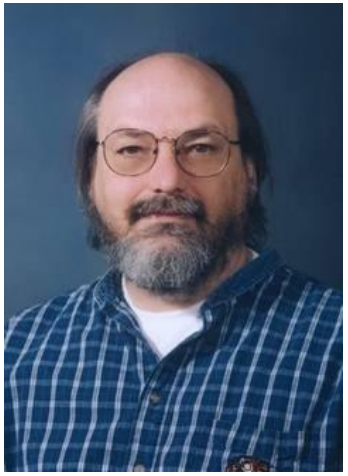
Introduction to UNIX

History of Unix



Kenneth Thompson

…
1966 -- Joins Bell Labs Computing Research Department, working on the Multics project
1969 -- Develops UNIX* operating system
1970 -- Writes B language, precursor to Dennis Ritchie's C language
1971 -- Moves UNIX from the PDP-7 to the PDP-11
1973 -- Rewrites UNIX in Dennis Ritchie's C language
…

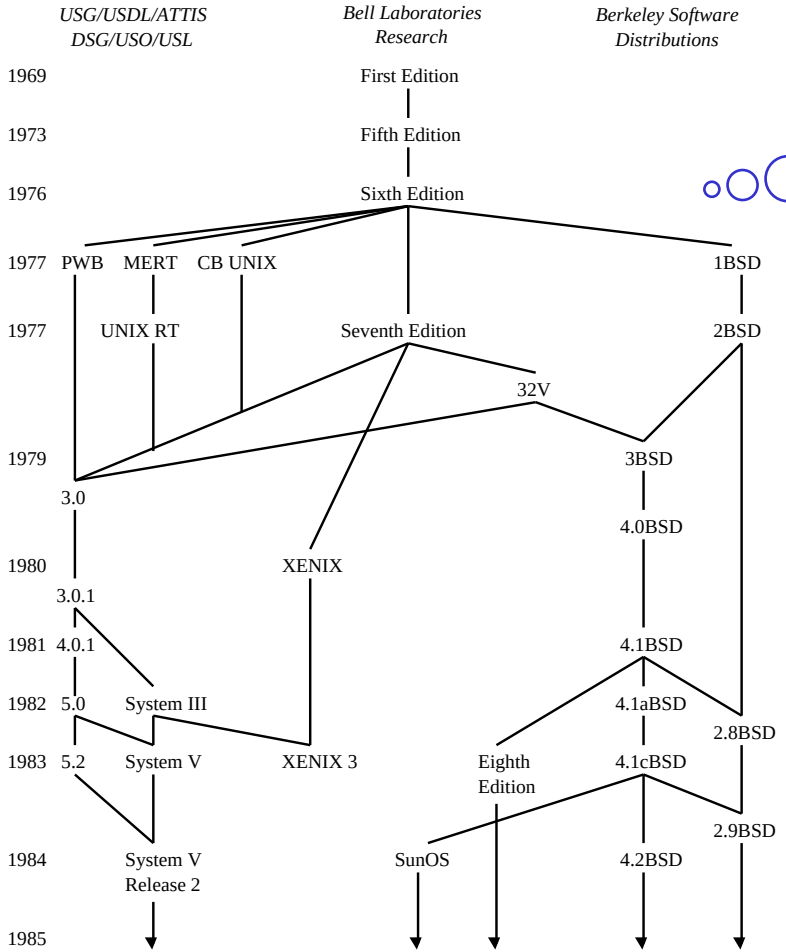
Dennis M. Ritchie

…
1968 -- Joins the Bell Labs team working on Multics, a joint effort of Bell Labs, MIT and GE to develop a general computer operating system
1972 -- Creates C language
…

History of Unix

- Ken Tompson develops it on PDP-7 in Bell Lab (1969)
- Dennis Ritchie joins and writes it in C
- Sixth Edition (1976)
  - First version allowing other institutions to use
  - After then UNIX was divided in AT&T and BSD series
- AT&T UNIX
  - System V, Release 3 (1987): employs STREAMS
  - System V, Release 4 (1989): C/Korn shell, Job control, Symbolic link
- BSD UNIX
  - BSD 4 (1980): Job control, Reliable signal
  - BSD 4.4 (1993)

History of Unix



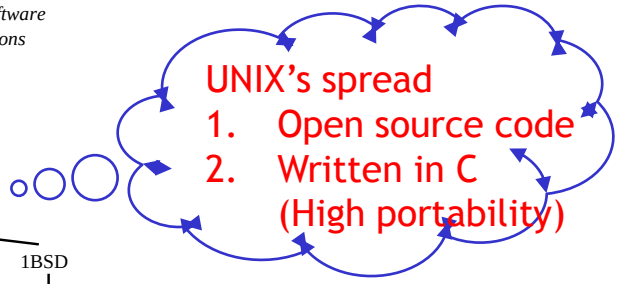


Figure 1.1 The UNIX system family tree, 1969-1985

History of Unix

There are too many variants of UNIX.
➔Need to standardize OS interface

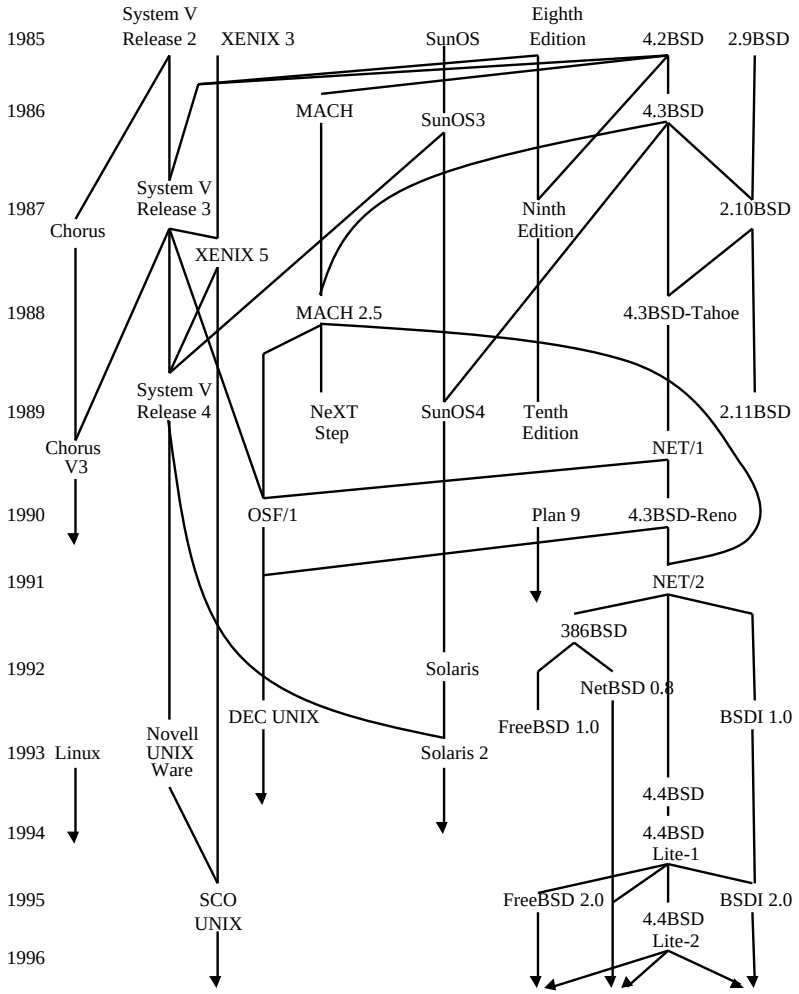


Figure 1.2 The UNIX system family tree, 1986-1996

UNIX Standardization

- ANSI C (1989)
  - American National Standards Institute
  - Establish C language grammar, library and header files
  - For portability to various operating systems
- POSIX (1988)
  - Portable Operating System Interface for Computer Environments
  - Define OS-providing services
  - 1003.1: Interface standard (called POSIX.1)
  - 1003.2, 1003.7, and so on.

Unix Characteristics

- What is Good with Unix?
  - Open System
  - Small is beautiful philosophy
    - file: just stream of bytes
    - Data, Device, Socket, Process, … can be treated as a file.
  - Portability
    - high-level language
    - client-server model, clustering, …
  - True Parallelism
    - Multitasking, Multiprocessor, …

Unix Characteristics

- What is Wrong with Unix?
  - Too many variants
    - dumping ground
  - Not small and simple any more
    - uncontrolled growth
  - Lack of GUI
    - not now (MIT's X)

What is Linux?

- Linux
  - UNIX-like OS
  - Powerful and stable as other commercial OS
    - Kernel is developed by many hackers
    - Tested and improved by many people over the world
  - COPYLEFT(open source)
    - Follows GNU General Public License (GPL)
      - Source code as well as execution file
      - Anyone can involve modification of source code
      - Open not only modified program but also modified source code

Linux History

- history
  - 1991 : Linus Tovalds (Graduate student)
    - version 0.01 based on Minix
    - Paging, timer interrupt, device driver, file system, …
  - 1992 : Linux distro (= Kernel + application programs)
  - 1993 : stabilize kernel
  - 1994 : version 1.0
  - 1996 : version 2.0
  - 1999 : version 2.2
  - 2001 : version 2.4
  - 2003 : version 2.6
  - 2012 : version 3.0, 3.2

Kernel Distro Website : http://www.kernel.org

Linus Benedict Torvalds

Why Linux?

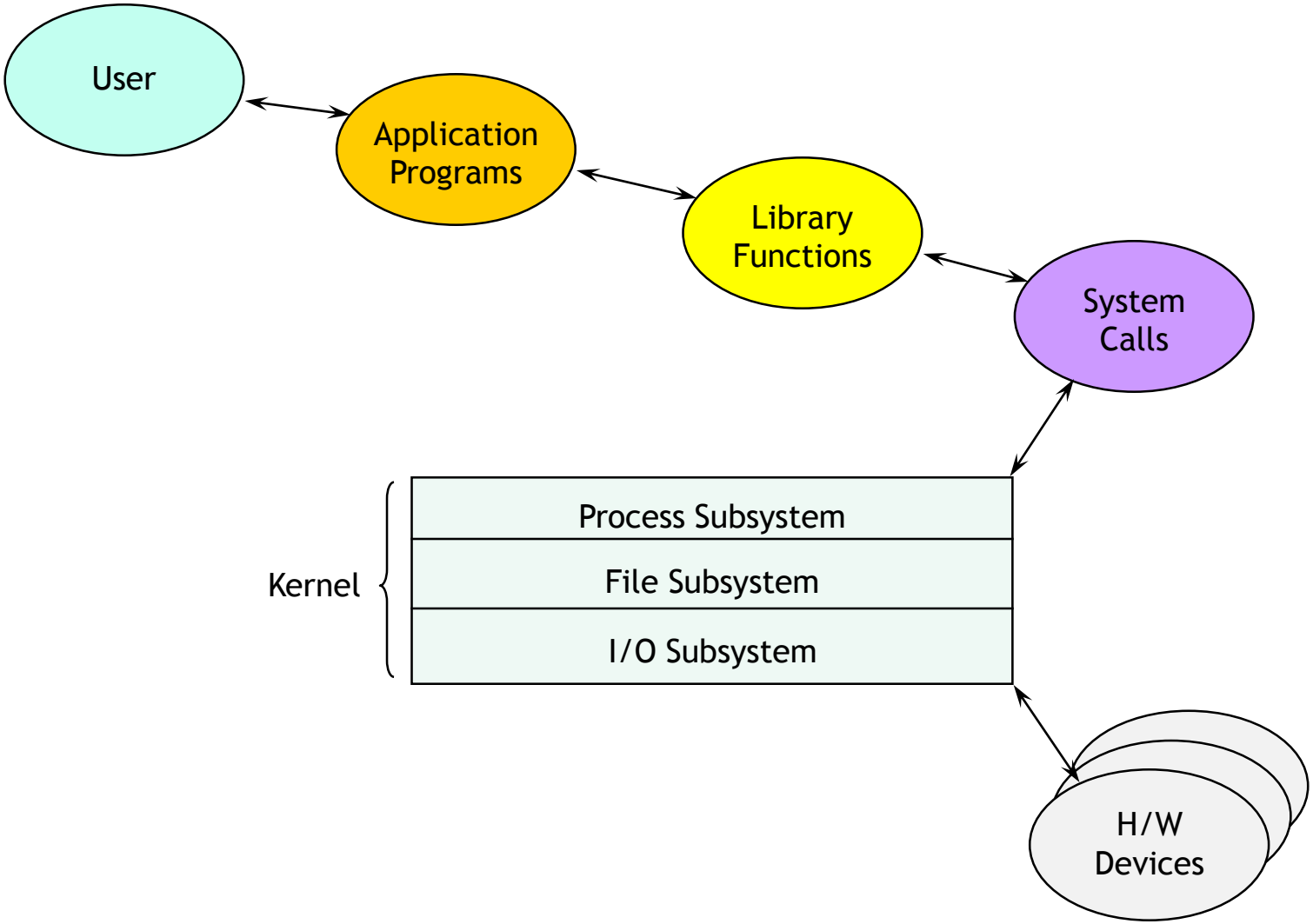
- Why Linux?
  - Powerful (see next page)
  - Unix based (POSIX 1003.1 standard support)
    - ➔ Can use powerful S/W in Unix
  - open source code
    - ➔ ‘experimenting’ with the system is possible.
  - Good documentations
    - FAQ, HOWTO

- ➔ We use Linux in lab.

Why Linux?

- Merits
  - Multi-Tasking
  - Multi-User access
  - POSIX 1003.1 standard support
  - Support various file systems
    - EXT2FS, EXT3FS, JFS, ReiserFS, NTFS, …
  - Support various network protocols
    - TCP/IP, SLIP, PPP, …
  - Support various architecture
    - 80*86, SPARC, ARM, PPC,...
  - Multi-processor
  - …

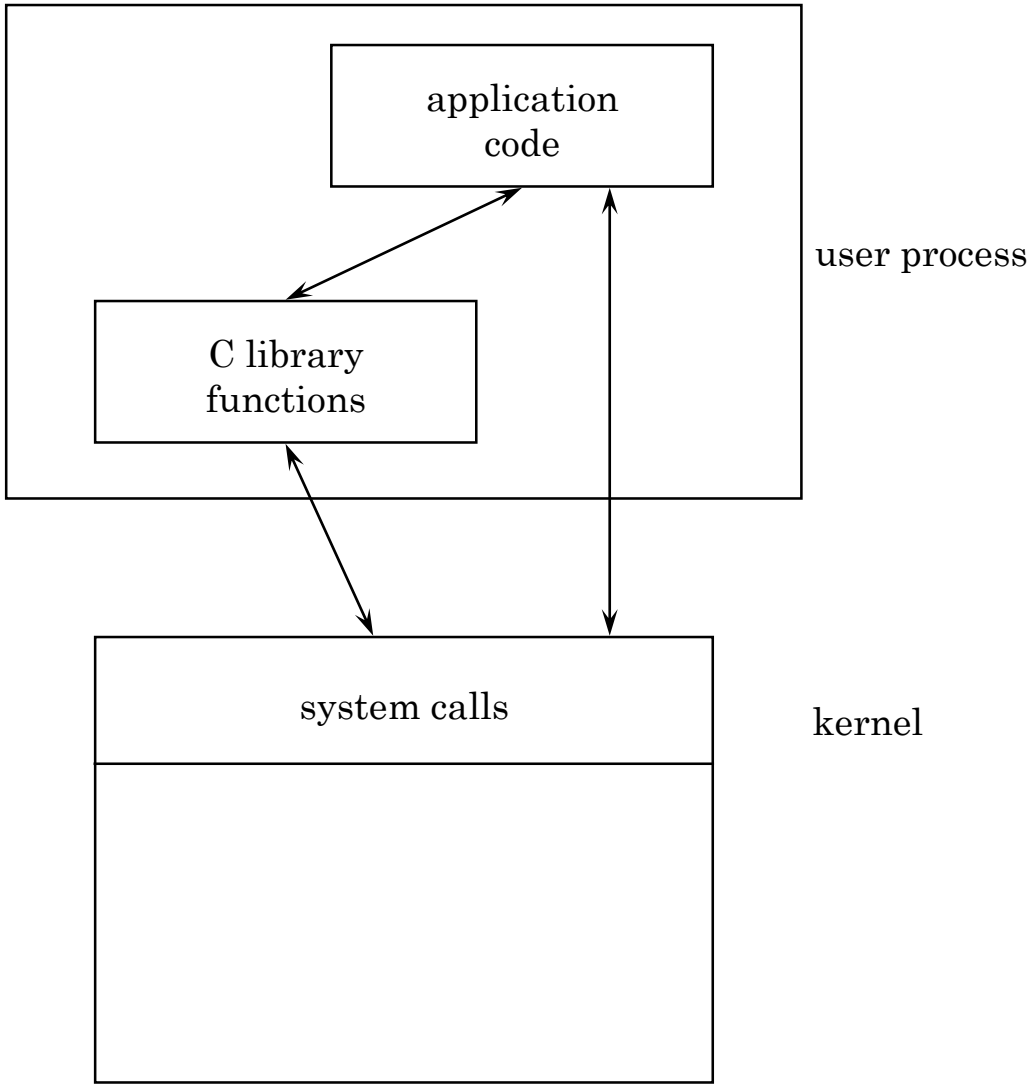
Unix/Linux Structure



Unix/Linux Structure

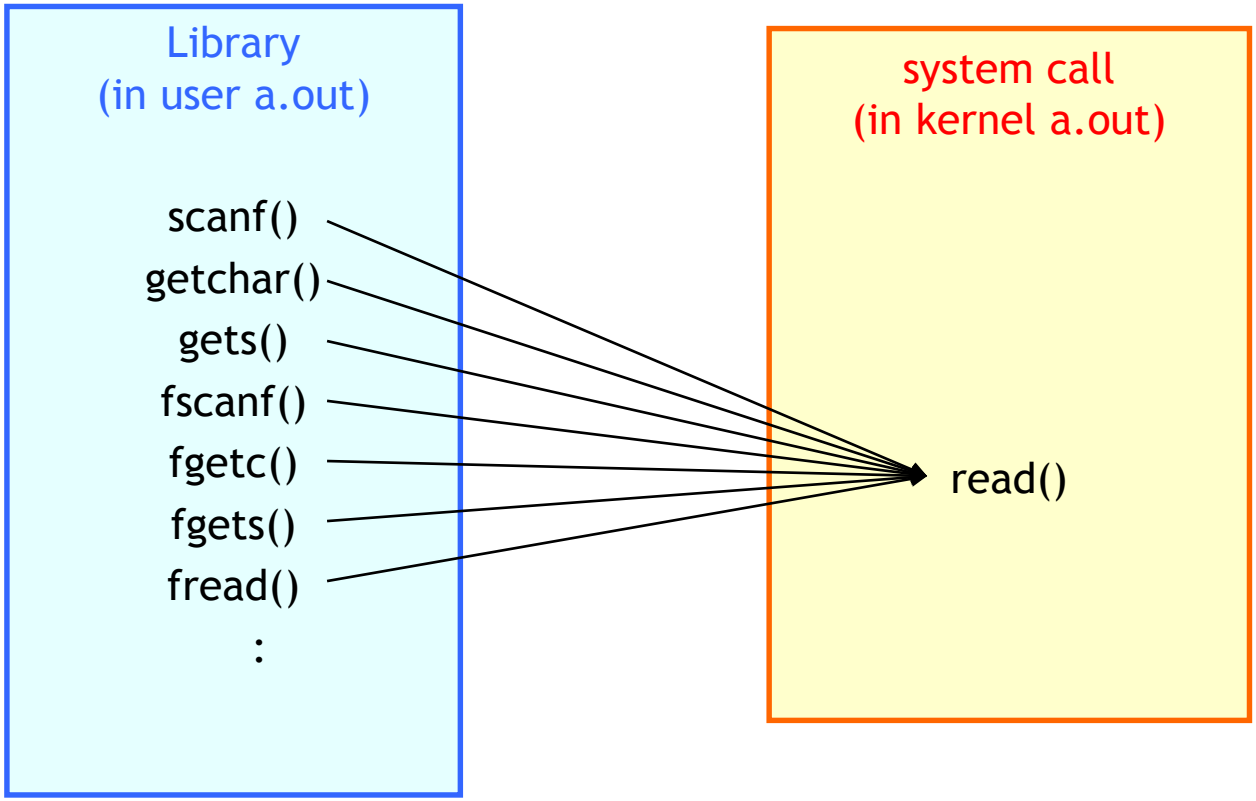
- Application program
  - e.g. ls, mkdir, chmod, vi, sh
- Library
  - Library function eventually calls system call
  - e.g. printf() ➔ write()
- System call
  - Interface between Application & Operating system
  - System call is called then Kernel code is executed
- Kernel
  - Manages efficient usage of system resource
  - process/memory/file/IO management

Library vs. system call

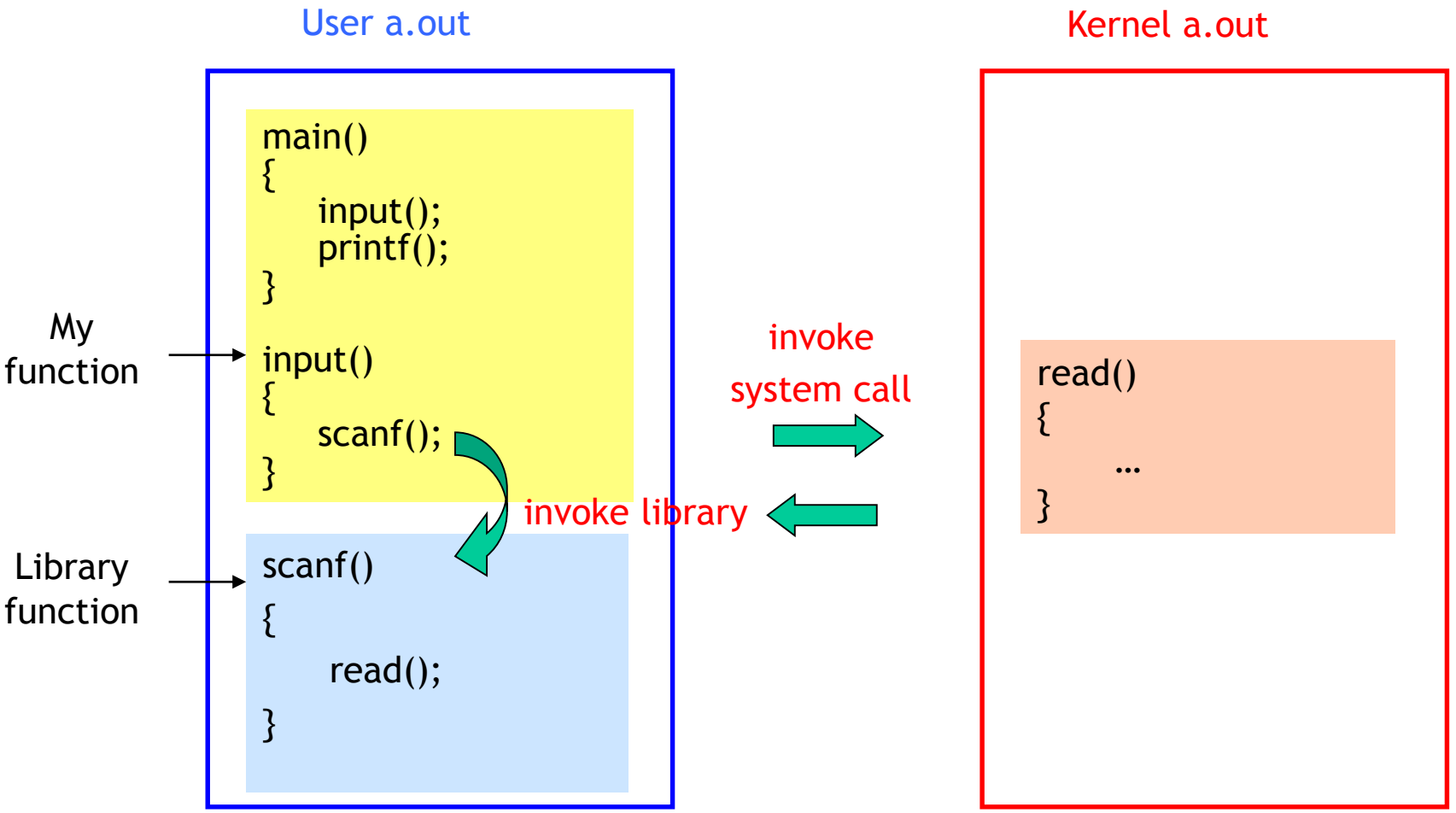


Library vs. system call

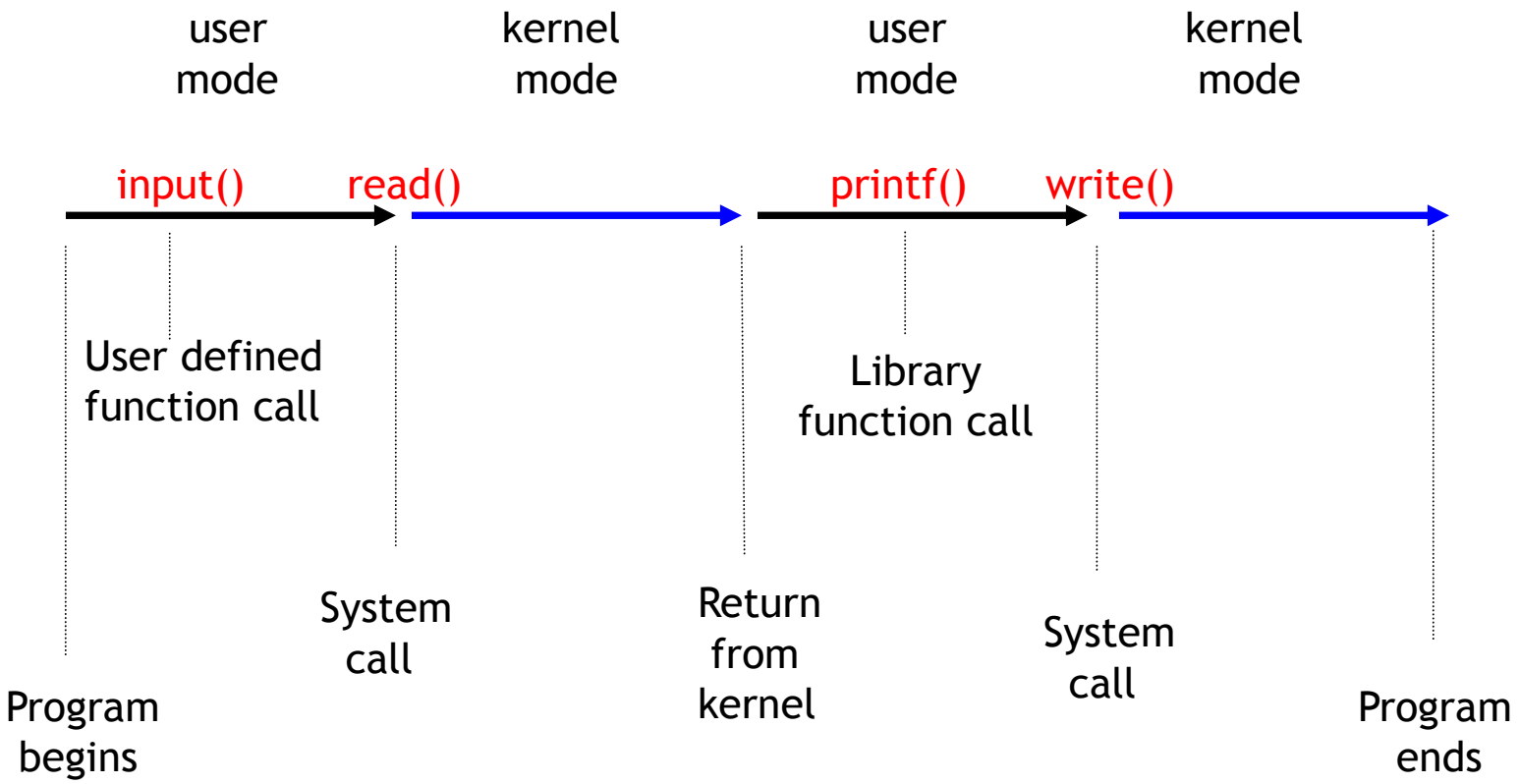
- Example



Library vs. system call



Program execution



Kernel mode & User mode

- kernel mode
  - privileged mode
  - no restriction is imposed on the kernel of the system
  - may use all the instructions of the processor
  - manipulate the whole of the memory
  - talk directly to the peripheral controllers

Kernel mode & User mode

- user mode
  - normal execution mode for a process
  - has no privileges
    - certain instructions are forbidden
    - only allowed to zones allocated to it
    - cannot interact with the physical machine
  - process carries out operations in its own environment, without interfering with other processes
  - process may be interrupted at any moment