

CS 3841 Operating Systems

An Introduction to Operating Systems

- Objectives

- Compare and contrast simple structured operating systems, layered operating systems, microkernels, and module based operating systems.
 - List the limitations of the MS-DOS operating system.
 - Draw a picture for a layered operating system.
 - List the advantages of a layered operating system.
 - List the problems of designing a layered operating system.
 - Explain the fundamental purpose for the microkernel within a microkernel based operating system.
 - Explain the relationship between a layered architecture and a virtual machine.
 - List the benefits of using a virtual machine.
 - Define simulation in the context of virtual machines.



Operating Systems Structures

- Simple operating systems
 - Older operating systems
 - Small, embedded operating systems
- Layered Operating Systems
 - Slightly newer approach to OS design
- Microkernels
 - Very small kernels
- Module Based Operating Systems
 - Most common OS approach

Organization



MS-DOS

- Written to provide the most functionality in the least space
 - Not divided into modules
 - Although MS-DOS has some structure, its interfaces and levels of functionality are not well separated

*All equal
in the system.*



Layered Approach

- The operating system is divided into a number of layers (levels), — 1 unit: analysis — each layer built on top of lower layers.
- Layer 0 is the hardware;
- Layer N is the user interface. — GOT — Text — Analysis — else
- Layers are selected such that each uses functions (operations) and services of only lower-level layers



Adv:

Simplicity
of construction

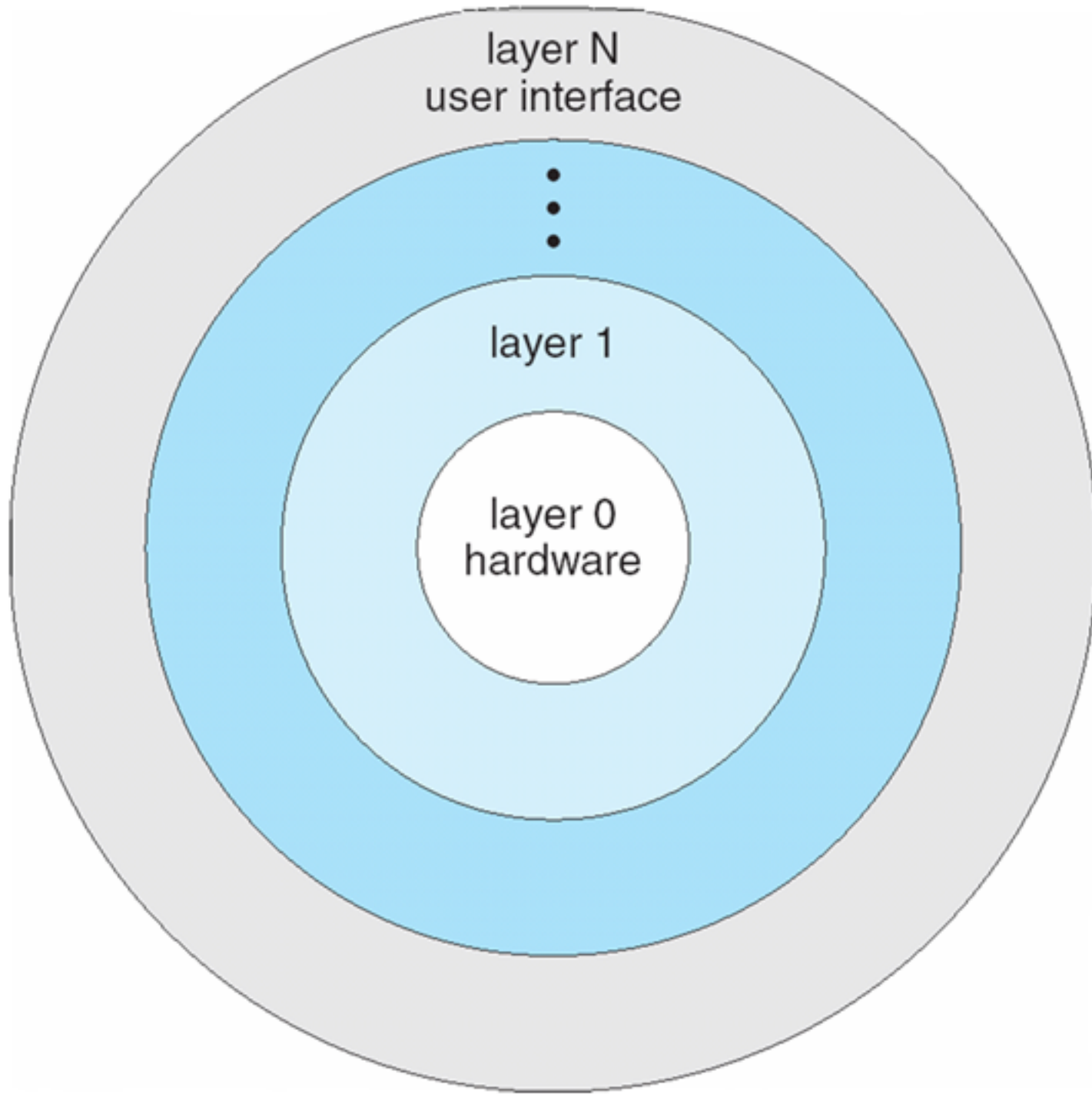
Security

⇒ Better debugging

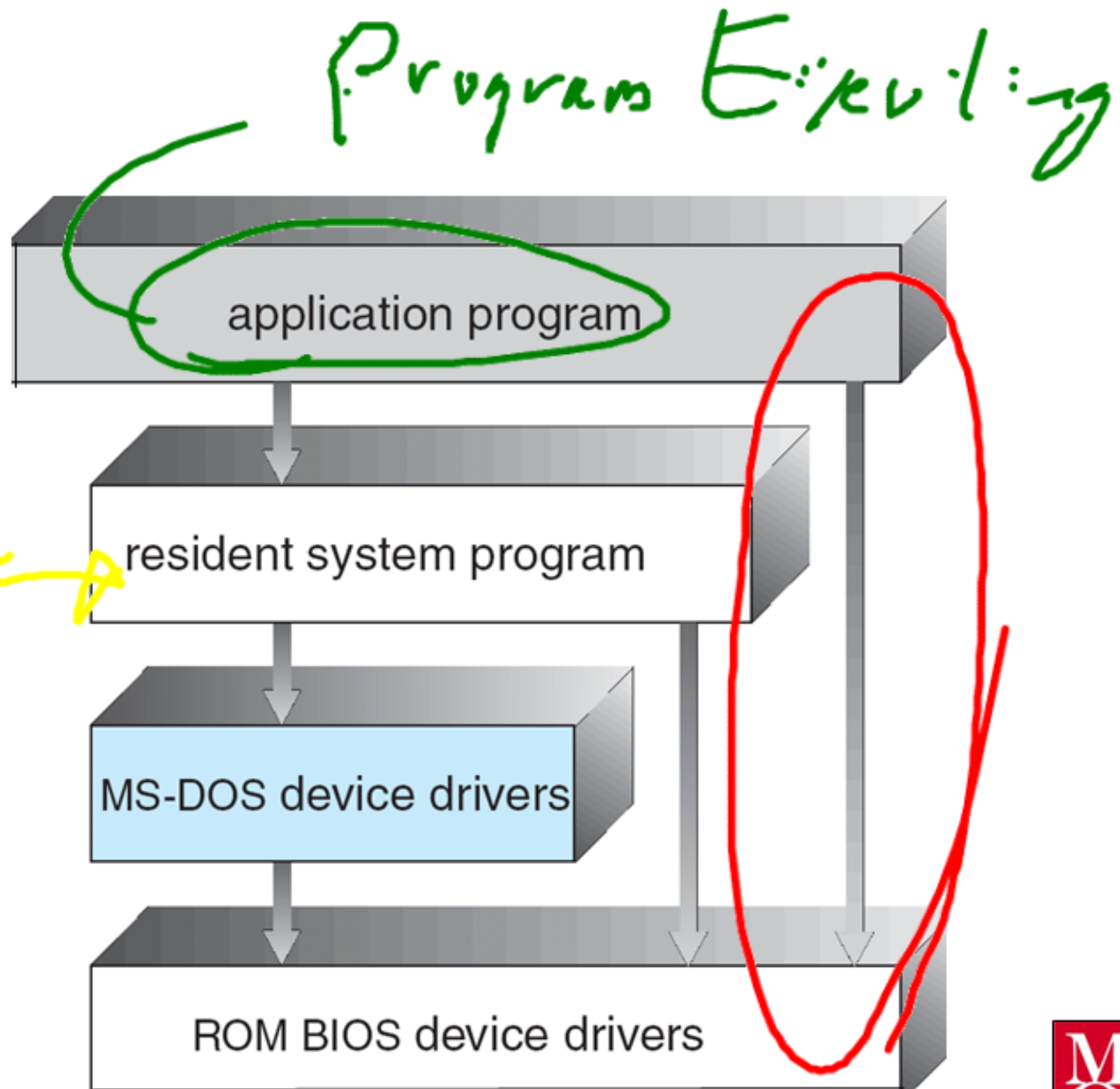
Abstraction

Problems: Complexity / Design issues
Efficiency

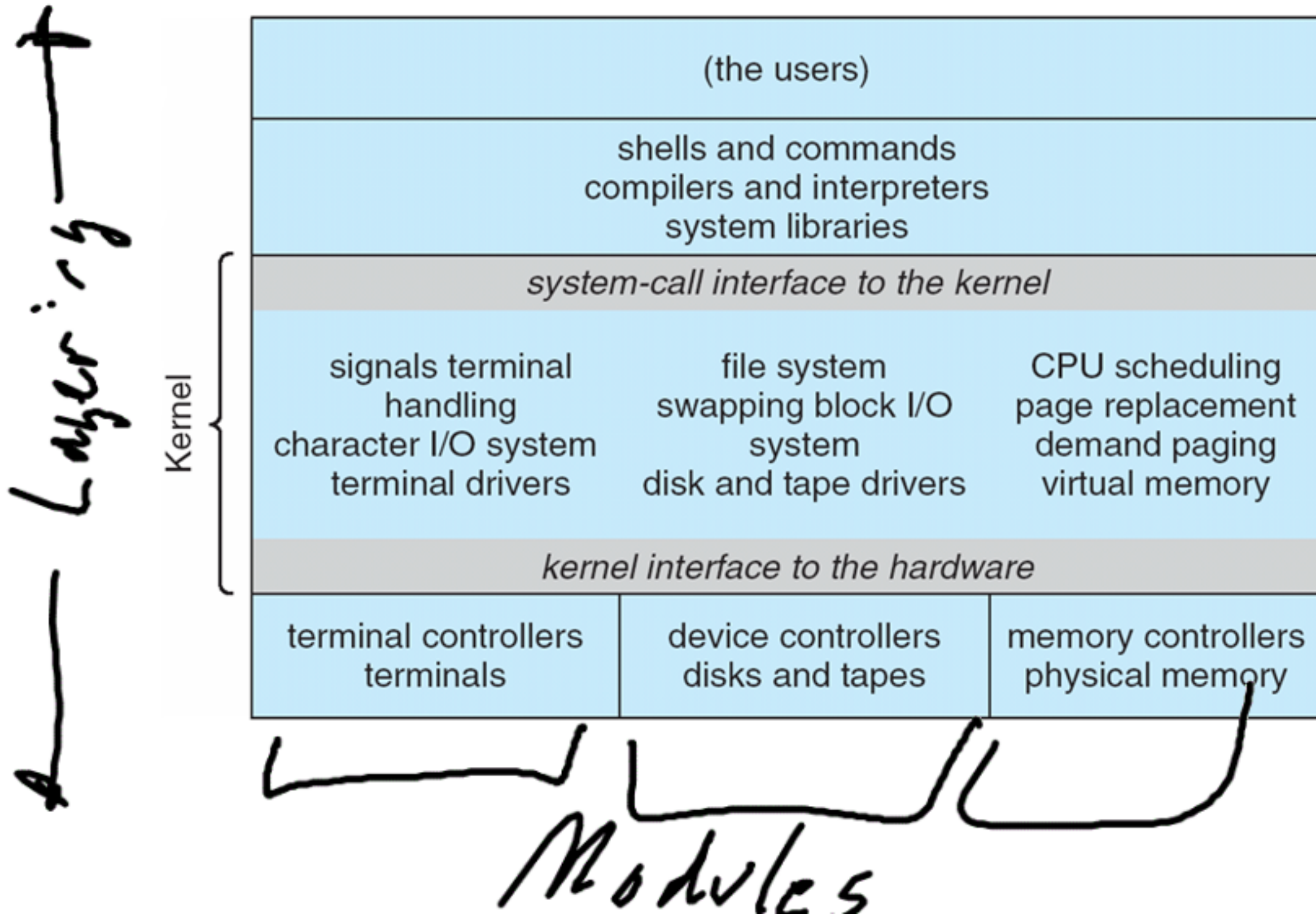
Layered Operating System



MS-DOS Layer Structure



Traditional UNIX System Structure



Microkernel System

Structure

- Moves as much from the kernel into "user" user space
- Communication takes place between user modules using message passing
- Benefits:

Easier to Extend / Easier to Port to new system.

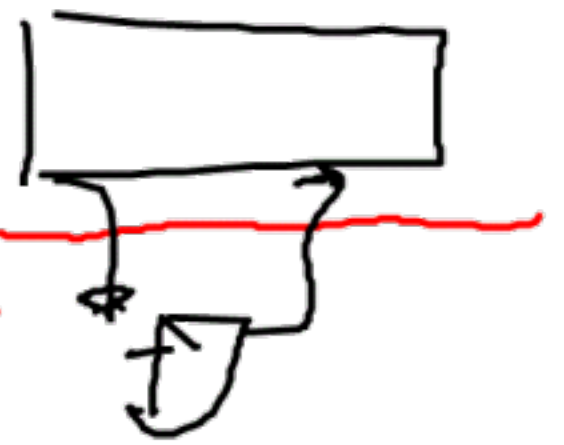
Better reliability

- Detriments:

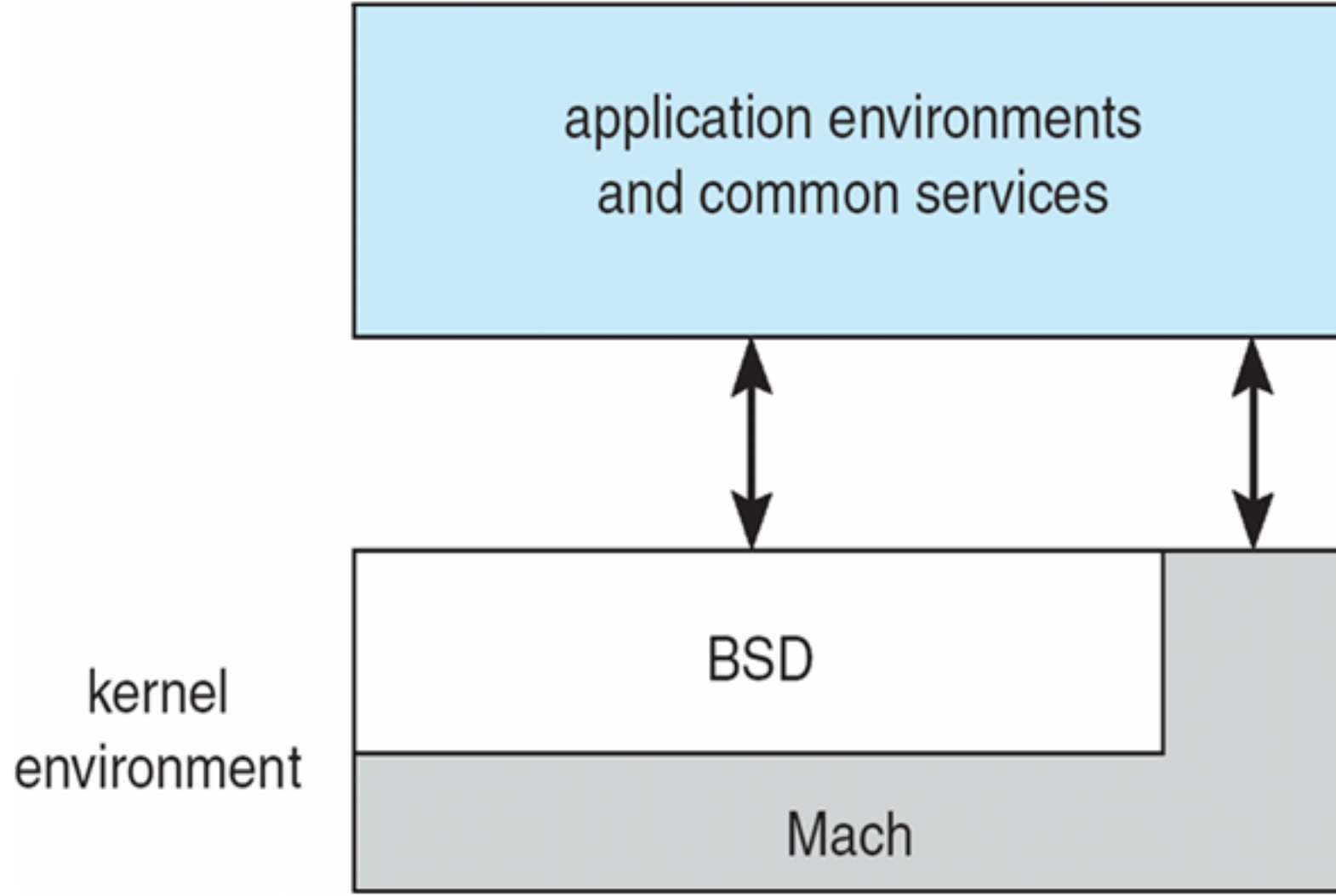
Performance overhead of user to kernel switch

MS
OE

Better security



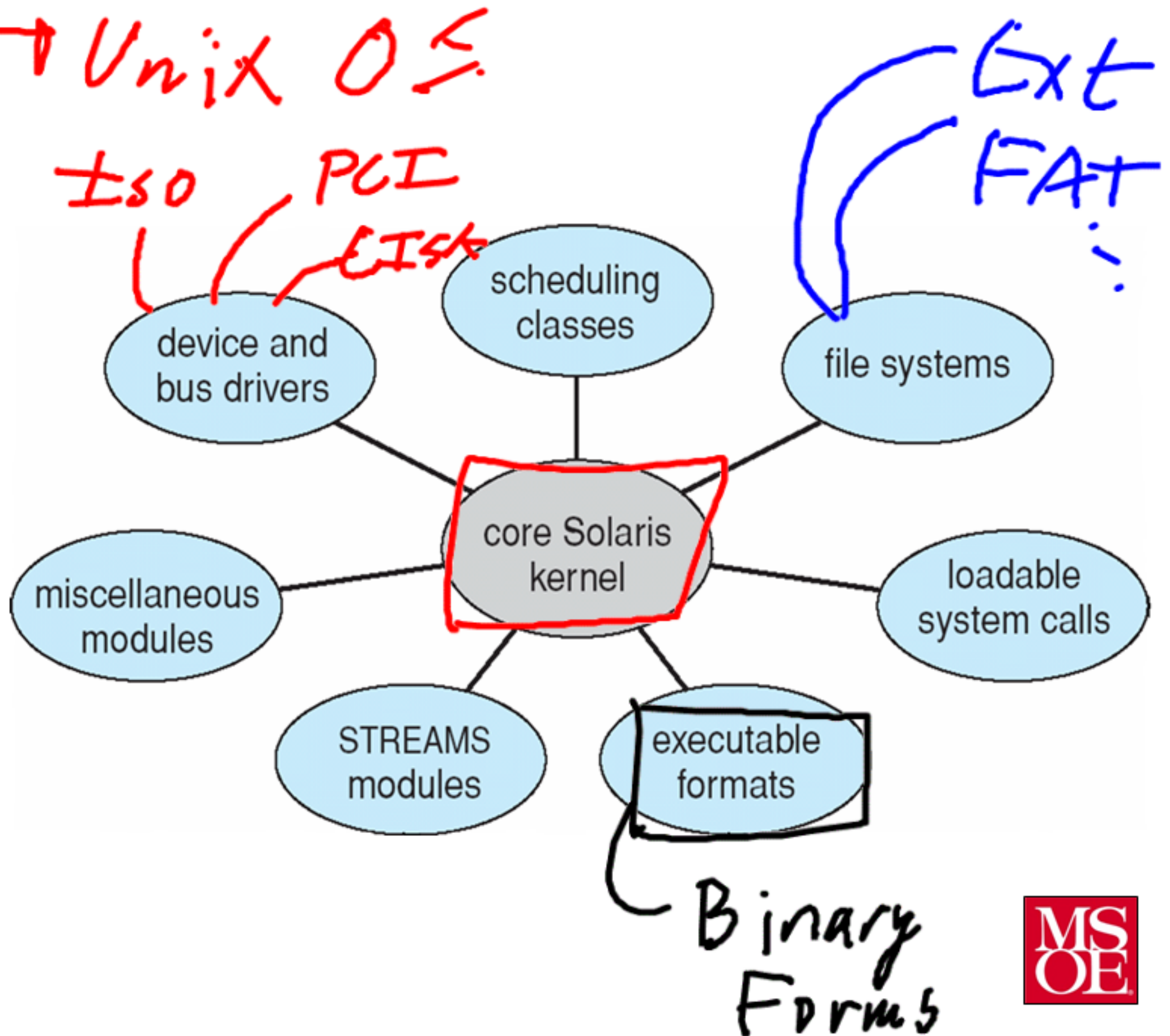
Mac OS X Structure



Modules

- Most modern operating systems implement kernel modules
 - Uses 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 flexible

Solaris Modular Approach



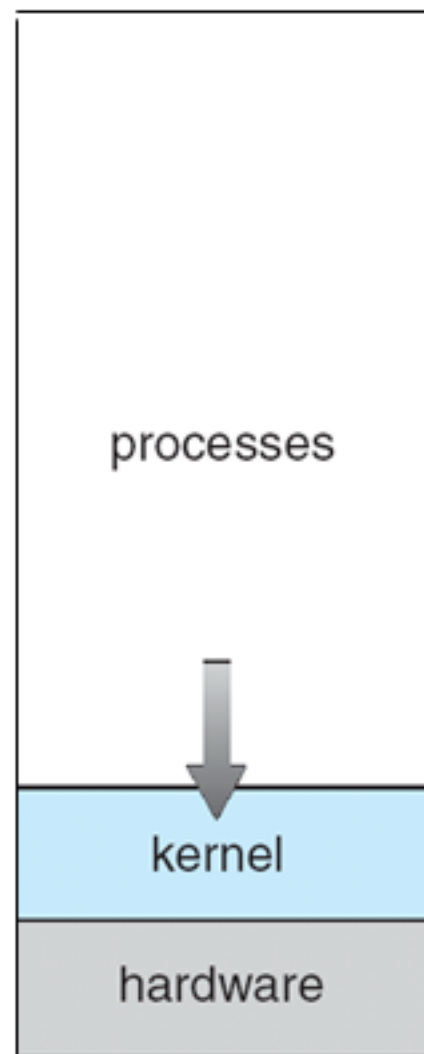
Virtual Machines

- A **virtual machine** takes the layered approach to its logical conclusion.
 - Treats hardware and the operating system kernel as though they were all hardware
- Provides an interface identical to the underlying bare hardware
- **host** creates the illusion that a process has its own processor and (virtual memory)
 - **guest** provided with a (virtual) copy of underlying computer

Windows 7

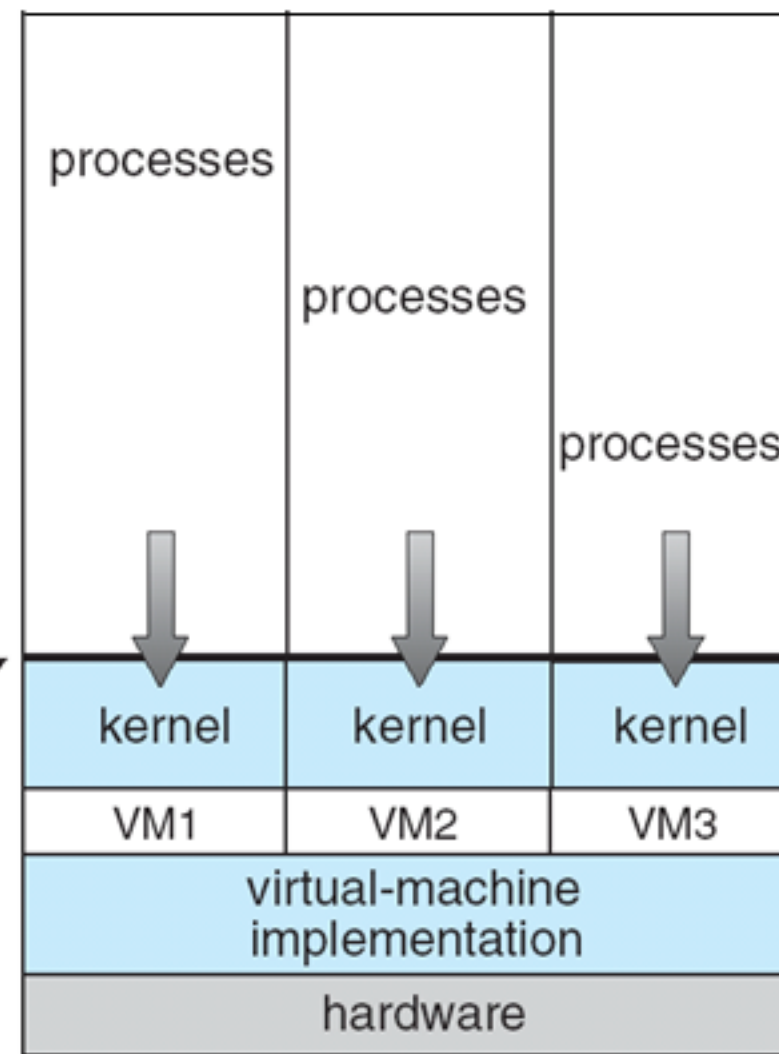
Ubuntu

Virtual Machines (Cont)



(a)

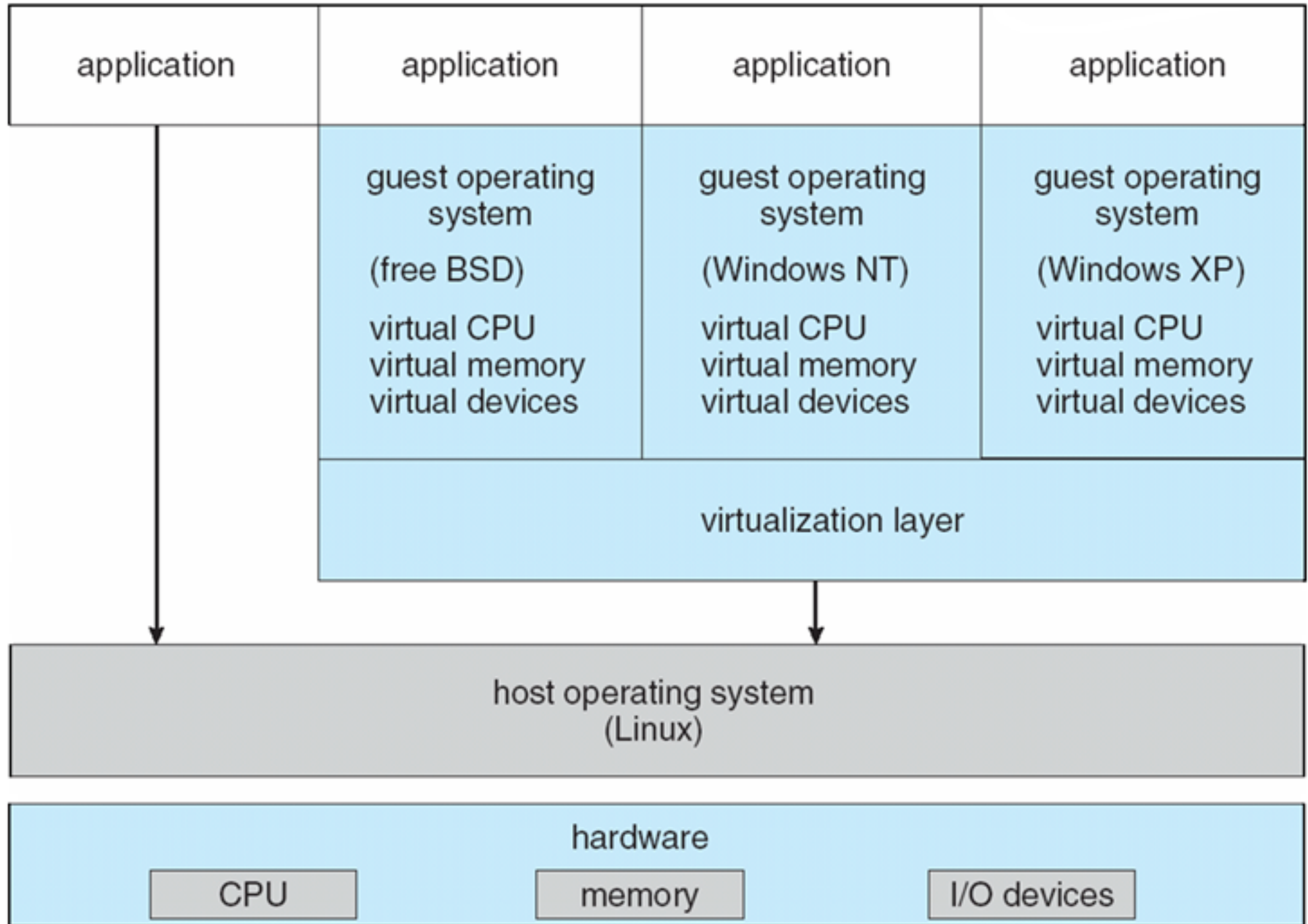
Standard Machine



(b)

Allows different OS's

VMware Architecture



Advantages of Virtual machine

Better Security

Multiple OS support

Data Center Consolidation

⇒ Physical Controlled
Space

Scalability

Simulation

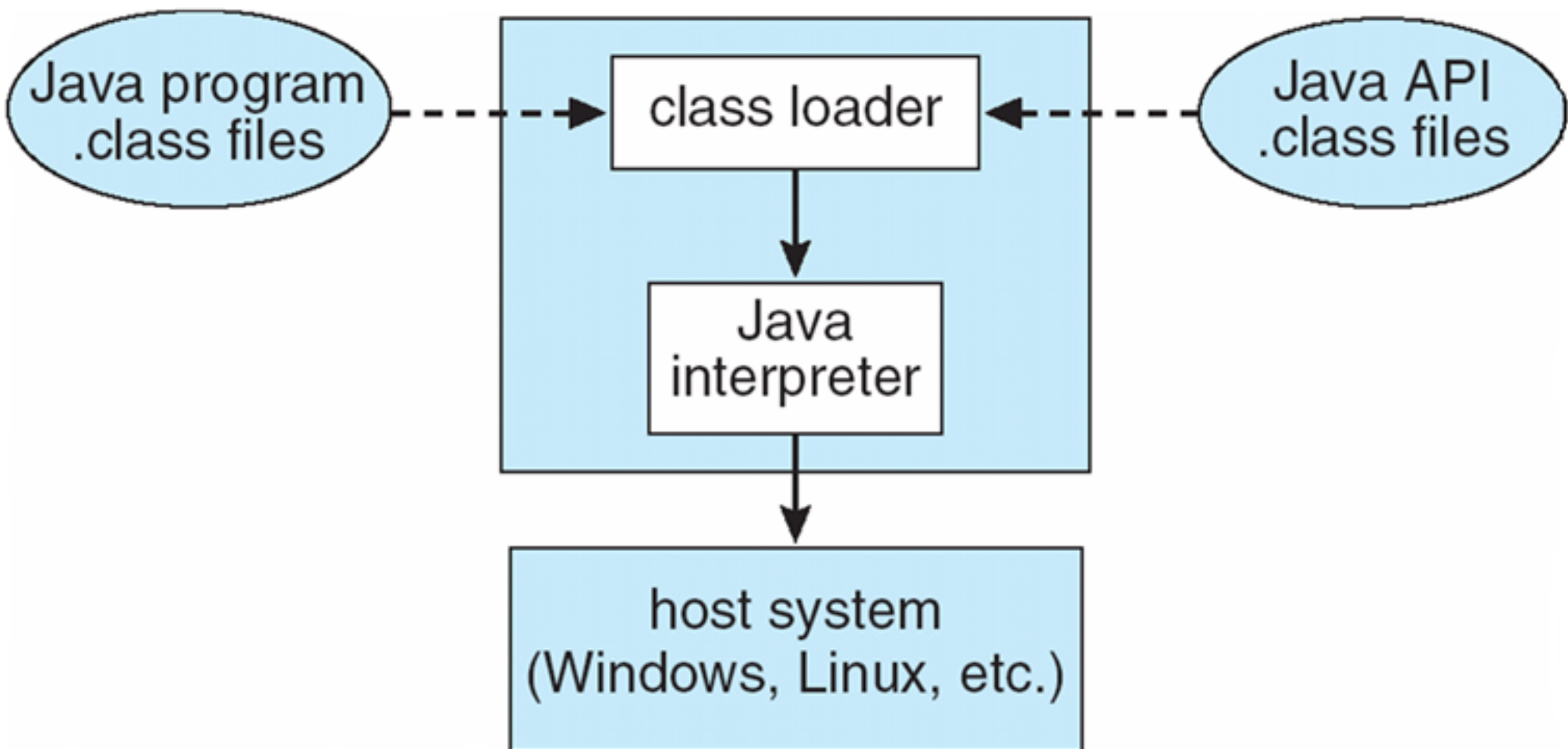
- Host system has one architecture and guest system has a different architecture
 - Emulation and translation

Atmega 32 Debug mode

- Problems?

*Speed & Performance
Complexity issues*

The Java Virtual Machine



The .NET Framework

