



Published in CodeX



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Dec 22, 2022 · 3 min read · Listen



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A Guide to Docker Multi-Stage Builds

An article regarding Multi-Stage Builds on Docker



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A Docker image is built up from a series of layers. Each layer represents an instruction in the image's Dockerfile. Each layer except the very last one is read-only.

One of the most challenging things about building images is decreasing image size. In this article, we will discuss how we can optimize a docker image size.

Let's create a custom docker image for a simple golang application.

```
# app.go

package main

import (
    "fmt"
    "time"
    "os/user"
)

func main () {
    user, err := user.Current()
    if err != nil {
        panic(err)
    }

    for {
        fmt.Println("user: " + user.Username + " id: " + user.Uid)
        time.Sleep(1 * time.Second)
    }
}
```

Now, let's write a **Dockerfile** to package the golang application :

```
# Dockerfile

FROM ubuntu # Base image
ARG DEBIAN_FRONTEND=noninteractive
RUN apt-get update && apt-get install -y golang-go # Install golang
COPY app.go . # Copy source code
RUN CGO_ENABLED=0 go build app.go
CMD ["/app"]
```

Next, Create a **docker image** and run a container from that image :

```
# Create image from the Dockerfile
>> docker build -t goapp .
...
Successfully built 0f51e92fe409
Successfully tagged goapp:latest

# Run a container from the image created above
>> docker run -d goapp

04eb7e2f8dd2ade3723af386f80c61bdf6f5d9afe6671011b60f3a61756bdab6
```

Now, 'exec' into the container we created earlier :

```
# exec into the container
>> docker exec -it 04eb7e2f8dd sh

# list the files
~ ls
app app.go bin boot dev etc home ...

# run the application
~ ./app
user: root id: 0
user: root id: 0
user: root id: 0
user: root id: 0
user: root id: 0
...
```

We can see that after building the application we have **app** artifact inside the container. If we check the image size which helped us to build our application artifact :

```
>> docker images goapp
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
goapp	latest	0f51e92fe409	16 hours ago	870MB

The image size is '870MB', but we can slim this down using multi-stage builds. With multi-stage builds, we will use multiple **FROM** statements in our Dockerfile. Each **FROM** instruction can use a different base, and each of them begins a new stage of the build. We can selectively copy artifacts from one stage to another by leaving

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We will divide our **Dockerfile** into two stages. One will be the **build stage**, which will help us to build our application and generate the artifact. And then we will only **copy the artifact from the build stage to another stage and create a tiny production image**.

```
# Dockerfile
# named this stage as builder -----
FROM ubuntu AS builder
ARG DEBIAN_FRONTEND=noninteractive
# Install golang
RUN apt-get update && apt-get install -y golang-go
# Copy source code
COPY app.go .
RUN CGO_ENABLED=0 go build app.go

# new stage -----
FROM alpine
# Copy artifact from builder stage
COPY --from=builder /app .
CMD ["/app"]
```

Now, build the image and check the image size :

```
>> docker build -t goapp-prod .

Successfully built 61627d74f8b8
Successfully tagged goapp-prod:latest

>> docker images goapp-prod
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
goapp-prod	latest	61627d74f8b8	5 minutes ago	8.92MB # <---

As we can see image size has been reduced significantly. It's time to check if we can run a container from the image we created.



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```
# create docker container
>> docker run goapp-prod

user: root id: 0
user: root id: 0
```

Great! We were able to use the tiny production image we created and it is working perfectly.

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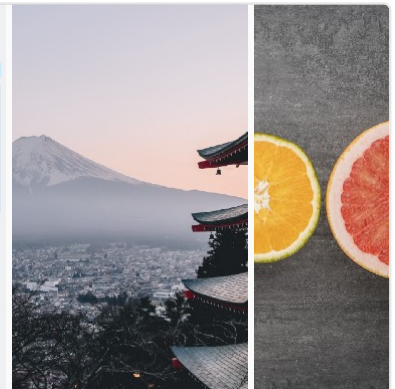
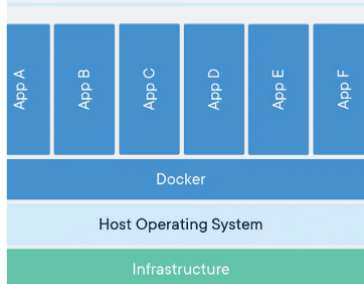
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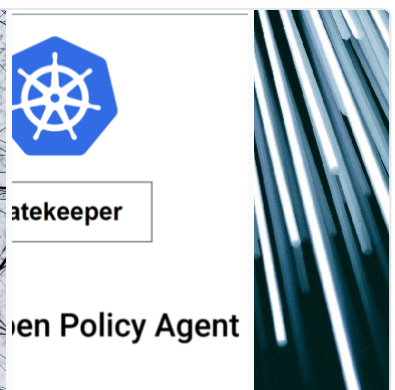
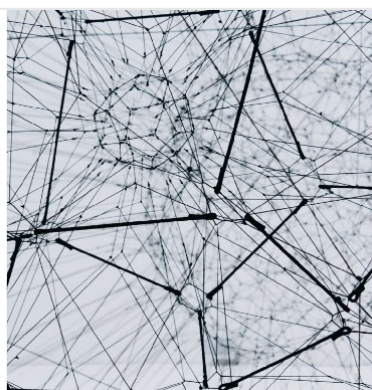


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