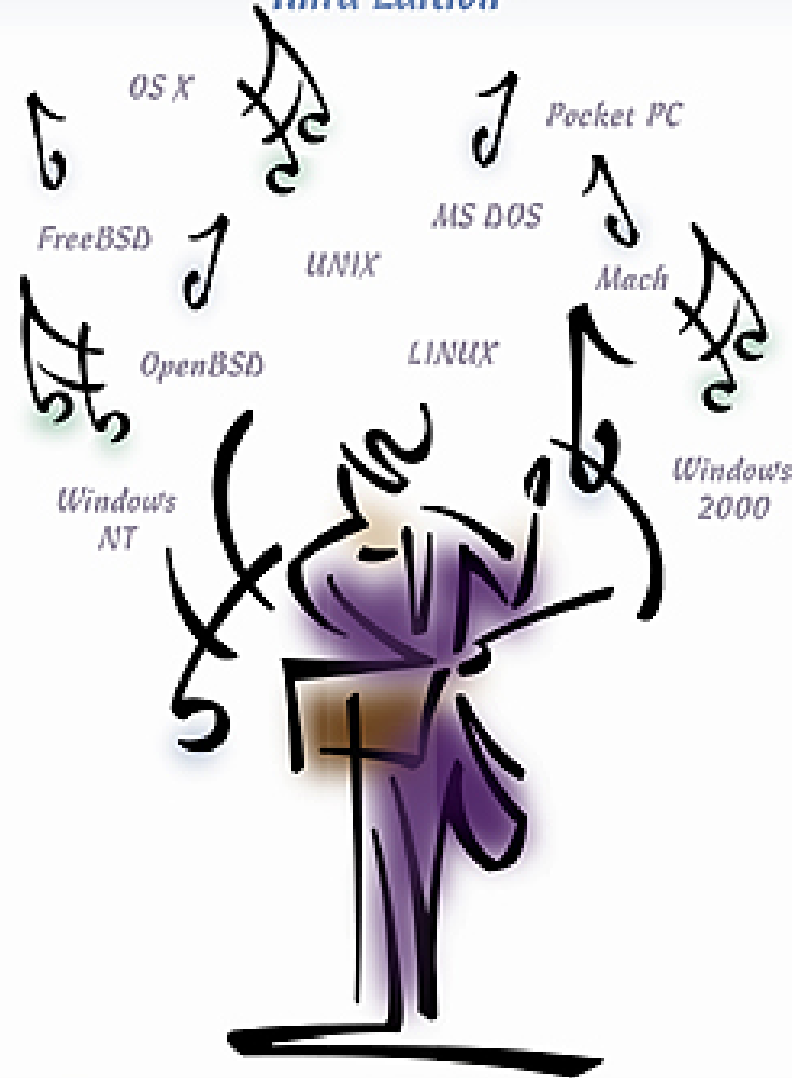


OPERATING SYSTEMS

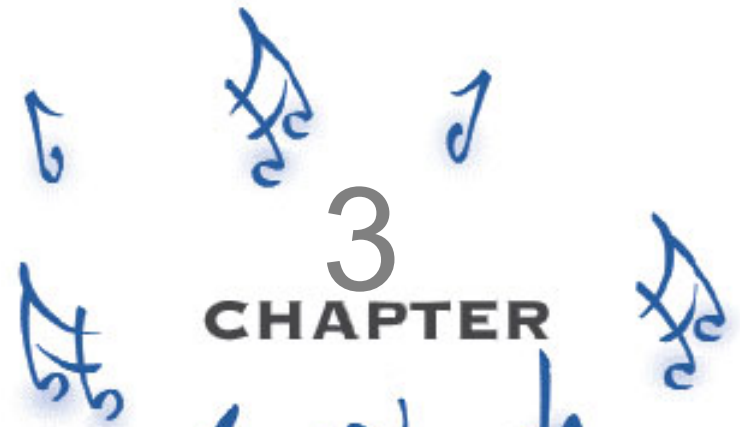
Third Edition



GARY NUTT



Operating System Organization



3 CHAPTER



Purpose of an OS



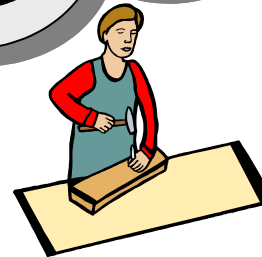
Processes



Coordinate Use
of the Abstractions



Create the Abstractions



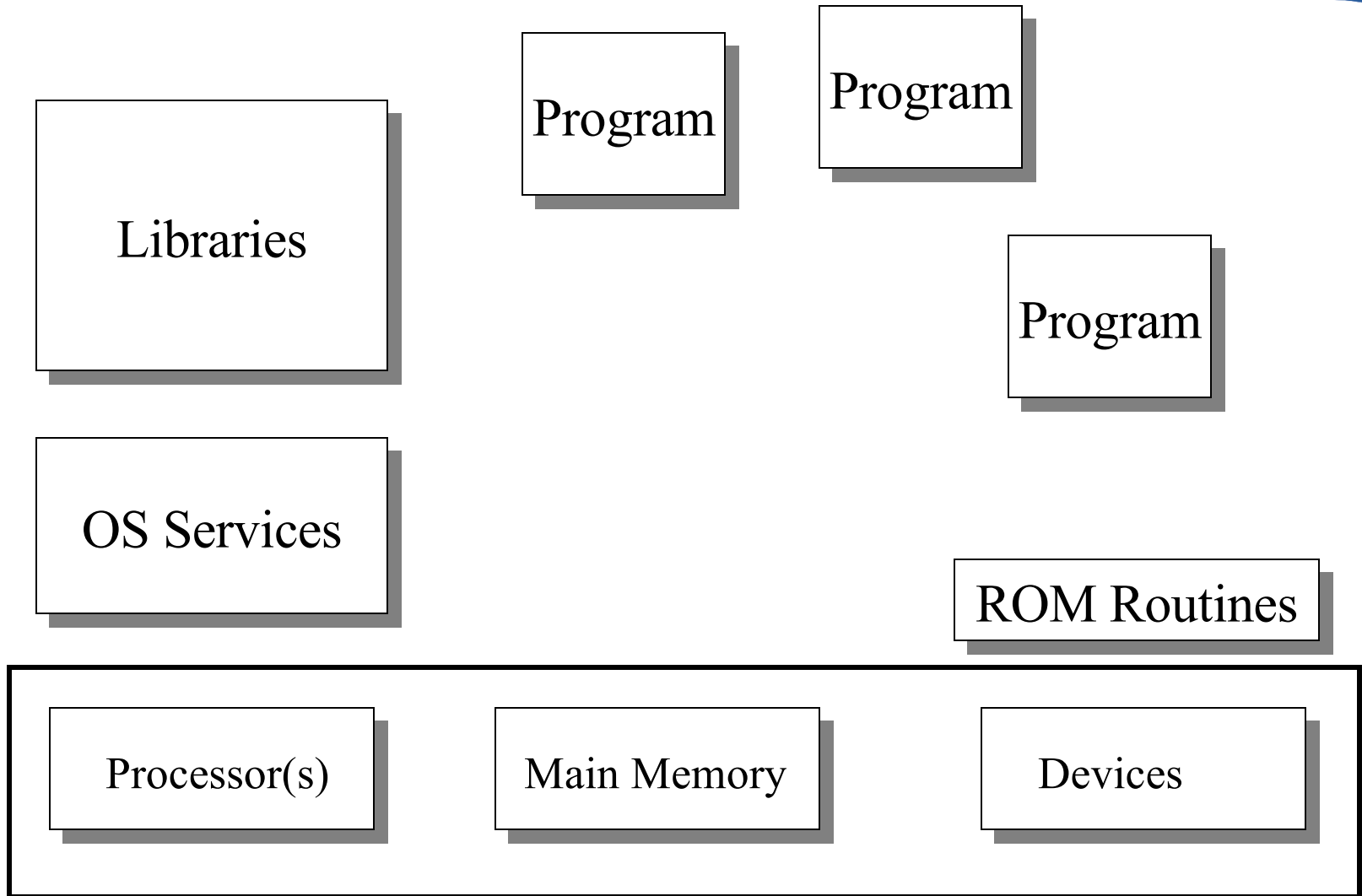
OS Requirements



- Provide resource abstractions
 - Process abstraction of CPU/memory use
 - Address space
 - Thread abstraction of CPU within address space
 - Resource abstraction
 - “Anything a process can request that can block the process if it is unavailable”
 - NT uses “object abstraction” to reference resources
 - File abstraction of secondary storage use



DOS -- Resource Abstraction Only



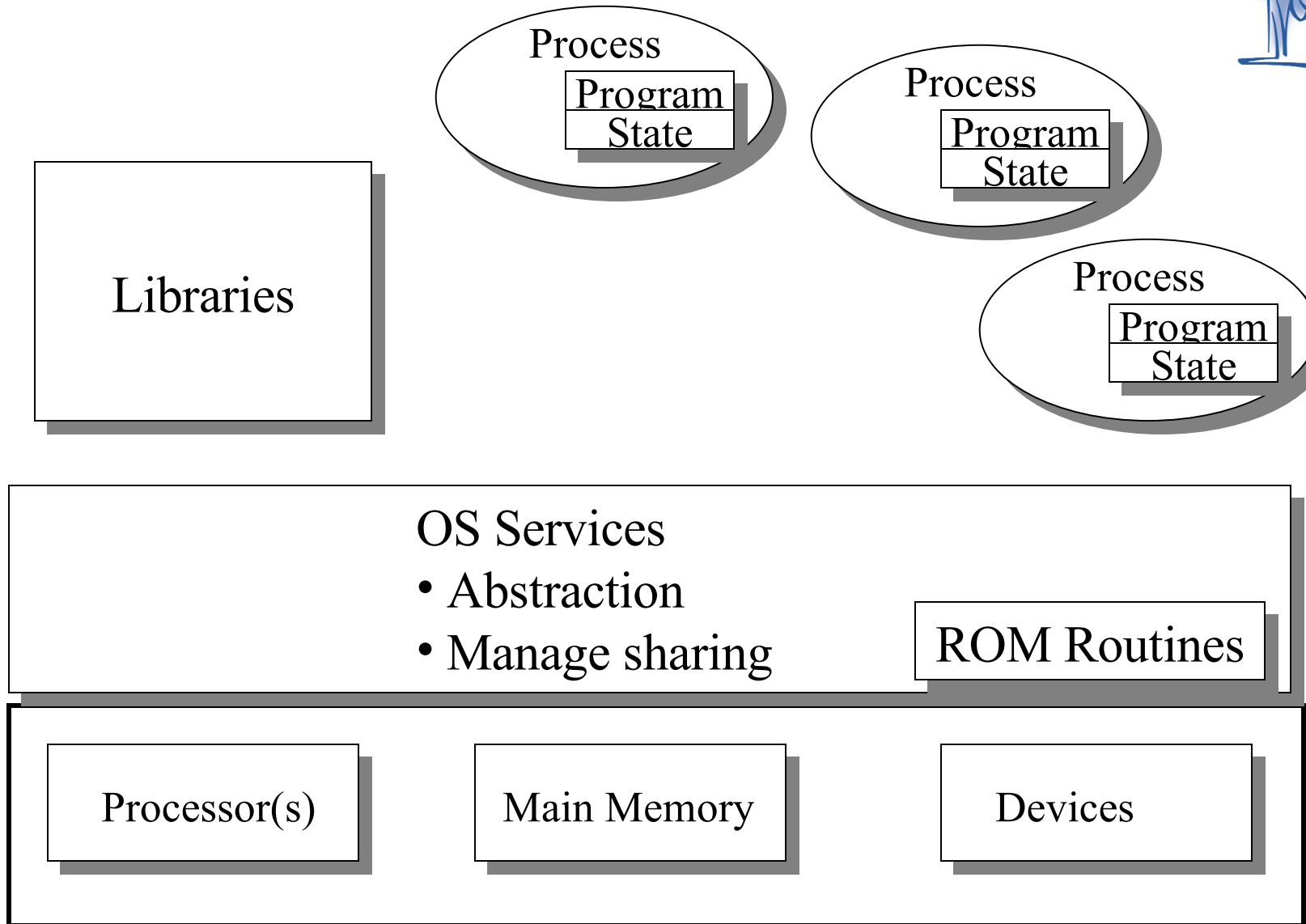


OS Requirements (cont)

- Provide resource abstractions
- Manage resource sharing
 - Time/space-multiplexing
 - Exclusive use of a resource
 - Isolation
 - Managed sharing



Abstraction & Sharing





OS Design Constraints

- Performance
- Protection and security
- Correctness
- Maintainability
- Commercial factors
- Standards and open systems

Performance



- The OS is an overhead function should not use too much of machine's resources
- Minimum functionality is to implement abstractions
- Additional function must be traded off against performance
 - DOS: one process
 - UNIX: low level file system

Protection & Security



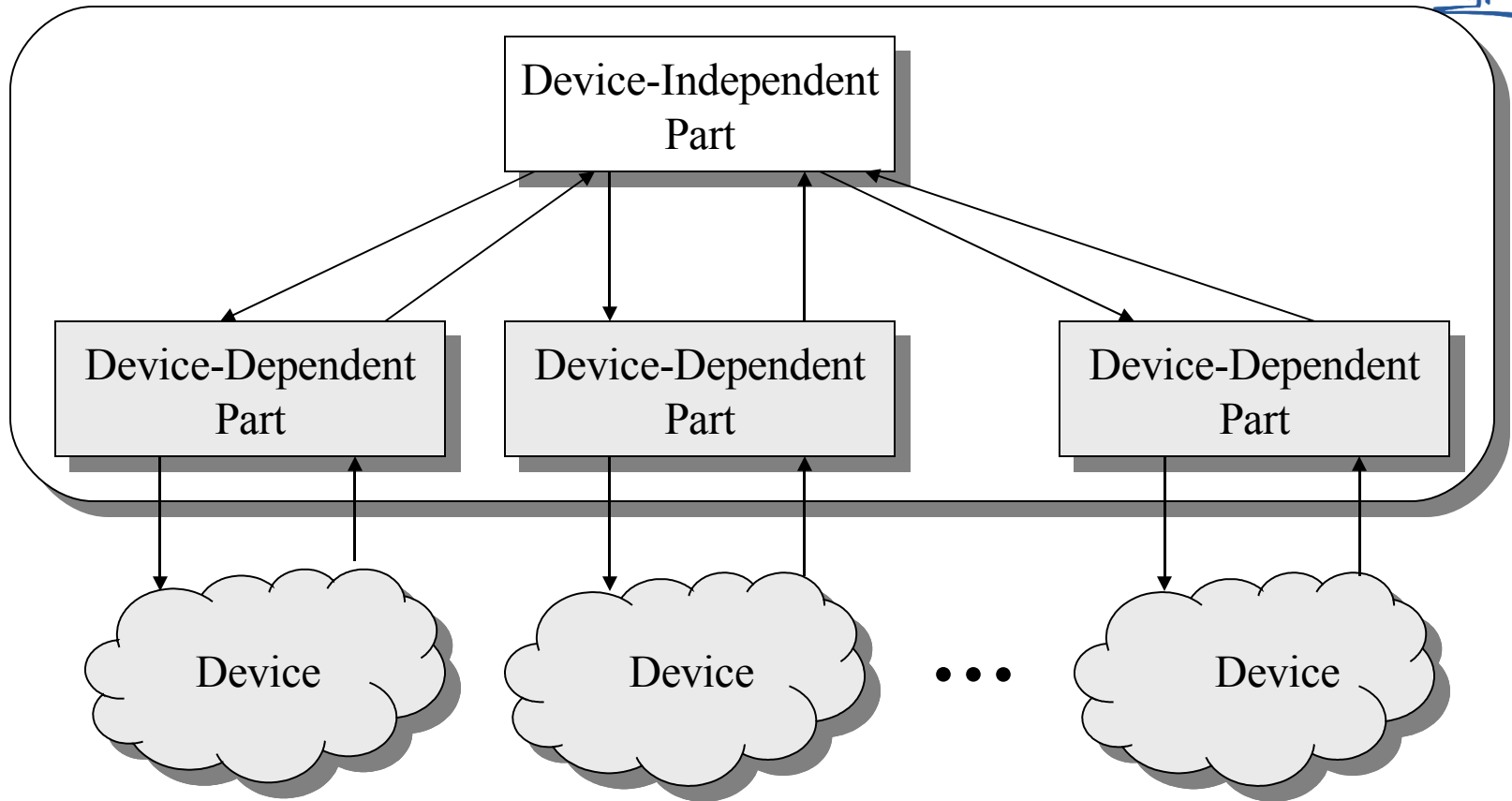
- Multiprogramming resource sharing
- Therefore, need software-controlled resource isolation
- Security policy: Sharing strategy chosen by computer's owner
- Protection mechanism: Tool to implement a family of security policies

Correctness & Maintainability

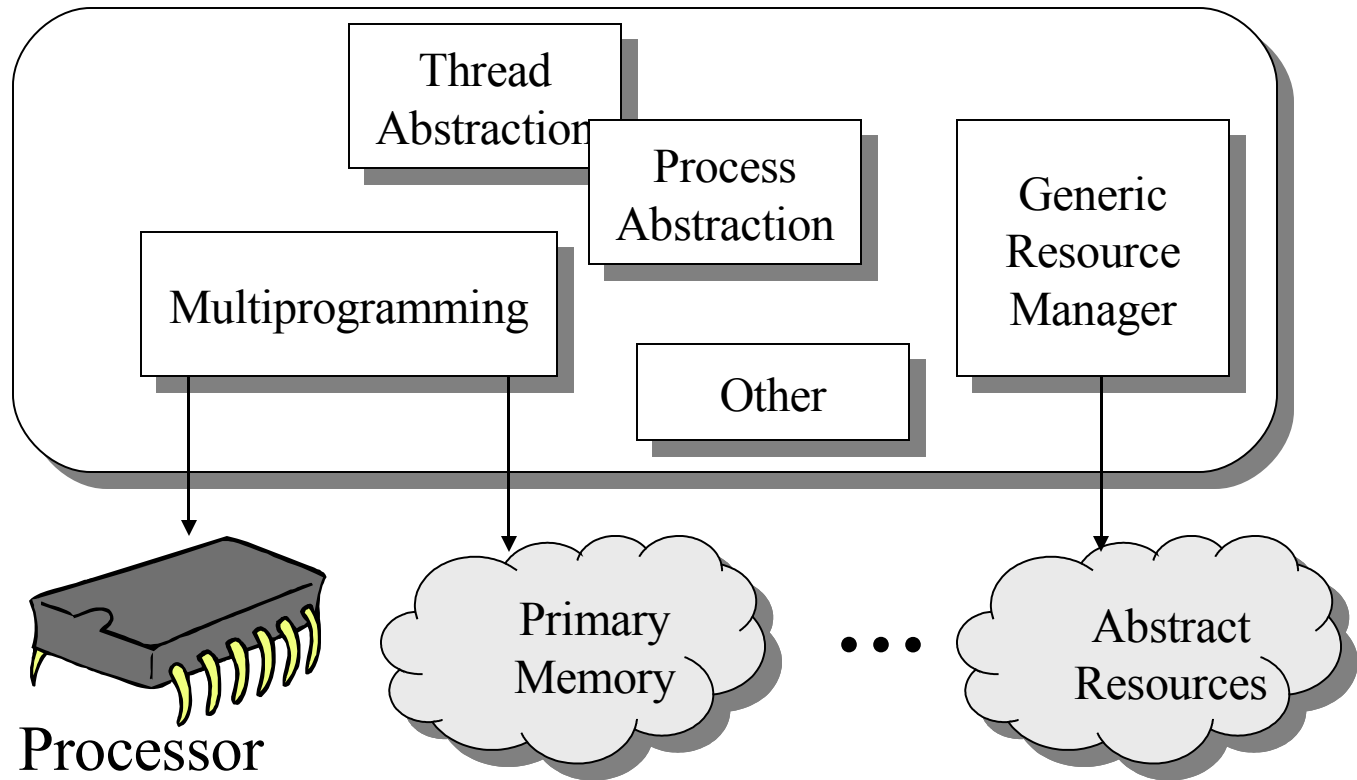


- Security depends on correct operation of software trusted vs untrusted software
- Maintainability relates to ability of software to be changed
- If either is sufficiently important, can limit the function of the OS
 - Guiding a manned spaceship
 - Managing a nuclear reactor

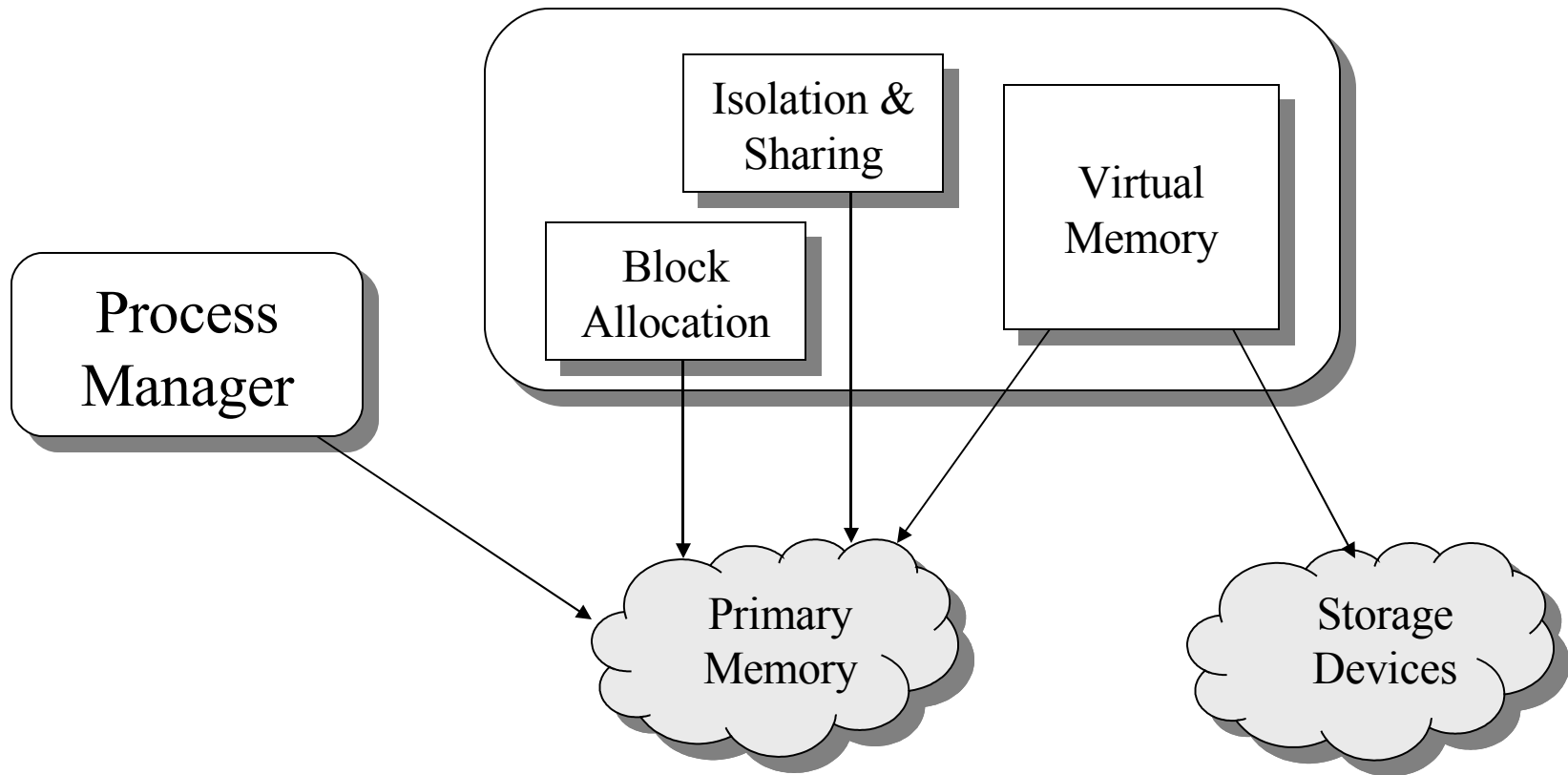
Device Management



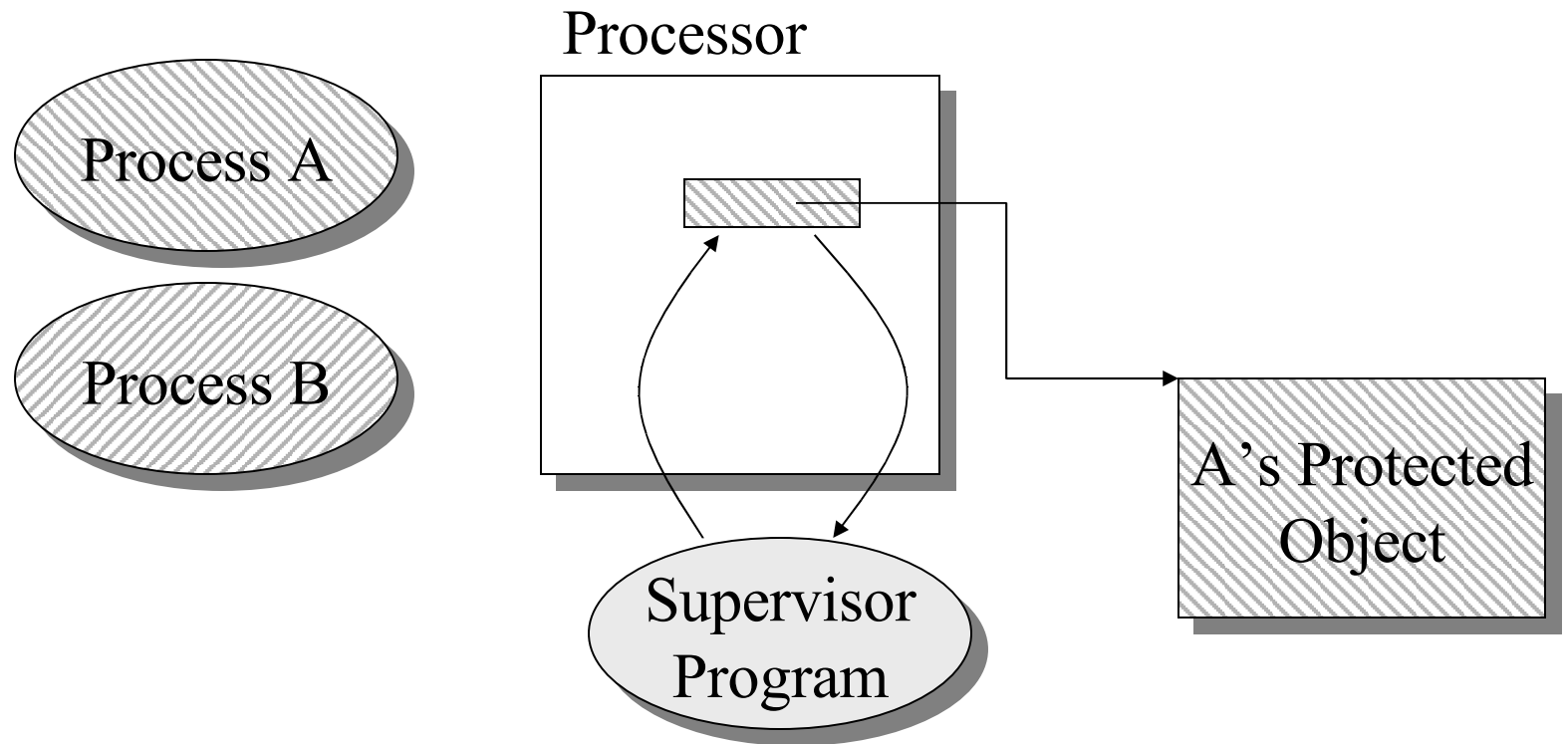
Process, Thread, and Resource Management



Memory Management



Exclusive Access to a Resource



Processor Modes



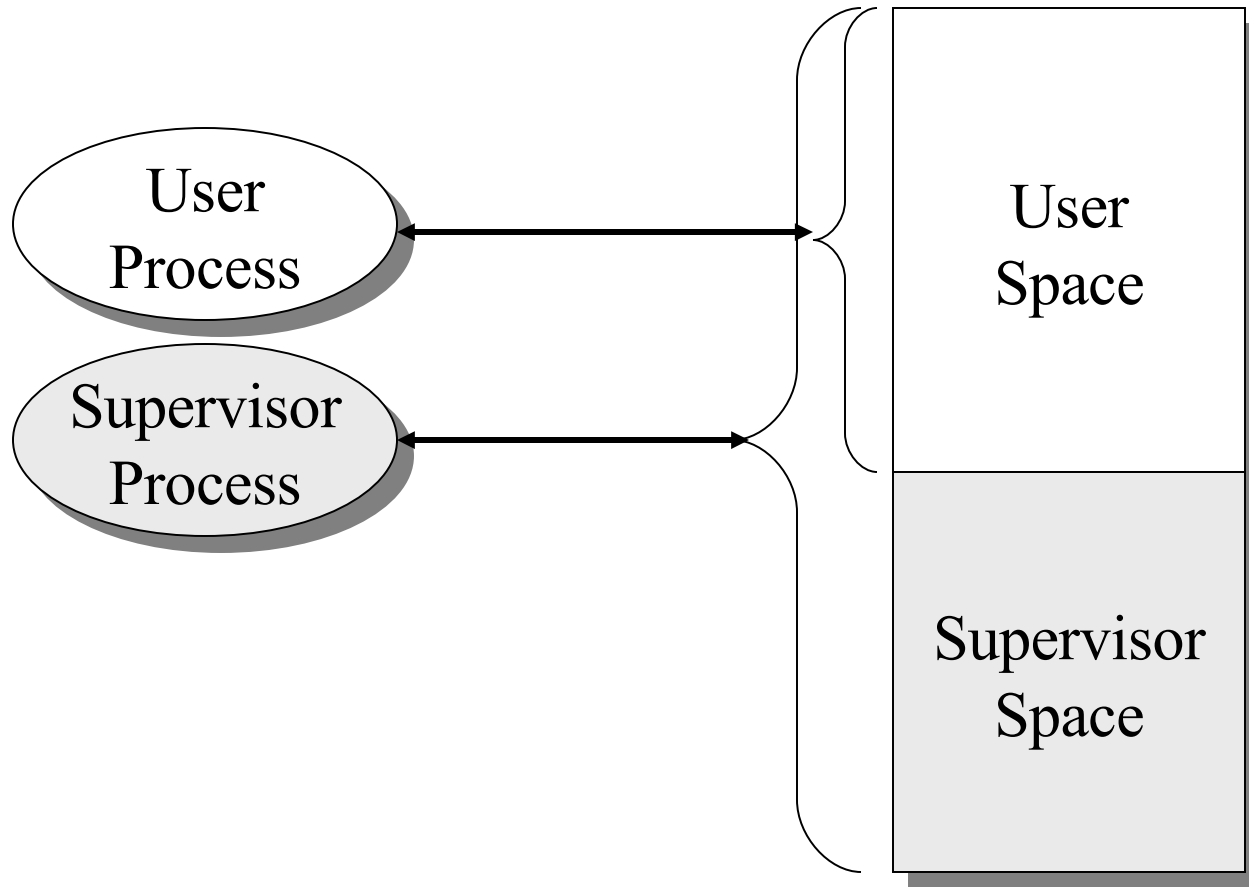
- Mode bit: Supervisor or User mode
- Supervisor mode
 - Can execute all machine instructions
 - Can reference all memory locations
- User mode
 - Can only execute a subset of instructions
 - Can only reference a subset of memory locations

Kernels

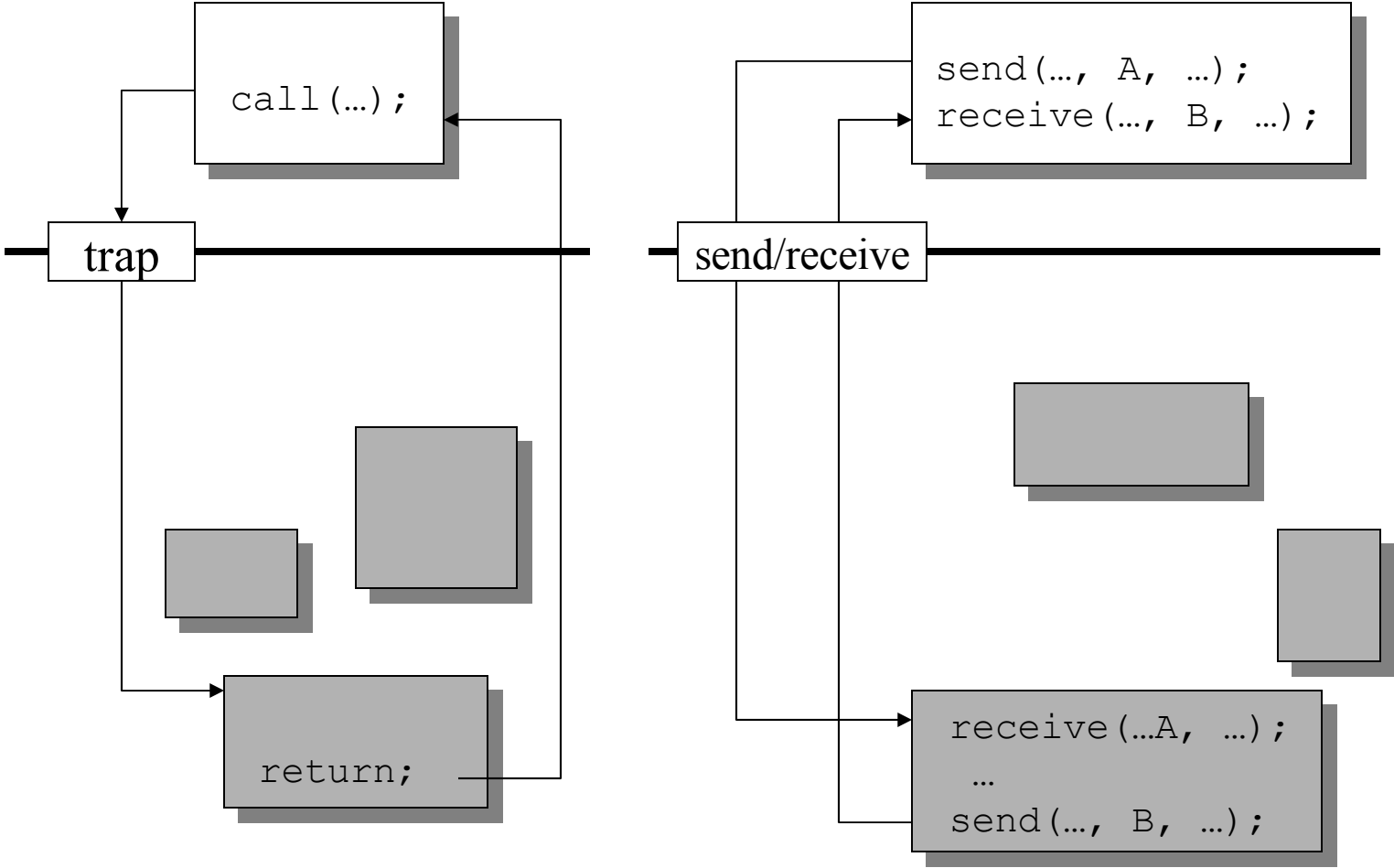


- The part of the OS critical to correct operation (trusted software)
- Executes in supervisor mode
- The `trap` instruction is used to switch from user to supervisor mode, entering the OS

Supervisor and User Memory

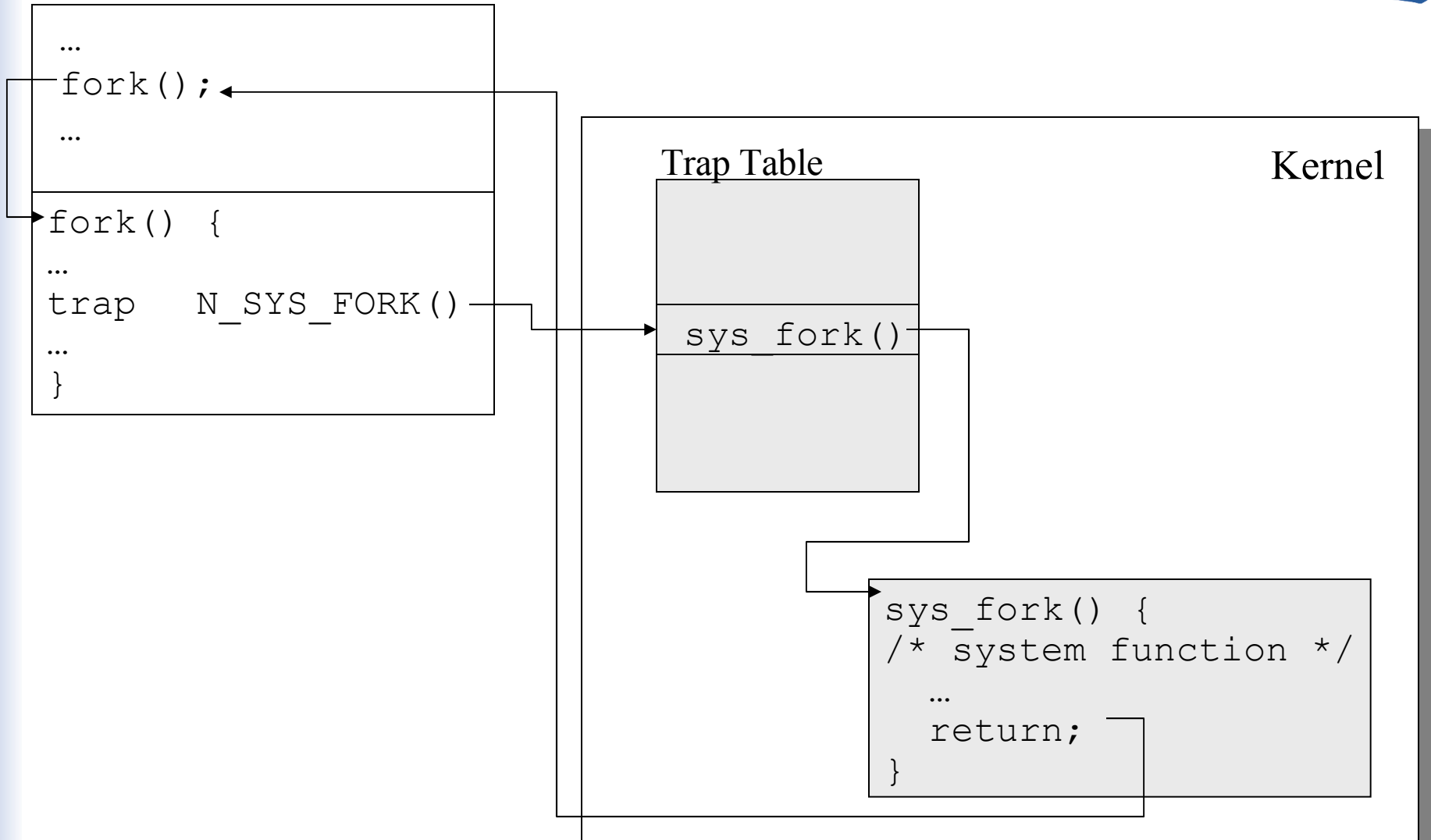


Procedure Call and Message Passing Operating Systems

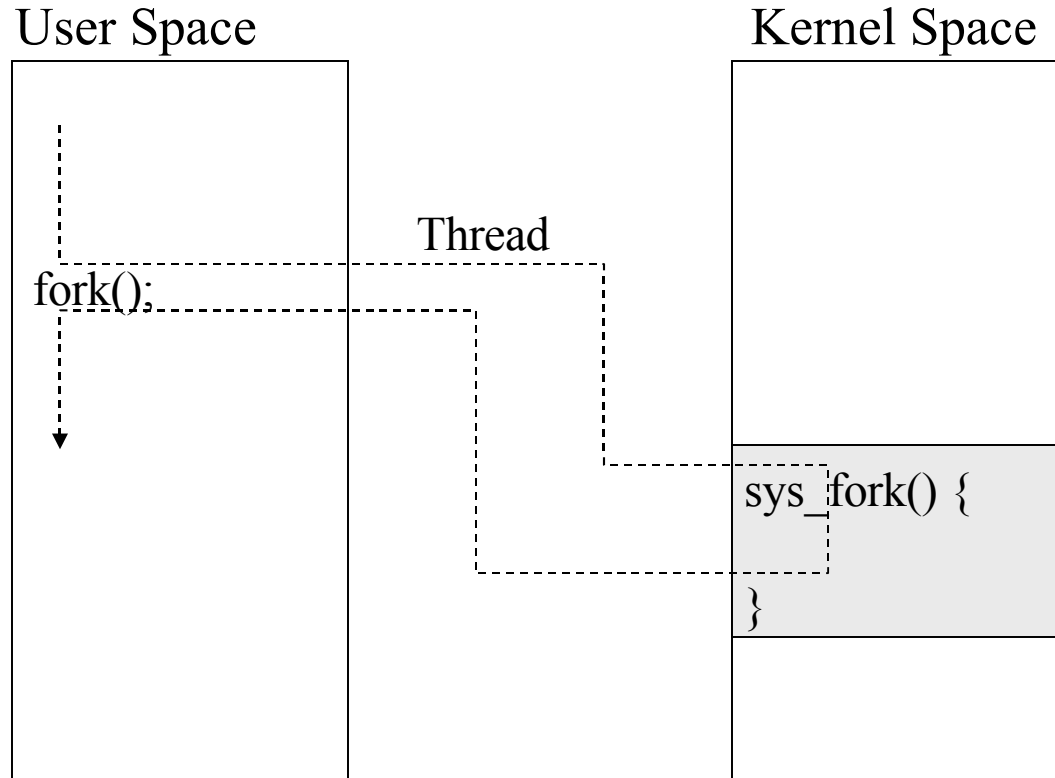




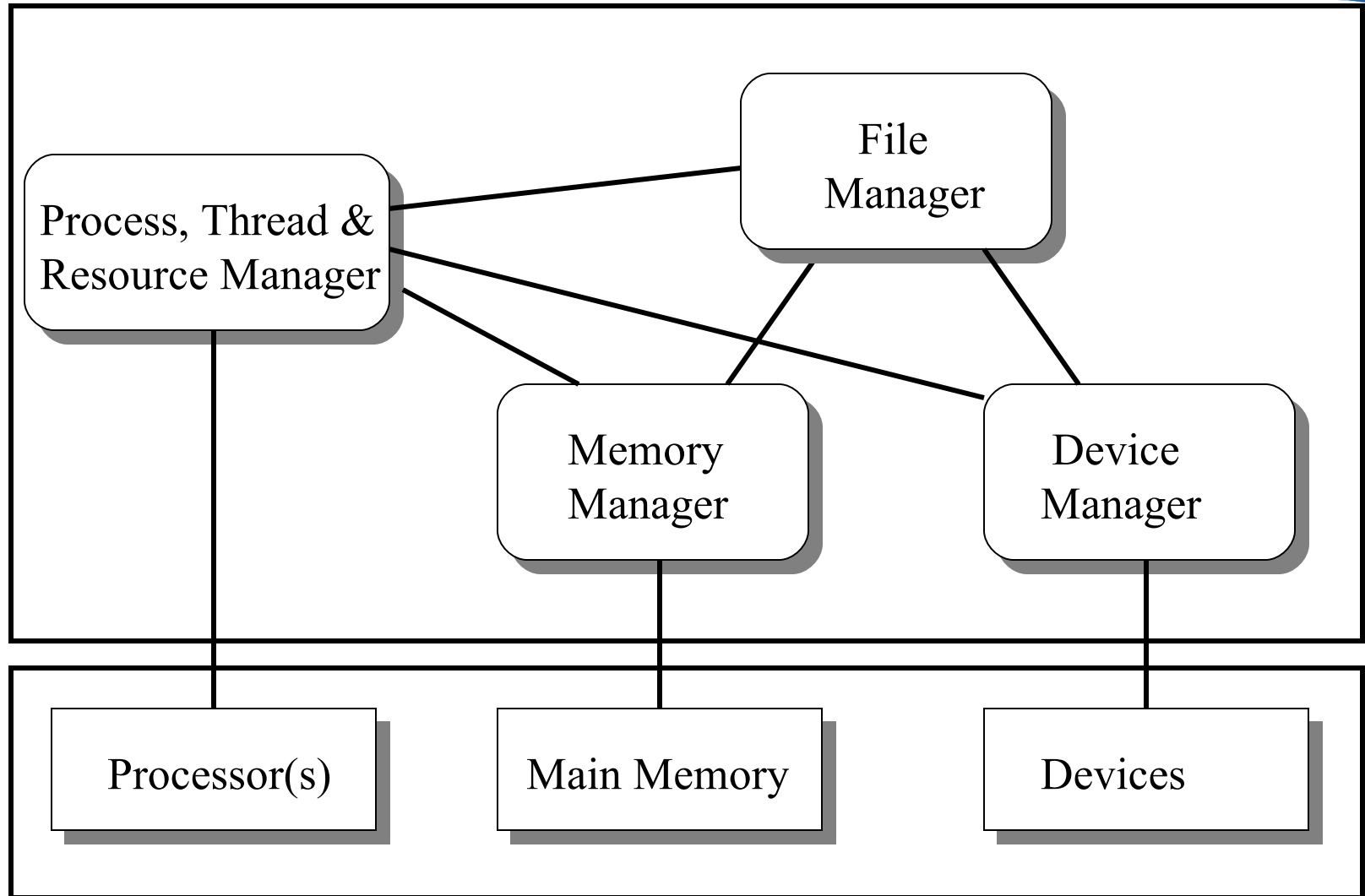
System Call Using the trap Instruction



A Thread Performing a System Call



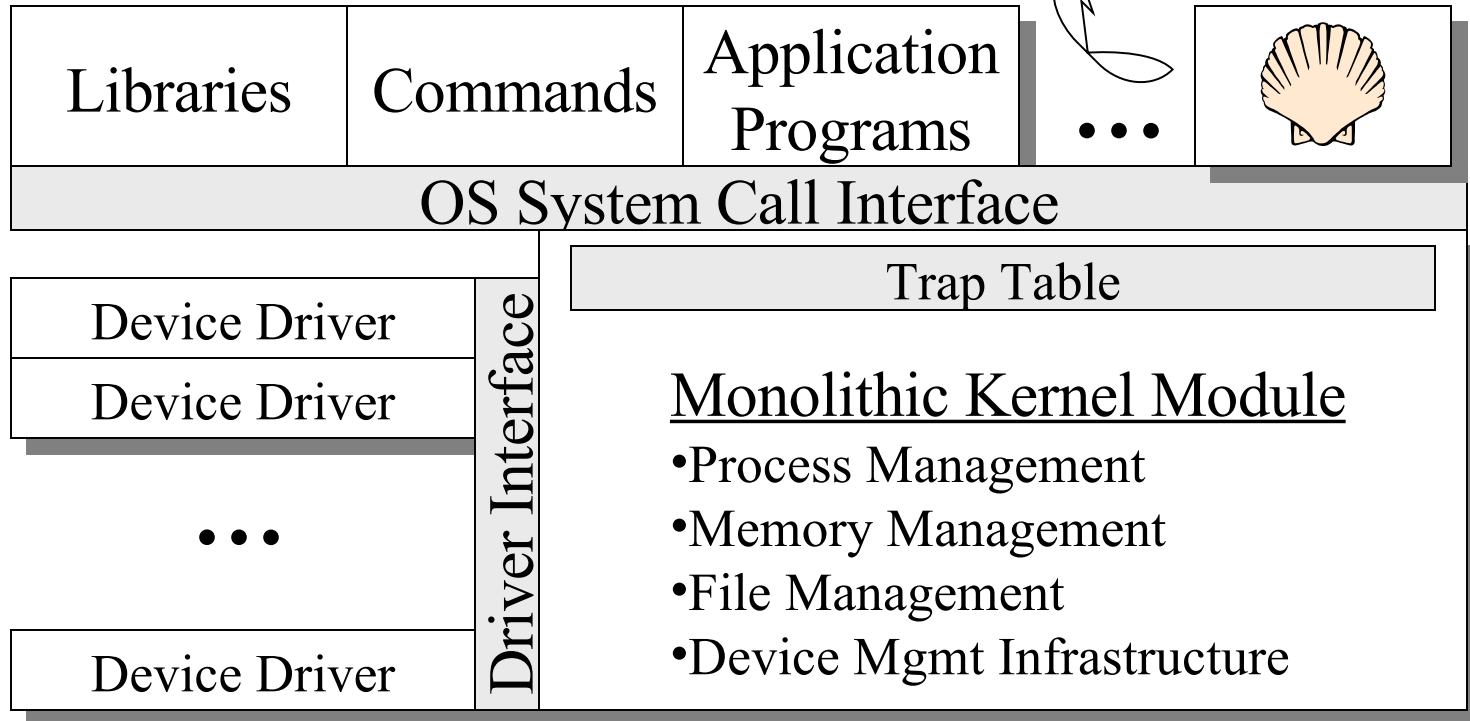
Basic Operating System Organization





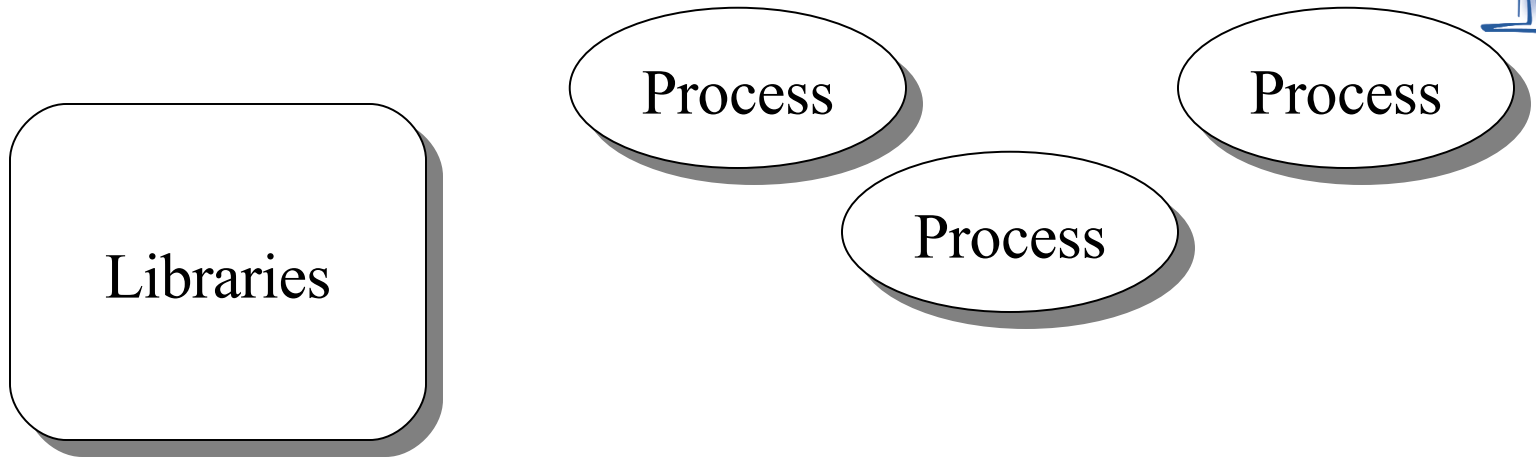
The UNIX Architecture

Interactive User



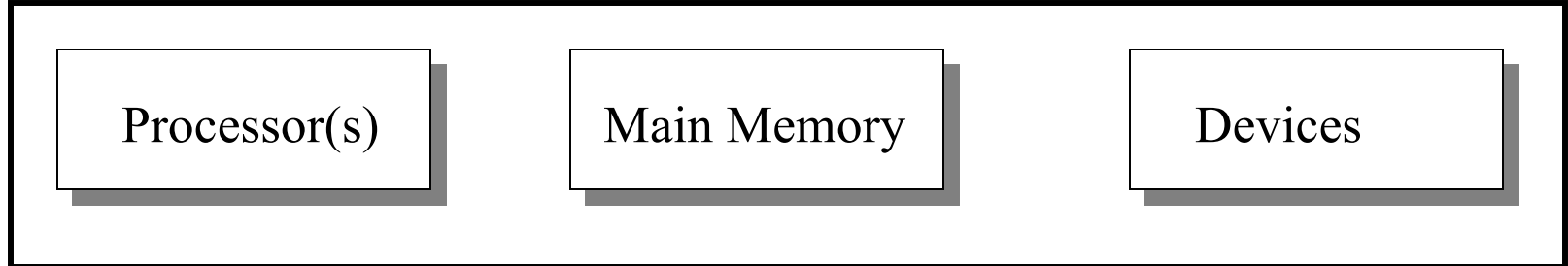
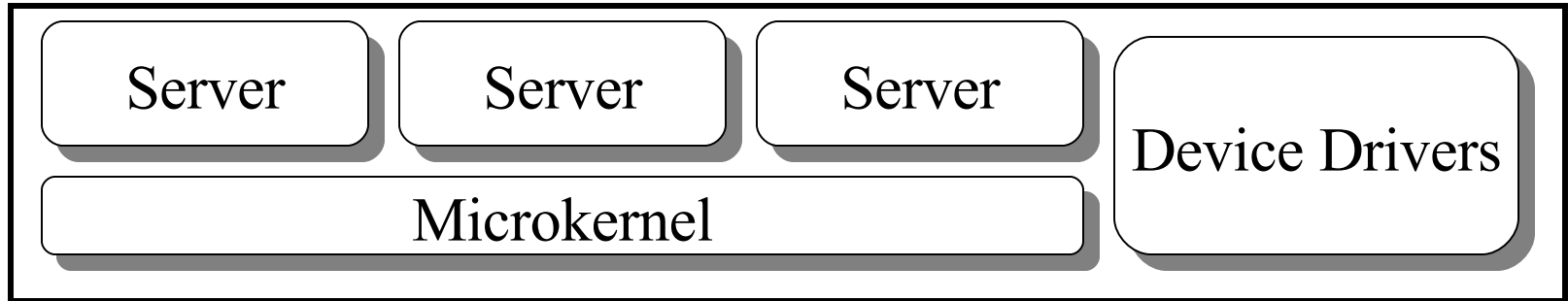


Microkernel Organization

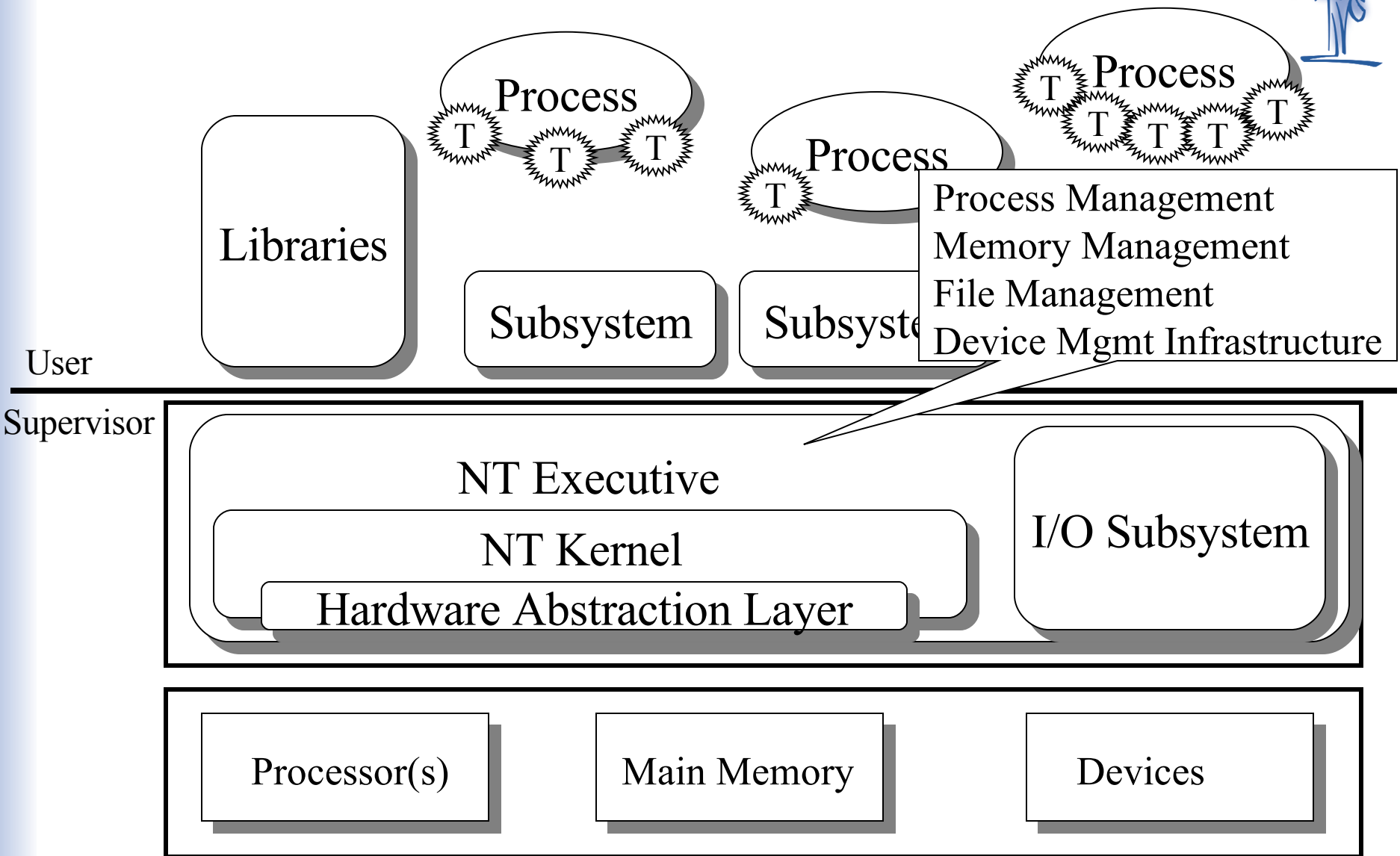


User

Supervisor



Windows NT Organization



Monitoring the Kernel

