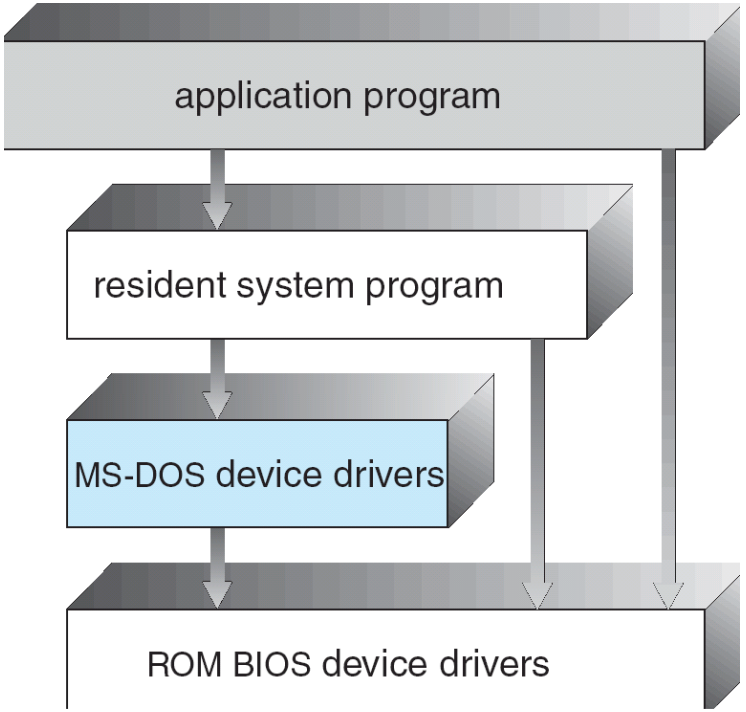
OS Structure

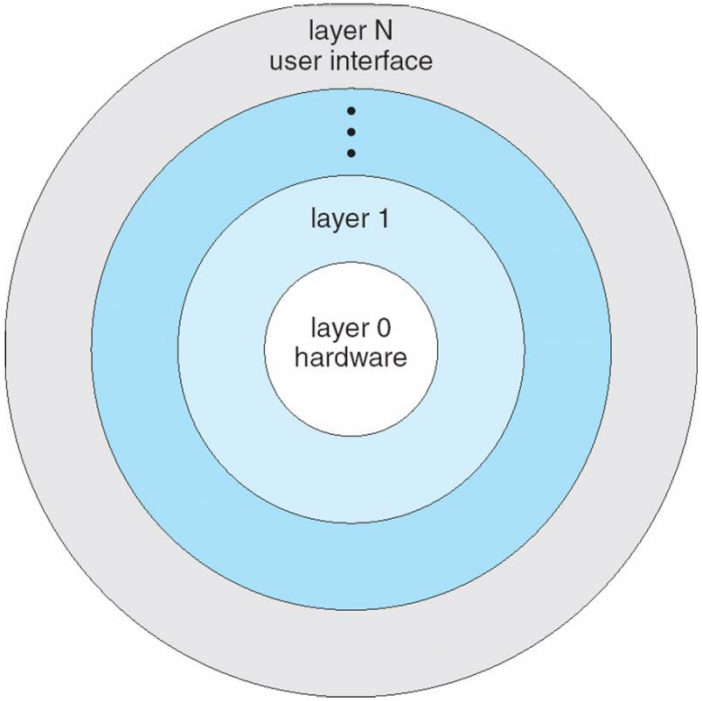
OS Structures: Simple Structure

- MS-DOS – written to provide the most functionality in the least space
  - Not strictly divided into modules
  - Although MS-DOS has some structure, its interfaces and levels of functionality are not well separated
  - Even application program can access devices

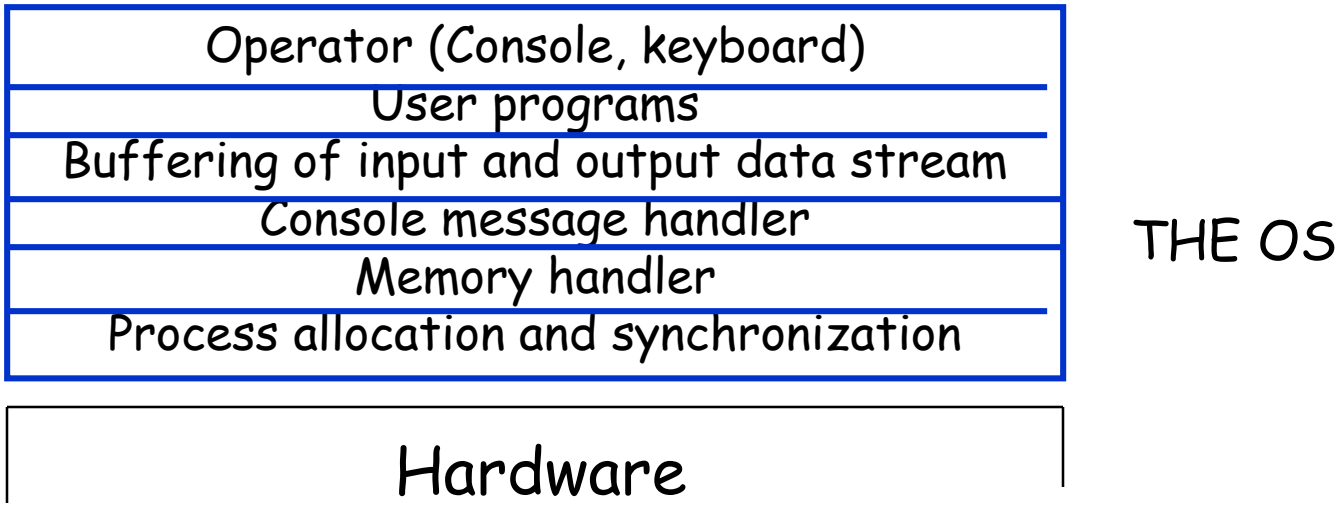


Layered Structure

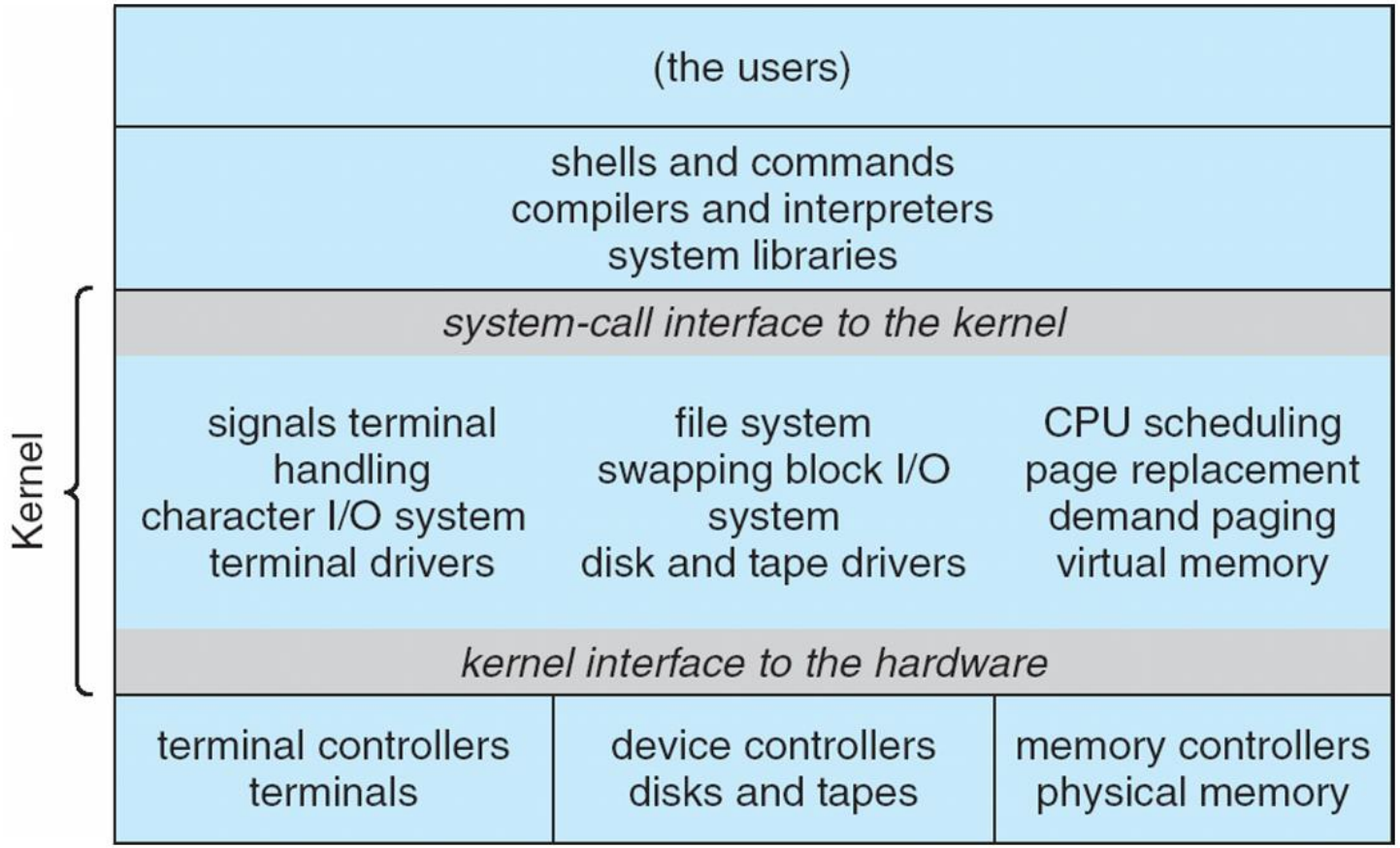
- The operating system is divided into a number of layers (levels), each built on top of lower layers. The bottom layer (layer 0), is the hardware; the highest (layer N) is the user interface.
- With modularity, layers are selected such that each uses functions (operations) and services of only lower-level layers



Example THE


Operator (Console, keyboard)
User programs
Buffering of input and output data stream
Console message handler
Memory handler
Process allocation and synchronization
Hardware
THE OS

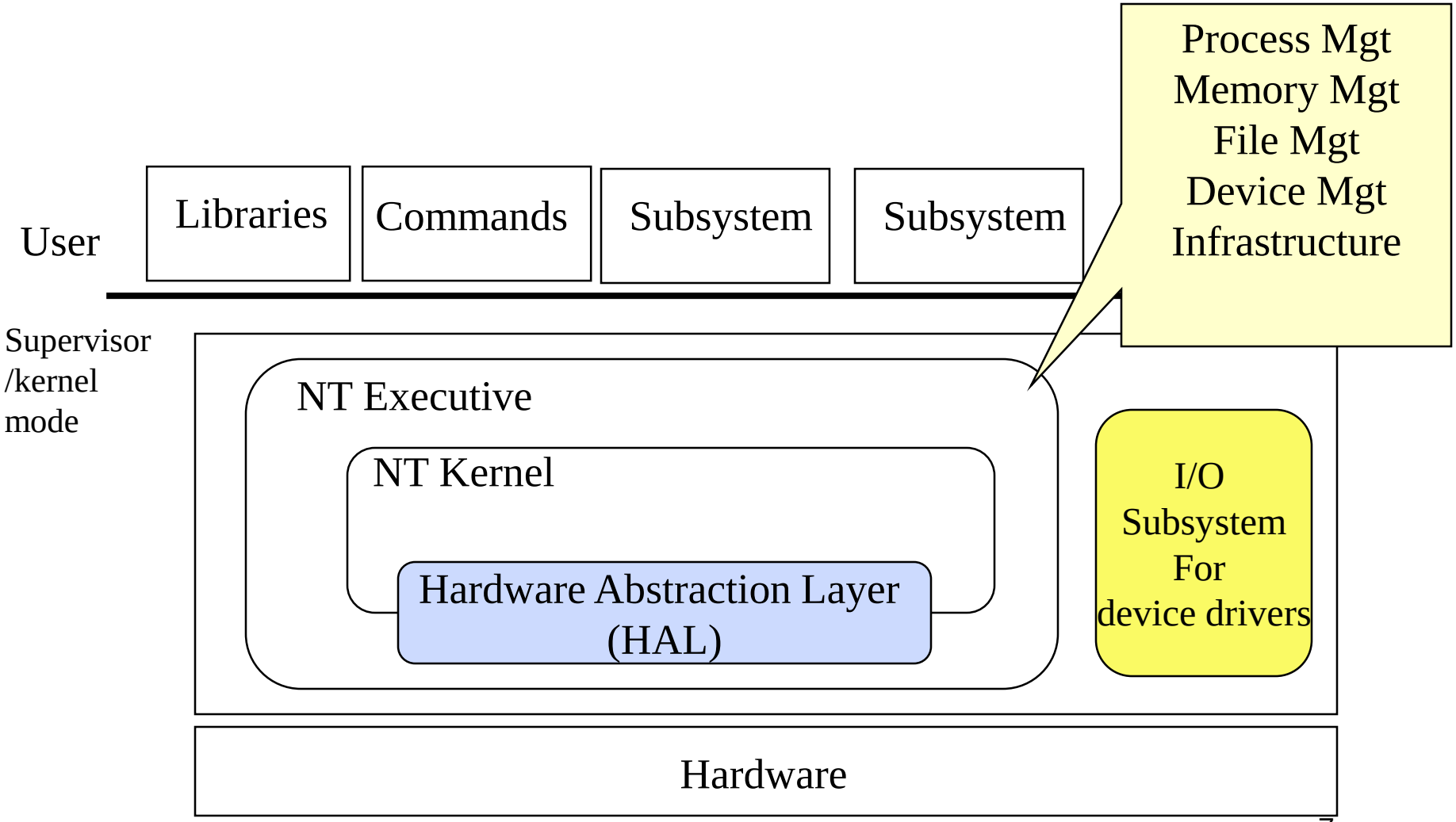
Example: Traditional UNIX System Structure



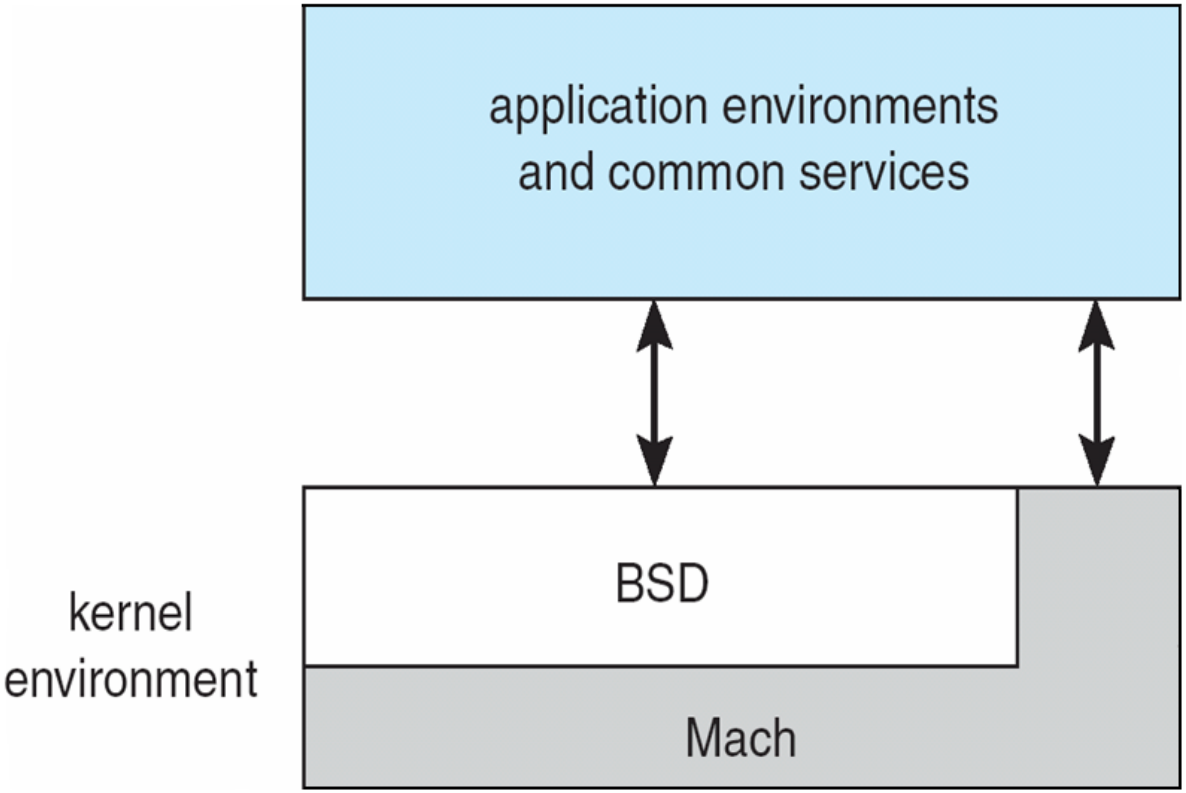
Microkernel System Structure

- Move as much from the kernel into "*user*" space
- Communication takes place between user modules using message passing
- Benefits:
  - Easier to extend a microkernel
  - Easier to port the operating system to new architectures
  - More reliable and secure
- Detriments:
  - Performance overhead of user space to kernel space communication

Windows NT/2000/XP



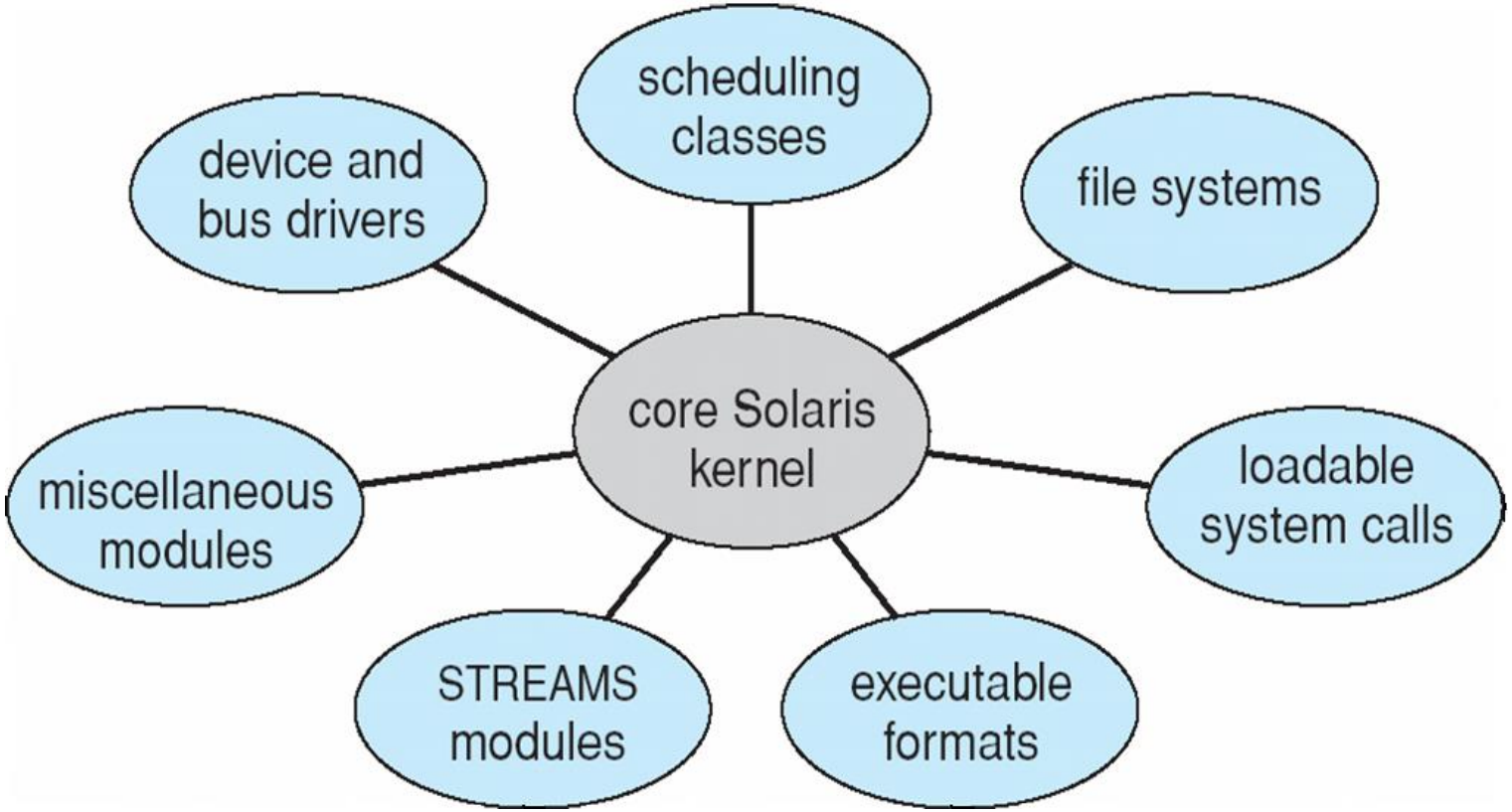
Mac OS X Structure



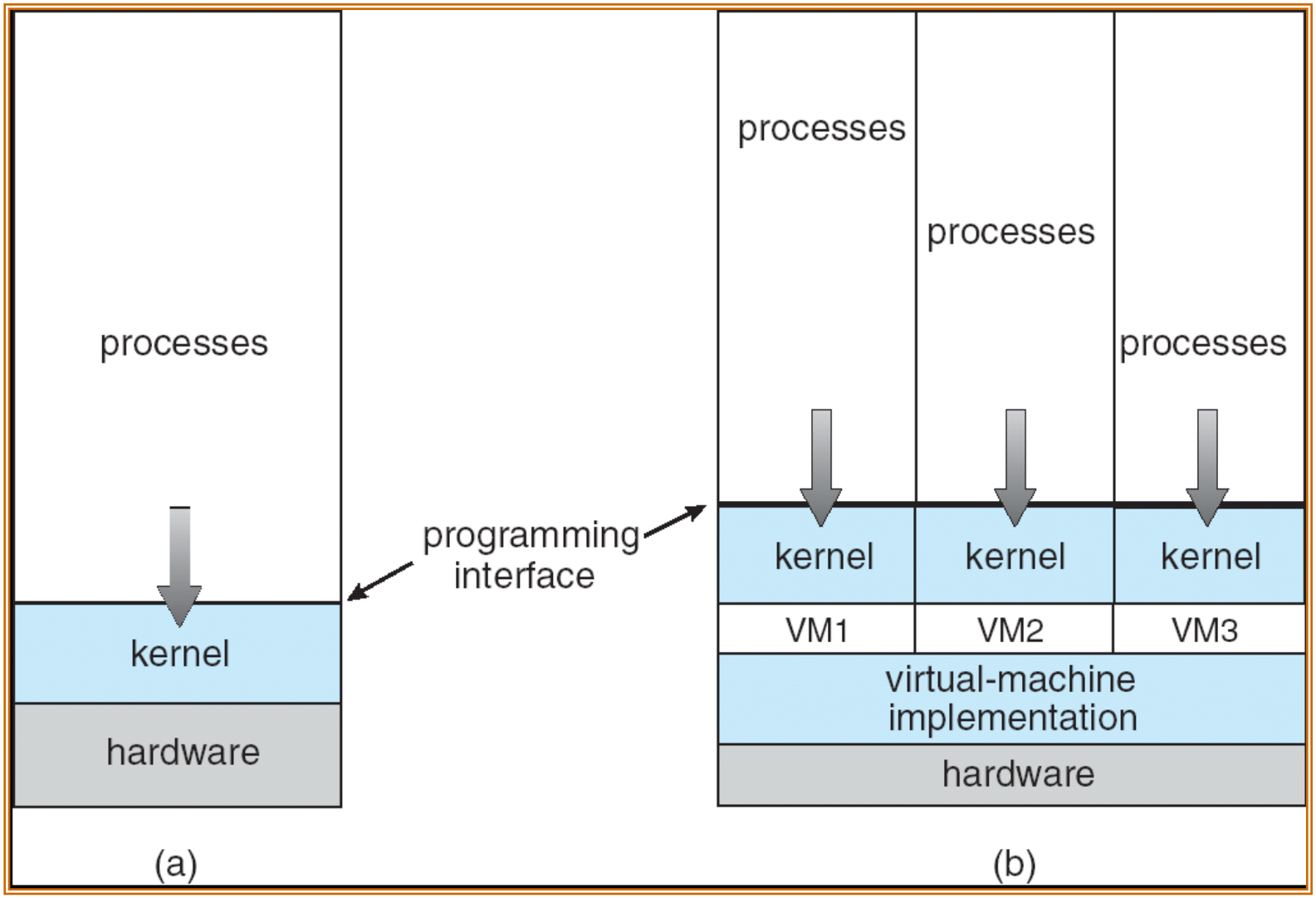
Modular Kernel

- Most modern operating systems implement kernel modules
  - Use object-oriented approach
  - Each core component is separate
  - Each talks to the others over known interfaces
  - Each is loadable as needed within the kernel
- Overall, similar to layers but with more flexibility

Example: Solaris Modular Approach



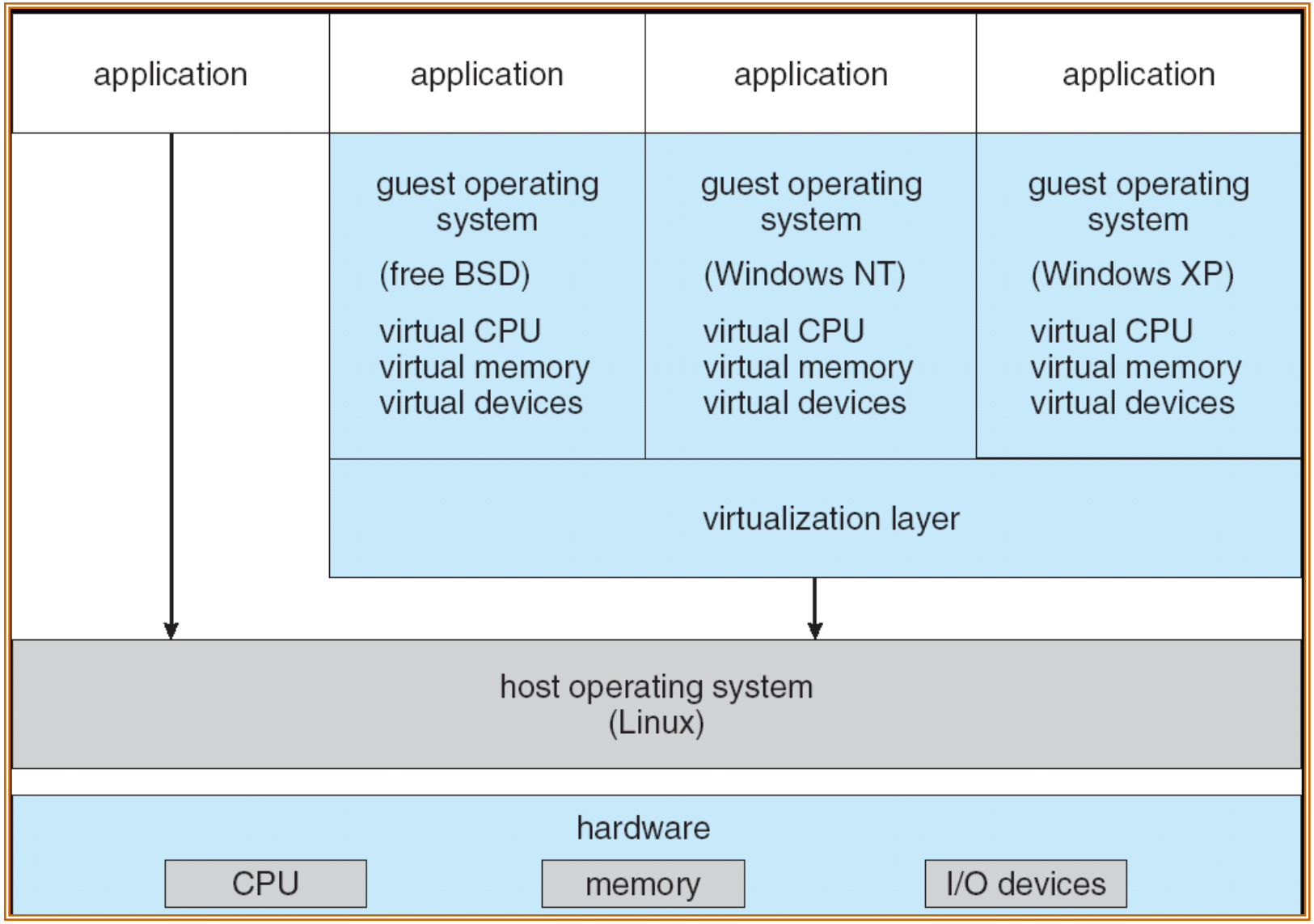
Virtual Machines



Virtual Machines

- Protection of system resources: each virtual machine is isolated from all other virtual machines.
- A virtual-machine system is a perfect vehicle for operating-systems research and development.
- The virtual machine concept is difficult to implement due to the effort required to provide an *exact* duplicate to the underlying machine

VMware Architecture



The Java Virtual Machine