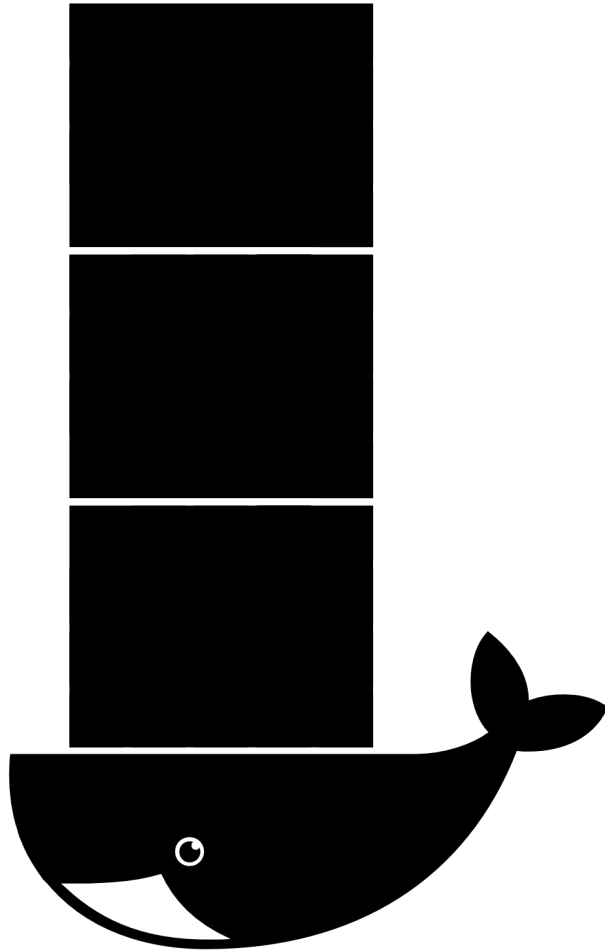


# Building *small* docker containers

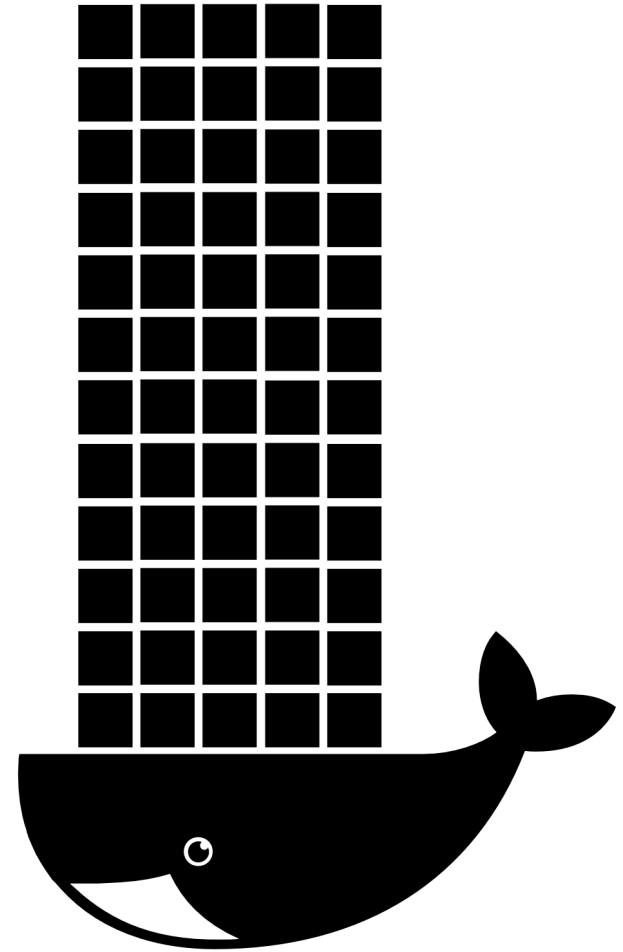
Ben Rusholme  
IPAC Containerization Workshop  
12th September 2019

**Docker containers can vary  
*drastically* in size  
depending on how they  
were built**

# Smaller is *better*



1. Less storage
2. Quicker transfers
3. Faster startup
4. Run more per host
5. More secure

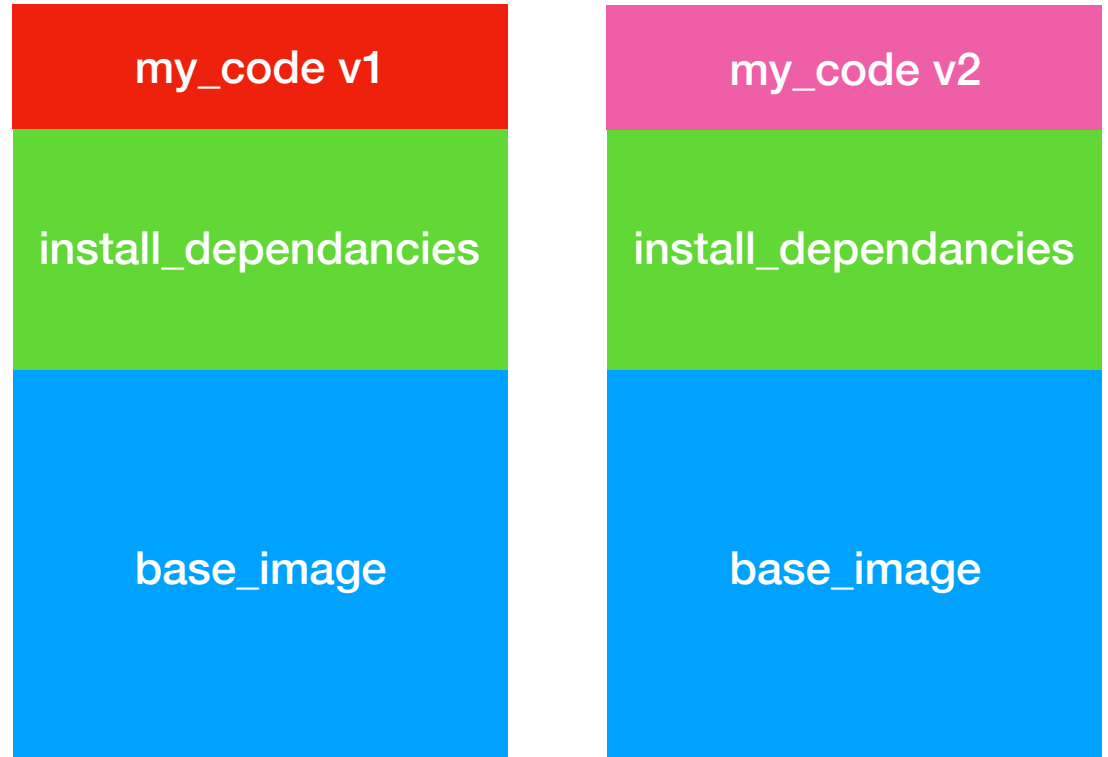


*Thanks to  
Jacob Llamas!*

# Layered Builds

- Docker images are built from a **Dockerfile** recipe
- Images are built in **immutable layers**
- Layers are differences!

```
FROM base_image  
  
RUN install_dependencies  
  
COPY my_code
```



# Contrived Example

```
+ dd if=/dev/urandom of=100MB.file count=195312
```

```
99999744 bytes (100 MB, 95 MiB) copied, 7.94837 s, 12.6 MB/s
```

```
+ cat Dockerfile
```

```
FROM centos:latest
```

```
RUN mkdir /test
```

```
COPY 100MB.file /test
```

```
RUN chmod u+x /test/100MB.file
```

```
RUN rm /test/100MB.file
```

```
+ docker build --tag=centos_file .
```

```
<5 steps>
```

```
+ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
centos_file	latest	7f398f5ec1e2	Less than a second ago	402MB
centos	latest	67fa590cfc1c	9 days ago	202MB

# Inspecting Layers

```
+ docker history centos_file
```

IMAGE	CREATED	CREATED BY	SIZE
7f398f5ec1e2	Less than a second ago	/bin/sh -c rm /test/100MB.file	0B
3ec9695dae1b	1 second ago	/bin/sh -c chmod u+x /test/100MB.file	100MB
99b1a264df95	4 seconds ago	/bin/sh -c #(nop) COPY file:0e74d191fd1d16d1	100MB
0f0f7789ff23	6 seconds ago	/bin/sh -c mkdir /test	0B
67fa590cfc1c	9 days ago	/bin/sh -c #(nop) CMD ["/bin/bash"]	0B
<missing>	9 days ago	/bin/sh -c #(nop) LABEL org.label-schema.sc	0B
<missing>	9 days ago	/bin/sh -c #(nop) ADD file:4e7247c06de9ad117	202MB

```
+ docker run 0f0f7789ff23 ls -l /test  
total 0
```

```
+ docker run 99b1a264df95 ls -l /test  
total 97656  
-rw-r--r-- 1 root root 99999744 Aug 30 04:21 100MB.file
```

```
+ docker run 3ec9695dae1b ls -l /test  
total 97656  
-rwxr--r-- 1 root root 99999744 Aug 30 04:21 100MB.file
```

```
+ docker run centos_file ls -l /test  
total 0
```

# Realistic Example

+ **cat Dockerfile**

```
FROM centos:latest

# Install package repositories
RUN yum -y install epel-release
RUN rpm nux-dextop-release-0-5.el7.nux.noarch.rpm

# Install packages
RUN yum -y install ImageMagick
RUN yum -y install ffmpeg
```

+ **docker build --tag=centos\_graphics .**

<5 steps, 4(+103) packages>

+ **docker images**

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
centos_graphics	latest	8bc9a17fc3e4	Less than a second ago	<b>792MB</b>
centos_file	latest	7f398f5ec1e2	About a minute ago	402MB
centos	latest	67fa590cfc1c	9 days ago	202MB

# Single-Layer Example

+ **cat Dockerfile**

```
FROM centos:latest
```

```
# Install/cleanup in single layer
```

```
RUN yum -y install epel-release \
```

```
&& rpm -Uvh nux-dextop-release-0-5.el7.nux.noarch.rpm \
```

```
&& yum -y install ImageMagick ffmpeg \
```

```
&& yum clean all
```

+ **docker build --tag=centos\_compact .**

<2 steps, 4(+103) packages>

+ **docker images**

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
centos_compact	latest	93c53548081d	Less than a second ago	<b>359MB</b> ( 47%)
centos_graphics	latest	8bc9a17fc3e4	About a minute ago	<b>792MB</b> (100%)
centos_file	latest	7f398f5ec1e2	3 minutes ago	402MB
centos	latest	67fa590cfc1c	9 days ago	202MB



# Base Image Size

Dockerhub currently contains 2.6 M images!

## CentOS:

- Full enterprise OS
- Personal choice for server compatibility
- Current latest image **202 MB**

## Alpine:

- Minimal OS focused on size
- Current latest image **5.58 MB**
- Default for official Docker containers since 2016 (1.12?)
- Drawbacks:
  - Based on musl rather than glibc
  - Truncates log lines to 1024 characters

# Alpine Example

+ **cat Dockerfile**

```
# Use smaller base image
FROM alpine:latest

# Use cleanup flag
RUN apk add --no-cache imagemagick ffmpeg
```

+ **docker build --tag=alpine\_graphics .**  
<2 steps, 91 packages>

+ **docker images**

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
alpine_graphics	latest	3ea6a3234a0c	Less than a second ago	<b>133MB</b> ( 17%)
centos_compact	latest	93c53548081d	15 seconds ago	<b>359MB</b> ( 47%)
centos_graphics	latest	8bc9a17fc3e4	About a minute ago	<b>792MB</b> (100%)
centos_file	latest	7f398f5ec1e2	3 minutes ago	402MB
centos	latest	67fa590cfc1c	9 days ago	202MB
alpine	latest	961769676411	9 days ago	5.58MB

# Summary

1. Understand layers
2. Remove build/install/tmp caches
3. Start from a small image

## 4. If all else fails:

```
docker rm $(docker ps -a -q)           # remove all containers  
docker rmi -f $(docker images -a -q)  # remove all images  
docker volume prune -f                # remove any volumes  
docker system prune -f                # clean system cache
```