

The Software Component

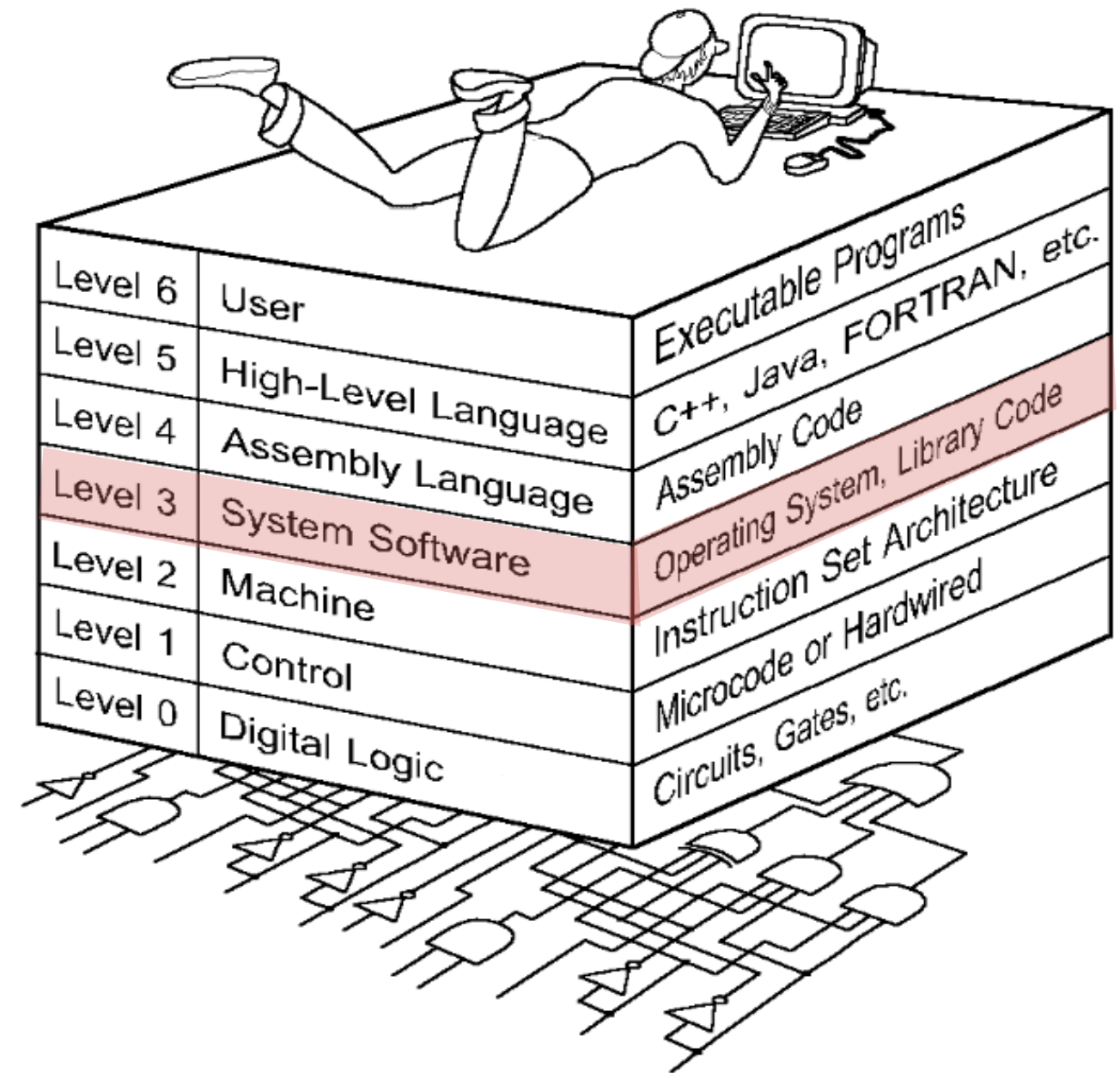
Mostly about OS
COMP30640

Link with Instruction Set Arch.

Bootstrapping

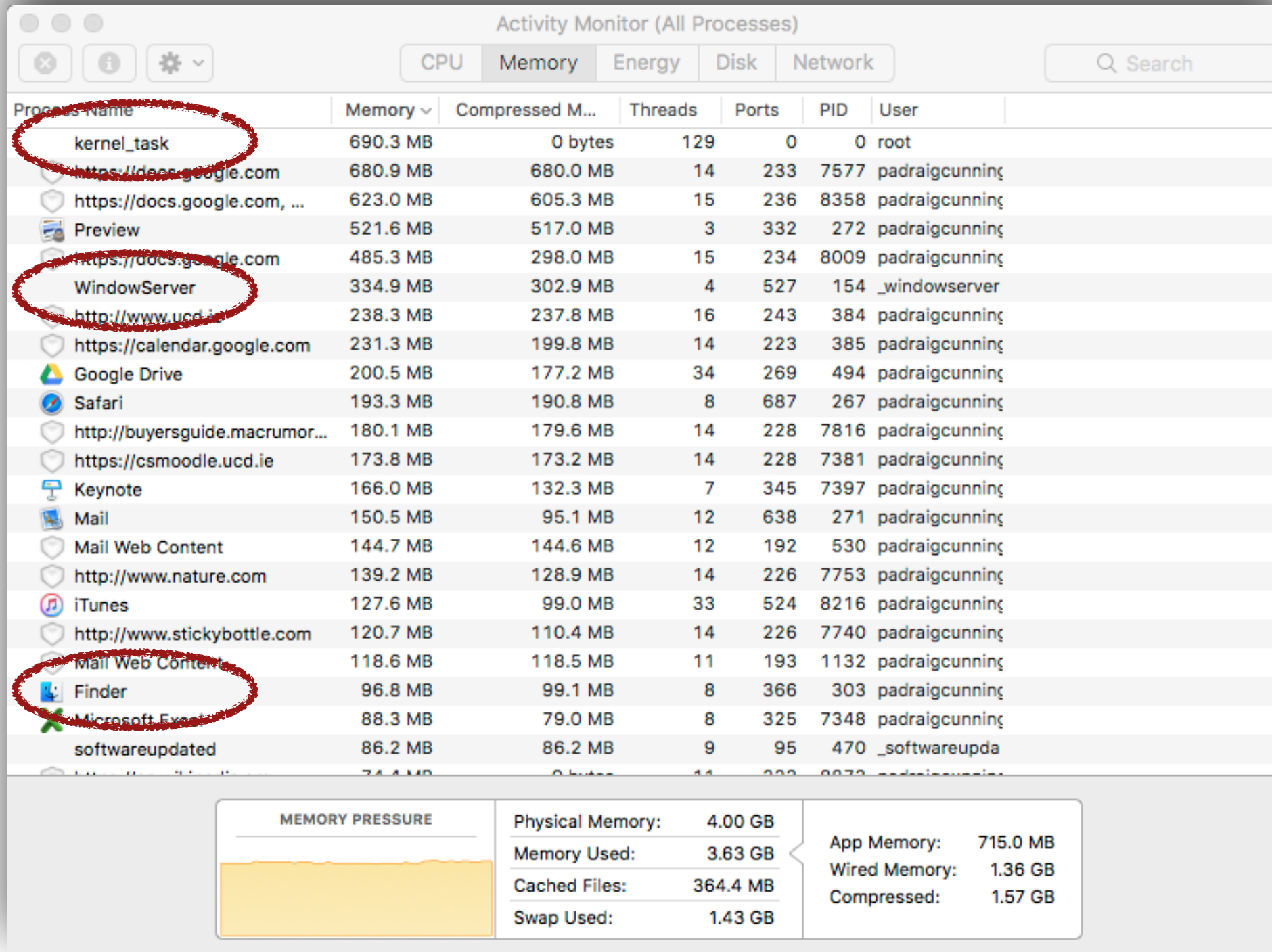
Virtualisation

Java VM
OS VMs

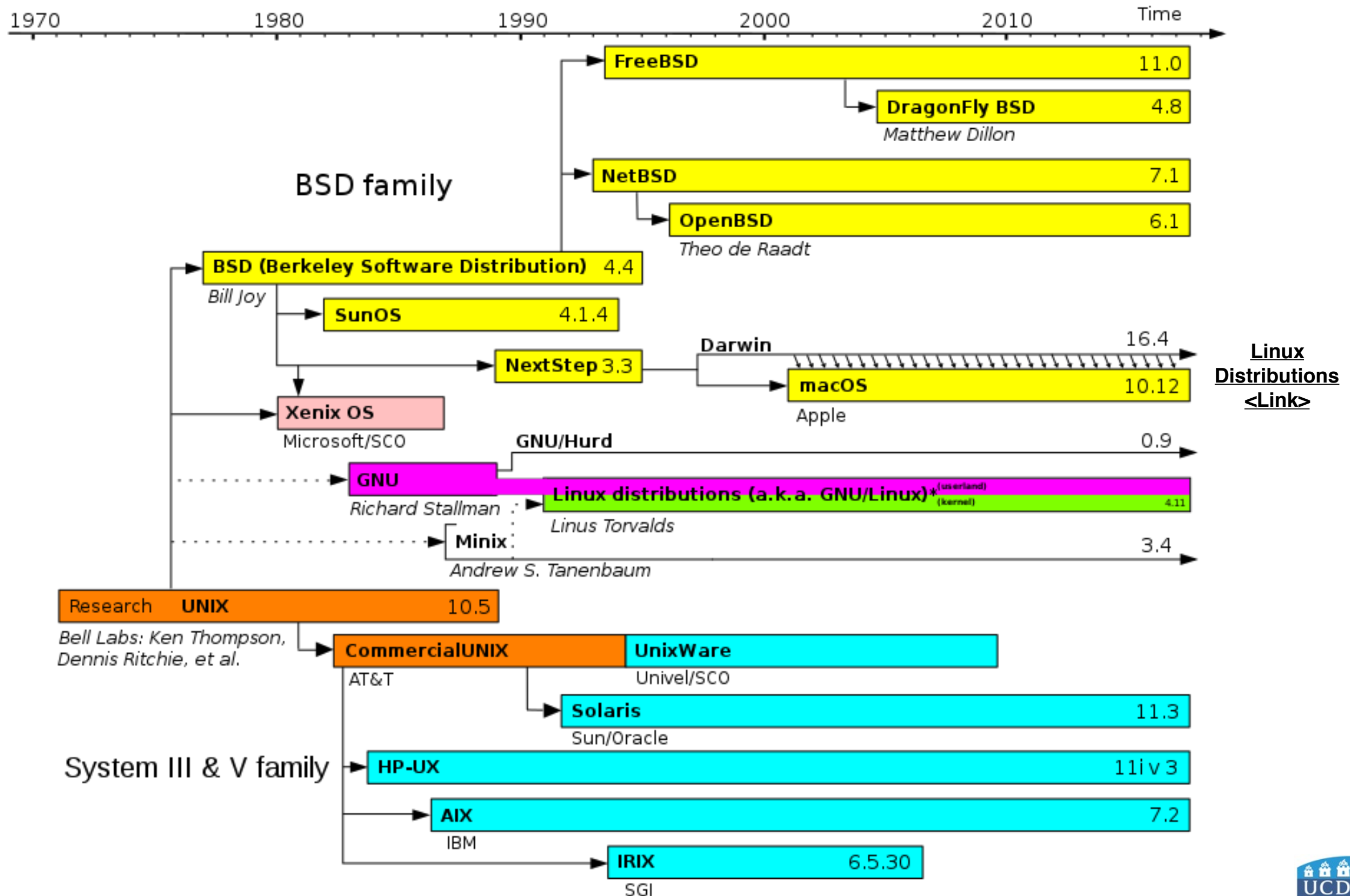


Mac OS example

The OS is a running process
In fact a few processes



BTW: MacOS is a UNIX



<https://en.wikipedia.org/wiki/MacOS>

Bootstrapping

No processes in RAM

No code to run

ROM can store some bootstrap code

BIOS Basic Input/Output System

- ▶ Perform hardware checks
- ▶ Load Boot sector from Boot Disk into RAM (Boot Loader)

BIOS can be interrupted to load from another disk

e.g. CD or USB

Boot Loader loads OS Kernel

It can also load a partition table and partition the disk

Boot different OS from different partitions



OS & ISA

OS may run on many ISAs, e.g.

Linux

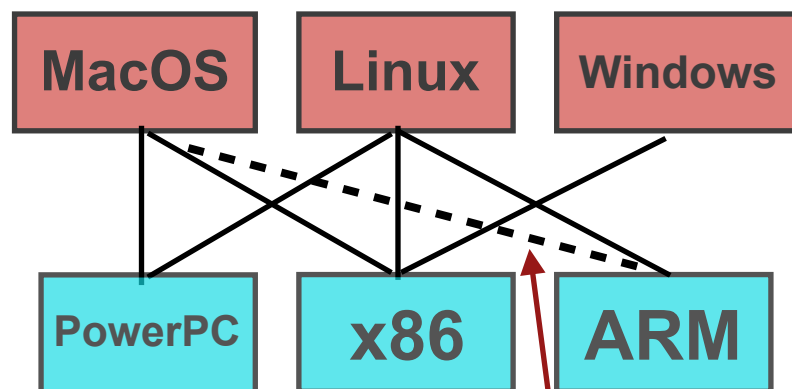
MacOS on x86 and PowerPC

Porting

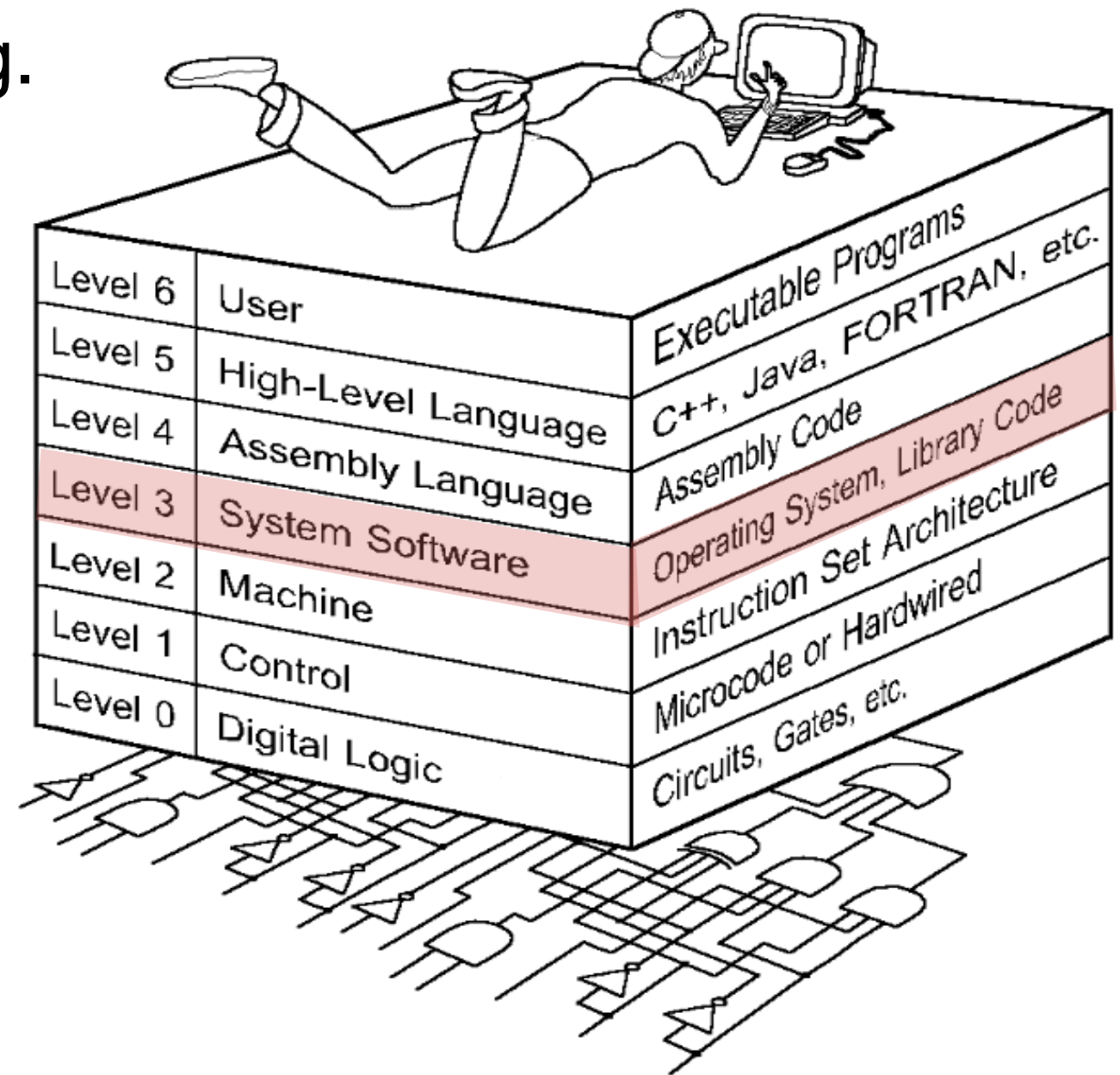
Rewrite Kernel for ISA

Rewrite drivers & Libraries

Recompile applications ?



<http://www.iclarified.com/57138/apple-adds-arm-support-to-macos-sierra-kernel>

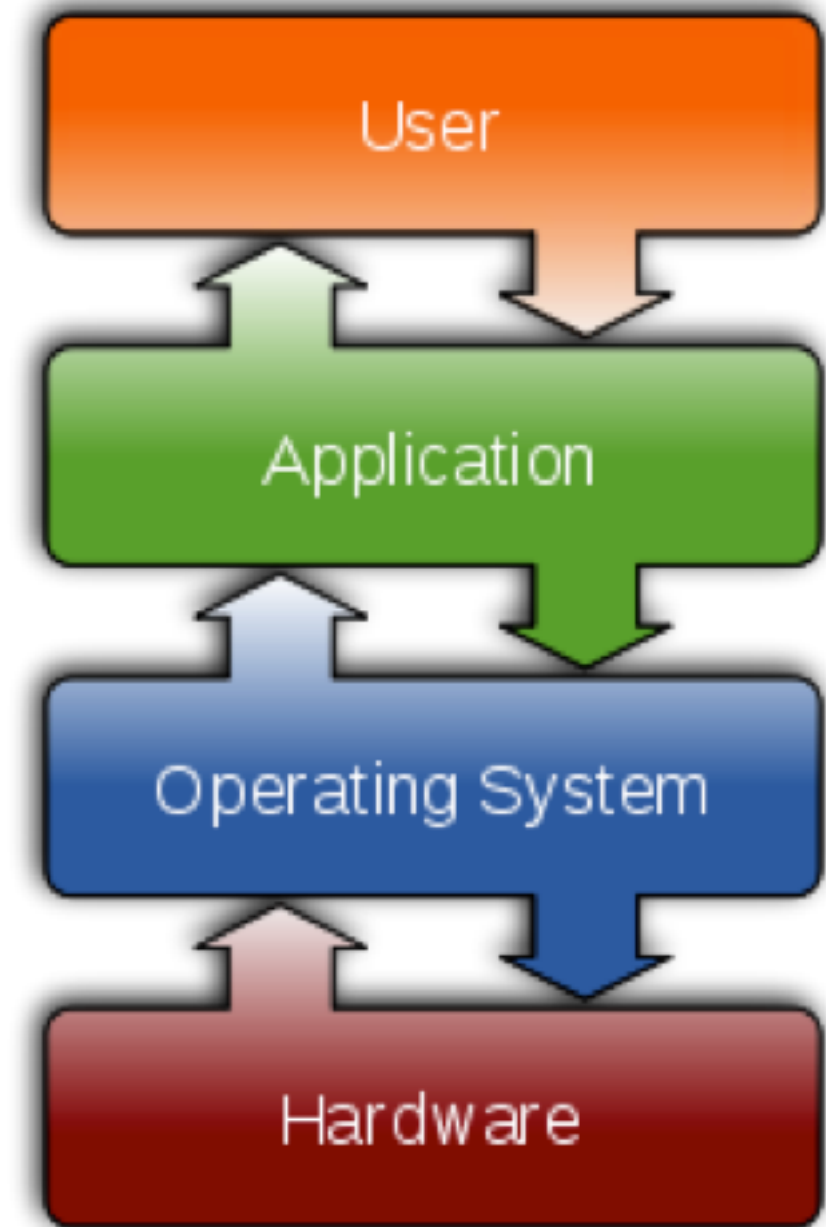


Summary in 4 Layers

OS runs on hardware (ISA)

Application runs on OS
tied to OS / ISA combination

Java Virtual Machine
breaks this tie
application runs on Java VM



The concept of virtualisation

Virtual Machine

Virtual Memory

Java Virtual Machine

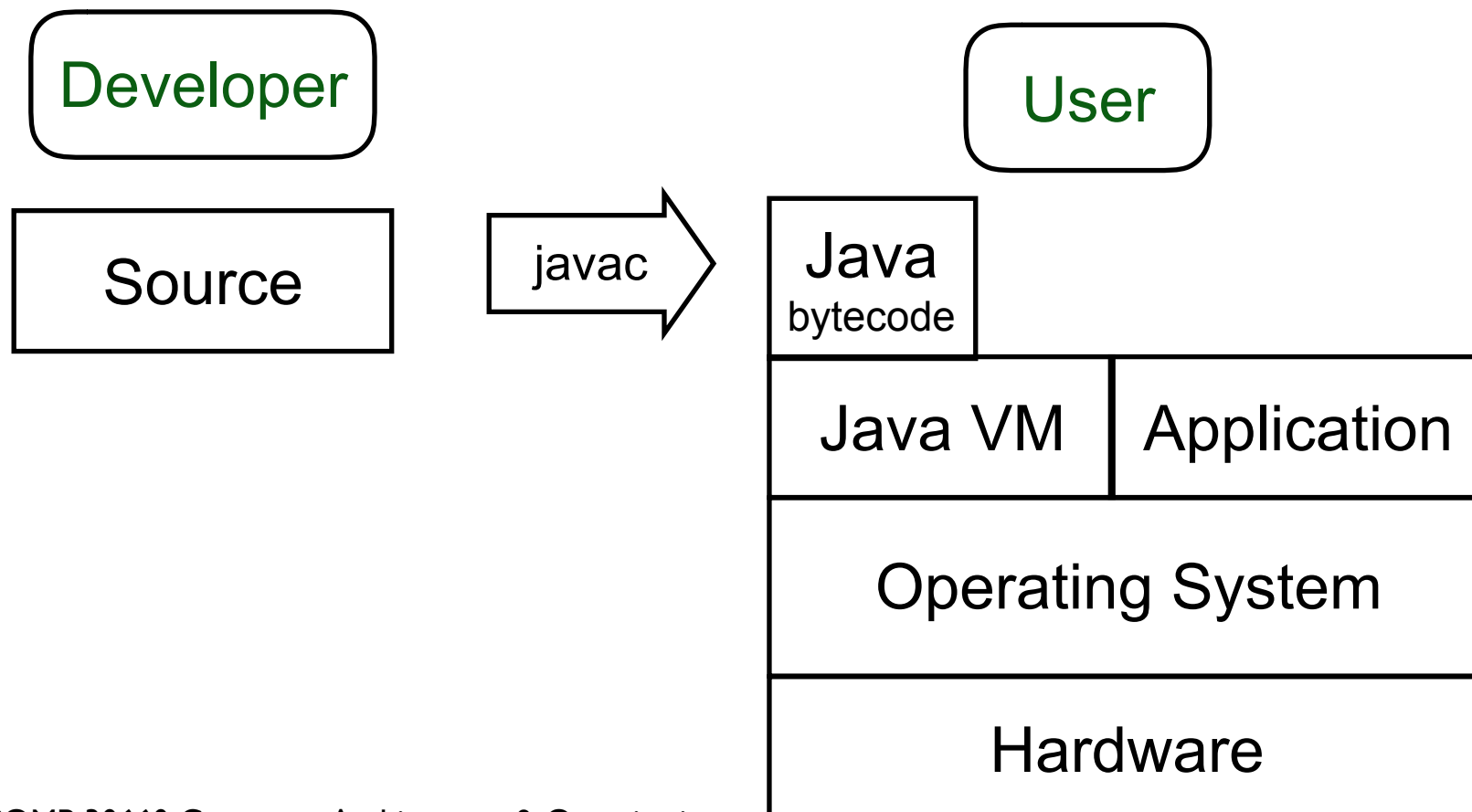
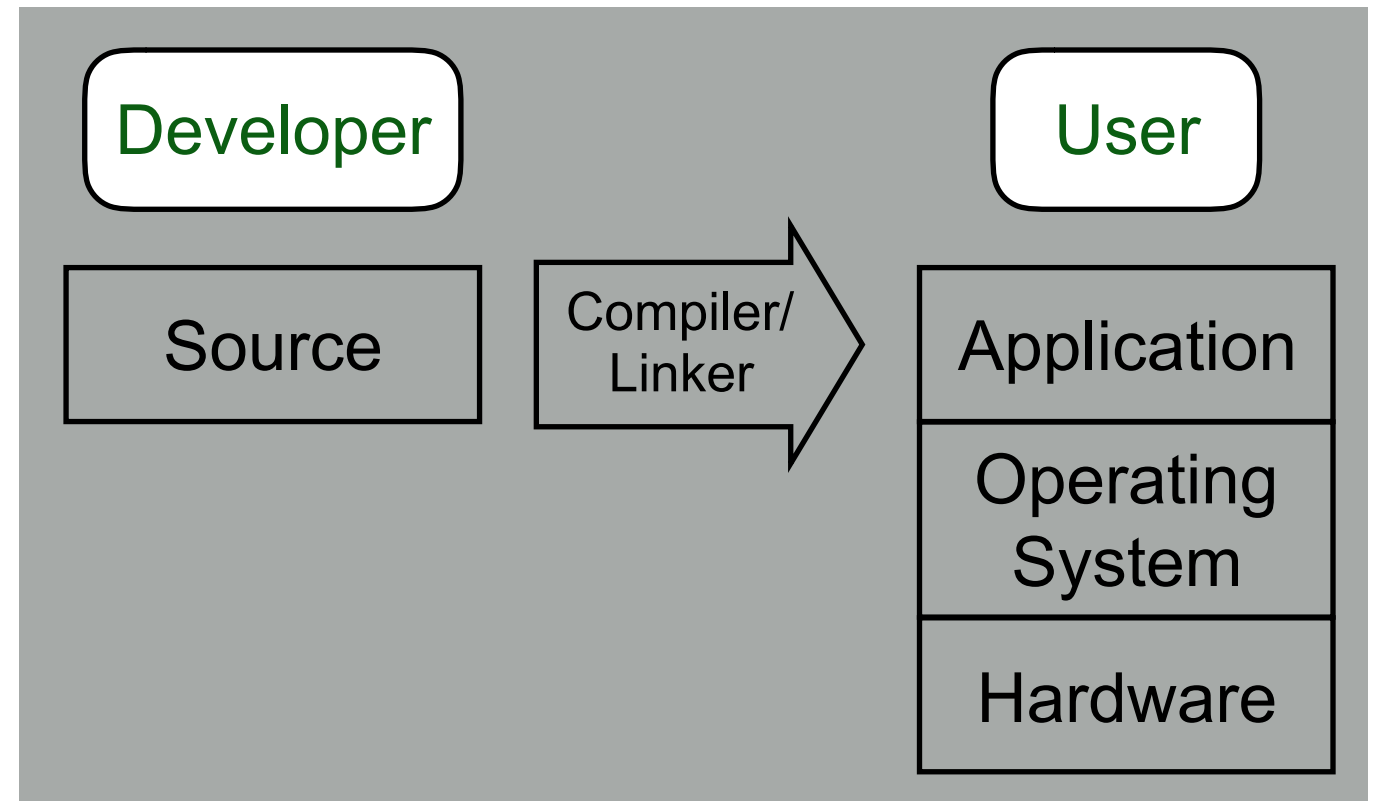
Virtual Private Network

Java VM

Java application will run on any platform that has a Java VM

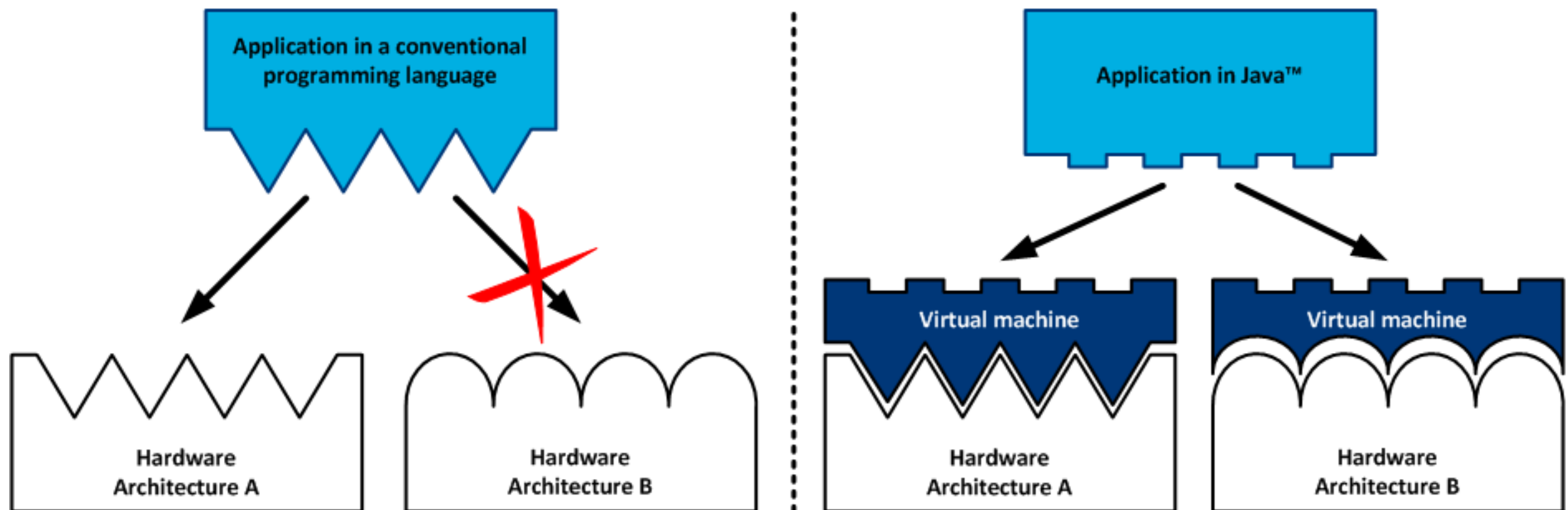
Slower than a native application
Eclipse IDE a popular example

Native code scenario



Java VM

Classic metaphor for Java VM



Virtualization

In computing, virtualization refers to the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, operating systems, storage devices, and computer network resources.

Snapshot: State of a VM, can be restored (resumed)

Migration: Move a Snapshot to another host

Standard

Application
Windows
Hardware

Virtual

Application
Linux
Windows
Hardware

e.g. **Microsoft Azure**

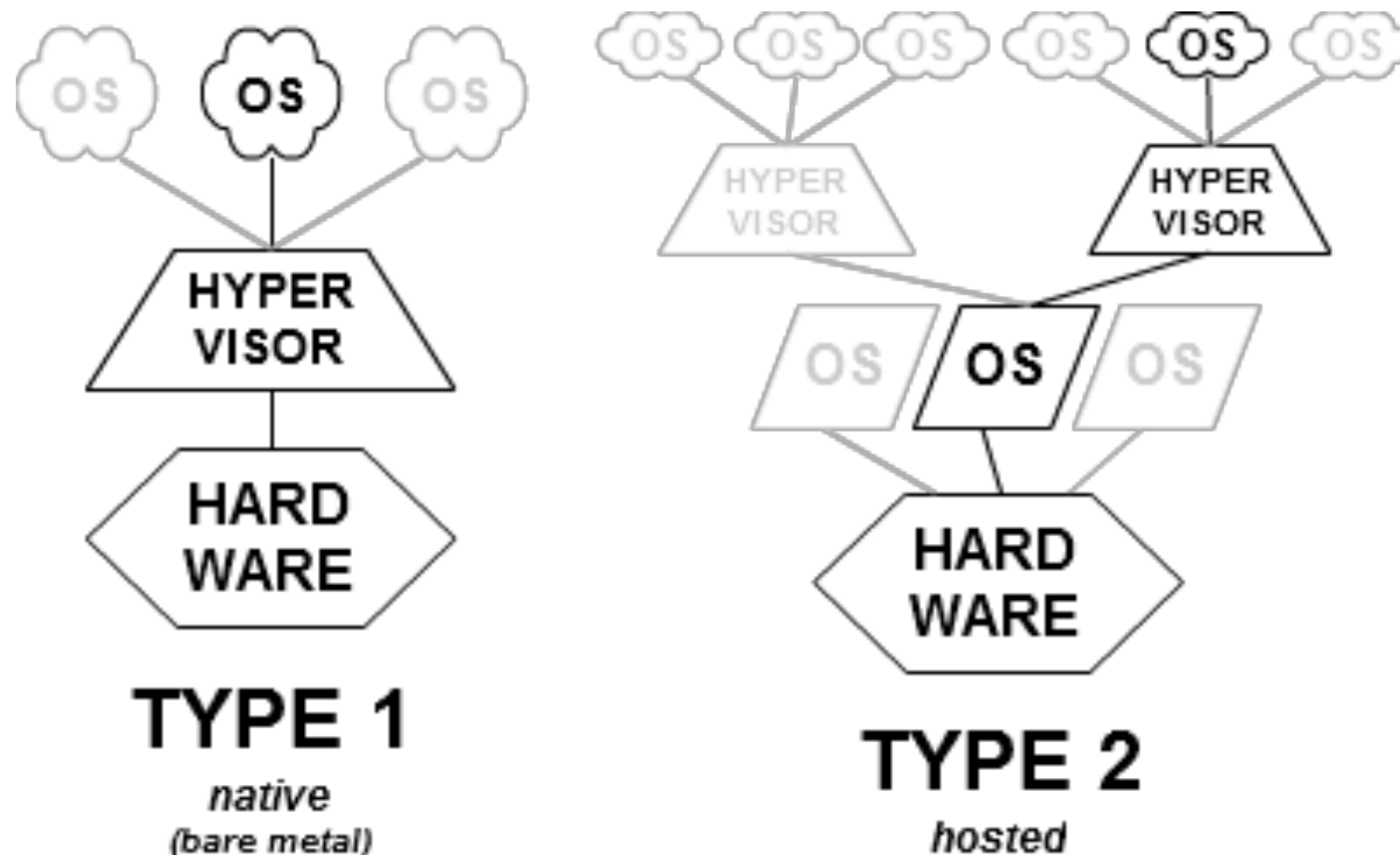
<https://azure.microsoft.com/en-gb/services/virtual-machines/>

or **VMWare**

<https://en.wikipedia.org/wiki/VMware>

Hypervisor - the supervisor of the supervisor

A **hypervisor** or **virtual machine monitor (VMM)** is a piece of computer software, firmware or hardware that creates and runs virtual machines.



<https://en.wikipedia.org/wiki/Hypervisor>

Virtualization

What is the difference between a PC that can run two operating systems (Windows & Linux)

1. by virtue of a hard drive that has Windows and Linux partitions,
2. by using a hosted hypervisor?

See Hypervisor Wikipedia page (Classification section)

<https://en.wikipedia.org/wiki/Hypervisor>

Cloud VM Exercise

What is the cheapest Cloud VM you can find (per hour)?

Consider

Amazon EC2 (Google EC2 VM prices)

Microsoft Azure

Others (Rackspace, DigitalOcean...)

What are the key performance 'dimensions'?

Apart from price and performance, what other considerations are important?

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