Virtualisation

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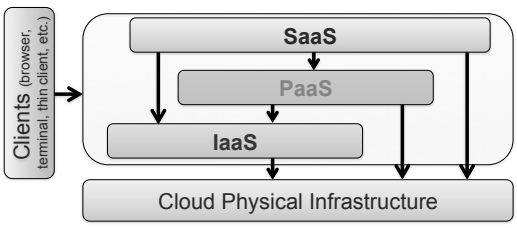
Outline

- Introduction to Virtualisation
- History of Virtualisation
- Virtualisation Technology (VT)
- Types of Virtualisation
- Pros and Cons

Keep the hierarchy in mind!



Introduction

- What is Virtualisation?
  - The use of hardware and software to create the perception that one or more entities exist
- Why it is interesting?
  - One server appear to many
  - Desktop computer appear to be running multiple OS simultaneously
  - Network connection
  - Vast amount of disk space

Standard Interfaces

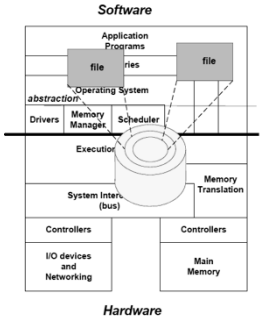
- Major design tasks are decoupled
- Different hardware and software development schedules
- Software can run on any machine *supporting a compatible interface*

Disadvantages

- Software compiled for one ISA will not run on hardware with a different ISA
  - Apple Mac (PowerPC) binaries on an x86? No
- Even if ISAs are the same, OSes may differ
  - Windows NT applications on a Solaris x86? No

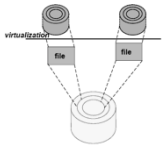
Abstraction

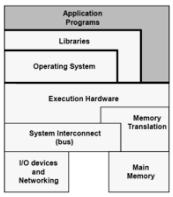
- Computer systems are built on levels of abstraction
- Higher level of abstraction hide details at lower levels
- Example: files are an abstraction of a disk



Virtualisation

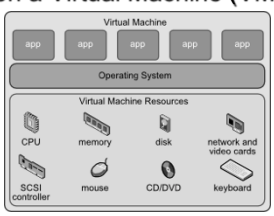
- An isomorphism from guest to host
  1. Map guest state to host state
  2. Implement “equivalent” functions
- Similar to abstraction
- Construct Virtual Disks
  - Files on a larger disk
  - Map state
  - Implement R/W/F/D function
- VMs: do the same thing with the whole “machine”





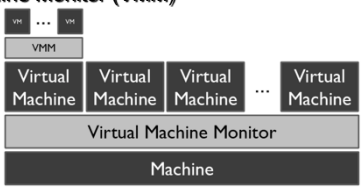
Virtual Machine

- Add Virtualizing Software to a Host platform and support Guest process or system on a Virtual Machine (VM)

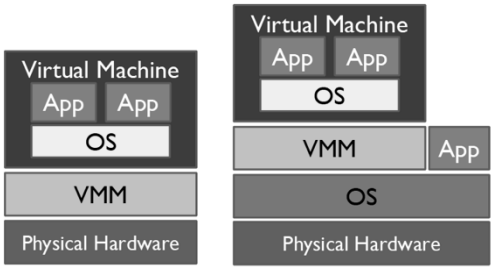


Virtualisation Technology (VT)

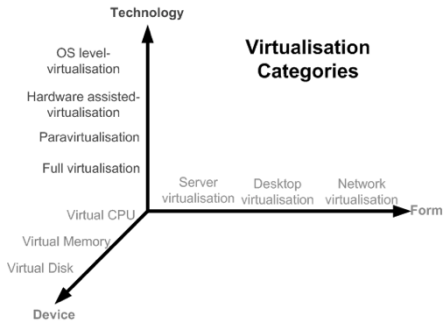
- Was dormant for decades because of its overhead
- Has became active after recent advanced in hardware and software technologies
- Two main concepts: Virtual Machine (VM), Virtual Machine Monitor (VMM)



VT Categories

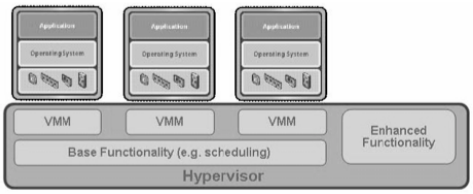


Virtualisation Categories



Hypervisor

- Manage VMMs
- Create a simulated computer environment for the guest software

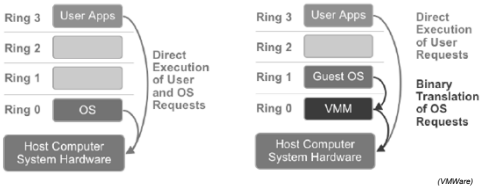


(VMWare)

Full Virtualisation

- The host emulates a complete installation, including hardware layer, for each guest

Ex: VMWare's, MS Virtual Server



(VMWare)

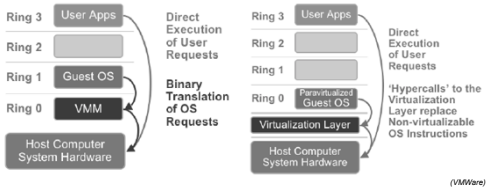
Privilege level architecture

Full virtualisation

Paravirtualisation

- Modifying the OS kernel to replace nonvirtualizable instructions with hypercalls that communicate directly with the virtualisation layer hypervisor.

Ex: Xen Server



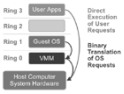
(VMWare)

Full virtualisation

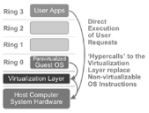
Paravirtualisation

Hardware-Assisted Virtualisation

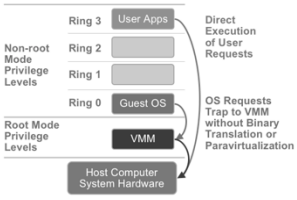
- Technology that allows for a CPU instruction set communication in which the VMM runs in a new root level mode below the OS kernel level. Ex: VT-x, AMD-V



Full virtualisation



Paravirtualisation



Hardware-Assisted Virtualisation

Forms of virtualisation

- Server virtualisation
  - One server appear as many
  - Virtual server may run the same or different operating systems
- Desktop virtualisation
  - Support for multiple OSs
  - Switch between OSs
- Virtual Networks
  - VPN
  - Connect to a network and access the network resources from any Internet-connected computer
- Virtual Storage
  - Access scalable and redundant physical storage through the use of abstract or logical disk drives, file systems or DBs

Pros and Cons

- Pros:
  - Increase: device utilisation, user access, flexibility
  - Decrease: device footprint, power consumption
  - Improve: use and management of software, capacity planning, disaster recovery
  - Simplify OS and application administration
  - Scalability
- Cons:
  - Not all applications are well suited for virtualisation (ex: Graphics-intensive applications)
  - Overhead

Summary

- Define Virtualisation and Virtualisation technology
- Types of virtualisation
- Pros and Cons of virtualisation