Modern Operating Systems

- Microkernel architecture
  - Assigns only a few essential functions to the kernel
    - Address spaces
    - Interprocess communication (IPC)
    - Basic scheduling

Modern Operating Systems

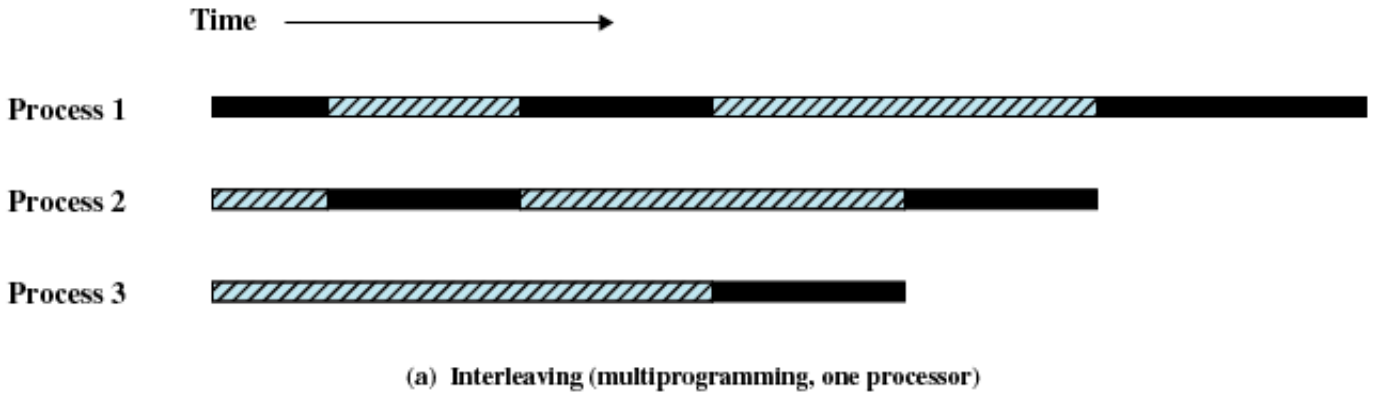
- Multithreading
  - Process is divided into threads that can run concurrently
    - Thread
      - Dispatchable unit of work
      - executes sequentially and is interruptable
    - Process is a collection of one or more threads

Modern Operating Systems

- Symmetric multiprocessing (SMP)
  - There are multiple processors
  - These processors share same main memory and I/O facilities
  - All processors can perform the same functions

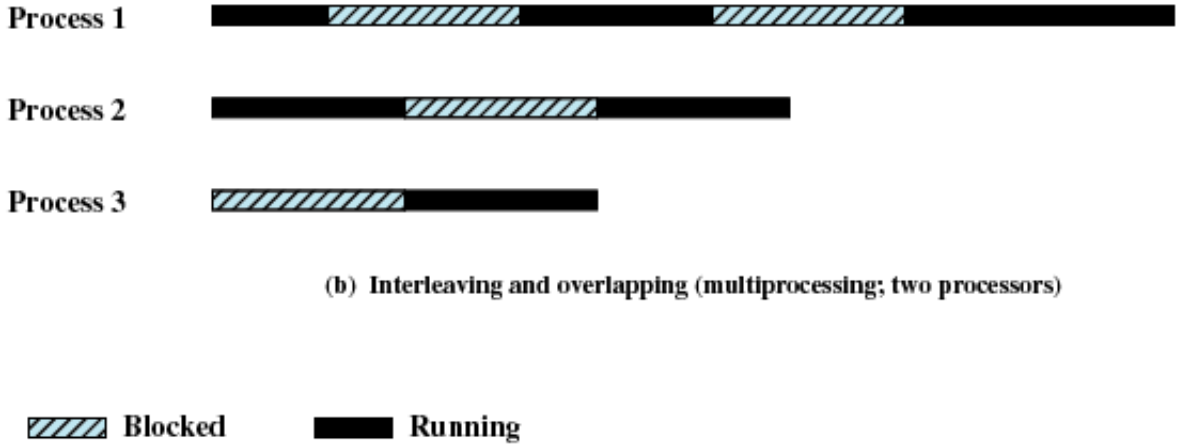
Multiprogramming and Multiprocessing

1 processor multiprogramming



(a) Interleaving (multiprogramming, one processor)

2 processors multiprocessing



(b) Interleaving and overlapping (multiprocessing; two processors)

Figure 2.12 Multiprogramming and Multiprocessing

Modern Operating Systems

- Distributed operating systems
  - Provides the illusion of a single main memory space and single secondary memory space

Modern Operating Systems

- Object-oriented design
  - Used for adding modular extensions to a small kernel
  - Enables programmers to customize an operating system without disrupting system integrity

UNIX

- Hardware is surrounded by the operating system software
- Operating system is called the system kernel
- Comes with a number of user services and interfaces
  - Shell
  - Components of the C compiler

UNIX

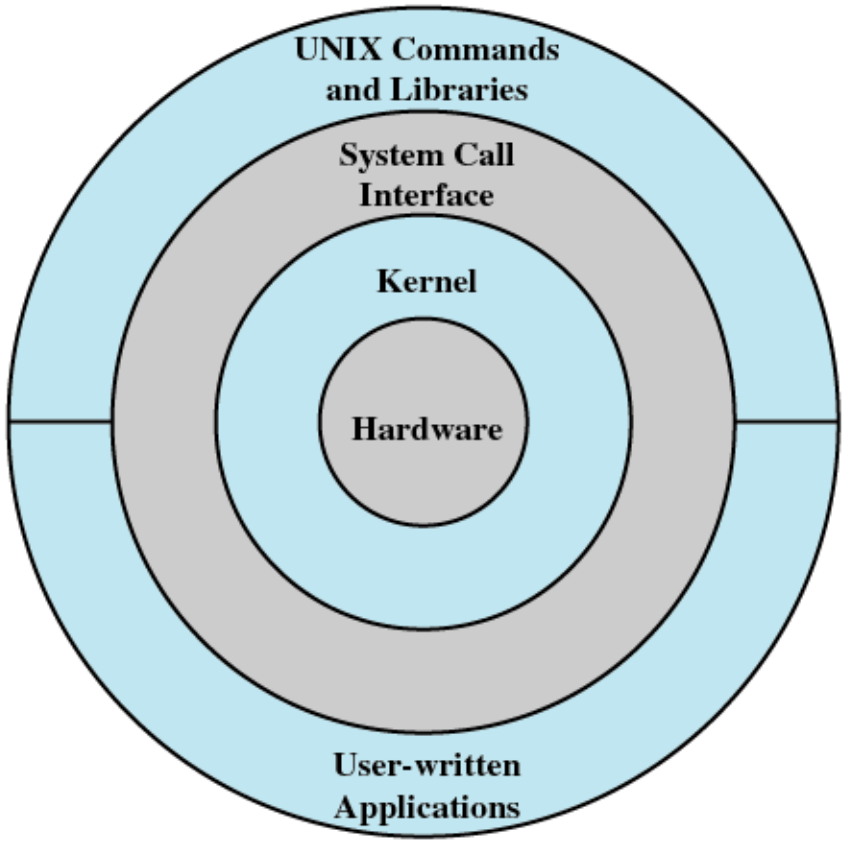
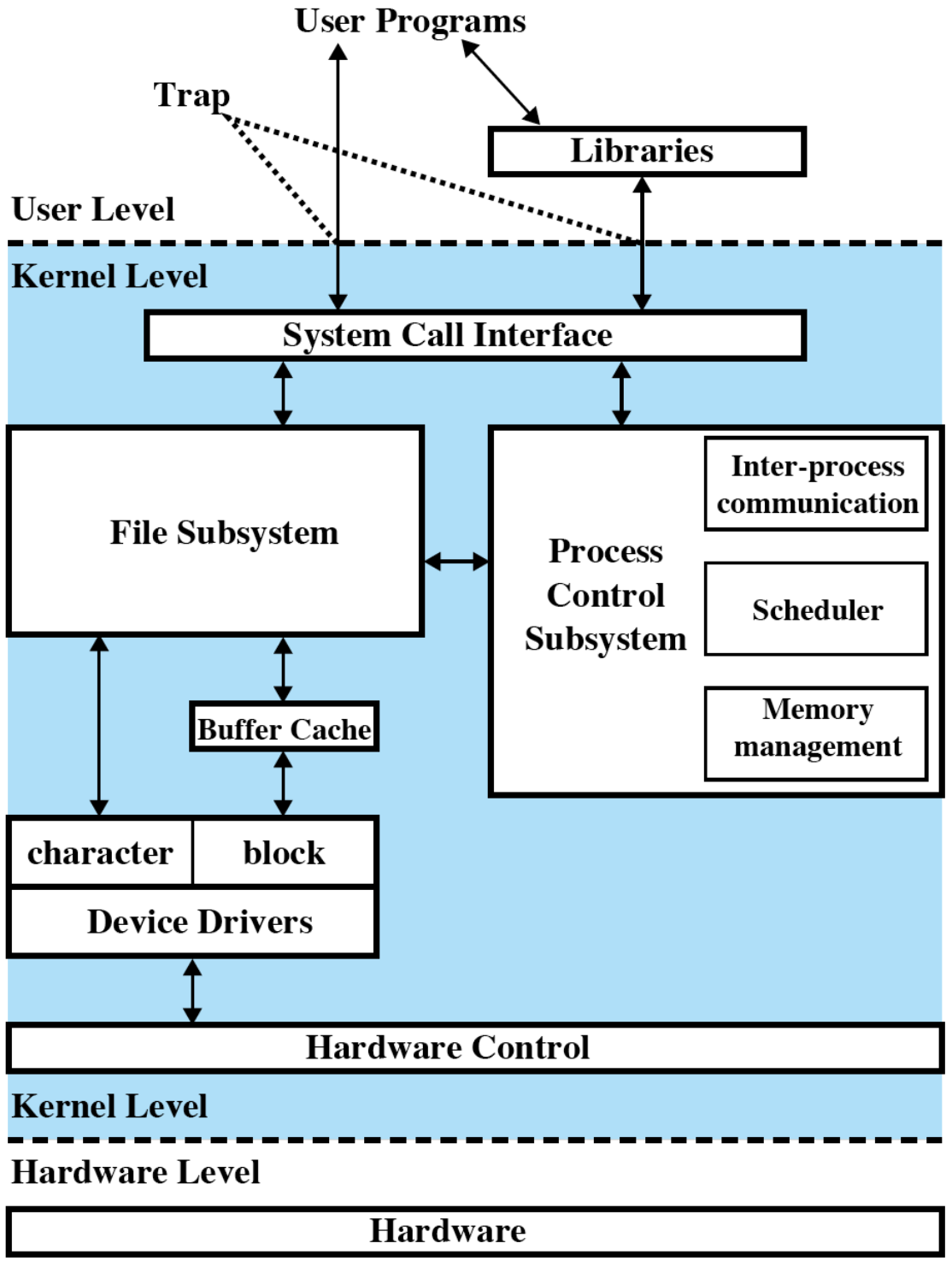


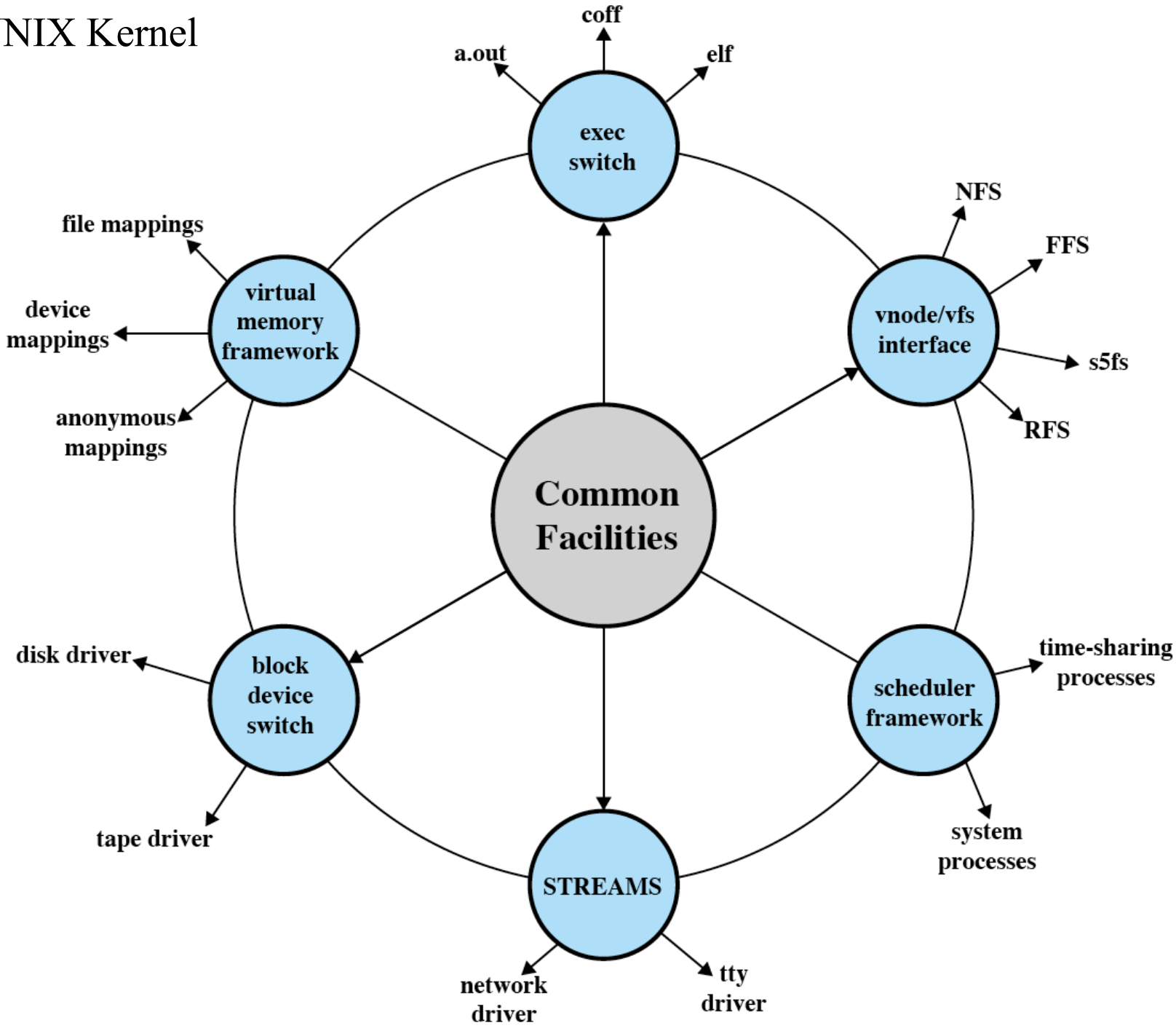
Figure 2.14 General UNIX Architecture

UNIX Kernel

Fig . 2.15



Modern UNIX Kernel
Fig 2.16



Sequence 4

Some UNIX Systems

- System V Release 4 (SVR4)
- Solaris 10
- 4.4BSD
- Linux
- OS X
- Android