SOFTWARE ARCHITECTURE

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Lecture Slide System

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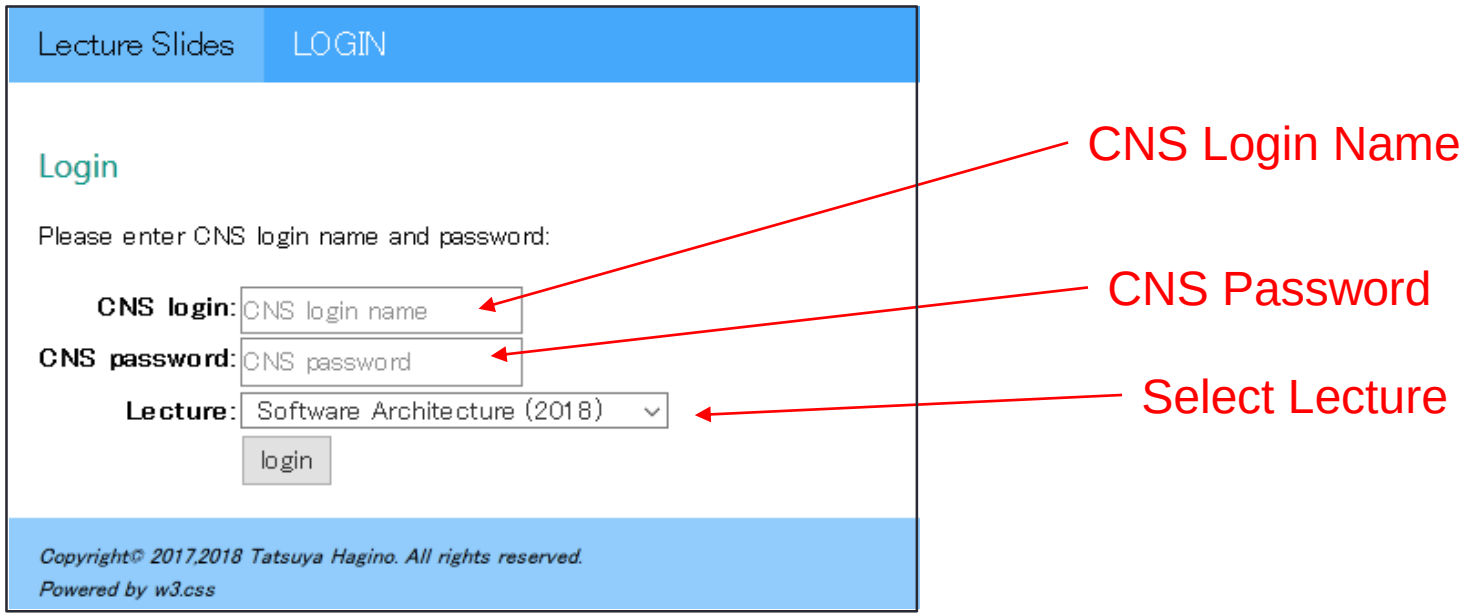
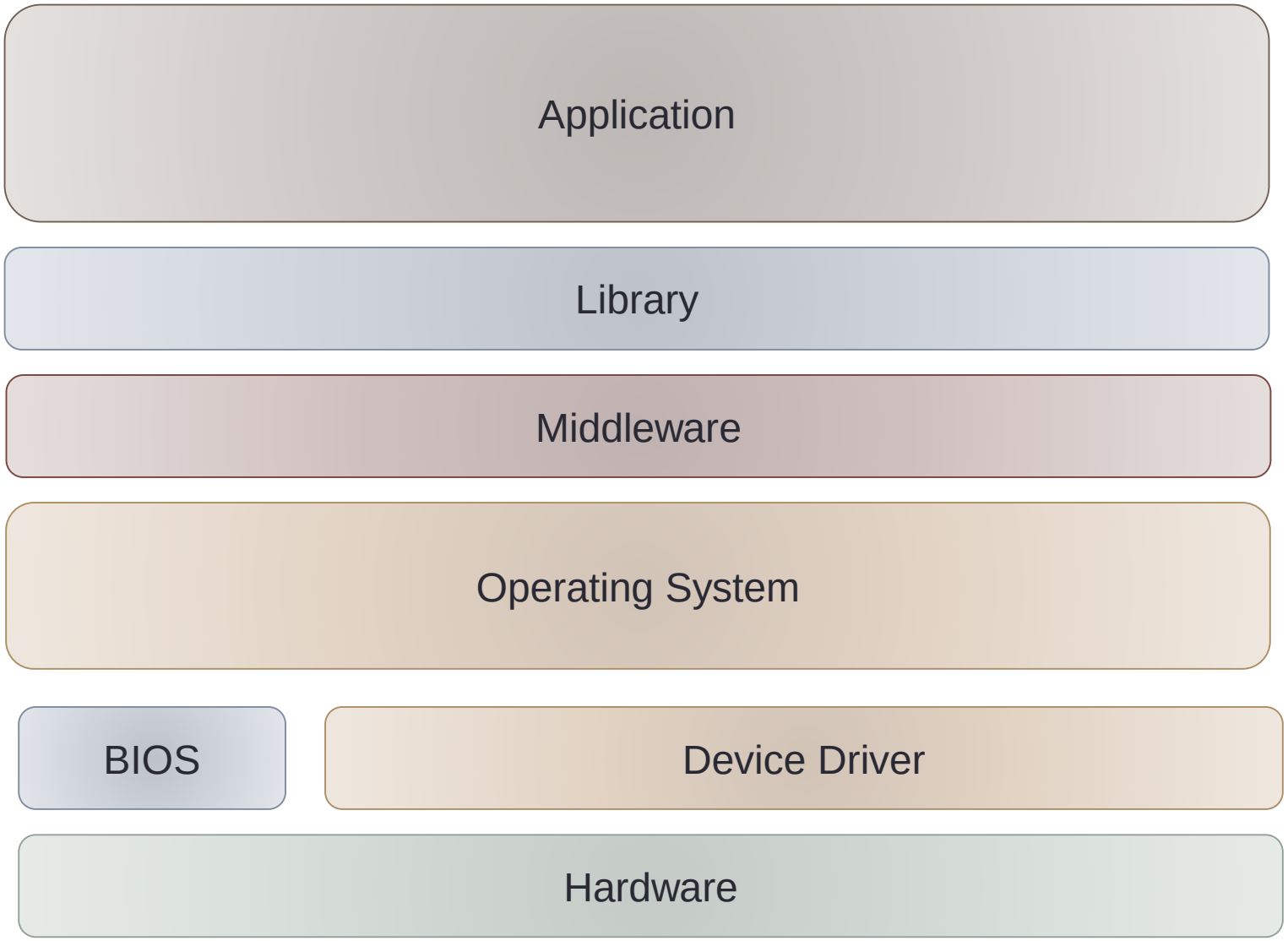
- Select: Software Architecture (2018)



Syllabus

1. Operating System
2. File System
3. Shell
4. Text Formatting
5. C Compiler
6. LISP Interpreter
7. Java Virtual Machine
8. Mid-tem Exam
9. Network System
10. Domain Name System
11. TELNET and Electric Mail
12. Distributed File System
13. World Wide Web
14. Window and Database Management System
15. Final Exam

Software Layer



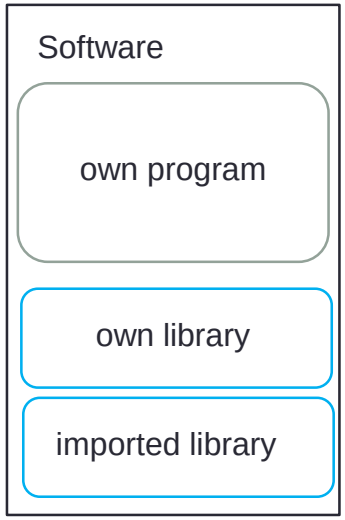
Application

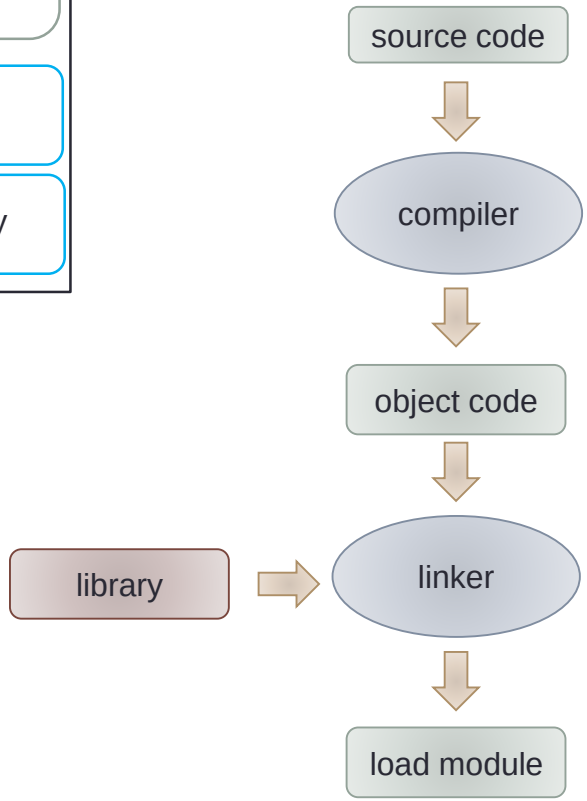
- Applications = User programs
  - Most of the programs users write are applications.

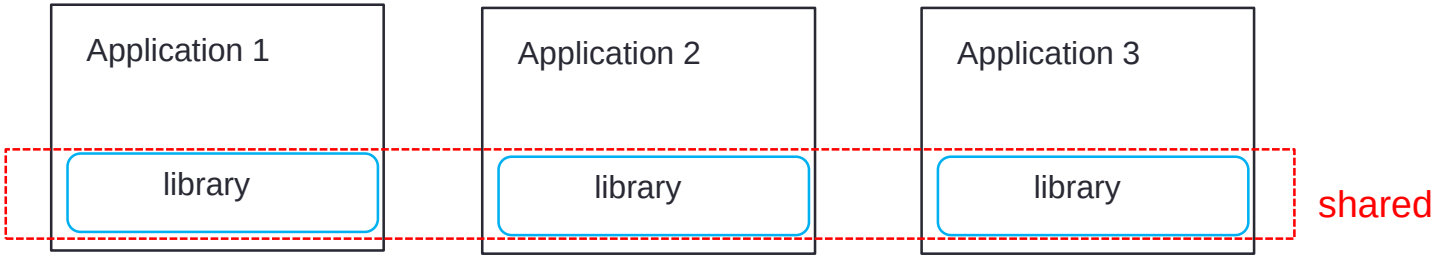
- Applications may be divided into:
  - System applications
    - Backup
    - maintenance
  - Language processing
    - Compiler
    - Interpreter
  - Text, graphics, image and video processing
    - Editors
  - Network applications
    - mail client
    - Web browser
  - Scientific applications
    - numerical analysis
    - simulation

Library

- Library
  - collection of functions and procedures
  - not a standalone software
  - embedded into another software
- Some libraries
  - Filesystem library
  - Mathematical library
  - Statistic library
  - String library
- Static vs Dynamic Link Library
  - Static: linked at compile time
  - Dynamic: linked at run time
- Shared Library
  - The same library is shared among different programs.







SOFTWARE ARCHITECTURE

1. OPERATING SYSTEM

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Operating System

- Usually called OS
  - Fundamental Software
    - Most PC needs one
  - Control all the programs running on the computer
  - Manage resources on the computer
  - Provide various services to programs
  - Enhance functions to the hardware and provide a virtual machine to each program

- Popular OS
  - Windows: 95, 98, Me, NT, XP, Vista, 7, 8, 8.1, 10
  - Mac OS: 9, X
  - UNIX: Linux, FreeBSD, NetBSD, OpenBSD, Solaris

- Other OS
  - Mobile Phone: iOS, Android, Windows phone
  - Realtime System: iTron, VxWorks

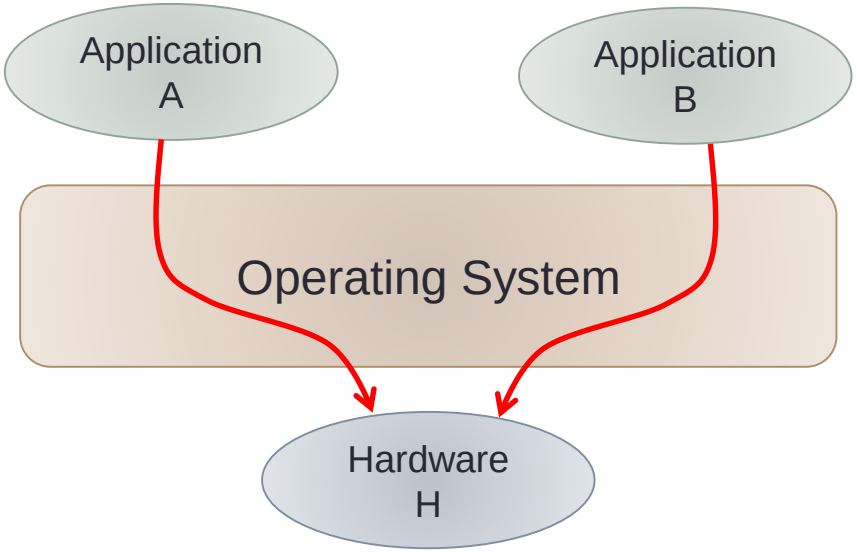
Role of Operating System

- Arbitration of hardware usage conflict
- Separation of programs
- Multi-programming
- Memory management
- File system
- Network system
- Communication among programs

Hardware Arbitration

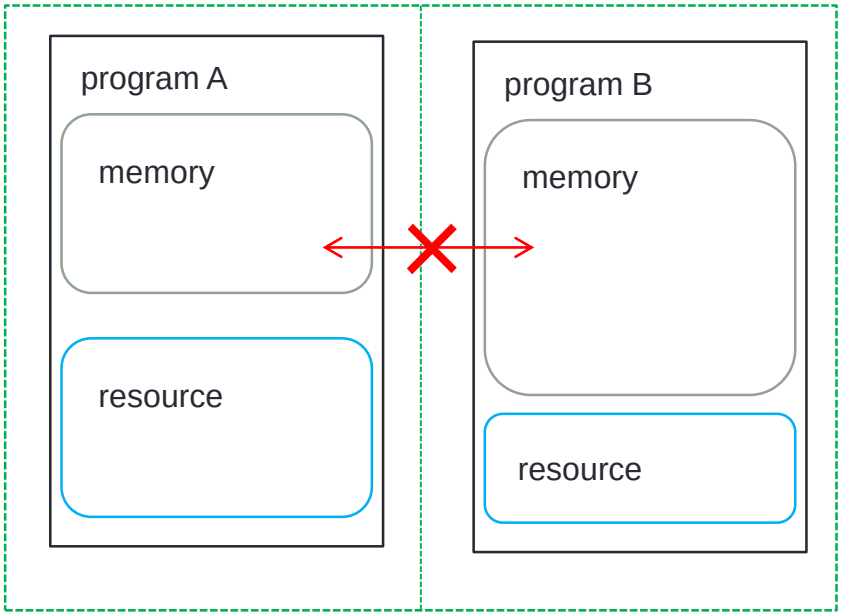
- Two applications cannot control the same hardware (e.g. keyboard, mouse, printer, etc.).

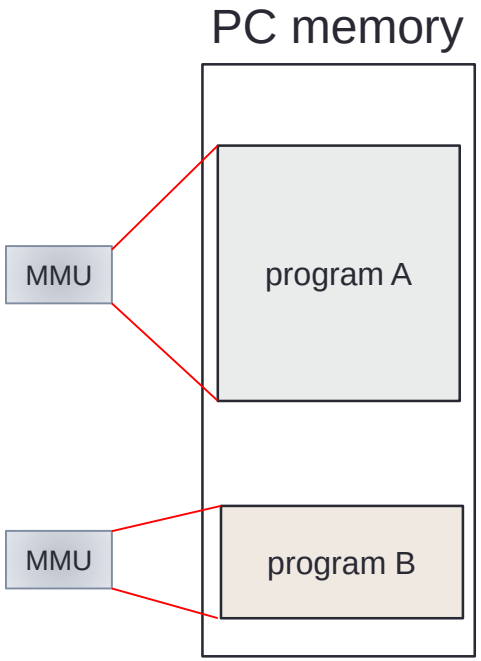
- Arbitration by OS
  - Applications cannot control hardware resource directly.
  - Hardware is controlled via OS.



Separation of Programs

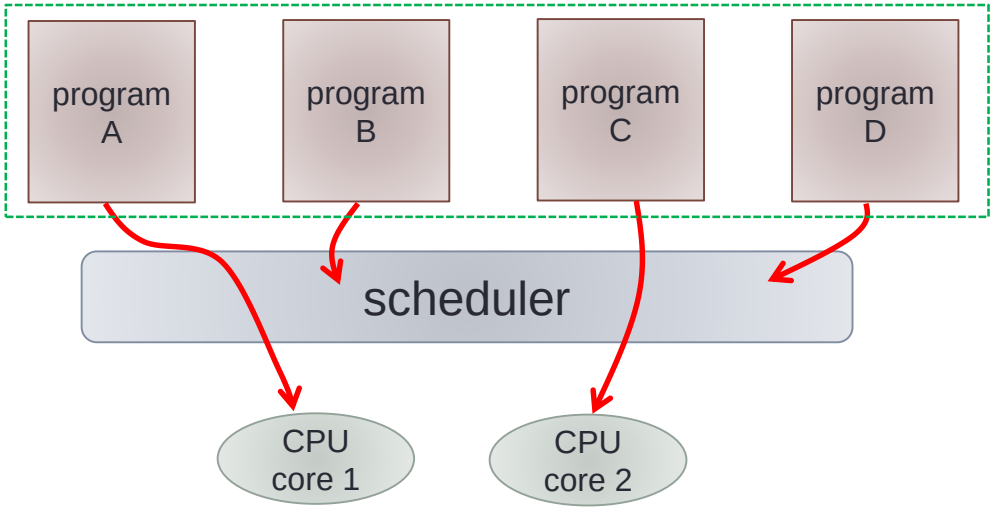
- Programs can run independently.
- Each program has its own memory space.
- Each memory space is protected (i.e. cannot be referenced or altered by other programs).

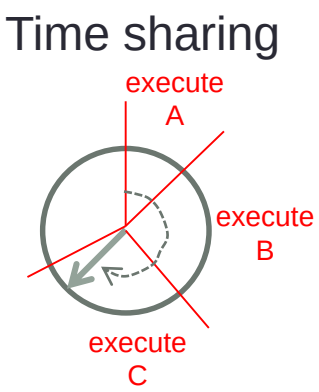




Multi-Programming

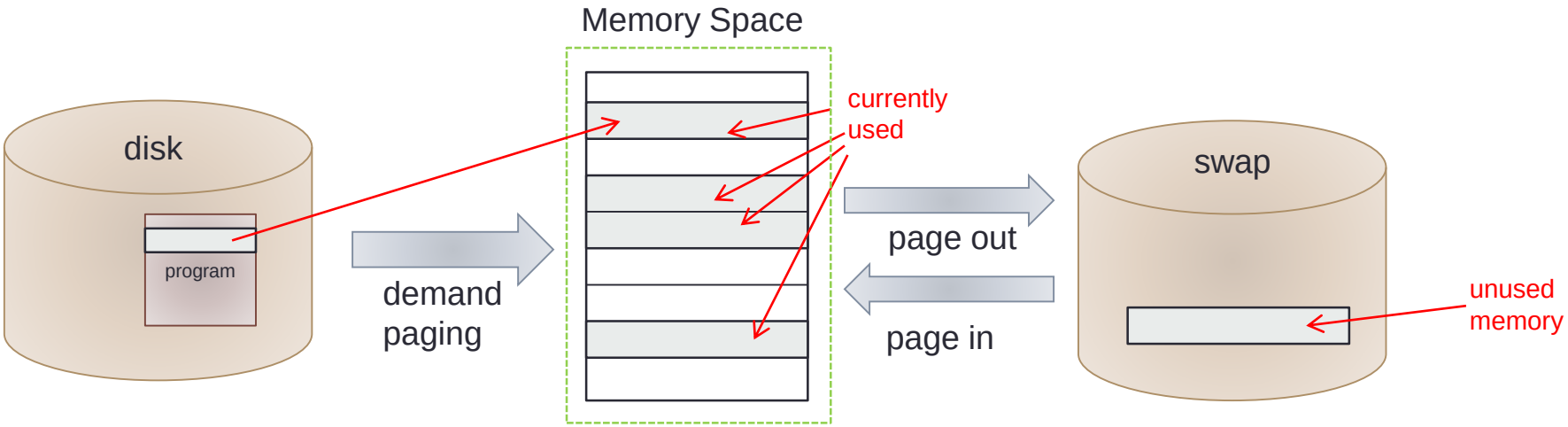
- Multiple programs can run at the same time.
- Number of programs which can be run at once is not limited by the number of CPU cores.
- CPU time is assigned to programs.
  - Process scheduling
  - Priority control





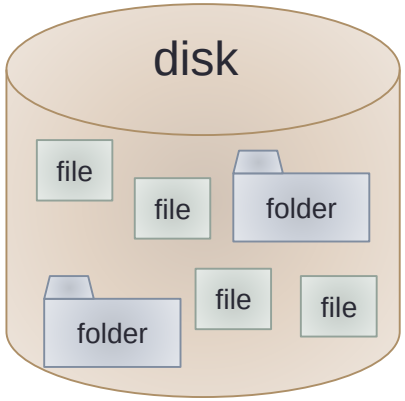
Memory Management

- Allocate memory for programs
  - Memory is divided into pages.
- Collect unused pages.
- Provide virtual memory
  - Pages not used frequently are paged out to the external storage.
  - Pages are paged in when necessary.
  - Programs do not need to worry about the hardware memory size. (vs. Memory Overlay used for game software)
- Demand paging
  - Program and data are loaded into memory when they are referenced at first time.



File System

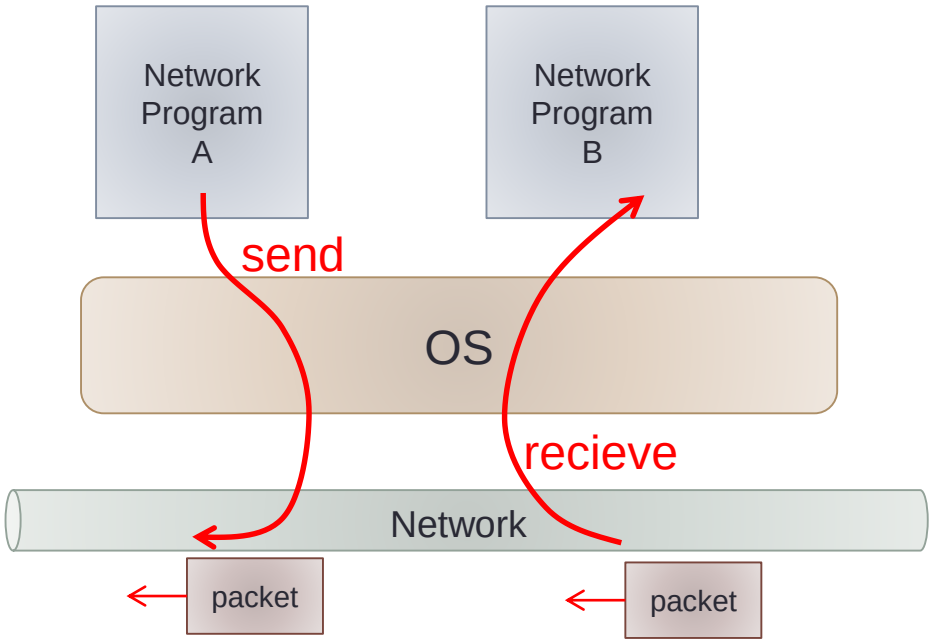
- Share disk drive with applications
- Create a file system on a disk
- Efficient buffering
- Popular File System
  - FAT (Fast Allocation Table)
  - NTFS (NT File System)
  - HFS (Hierarchical File System)
  - UFS (UNIX File System)
  - LFS (Log File System)



Network System

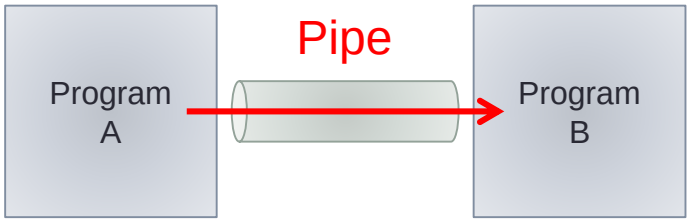
- Process network packets
  - send (programs to network)
  - receive (network to programs)

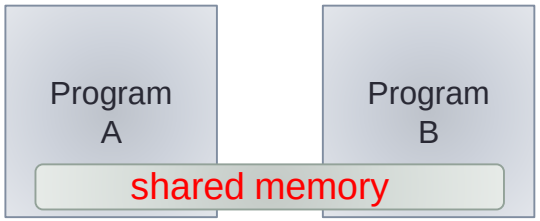
- TCP/IP control
  - fragmentation
  - resend
  - ordering
  - window control



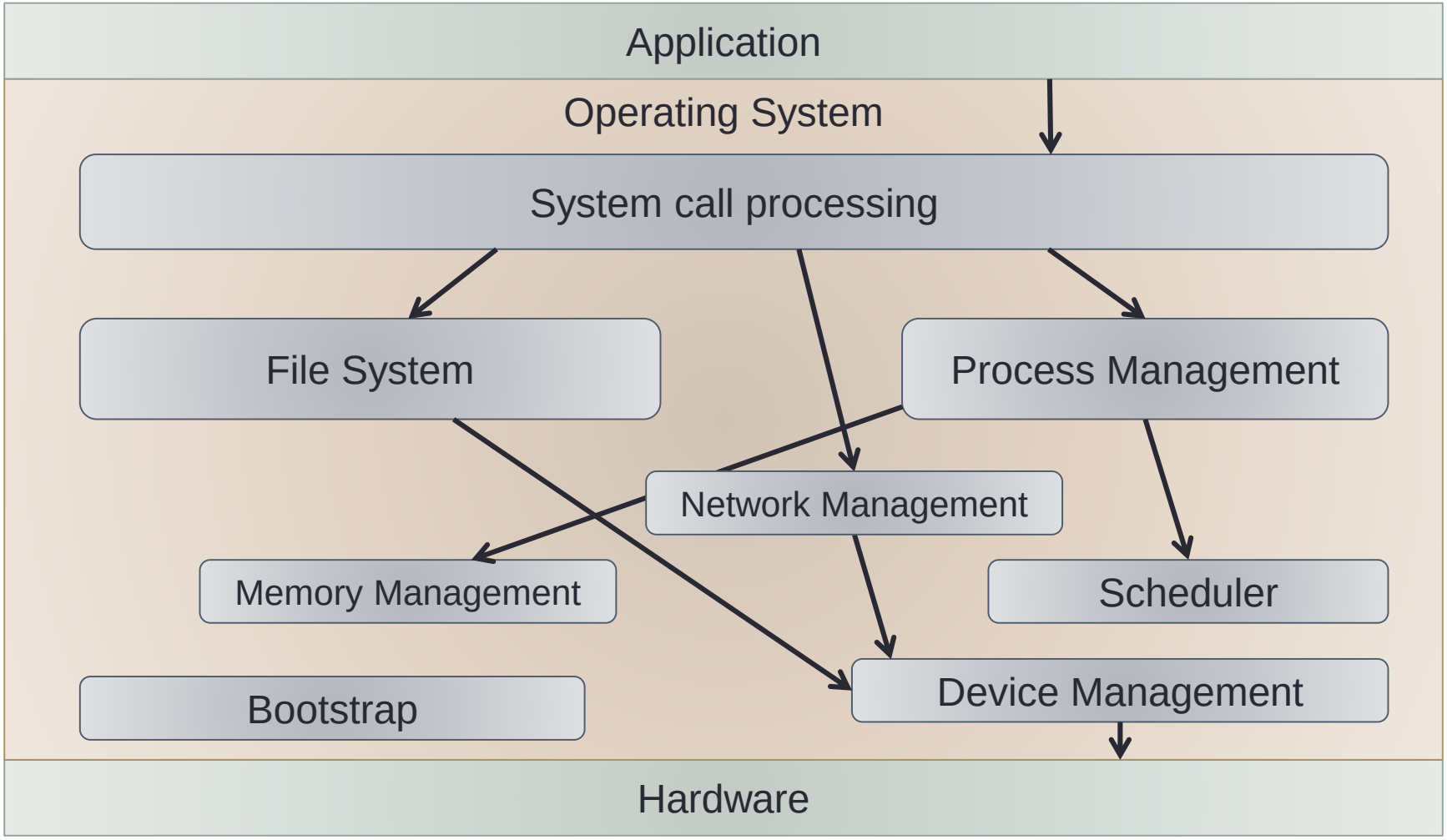
Communication among Programs

- Send data from one program to another
  - Pipe
  - Shared Memory
  - Semaphore
  - Lock





Operating System Structure



Summary

- Operating System
  - Hardware Arbitration
  - Separation of Programs
  - Multi-Programming
  - Memory Management
  - File system
  - Network system
  - Communication among Programs