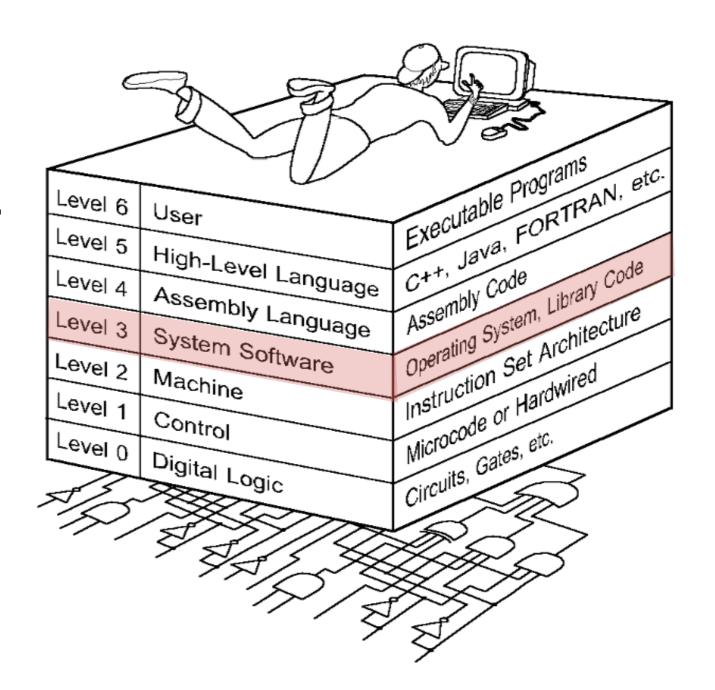
The Software Component

Mostly about OS COMP30640

Link with Instruction Set Arch.

Bootstrapping

Virtualisation
Java VM
OS VMs





Mac OS example

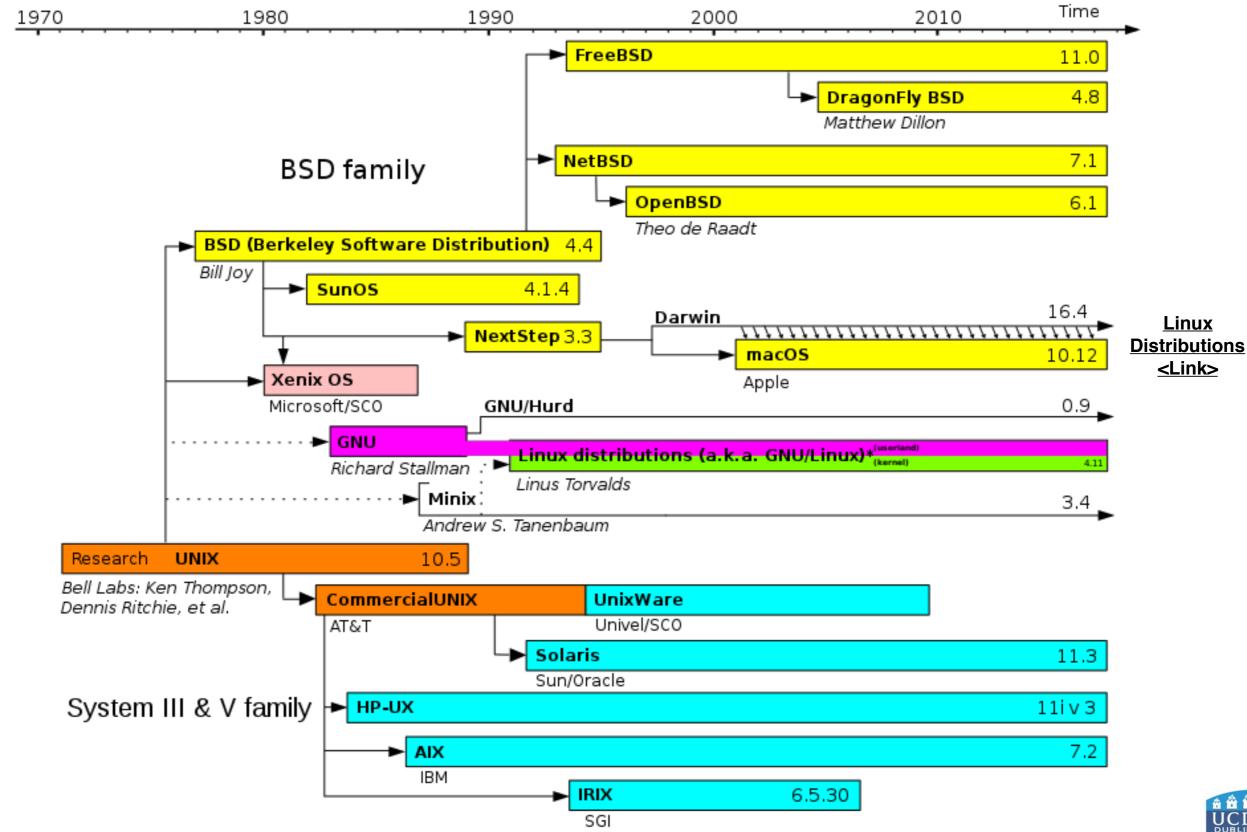
The OS is a running process

In fact a few processes

3 6 4 ~	CP	U Memory E	nergy [Disk N	letwork		Q Search
	-	o Michiery E	norgy .	71010	CENTOTT		OCCUTO!
S-Name	Memory ~	Compressed M	Threads	Ports	PID	User	
kernel_task	690.3 MB	0 bytes	129	0	0	root	
https://dees.google.com	680.9 MB	680.0 MB	14	233	7577	padraigcunning	
nttps://docs.google.com,	623.0 MB	605.3 MB	15	236	8358	padraigcunning	
Preview	521.6 MB	517.0 MB	3	332	272	padraigcunning	
attps://docs.sc. gle.com	485.3 MB	298.0 MB	15	234	8009	padraigcunning	
WindowServer	334.9 MB	302.9 MB	4	527	154	_windowserver	
http://www.ued-i	238.3 MB	237.8 MB	16	243	384	padraigcunning	
https://calendar.google.com	231.3 MB	199.8 MB	14	223	385	padraigcunning	
🔼 Google Drive	200.5 MB	177.2 MB	34	269	494	padraigcunning	
Safari	193.3 MB	190.8 MB	8	687	267	padraigcunning	
http://buyersguide.macrumor	180.1 MB	179.6 MB	14	228	7816	padraigcunning	
https://csmoodle.ucd.ie	173.8 MB	173.2 MB	14	228	7381	padraigcunning	
T Keynote	166.0 MB	132.3 MB	7	345	7397	padraigcunning	
뢻 Mail	150.5 MB	95.1 MB	12	638	271	padraigcunning	
Mail Web Content	144.7 MB	144.6 MB	12	192	530	padraigcunning	
http://www.nature.com	139.2 MB	128.9 MB	14	226	7753	padraigcunning	
iTunes	127.6 MB	99.0 MB	33	524	8216	padraigcunning	
http://www.stickybottle.com	120.7 MB	110.4 MB	14	226	7740	padraigcunning	
iviall Web Contest	118.6 MB	118.5 MB	11	193	1132	padraigcunning	
🛂 Finder	96.8 MB	99.1 MB	8	366	303	padraigcunning	
Microsoft Exect	88.3 MB	79.0 MB	8	325	7348	padraigcunning	
softwareupdated	86.2 MB	86.2 MB	9	95	470	_softwareupda	
<u> </u>	74.440	0	4.4	222	0072		
МЕМО	MEMORY PRESSURE Physical Memory:		nory: 4.	4.00 GB			
		Memory Use	Memory Used: 3.63 GB			App Memory: 715.0 MB	
		Cached Files	s: 364.4 MB		Wired Memory: 1.36 GB Compressed: 1.57 GB		
		Swap Used:	1.	43 GB	Com	pressed. 1.07 Ob	



BTW: MacOS is a UNIX



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

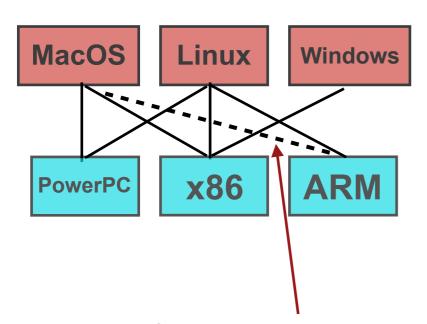
OS may run on many ISAs, e.g.

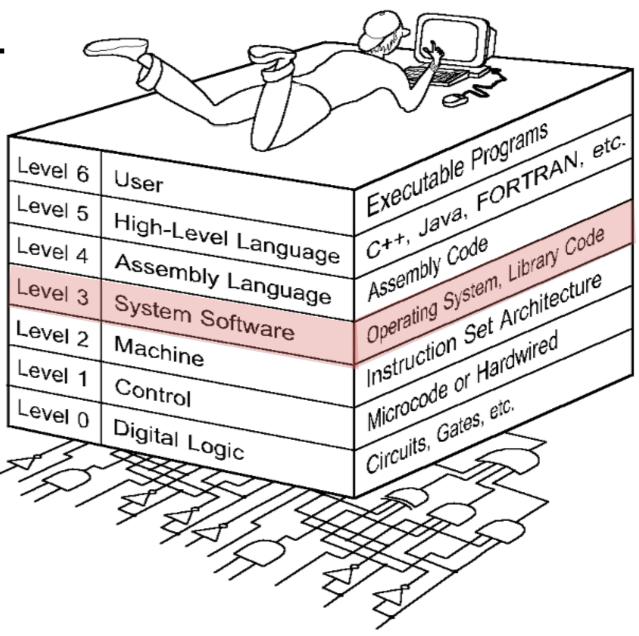
Linux

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

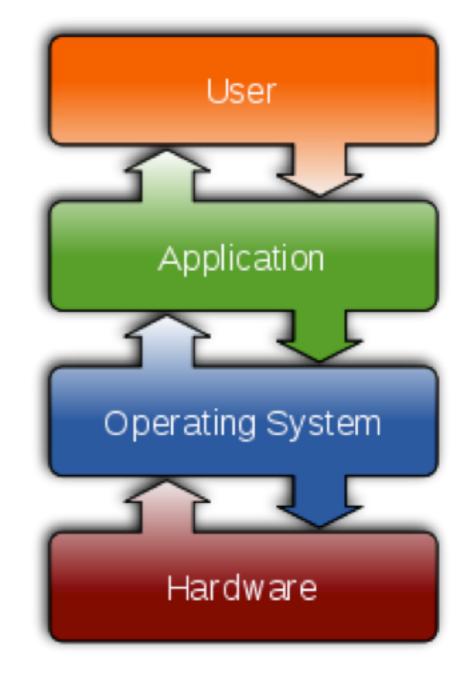


Summary in 4 Layers

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

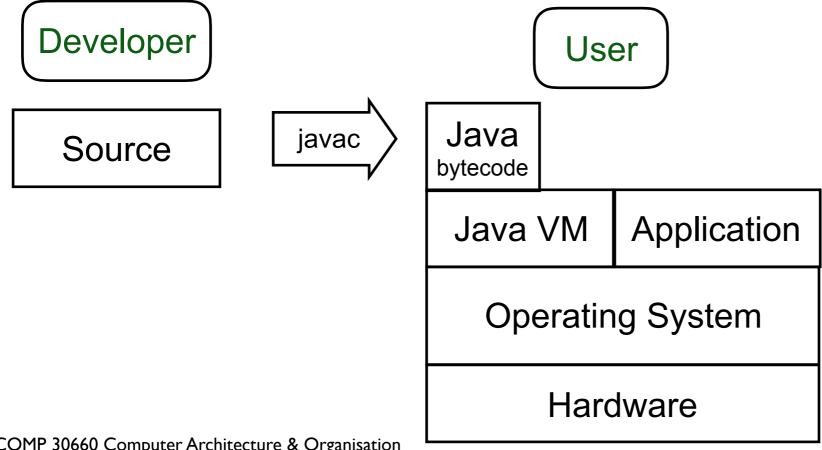
Virtual Private Network



Java VM

Java application will run on any platform that has a Java VM Slower than a native application Eclipse IDE a popular example

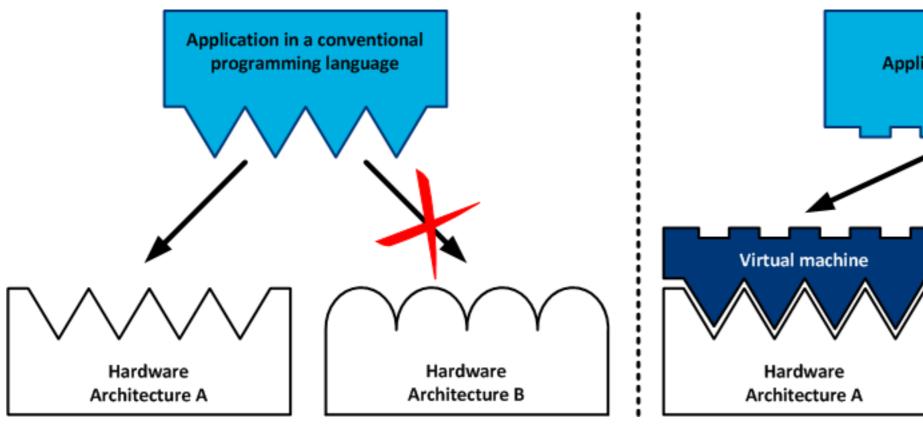
Native code scenario Developer User Compiler **Application** Source Linker Operating System Hardware

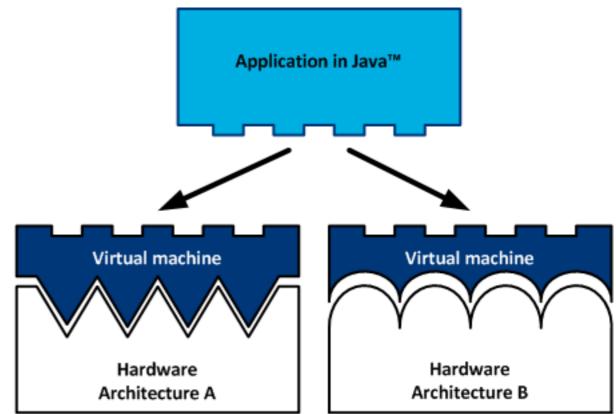




Java VM

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	_	Virtual		
	Application		Application		
Windows		Linux			
VVIIIdows			Windows		
	Hardware		Hardware		

e.g. Microsoft Azure

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

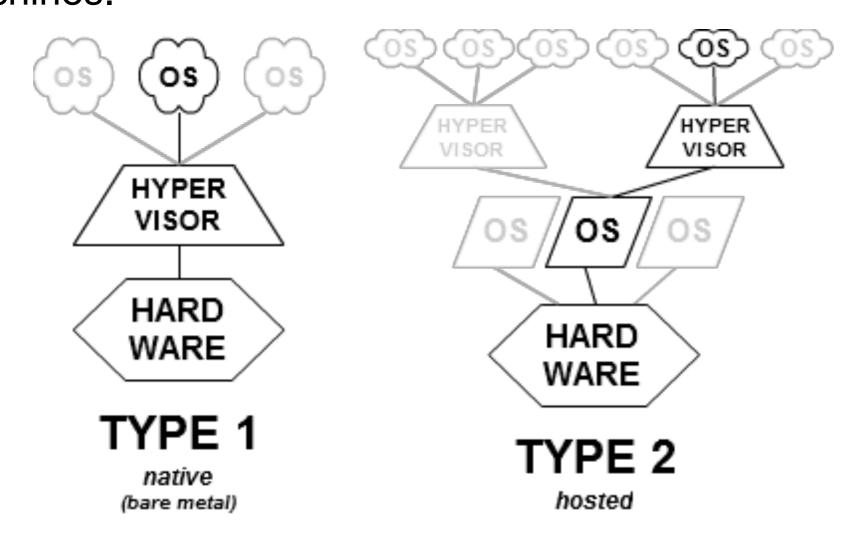
or **VMWare**

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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