Dockerfile Image build recipe

START HERE

`FROM <image>:<tag>`
Pick a base image

`ENV <key>=<value>`
Set an environment variable

`WORKDIR /app`
Set the working directory

`EXPOSE <port>`
Document a listening port

`COPY <src> <dest>`
Add files from the context

`USER <user>`
Drop root

`RUN <command>`
Run a command at build time

`CMD ["exe", "arg"]`
Default start command

Base image FROM → **`RUN` / `COPY`** **Layers** one per step → **`cache`** **Final stage** what ships → **`CMD`** **Container** running process

CONCEPTS

Each instruction adds a layer, and a changed layer invalidates every layer after it. Put rarely changing steps first.

RUN, COPY and ADD happen at build time. CMD and ENTRYPOINT only describe what runs when a container starts.

BASE AND STAGES

`FROM <image>:<tag>`
Start from a base image
Without a tag you get latest. Pin a tag or an @sha256 digest for repeatable builds.

`FROM <image> AS <name>`
Name a build stage

`COPY --from=<stage> <src> <dest>`
Copy files out of another stage

`FROM scratch`
Start from an empty image

`FROM --platform=$BUILDPLATFORM <image>`
Run the stage on the build host

`FROM <image>@sha256:<digest>`
Pin a base by digest

`docker build --target <stage> .`
Build only up to one stage

`COPY --from=<image> <src> <dest>`
Copy from an external image

`ARG <name>=<default>`
Before FROM: parametrize the base
A global ARG is only usable in FROM lines. Redeclare it without a value inside a stage to use it there.

BUILD STEPS

`RUN <command>`
Run a command in a new layer

`COPY <src> <dest>`
Copy files from the build context

`COPY --chown=<user>:<group> <src> <dest>`
Copy and set owner

`COPY --chmod=<mode> <src> <dest>`
Copy and set permissions

`COPY --link <src> <dest>`
Copy into an independent layer

`ADD <url> <dest>`
Download a remote file

BUILD STEPS (cont.)

`ADD <archive>.tar.gz <dest>`
Copy and auto-extract a local tar
For plain files prefer COPY. ADD is for tar auto-extract and URLs.

`RUN --mount=type=cache, target=<dir> <command>`
Reuse a package cache between builds

`RUN --mount=type=secret,id=<id> <command>`
Use a secret without baking it in
Read it from /run/secrets/<id>. Pass it with docker build --secret id=<id>,src=<file>.

`RUN --mount=type=bind, source=<src>,target=<dir> <command>`
Read context files without copying

`RUN --mount=type=ssh <command>`
Use the host SSH agent

`RUN a && b && c`
Chain steps in one layer

CONFIGURATION

`ENV <key>=<value>`
Set a variable for build and runtime

`ARG <name>[=<default>]`
Declare a build-time variable
Set with docker build --build-arg <name>=<value>. Not for secrets: values show up in image history.

`WORKDIR <path>`
Set the directory for later steps
Creates the directory if needed. Prefer it over RUN cd.

`USER <user>[:<group>]`
Run later steps as this user

`LABEL <key>=<value>`
Attach image metadata

`SHELL ["/bin/bash", "-c"]`
Change the shell for shell-form steps

`RUN useradd -r -u 10001 <user>`
Create an unprivileged user

RUNTIME

`EXPOSE <port>[/tcp|/udp]`
Document a port
This does not publish anything. Use -p or -P at docker run.

`CMD ["exe", "arg"]`
Default command (exec form)

`ENTRYPOINT ["exe"]`
Fixed executable for the container

RUNTIME (cont.)

`CMD ["arg1", "arg2"]`
Default arguments for ENTRYPOINT

`CMD <command> <arg>`
Default command via /bin/sh -c
Shell form runs under sh -c, so signals do not reach your process. Prefix with exec or use exec form.

`VOLUME ["<path>"]`
Declare a mount point

`HEALTHCHECK CMD <command>`
Probe container health

`HEALTHCHECK --interval=<d> --timeout=<d> --retries=<n> CMD <command>`
Tune the probe
Defaults: interval 30s, timeout 30s, retries 3. Exit 0 is healthy, 1 unhealthy.

ENTRYPOINT and CMD

Dockerfile	Runs
`CMD ["a"]`	a
`ENTRYPOINT ["e"]`	e
`ENTRYPOINT ["e"] + CMD ["a"]`	e a
`docker run <image> x`	replaces CMD
`docker run --entrypoint <p> <image>`	replaces ENTRYPO

SYNTAX AND CONTEXT

`# syntax=docker/dockerfile:1`
Parser directive: current stable frontend
Must be the very first line of the file.

`RUN <<EOF`
Multi-line script with a heredoc

`<command> \`
Continue a line

`# comment`
Comment line

`docker build -f <file> <context>`
Use another Dockerfile

`docker build -t <name> .`
Build with a tag

`node_modules`
In .dockerignore: skip a path

`**/*.log`
In .dockerignore: match at any depth

`!<pattern>`
In .dockerignore: re-include a match
The last matching line wins, so put exceptions after the pattern they carve out.

Keep .git, node_modules and build output out of the context: it makes builds faster and keeps COPY . from invalidating the cache.

CACHE AND SIZE

Copy dependency manifests first, install, then copy the rest of the source. Code edits then do not re-run the install.

Use a multi-stage build: compile in a fat stage, copy only the artifact into a slim final stage.

Clean package manager caches in the same RUN that created them. A later RUN cannot shrink an earlier layer.

Never put secrets in ARG, ENV or COPY: they stay in the layers. Use RUN --mount=type=secret.

Prefer exec form for CMD and ENTRYPOINT so the process gets SIGTERM from docker stop.

Group changing steps last and pin versions of base images and packages for reproducible builds.

RECIPES

Cache-friendly Node image

```
FROM node:22-slim
WORKDIR /app
COPY package*.json ./
RUN --mount=type=cache,target=/root/.npm npm ci
COPY . .
CMD ["node", "server.js"]
```

Multi-stage Go binary

```
FROM golang:1.23 AS build
WORKDIR /src
COPY . .
RUN CGO_ENABLED=0 go build -o /out/app .

FROM gcr.io/distroless/static
COPY --from=build /out/app /app
USER 65532
ENTRYPOINT ["/app"]
```

Entrypoint script that forwards signals

```
COPY entrypoint.sh /entrypoint.sh
ENTRYPOINT ["/entrypoint.sh"]
CMD ["serve"]
# last line of entrypoint.sh:
# exec "$@"
```

Heredoc script with a build secret

```
RUN --mount=type=secret,id=token <<EOF
  set -e
  curl -fsS -H "Authorization: Bearer $(cat /run/secrets/token)" <url> -o /tmp/pkg
EOF
```