Java Containers 101

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About Me

- Studied Computer and Business Studies at Uni. of Warwick
- Worked at IBM as a developer for 2 ½ years
- Worked in an agile team that developed Java based micro-services shipped as helm charts to be managed in K8s
- Manchester United Fan
- Love Fifa & Fortnite
- Twitter: @moffusa

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Agenda

Containers:

- Setting the scene
- What are containers?
- What are the advantages of containers?

Docker:

- What is Docker?
- Overview of the Docker ecosystem

Java Considerations:

- How to choose the right Java ‘flavour’
- Java optimisations
- Respecting resource constraints

Hands-on Workshop

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Changes to software consumption

BEFORE: “Download our software and follow the docs to configure your environment”

NOW: “Here is the software, we’ll host it, just access it over the internet”

WHY?

– It just works

– We don’t have expertise

– We don’t care

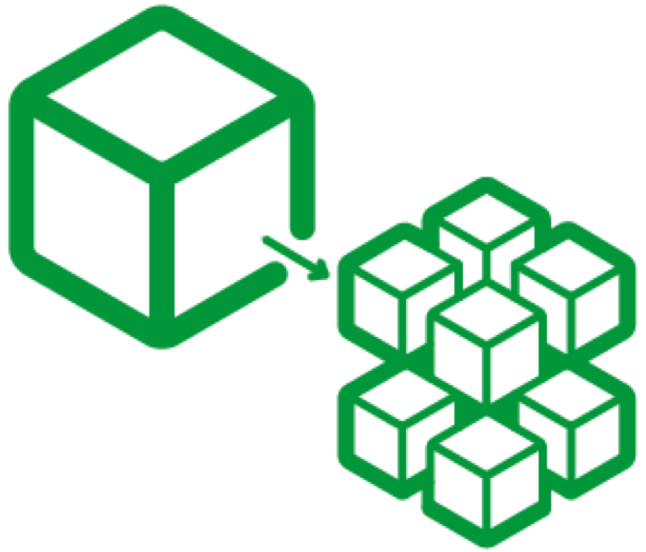
Changes to building software

BEFORE: “Let’s build this thing that can do A, B and C... and Z and then we’ll test it in a year!”

NOW: “Let’s have short dev. cycles and split into smaller teams working on capabilities”

WHY?

- More efficient to reuse smaller components
- More efficient to scale with smaller components
- Easier to do agile with smaller components



Experience is the best teacher...

VI – Processes - Execute the app as one or more stateless processes

VII – Concurrency - Scale out via the process model

IX – Disposability – Maximize robustness with fast startup and graceful shutdown

https://12factor.net

Where do containers fit into this?

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Container Basics

- A container contains!
- Virtualizing the hardware OS subsystems
- Interaction with a single OS

Container Isolation

Namespaces

“What you can see”

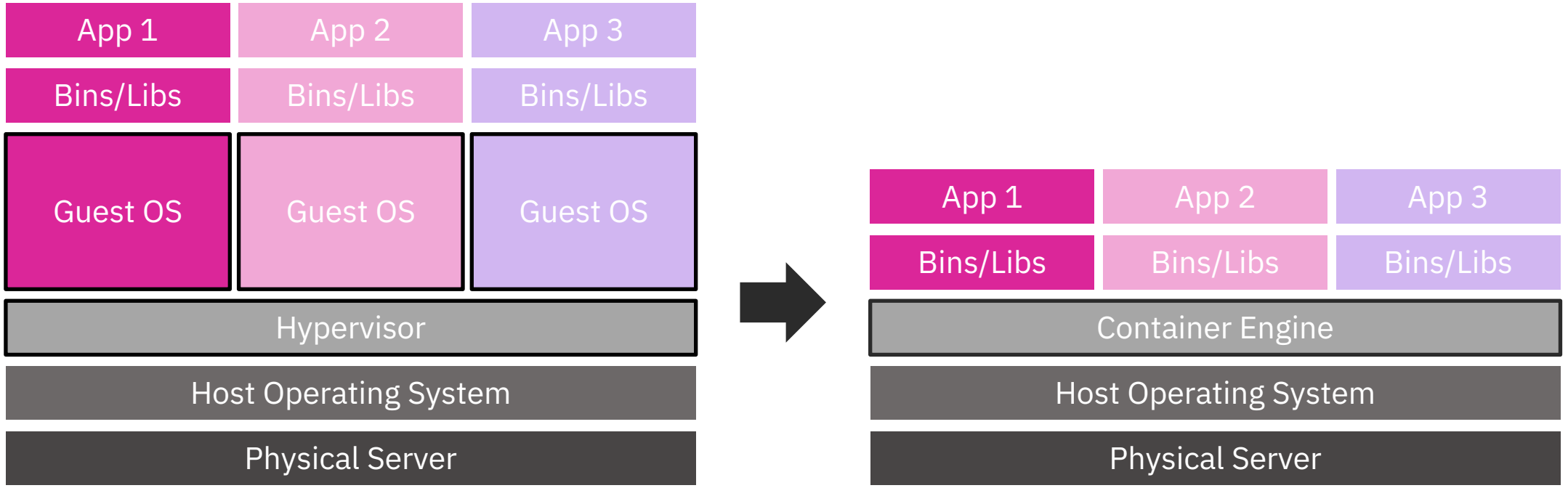
- Process IDs
- Filesystems
- Users
- IPC
- Networking

Cgroups

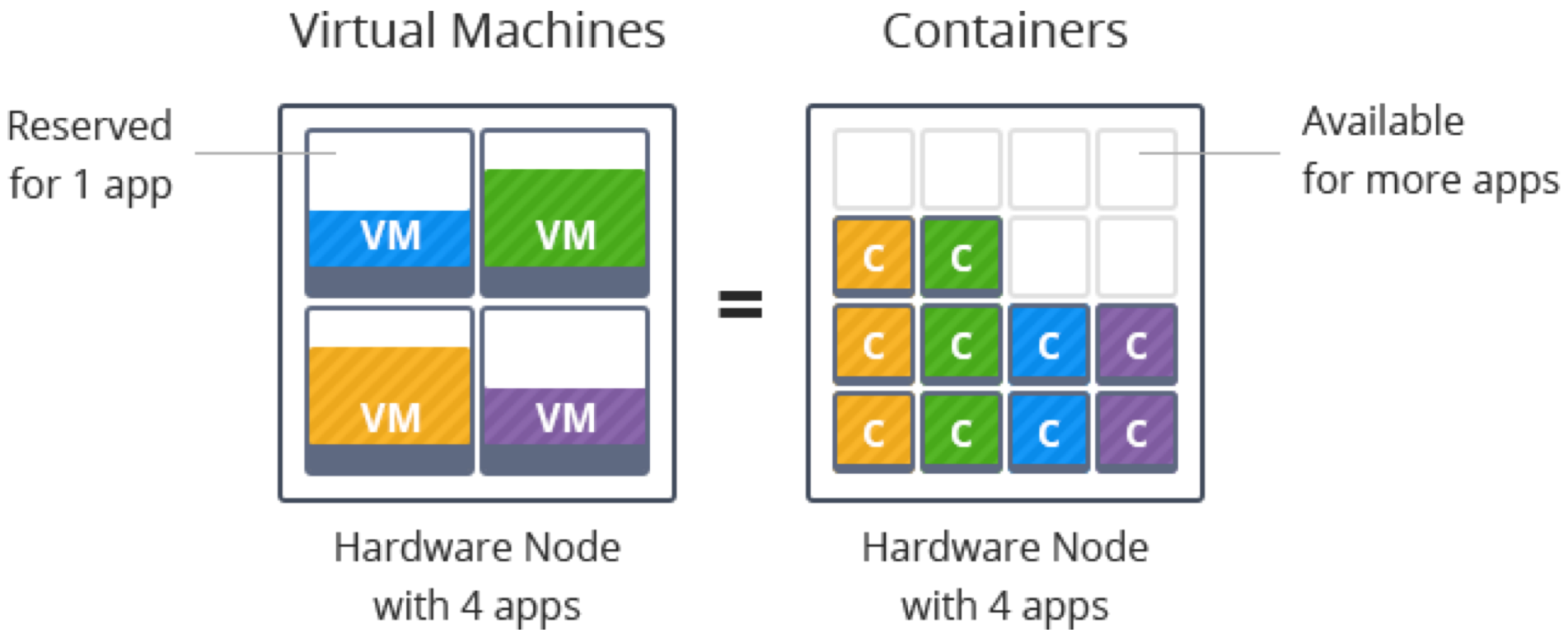
“what you can use”

- CPU
- Memory
- Disk I/O
- Network
- Device permissions (/dev)

VMs vs. Container Virtualization



Advantages



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What is Docker?

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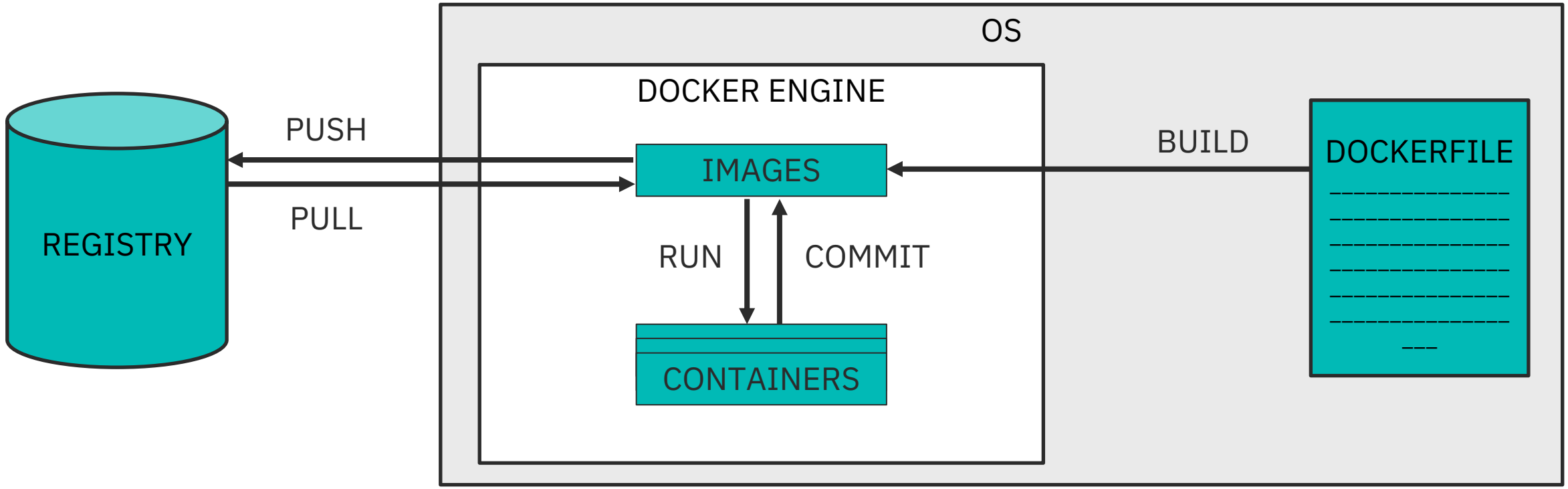
History of the concept of isolation

- Unix V7's Chroot – 1979
- Linux VServer – 2001
- Oracle Solaris Containers – 2004
- Open VZ (Open Virtuzzo) - 2005
- **Google's Process Containers (Control Groups – cgroups) – 2006**
- **LXC (Linux Containers) – 2008**
- CloudFoundry's Warden – 2011
- **Docker – 2013**
- Open Container Initiative – 2015
- The rise of the container tools – 2017

Docker Basics

- The Docker image format
- Docker engine which instantiates containers and manages the lifecycle

Docker Architecture



Dockerfile

Each line is a layer

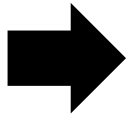
Dockerfile commands:

- FROM
- LABEL
- RUN
- CMD/ENTRYPOINT
- VOLUME
- ENV
- EXPOSE

```
FROM ubuntu

LABEL maintainer=“Bob Smith (bob.smith@gmail.com)”

RUN apt-get update

RUN apt-get install -y nginx

CMD ["nginx", "-g", "daemon off;"]

EXPOSE 80
```

Docker Images

```
FROM ubuntu

LABEL maintainer=“Bob Smith (bob.smith@gmail.com)”

RUN apt-get update

RUN apt-get install -y nginx

CMD ["nginx", "-g", "daemon off;"]

EXPOSE 80
```



3d92d4c5112	EXPOSE 80	0B
C8577c27a2ef	CMD [“nginx”, ”-...	0B
9ee6b6aa5847	RUN apt-get inst...	57.5MB
103ccd6ad90f	RUN apt-get upd...	40.3MB
d2603e1b347d	LABEL maintaine...	0B
ad89def2e29b	FROM ubuntu	80MB

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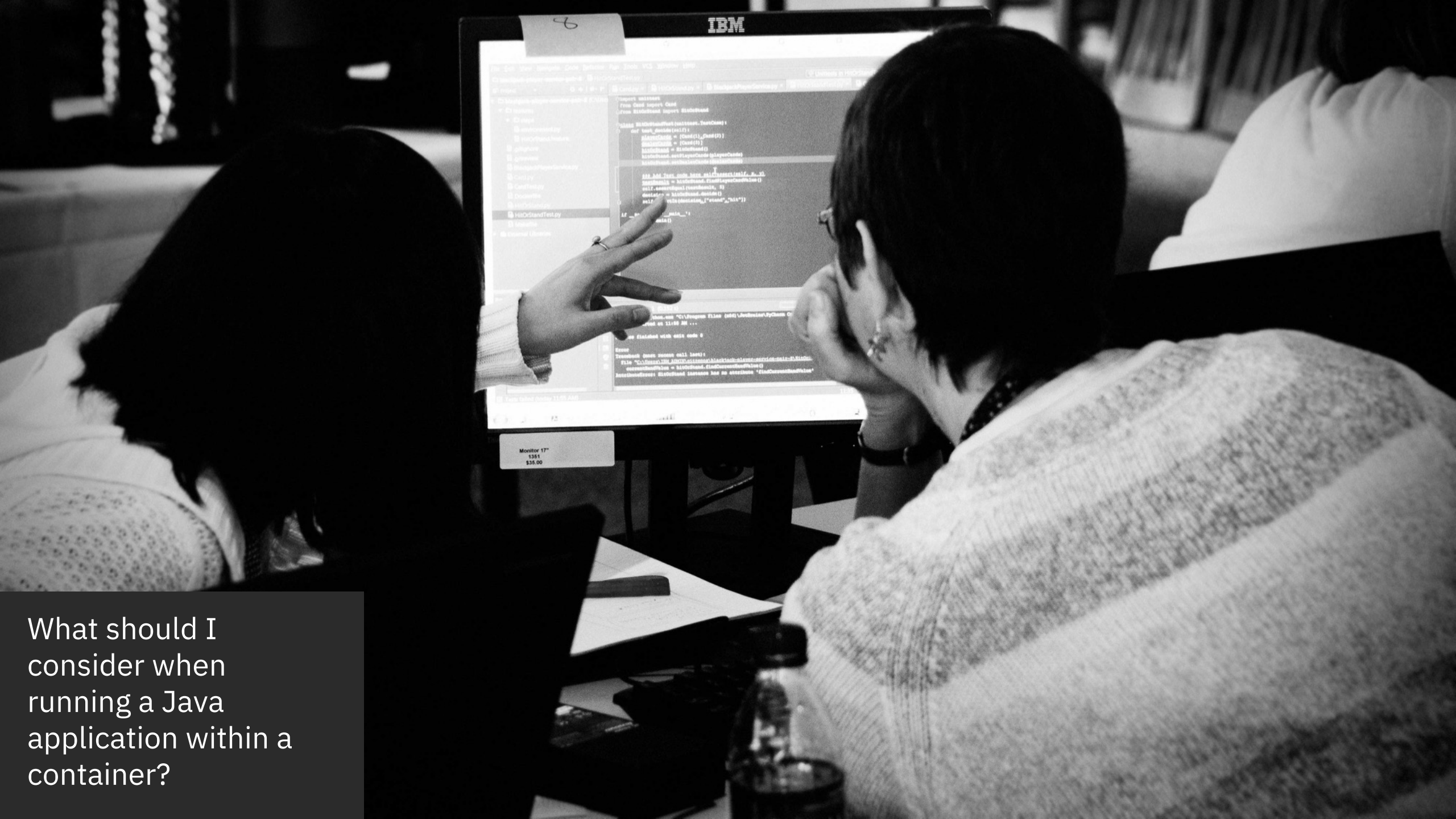

What should I consider when running a Java application within a container?

Choosing a Java version

- Licensing issues with Oracle
- OpenJDK
  - Versions 8, 9, 10, 11 (early access - http://jdk.java.net/11/)
  - Issues with running <9 (https://bugs.openjdk.java.net/browse/JDK-8146115)
  - Java 9+ has native support for container limits
- Java flavours:
  - Full JDK? Full JRE? Other?
- New Java release cadence!

How can we optimise our applications?

- I want my applications to start up faster
- I want my image sizes to be smaller
- I don’t want to have unnecessary tools in my container
- I want my Java flavour to only contain the stuff my application will use!

Respecting resource constraints

- I don’t want my Java processes to use all the available resources on my machine
- I want to control the resources my Java applications use within the container:
  - Memory
  - CPU

Workshop time!

Go to: https://github.com/IBMCodeLondon/java-containers101

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