



Microservices and DevOps

DevOps and Container Technology

Virtualization

Henrik Bærbak Christensen

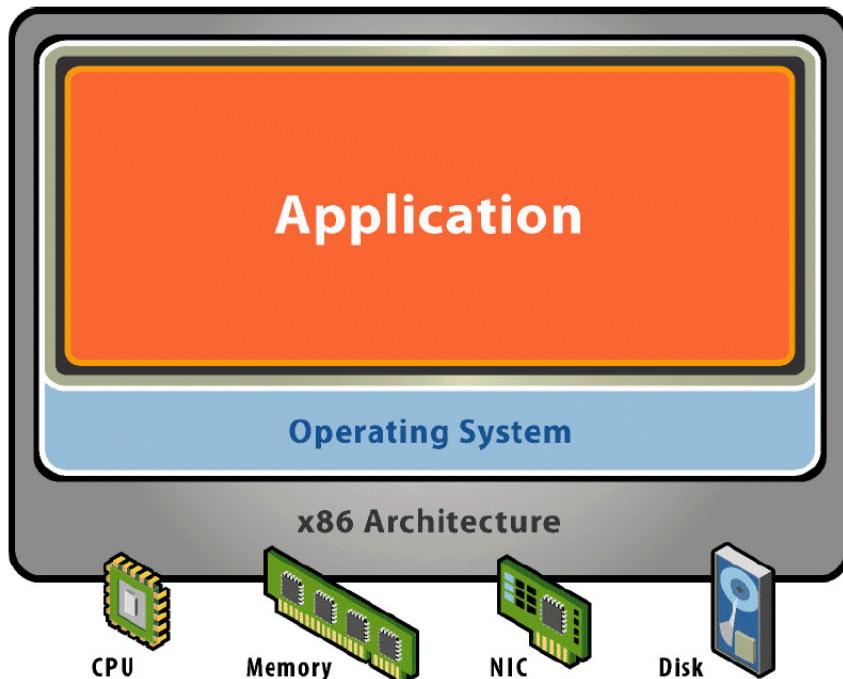
What is it?

- **virtual (adj):**
 - existing in essence or effect, though not in actual fact



- Example
 - *ScummVM is a program which allows you to run certain classic graphical point-and-click adventure games, provided you already have their data files. The clever part about this: ScummVM just replaces the executables shipped with the games, allowing you to play them on systems for which they were never designed!*

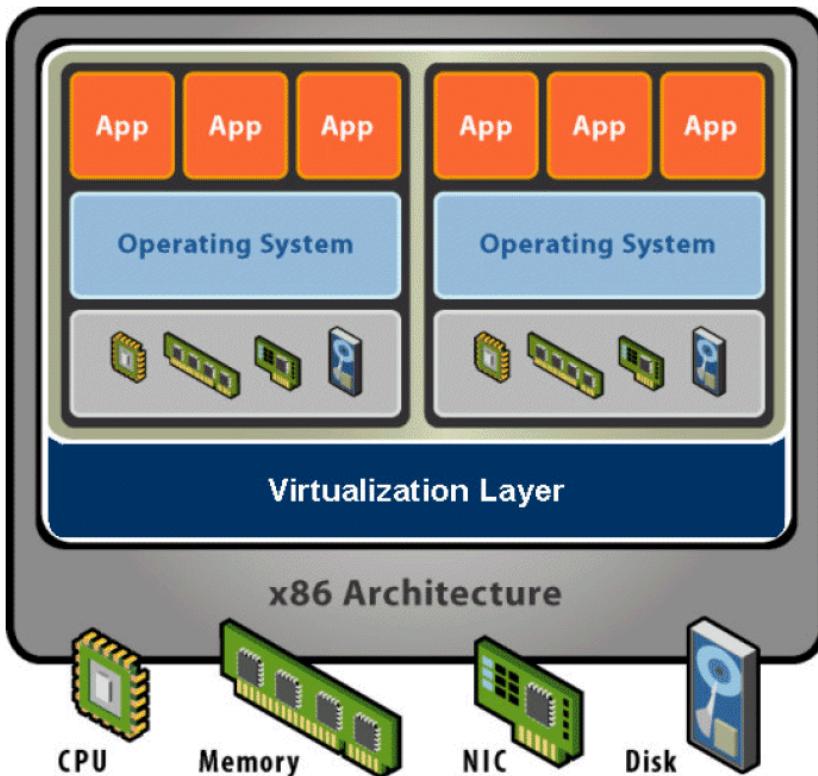
A Physical Machine

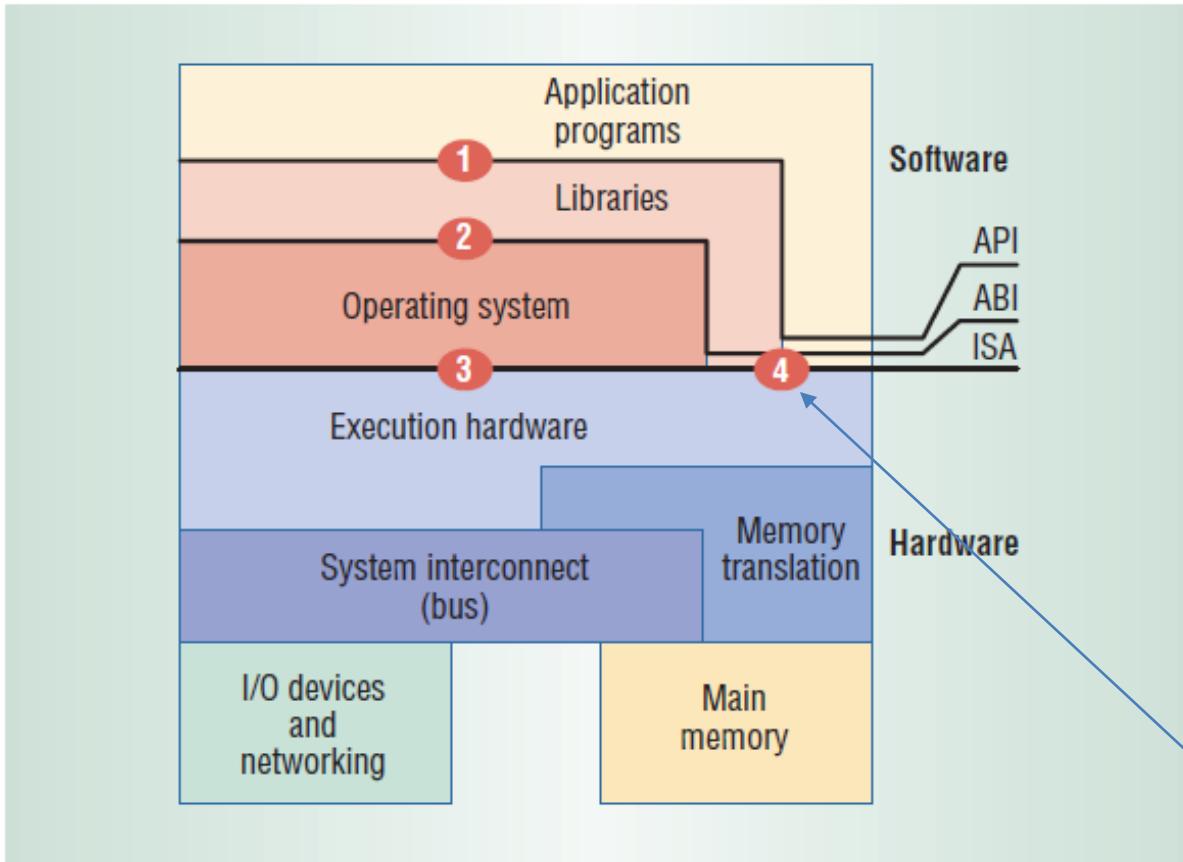


- Hardware
 - Processors, devices, memory, etc.
- Software
 - Built to the given hardware (**Instruction Set Architecture**, e.g. x86)
 - Built to given OS (**App. Programming Interface**, e.g. Win XP)
 - OS controls hardware

A Virtual Machine

- Hardware Abstraction
 - Virtual processor, memory, devices, etc.
- Virtualization Software
 - Indirection: Decouple hardware and OS
 - Multiplex physical hardware across guest VMs





Why VMs?

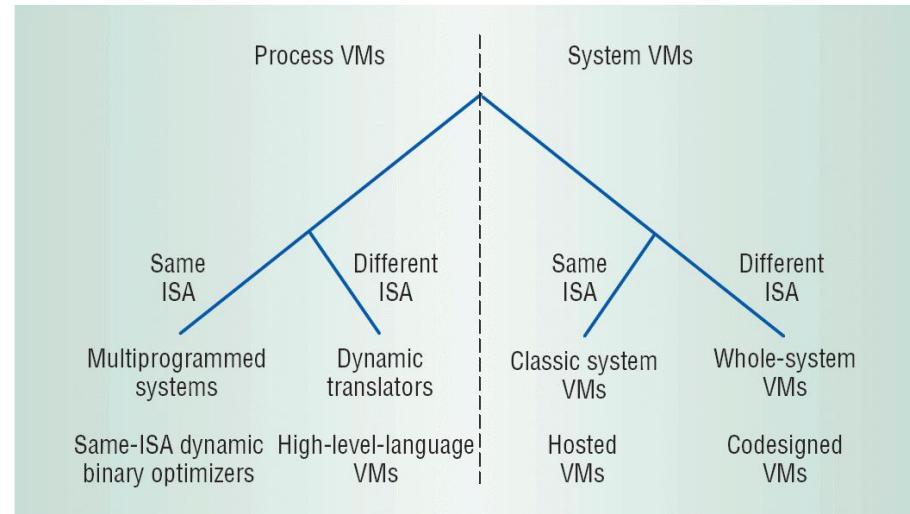
- Many advantages (often business related)
 - Utilization of resources
 - VM1 that idles automatically free resources to VM2
 - Of course not the case for physical machines
 - Isolation
 - Crash, virus, in VM1 does not propagate to VM2
 - Encapsulation
 - A VM is a **file**: (OS , Apps, Data, Config, run-time state)
 - Content distribution: Demos as snapshots
 - Snapshot provides recovery point
 - Migration to new physical machines by snapshot/restore
 - In e.g. server farms

Why VMs?

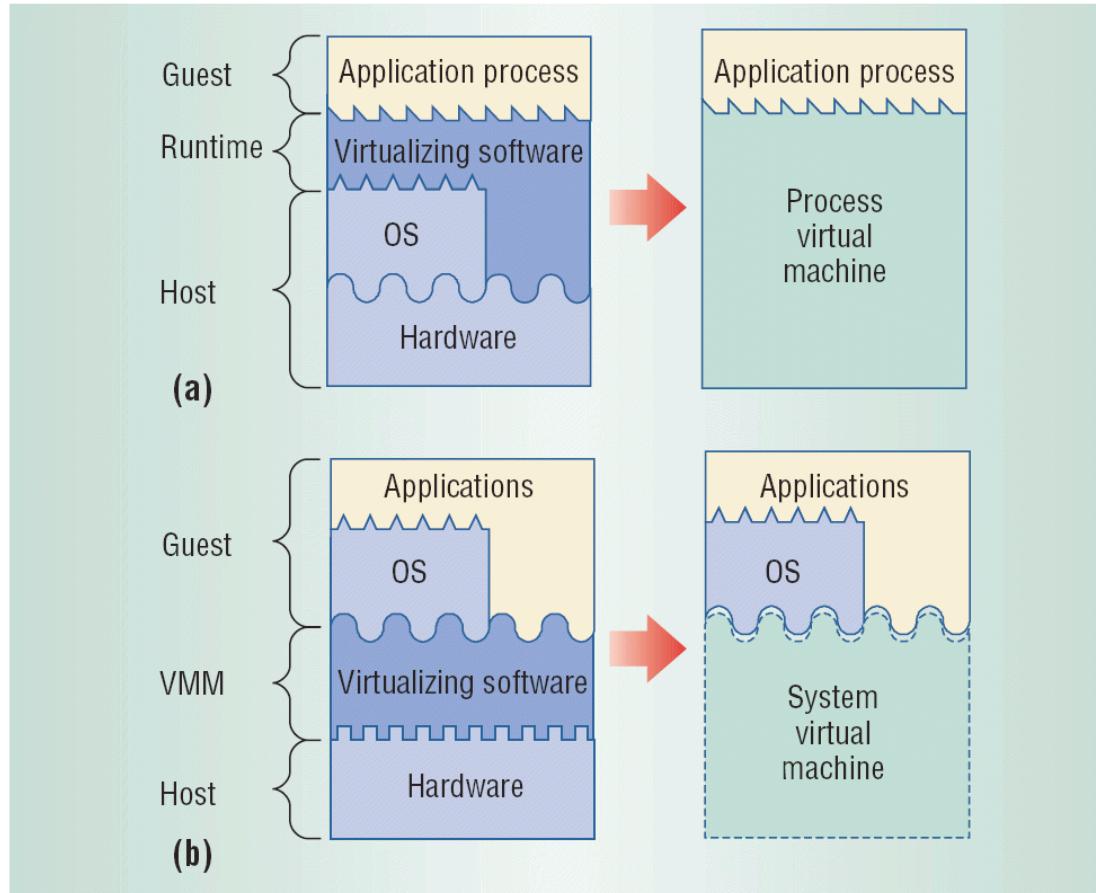
- More advantages
 - Maintenance costs
 - Maintain 100 Linux-based web server machines versus a few big VM platforms
 - Legacy VMs
 - Run ancient apps (like DOS or Win98 programs)
 - Create once, run anywhere
 - No configuration issues
 - E.g. complex setup of app suite of database, servers, etc.

- Smith & Nair 2005
- Two super classes
 - Process VM
 - System VM
- Both can be sub classed based upon supporting virtualization of *same* or *different* ISA (Instruction Set Architecture).

Types of VMs



Process / System VM



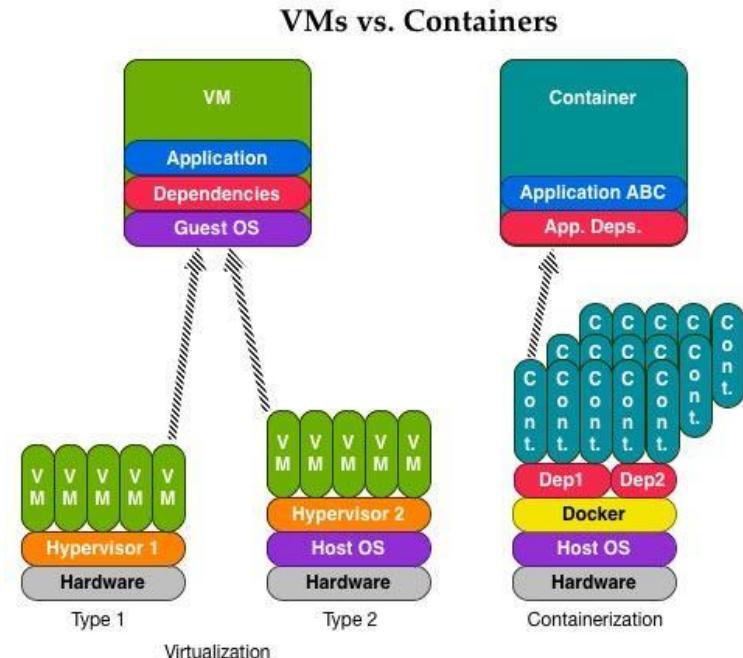
- The **process VM** puts the virtualization border line at the *process* line.
 - A application process/program executes in a
 - Logical address space (assigned/handled by the OS)
 - Using user-level instructions and registers (CPU user-mode)
 - Only do IO using OS calls or High-Level Library(HHL) calls
- Thus a process VM becomes a ***virtual OS*** in which a process may execute.
- Example: *Different ISA Process VM*
 - JavaVM defines its own ISA (stack-based) as well as normal OS operations

System VM

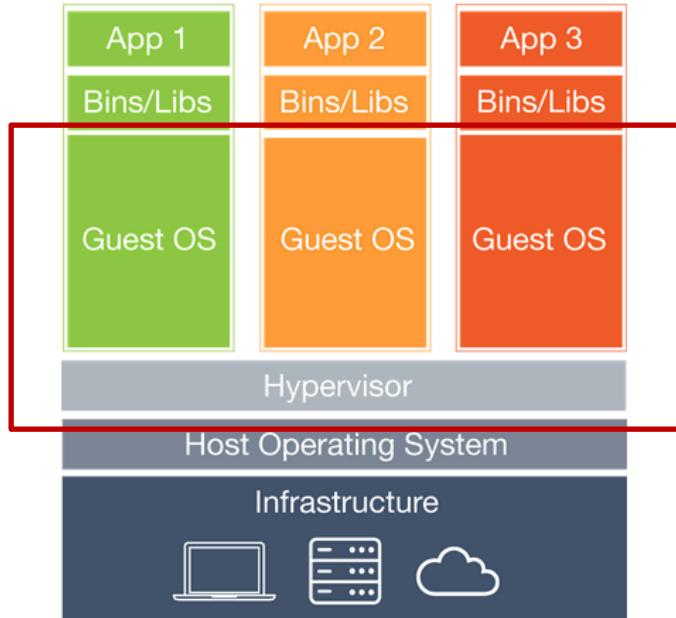
- The **system VM** sets the virtualization border at the system or hardware line
 - A system/OS executes in a
 - Physical memory space
 - Using the full ISA of the underlying machine
 - Interact directly with IO
- Thus a system VM becomes a ***virtual machine*** in which a system as a whole may execute
- Example: *Same ISA System VM*
 - VMWare: Executes Guest OS that is running on the x86 ISA.

OS Level VM

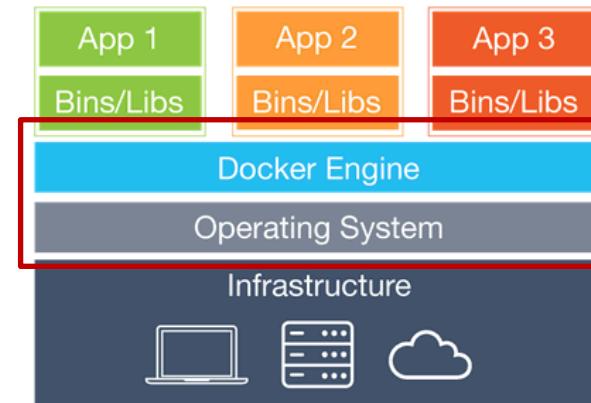
- OS-Layer Virtualization (Sahoo, 2010), or
- *Operating System Level* virtualization
 - Merkel (2014)
- Ex:
 - *Docker*



- From Docker



Traditional VMs



Docker

Classic Versus Hosted VMs

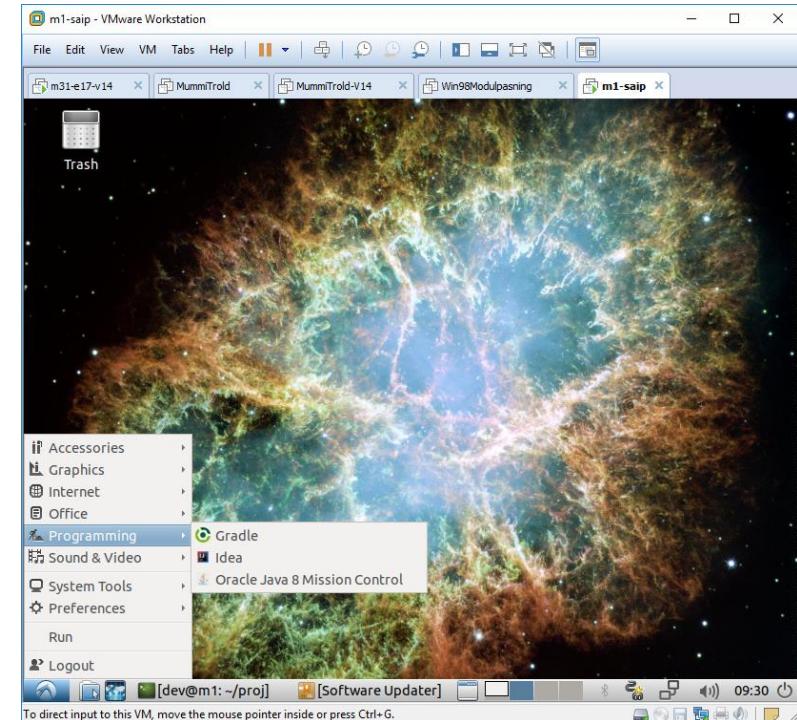
- **Hosted**
- VMWare Player (free) / Workstation Pro
 - Ordinary application in Linux/Windows
- **Classic (Bare metal)**
- VMWare ESXi (free of charge!)
 - Runs on the bare machine using a minimal Linux core



Examples

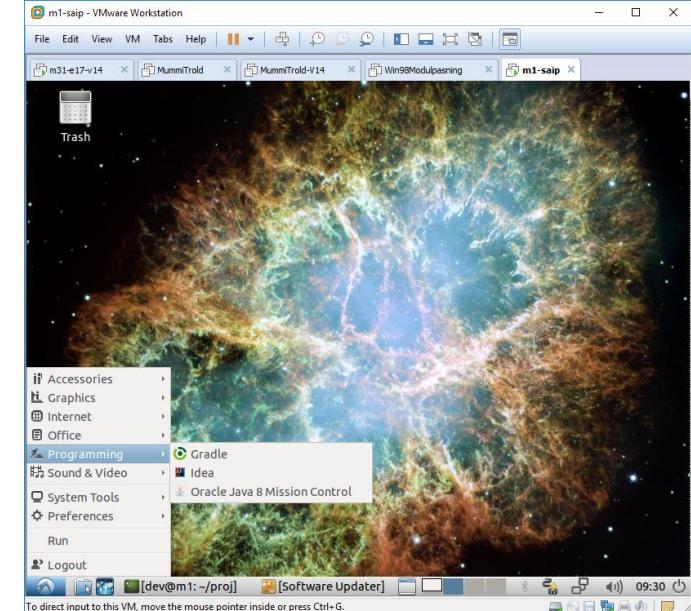
Packages for Students

- For my course, I hand out a dedicated VM
 - Faster ‘get going’



Avoid Poluted Machine

- The last couple of years I have removed code development from my laptop completely...
 - I *only* develop using my M1, M17, ... Virtual linux machines on my VMWare Workstation or on my ESXi hypervisors
 - One machine per course
 - Easier to switch
 - No *polution* of my laptop

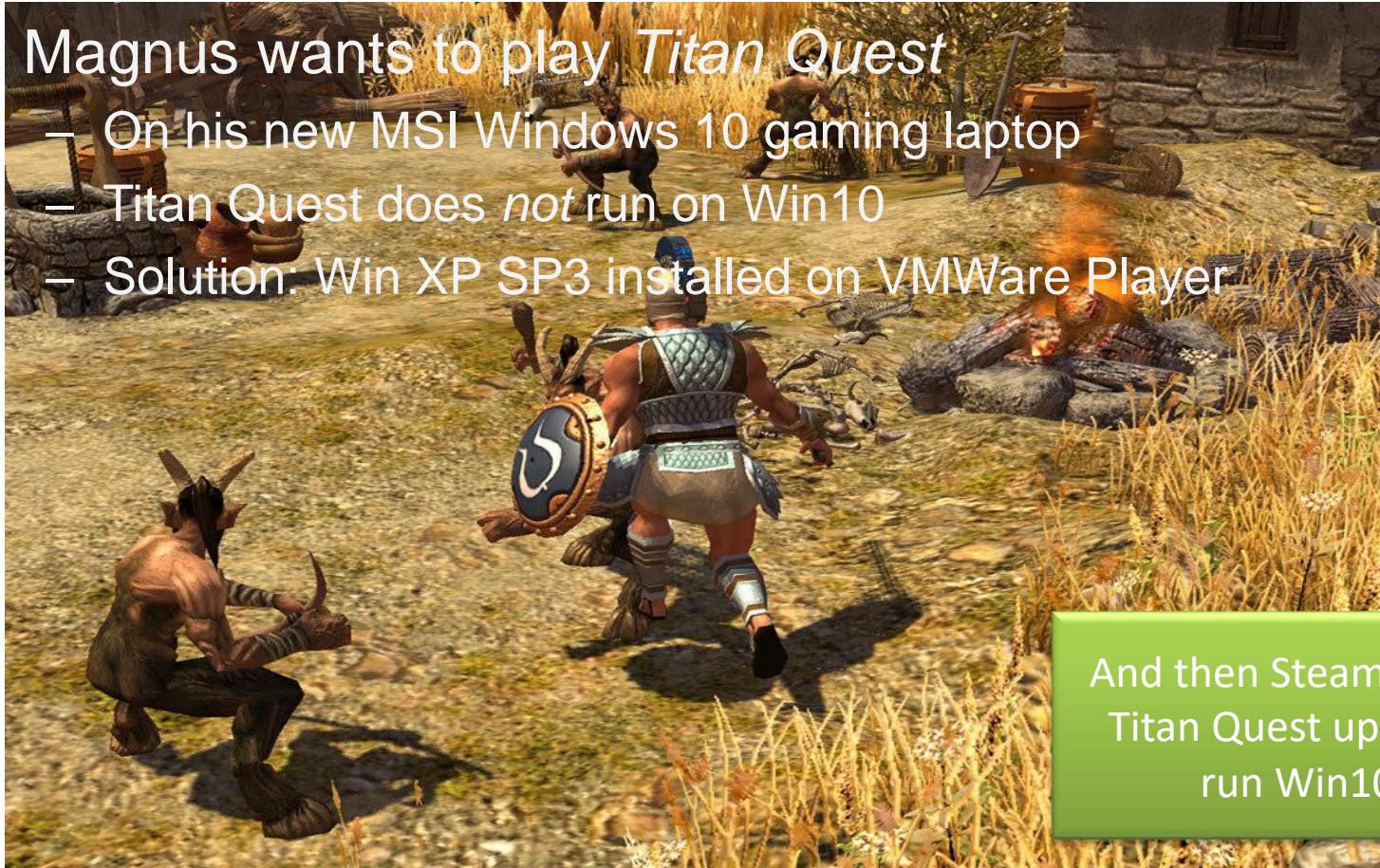


Moving Production

- Crunch3 machine was the production machine to do *awesome* stuff in another course I am running
 - It runs on my local ESXI
 - But, but – our students could not see it!
- Moved to the AUIT vSphere infrastructure
 - VMWare converter...
- Crunch3 is highly disk IO sensitive
 - Staff moved it ‘as we spoke’ to a pure SSD hypervisor

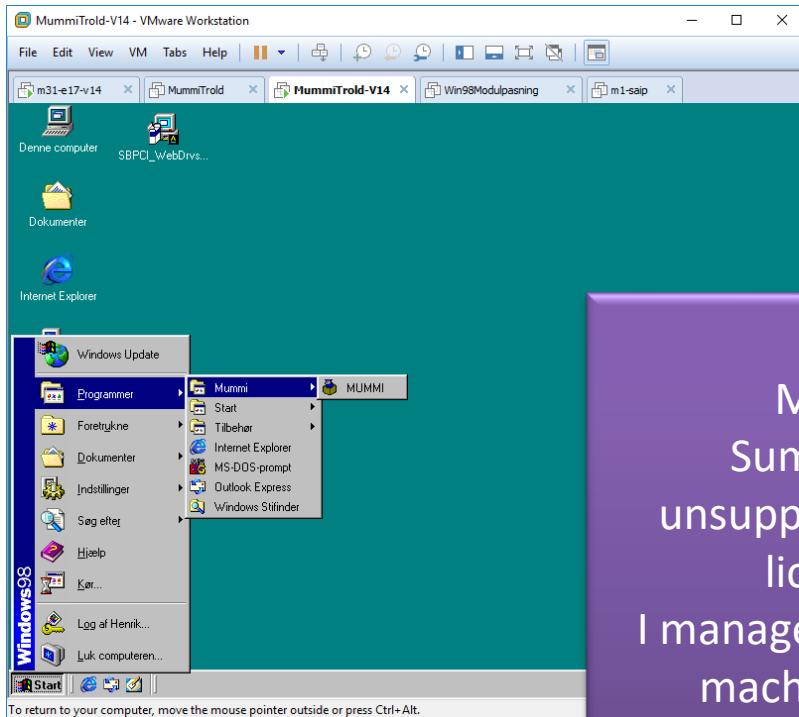
Keep Legacy Running

- Magnus wants to play *Titan Quest*
 - On his new MSI Windows 10 gaming laptop
 - *Titan Quest* does *not* run on Win10
 - Solution: Win XP SP3 installed on VMWare Player



And then Steam released
Titan Quest updated to
run Win10 ☺

Keep Legacy Running

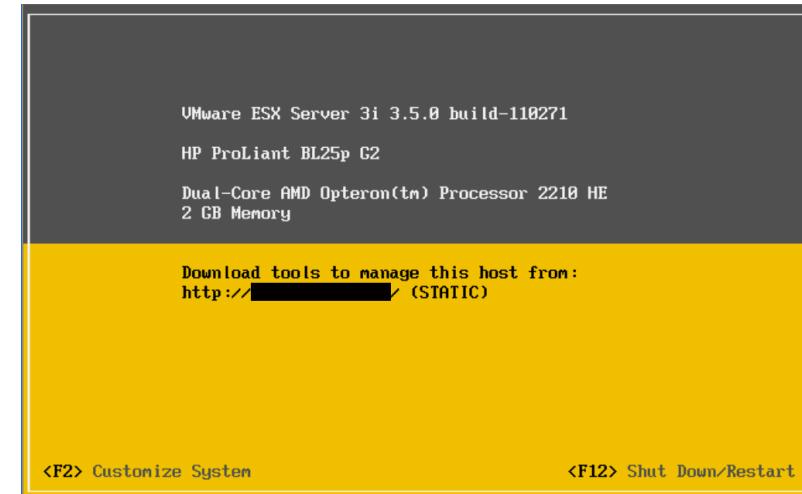


My company's accounting system, SummaSummerum, is a legacy system, unsupported and cannot be reinstalled due to license server has been shut down. I managed to pull license files from my company machine, and "save it" in a VM. It is called "TheArk" ☺

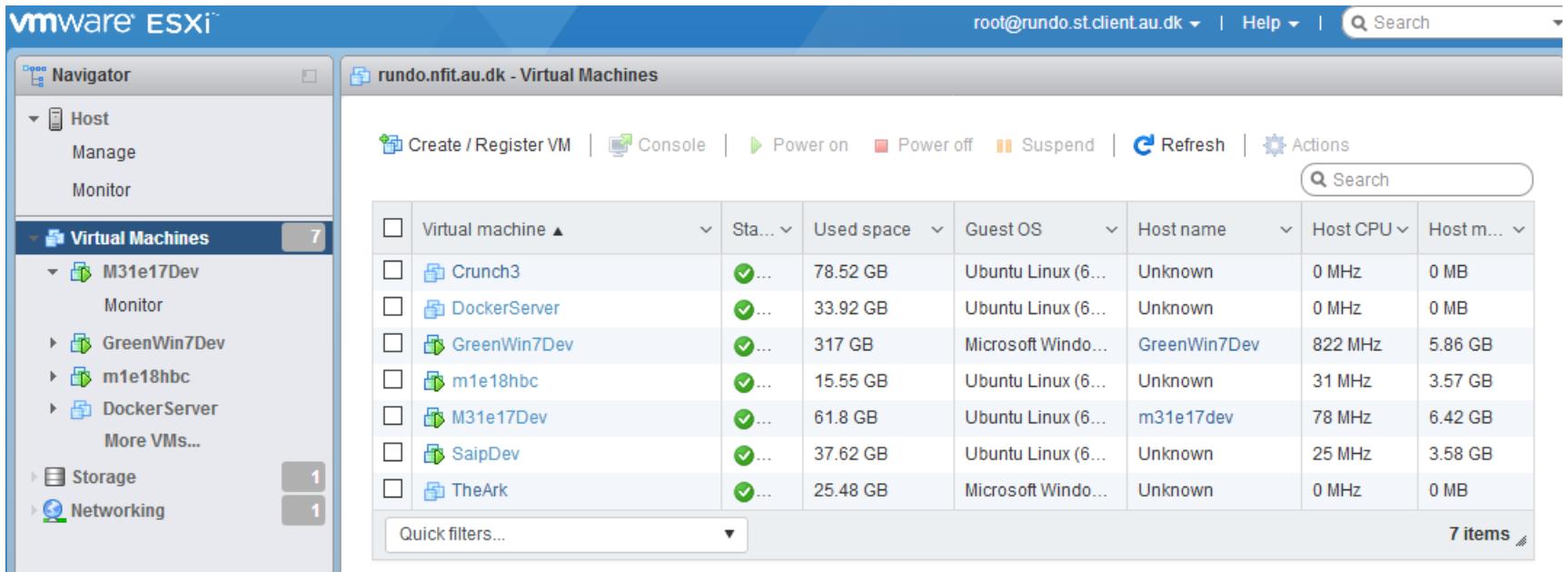
My 'Private Cloud' ☺



- (Linux based) Minimal OS
 - My 'Rundo' runs from the USB stick
 - ... and drivers were hell ☹
- Run Mgt application from its web server



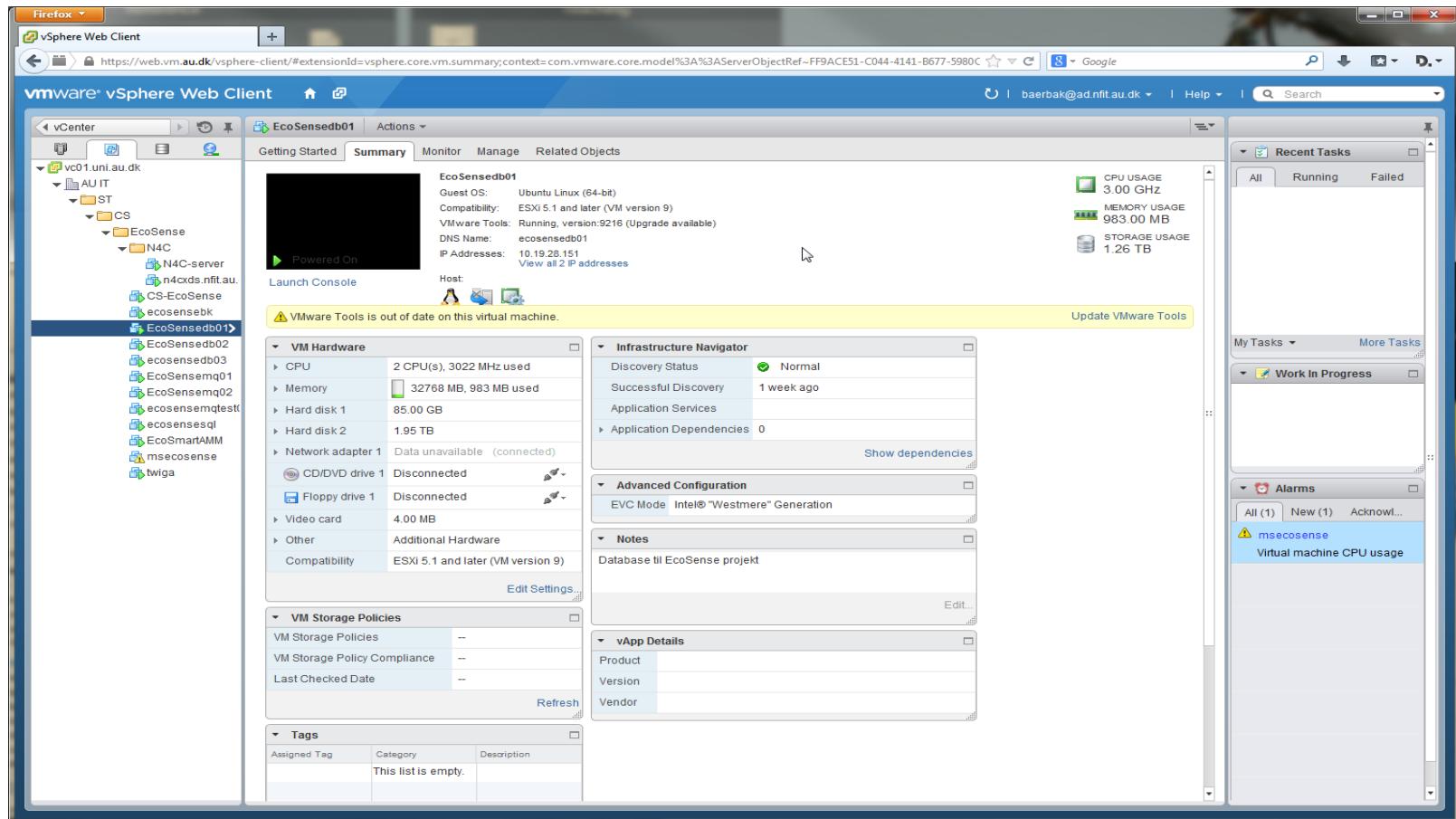
- Remote client to access the VMM



The screenshot shows the VMware ESXi interface. The left sidebar has a 'Virtual Machines' section with 7 items, including 'M31e17Dev', 'GreenWin7Dev', 'm1e18hbc', 'DockerServer', and 'TheArk'. The main pane displays a table of virtual machines with the following data:

Virtual machine	Used space	Guest OS	Host name	Host CPU	Host memory
Crunch3	78.52 GB	Ubuntu Linux (6...)	Unknown	0 MHz	0 MB
DockerServer	33.92 GB	Ubuntu Linux (6...)	Unknown	0 MHz	0 MB
GreenWin7Dev	317 GB	Microsoft Windo...	GreenWin7Dev	822 MHz	5.86 GB
m1e18hbc	15.55 GB	Ubuntu Linux (6...)	Unknown	31 MHz	3.57 GB
M31e17Dev	61.8 GB	Ubuntu Linux (6...)	m31e17dev	78 MHz	6.42 GB
SaipDev	37.62 GB	Ubuntu Linux (6...)	Unknown	25 MHz	3.58 GB
TheArk	25.48 GB	Microsoft Windo...	Unknown	0 MHz	0 MB

A Much Bigger VMM

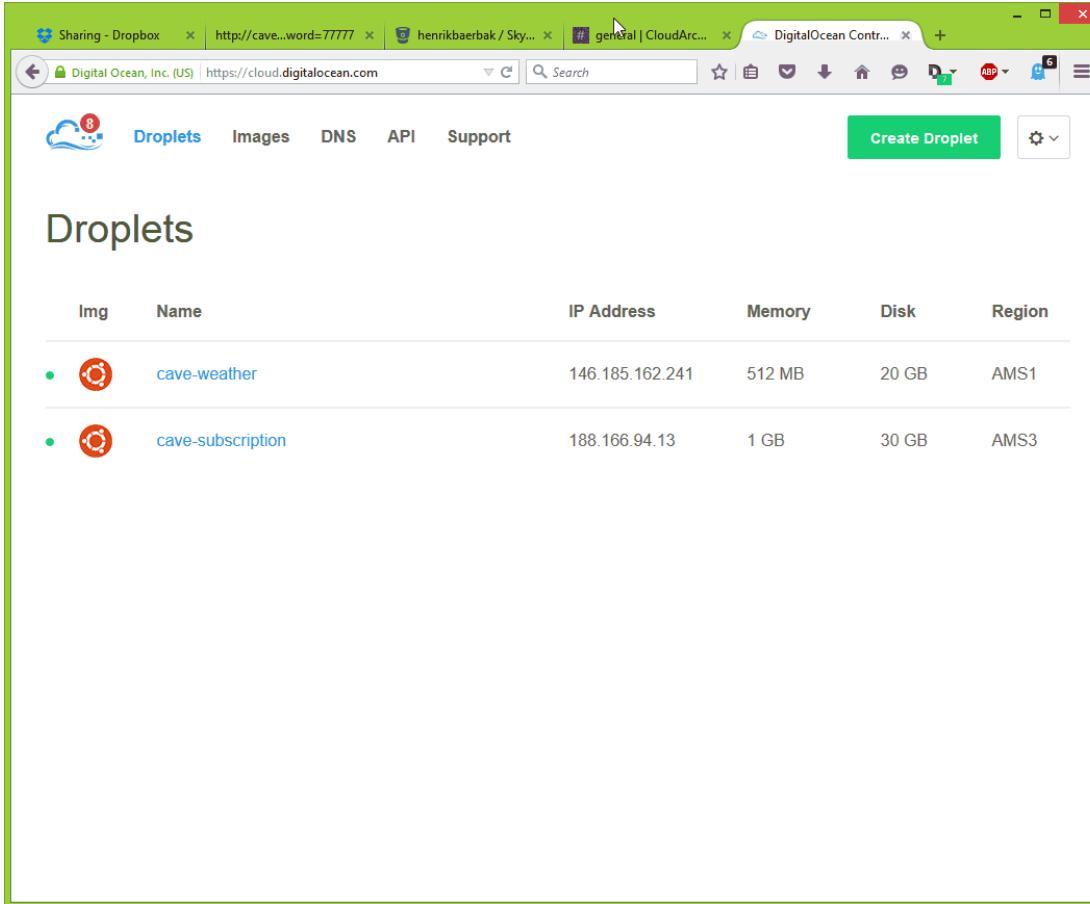


Amazon EC2 Dashboard

The screenshot shows the Amazon EC2 Dashboard with the following details:

- Left Sidebar:** Lists navigation options including EC2 Dashboard, Instances, Images, Elastic Block Store, Network & Security, Load Balancing, and Auto Scaling.
- Resources Section:** Displays EC2 resources in the EU West (Ireland) region:
 - 0 Running Instances
 - 0 Dedicated Hosts
 - 0 Volumes
 - 1 Key Pairs
 - 0 Placement Groups
 - 0 Elastic IPs
 - 0 Snapshots
 - 0 Load Balancers
 - 5 Security Groups
- Account Attributes:** Lists Supported Platforms (EC2, VPC), Resource ID length management, and Console experiments.
- Additional Information:** Links to Getting Started Guide, Documentation, All EC2 Resources, Forums, Pricing, and Contact Us.
- AWS Marketplace:** Lists products like Barracuda CloudGen Firewall for AWS - PAYG, Matillion ETL for Amazon Redshift, and Matillion Business Software.
- Service Health:** Shows Service Status for EU West (Ireland) and Availability Zone Status for eu-west-1a, eu-west-1b, and eu-west-1c, all marked as operating normally.
- Scheduled Events:** Shows no events scheduled.
- Bottom Navigation:** Includes Feedback, English (US), and links to Privacy Policy and Terms of Use.

DigitalOcean Dashboard



The screenshot shows the DigitalOcean Control Panel. The top navigation bar includes links for Sharing - Dropbox, http://cave...word=77777, henrikbaerbak / Sky..., general | CloudArc..., and DigitalOcean Contr... . The main navigation menu at the top has links for Droplets, Images, DNS, API, and Support. A green 'Create Droplet' button is located on the right. The main content area is titled 'Droplets' and displays a table with two entries:

Img	Name	IP Address	Memory	Disk	Region
	cave-weather	146.185.162.241	512 MB	20 GB	AMS1
	cave-subscription	188.166.94.13	1 GB	30 GB	AMS3