```

```
    volumes:
```

```
      - ./:/app
```

```
    environment:
```

```
      MYSQL_HOST: mysql
```

```
      MYSQL_USER: root
```

```
      MYSQL_PASSWORD: secret
```

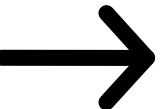
```
      MYSQL_DB: todos
```

```
    ...
```

Docker compose used to define multi-container applications.

`docker-compose.yml` used to define services.

With a single docker-compose command, everything can be launched or destroyed using a single host.



Working Knowledge – Swarm vs K8s

Docker swarm was a tool for running and connecting containers on multiple hosts.

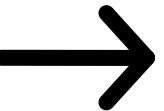
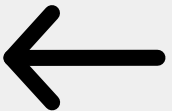
It is no longer maintained or supported.

<https://stackoverflow.com/questions/47536536/whats-the-difference-between-docker-compose-and-kubernetes>

Kubernetes (K8s) is a distributed container orchestration tool initially created by Google.

It was open-sourced in 2014 and handed over to the Cloud Native Computing Foundation (CNCF) the following year.

OpenShift is Redhat's container orchestration solution.



Security Considerations



01

Host and docker

Keep up-to-date with patches and versions.

Remember the docker container shares the kernel with the host.

02

Limit capabilities

Grant only specific capabilities needed by the container.

Remember the principle of least privilege.

03

Limit resources

Limit memory, CPU, and processes. A maximum number of restarts can be set via '`--restart=on-failure:<#>`'



Cloud Provider Use-Cases - AWS



ECR

Amazon Elastic Container Registry

ECR, like DockerHub, allows for storage, management, and deployment of container images.

ECS

Amazon Elastic Container Service

ECS supports Docker containers, allows running application on cluster of Elastic Compute Cloud (EC2) instances.

Fargate

ECS Serverless Compute

AWS Fargate allows running containers without managing server for a serverless solution.

<https://www.educba.com/aws-containers/>



Resources



Docker Con 2021 Highlights

https://www.youtube.com/watch?v=R_mcN0QR5qw

3M Udemy for Business

<https://www.udemy.com/topic/docker>

Docker docs

<https://docs.docker.com/get-started/>

Containers From Scratch | Liz Rice | goto;

<https://www.youtube.com/watch?v=8fi7uSYIOdc>

Others

Dockerfile Commands Explained

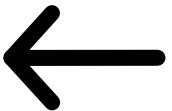
<https://www.decodingdevops.com/dockerfile-commands-explained-cheat-sheet/>

OWASP Docker Cheatsheet

https://cheatsheetseries.owasp.org/cheatsheets/Docker_Security_Cheat_Sheet.html

What is Docker | Microsoft Docs

<https://docs.microsoft.com/en-us/dotnet/architecture/microservices/container-docker-introduction/docker-defined>

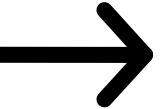
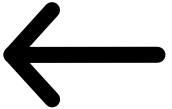


Questions?



“Judge a man by his questions
rather than by his answers.”

— Voltaire





Thank you!

<https://www.docker.com>

What is Docker? | Microsoft

<https://opencontainers.org>

**Tech group presentation
by Lisa Hatch**



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