Kaniko

Rootless Container Builds in 2026

slides

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Running `docker build` in CI

To run `docker build` inside a CI container, the Docker sidecar needs `privileged`:

```
  apiVersion: v1
  kind: Pod
  spec:
    containers:
    - name: docker
      image: docker:dind
+     securityContext:
+       privileged: true
```

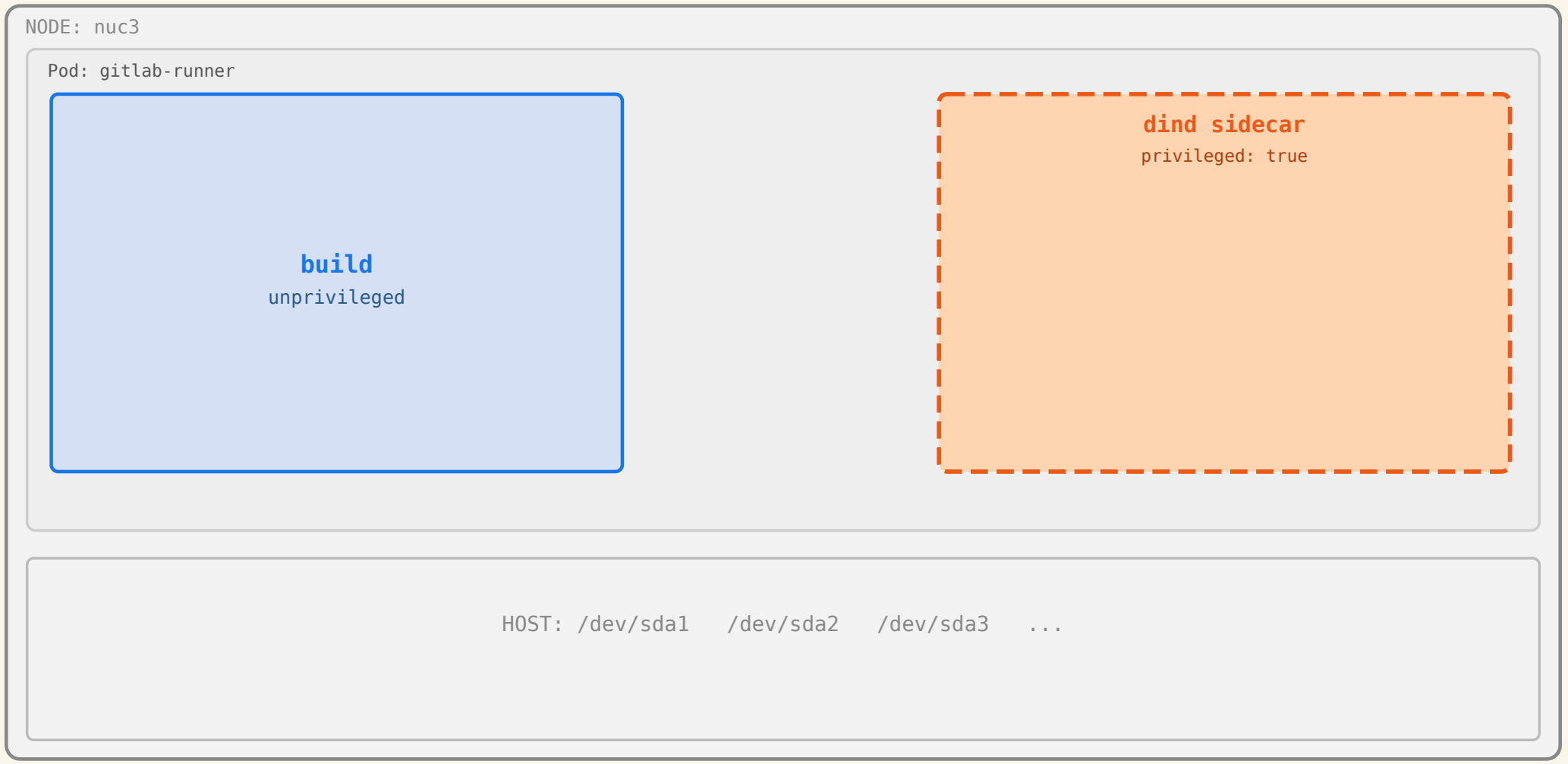
setup

`privileged: true` gives the container **root-level access to the underlying host.**

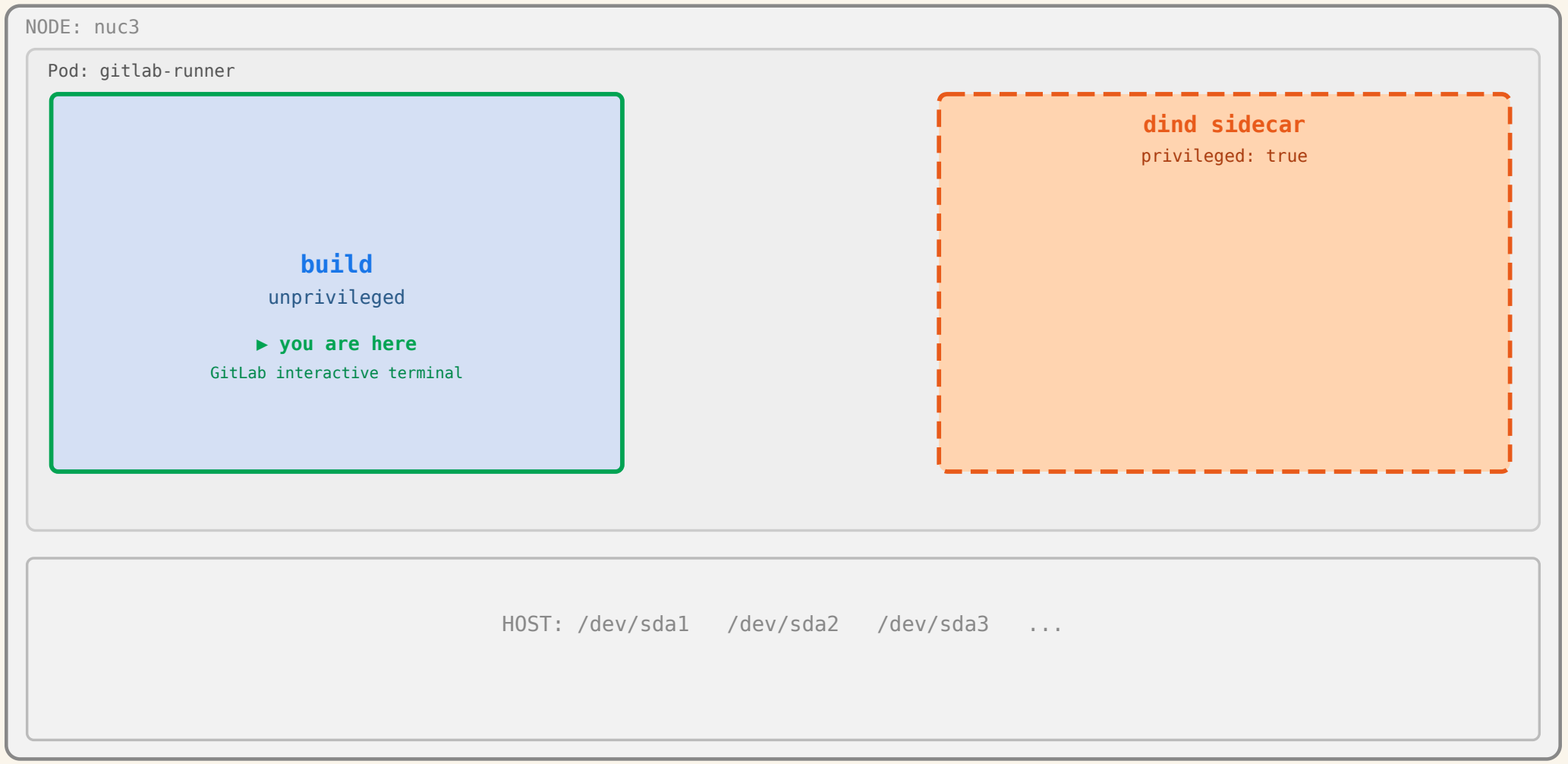
Context: MR!48

`list host /dev`	⧉  run
`read host shadow`	⧉  run
`inject SSH key`	⧉  run

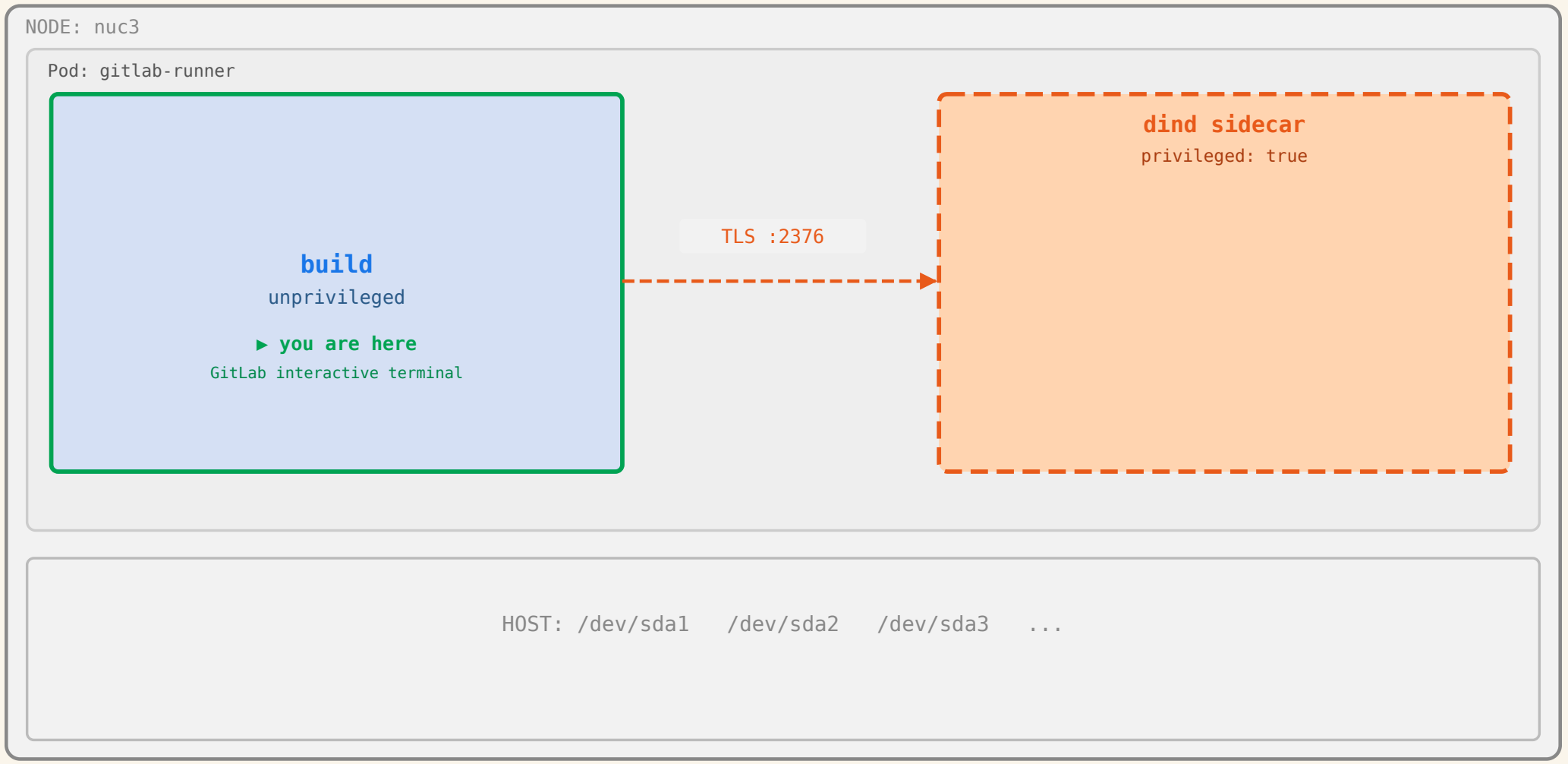
The Attack Path



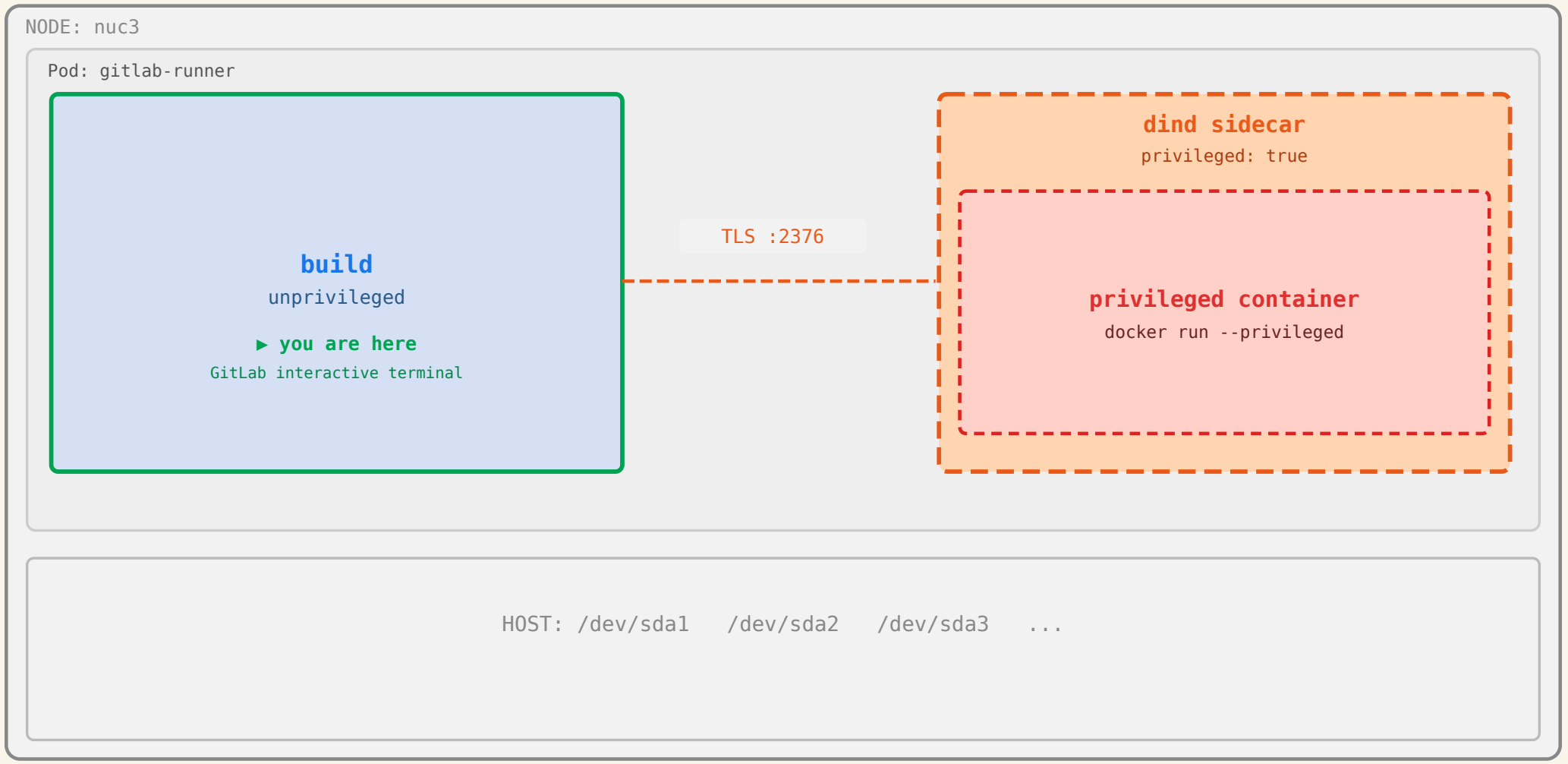
The Attack Path



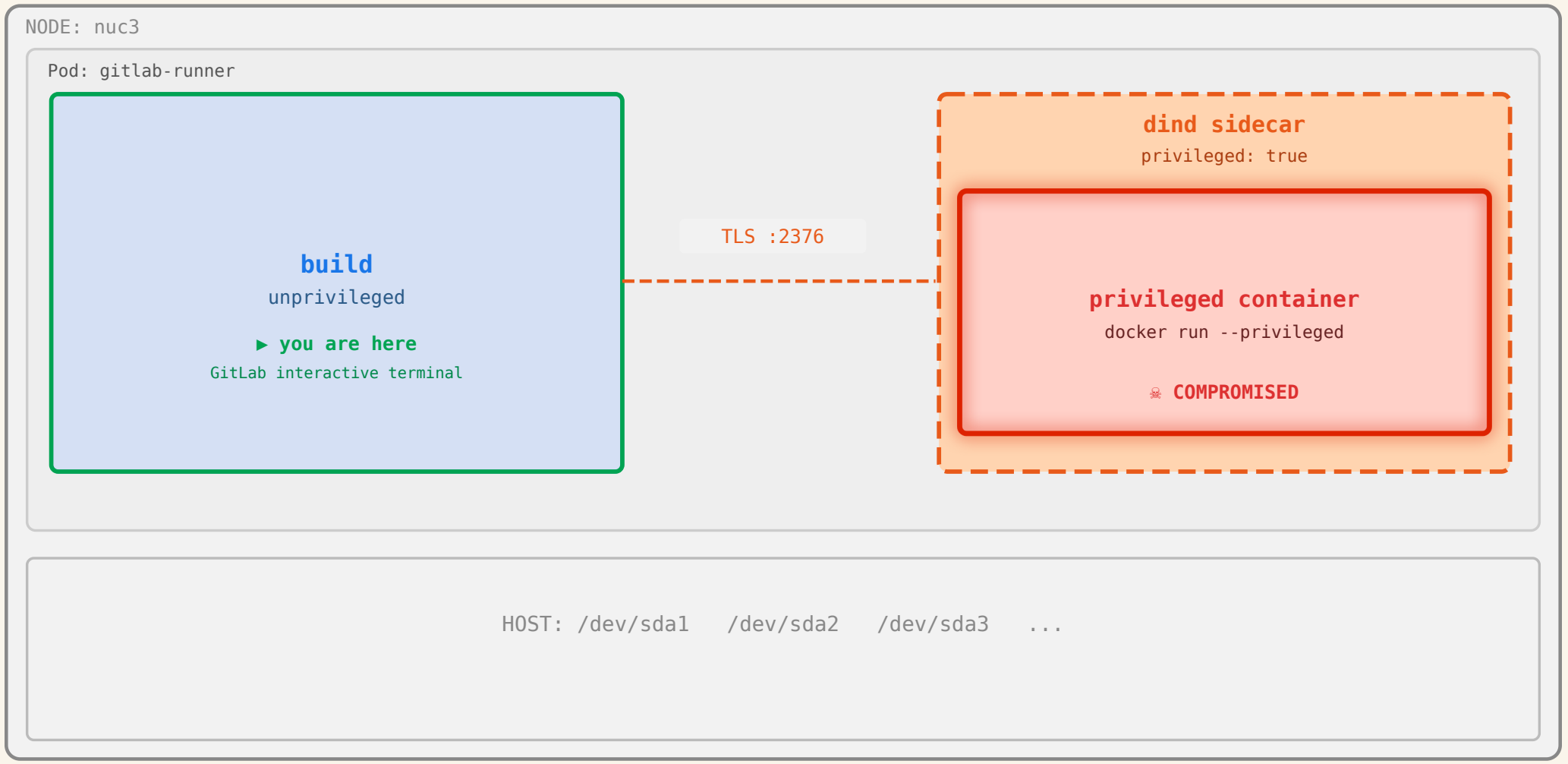
The Attack Path



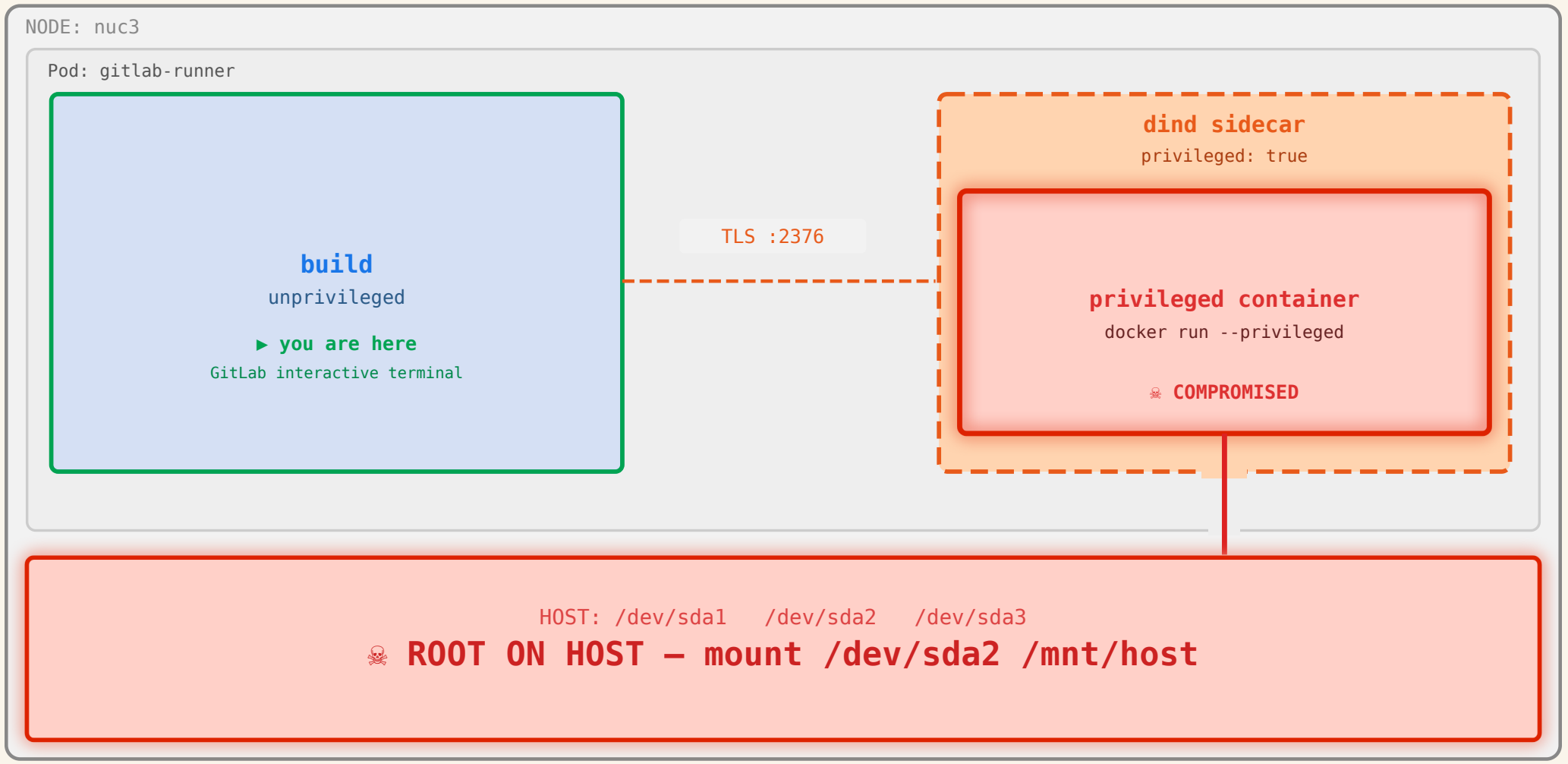
The Attack Path



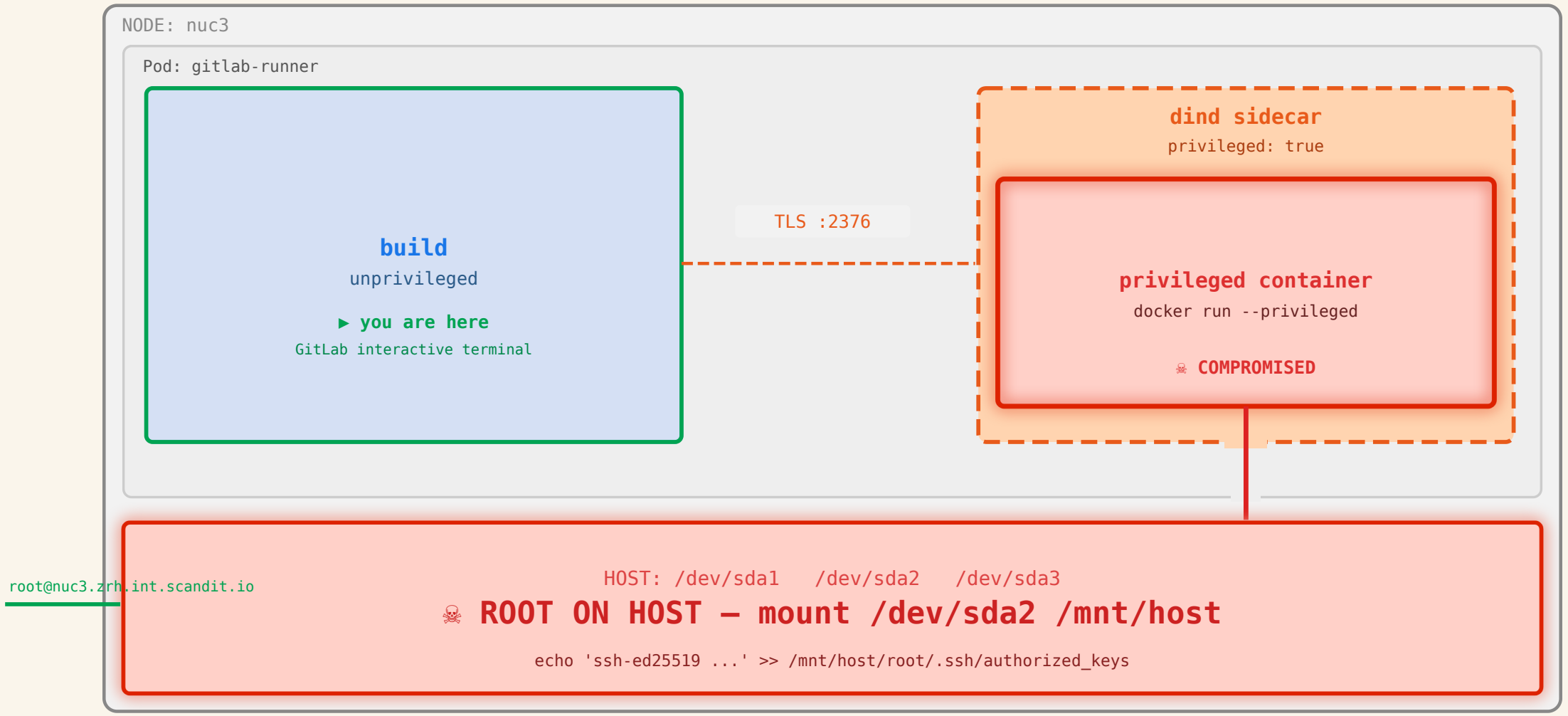
The Attack Path

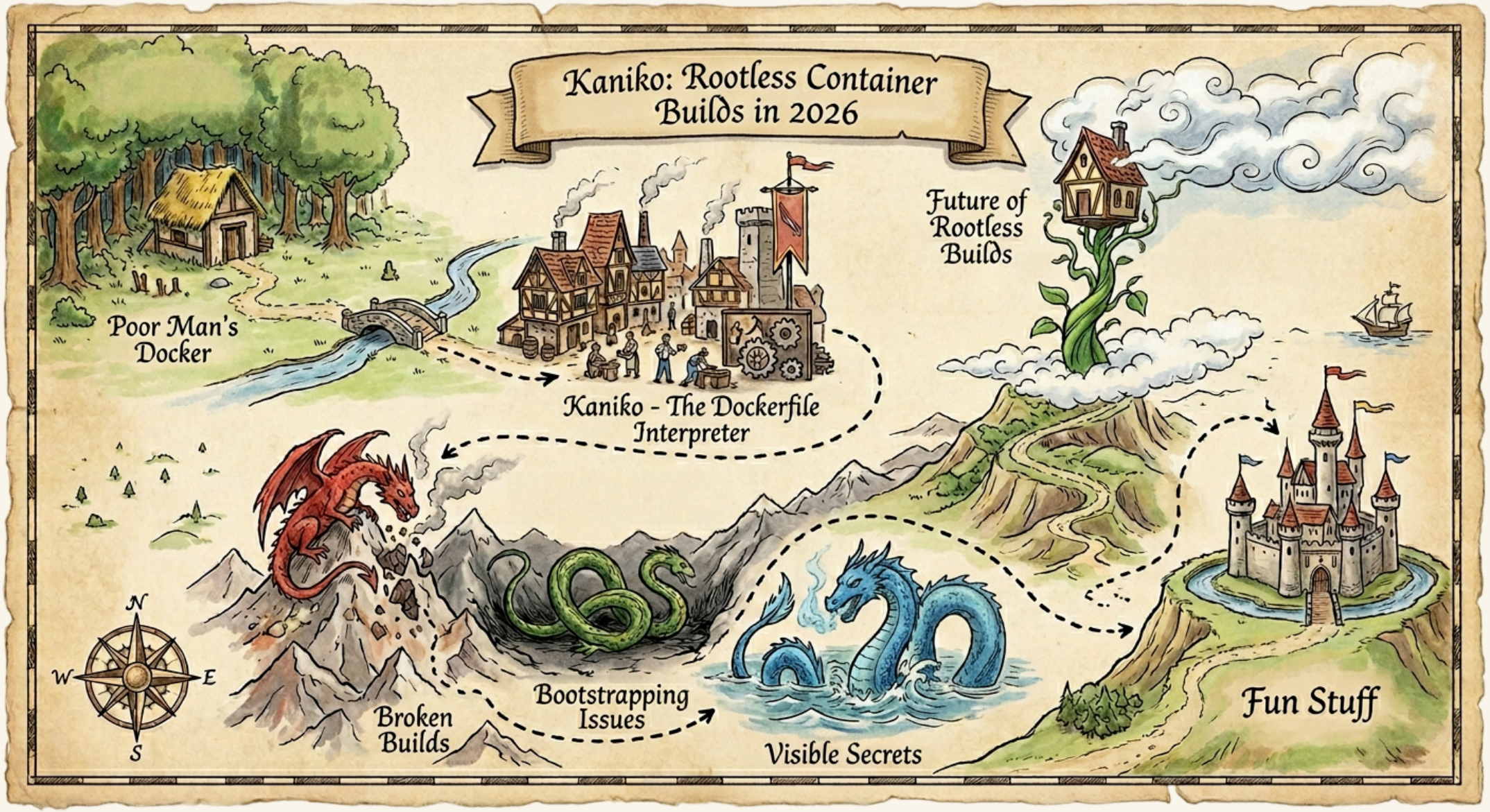


The Attack Path



The Attack Path




Kaniko: Rootless Container Builds in 2026
Poor Man's Docker
Kaniko - The Dockerfile Interpreter
Future of Rootless Builds
Broken Builds
Bootstrapping Issues
Visible Secrets
Fun Stuff
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PART 1

Poor Man's Docker

a container under the hood is just the **unshare** syscall

Creating a container — manually

```
sudo unshare --mount --pid --fork --mount-proc sh
```

run

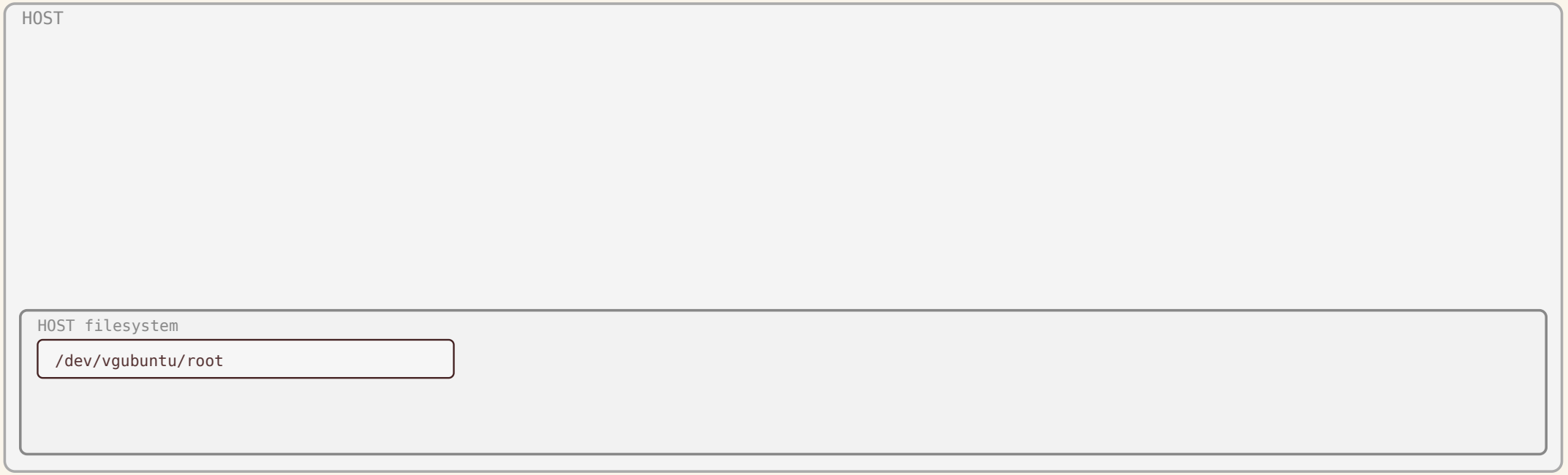
Creating a container — manually

```
sudo unshare --mount --pid --fork --mount-proc sh
```

⧉ run

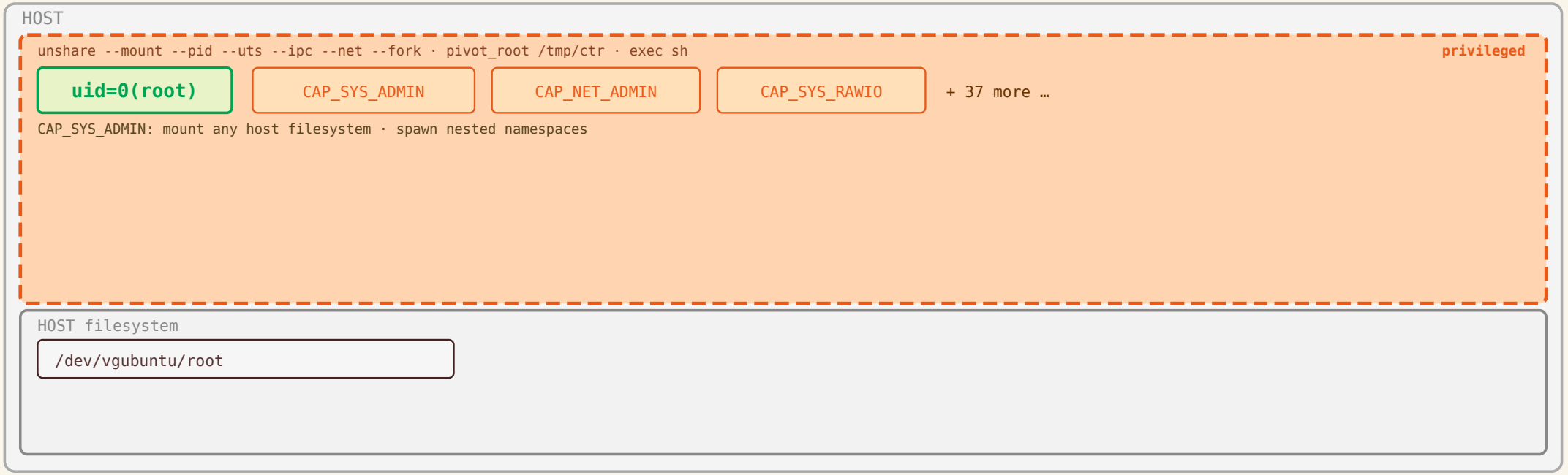
root in the container is **root on the host**

Privileged container



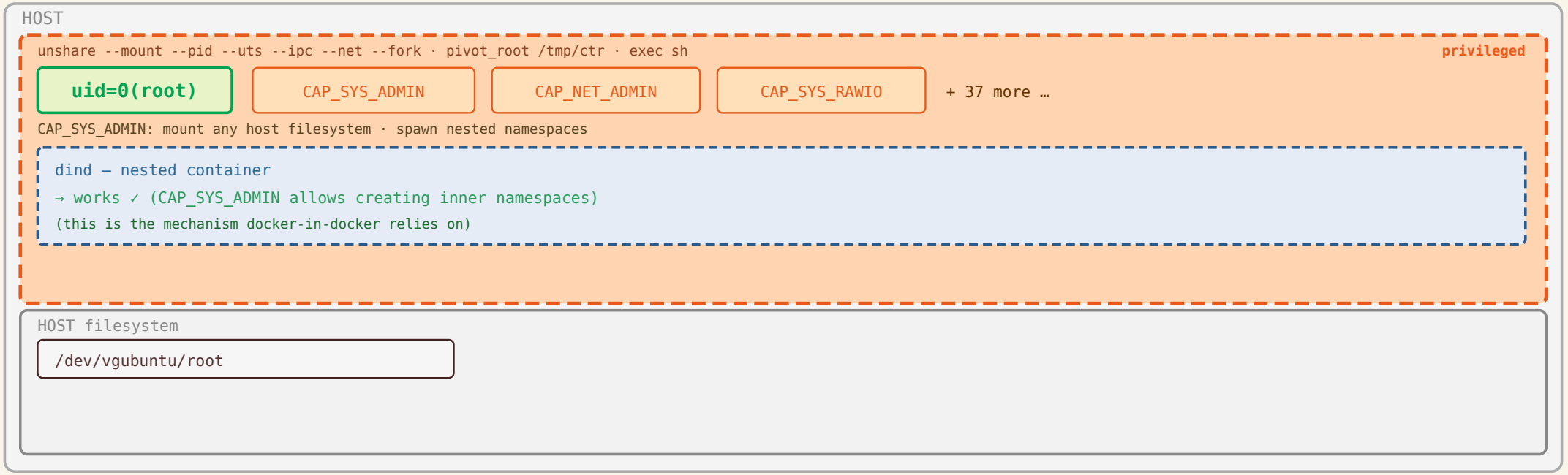
run

Privileged container



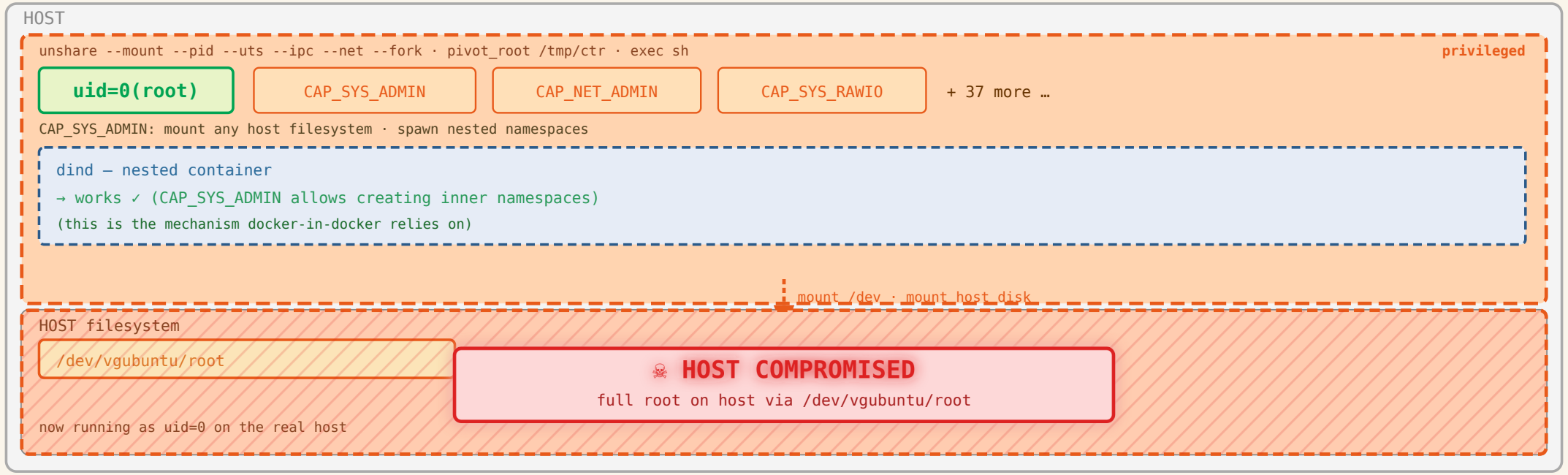
dind

Privileged container

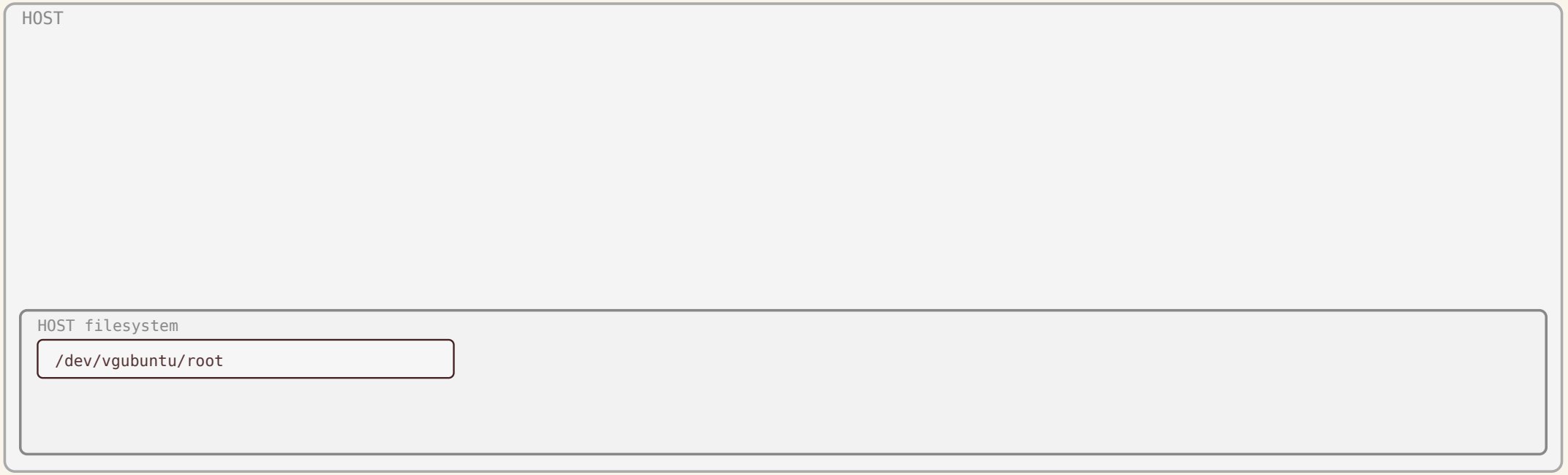


breakout

Privileged container



Unprivileged container

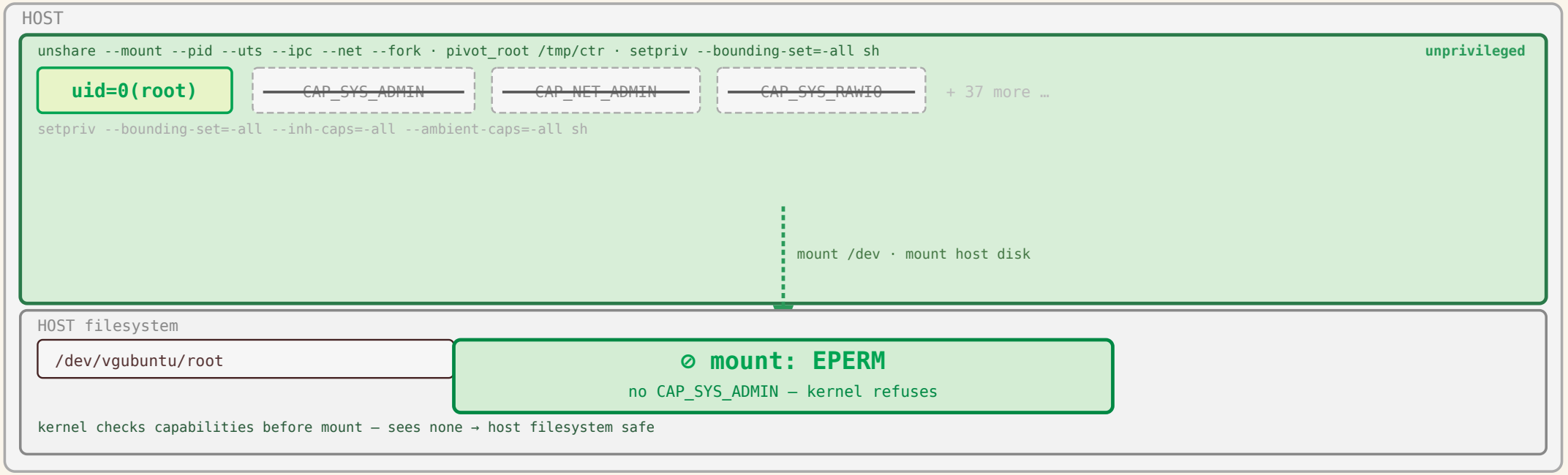


run

Unprivileged container

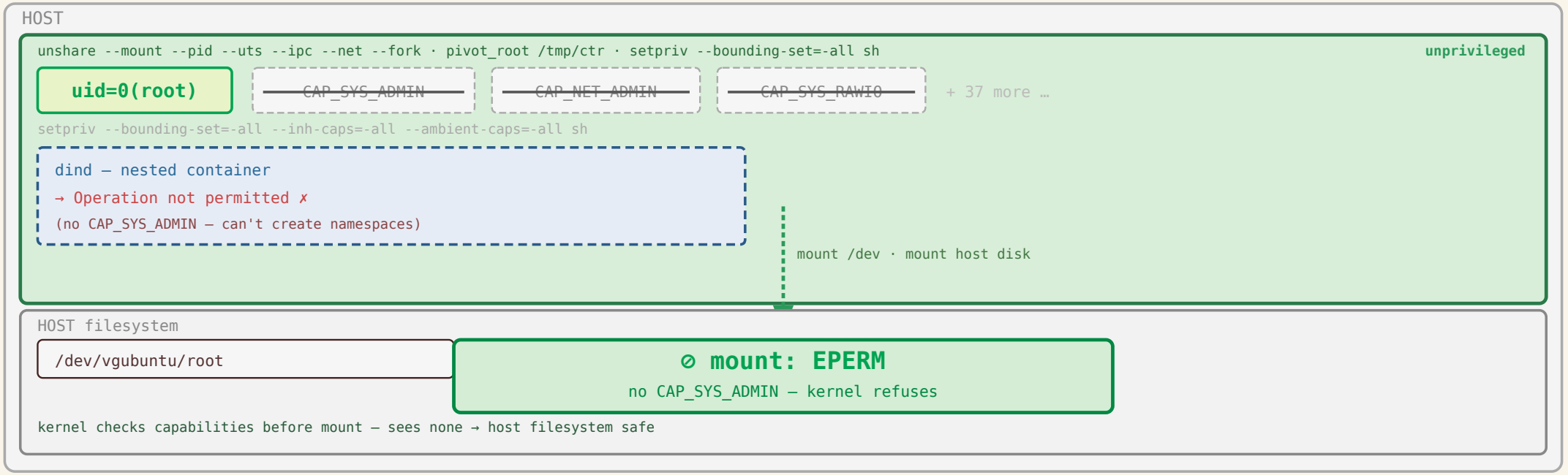
breakout

Unprivileged container



dind

Unprivileged container



The cruel irony of

CAP_SYS_ADMIN

The same capability that lets you **create** containers

also lets you **escape** them.

The kernel can't tell which you intend — once granted, it applies to all uses.

What if we skip the Docker daemon?

Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L -o /tmp/crane.tar.gz \
    https://…/go-containerregistry_Linux_x86_64.tar.gz \
    && tar -xzf /tmp/crane.tar.gz \
       -C /usr/local/bin \
    && rm /tmp/crane.tar.gz

RUN crane version
```

.gitlab-ci.yml

```
job:
  image: alpine
  script:
    - apk add --no-cache curl
    - |
      curl -L -o /tmp/crane.tar.gz \
         https://…/go-containerregistry_Linux_x86_64.tar.gz
      tar -xzf /tmp/crane.tar.gz \
         -C /usr/local/bin
      rm /tmp/crane.tar.gz

    - crane version
```

What if we skip the Docker daemon?

Dockerfile

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FROM alpine

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    && tar -xzf /tmp/crane.tar.gz \
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RUN crane version
```

same base

.gitlab-ci.yml

```
job:
  image: alpine
  script:
    - apk add --no-cache curl
    - |
      curl -L -o /tmp/crane.tar.gz \
         https://…/go-containerregistry_Linux_x86_64.tar.gz
      tar -xzf /tmp/crane.tar.gz \
         -C /usr/local/bin
      rm /tmp/crane.tar.gz

    - crane version
```

What if we skip the Docker daemon?

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       -C /usr/local/bin \
    && rm /tmp/crane.tar.gz

RUN crane version
```

same base

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job:
  image: alpine
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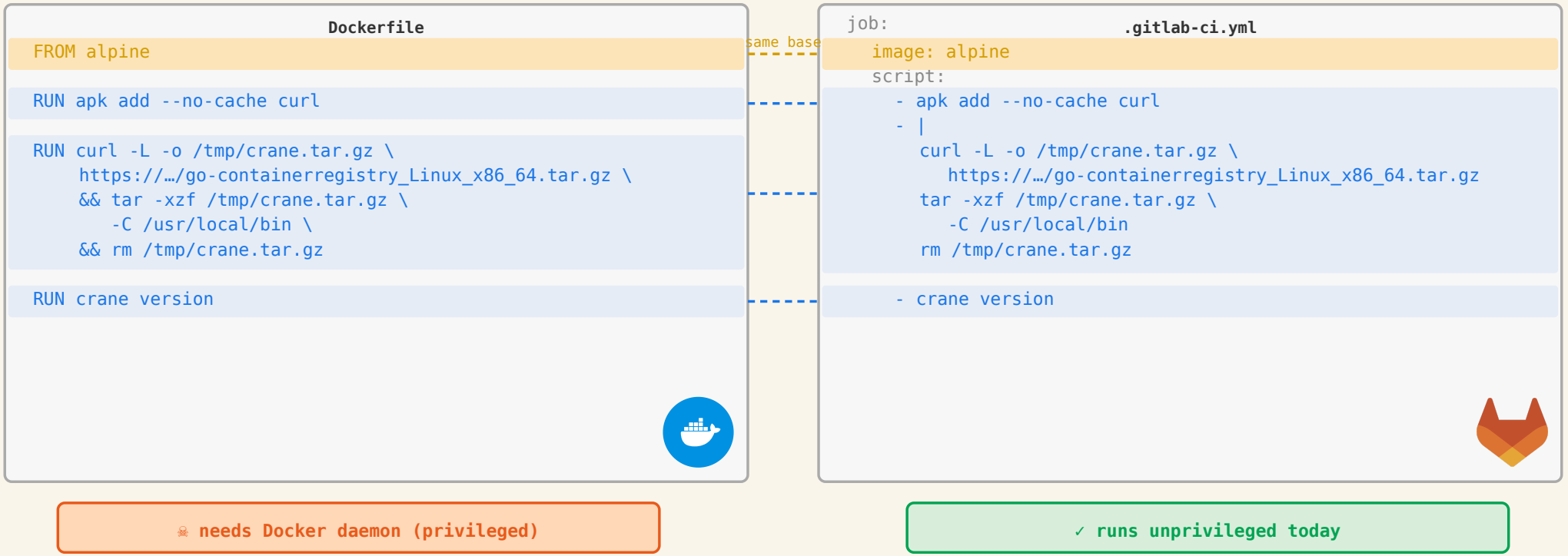
    - apk add --no-cache curl
    - |
      curl -L -o /tmp/crane.tar.gz \
        https://…/go-containerregistry_Linux_x86_64.tar.gz
      tar -xzf /tmp/crane.tar.gz \
        -C /usr/local/bin
      rm /tmp/crane.tar.gz
    - crane version
```

What if we skip the Docker daemon?



What if we skip the Docker daemon?

Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L -o /tmp/crane.tar.gz \
    https://…/go-containerregistry_Linux_x86_64.tar.gz \
    && tar -xzf /tmp/crane.tar.gz \
       -C /usr/local/bin \
    && rm /tmp/crane.tar.gz

RUN crane version
```

same base

.gitlab-ci.yml

```
job:
  image: alpine
  script:
    - apk add --no-cache curl
    - |
      curl -L -o /tmp/crane.tar.gz \
        https://…/go-containerregistry_Linux_x86_64.tar.gz
      tar -xzf /tmp/crane.tar.gz \
        -C /usr/local/bin
      rm /tmp/crane.tar.gz
    - crane version
```

☠ **needs Docker daemon (privileged)**

✓ **runs unprivileged today**

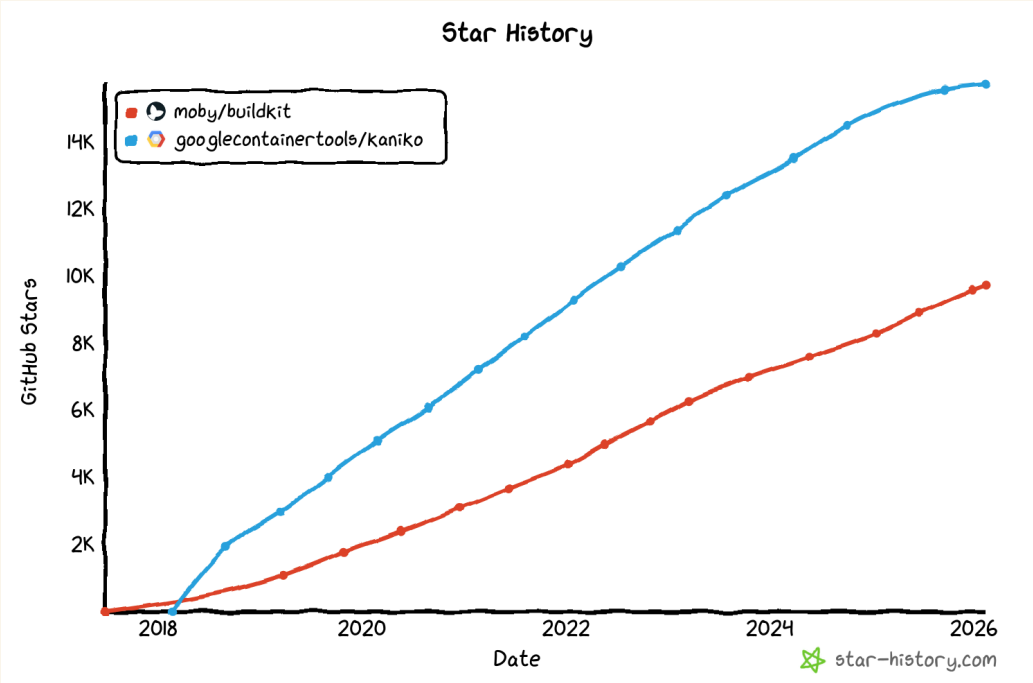
Same result — but one already works without Docker.

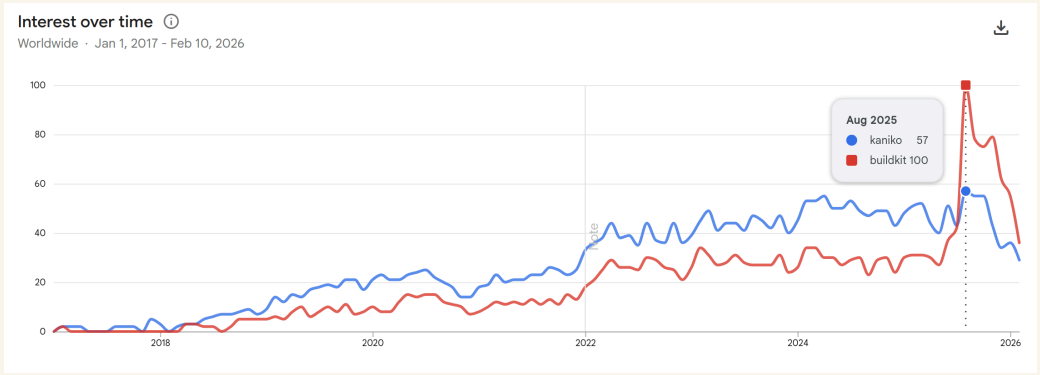
Can we formalize the right side into a proper image builder?

What if we just write an interpreter for Dockerfiles?

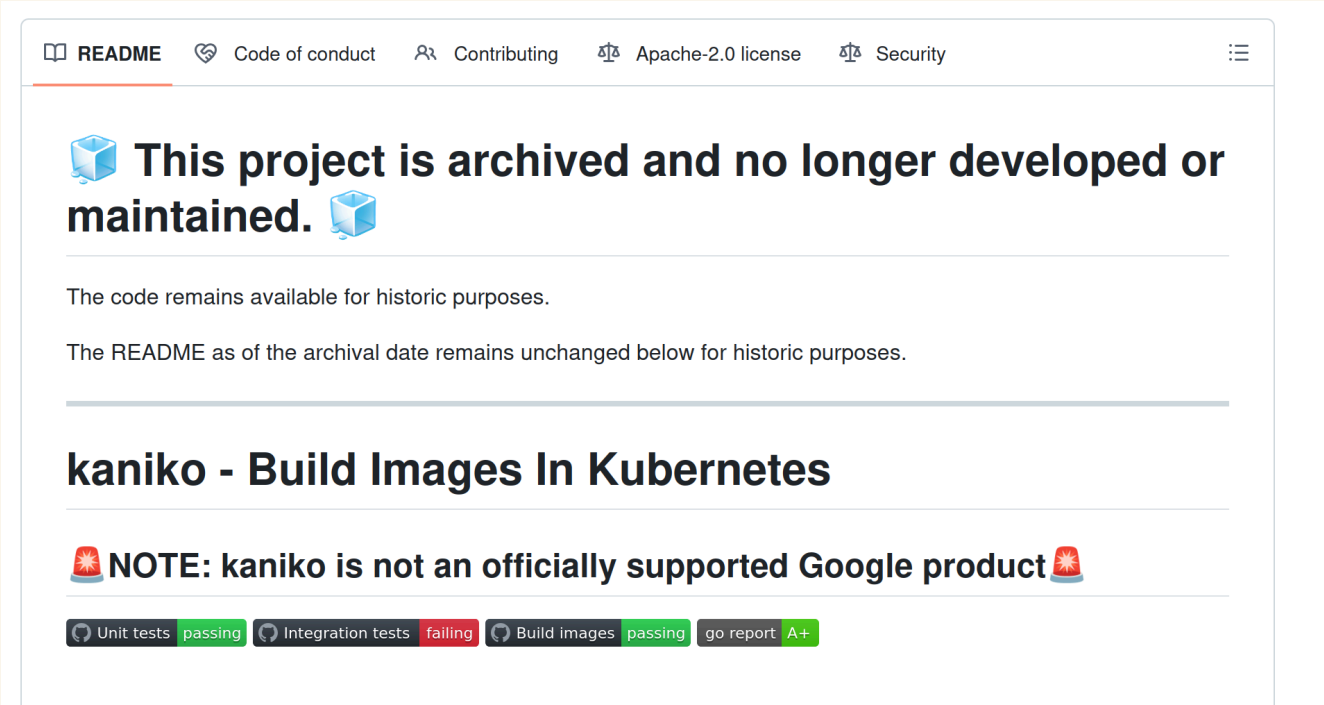
Google's Brainchild

Kaniko started as a random experiment by **Priya Wadhwa** and **Dan Lorenc** at Google — just to prove that building a Docker image without privileges is possible.





Then Google archived it.



So we forked it:
`github.com/osscontainertools/kaniko`

PART 2

Kaniko — The Dockerfile Interpreter

Parser

Interpreter

Snapshotter

Parser

```
FROM alpine

RUN apk add curl

RUN echo "hello" \
 > /app.txt
```

Parser

Interpreter

Snapshotter

Parser

Interpreter

Snapshotter

Parser

Interpreter

Snapshotter

Parser

Interpreter

Snapshotter

Parser

```
FROM alpine


RUN apk add curl


RUN echo "hello" \
 > /app.txt
```

Interpreter

```
/busybox/
/kaniko/
```

Parser

Interpreter

Snapshotter

Parser

```
▶ FROM alpine

RUN apk add curl

RUN echo "hello" \
 > /app.txt
```

Interpreter

```
/busybox/
/kaniko/
/bin/
/etc/
/lib/
/usr/
```

Parser

Interpreter

Snapshotter

Parser

```
FROM alpine

▶ RUN apk add curl

RUN echo "hello" \
 > /app.txt
```

Interpreter

```
/busybox/
/kaniko/

/bin/
/etc/
/lib/
/usr/
/usr/bin/curl
+ /usr/lib/libcurl.so…
```

Parser

Interpreter

Snapshotter

Parser

```
FROM alpine

RUN apk add curl

▶ RUN echo "hello" \
  > /app.txt
```

Interpreter

```
/busybox/
/kaniko/

/bin/
/etc/
/lib/
/usr/
/usr/bin/curl
+ /usr/lib/libcurl.so…
/app.txt
```

Parser

Parser

```
FROM alpine

RUN apk add curl

RUN echo "hello" \
 > /app.txt
```

Interpreter

Interpreter

```
/busybox/
/kaniko/
/bin/
/etc/
/lib/
/usr/
/usr/bin/curl
+ /usr/lib/libcurl.so…
/app.txt
```

Snapshotter

Snapshotter

Parser

Parser

▶ FROM alpine

RUN apk add curl

RUN echo "hello" \
 > /app.txt

Interpreter

Interpreter

/busybox/
/kaniko/

/bin/
/etc/
/lib/
/usr/
/usr/bin/curl
+ /usr/lib/libcurl.so…
/app.txt

Snapshotter

Snapshotter

Layer 0 · base
FROM alpine
/bin/ /etc/ /lib/ /usr/ …

Parser

Parser

```
FROM alpine

▶ RUN apk add curl

RUN echo "hello" \
 > /app.txt
```

Interpreter

Interpreter

```
/busybox/
/kaniko/
/bin/
/etc/
/lib/
/usr/
/usr/bin/curl
+ /usr/lib/libcurl.so…
/app.txt
```

Snapshotter

Snapshotter

Layer 0 · base

FROM alpine

/bin/ /etc/ /lib/ /usr/ …

Layer 1 · diff

RUN apk add curl

+/usr/bin/curl +/usr/lib/libcurl*

Parser

Parser

```
FROM alpine

RUN apk add curl

▶ RUN echo "hello" \
  > /app.txt
```

Interpreter

Interpreter

```
/busybox/
/kaniko/
/bin/
/etc/
/lib/
/usr/
/usr/bin/curl
+ /usr/lib/libcurl.so…
/app.txt
```

Snapshotter

Snapshotter

Layer 0 · base
FROM alpine
/bin/ /etc/ /lib/ /usr/ …

Layer 1 · diff
RUN apk add curl
+/usr/bin/curl +/usr/lib/libcurl*

Layer 2 · diff
RUN echo "hello" > /app.txt
+/app.txt (6 B)

Parser

Parser

```
FROM alpine

RUN apk add curl

RUN echo "hello" \
 > /app.txt
```

Interpreter

Interpreter

/busybox/
/kaniko/

/bin/
/etc/
/lib/
/usr/
/usr/bin/curl
+ /usr/lib/libcurl.so…
/app.txt

Snapshotter

Snapshotter

Layer 0 · base
FROM alpine
/bin/ /etc/ /lib/ /usr/ …

Layer 1 · diff
RUN apk add curl
+/usr/bin/curl +/usr/lib/libcurl*

Layer 2 · diff
RUN echo "hello" > /app.txt
+/app.txt (6 B)

myimage:latest
image = union of all layer diffs
config + 3 layers (OCI manifest)

There is no container

PART 3

Here be Dragons

Custom Kaniko Images

Kaniko is a **container image**, not an executable. Running it from a different base can have weird effects.

We want crane in our kaniko image — let's build a custom one:

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L -o /tmp/crane.tar.gz https://github.com/.../go-containerregistry_Linux_x86_64.tar.gz \
    && tar -xzf /tmp/crane.tar.gz -C /usr/local/bin

COPY --from=martizih/kaniko:v1.27.4 /kaniko /kaniko
ENV SSL_CERT_DIR=/kaniko/ssl/certs
ENTRYPOINT ["/kaniko/executor"]
```

Now build with it

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L -o /tmp/crane.tar.gz https://github.com/.../go-containerregistry_Linux_x86_64.tar.gz \
    && tar -xzf /tmp/crane.tar.gz -C /usr/local/bin \
    && rm /tmp/crane.tar.gz

RUN crane version
```

official kaniko

build

run

kaniko-custom

build

run

Why the build looks fine but the image is broken

Dockerfile

```
FROM alpine


RUN apk add --no-cache curl



RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz



RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

/busybox/

/kaniko/

Custom kaniko

■ snapshotted ■ kaniko

/busybox/

/kaniko/

/usr/local/bin/crane
↑ pre-installed in kaniko base

Why the build looks fine but the image is broken

Dockerfile

```
▶ FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/

Custom kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/

/usr/local/bin/crane
↑ pre-installed in kaniko base

Why the build looks fine but the image is broken

Dockerfile

```
FROM alpine

▶ RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl

Custom kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
↑ pre-installed in kaniko base

Why the build looks fine but the image is broken

Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

▶ RUN curl -L ... \
  && tar -C /usr/local/bin \
  && rm /tmp/crane.tar.gz

RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane

Custom kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane ✗ **no delta**

↑ pre-installed in kaniko base

Why the build looks fine but the image is broken

Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz
```

▶ RUN crane version

Official kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane

```
$ crane version
v0.21.5
```

build succeeds — crane is present in both

Custom kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane **✗ no delta**

↑ pre-installed in kaniko base

```
$ crane version
v0.21.5
```

Why the build looks fine but the image is broken

running

```
$ docker run kaniko-official \
  crane version

$ docker run kaniko-custom \
  crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane

```
$ crane version
v0.21.5 ✓
```

Custom kaniko

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl

```
$ crane version
crane: not found ✗
```

Fix: wipe pre-installed tools before the build

Dockerfile

```
FROM alpine


RUN apk add --no-cache curl



RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz



RUN crane version
```

Official kaniko

snapshotted kaniko

/busybox/

/kaniko/

Custom kaniko

snapshotted kaniko

/busybox/

/kaniko/

~~/usr/local/bin/crane~~

↑ deleted before build

Fix: wipe pre-installed tools before the build

Dockerfile

```
FROM alpine


RUN apk add --no-cache curl



RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz



RUN crane version
```

Official kaniko

snapshotted kaniko

/busybox/

/kaniko/

Custom kaniko

snapshotted kaniko

/busybox/

/kaniko/

Fix: wipe pre-installed tools before the build

Dockerfile

```
▶ FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/

Custom kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/

Fix: wipe pre-installed tools before the build

Dockerfile

```
FROM alpine

▶ RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

```
/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
```

Custom kaniko

■ snapshotted ■ kaniko

```
/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
```

Fix: wipe pre-installed tools before the build

Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

▶ RUN curl -L ... \
  && tar -C /usr/local/bin \
  && rm /tmp/crane.tar.gz

RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane

Custom kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
↑ properly snapshotted ✓

Fix: wipe pre-installed tools before the build

Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

▶ RUN crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane

$ crane version
v0.21.5

build succeeds — crane is present in both

Custom kaniko

■ snapshotted ■ kaniko

/bin/
/busybox/
/etc/
/kaniko/
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
↑ properly snapshotted ✓

$ crane version
v0.21.5

Fix: wipe pre-installed tools before the build

running

```
$ docker run kaniko-official \
  crane version

$ docker run kaniko-custom \
  crane version
```

Official kaniko

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane

```
$ crane version
v0.21.5 ✓
```

Custom kaniko

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
↑ properly snapshotted ✓

```
$ crane version
v0.21.5 ✓
```

Bootstrapping

What if we build our custom kaniko image *using* kaniko itself?

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L -o /tmp/crane.tar.gz https://github.com/.../go-containerregistry_Linux_x86_64.tar.gz \
    && tar -xzf /tmp/crane.tar.gz -C /usr/local/bin \
    && rm /tmp/crane.tar.gz

COPY --from=martizih/kaniko:v1.27.4 /kaniko /kaniko
ENV SSL_CERT_DIR=/kaniko/ssl/certs
ENTRYPOINT ["/kaniko/executor"]
```

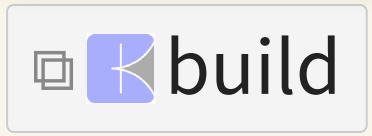
Now build with it

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L -o /tmp/crane.tar.gz https://github.com/.../go-containerregistry_Linux_x86_64.tar.gz \
    && tar -xzf /tmp/crane.tar.gz -C /usr/local/bin \
    && rm /tmp/crane.tar.gz

RUN crane version
```



Why the `COPY /kaniko` disappears silently

kaniko_custom Dockerfile

```
FROM alpine


RUN apk add --no-cache curl



RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz



COPY --from=kaniko \
 /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

snapshotted kaniko

kaniko build

snapshotted kaniko

/busybox/ ← pre-existing

/kaniko/ ← pre-existing

Why the `COPY /kaniko` disappears silently

kaniko_custom Dockerfile

```
▶ FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

COPY --from=kaniko \
 /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
```

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko/           ← pre-existing
/lib/
/tmp/
/usr/
```

Why the `COPY /kaniko` disappears silently

kaniko_custom Dockerfile

```
FROM alpine


▶ RUN apk add --no-cache curl



RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz



COPY --from=kaniko \
 /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
```

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko/           ← pre-existing
/lib/
/tmp/
/usr/
/usr/bin/curl
```

Why the `COPY /kaniko` disappears silently

kaniko_custom Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

▶ RUN curl -L ... \
  && tar -C /usr/local/bin \
  && rm /tmp/crane.tar.gz

COPY --from=kaniko \
  /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
```

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko/           ← pre-existing
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
```

Why the `COPY /kaniko` disappears silently

kaniko_custom Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

▶ COPY --from=kaniko \
  /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
/kaniko/
  └ executor
  └ ssl/certs …
```

captured ✓

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko/           ← pre-existing
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
```

snapshotter: /kaniko excluded

writes here never reach the output image

Why the `COPY /kaniko` disappears silently

run the image

```
$ docker run kaniko-docker \
  --no-push …

$ docker run kaniko-kaniko \
  --no-push …
```

docker build

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
/kaniko/
  └ executor
  └ ssl/certs …

captured ✓

```
$ /kaniko/executor …
```

works ✓

kaniko build

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane

```
$ /kaniko/executor …
```

exec: no such file or directory ✗

/kaniko/ was never committed to a layer

Fix: rename /kaniko before the build

kaniko_custom Dockerfile

```
FROM alpine


RUN apk add --no-cache curl



RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz



COPY --from=kaniko \
 /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

snapshotted kaniko

kaniko build

snapshotted kaniko

/busybox/ ← *pre-existing*

/kaniko2/ ← *renamed ✓*

Fix: rename /kaniko before the build

kaniko_custom Dockerfile

```
▶ FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

COPY --from=kaniko \
 /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
```

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko2/          ← renamed
/lib/
/tmp/
/usr/
```

Fix: rename /kaniko before the build

kaniko_custom Dockerfile

```
FROM alpine

▶ RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

COPY --from=kaniko \
 /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
```

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko2/          ← renamed
/lib/
/tmp/
/usr/
/usr/bin/curl
```

Fix: rename /kaniko before the build

kaniko_custom Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

▶ RUN curl -L ... \
  && tar -C /usr/local/bin \
  && rm /tmp/crane.tar.gz

COPY --from=kaniko \
  /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
```

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko2/          ← renamed
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
```

Fix: rename /kaniko before the build

kaniko_custom Dockerfile

```
FROM alpine

RUN apk add --no-cache curl

RUN curl -L ... \
 && tar -C /usr/local/bin \
 && rm /tmp/crane.tar.gz

▶ COPY --from=kaniko \
  /kaniko /kaniko

ENTRYPOINT ["/kaniko/executor"]
```

docker build

■ snapshotted ■ kaniko

```
/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
/kaniko/
  └ executor
  └ ssl/certs …
```

captured ✓

kaniko build

■ snapshotted ■ kaniko

```
/bin/
/busybox/          ← pre-existing
/etc/
/kaniko2/          ← renamed
/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
/kaniko/
  └ executor
  └ ssl/certs …
```

captured ✓

Fix: rename /kaniko before the build

run the image

```
$ docker run kaniko-docker \
  --no-push …

$ docker run kaniko-kaniko \
  --no-push …
```

docker build

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
/kaniko/
└ executor
└ ssl/certs …

captured ✓

```
$ /kaniko/executor …
```

works ✓

kaniko build

■ snapshotted ■ kaniko

/bin/

/etc/

/lib/
/tmp/
/usr/
/usr/bin/curl
/usr/local/bin/crane
/kaniko/
└ executor
└ ssl/certs …

captured ✓

```
$ /kaniko/executor …
```

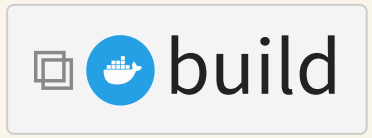
works ✓

No Sandboxing

```
FROM busybox

RUN ls -la /kaniko
```

Sandboxing requires privileges, so kaniko doesn't



Build isolation: what RUN can see

Dockerfile

```
FROM busybox

RUN ls -la /kaniko
```

DinD

build daemon

image being built (isolated)

build tooling — not mounted into image container

encapsulated ✓

snapshotted

Kaniko

executor container (build env = image being built)

/busybox/

/kaniko/ ← *visible to RUN*

no isolation boundary

snapshotted kaniko

Build isolation: what RUN can see

Dockerfile

▶ FROM busybox

RUN ls -la /kaniko

DinD

build daemon

image being built (isolated)

/bin/
/etc/
/lib/
/tmp/
/usr/

build tooling — not mounted into image container

encapsulated ✓

■ snapshotted

Kaniko

executor container (build env = image being built)

/bin/
/busybox/
/etc/
/kaniko/ ← *visible to RUN*
/lib/
/tmp/
/usr/

no isolation boundary

■ snapshotted ■ kaniko

Build isolation: what RUN can see

Dockerfile

```
FROM busybox

▶ RUN ls -la /kaniko
```

DinD

build daemon

image being built (isolated)

```
/bin/
/etc/
/lib/
/tmp/
/usr/
```

build tooling — not mounted into image container

encapsulated ✓

```
$ ls -la /kaniko
ls: /kaniko: No such file or directory
build tooling correctly isolated ✓
```

■ snapshotted

Kaniko

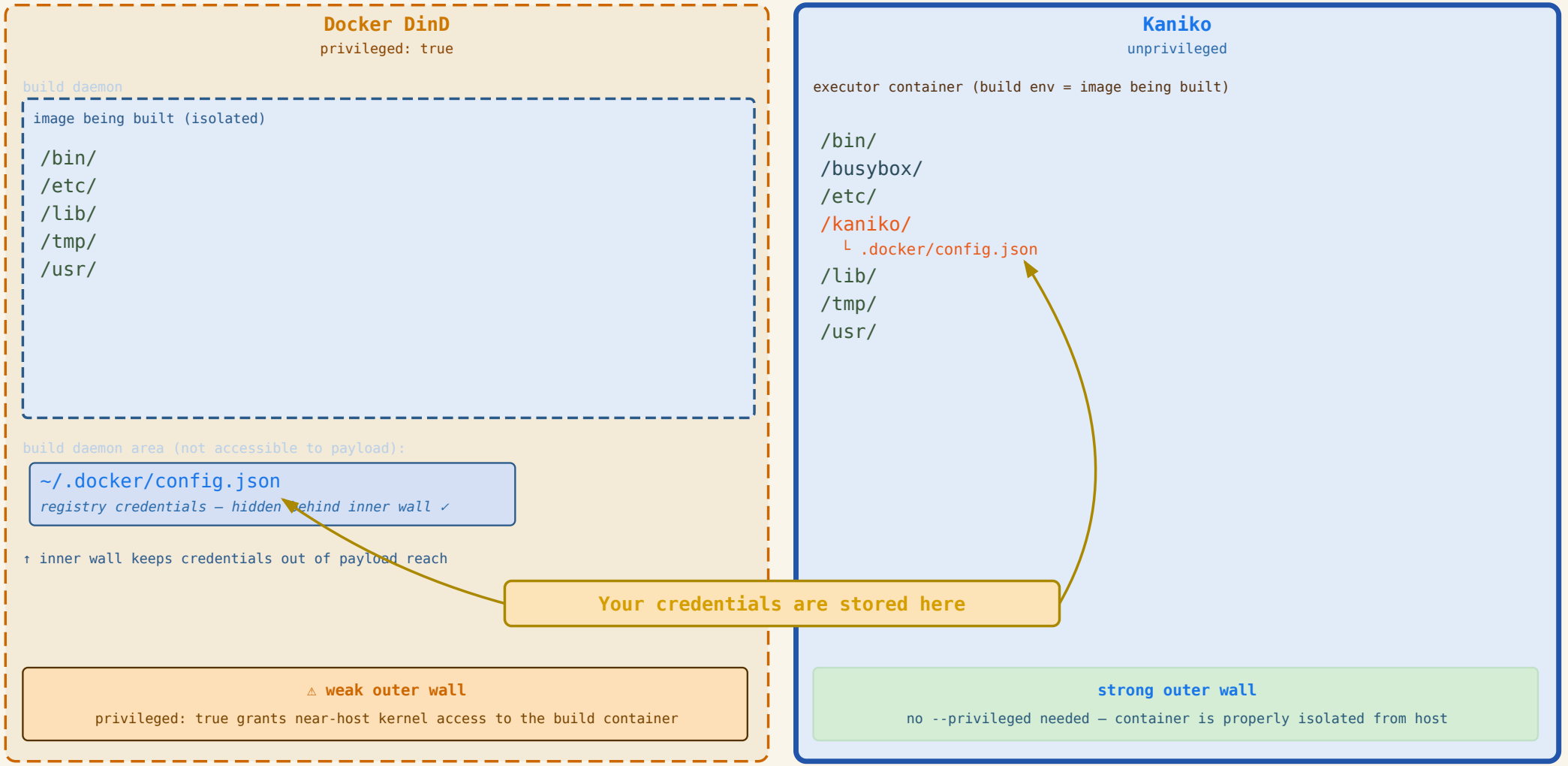
executor container (build env = image being built)

```
/bin/
/busybox/
/etc/
/kaniko/        ← visible to RUN
/lib/
/tmp/
/usr/
```

no isolation boundary

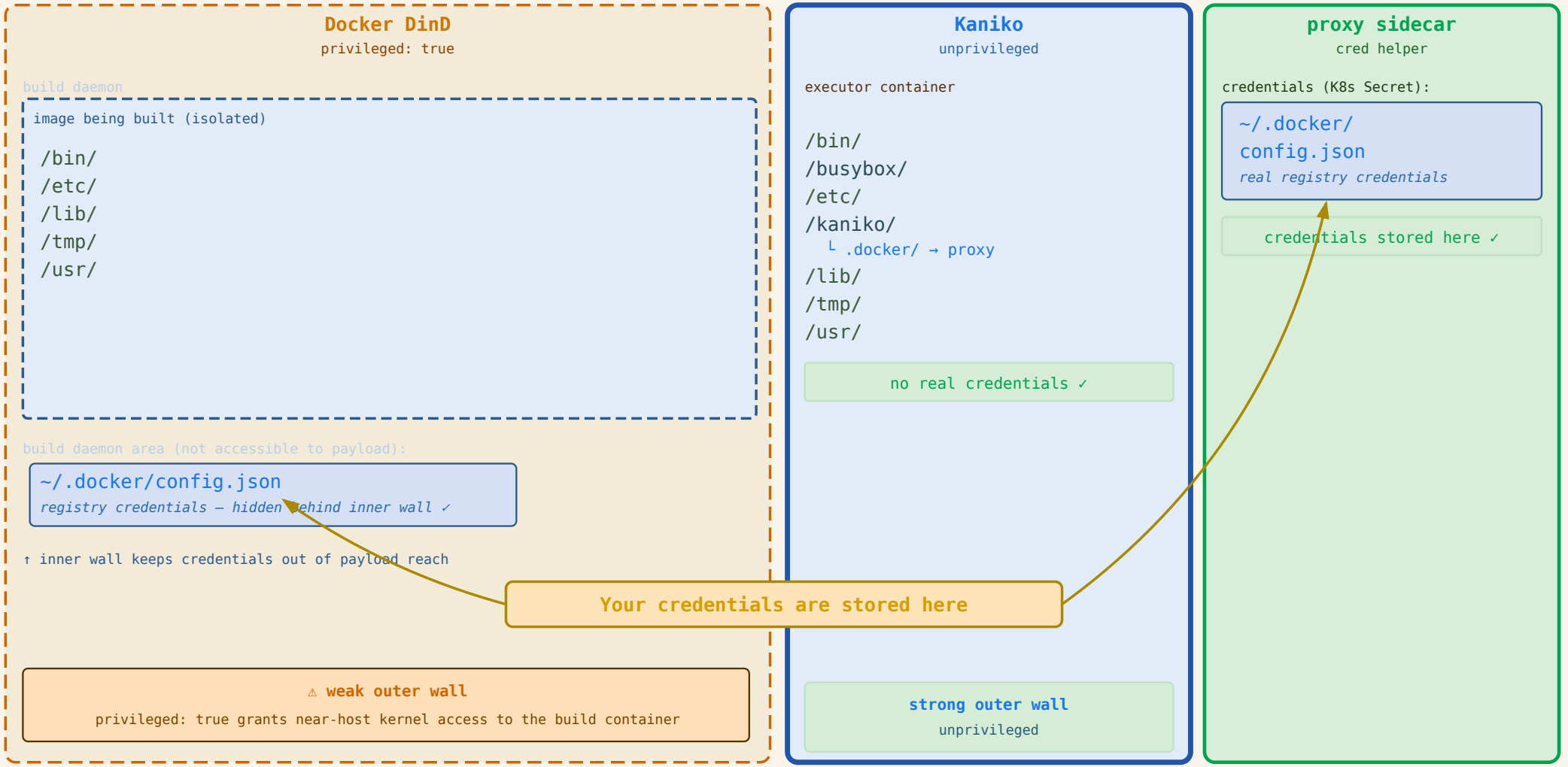
```
$ ls -la /kaniko
-rwxr-xr-x executor
drwx------ .docker/          ← registry creds!
drwxr-xr-x ssl/
…
build tooling + credentials exposed to payload ✗
```

Security trade-offs



DinD protects your passwords — Kaniko protects your servers

Fix: credential proxy sidecar



Your token lives in the proxy — never touches kaniko's filesystem

All Dragons slayed

All Dragons slayed



Kaniko's philosophy: don't invent your own security model, just use K8s correctly.

All Dragons slayed



Kaniko's philosophy: don't invent your own security model, just use K8s correctly.

…but we're still root `uid=0`

PART 4

Future of rootless builds

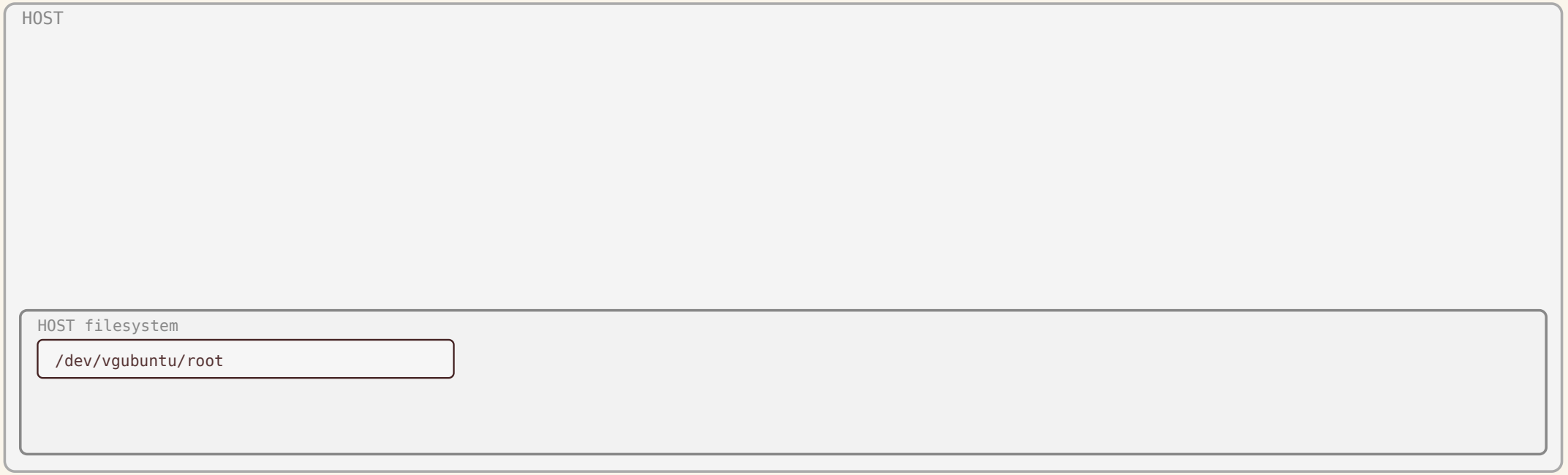
Running `docker build` in CI — k8s 1.36

With user namespaces, container root maps to an unprivileged UID on the host:

```
  apiVersion: v1
  kind: Pod
  spec:
+   hostUsers: false
    containers:
    - name: docker
      image: docker:dind
      securityContext:
        privileged: true
```

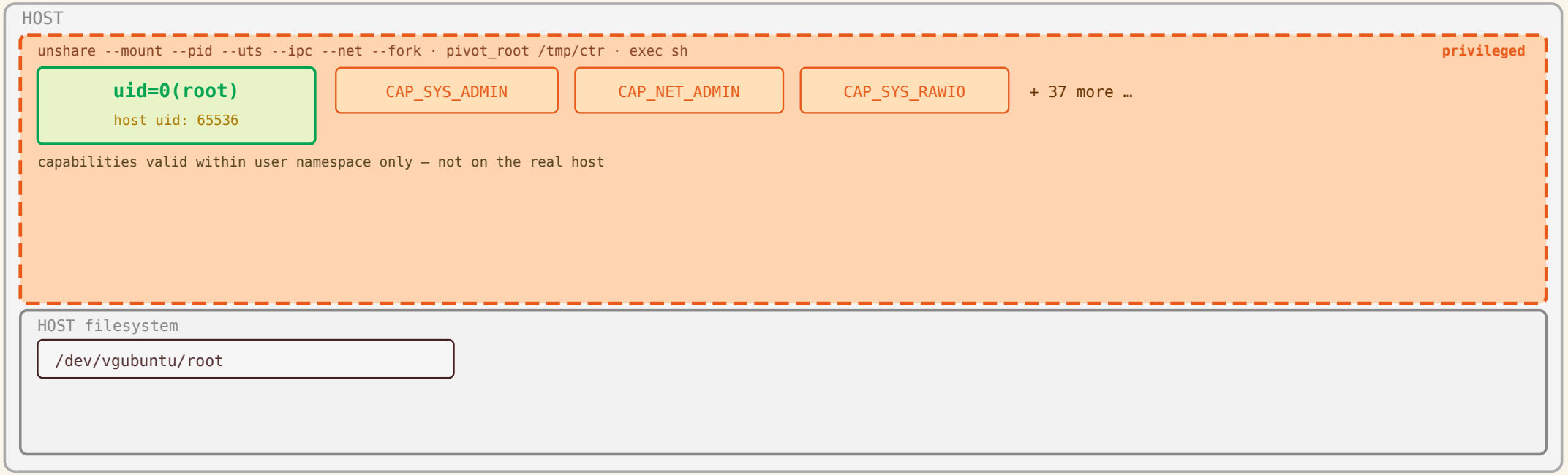
Container UID 0 → Host UID ~65536: `privileged` is still required for dind, but escaping the container no longer gives host root.

Privileged container — mapped root



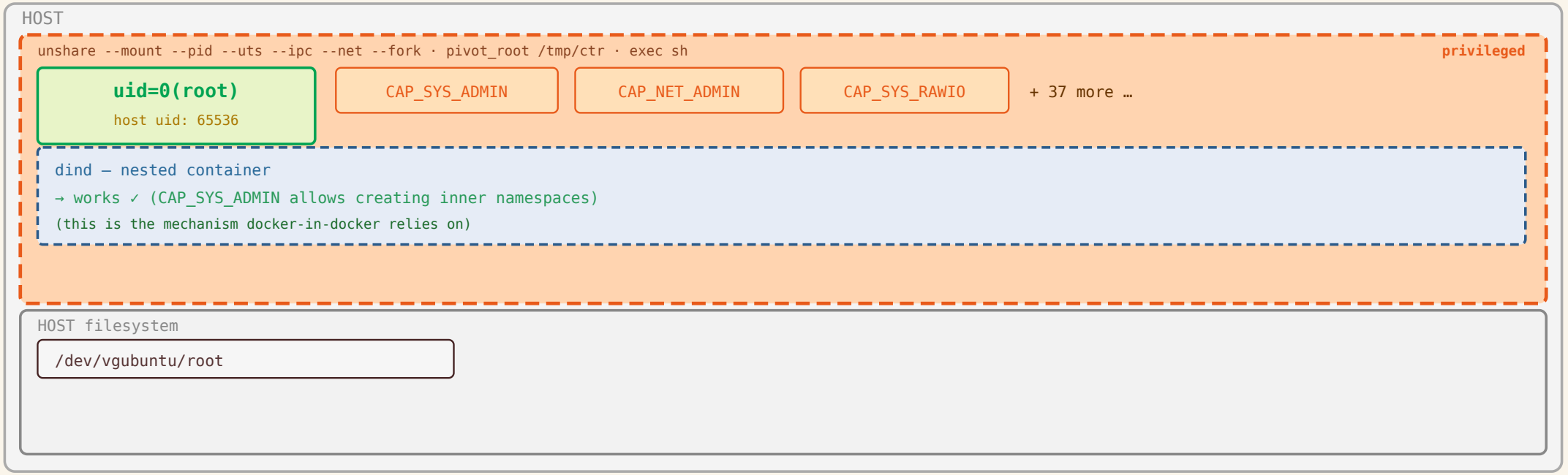
run

Privileged container — mapped root



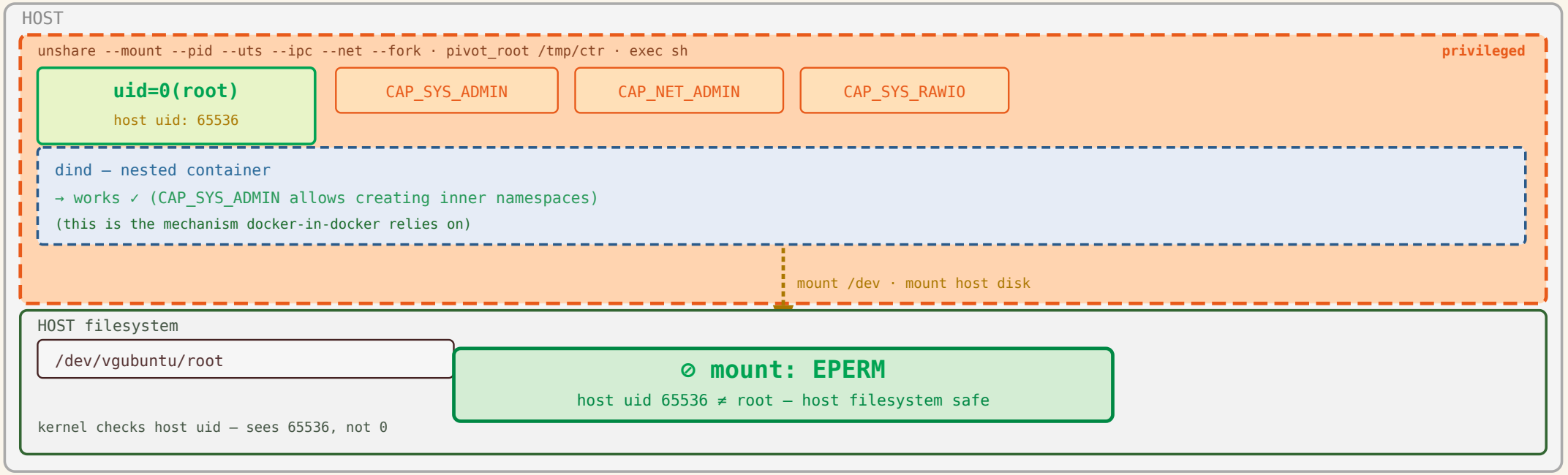
dind

Privileged container — mapped root



breakout

Privileged container — mapped root



The landscape — before K8s 1.36

Tool	Root user	CAP_SYS_ADMIN	Kernel features	Dockerfile	Complexity
ko / Jib	No	No	—	No	build plugin
Nix	No	No	—	No	Nix toolchain
Podman†	No	No	user ns	Yes	job pod + sysctl
buildkitd†	No	optional	user ns, FUSE	Yes	daemon + sysctl
Kaniko	root	No	—	Yes	job pod
Podman	root	No	—	Yes	job pod
buildkitd	root	optional	—	Yes	daemon pod
DinD	root	Yes	cgroups, ns, overlayfs	Yes	sidecar

† rootless variant

The landscape — after K8s 1.36 hostUsers: false

Tool	Root user	CAP_SYS_ADMIN	Kernel features	Dockerfile	Complexity
ko / Jib	No	No	—	No	build plugin
Nix	No	No	—	No	Nix toolchain
Kaniko	root	No	—	Yes	job pod
Podman	root	No	—	Yes	job pod
buildkitd	root	optional	—	Yes	daemon pod
DinD	root	Yes	cgroups, ns, overlayfs	Yes	sidecar

† rootless variant · root in pod → uid 65536 on host · CAP_SYS_ADMIN scoped to user namespace

PART 4

Fun Stuff

Non-Docker Applications

Kaniko lets an agent **boot into any Docker image**, mid-task, no privileges needed.

`coder.zrh.int.scandit.io/tasks`

prompt

Questions?

osscontainertools/kaniko