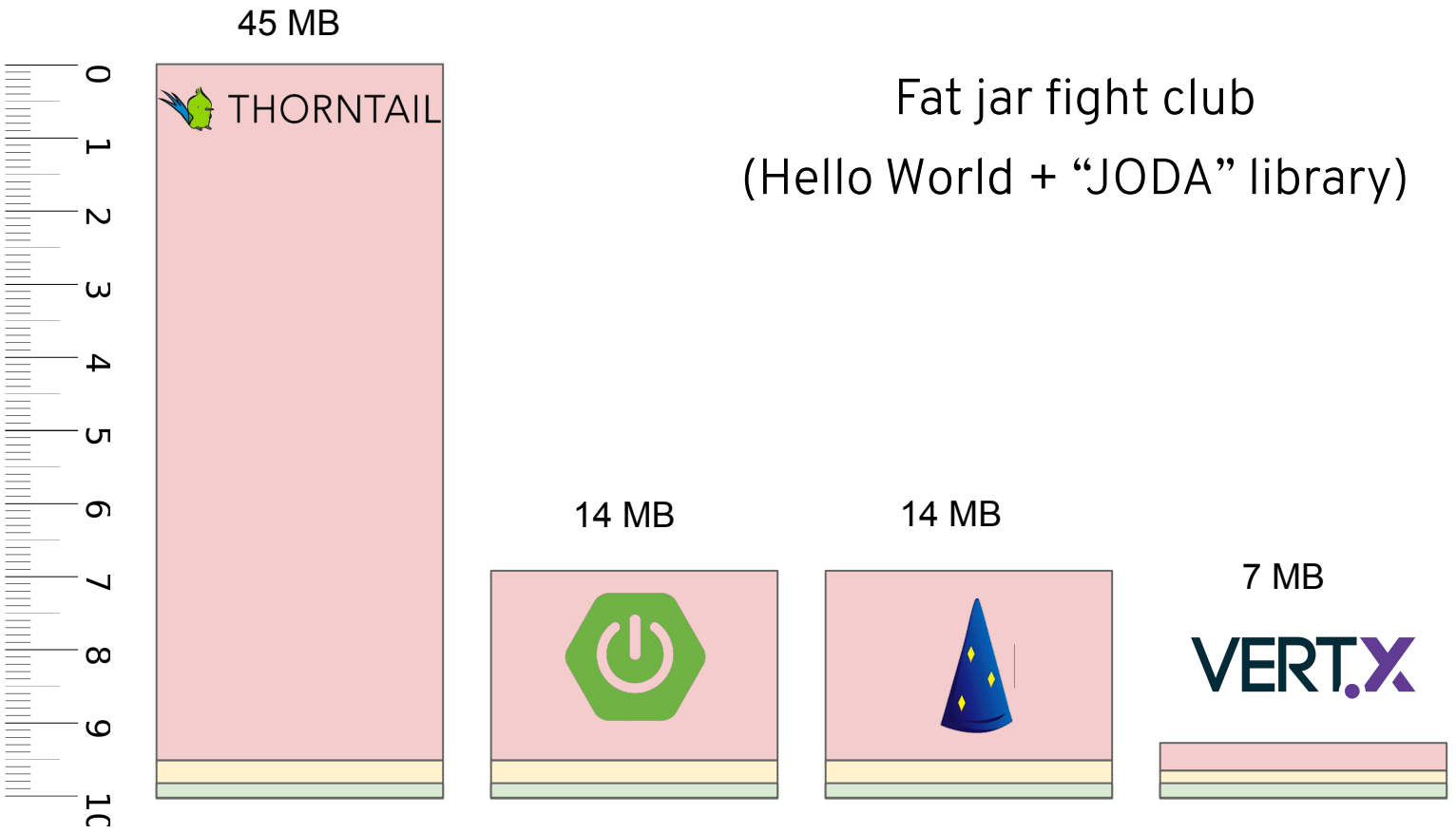
Monoliths to microservices: App Transformation

Hands-on Technical Workshop

Packaging microservices

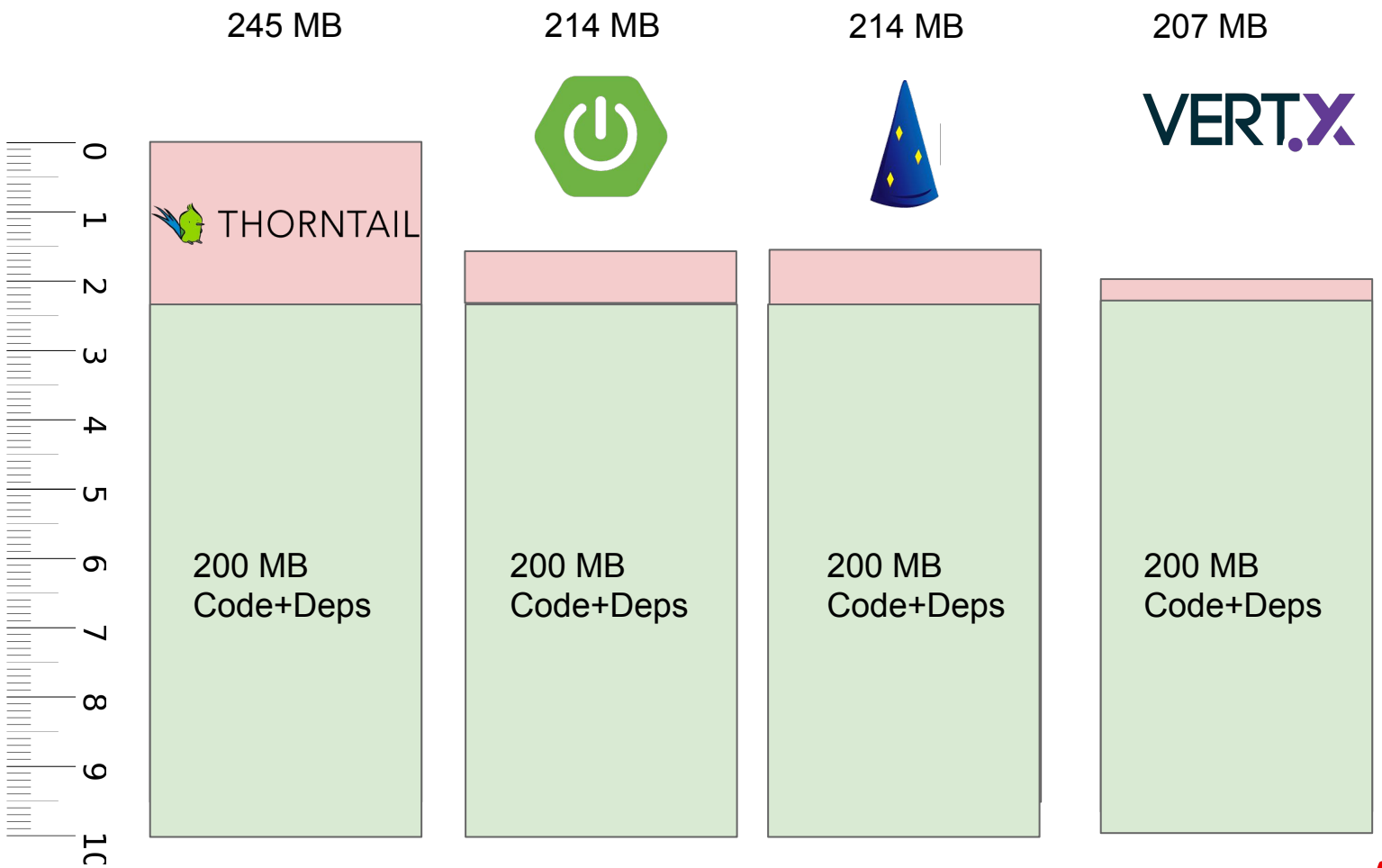
Packaging with fat jars

- Easily Portable, easily runnable (esp. in IDEs)
- Dependencies resolved at build time (not in production)
- Everyone supports it
  - Dropwizard was first (March 2011)
- Everything in one JAR
- Everything in one container layer
- Fat JAR is rebuilt for single line change (!)



Fat jar fight club

(Hello World + “JODA” library)


245 MB
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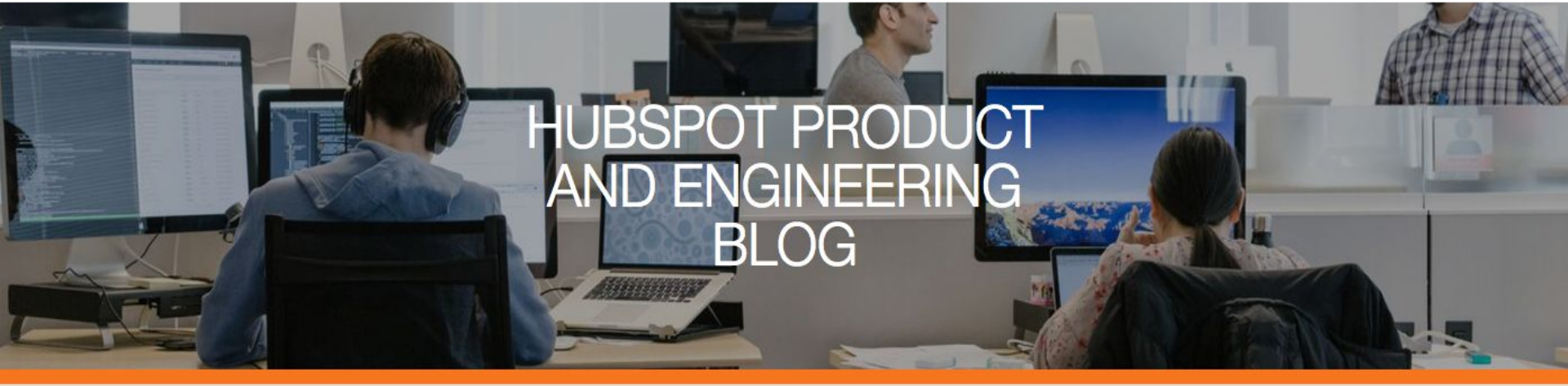


The Fault in Our JARs: Why We Stopped Building Fat JARs

JUN 16, 2016 / BY JONATHAN HABER

HubSpot's backend services are almost all written in Java. We have over 1,000 microservices

With over 100 engineers constantly committing, we usually do 1,000-2,000 builds per day. With each of these builds uploading a fat JAR, we were generating 50-100GB of build artifacts *per day*. And the most painful part is how much duplication there is between each of these artifacts. Our applications have a lot of overlap in terms of 3rd party libraries, for example they all use Guice, Jackson, Guava, Logback, etc. Imagine how many copies of these libraries we have sitting in S3!

```
~  % docker history 7ac5d7400c9e
IMAGE               CREATED             CREATED BY                                      SIZE
7ac5d7400c9e        6 weeks ago         /bin/sh -c tar -C /tmp -xf - && /usr/local...   209 MB
2d35763bda38        2 months ago        /bin/sh -c #(nop) CMD ["/usr/local/s2i/run"]    0 B
<missing>           2 months ago        /bin/sh -c mkdir -p /deployments/data           7 B
<missing>           2 months ago        /bin/sh -c #(nop) COPY file:093cf59865b7eb...   421 B
<missing>           2 months ago        /bin/sh -c mkdir -p /opt/jboss/.m2              7 B
<missing>           2 months ago        /bin/sh -c #(nop) USER [1000]                   0 B
<missing>           2 months ago        /bin/sh -c mkdir -p /deployments/data  && ...   7 B
<missing>           2 months ago        /bin/sh -c chmod 755 /opt/run-java/run-env.sh   96 B
<missing>           2 months ago        /bin/sh -c #(nop) COPY file:41c68bae60a2fc...   89 B
<missing>           2 months ago        /bin/sh -c chmod 755 /opt/run-java/run-jav...   11.2 kB
<missing>           2 months ago        /bin/sh -c #(nop) COPY multi:f0215f3bf07a5...   11.2 kB
<missing>           2 months ago        /bin/sh -c #(nop) ADD file:a997b3875f55a65...   7.78 kB
<missing>           2 months ago        /bin/sh -c chmod 755 /usr/local/s2i/*           7.37 kB
<missing>           2 months ago        /bin/sh -c #(nop) COPY dir:d2bc92464c815ef...   7.36 kB
<missing>           2 months ago        /bin/sh -c #(nop) EXPOSE 8778/tcp               0 B
<missing>           2 months ago        /bin/sh -c chmod 444 /opt/jolokia/jolokia....   448 kB
<missing>           2 months ago        /bin/sh -c #(nop) ADD file:7428506ba578dc4...   2.78 kB
<missing>           2 months ago        /bin/sh -c mkdir -p /opt/jolokia/etc  && c...   445 kB
<missing>           2 months ago        /bin/sh -c curl https://archive.apache.org...   9.52 MB
<missing>           2 months ago        /bin/sh -c usermod -g root -G jboss jboss       3.36 kB
<missing>           2 months ago        /bin/sh -c echo securerandom.source=file:/...   32.8 kB
<missing>           2 months ago        /bin/sh -c #(nop) USER [root]                   0 B
<missing>           2 months ago        /bin/sh -c #(nop) LABEL io.fabric8.s2i.ver...   0 B
<missing>           2 months ago        /bin/sh -c #(nop) ENV JOLOKIA_VERSION=1.3....   0 B
<missing>           2 months ago        /bin/sh -c #(nop)  ENV JAVA_HOME=/usr/lib/...   0 B
<missing>           2 months ago        /bin/sh -c #(nop)  USER [jboss]                 0 B
<missing>           2 months ago        /bin/sh -c yum -y install java-1.8.0-openj...   200 MB
<missing>           2 months ago        /bin/sh -c #(nop)  USER [root]                  0 B
<missing>           2 months ago        /bin/sh -c #(nop)  MAINTAINER Marek Goldma...   0 B
<missing>           2 months ago        /bin/sh -c #(nop)  USER [jboss]                 0 B
<missing>           2 months ago        /bin/sh -c #(nop) WORKDIR /opt/jboss            0 B
<missing>           2 months ago        /bin/sh -c groupadd -r jboss -g 1000 && us...   296 kB
<missing>           2 months ago        /bin/sh -c yum update -y && yum -y install...   27.6 MB
<missing>           2 months ago        /bin/sh -c #(nop)  MAINTAINER Marek Goldma...   0 B
<missing>           2 months ago        /bin/sh -c #(nop)  CMD ["/bin/bash"]            0 B
<missing>           2 months ago        /bin/sh -c #(nop)  LABEL name=CentOS Base ...   0 B
<missing>           2 months ago        /bin/sh -c #(nop) ADD file:d22a9c627d1d1f3...   193 MB
```

App Server + App (200M++)

Build scripts (negligible)

TRADITIONAL JAVA EE CONTAINER LAYERS

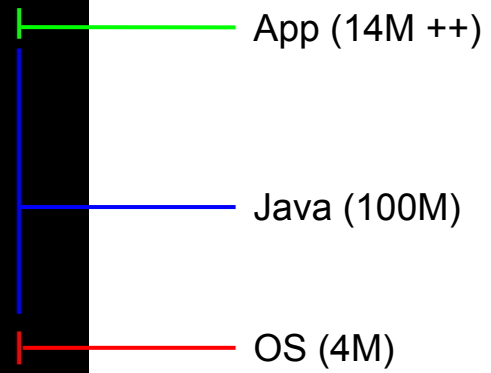
Java (~200M)

OS (~200M)

Red Hat

Spring Boot “Hello World” fat jar in a container

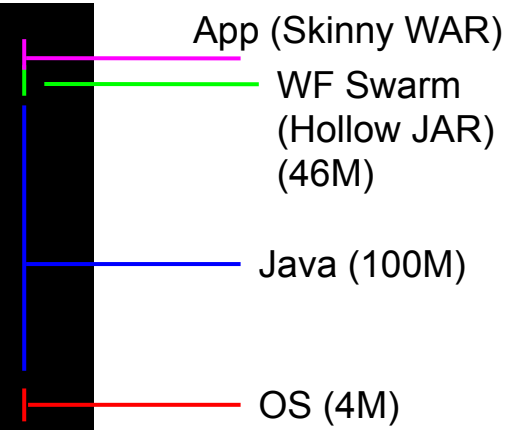
```
IMAGE               CREATED             CREATED BY                                      SIZE
COMMENT
470e32ddc492        7 seconds ago       /bin/sh -c #(nop) ADD file:8a5315547de4c8d...   14.4 MB
a5bfb986fd7f        19 seconds ago      /bin/sh -c #(nop)  EXPOSE 8080/tcp              0 B
dc85e81854d1        19 seconds ago      /bin/sh -c #(nop)  ENTRYPOINT ["sh" "-c" "...   0 B
661b82f1b4f6        2 days ago          /bin/sh -c #(nop)  VOLUME [/tmp]                0 B
a8bd10541772        2 weeks ago         /bin/sh -c set -x  && apk add --no-cache  ...   97.1 MB
<missing>           2 weeks ago         /bin/sh -c #(nop)  ENV JAVA_ALPINE_VERSION...   0 B
<missing>           2 weeks ago         /bin/sh -c #(nop)  ENV JAVA_VERSION=8u131       0 B
<missing>           2 weeks ago         /bin/sh -c #(nop)  ENV PATH=/usr/local/sbi...   0 B
<missing>           2 weeks ago         /bin/sh -c #(nop)  ENV JAVA_HOME=/usr/lib/...   0 B
<missing>           2 weeks ago         /bin/sh -c {   echo '#!/bin/sh';   echo 's...   87 B
<missing>           2 weeks ago         /bin/sh -c #(nop)  ENV LANG=C.UTF-8             0 B
<missing>           2 weeks ago         /bin/sh -c #(nop)  CMD ["/bin/sh"]              0 B
<missing>           2 weeks ago         /bin/sh -c #(nop) ADD file:4583e12bf5caec4...   3.97 MB
```



Red Hat

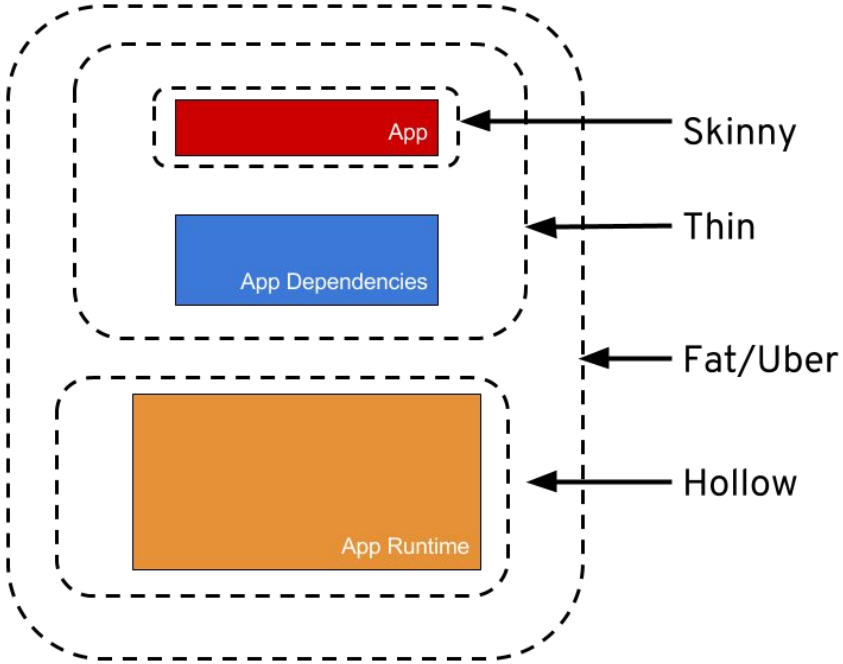
Thorntail “Hello World” skinny jar/war in a container

```
IMAGE          CREATED             CREATED BY                                      SIZE
2c2a26c16ba3   9 seconds ago       /bin/sh -c #(nop) ADD file:267565476904261...   2.27 kB
37cdd8f0be3e   10 seconds ago      /bin/sh -c #(nop) ADD file:3696ab070f867a9...   46.3 MB
da2c317b1fad   35 hours ago        /bin/sh -c #(nop)  EXPOSE 8080/tcp              0 B
5827f39ca476   35 hours ago        /bin/sh -c #(nop)  ENTRYPOINT ["sh" "-c" "...   0 B
661b82f1b4f6   3 days ago          /bin/sh -c #(nop)  VOLUME [/tmp]                0 B
a8bd10541772   2 weeks ago         /bin/sh -c set -x  && apk add --no-cache  ...   97.1 MB
<missing>      2 weeks ago         /bin/sh -c #(nop)  ENV JAVA_ALPINE_VERSION...   0 B
<missing>      2 weeks ago         /bin/sh -c #(nop)  ENV JAVA_VERSION=8u131       0 B
<missing>      2 weeks ago         /bin/sh -c #(nop)  ENV PATH=/usr/local/sbi...   0 B
<missing>      2 weeks ago         /bin/sh -c #(nop)  ENV JAVA_HOME=/usr/lib/...   0 B
<missing>      2 weeks ago         /bin/sh -c {   echo '#!/bin/sh';   echo 's...   87 B
<missing>      2 weeks ago         /bin/sh -c #(nop)  ENV LANG=C.UTF-8             0 B
<missing>      3 weeks ago         /bin/sh -c #(nop)  CMD ["/bin/sh"]              0 B
<missing>      3 weeks ago         /bin/sh -c #(nop) ADD file:4583e12bf5caec4...   3.97 MB
```



Fat, thin, skinny, hollow

- Thin
  - App + Direct Dependencies (ex: traditional Java EE .WAR files)
- Skinny
  - App only, dependencies satisfied externally
  - Must be “deployed” to hollow app
- Hollow
  - App runtime only, contains app dependencies



developers.redhat.com/blog/2017/08/24/the-skinny-on-fat-thin-hollow-and-uber/

Fat jar comparison

github.com/jamesfalkner/wfswarm/packaging-demo

Demo

Fat, thin, skinny support matrix

	Fat	Thin	Skinny/Hollow
Spring Boot	✔️	✔️ (via SB Thin Launcher)	✔️ (via Docker Prep Plugin)
Thorntail	✔️	✔️	✔️ (via fractions)
Eclipse Vert.x	✔️	✔️ (via maven)	✔️ (via Capsule?)
Dropwizard	✔️	✔️ (via maven)?	✔️ (via Capsule?)

Microservice packaging recommendations

- Fat JAR
  - Works well in many cases, dev-friendly
  - Consider size of resulting app & (re-)deployment speed esp. w/containers
- Thin
  - Useful for large dependency sets at scale
- Skinny/Hollow
  - Highly efficient packaging
  - Additional initial complexity

Thank you

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