CAB432 Cloud Computing
Lecture 2: Container as a Service

Faculty of Science

The basics of being a container

DOCKER OVERVIEW

Cloud = Utility Computing + Elasticity + Scale

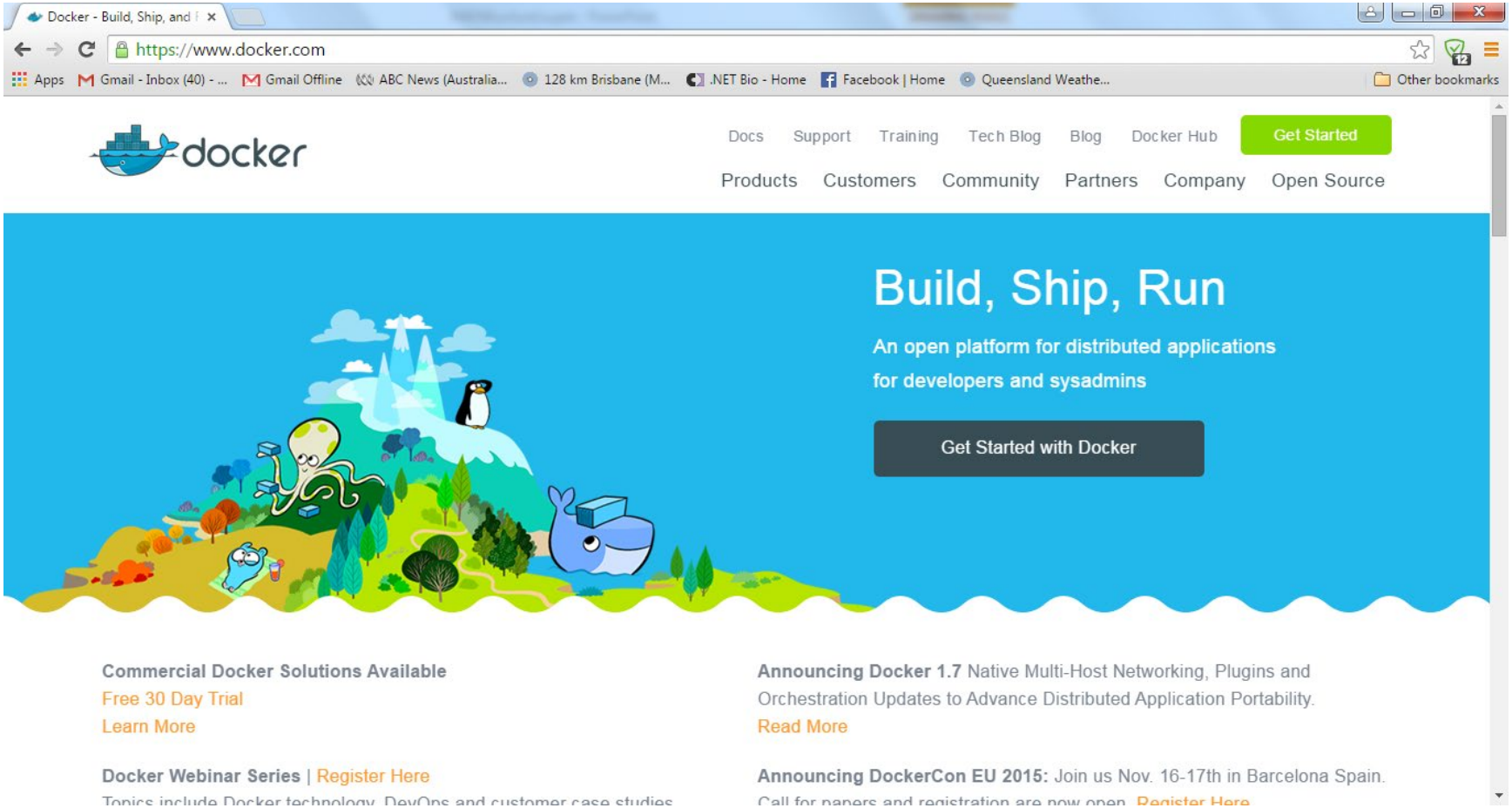
- Utility Computing means virtualization
- IaaS virtualizes an entire “stack”
  - Hardware, operating system/device drivers
  - Optionally: middleware [databases, app server, messaging, etc.]
  - Some Applications
- High setup, maintenance cost
  - Hypervisors and VM Monitors
  - Entire stack even when we don’t need it
  - Consumes excess resources – storage, CPU
-

Container as a Service (CaaS)

- Alternative: Don't virtualize the whole machine
- Focus on a custom set of services:
  - Basic OS, middleware services and applications
- Main Example: Docker (https://www.docker.com)
  - Many other alternatives

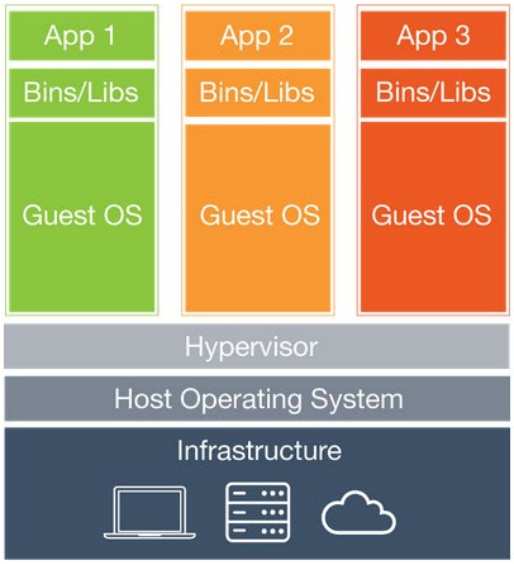
- Orchestration:
  - Kubernetes - https://kubernetes.io/
  - Docker Swarm - https://docs.docker.com/engine/swarm/
  - All the majors now have managed container services

Docker



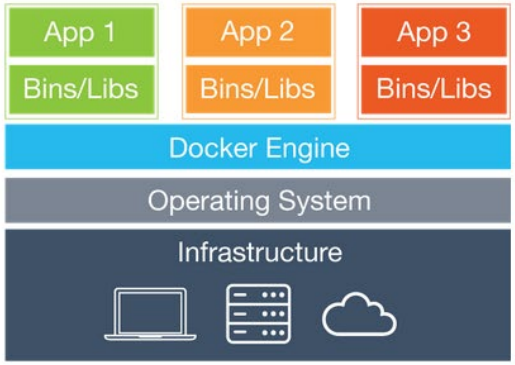
The 2016 slide, but so much more interesting than the current page ☺

Simplified Virtualisation



Virtual Machines

Each virtual machines includes the application, the necessary binaries and libraries and an entire guest operating system - all of which may be tens of GBs in size.



Containers

Containers include the application and all of its dependencies, but share the kernel with other containers. They run as an isolated process in userspace on the host operating system. They're also not tied to any specific infrastructure – Docker containers run on any computer, on any infrastructure and in any cloud.

Application Virtualisation

- Layered **on top** of an OS (typically, Linux)
  - Uses OS capabilities (Linux cgroups)
- Does **not** virtualise everything
  - hardware + firmware + OS + middleware + standard tools
- Precise, user-defined set of software and configuration
  - No need to clone the VM – so much lighter and faster
  - Script instantiates a cloned container in a matter of seconds (your mileage may vary)
  - Pre-canned scripts or images (see next slides) may be shared with others

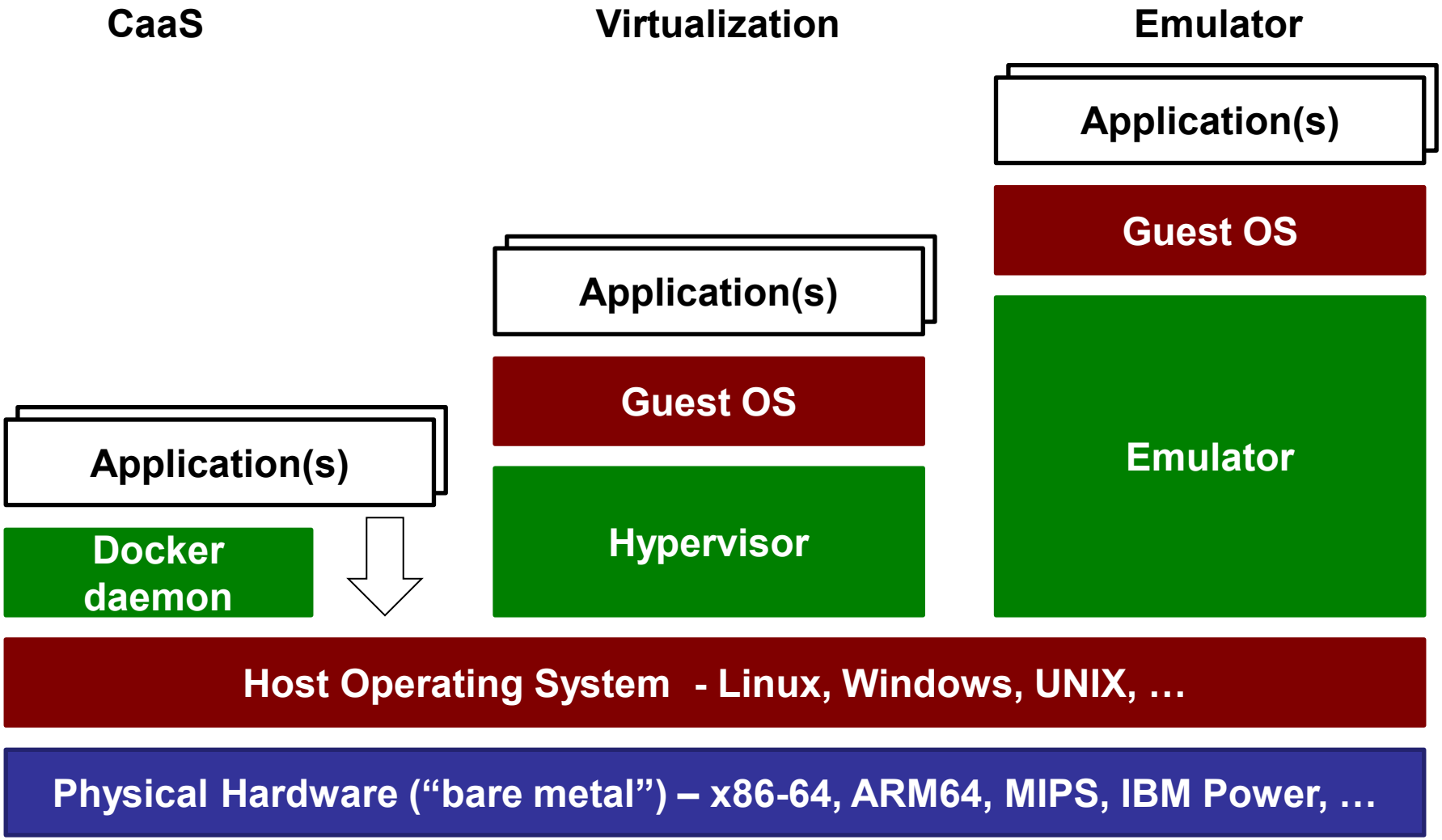
Pros and Cons

- Pros:
  - *Much* more efficient use of “bare metal” hardware resources
  - Orders of magnitude (multiple digits) more containers than VMs
  - More efficient use of CPU cycles, main memory
  - No need to maintain an entire OS stack
  - Simpler management and orchestration c.f. Puppet and Chef
  - Reboot times orders of magnitude better than rebooting VMs

Pros and Cons

- Cons:
  - Assumes guest software to be compatible with Linux
  - True VMs allow better isolation
  - Containers have possible port collisions
  - No access to OS-level daemons

CaaS vs Virtualization vs Emulators



Next Steps

- We will learn about virtualisation
- Then we will learn to use Docker
- Finally (later) we will learn about Kubernetes & Swarm