TRƯỜNG ĐẠI HỌC CÔNG NGHỆ THÔNG TIN - ĐHQG-HCM
KHOA MẠNG MÁY TÍNH VÀ TRUYỀN THÔNG

GIỚI THIỆU VỀ ẢO HÓA
Virtualization Overview

QUẢN TRỊ MẠNG VÀ HỆ THỐNG
Networks and Systems Administration

Bùi Thanh Bình

CONTENT

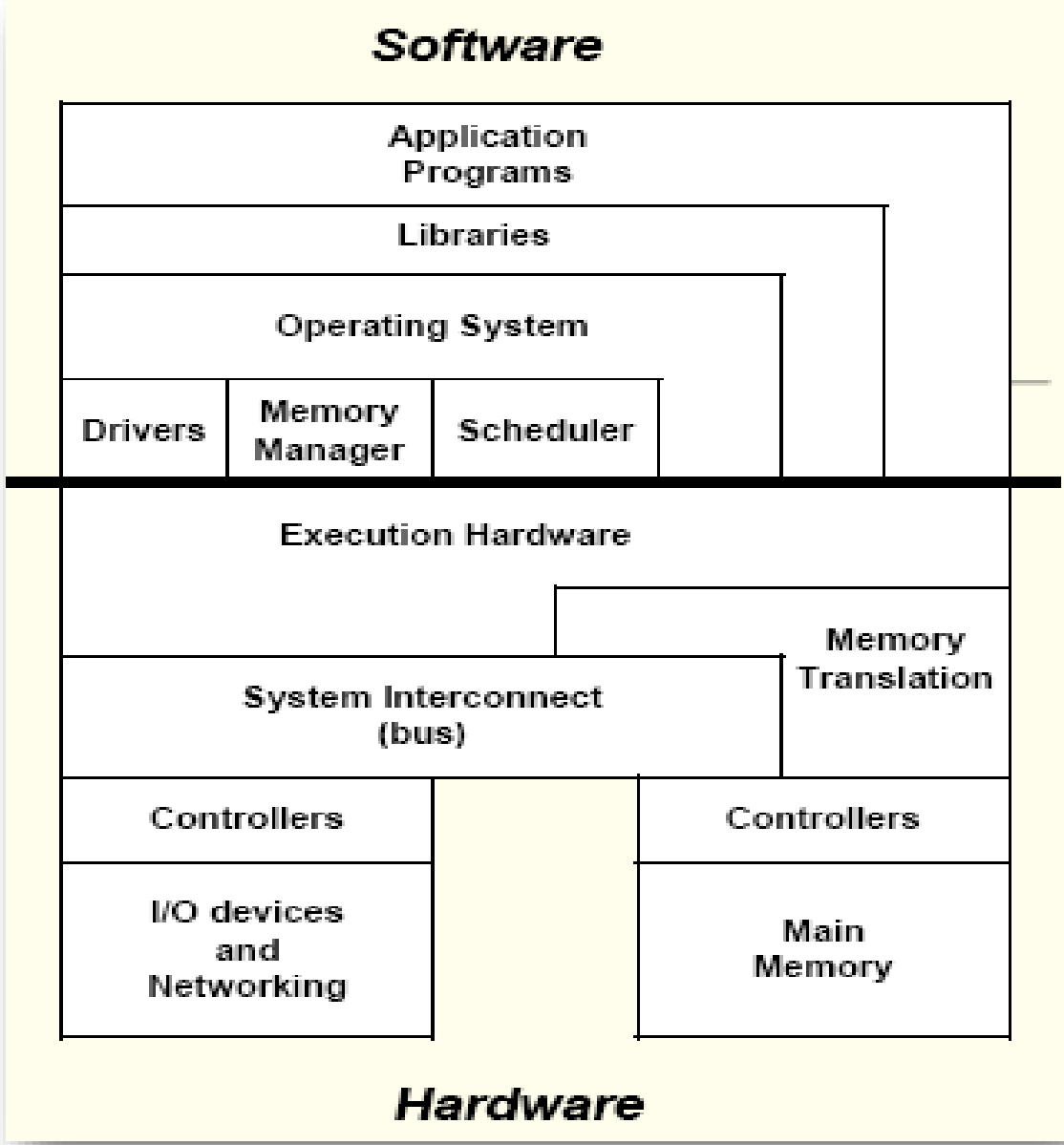
- What is Virtualization ?
- Virtual Machine Monitor
- Virtualization Types
- Virtualization Techniques

What is virtualization ?

- Virtualization is the creation of a virtual (rather than physical) version of something, such as an operating system, a server, a storage device or network resources.
- It hides the physical characteristics of a resource from users, instead showing another abstract resource.

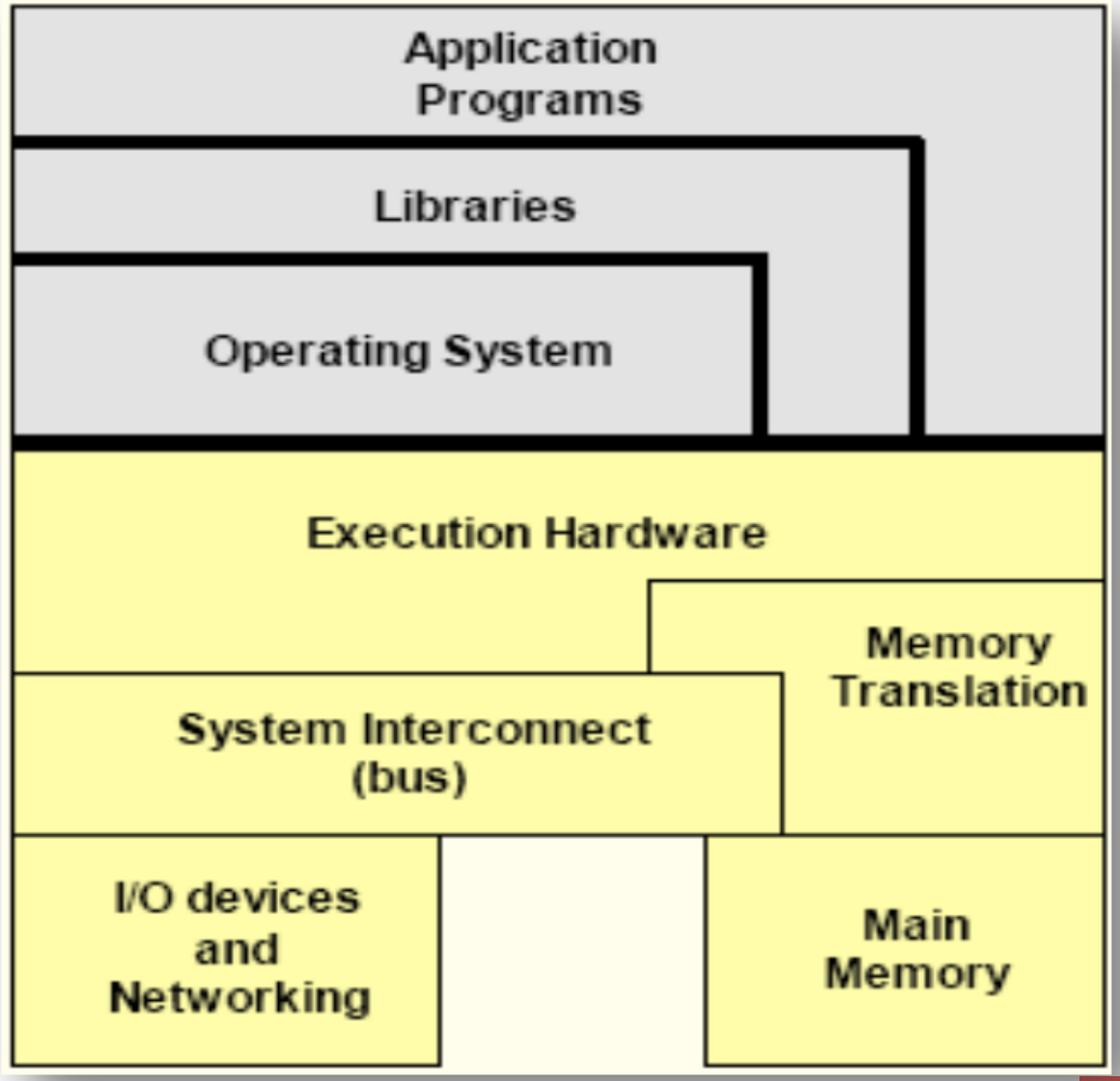
What is virtualization ?
System abstraction

- Computer systems are built on levels of abstraction.
- Higher level of abstraction hide details at lower levels.
- Designer of each abstraction level make use of the functions supported from its lower level, and provide another abstraction to its higher one.



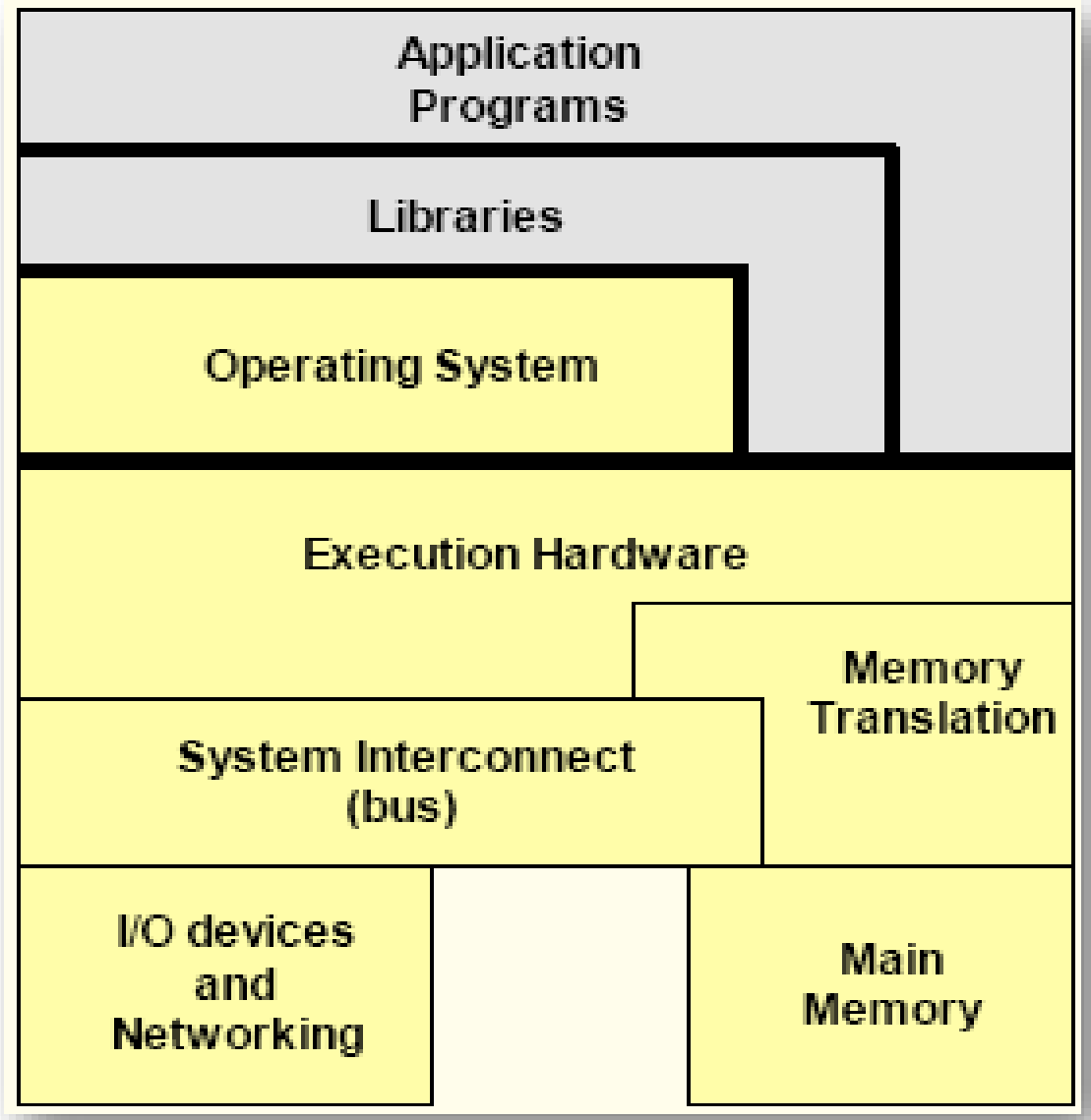
What is virtualization ?
Machine level abstraction

- For OS developers, a machine is defined by ISA (Instruction Set Architecture).
- This is the major division between hardware and software.



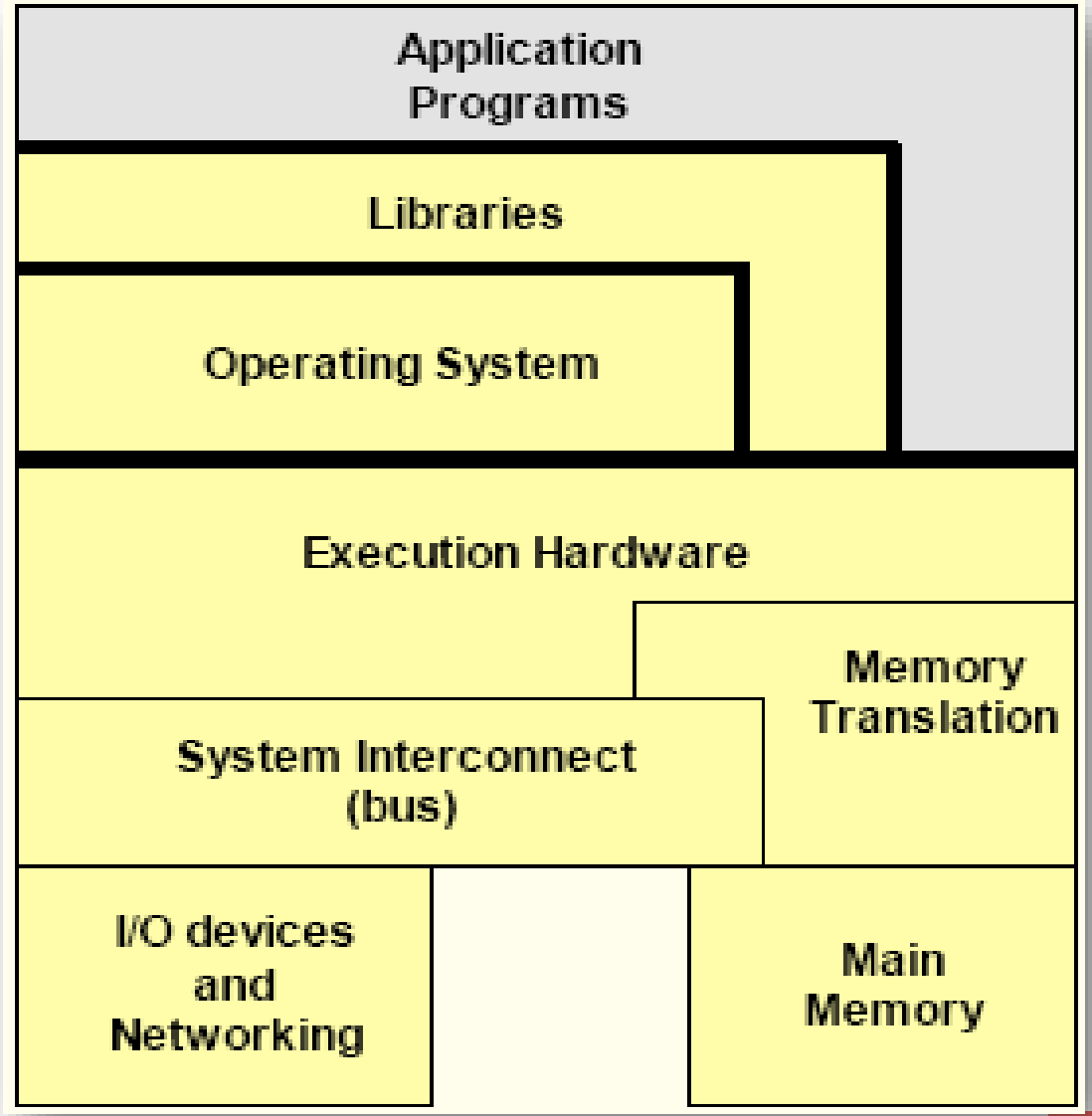
What is virtualization ?
OS level abstraction

- For compiler or library developers, a machine is defined by ABI (Application Binary Interface).
- This define the basic OS interface which may be used by libraries or user.



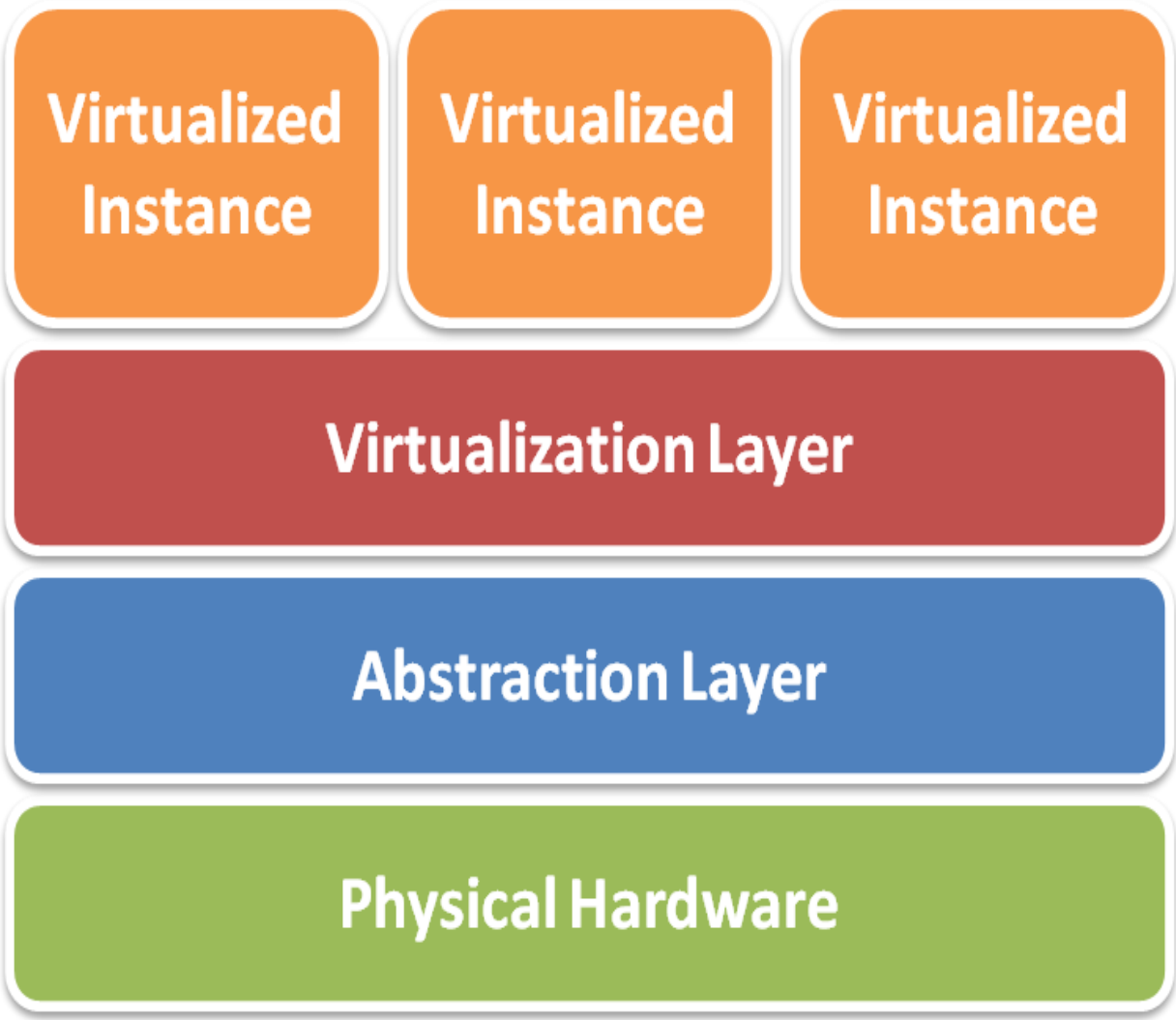
What is virtualization ?
Library level abstraction

- For application developers, a machine is defined by API (Application Programming Interface).
- This abstraction provides the well-rounded functionalities.



What is virtualization ?
General virtualization implementation level

- Virtualized instance
  - Software virtualized hardware instance
- Virtualization layer
  - Software virtualization implementation
- Abstraction layer
  - Various types of hardware access interface
- Physical hardware
  - Various types of infrastructure resources
- Different physical resources :
  - Server, Storage and Network



Emulation vs. Virtualization

- Emulation technique: Simulate an independent environment where guest ISA and host ISA are different.
- Example
  - Emulate x86 architecture on ARM platform.

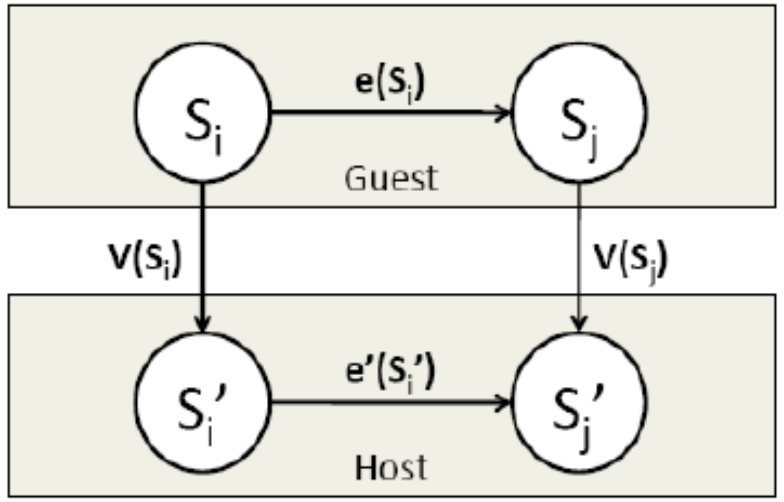
- Virtualization technique Simulate an independent environment where guest ISA and host ISA are the same.
- Example
  - Virtualize x86 architecture to multiple instances.

Virtual Machine

- Virtual Machine (VM)?
  - VM is a software implementation of a machine (i.e. a computer) that executes programs like a real machine.

- Terminology :
  - Host (Target): The primary environment where will be the target of virtualization.
  - Guest (Source): The virtualized environment where will be the source of virtualization.

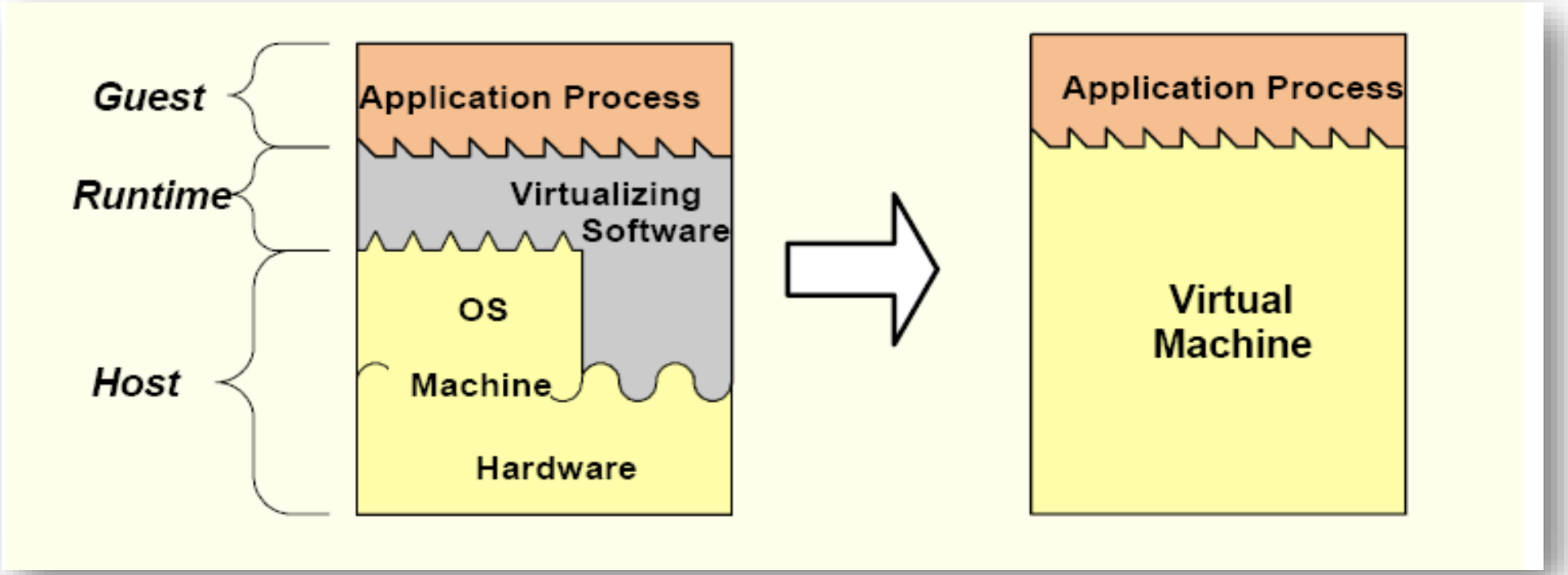
Isomorphism



Formally, virtualization involves the construction of an **isomorphism** from **guest** state to **host** state.

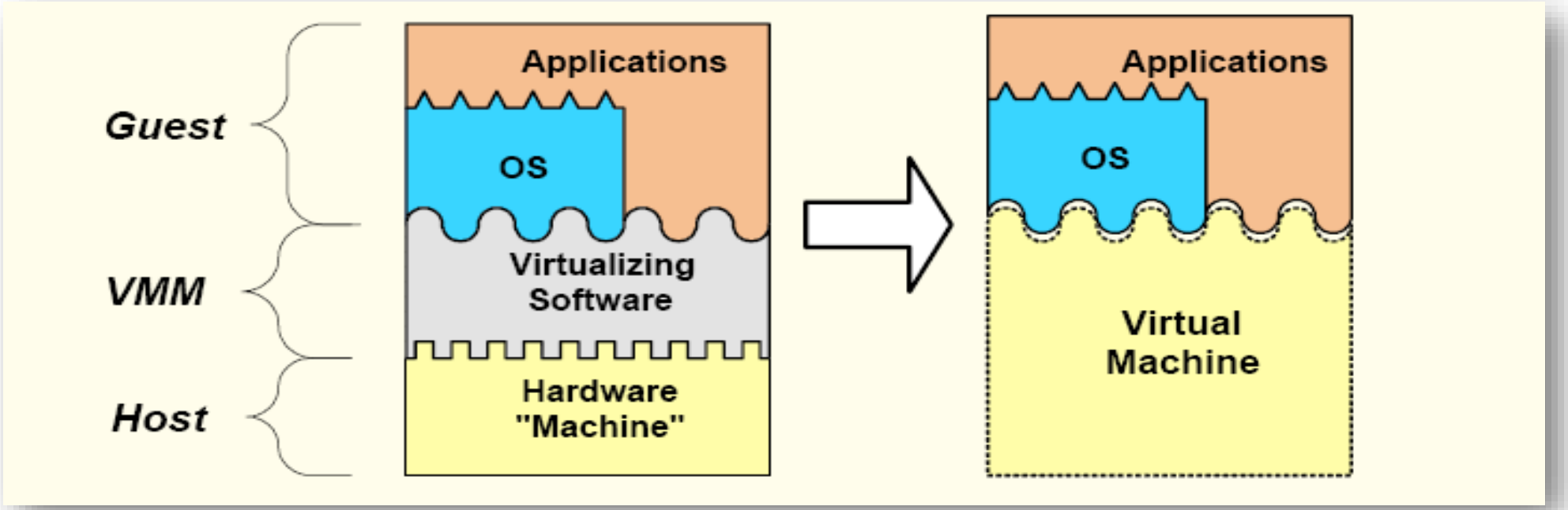
Process Virtual Machine

- Usually execute guest applications with an ISA different from host
- Couple at ABI(Application Binary Interface) level via runtime system
- Not persistent
- Ex: Java runtime environment or Microsoft CLI



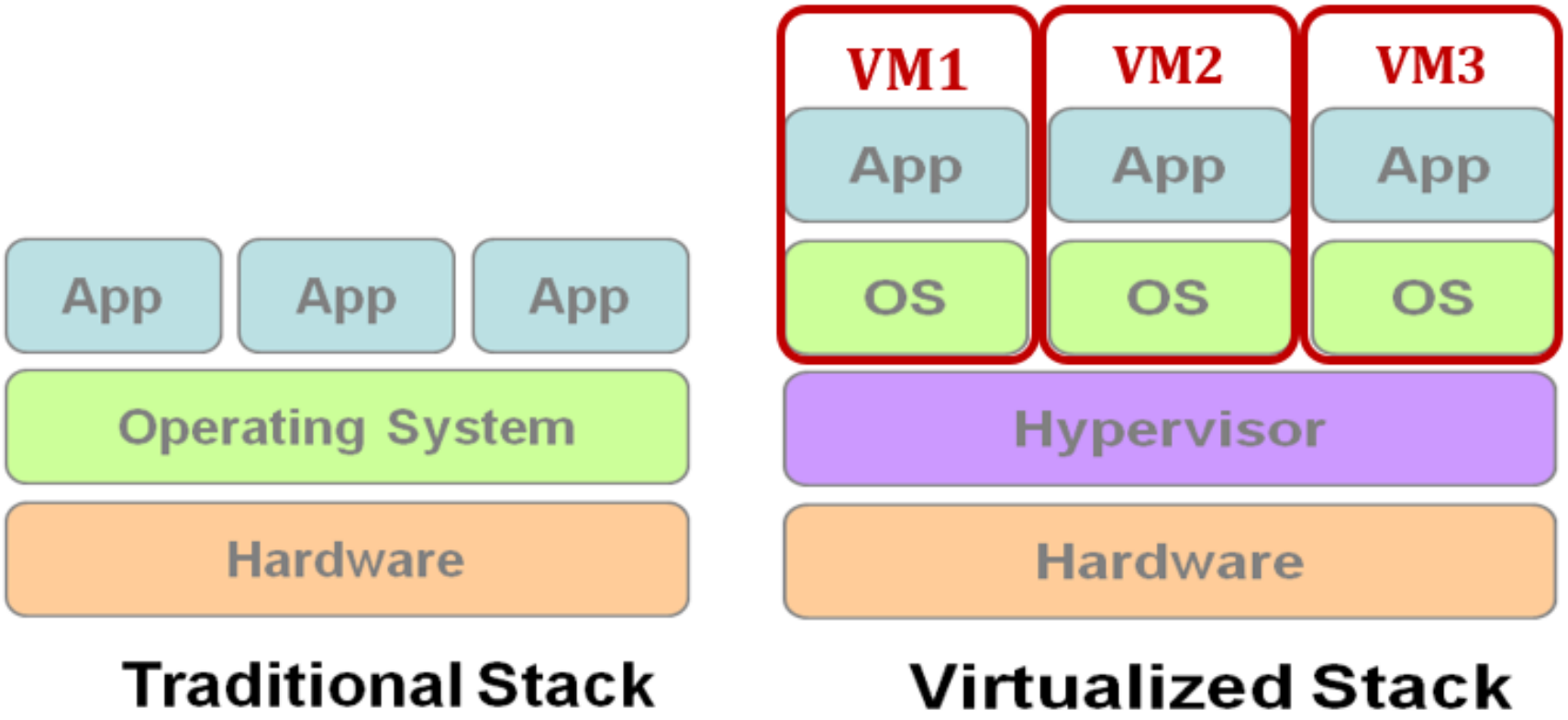
System Virtual Machine

- Provide the entire operating system on same or different host ISA
- Constructed at ISA level
- Persistent
- Ex: XEN, KVM, VMWare *(x86 virtualization software)*



Virtual Machine Monitor

- Virtual Machine Monitor (VMM) or Hypervisor is the software layer providing the virtualization.
- System architecture :

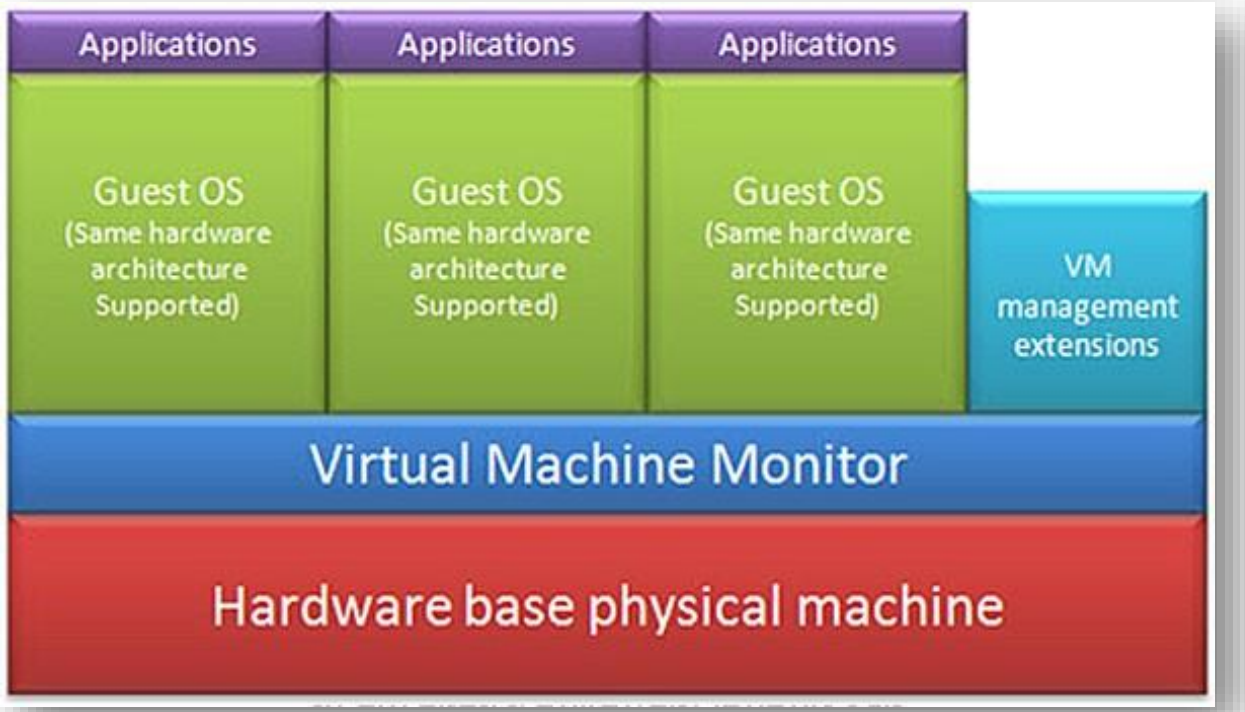


Virtualization Types

- Type 1 – Bare metal: VMMs run directly on the host's hardware as a hardware control and guest operating system monitor.
- Type 2 – Hosted: VMMs are software applications running within a conventional operating system.

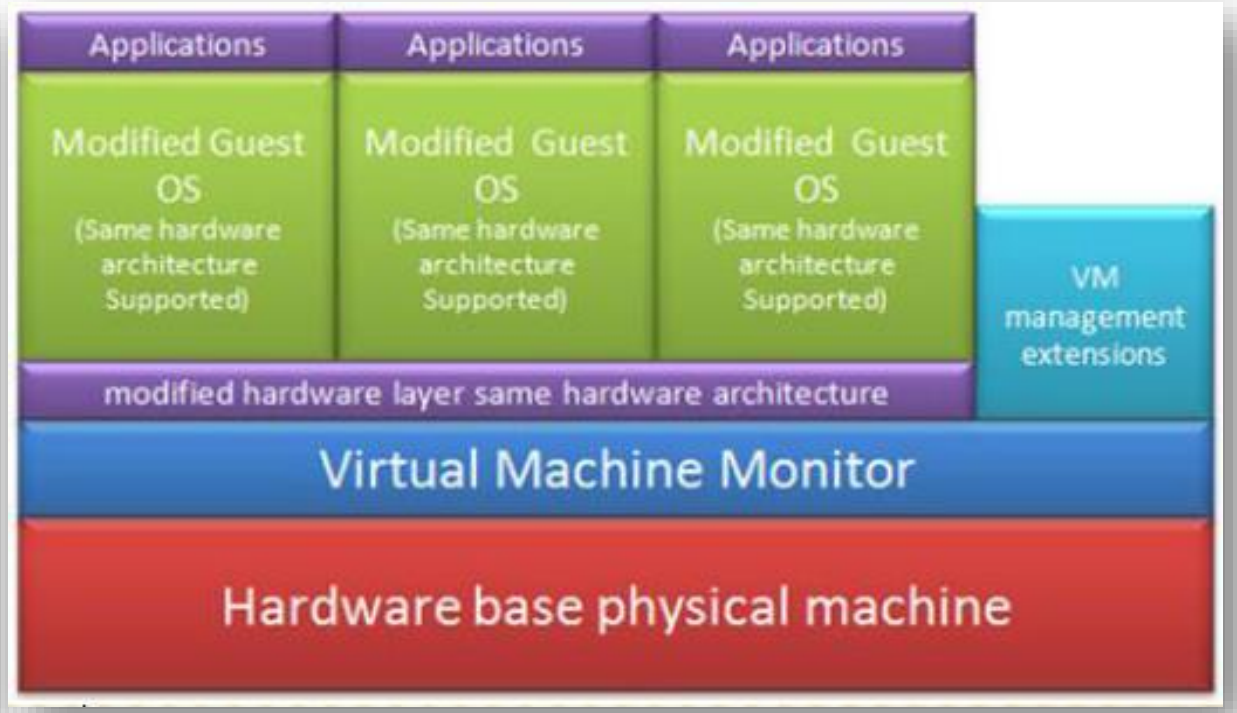
Virtualization Approaches

- Full-Virtualization
  - VMM simulates enough hardware to allow an unmodified guest OS.



Pros	**Need not to modify guest OS**
Cons	**Significant performance hit**

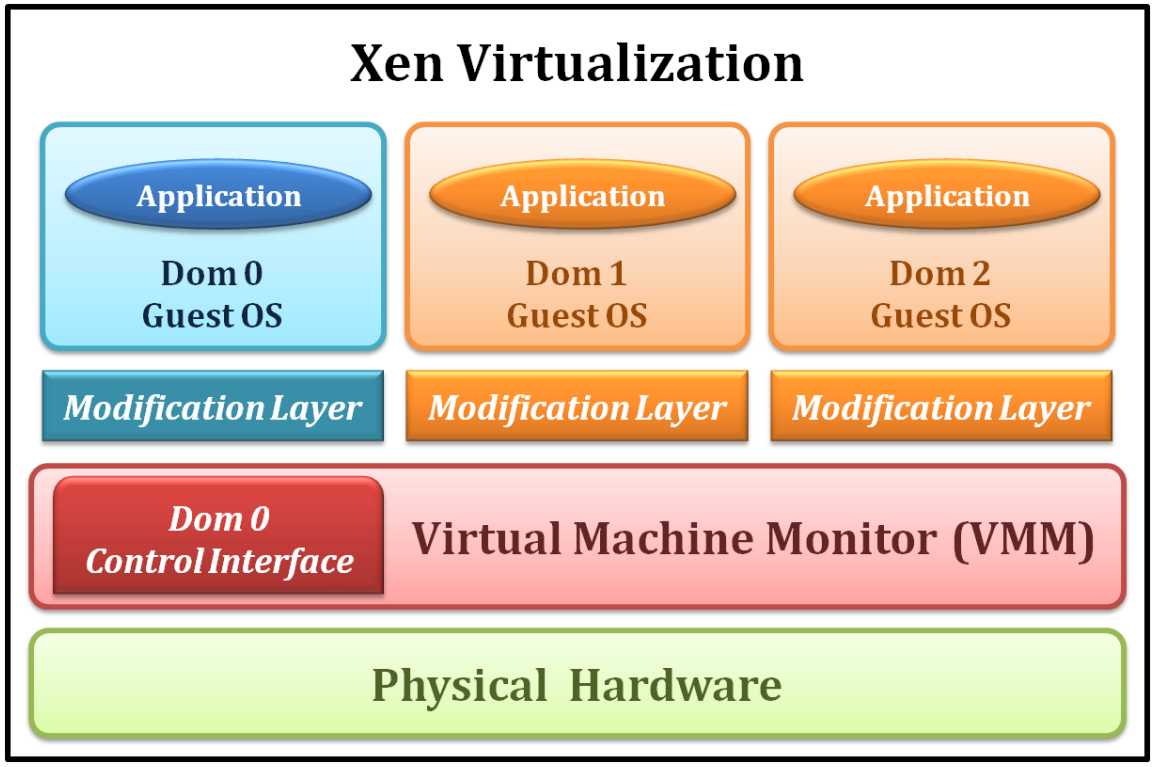
- Para-Virtualization
  - VMM does not necessarily simulate hardware, but instead offers a special API that can only be used by the modified guest OS.

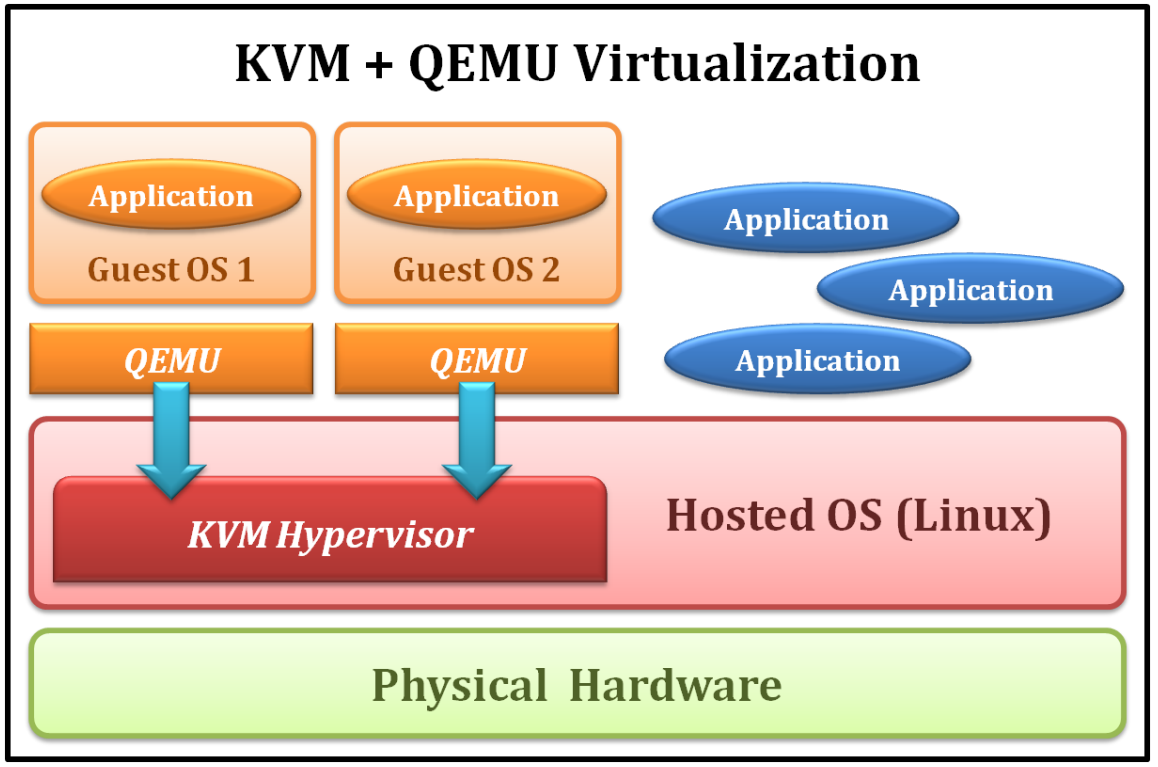


Pros	**Light weight and high performance**
Cons	**Require modification of guest OS**

Virtualization Example

- Xen
  - Type 1 Virtualization
  - Para-Virtualization
- KVM
  - Type 2 Virtualization
  - Full-Virtualization





Virtualization Techniques