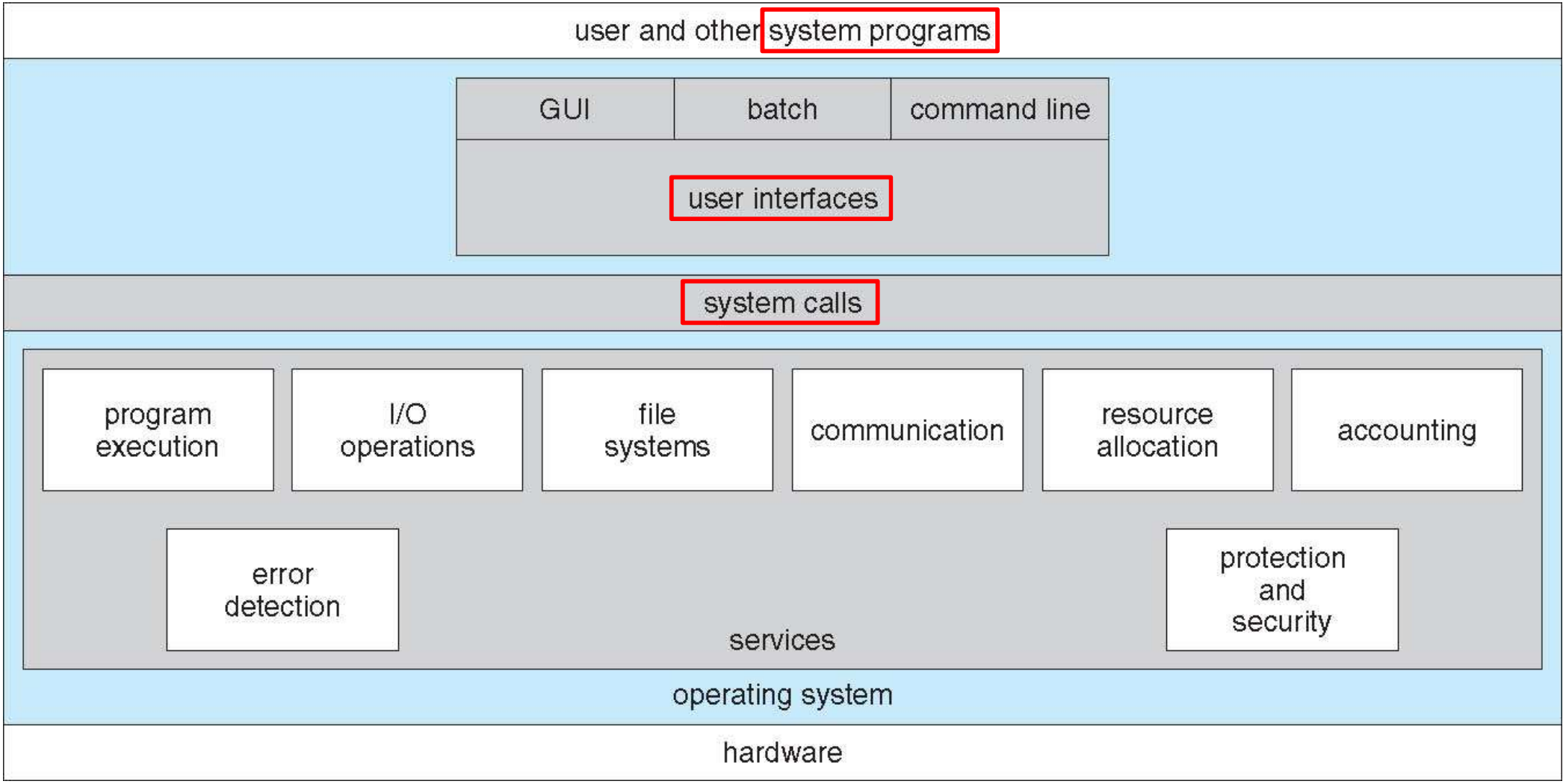
Chap. 2) Operating System Structures

경희대학교 컴퓨터공학과

조 진 성

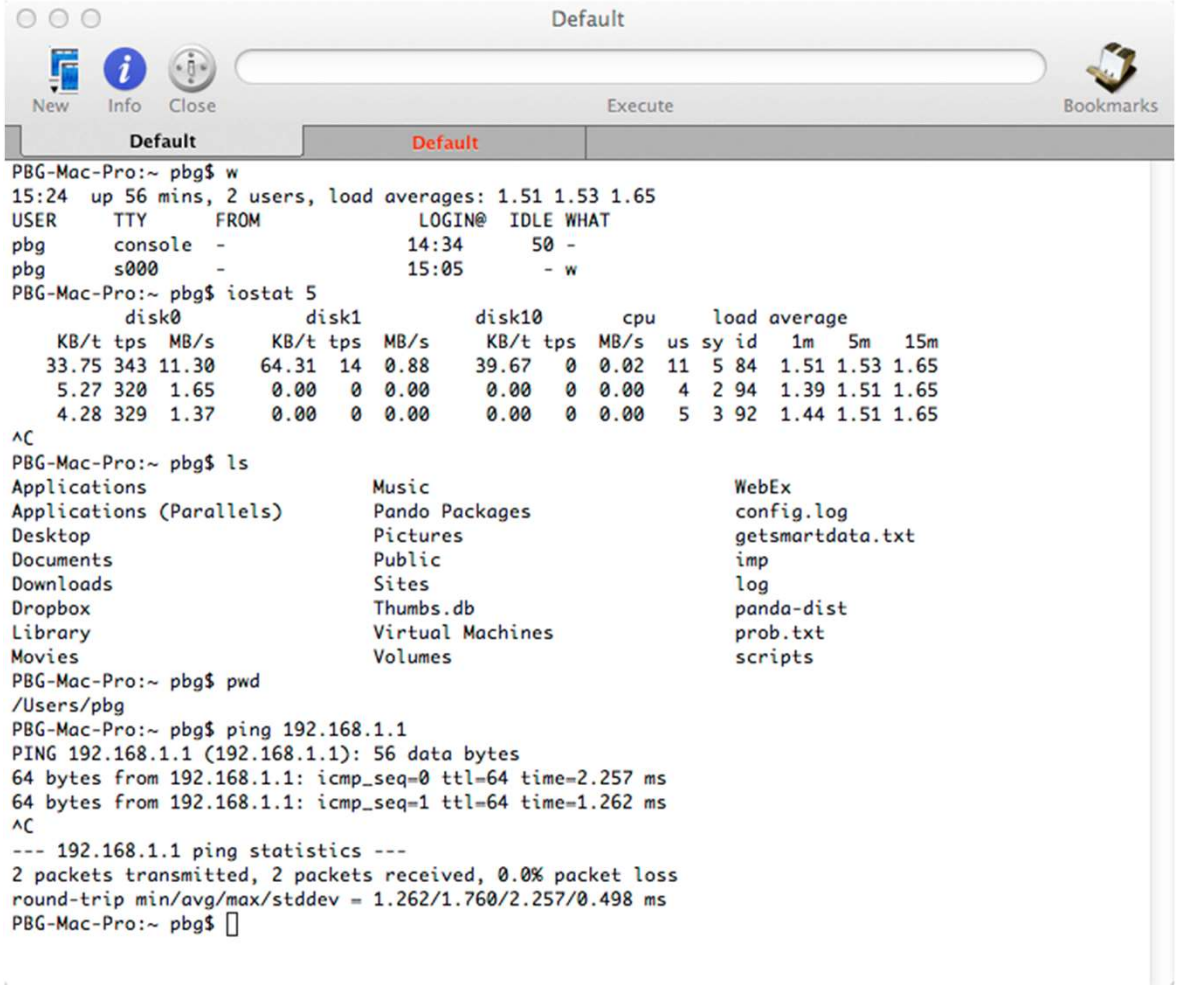
Operating System Services



Operating System Services

User interface service

- ✓ Command-Line Interpreter (CLI)
- ✓ Bourne shell, bash, etc.



Operating System Services

User interface service

- ✓ Graphical User Interface (GUI)
  - E.g.) Mac OS X
- ✓ Touch screen interface
  - E.g.) iPhone

Operating System Services

System programs

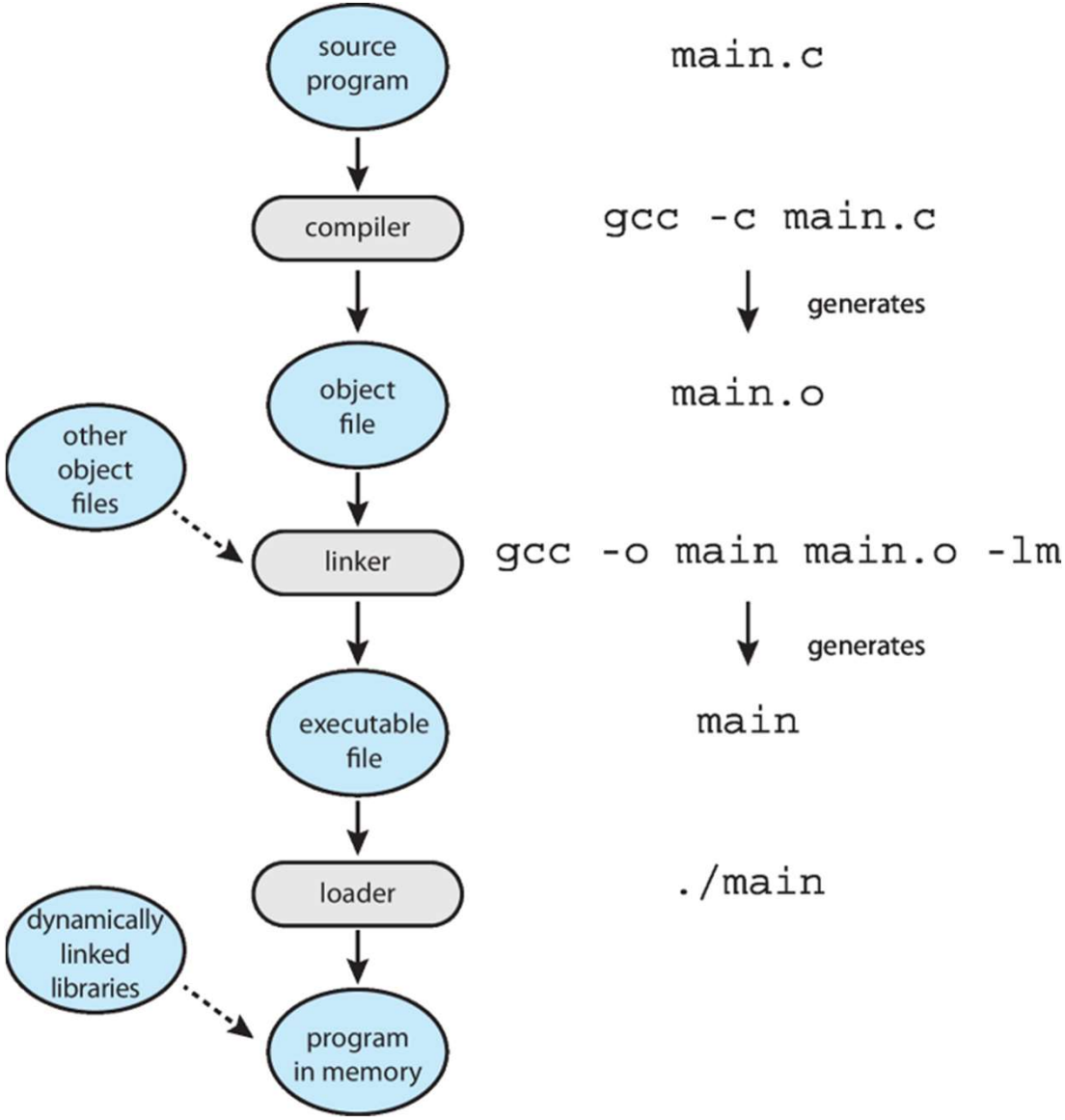
- ✓ Provide a convenient environment for program development and execution

- ✓ File manipulation
- ✓ Status information sometimes stored in a file modification
- ✓ Programming language support
- ✓ Program loading and execution
  - Linker and loader
- ✓ Communications
- ✓ Background services
- ✓ Cf) Application programs

Operating System Services

Linkers and loaders

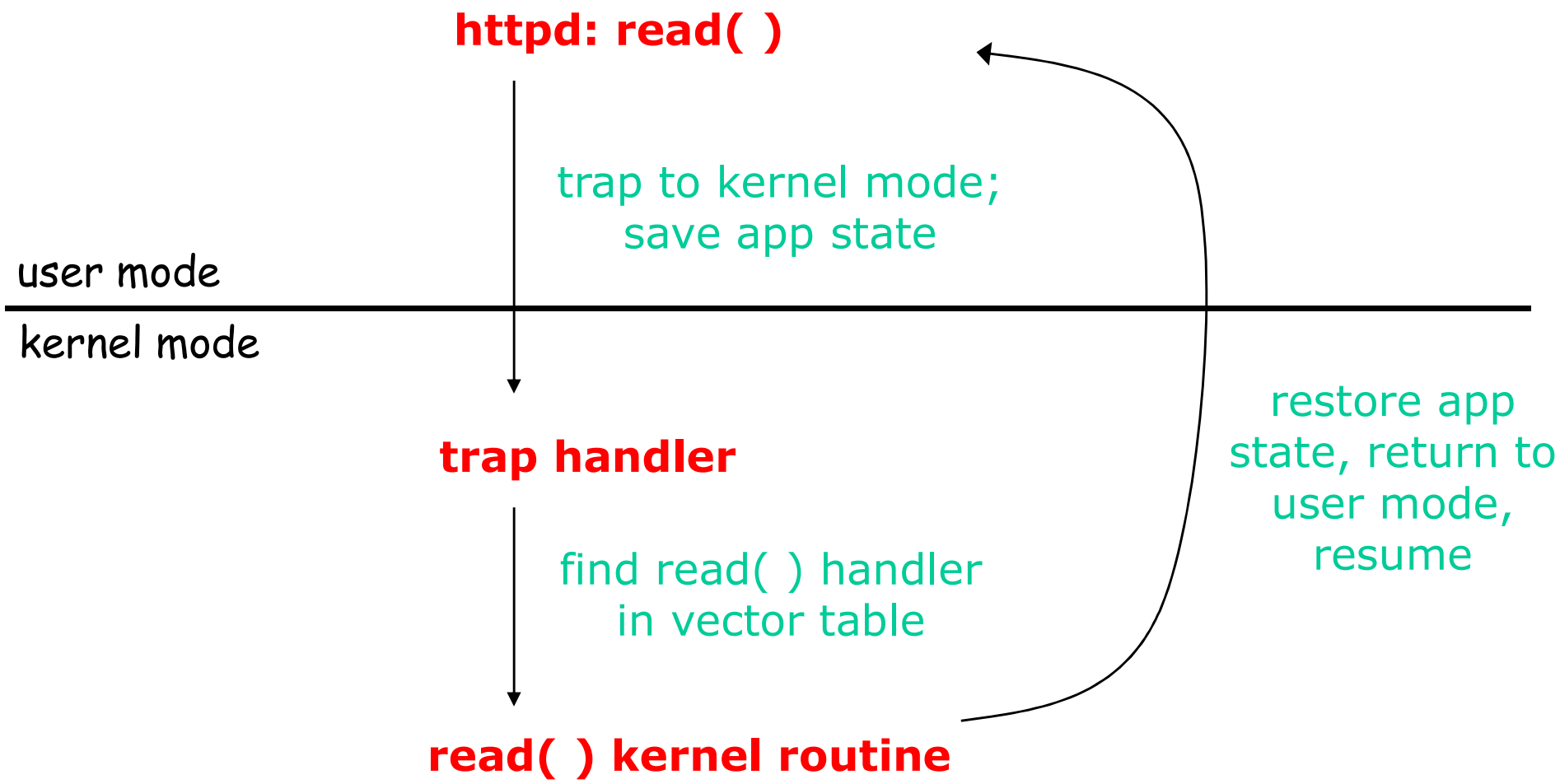
- ✓ Static vs. Dynamic linking
- ✓ .dll (Dynamically Linked Library) in Windows
- ✓ .sa & .so (shared library) in Linux



Operating System Services

System call service

- ✓ Cf) Function call



Operating System Services

System call service

- ✓ Example of standard API

EXAMPLE OF STANDARD API

As an example of a standard API, consider the `read()` function that is available in UNIX and Linux systems. The API for this function is obtained from the `man` page by invoking the command

```
man read
```

on the command line. A description of this API appears below:

```
#include <unistd.h>

ssize_t    read(int fd, void *buf, size_t count)
```

return value — function name — parameters

A program that uses the `read()` function must include the `unistd.h` header file, as this file defines the `ssize_t` and `size_t` data types (among other things). The parameters passed to `read()` are as follows:

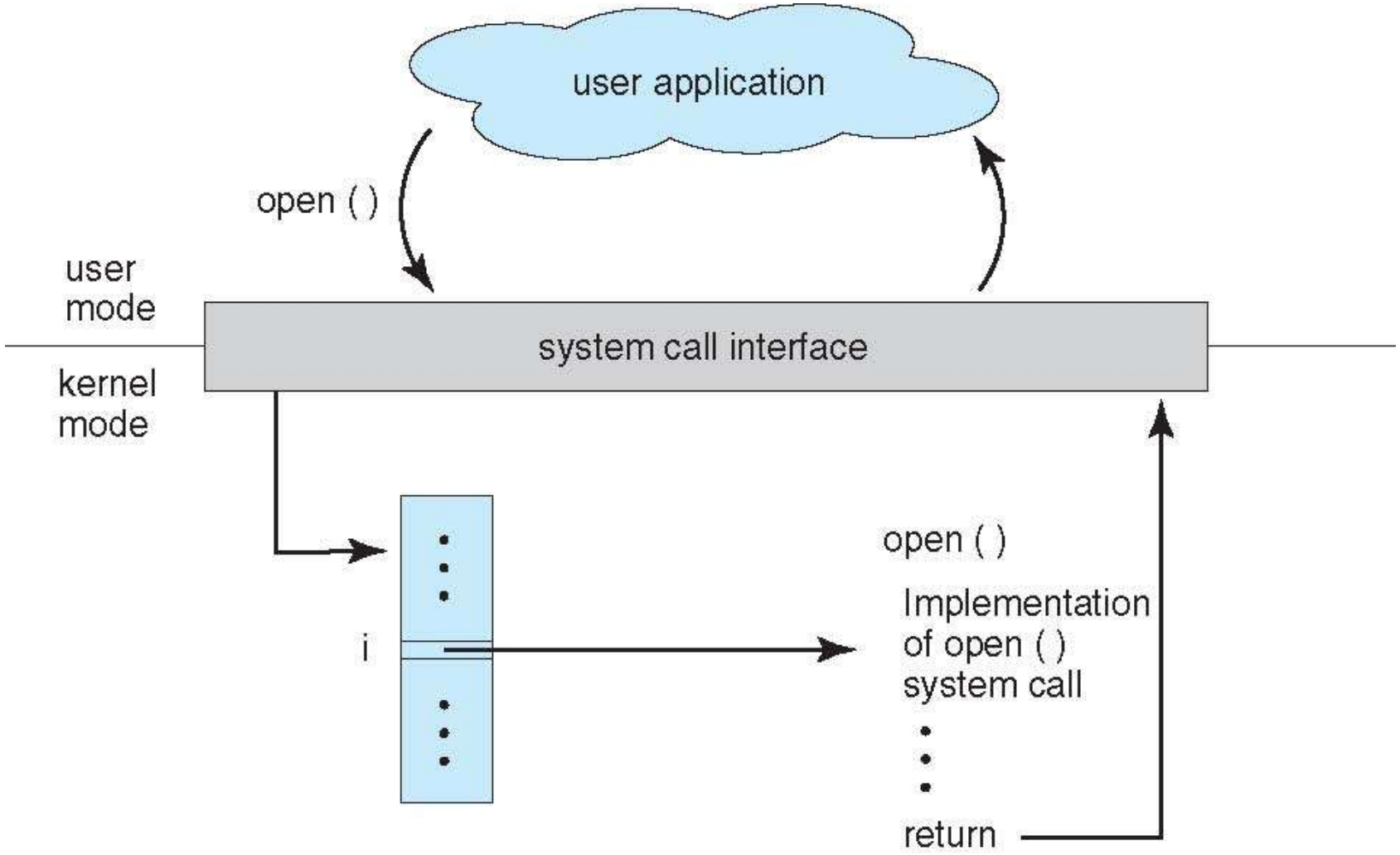
- `int fd`—the file descriptor to be read
- `void *buf`—a buffer where the data will be read into
- `size_t count`—the maximum number of bytes to be read into the buffer

On a successful read, the number of bytes read is returned. A return value of 0 indicates end of file. If an error occurs, `read()` returns −1.

Operating System Services

System call service

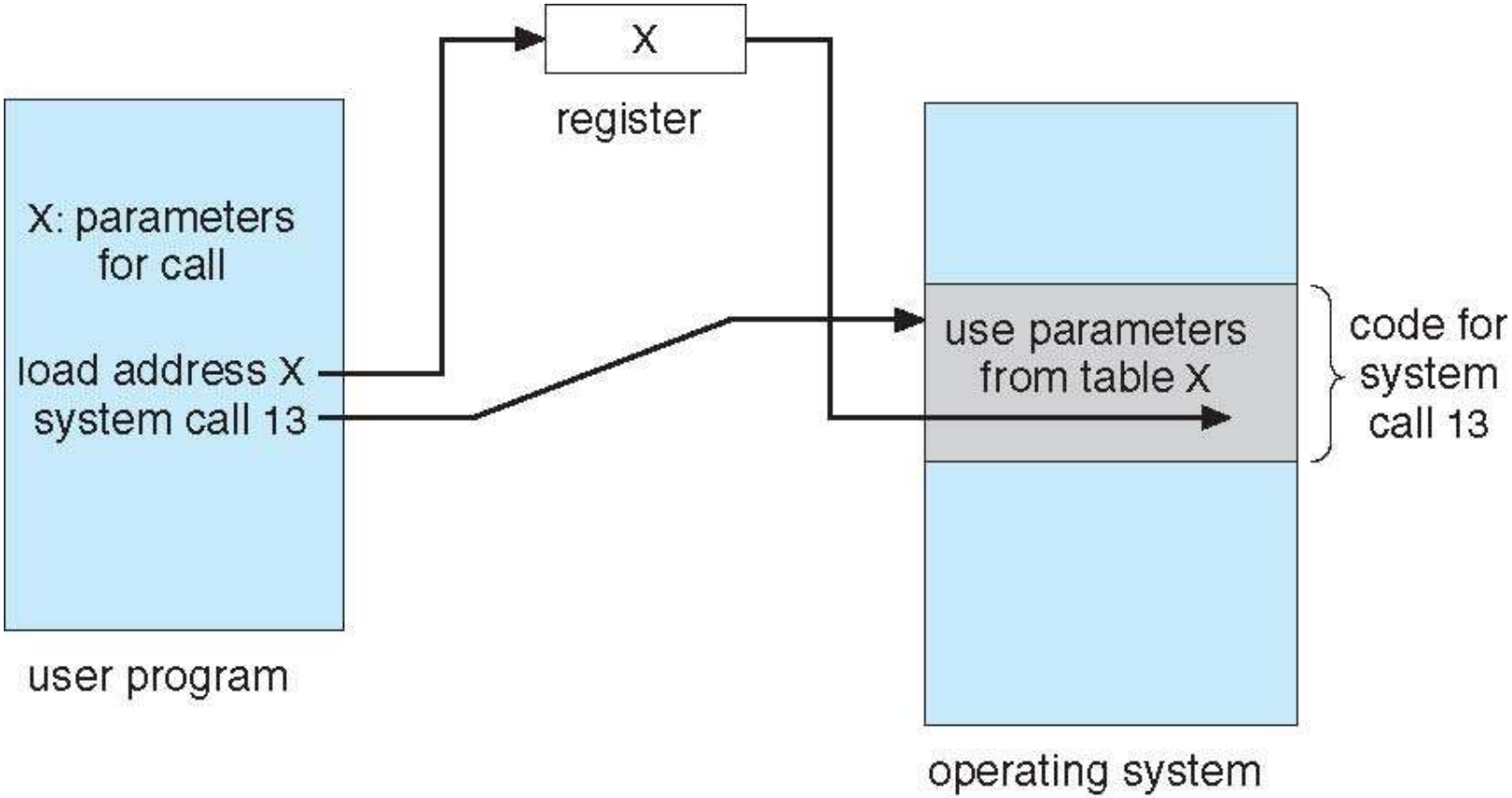
- ✓ Handling in OS



Operating System Services

System call service

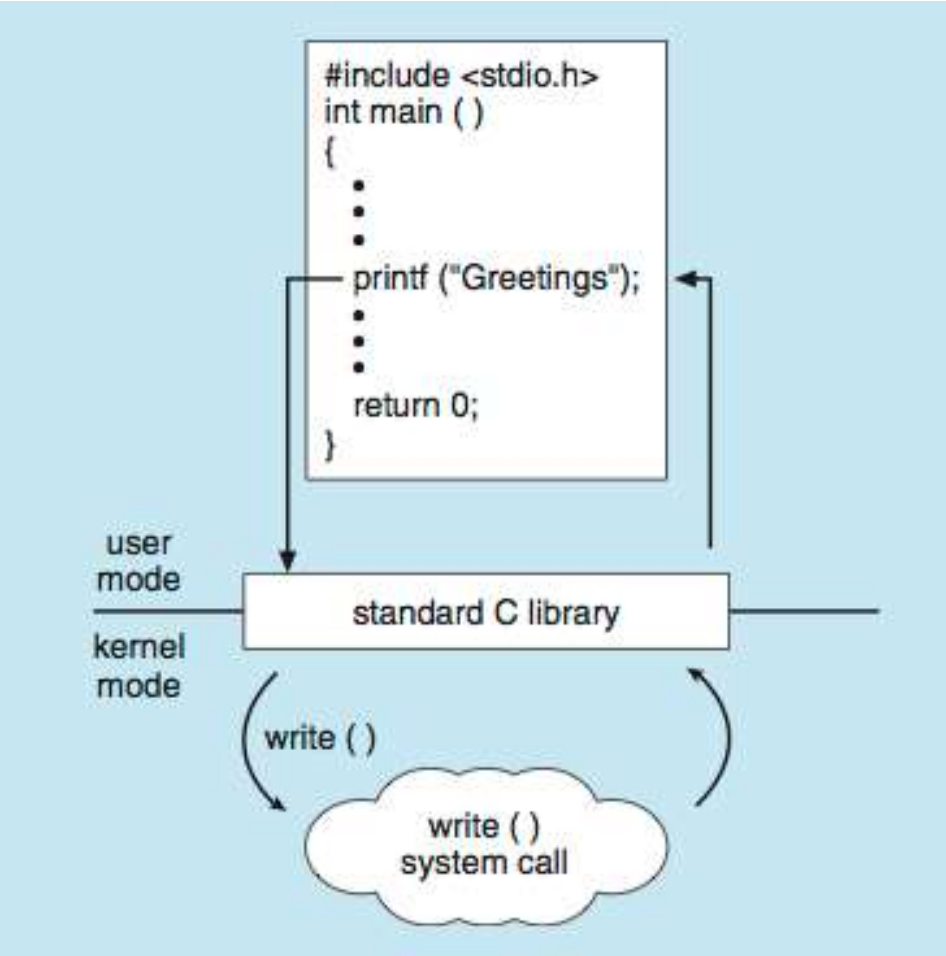
- ✓ Parameter passing



Operating System Services

System call service

- ✓ Standard C library example



Operating System Services

System call service

- ✓ Examples of Windows and Unix system calls

	Windows	Unix
Process Control	CreateProcess()	fork()
	ExitProcess()	exit()
	WaitForSingleObject()	wait()
File Manipulation	CreateFile()	open()
	ReadFile()	read()
	WriteFile()	write()
	CloseHandle()	close()
Device Manipulation	SetConsoleMode()	ioctl()
	ReadConsole()	read()
	WriteConsole()	write()
Information Maintenance	GetCurrentProcessID()	getpid()
	SetTimer()	alarm()
	Sleep()	sleep()
Communication	CreatePipe()	pipe()
	CreateFileMapping()	shmget()
	MapViewOfFile()	mmap()
Protection	SetFileSecurity()	chmod()
	InitlializeSecurityDescriptor()	umask()
	SetSecurityDescriptorGroup()	chown()

Operating System Services

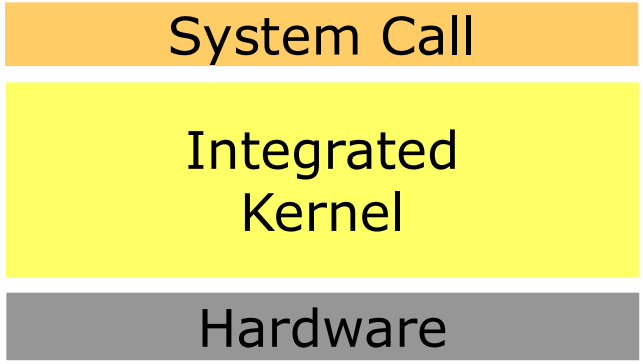
System call service

Process Management	**fork**	**CreateProcess**	Create a new process
	waitpid	**WaitForSingleObject**	Wait for a process to exit
	execve	**(none)**	CreateProcess = fork + execve
	exit	**ExitProcess**	Terminate execution
	kill	**(none)**	Send a signal
File Management	**open**	**CreateFile**	Create a file or open an existing file
	close	**CloseHandle**	Close a file
	read	**ReadFile**	Read data from a file
	write	**WriteFile**	Write data to a file
	lseek	**SetFilePointer**	Move the file pointer
	stat	**GetFileAttributesEx**	Get various file attributes
	chmod	**(none)**	Change the file access permission
File System Management	**mkdir**	**CreateDirectory**	Create a new directory
	rmdir	**RemoveDirectory**	Remove an empty directory
	link	**(none)**	Make a link to a file
	unlink	**DeleteFile**	Destroy an existing file
	mount	**(none)**	Mount a file system
	umount	**(none)**	Unmount a file system
	chdir	**SetCurrentDirectory**	Change the curent working directory

Operating System Structure

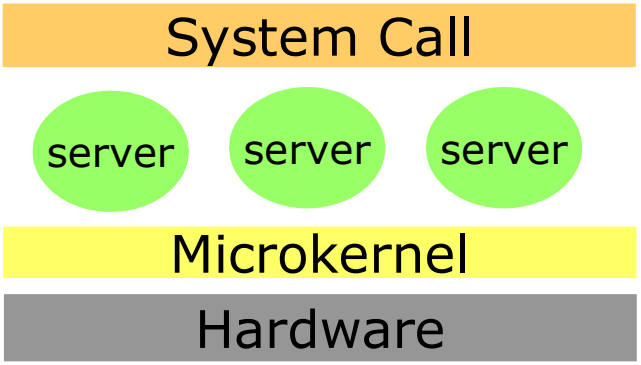
Monolithic kernel

- ✓ Function calls
- ✓ Unixware, Solaris, AIX, HP-UX, Linux, etc.



Micro(μ) kernel

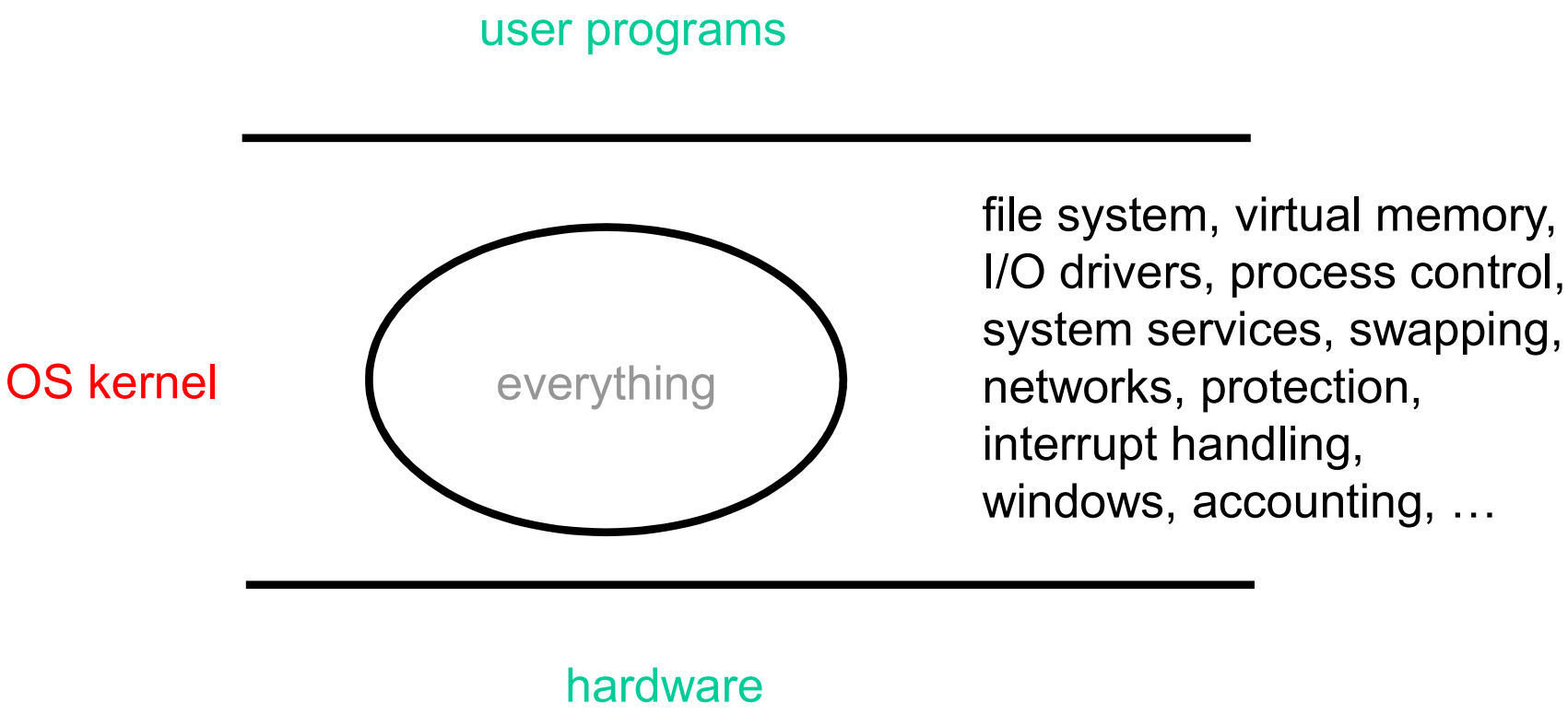
- ✓ Multiple servers
- ✓ Message passing
- ✓ Mach, Chorus, Linux mk, etc.



Operating System Structure

Monolithic structure

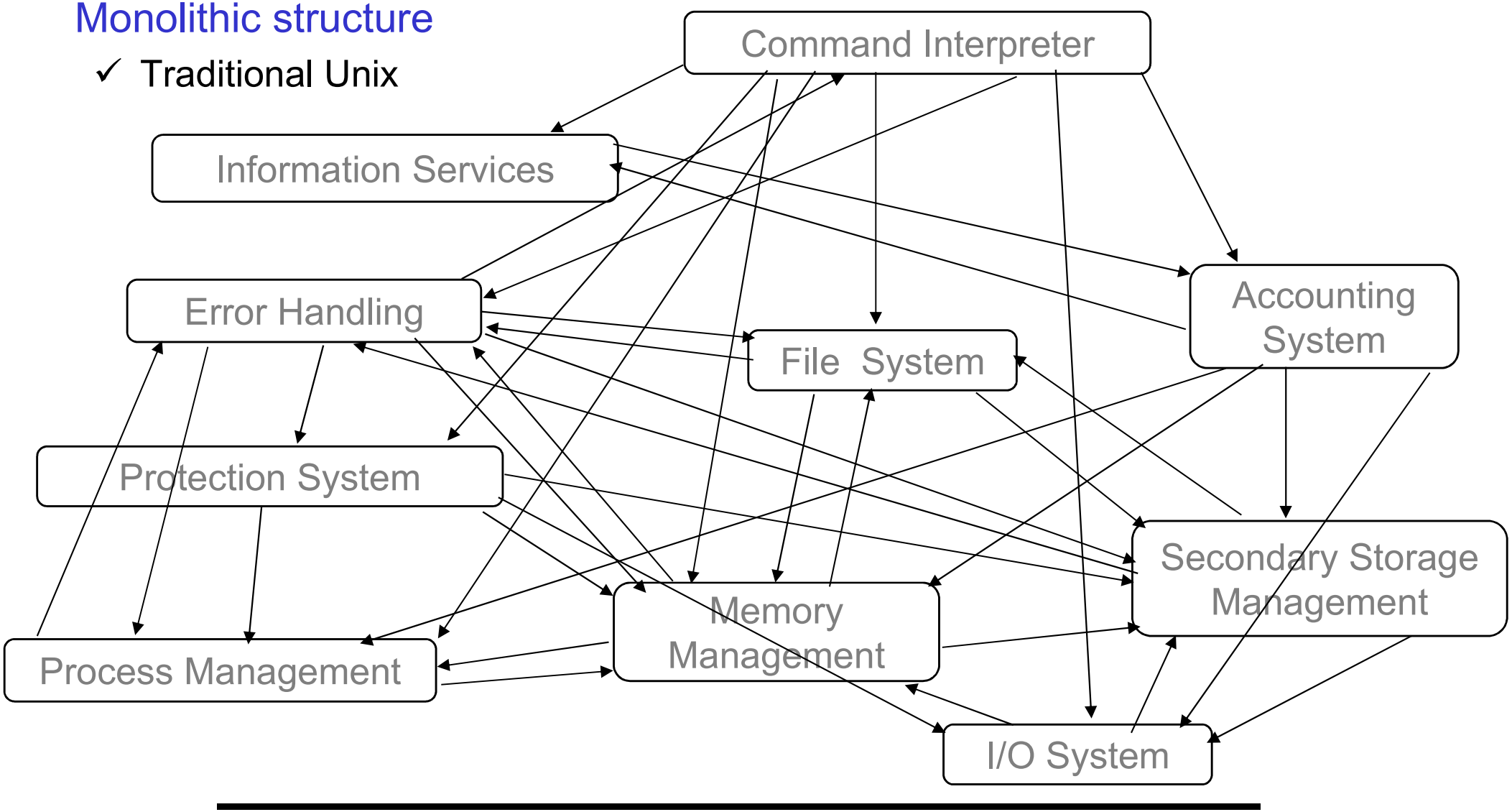
- ✓ Traditional Unix



Operating System Structure

Monolithic structure

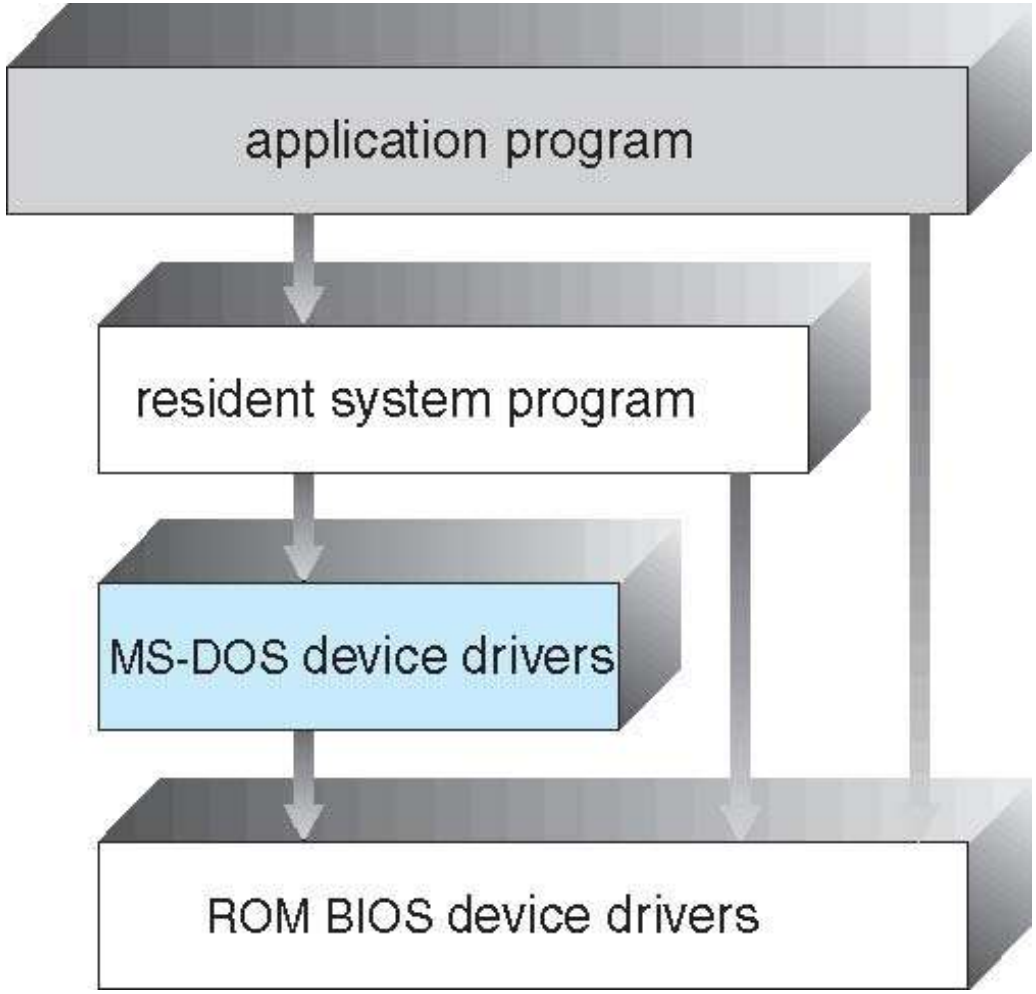
- ✓ Traditional Unix



Operating System Structure

Simple structure

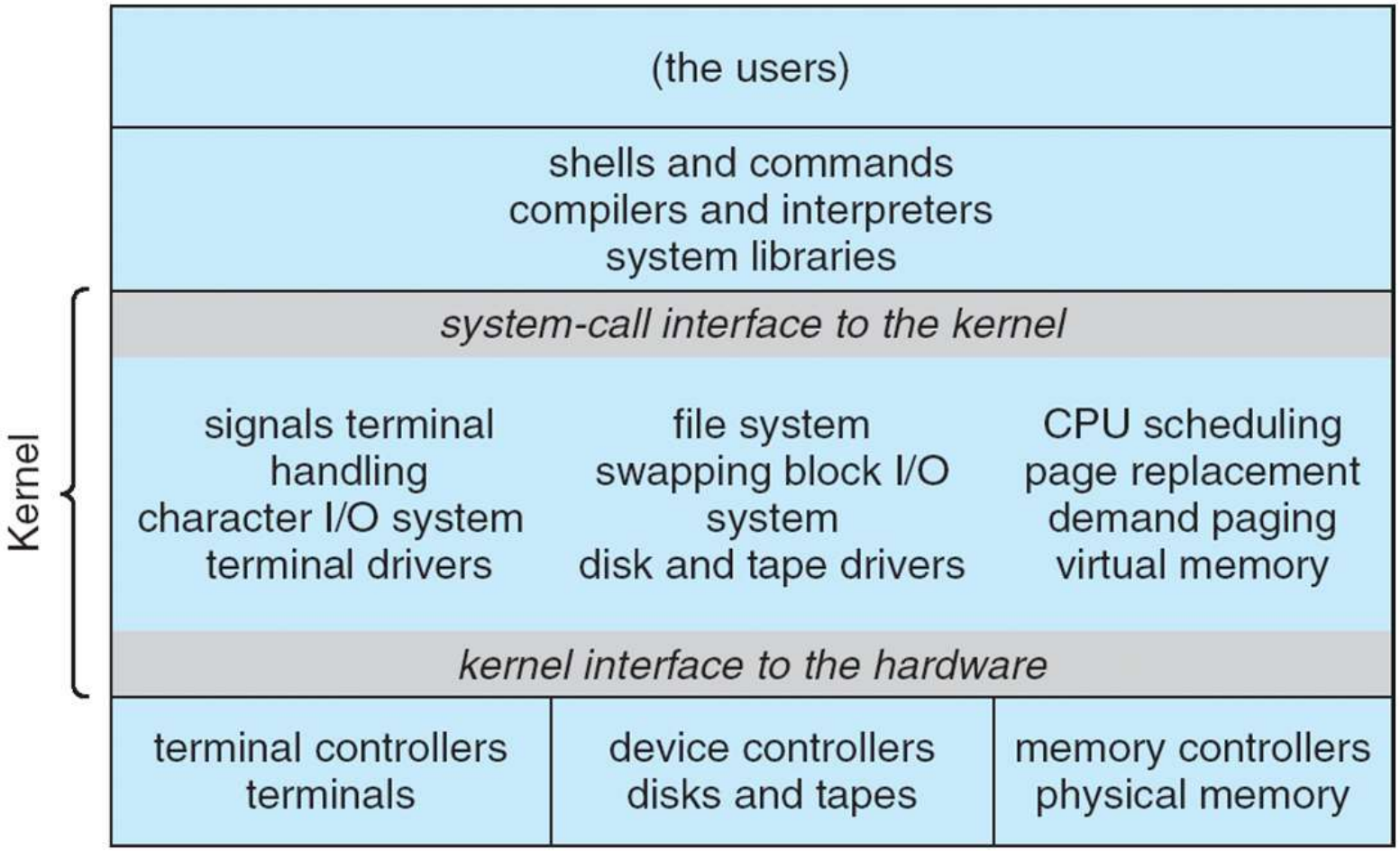
- ✓ MS-DOS



Operating System Structure

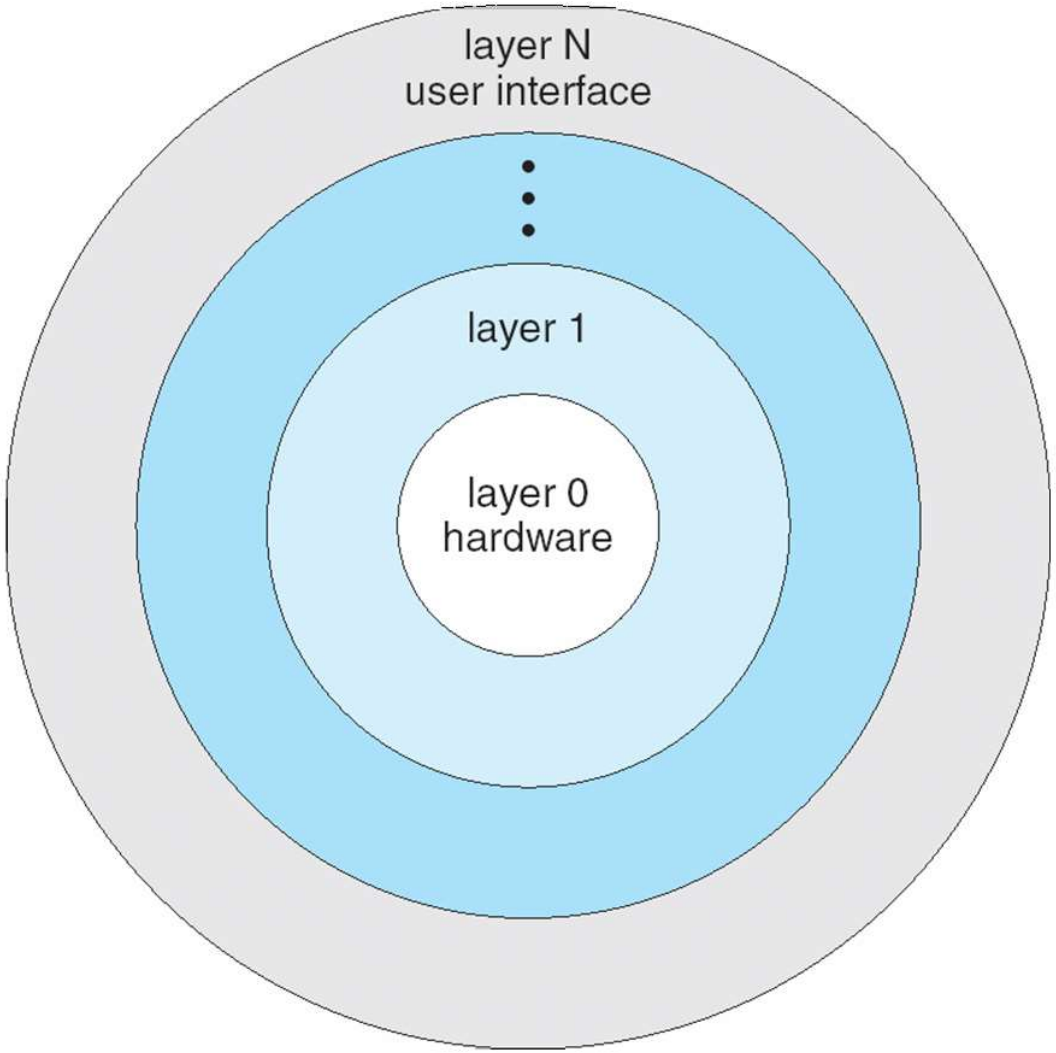
Monolithic structure

- ✓ Traditional Unix



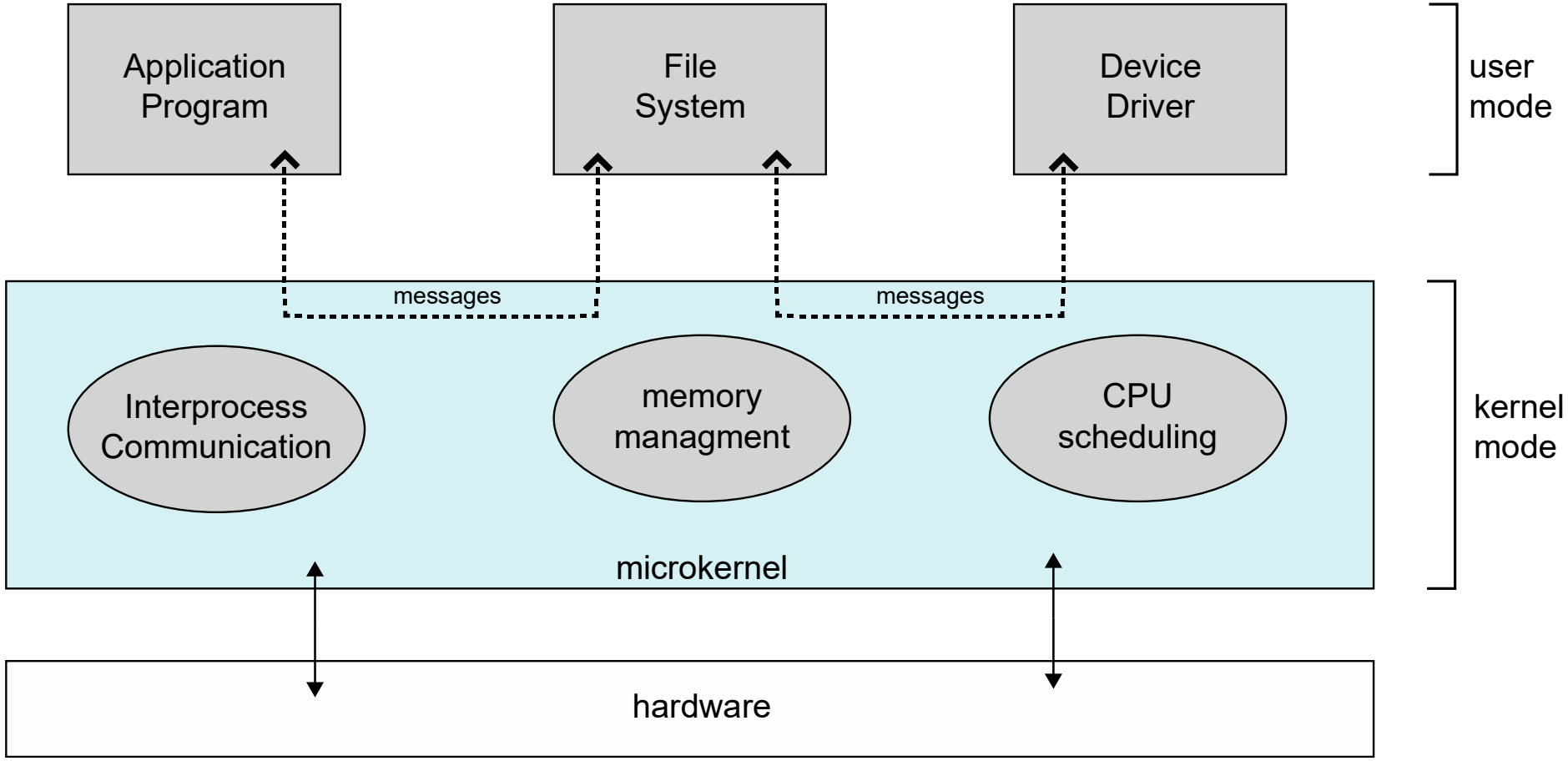
Operating System Structure

Layered approach



Operating System Structure

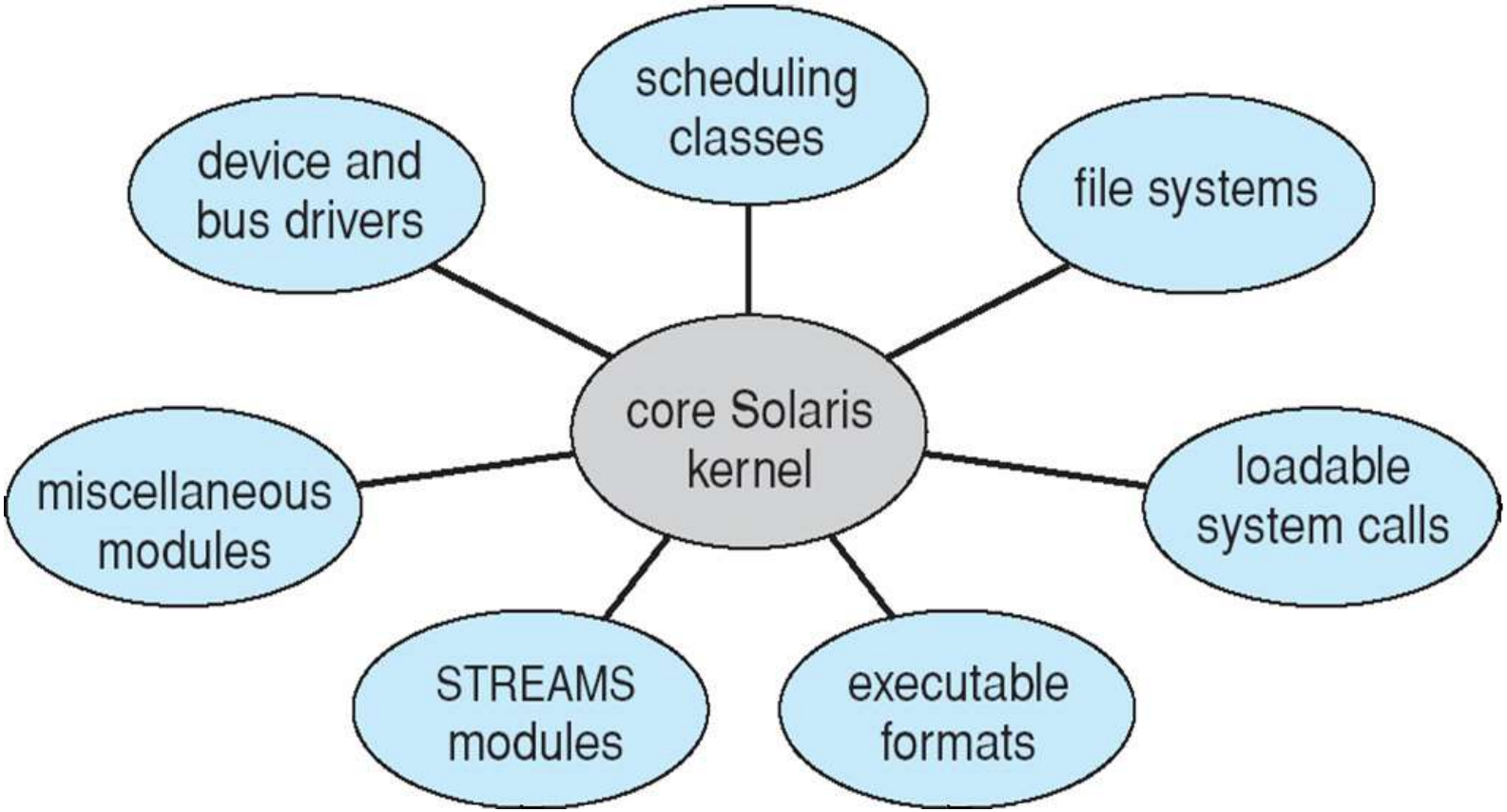
Microkernel structure



Operating System Structure

Modular approach

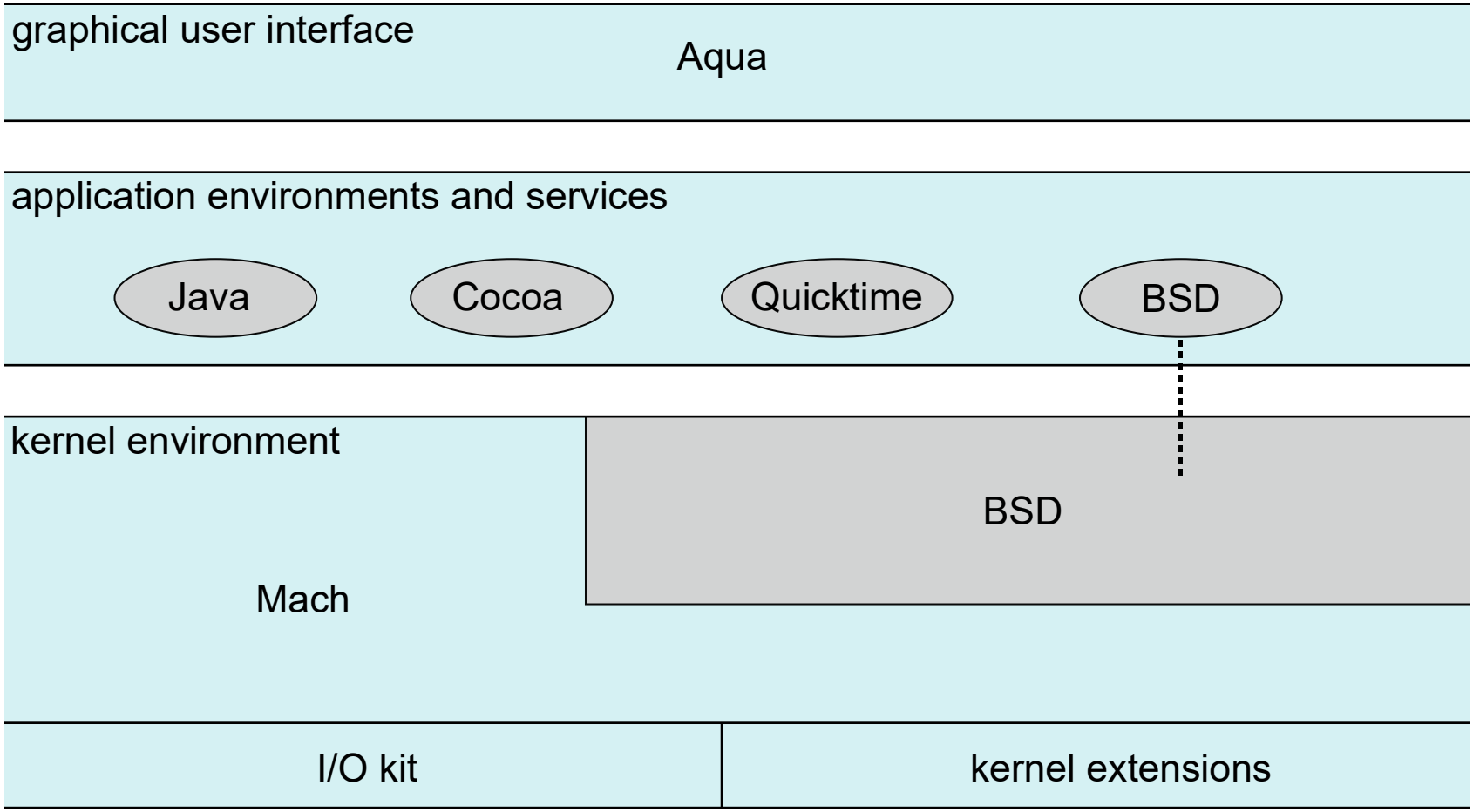
- ✓ Loadable Kernel Module (LKM)
- ✓ Linux, Solaris, etc.



Operating System Structure

Hybrid approach

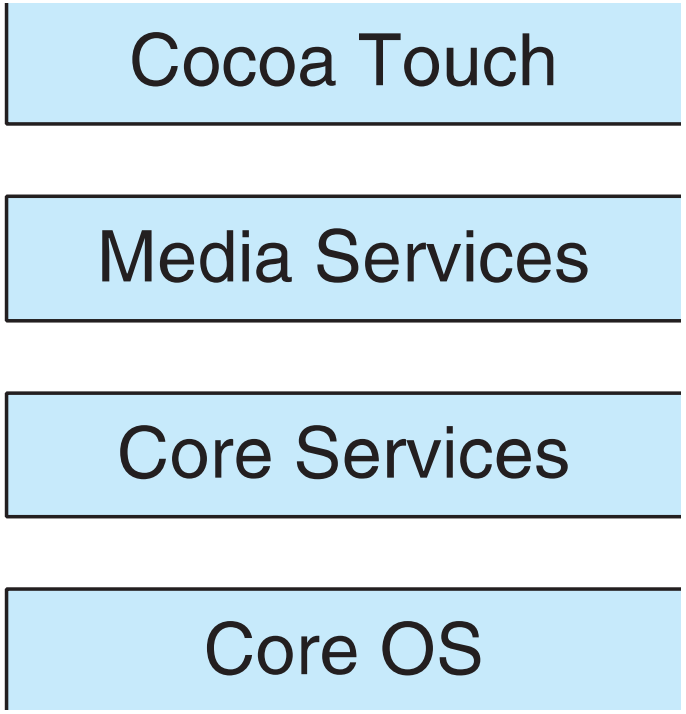
- ✓ Mac OS X



Operating System Structure

Hybrid approach

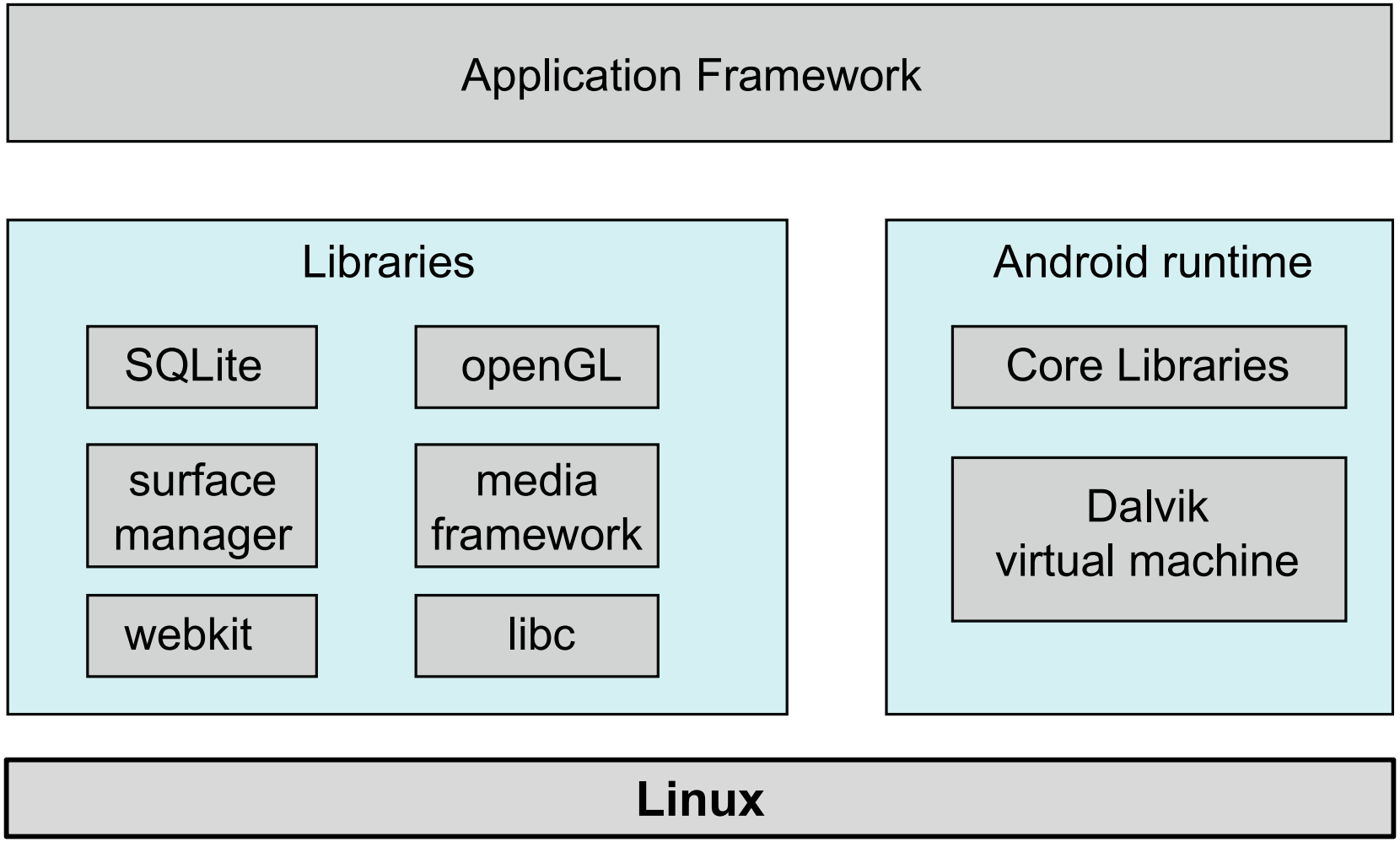
- ✓ iOS



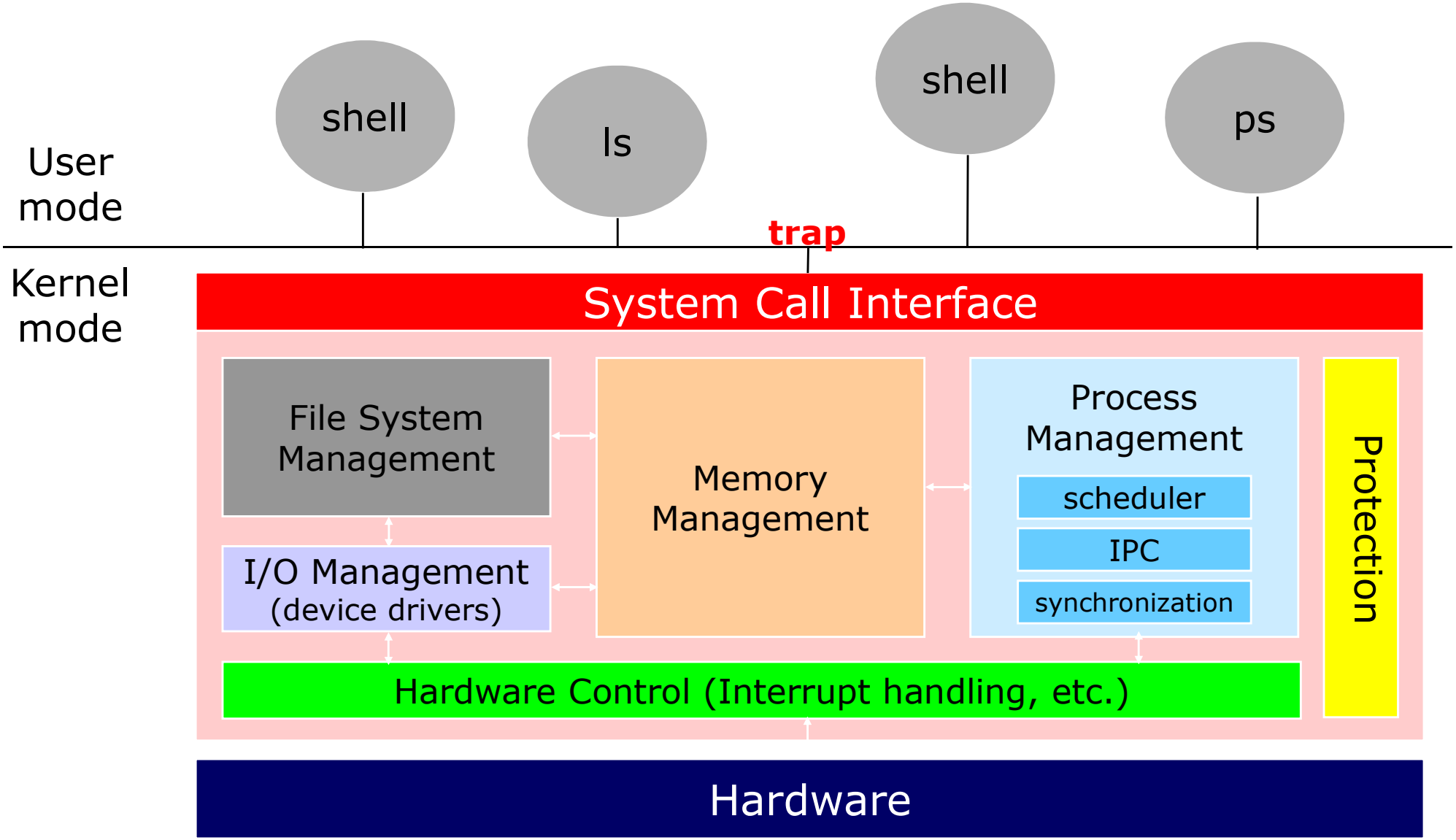
Operating System Structure

Hybrid approach

- ✓ Android



Operating System



Operating System

Manages computer HW resources

- ✓ CPU management
  - Chapter 3: Processes
  - Chapter 4: Threads & Concurrency
  - Chapter 5: CPU Scheduling
  - Chapter 6: Synchronization Tools
  - Chapter 7: Synchronization Examples
  - Chapter 8: Deadlocks
- ✓ Memory management
  - Chapter 9: Main Memory
  - Chapter 10: Virtual Memory
- ✓ I/O management
  - Chapter 11: Mass-Storage Structure
  - Chapter 12: I/O Systems
  - Chapter 13: File-System Interface
  - Chapter 14: File-System Implementation
  - Chapter 15: File-System Internals
- ✓ Chapter 16: Security