ESCOLA SUPERIOR DE REDES

Orquestração de Containers

Visão geral sobre containers

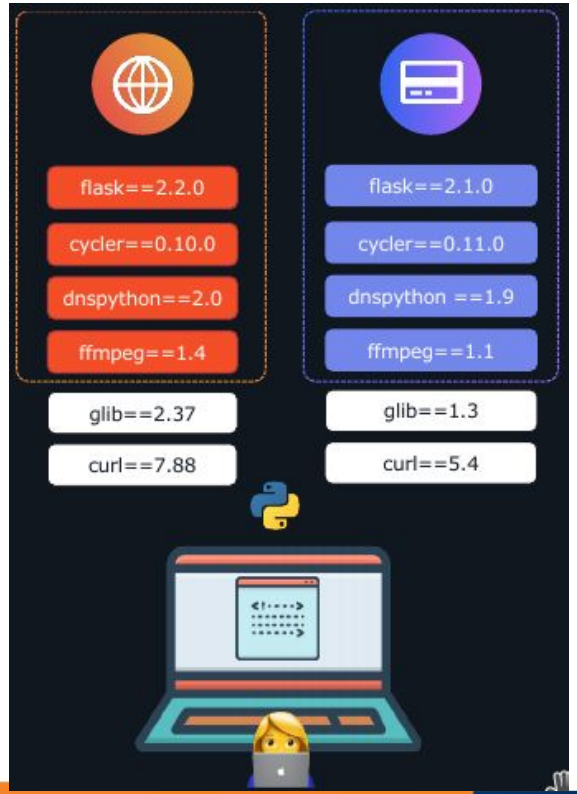
Tópicos abordados

- Problemática das dependências da aplicação com o ambiente de execução
- O que é um container?
- Containers vs VMs
- Ciclo de vida de aplicações
- Container e a esteira de CI/CD

Tópicos abordados

- Histórico de isolamento de processos
- Docker
- Arquitetura do Docker
- Interagindo com o daemon Docker
- Docker Compose
- Container Private Registry

Problema das dependências da aplicação com o ambiente de execução



Problema das dependência da aplicação com o ambiente de execução

Matriz do inferno

	Development VM	QA Server	Single Prod Server	Production Cluster	Public cloud	Developer's Laptop	Customer Servers
Static Website	?	?	?	?	?	?	?
Web Frontend	?	?	?	?	?	?	?
Background Workers	?	?	?	?	?	?	?
User DB	?	?	?	?	?	?	?
Analytics DB	?	?	?	?	?	?	?
Queue	?	?	?	?	?	?	?

Source: https://blog.docker.com/2013/08/paas-present-and-future/

O que é um container?

"Um contêiner é uma unidade padrão de software que empacota o código e todas as suas dependências para que um aplicativo seja executado de forma rápida e confiável de um ambiente de computação para outro"

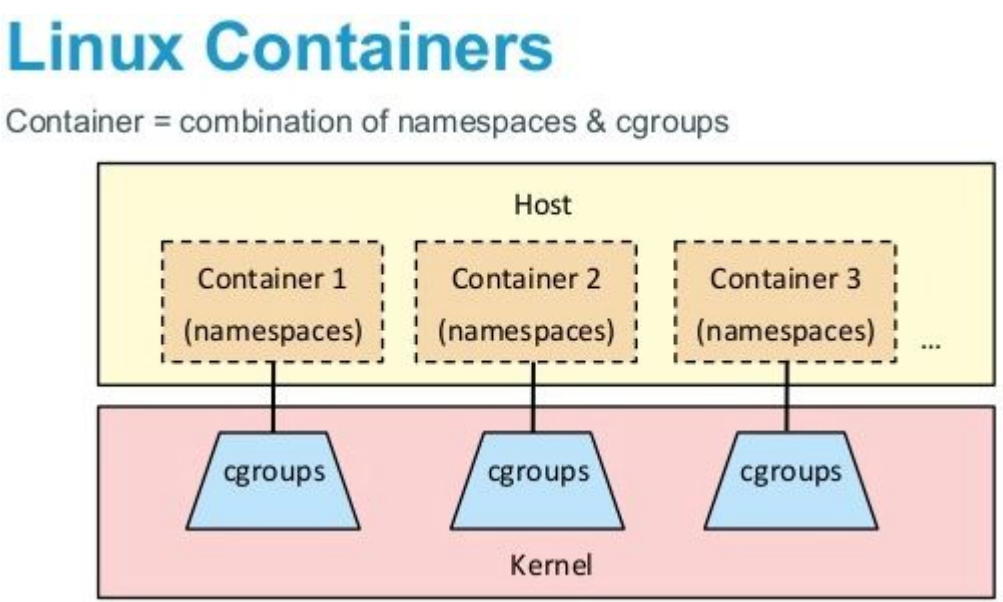
Conceito docker.com (tradução literal)

O que é um container?

Container isola o código e as dependências da aplicação para não conflitar com o SO do host

O que é um container?

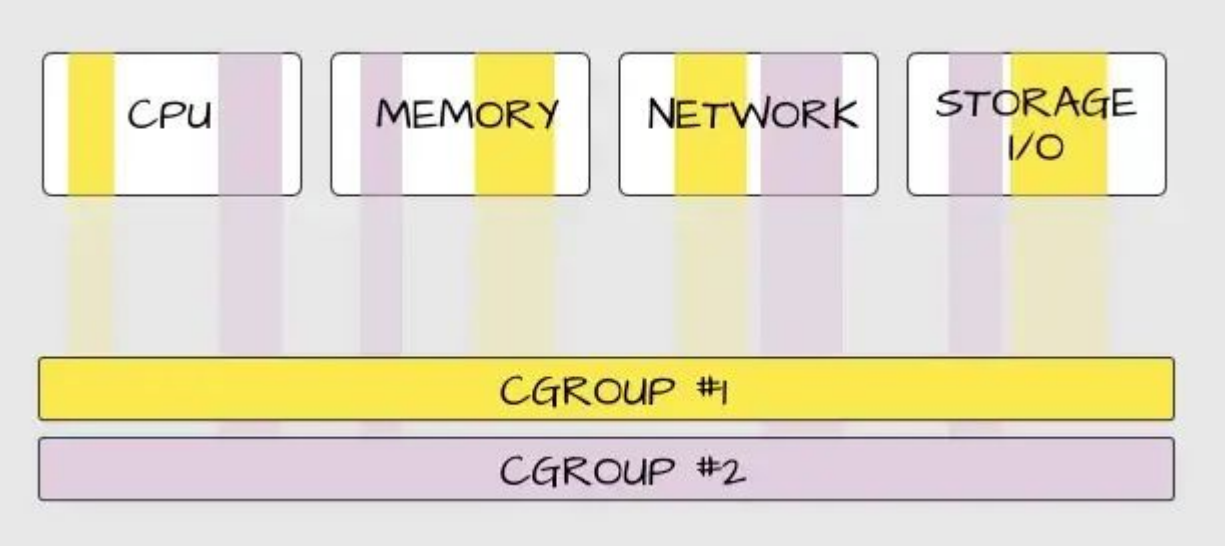
Source: https://blog.docker.com/2013/08/paas-present-and-future/



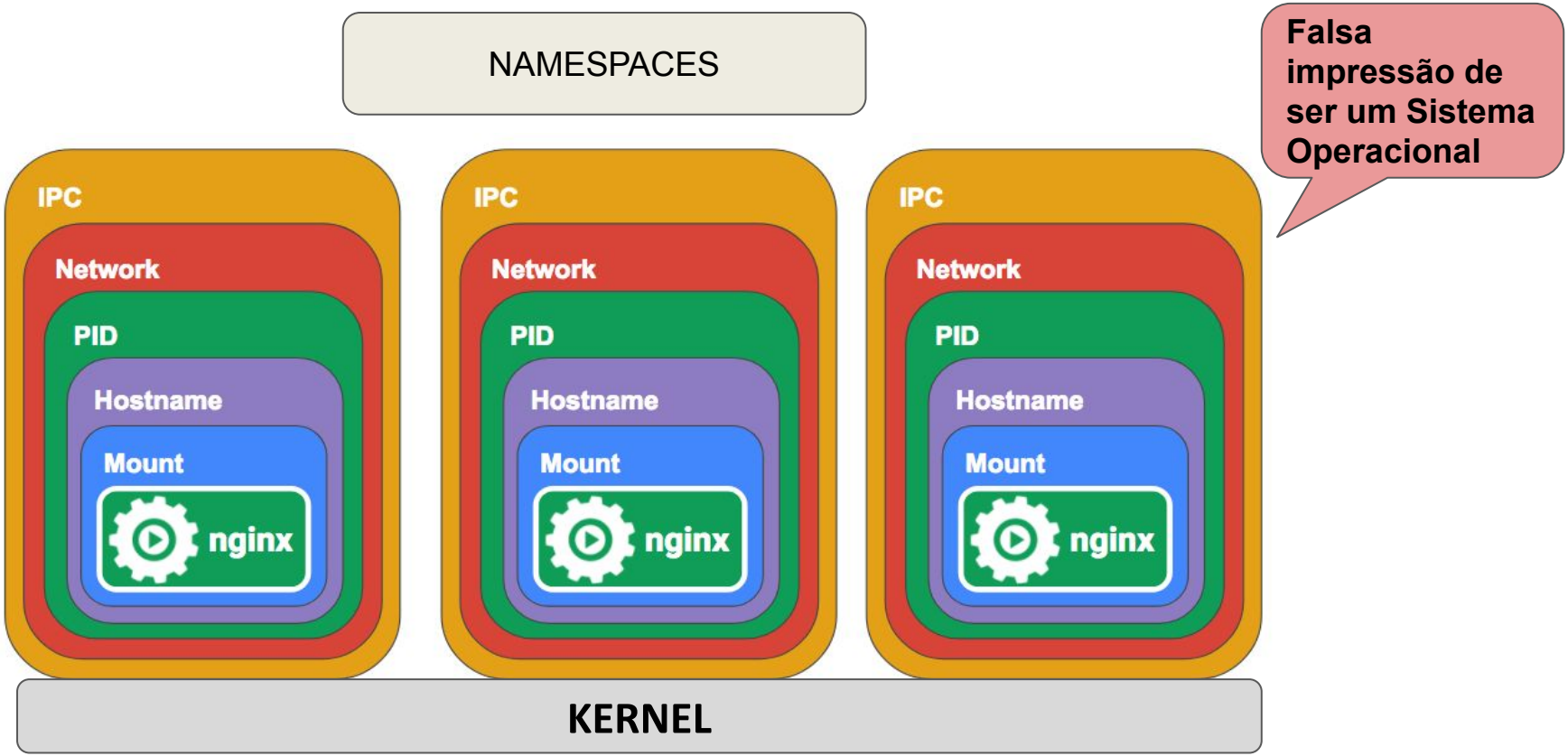
Container é um um processo do SO **isolado** dos demais, através de recursos como **cgroup** (CPU, memória, I/O) e **namespace** (pid, user, net)

O que é um container?

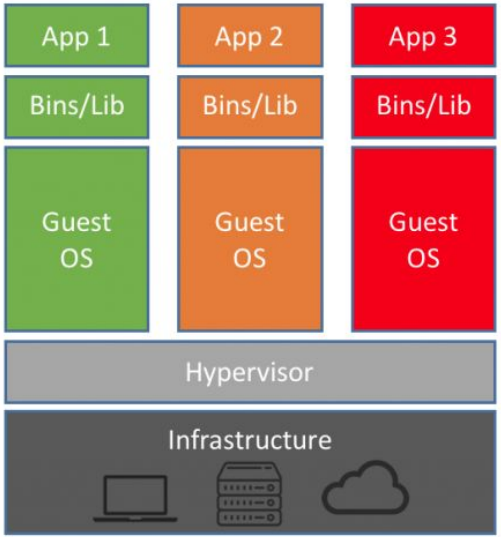
CGROUPS



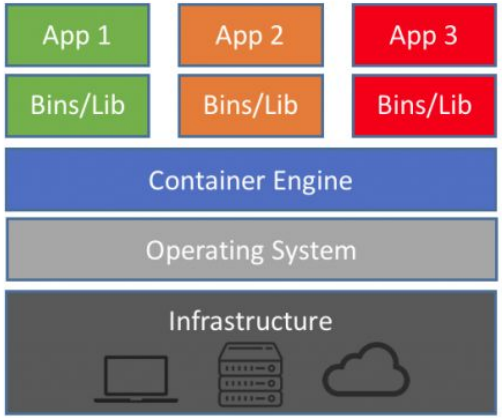
O que é um container?



Containers vs Máquinas Virtuais



Machine Virtualization



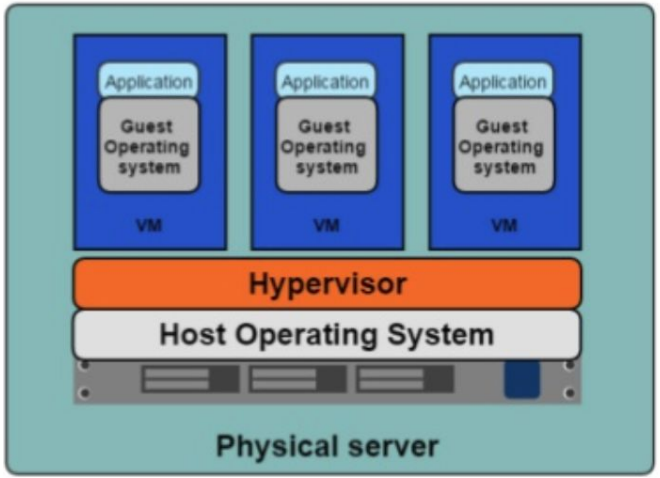
Containers

CONTAINERS

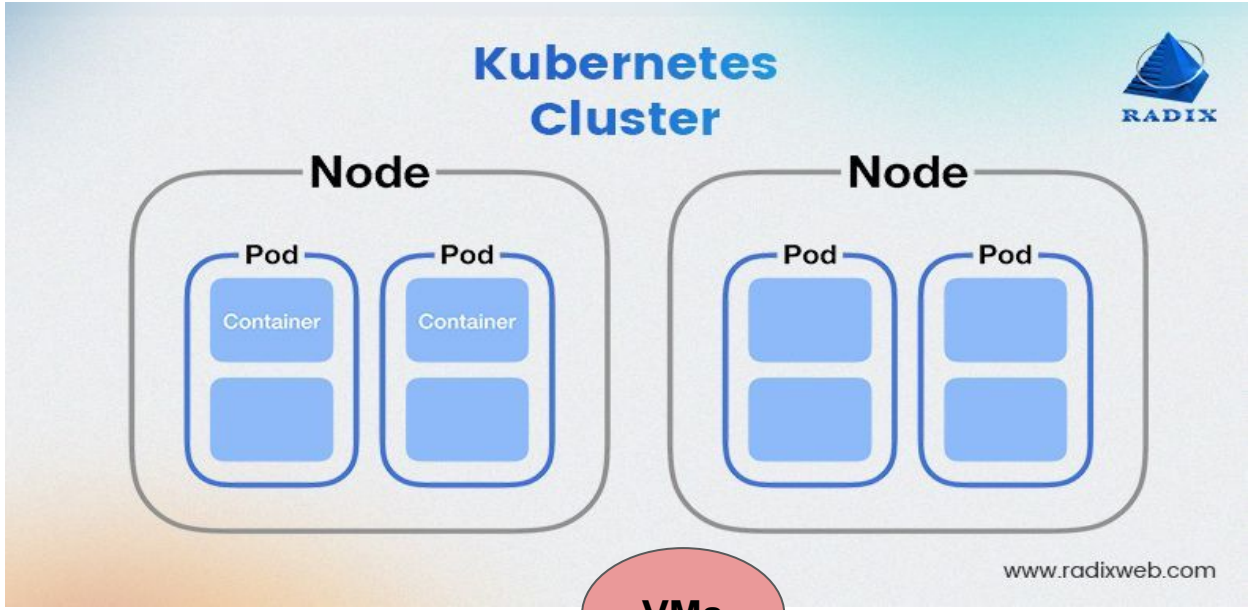
- Mais velocidade na inicialização
- Menor *footprint* de memória
- Racionalização no uso de recursos
- Mais instâncias por unidade de hardware
- Maior flexibilidade e portabilidade
  Perfeito para multicloud / microserviços

Limitações da virtualização tradicional

- VMs são “pesadas”: CPU, RAM, disco e SO **dedicados**
- VM *sprawl*
- **Redundância** de recursos
- **Portabilidade** dev > teste > produção não é garantida



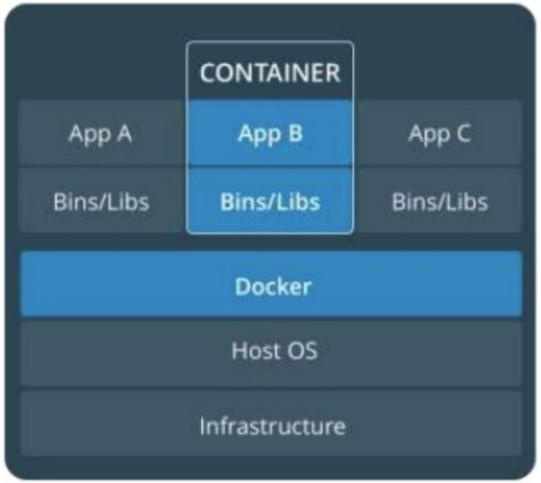
Será o fim das VMs?



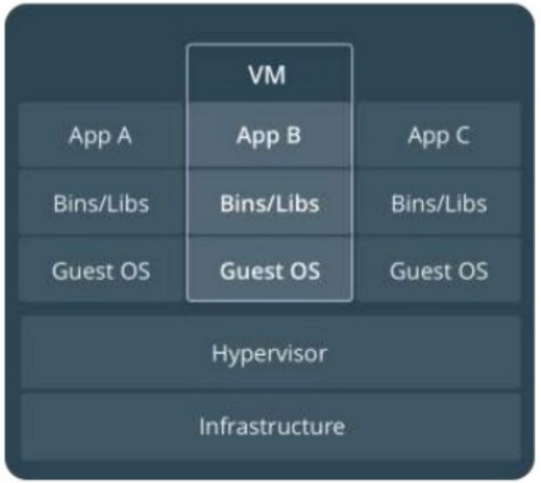
VMs

Containers vs Máquinas Virtuais

Artefato em nível de **aplicação**



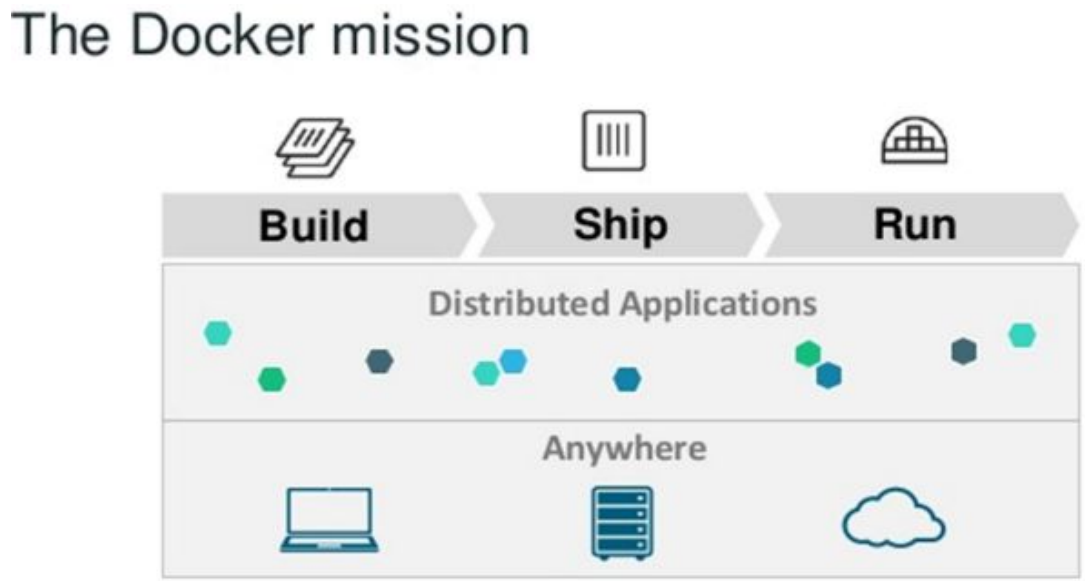
Artefato em nível de **infraestrutura**



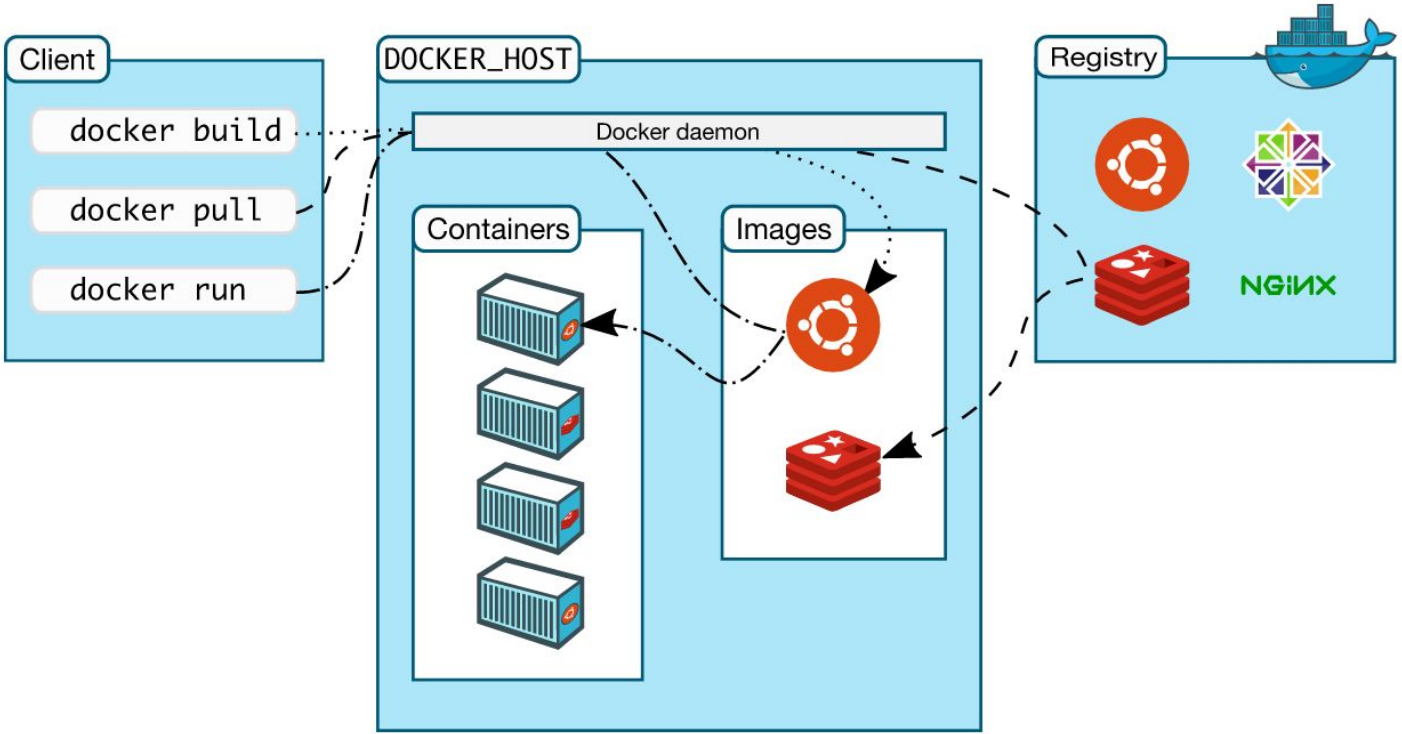
- É uma PLATAFORMA que permite:

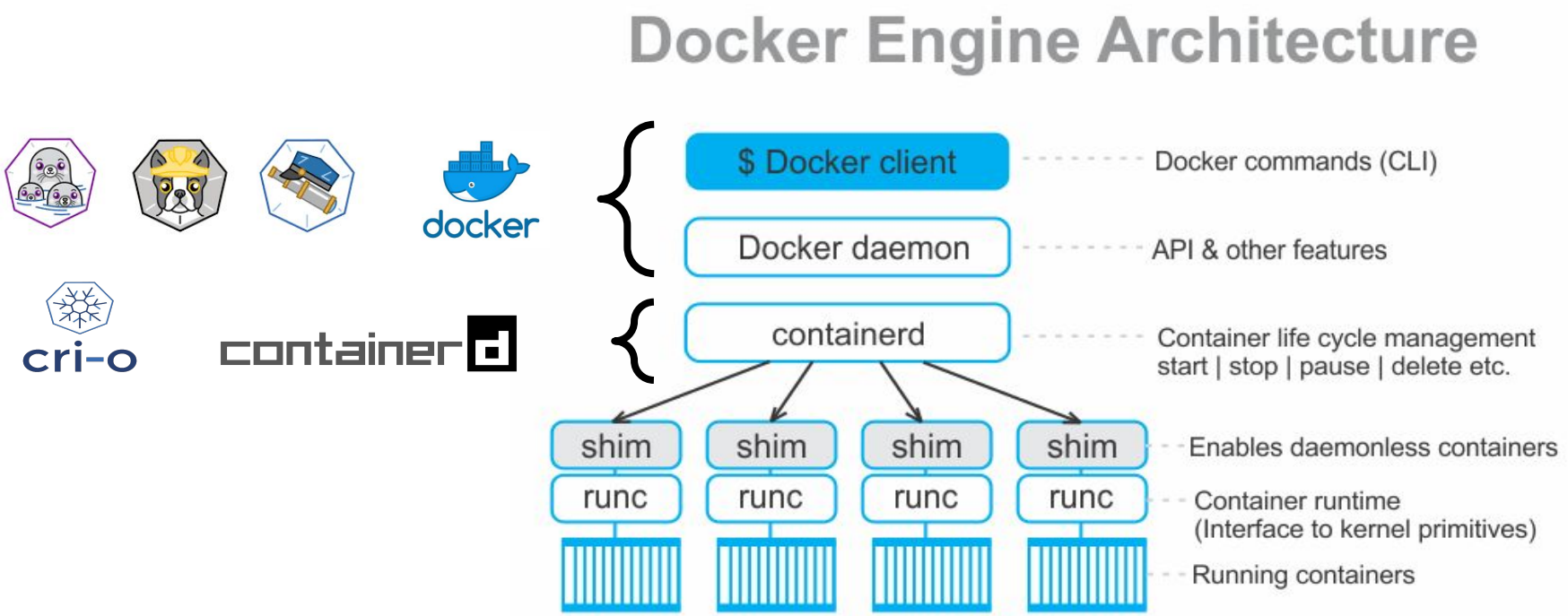
  CRIAR e EXECUTAR APLICAÇÕES
  através de

  CONTAINERS



Arquitetura do Docker





https://hemanta.io/a-detailed-guide-to-docker-engine/

Interagindo com o Docker

Agora, vamos ver alguns exemplos de comandos usualmente utilizados para interagir via CLI *docker*

docker run | ps | ps -a

```
root@docker:~# docker run alpine
root@docker:~#
root@docker:~# docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@docker:~#
root@docker:~# docker ps -a
CONTAINER ID   IMAGE     COMMAND     CREATED          STATUS                      PORTS     NAMES
f45a9b368bac   alpine    "/bin/sh"   8 seconds ago    Exited (0) 7 seconds ago              jolly_merkle
root@docker:~#
```

docker run [options]

```
root@docker:~# docker run -it alpine /bin/sh
/ # whoami
root
/ # hostname
1518f87a27ee
/ # exit
root@docker:~# docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@docker:~# docker ps -a
CONTAINER ID   IMAGE     COMMAND     CREATED         STATUS                           PORTS     NAMES
1518f87a27ee   alpine    "/bin/sh"   2 minutes ago   Exited (0) About a minute ago              frosty_saha
f45a9b368bac   alpine    "/bin/sh"   4 minutes ago   Exited (0) 4 minutes ago                   jolly_merkle
root@docker:~#
root@docker:~# docker container prune
WARNING! This will remove all stopped containers.
Are you sure you want to continue? [y/N] y
Deleted Containers:
1518f87a27ee12689dac048e6379c109a1e50d18a2d5bcd50c2e1ef3276bb767
f45a9b368bac39e5233e0fb9b810e5bb124d525e4c6cead4b2d9c32585137ee6

Total reclaimed space: 22B
root@docker:~# docker ps -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@docker:~#
root@docker:~# docker run --rm -it alpine /bin/sh
/ # exit
root@docker:~# docker ps -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@docker:~#
```

docker run [options]

```
root@docker:~# docker run nginx:alpine
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2023/10/14 03:24:59 [notice] 1#1: using the "epoll" event method
2023/10/14 03:24:59 [notice] 1#1: nginx/1.25.2
2023/10/14 03:24:59 [notice] 1#1: built by gcc 12.2.1 20220924 (Alpine 12.2.1_git20220924-r10)
2023/10/14 03:24:59 [notice] 1#1: OS: Linux 5.10.0-21-amd64
2023/10/14 03:24:59 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2023/10/14 03:24:59 [notice] 1#1: start worker processes
2023/10/14 03:24:59 [notice] 1#1: start worker process 30
2023/10/14 03:24:59 [notice] 1#1: start worker process 31
```

docker stop | pause

docker stop => SIGTERM -> SIGKILL

docker pause => SIGSTOP

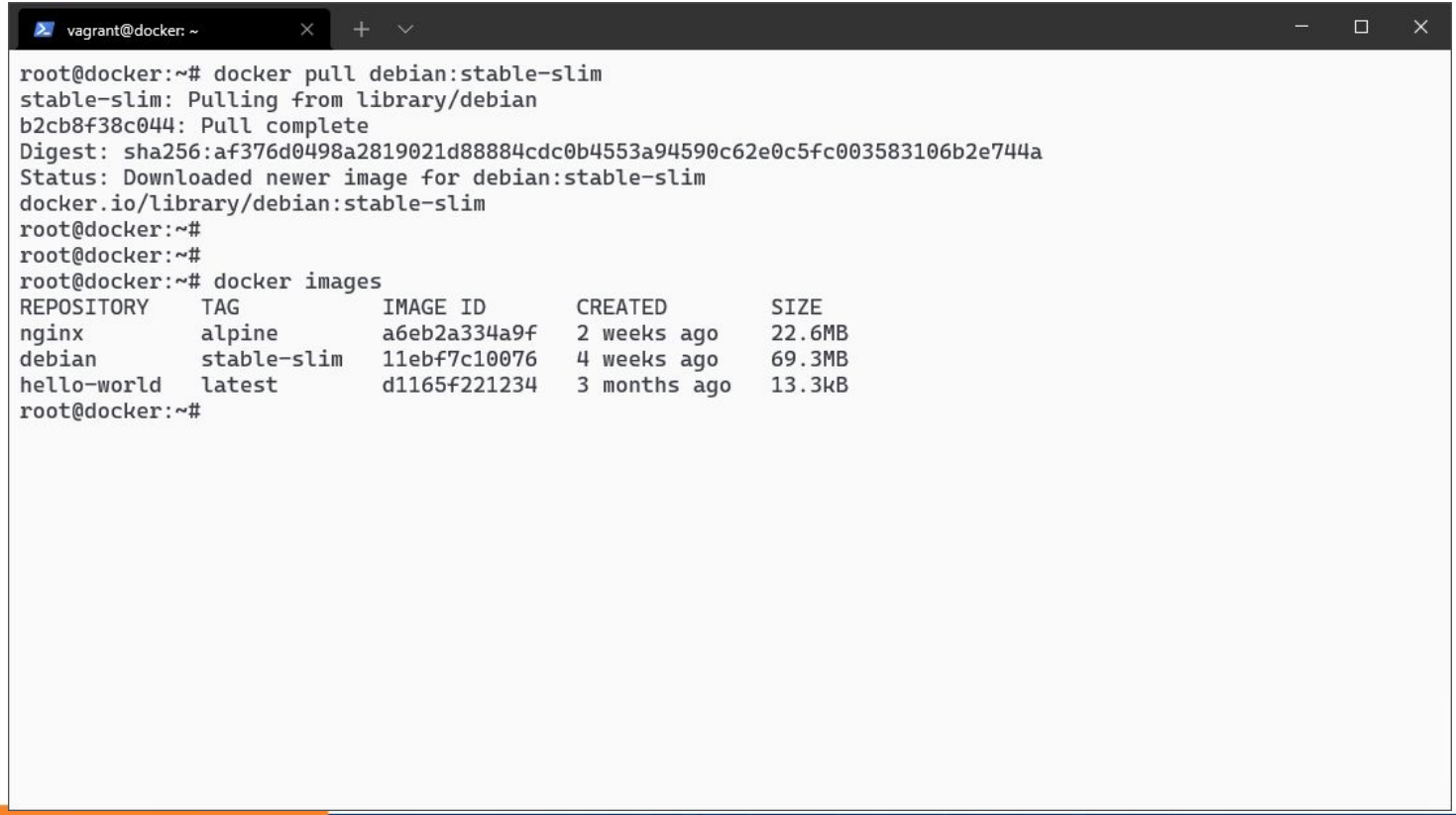
docker rm

```
root@docker:~# docker run alpine
root@docker:~# docker ps -a
CONTAINER ID   IMAGE     COMMAND     CREATED          STATUS                      PORTS     NAMES
33958a7b6960   alpine    "/bin/sh"   5 seconds ago    Exited (0) 3 seconds ago              compassionate_wescoff
root@docker:~# docker rm compassionate_wescoff
compassionate_wescoff
root@docker:~#
root@docker:~# docker ps -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@docker:~#
```

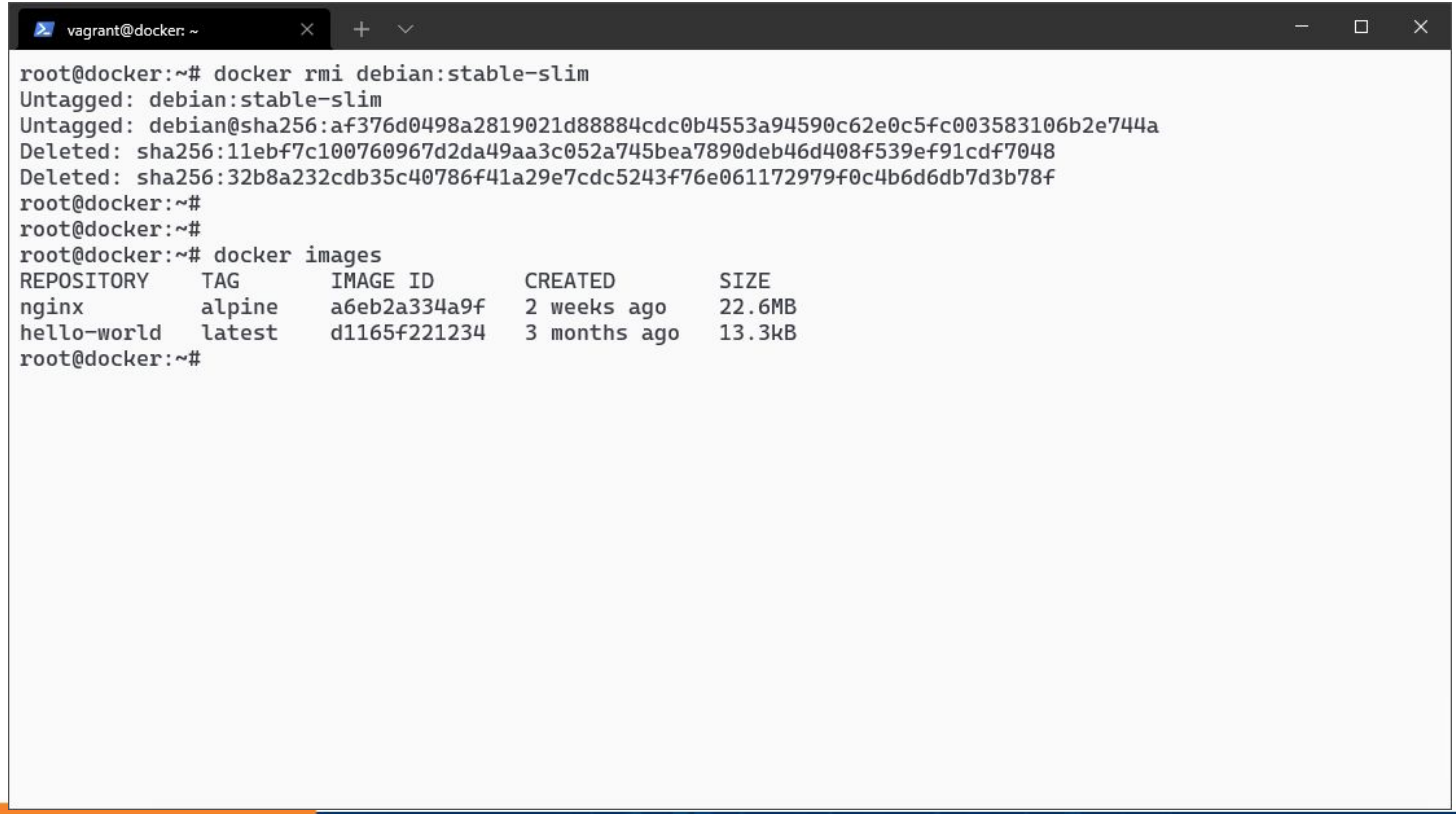
docker images

```
root@docker:~# docker images
REPOSITORY                    TAG         IMAGE ID       CREATED         SIZE
example-voting-app-worker     latest      217475583bd1   2 hours ago     194MB
example-voting-app-result     latest      4cec867d7554   2 hours ago     266MB
example-voting-app-vote       latest      8e600062fb12   2 hours ago     145MB
nginx                         latest      bc649bab30d1   2 days ago      187MB
postgres                      15-alpine   9f959158ce82   9 days ago      237MB
nginx                         alpine      d571254277f6   2 weeks ago     42.6MB
alpine                        latest      8ca4688f4f35   2 weeks ago     7.34MB
redis                         alpine      2d5230e57b1b   5 weeks ago     37.8MB
busybox                       latest      a416a98b71e2   2 months ago    4.26MB
hello-world                   latest      9c7a54a9a43c   5 months ago    13.3kB
fbscarel/myapp-color          latest      9ce9b81d5bac   3 years ago     51.5MB
```

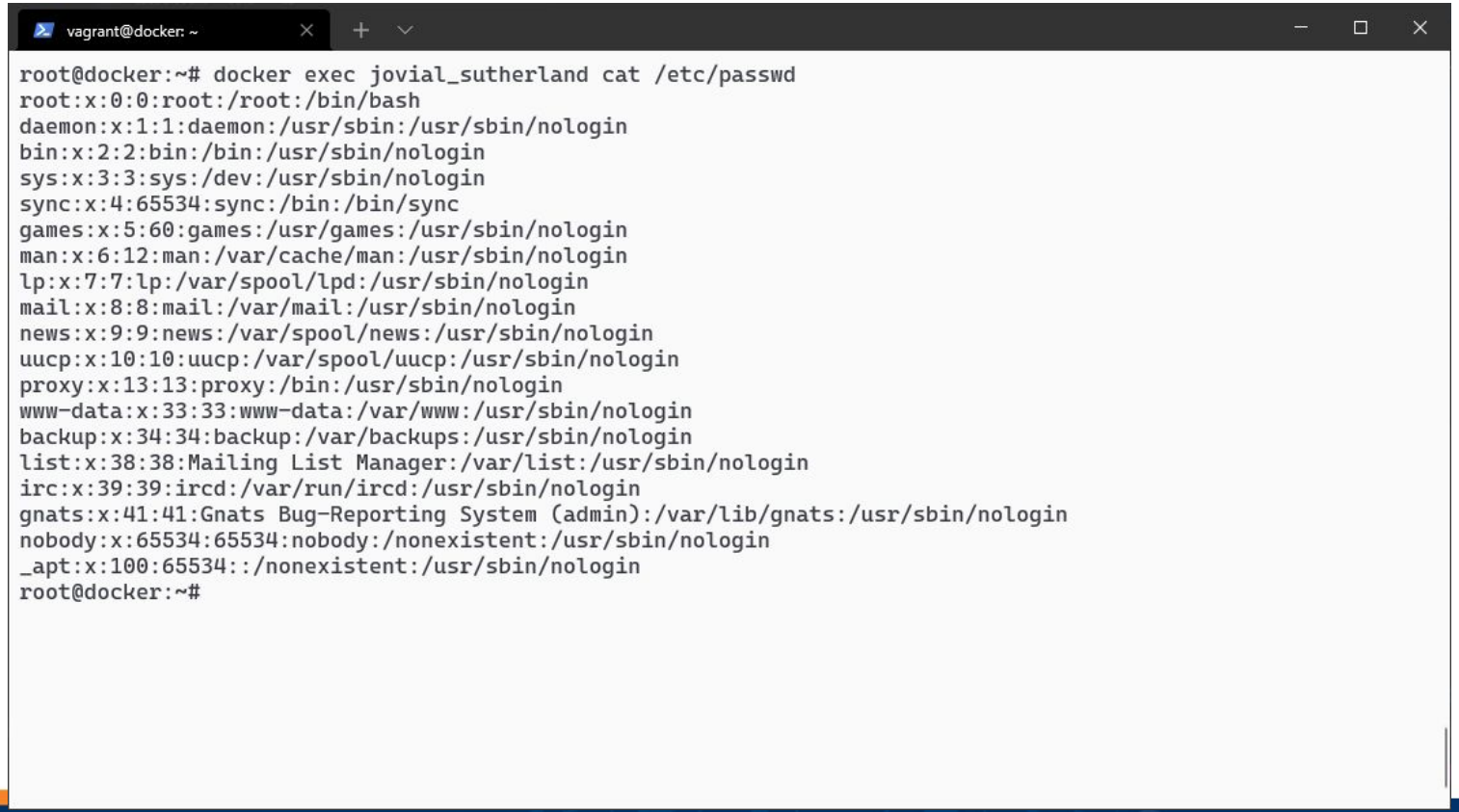
docker pull


vagrant@docker: ~
root@docker:~# docker pull debian:stable-slim
stable-slim: Pulling from library/debian
b2cb8f38c044: Pull complete
Digest: sha256:af376d0498a2819021d88884cdc0b4553a94590c62e0c5fc003583106b2e744a
Status: Downloaded newer image for debian:stable-slim
docker.io/library/debian:stable-slim
root@docker:~#
root@docker:~#
root@docker:~# docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
nginx alpine a6eb2a334a9f 2 weeks ago 22.6MB
debian stable-slim 11ebf7c10076 4 weeks ago 69.3MB
hello-world latest d1165f221234 3 months ago 13.3kB
root@docker:~#

docker rmi


vagrant@docker: ~
root@docker:~# docker rmi debian:stable-slim
Untagged: debian:stable-slim
Untagged: debian@sha256:af376d0498a2819021d88884cdc0b4553a94590c62e0c5fc003583106b2e744a
Deleted: sha256:11ebf7c100760967d2da49aa3c052a745bea7890deb46d408f539ef91cdf7048
Deleted: sha256:32b8a232cdb35c40786f41a29e7cdc5243f76e061172979f0c4b6d6db7d3b78f
root@docker:~#
root@docker:~#
root@docker:~# docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
nginx alpine a6eb2a334a9f 2 weeks ago 22.6MB
hello-world latest d1165f221234 3 months ago 13.3kB
root@docker:~#

docker exec

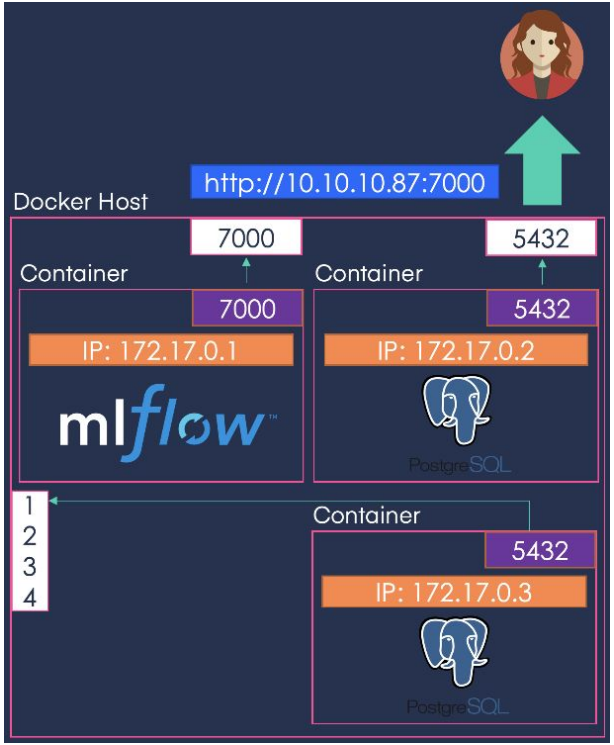

vagrant@docker: ~
root@docker:~# docker exec jovial_sutherland cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
_apt:x:100:65534::/nonexistent:/usr/sbin/nologin
root@docker:~#

Expondo portas de containers

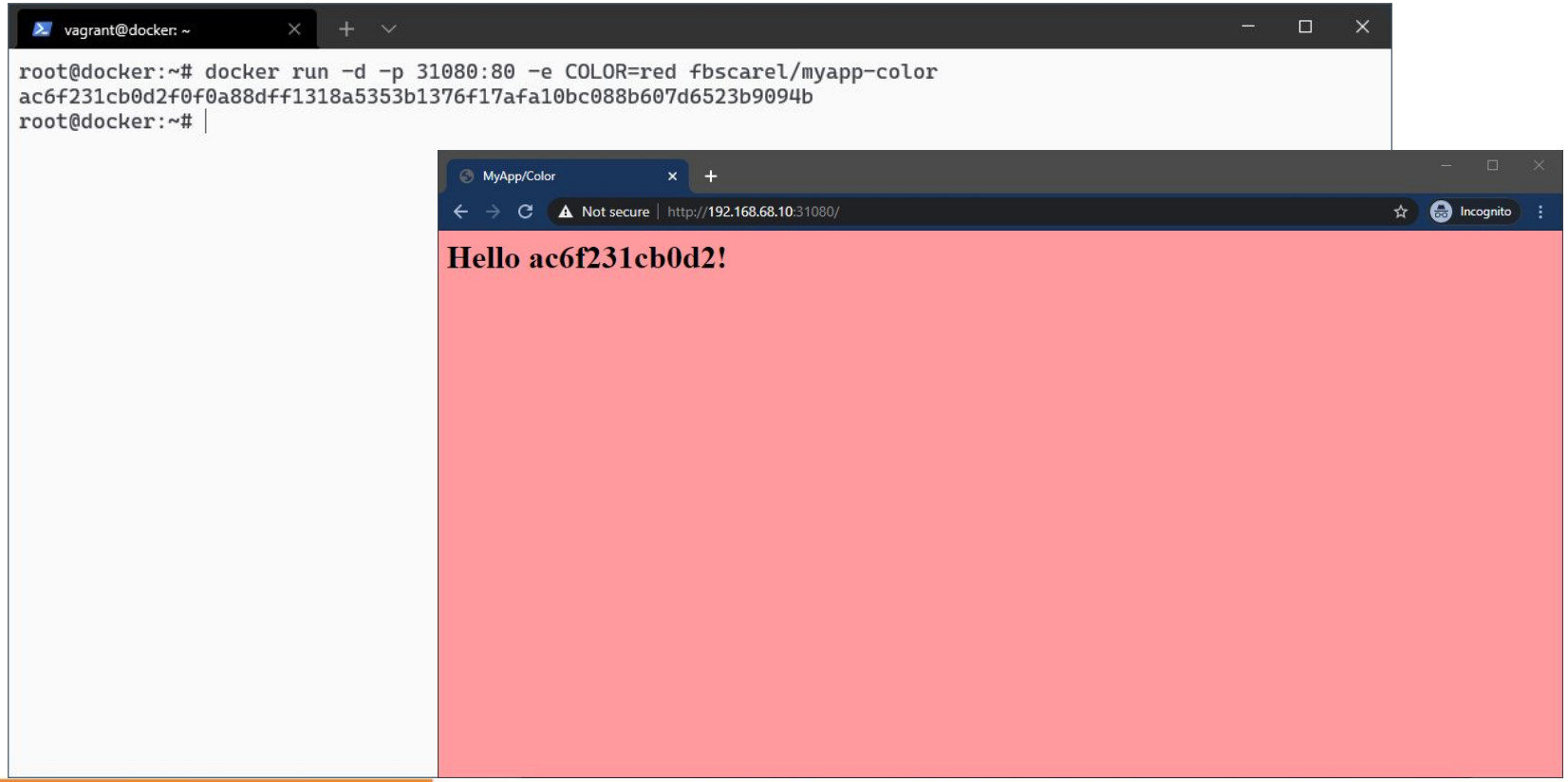
```
root@docker:~# docker run --rm -d -p 80:80 fbscarel/myapp-color
Unable to find image 'fbscarel/myapp-color:latest' locally
latest: Pulling from fbscarel/myapp-color
df20fa9351a1: Pull complete
36b3adc4ff6f: Pull complete
8ad3a11d3b57: Pull complete
46f8f816bc3b: Pull complete
93b61091891f: Pull complete
c8255aeac7cd: Pull complete
b5899b1f8004: Pull complete
Digest: sha256:0e8179db14378826d62d1934fe56d23f78d3f4c18cd97ae1642cb56eb553bf23
Status: Downloaded newer image for fbscarel/myapp-color:latest
824d7680bf20e4d12a39103cdb3d161a675a7debe07c9fdac5c190cb27df0747
root@docker:~#
root@docker:~# curl localhost
<html>
  <head>
    <title>MyApp/Color</title>
  </head>
  <body style="background: #7ac8ee;"></body>
    <h1>Hello 824d7680bf20!</h1>
  </body>
</html>root@docker:~#
```

Expondo portas de containers

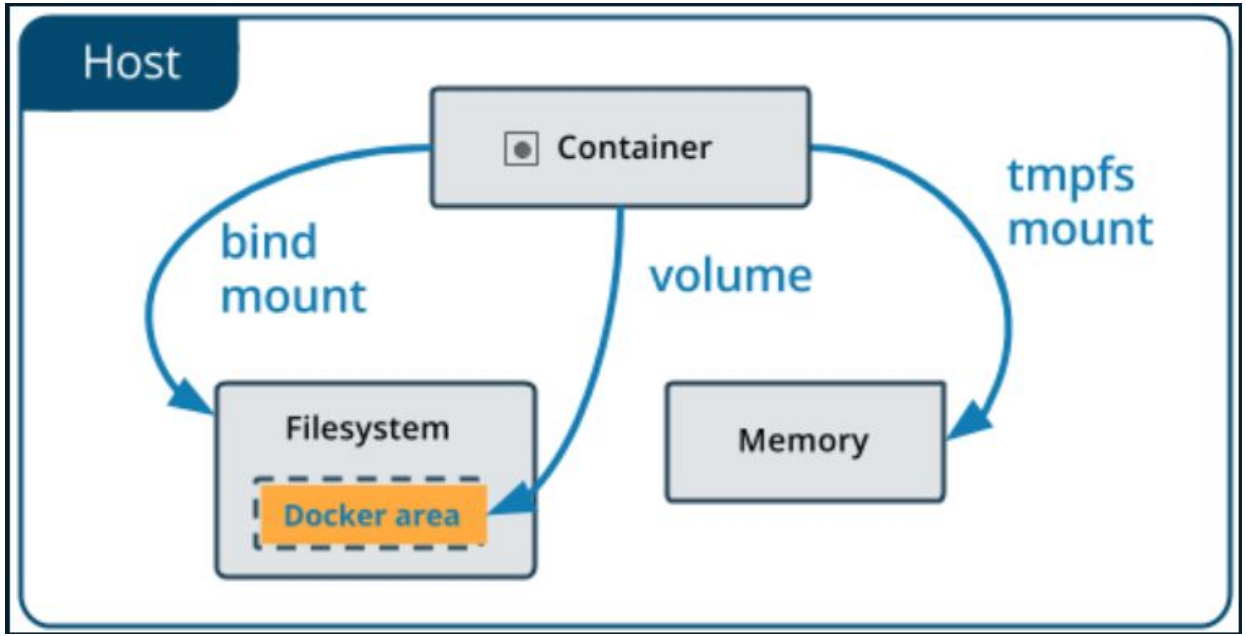
Diversas portas podem ser expostas para o mesmo container, ou para diferentes containers, no *host* físico ou virtual



Variáveis de ambiente



Mapeando volumes



https://docs.docker.com/storage/volumes/

Mapeando volumes

Mapeando diretório específico do filesystem do host (bind mount)

docker run -v /tmp/app:/app nginx

Criando volumes

docker volume create app1 (opcional)

docker run -v app1:/app nginx

docker volume inspect app1


```
[
  {
    "CreatedAt": "2019-08-18T14:00:16Z",
    "Driver": "local",
    "Labels": {},
    "Mountpoint": "/var/lib/docker/volumes/app1/_data",
    "Name": "app1",
    "Options": {},
    "Scope": "local"
  }
]
```

Mapeando volumes

```
root@docker:~# docker run -d --name redis redis:alpine
d31ae04306df32f9f1ccaa1f2bd18f82fc0f11eff462e45071f2fcfe90aa19e7
root@docker:~#
root@docker:~# docker exec redis redis-cli set fruta banana
OK
root@docker:~# docker exec redis redis-cli set cor azul
OK
root@docker:~# docker exec redis redis-cli get fruta
banana
root@docker:~# docker exec redis redis-cli get cor
azul
root@docker:~# docker exec redis redis-cli save
OK
root@docker:~# docker rm -f redis
redis
root@docker:~# docker run -d --name redis redis:alpine
304e0bbde21b762a46235ef0459be8623dfc5e8f4e10d054e21c8037607072a6
root@docker:~#
root@docker:~# docker exec redis redis-cli get fruta
```

Mapeando volumes

```
root@docker:~# docker run -d --name redis -v data:/data redis:alpine
d2f505d17240a7b63334249e44cee15cb2c07b80ae14619953a99ba2dbf72fc6
root@docker:~# docker exec redis redis-cli set fruta banana
OK
root@docker:~# docker exec redis redis-cli set cor azul
OK
root@docker:~# docker exec redis redis-cli save
OK
root@docker:~# docker rm -f redis
redis
root@docker:~#
root@docker:~# docker run -d --name redis -v data:/data redis:alpine
e0e505b06581433ad7963b6eb88935e80775214a87520fc74e06b582c322527c
root@docker:~#
root@docker:~# docker exec redis redis-cli get fruta
banana
root@docker:~# docker exec redis redis-cli get cor
azul
```

docker logs

```
root@docker:~# docker run -d -p 80:80 nginx:alpine
36ddf66a5358b42f1ee856eec454ab320b176cf15fb124c123eb195c2f69340c
doroot@docker:~# docker logs silly_ganguly
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
```

```
root@docker:~# curl localhost
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>
```

```
root@docker:~# docker logs -n 1 silly_ganguly
172.17.0.1 - - [14/Oct/2023:04:44:46 +0000] "GET / HTTP/1.1" 200 615 "-" "curl/7.74.0" "-"
```

Dockerfiles

git clone https://github.com/fbscarel/myapp-color.git
cd myapp-color
cat Dockerfile

```
FROM python:3.6-alpine

WORKDIR /opt

COPY . /opt/

RUN pip install -r requirements.txt

EXPOSE 80

ENTRYPOINT ["python", "app.py"]
```

```
FROM python

WORKDIR /opt

COPY . /opt/

RUN pip install -r requirements.txt

EXPOSE 80

ENTRYPOINT ["python", "app.py"]
```

docker *build*

imagem python

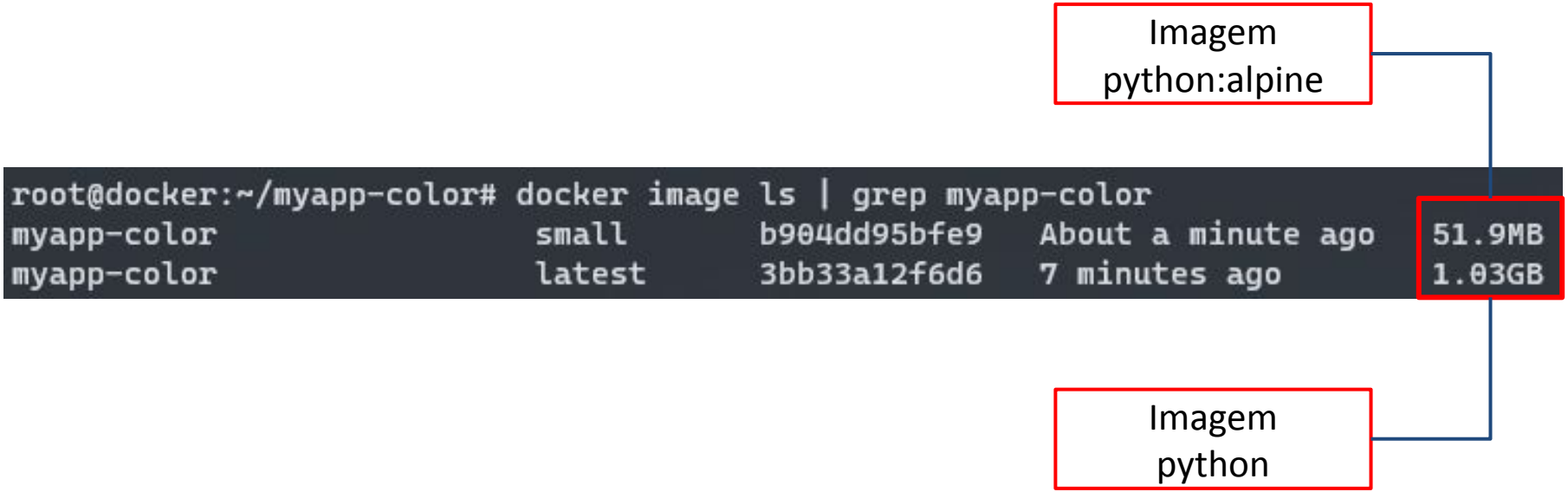
```
root@docker:~/myapp-color# docker build -t myapp-color .
[+] Building 140.4s (9/9) FINISHED                                                                                       docker:default
 => [internal] load build definition from Dockerfile                                                                              0.2s
 => => transferring dockerfile: 158B                                                                                              0.0s
 => [internal] load .dockerignore                                                                                                 0.3s
 => => transferring context: 2B                                                                                                   0.0s
 => [internal] load metadata for docker.io/library/python:latest                                                                  2.8s
 => [1/4] FROM docker.io/library/python@sha256:1615c71b5f3d48844b8d20cac4838f34267d96c3b061dcb6e4fda61a71599a9d                121.3s
 => => resolve docker.io/library/python@sha256:1615c71b5f3d48844b8d20cac4838f34267d96c3b061dcb6e4fda61a71599a9d                  0.2s
 => => sha256:1615c71b5f3d48844b8d20cac4838f34267d96c3b061dcb6e4fda61a71599a9d 2.14kB / 2.14kB                                   0.0s
 => => sha256:c29963e5963a17bda75b34b04d0eda9f01b3f0e1811b22dcfb095a6145c1ebe8 2.01kB / 2.01kB                                   0.0s
 => => sha256:3c055746a2ccda17e451bae4cd77b3acd7d91f6163acfd008cbab0ff139ac5b1 7.30kB / 7.30kB                                   0.0s
 => => sha256:1ccc26d841b4acc2562483bf393ce1cf8bc358ced09ccd825425226827c79c92 24.05MB / 24.05MB                                 6.2s
 => => sha256:0a9573503463fd3166b5b1f34a7720dac28609e98d731e50e7068f92e79b8545 49.58MB / 49.58MB                                 8.4s
 => => sha256:800d84653581fc119cd75cd572fa190d3b813d49221b9e5ee463e3560e2cb342 64.13MB / 64.13MB                                16.6s
 => => sha256:7c632e57ea62ea950c367f484f52cdcfd2adb12060a31f5c413f40db9822e96e 211.06MB / 211.06MB                              33.4s
 => => sha256:f9a1922eee8a7d8ea8d227102bf5b6671dd4f68a152a438c803c54092410bb28 6.39MB / 6.39MB                                  10.0s
 => => extracting sha256:0a9573503463fd3166b5b1f34a7720dac28609e98d731e50e7068f92e79b8545                                       24.0s
 => => sha256:7c45daddd450da82621d3670e1862f4b8a0da6a7a2fd7b3d123689bd9bb14850 22.51MB / 22.51MB                                14.7s
 => => sha256:0952bd8ba4ecedd2507f098cb24a60895729d644dfef9b7240bee40c07910e0e 242B / 242B                                      15.1s
 => => sha256:f0f1ba98266589a2bb0ea1ced8bd1309f5cd3e59047429a16610db082554e75d 2.67MB / 2.67MB                                  16.1s
 => => extracting sha256:1ccc26d841b4acc2562483bf393ce1cf8bc358ced09ccd825425226827c79c92                                        4.9s
 => => extracting sha256:800d84653581fc119cd75cd572fa190d3b813d49221b9e5ee463e3560e2cb342                                       17.7s
 => => extracting sha256:7c632e57ea62ea950c367f484f52cdcfd2adb12060a31f5c413f40db9822e96e                                       53.7s
 => => extracting sha256:f9a1922eee8a7d8ea8d227102bf5b6671dd4f68a152a438c803c54092410bb28                                        2.2s
 => => extracting sha256:7c45daddd450da82621d3670e1862f4b8a0da6a7a2fd7b3d123689bd9bb14850                                        4.5s
 => => extracting sha256:0952bd8ba4ecedd2507f098cb24a60895729d644dfef9b7240bee40c07910e0e                                        0.0s
 => => extracting sha256:f0f1ba98266589a2bb0ea1ced8bd1309f5cd3e59047429a16610db082554e75d                                        1.5s
 => [internal] load build context                                                                                                 0.3s
 => => transferring context: 36.65kB                                                                                             0.1s
 => [2/4] WORKDIR /opt                                                                                                            2.5s
 => [3/4] COPY . /opt/                                                                                                            0.5s
 => [4/4] RUN pip install -r requirements.txt                                                                                    11.8s
 => exporting to image                                                                                                            0.7s
 => => exporting layers                                                                                                           0.7s
 => => writing image sha256:3bb33a12f6d6ba1738add80729b6e2b873dfc404421832865d3d568531d66eaf                                      0.0s
 => => naming to docker.io/library/myapp-color                                                                                    0.0s
```

docker *build*

imagem python:alpine

```
root@docker:~/myapp-color# docker build -t myapp-color:small .
[+] Building 27.1s (9/9) FINISHED                                                                                    docker:default
 => [internal] load build definition from Dockerfile                                                                          0.1s
 => => transferring dockerfile: 171B                                                                                          0.0s
 => [internal] load .dockerignore                                                                                             0.1s
 => => transferring context: 2B                                                                                               0.0s
 => [internal] load metadata for docker.io/library/python:3.6-alpine                                                          3.2s
 => [1/4] FROM docker.io/library/python:3.6-alpine@sha256:579978dec4602646fe1262f02b96371779bfb0294e92c91392707fa            8.3s
 => => resolve docker.io/library/python:3.6-alpine@sha256:579978dec4602646fe1262f02b96371779bfb0294e92c91392707fa            0.1s
 => => sha256:579978dec4602646fe1262f02b96371779bfb0294e92c91392707fa999c0c989 1.65kB / 1.65kB                               0.0s
 => => sha256:bc3447f6ba006c2268ccab840236cd1e27502a1d9133381f17db8bfc603bc810 1.37kB / 1.37kB                               0.0s
 => => sha256:3a9e80fa460687aa888ebe54540132662b58a3bb1a222c3809fd412d4652eb9c 8.08kB / 8.08kB                               0.0s
 => => sha256:59bf1c3509f33515622619af21ed55bbe26d24913cedbca106468a5fb37a50c3 2.82MB / 2.82MB                               2.1s
 => => sha256:8786870f287676cca49c1e1e5029467c087ad293b824fcddc489cbe2819745b2 282.15kB / 282.15kB                           0.5s
 => => sha256:acb0e804800ed3c10624ddeac73a6ebd3f2d6dbb03970f054233ae066cd033ba 10.18MB / 10.18MB                             2.3s
 => => sha256:52bedcb3e853dd5d782c46d387f2af404af9ec75c2aba3a3114e9fbf913c82ed 229B / 229B                                   0.9s
 => => sha256:b064415ed3d75cd9bf462c4ea1a29aebe67dfe8fc76e672dc6bd72f29e91061b 2.21MB / 2.21MB                               1.7s
 => => extracting sha256:59bf1c3509f33515622619af21ed55bbe26d24913cedbca106468a5fb37a50c3                                    0.6s
 => => extracting sha256:8786870f287676cca49c1e1e5029467c087ad293b824fcddc489cbe2819745b2                                    0.1s
 => => extracting sha256:acb0e804800ed3c10624ddeac73a6ebd3f2d6dbb03970f054233ae066cd033ba                                    2.7s
 => => extracting sha256:52bedcb3e853dd5d782c46d387f2af404af9ec75c2aba3a3114e9fbf913c82ed                                    0.0s
 => => extracting sha256:b064415ed3d75cd9bf462c4ea1a29aebe67dfe8fc76e672dc6bd72f29e91061b                                    1.0s
 => [internal] load build context                                                                                             0.1s
 => => transferring context: 2.21kB                                                                                           0.0s
 => [2/4] WORKDIR /opt                                                                                                        1.1s
 => [3/4] COPY . /opt/                                                                                                        0.3s
 => [4/4] RUN pip install -r requirements.txt                                                                                13.0s
 => exporting to image                                                                                                        0.7s
 => => exporting layers                                                                                                       0.7s
 => => writing image sha256:b904dd95bfe9ca9525b713d9f21ba3c046212f38389b8716bb02e76f12dca0b5                                  0.0s
 => => naming to docker.io/library/myapp-color:small                                                                          0.0s
```

docker *build*



Executando comandos na invocação

CMD

```
FROM alpine

CMD ["echo", "alô mundo"]
```

```
root@docker:~# docker run cmd
alô mundo
root@docker:~# docker run cmd "alô alunos"
docker: Error response from daemon: failed to create task for container:
 failed to create shim task: OCI runtime create failed: runc create fail
ed: unable to start container process: exec: "alô alunos": executable fi
le not found in $PATH: unknown.
ERRO[0001] error waiting for container:
```

ENTRYPOINT

```
FROM alpine

ENTRYPOINT ["echo", "alô mundo"]
```

```
root@docker:~# docker run entrypoint
alô mundo
root@docker:~# docker run entrypoint alunos
alô mundo alunos
```

Executando comandos na invocação

CMD + ENTRYPOINT

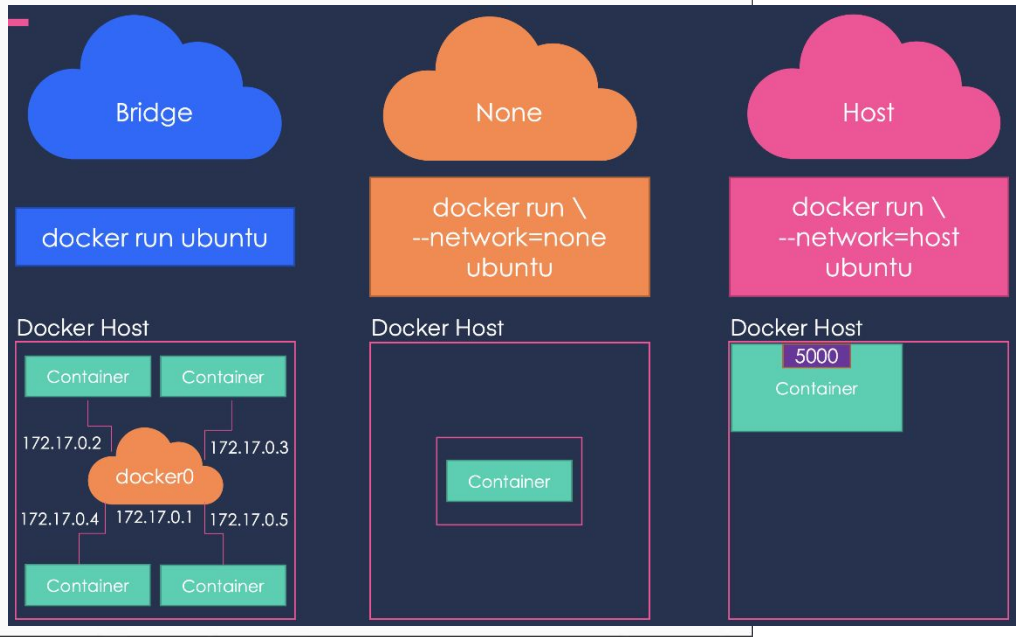
```
FROM alpine

ENTRYPOINT ["echo"]

CMD ["alô mundo"]
```

```
root@docker:~# docker run entrypoint_cmd
alô mundo
root@docker:~# docker run entrypoint_cmd "alô alunos"
alô alunos
```

Redes no Docker

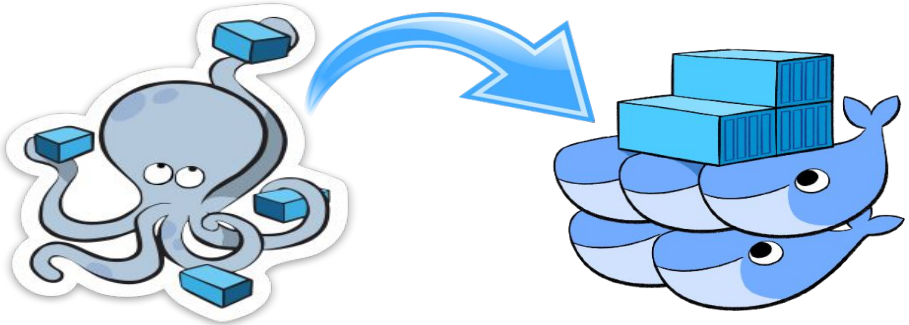
vagrant@docker: ~

```
root@docker:~# docker network ls
NETWORK ID     NAME      DRIVER    SCOPE
c32a8356cd6f   bridge    bridge    local
0de5ae720006   host      host      local
1c6d24ddc0b8   none      null      local
root@docker:~#
```



Construindo serviços com o Docker Compose

- Múltiplos containers compondo uma aplicação
- Arquivo YAML declarativo
- Primeiro passo para orquestração



Docker-Compose

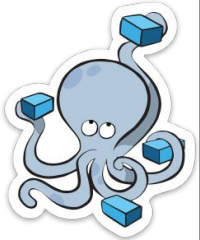
Docker Swarm

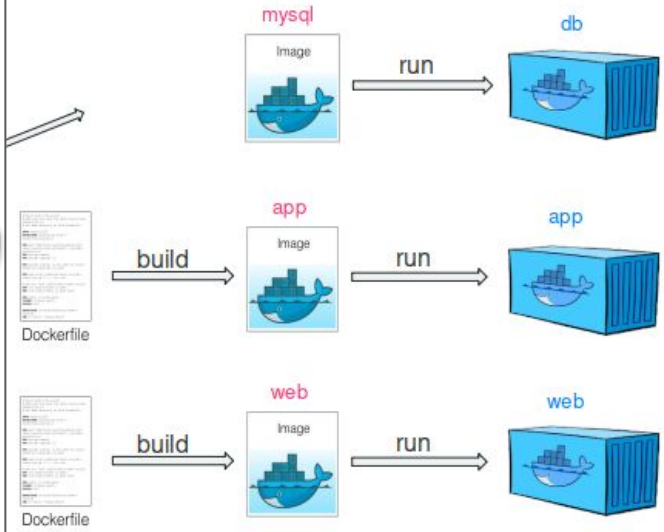
```
→ container-php tree --dirsfirst
.
├── docker
│   ├── database
│   │   └── Dockerfile
│   ├── nginx
│   │   └── Dockerfile
│   ├── php-fpm
│   │   └── Dockerfile
│   ├── compose-alternativo.yml
│   └── docker-compose.yml
└── src
```

Docker Compose

docker-compose.yml

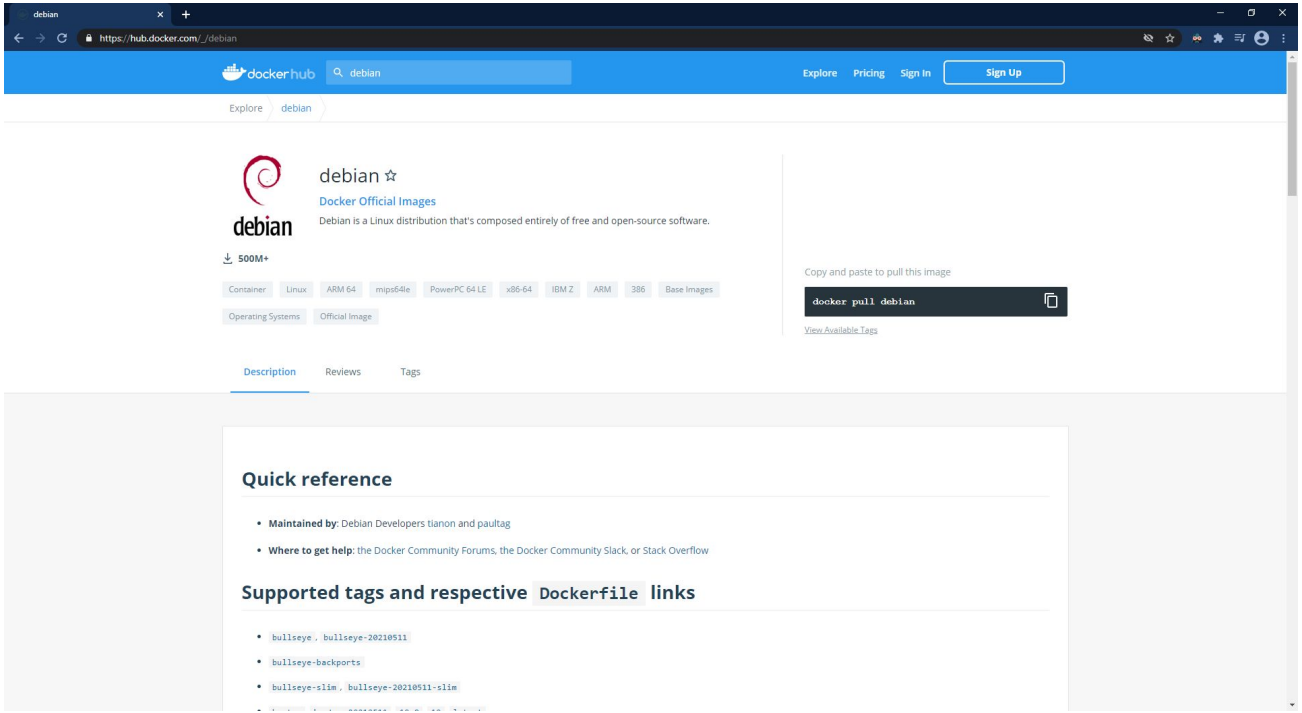
```
version: '3.7'
services:
  db:
    image: mysql:8.0.19
    restart: always
    environment:
      - MYSQL_DATABASE=exemplo
      - MYSQL_ROOT_PASSWORD=password
  app:
    build: .
        context: ./src
        dockerfile: dockerfile-alternativo
    restart: always
    depends_on: db
  web:
    image: nginx
    restart: always
    ports:
      - 80:80
```



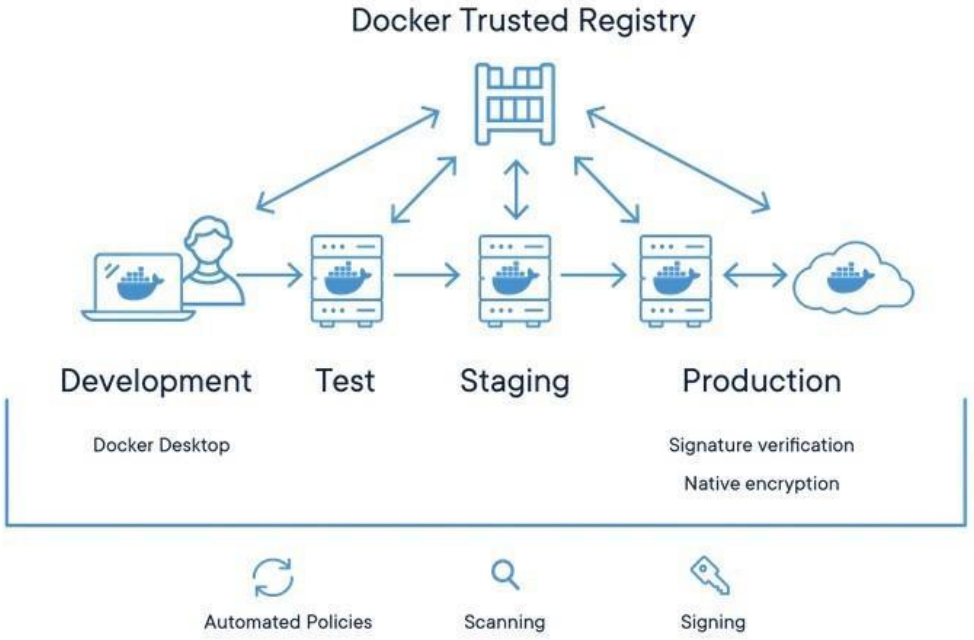


docker compose up --scale [service=número]

Docker Hub


debian
https://hub.docker.com/_/debian
dockerhub
debian
Explore
Pricing
Sign In
Sign Up
Explore
debian
debian ☆
Docker Official Images
Debian is a Linux distribution that's composed entirely of free and open-source software.
500M+
Container
Linux
ARM 64
mips64le
PowerPC 64 LE
x86-64
IBM Z
ARM
386
Base Images
Operating Systems
Official Image
Copy and paste to pull this image
docker pull debian
View Available Tags
Description
Reviews
Tags
Quick reference
Maintained by: Debian Developers tianon and paultag
Where to get help: the Docker Community Forums, the Docker Community Slack, or Stack Overflow
Supported tags and respective Dockerfile links
bullseye, bullseye-20210511
bullseye-backports
bullseye-slim, bullseye-20210511-slim

Container *private registry*



https://docs.docker.com/registry/deploying/

https://goharbor.io/

Tarefa 1

As atividades práticas desta sessão podem ser obtidas em formato HTML via:

https://bit.ly/notion-ads19
ou
https://bit.ly/ads19-tarefas-s1

ESCOLA SUPERIOR DE REDES

Visão geral sobre containers

RNP ORGANIZAÇÃO SOCIAL DO MCTI

MINISTÉRIO DO TURISMO

MINISTÉRIO DA DEFESA

MINISTÉRIO DA SAÚDE

MINISTÉRIO DA EDUCAÇÃO

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÕES

PÁTRIA AMADA BRASIL GOVERNO FEDERAL