DESVENDANDO O FUNCIONAMENTO POR TRÁS DO DOCKER

Palestrante:
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QUEM É O PALESTRANTE?

Professor Mestre e pesquisador do Instituto Federal da Paraíba (IFPB) desde 2014. Tem mais de 20 anos de experiência na área de Redes de Computadores executando e construíndo projetos que envolvem sistemas virtualizados, roteamento, linux, práticas de segurança, cloud, Devops, entre outros.

Também é membro do grupo OWASP da paraíba

Instrutor oficial da academia CISCO com habilitação para formar outro instrutores.

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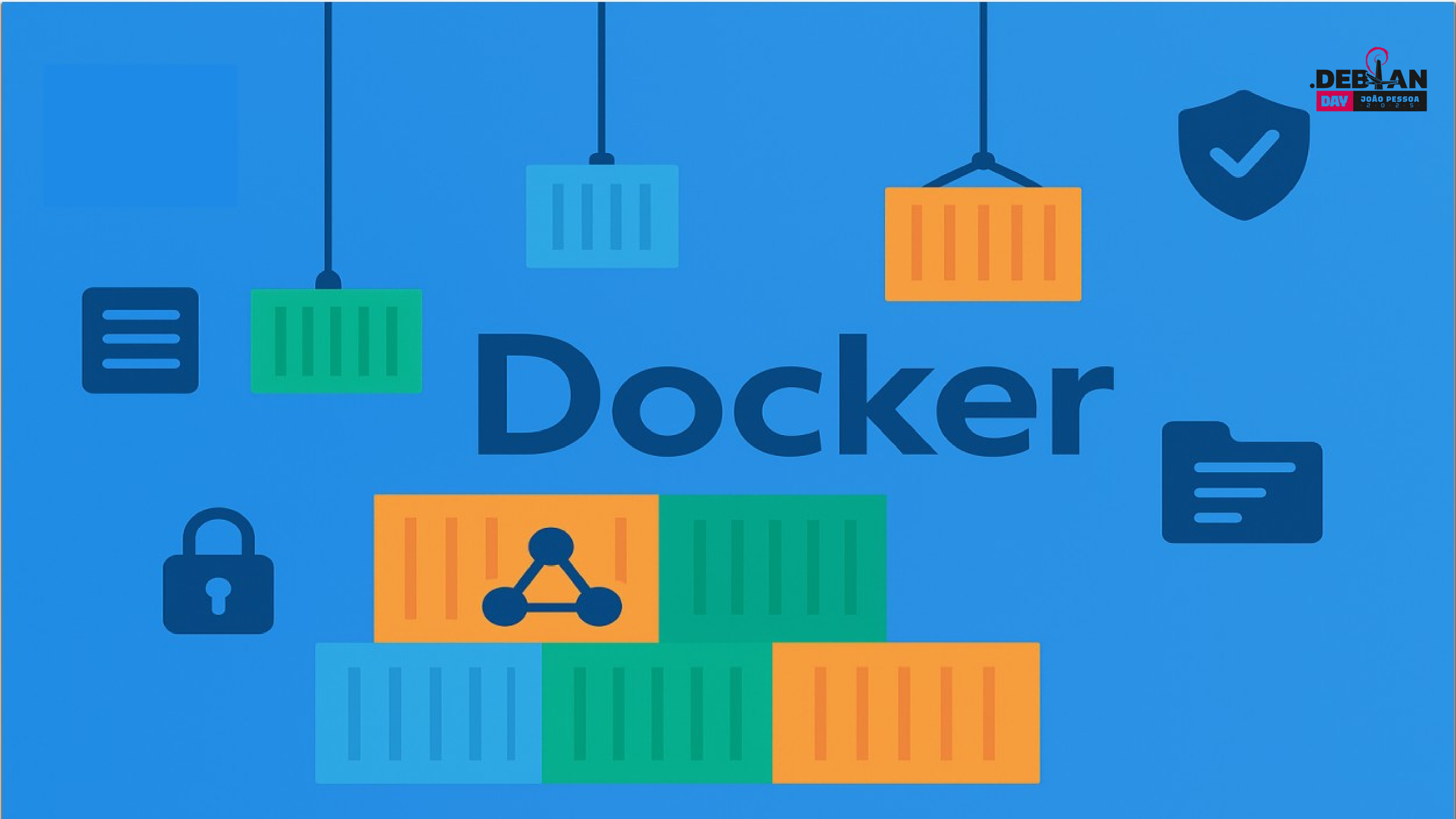
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2025
Docker

HISTÓRIA DAS TECNOLOGIAS DE CONTAINERS NO LINUX

UNIX V7

→ CHROOT

1979

FREEBD JAIL

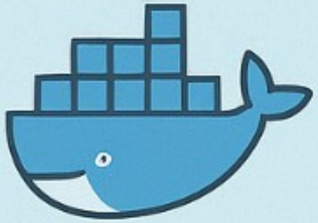
2000

NAMESPACES
(MNT, UTS, IPC, PID, NET, USER)

2002-2013

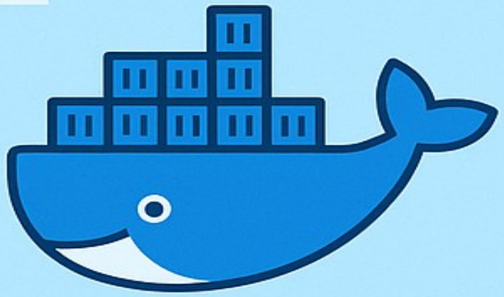
CGROUPS LXC

2006-2007



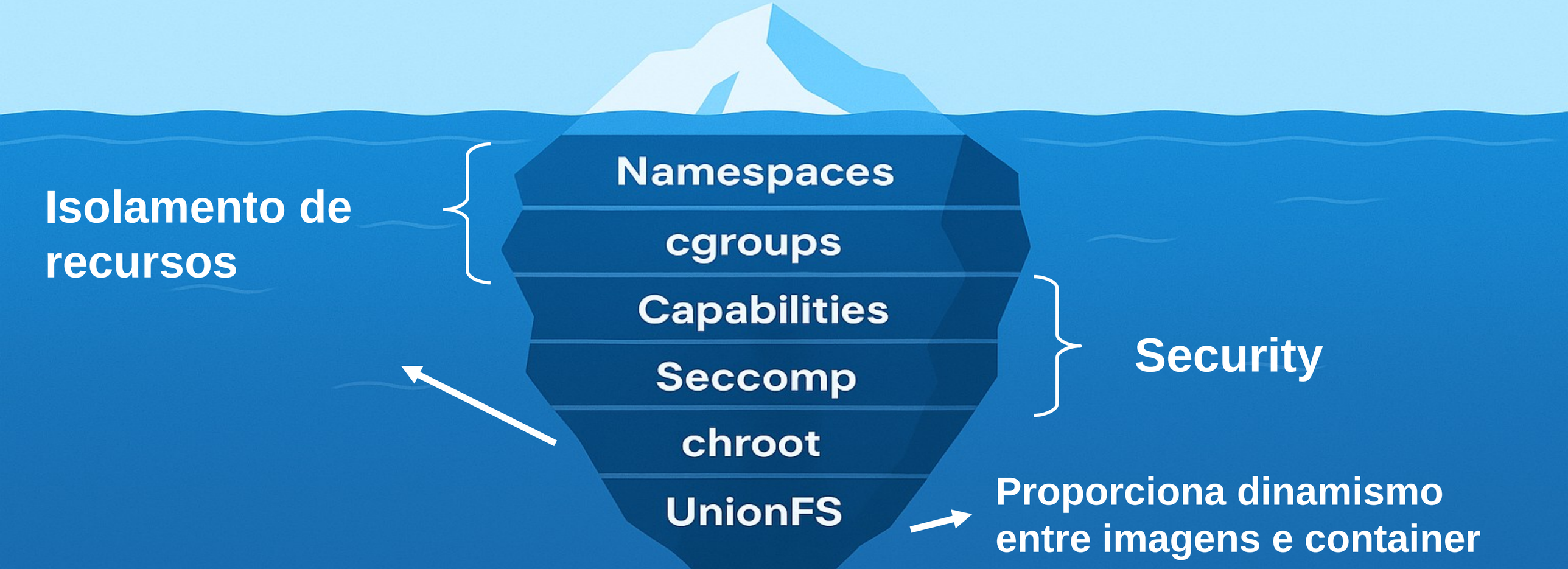
DOCKER

2013



Docker no Linux

Docker no Linux

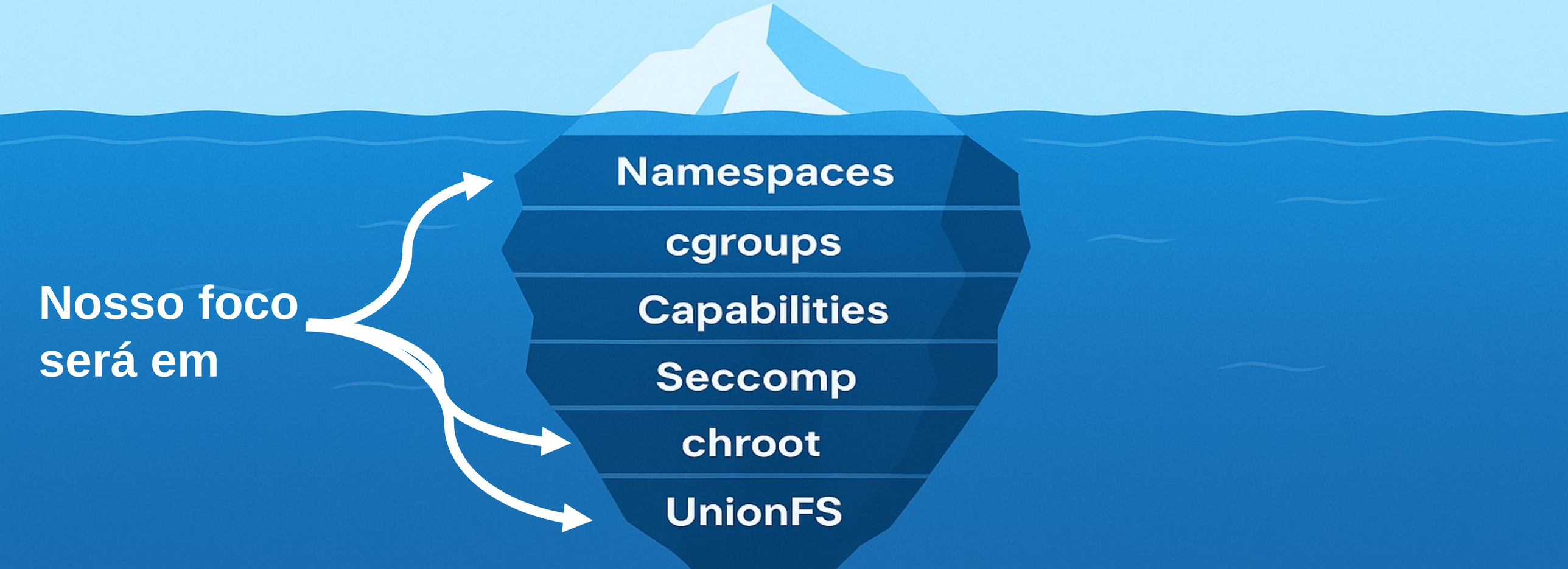


Isolamento de recursos

Security

Proporciona dinamismo entre imagens e container

Docker no Linux



Do dockerfile ao container ...

Camadas da imagem Docker

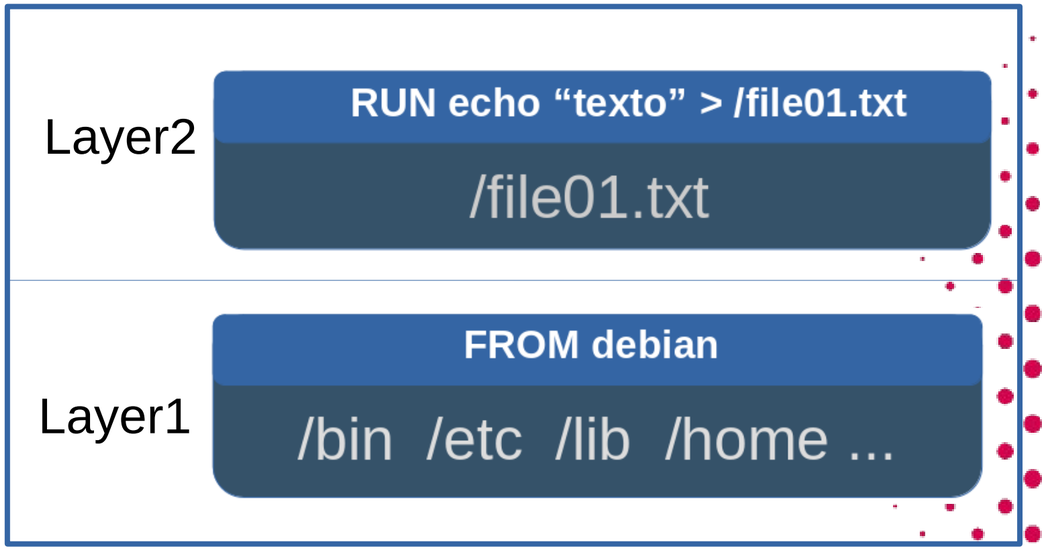
Dockerfile

```
FROM debian:latest
RUN echo "Texto" > /file01.txt
CMD ["tail","-f","/dev/null"]
```

Docker build ....

```
Step 1/3 : FROM debian:latest
 ---> c93961f83a1e
Step 2/3 : RUN echo "Texto" > /file01.txt
 ---> Running in 449e5043eba7
 ---> Removed intermediate container 449e5043eba7
 ---> c565509506de
Step 3/3 : CMD ["tail","-f","/dev/null"]
 ---> Running in fdaff621c92c
 ---> Removed intermediate container fdaff621c92c
 ---> 3d7a820d52c6
Successfully built 3d7a820d52c6
Successfully tagged union-simples:latest
```

Image Docker



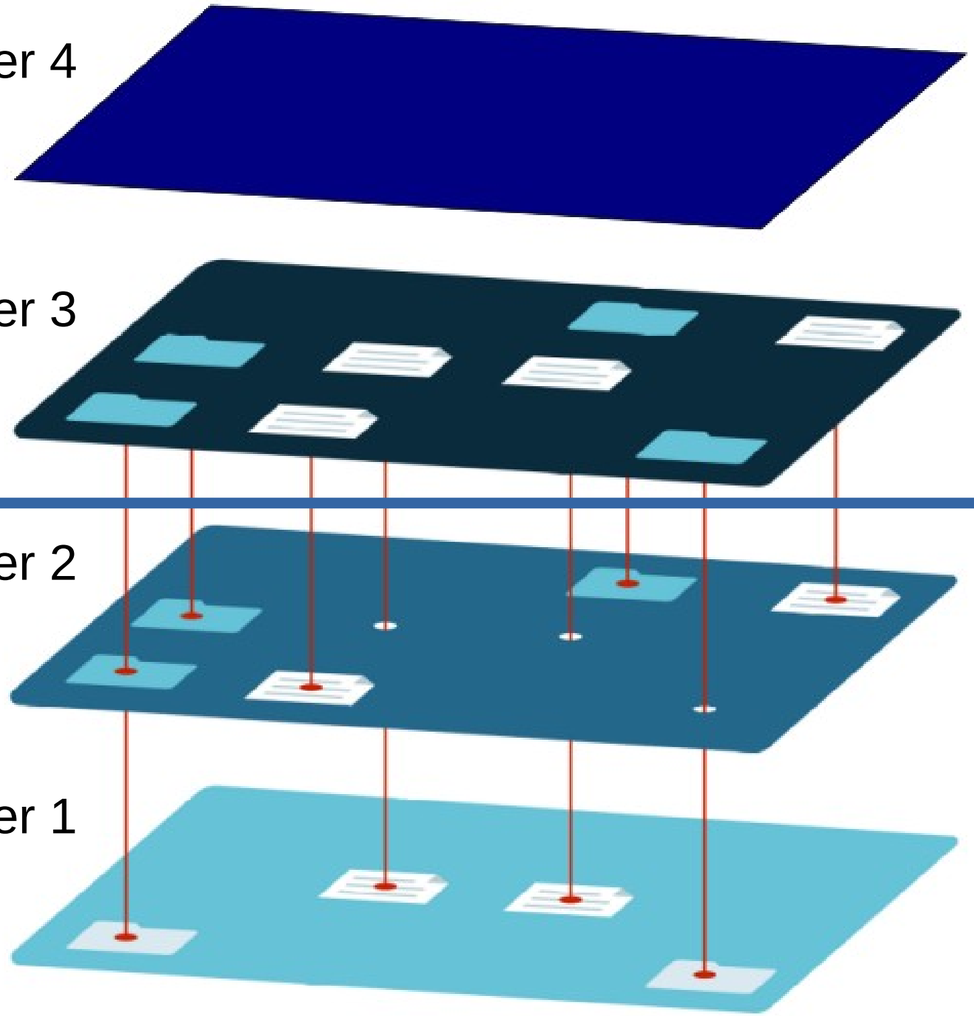
Cada Layer é um diretório em:
/var/lib/docker/overlay2/

A estrutura base das imagens são diretórios que representam as camadas

Camadas do UnionFS (driver overlay2)

Container

Image



UpperDir

MergedDir

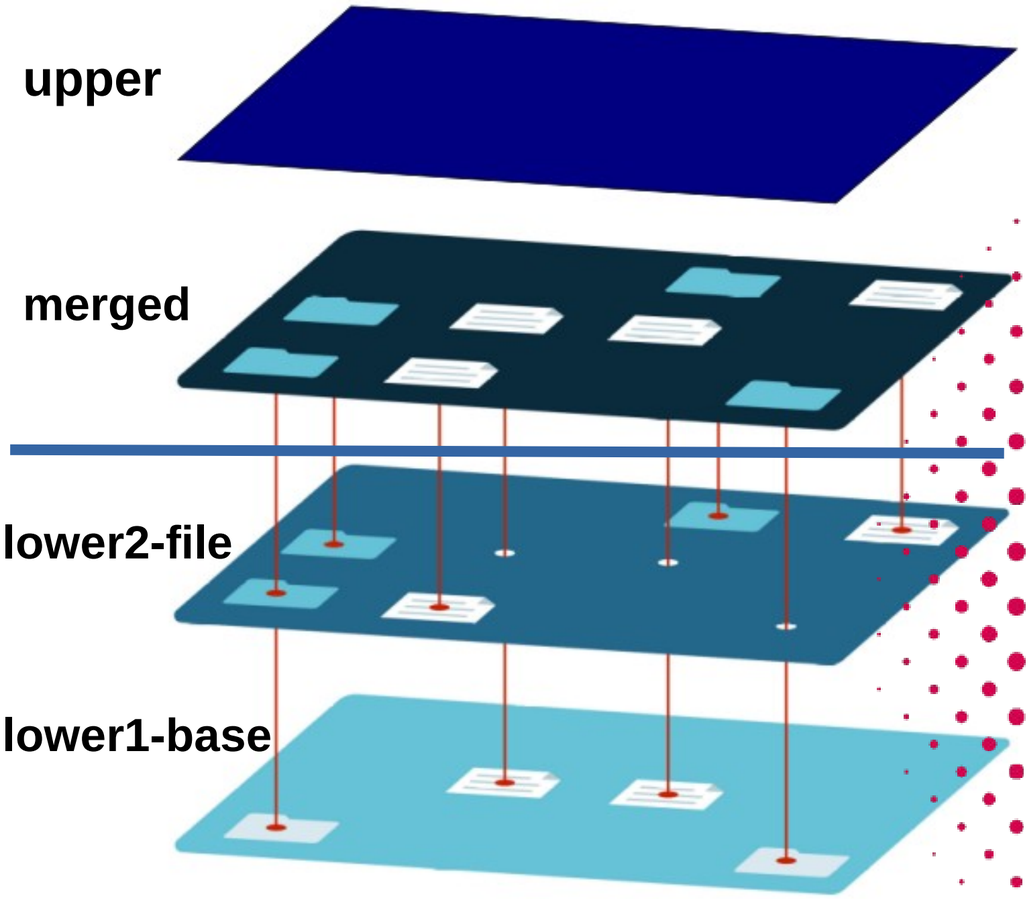
LowerDir

Criando as camadas do UnionFS

```
----------------------------------------
== Diretorios do unionFS
mkdir -p /overlay/{lower1-base,lower2-file,upper,work,merged}

lower1-base  lower2-file  merged  upper  work
```

```
----------------------------------------
== Listando as camadas
ls --color /overlay/{lower1-base,upper,work,merged}

/overlay/lower1-base:
bin   dev  home  lib64  mnt  proc  run   srv  tmp  var
boot  etc  lib   media  opt  root  sbin  sys  usr

/overlay/lower2-file:
file01.txt

/overlay/merged:

/overlay/upper:

/overlay/work:
work
```

Observe que file01.txt
não está em lower1-base



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UnionFS (driver overlay2)

```
----------------------------------------
== Montando o sistema de arquivos Overlay
mount -t overlay overlay -o\
lowerdir=/overlay/lower2-file:/overlay/lower1-base,\
upperdir=/overlay/upper,\
workdir=/overlay/work\  /overlay/merged
```

```
root@meu-pc:~#
df -h | grep overlay
overlay          77G   20G   53G  28% /overlay/merged
```

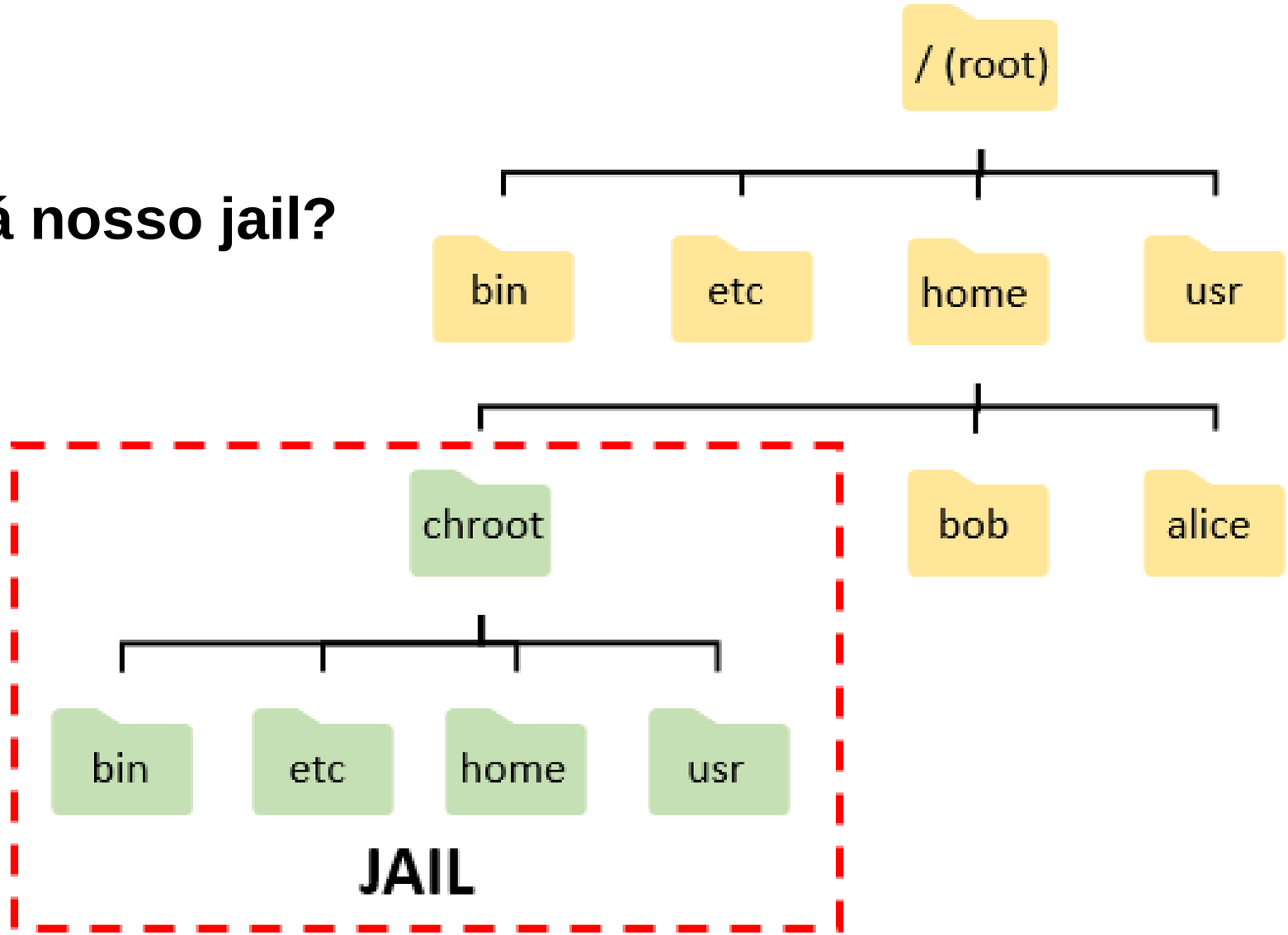
```
root@meu-pc:~#
ls /overlay/merged/
bin   dev  file01.txt  lib    media  opt   root  sbin  sys  usr
boot  etc  home        lib64  mnt    proc  run   srv   tmp  var
```

O arquivo file01.txt na camada merged

chroot (jail)

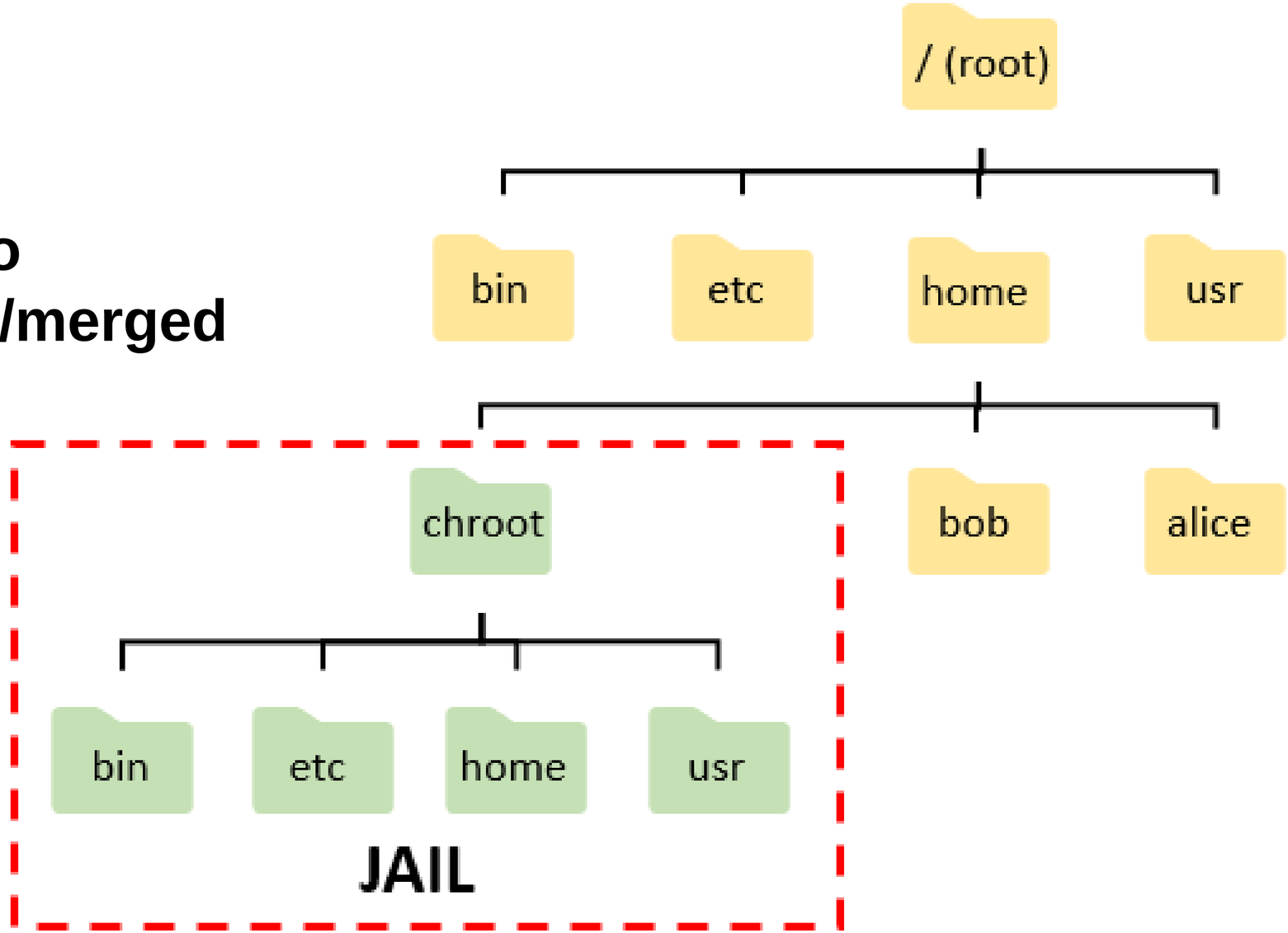
Redireciona o ponteiro do diretório raiz (/) isolando o sistema de arquivos

Quem será nosso jail?



chroot (jail)

Diretório
/overlay/merged



chroot (jail)

```
root@meu-pc:/#
ls /
bin    debian-day  home   lib64       media  overlay  run   sys  var
boot   dev         lib    libx32      mnt    proc     sbin  tmp
dados  etc         lib32  lost+found  opt    root     srv   usr

root@meu-pc:/#
ls /overlay/merged/
bin   dev  file01.txt  lib    media  opt   root  sbin  sys  usr
boot  etc  home        lib64  mnt    proc  run   srv   tmp  var

root@meu-pc:/#
chroot /overlay/merged/
```

Diretório /overlay/merged/ dentro do jail

```
root@meu-pc:/# ls /
bin   dev  file01.txt  lib    media  opt   root  sbin  sys  usr
boot  etc  home        lib64  mnt    proc  run   srv   tmp  var
```

chroot (jail)

Não proporciona isolamento de processos, rede, user...

```
root@meu-pc:/# mount -t proc proc /proc/
root@meu-pc:/# ps ax
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:03 /sbin/init
      2 ?        S      0:00 [kthreadd]
      3 ?        S      0:00 [pool_workqu
      4 ?        I<     0:00 [kworker/R-
      5 ?        I<     0:00 [kworker/R-
      6 ?        I<     0:00 [kworker/R-
      7 ?        I<     0:00 [kworker/R-
      9 ?        I<     0:00 [kworker/0:
     12 ?        I<     0:00 [kworker/R-
     13 ?        I      0:00 [rcu_tasks_
     14 ?        I      0:00 [rcu_tasks_
     15 ?        I      0:00 [rcu_tasks_
     16 ?        S      0:10 [ksoftirqd/
     17 ?        I      0:34 [rcu_preempt
     18 ?        S      0:00 [rcu_exp_par
     19 ?        S      0:00 [rcu_exp_gp_
```

```
root@meu-pc:/# ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKN
oup default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp2s0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fo
 state DOWN group default qlen 1000
    link/ether 20:04:0f:fd:85:f2 brd ff:ff:ff:ff:ff:ff
3: wlp3s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqu
ate UP group default qlen 1000
    link/ether 28:3a:4d:92:d4:29 brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.134/24 brd 10.0.0.255 scope global dynamic nopre
te wlp3s0
       valid_lft 21504sec preferred_lft 21504sec
    inet6 2804:2b5c:e08a:7000:12c7:4e0d:da8a:1bc/64 scope global
rary dynamic
```

Namespaces (unshare)

São uma feature do kernel Linux que isolam vistas de recursos do sistema para um conjunto de processos

Tipos principais

- **pid** — espaço de IDs de processo (processos em ns diferentes podem ter o mesmo PID).
- **net** — pilha de rede (interfaces, roteamento, iptables).
- **uts** — hostname e domainname.
- **ipc** — System V IPC e POSIX message queues.
- **user** — mapeamento UID/GID (permite que um processo seja root *dentro* do namespace mas não fora).
- **cgroup** — visibilidade do namespace de cgroups.

Namespaces (unshare)

```
root@meu-pc:/#
ls /
bin          dev   lib32        media    proc  srv  var
boot         etc   lib64        mnt      root  sys
dados        home  libx32       opt      run   tmp
debian-day   lib   lost+found   overlay  sbin  usr

root@meu-pc:/#
unshare --fork --pid --net --mount-proc=/overlay/merged/proc
 chroot /overlay/merged/
```

Criando isolamento de processo e rede

```
root@meu-pc:/# ls --color /
bin   dev  file01.txt  lib    media  opt   root  sbin  sys  usr
boot  etc  home        lib64  mnt    proc  run   srv   tmp  var
root@meu-pc:/# ps au
USER         PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root           1  0.0  0.0   4332  3536 ?        SN   00:33   0:00 /bin/bash -i
root           6  0.0  0.0   6396  3648 ?        RN+  00:34   0:00 ps au
root@meu-pc:/# ip a
1: lo: <LOOPBACK> mtu 65536 qdisc noop state DOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
```

Namespaces (unshare)

```
FROM debian:latest
RUN echo "Texto" > /file01.txt
CMD ["tail","-f","/dev/null"]
```

```
root@meu-pc:/#
unshare --fork --pid --net --mount-proc=/overlay/merged/proc
 chroot /overlay/merged/  tail -f /dev/null
```

E ahe, curtiu nossa jornada?

Dúvidas?

OBRIGADO! TENHA UM ÓTIMO DEBIAN DAY!