Hot Topics: Virtualization

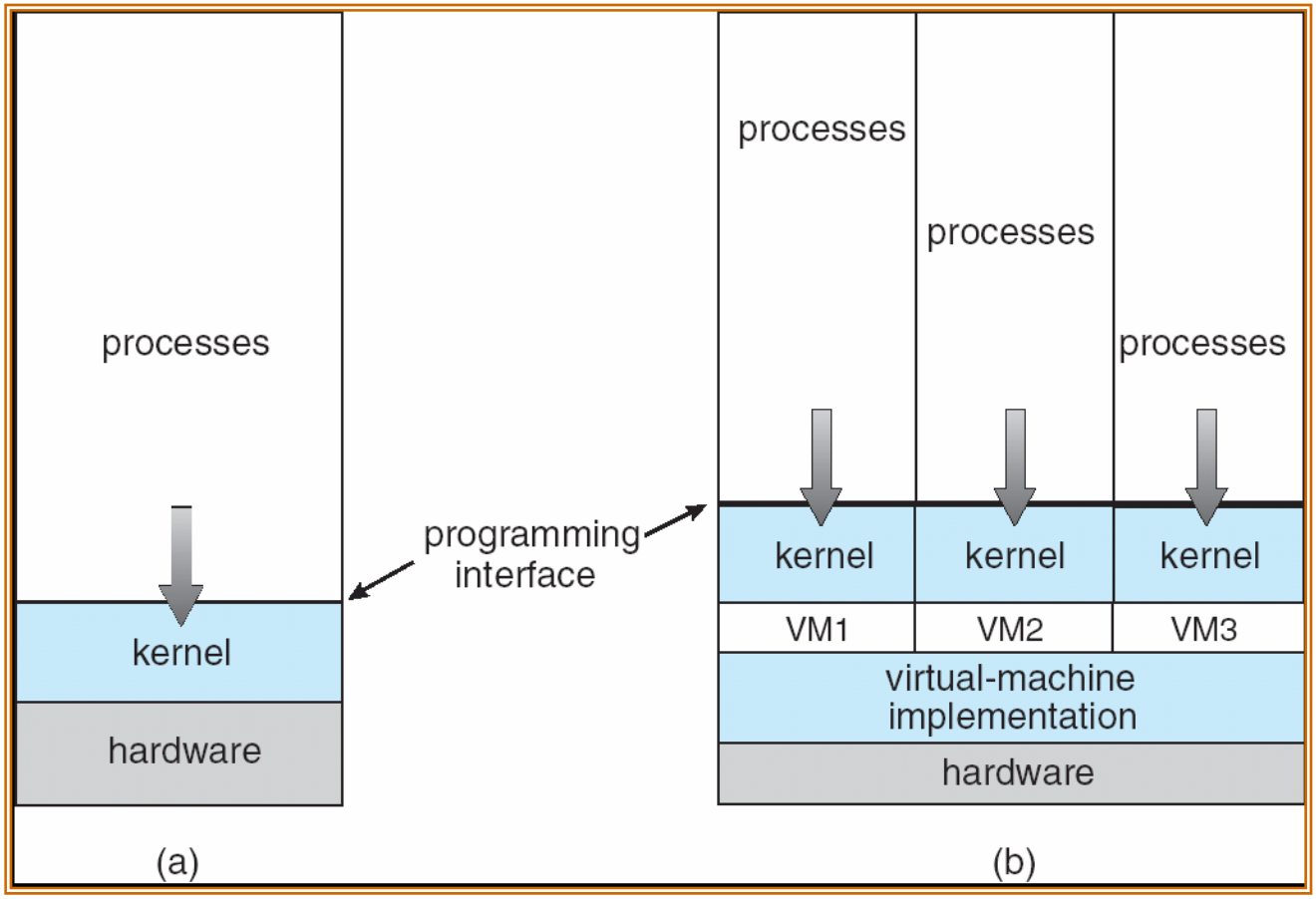
Virtual Machines

- A *virtual machine* takes the layered approach to its logical conclusion. It treats hardware and the operating system kernel as though they were all hardware
- A virtual machine provides an interface *identical* to the underlying bare hardware
- The operating system creates the illusion of multiple processes, each executing on its own processor with its own (virtual) memory

Virtual Machines (Cont.)

- The resources of the physical computer are shared to create the virtual machines
  - CPU scheduling can create the appearance that users have their own processor
  - Spooling and a file system can provide virtual card readers and virtual line printers
  - A normal user time-sharing terminal serves as the virtual machine operator's console

Virtual Machines (Cont.)



Virtual Machines (Cont.)

- The virtual-machine concept provides complete protection of system resources since each virtual machine is isolated from all other virtual machines. This isolation, however, permits no direct sharing of resources.
- A virtual-machine system is a perfect vehicle for operating-systems research and development. System development is done on the virtual machine, instead of on a physical machine and so does not disrupt normal system operation.
- The virtual machine concept is difficult to implement due to the effort required to provide an *exact* duplicate to the underlying machine

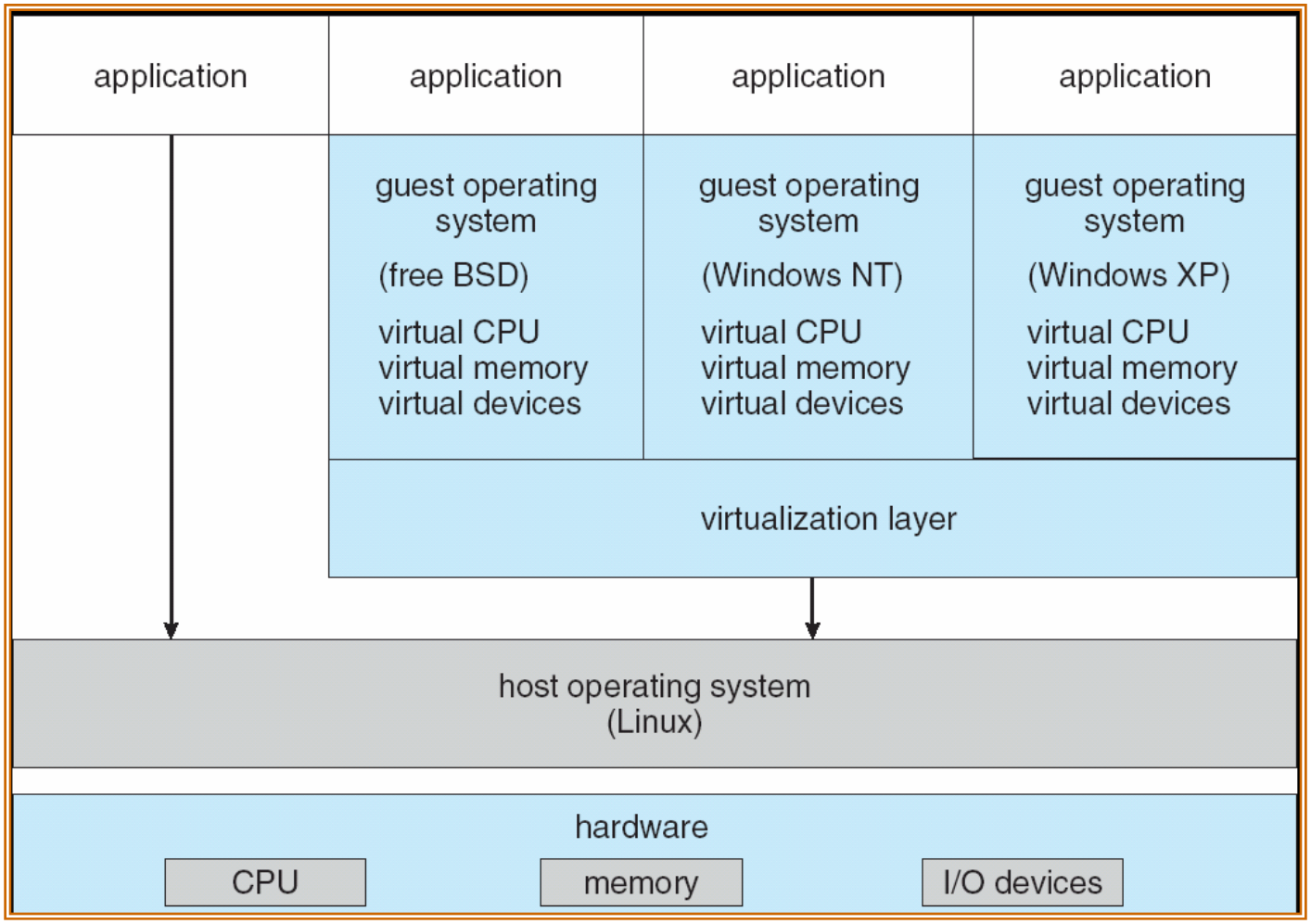
Benefits

- Manageability, Reliability, Availability
  - Server consolidation, staged upgrade deployment, failure confinement, …
- Security
  - Encapsulate untrusted SW
  - Separate environment for trusted SW
- Support for legacy OSs, ISAs…
- Development

Virtualization Options

- Hosted or Hypervisor-based
- Para- or Full-virtualization
  - modified or unmodifed guest OSs

VMware Architecture – hosted, full



Xen – hypervisor-based, para