CS270
Systems Software

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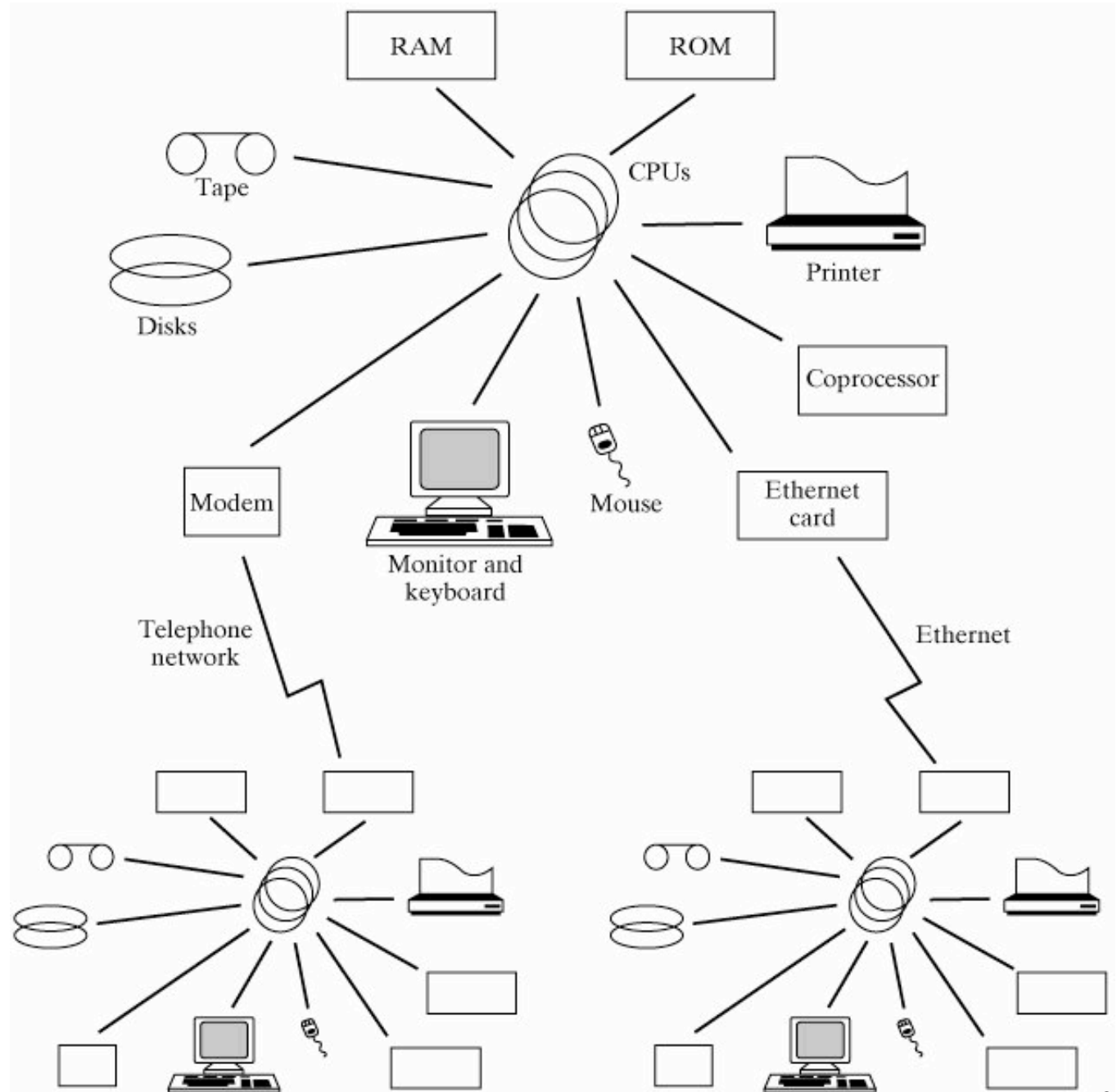
krings@uidaho.edu
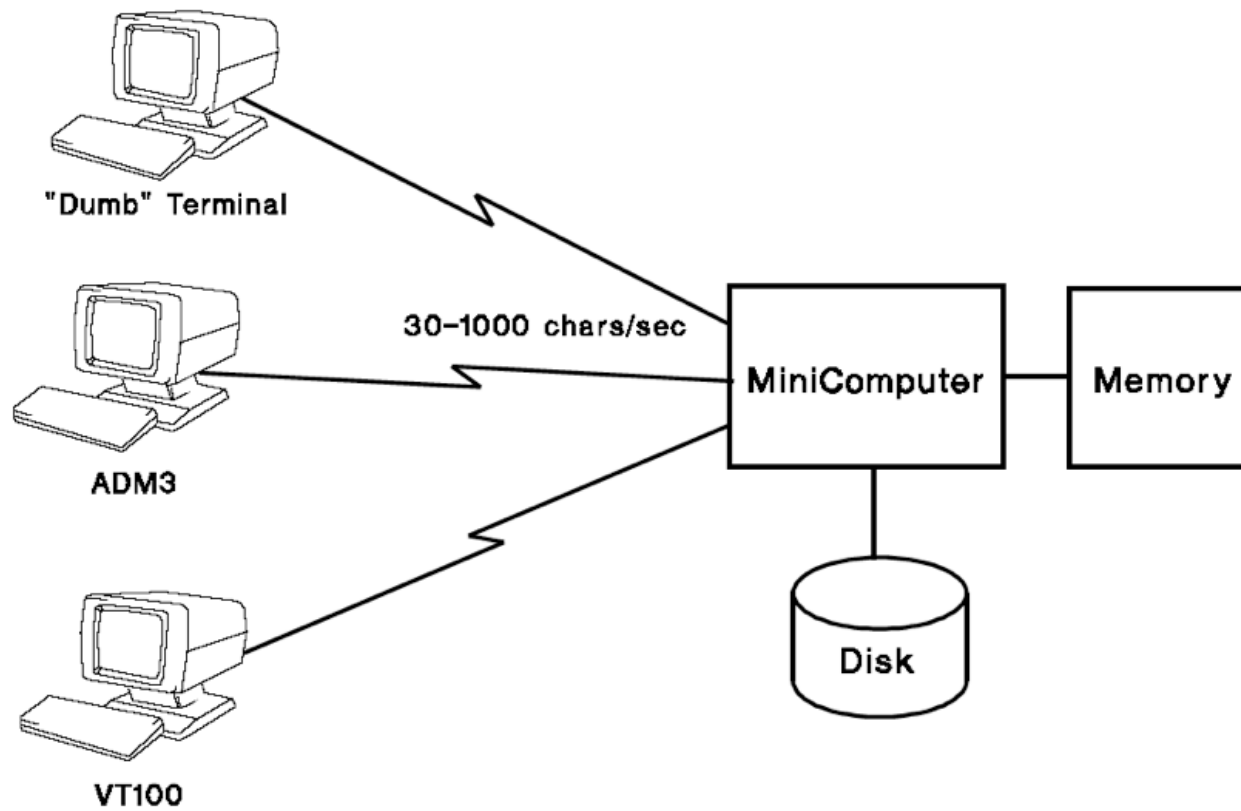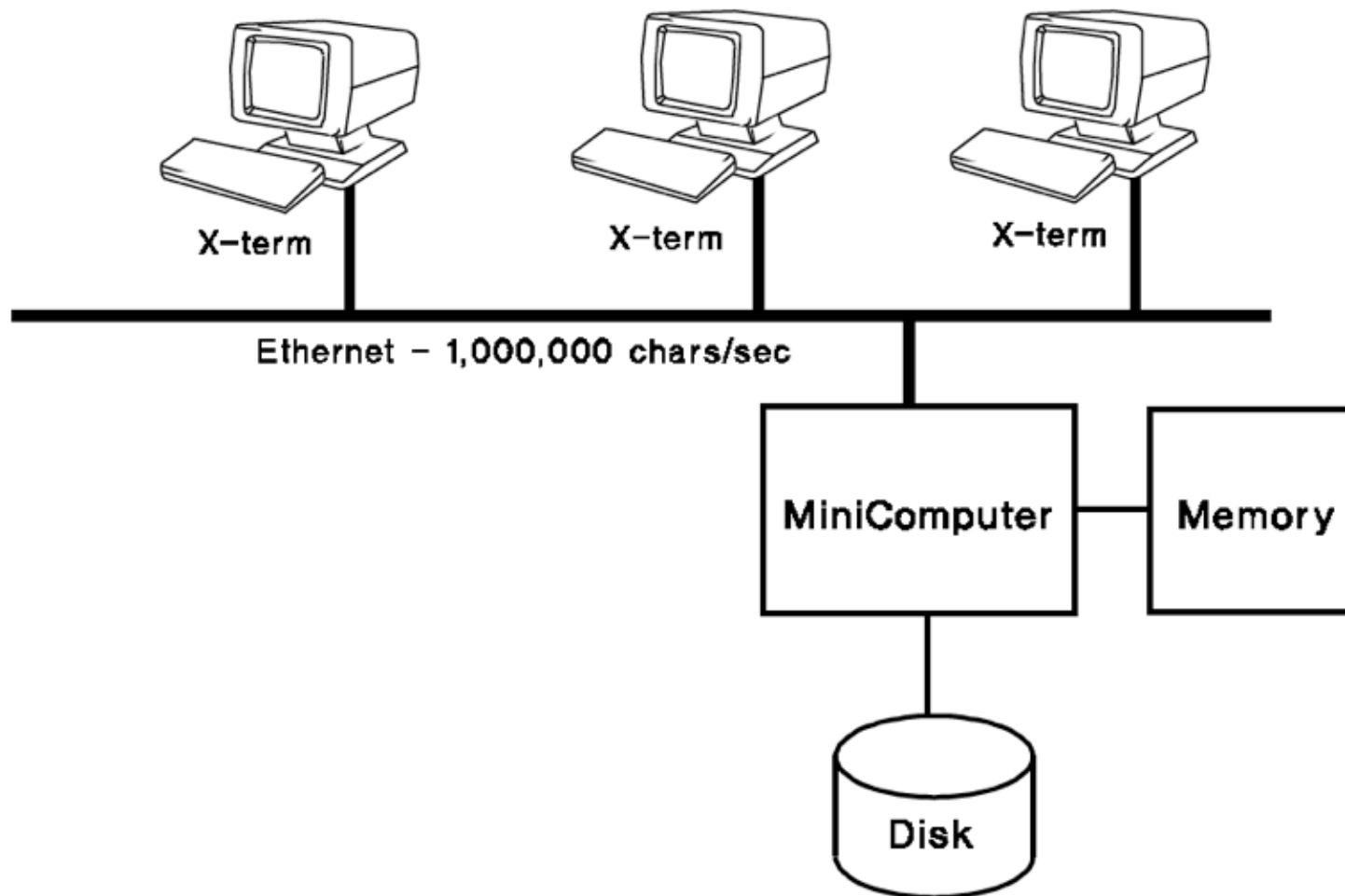
http://www.cs.uidaho.edu/~krings

Typical Computer System

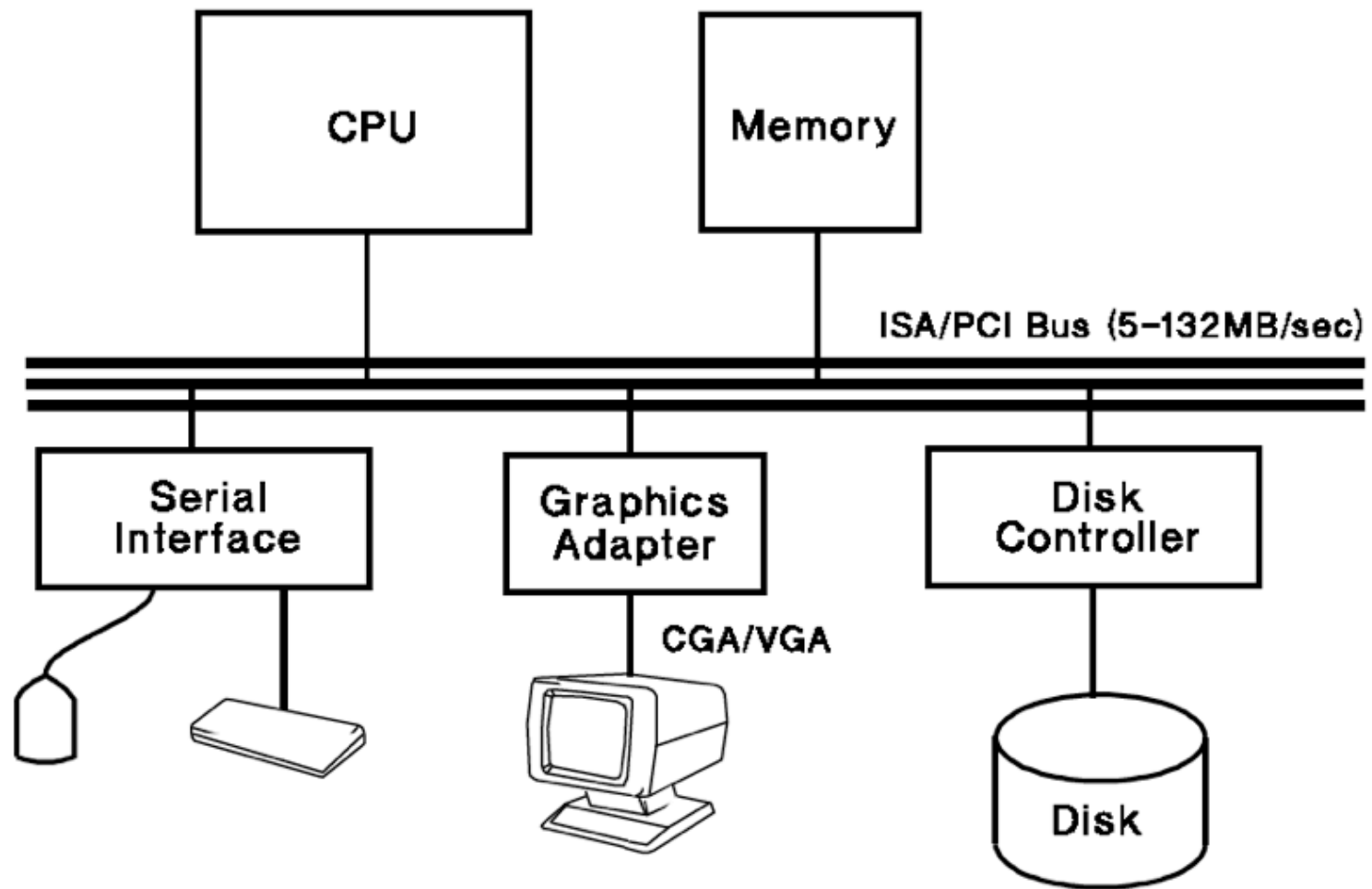**Hardware:**
CPU
Bus
RAM/ROM
Disk(s)
CD-ROM, DVD
Monitor
Graphics Card(s)
Keyboard
Mouse
Printer
Tape
Modem
Network int. NIC

"Dumb" Terminal

ADM3

VT100

30-1000 chars/sec

MiniComputer

Memory

Disk

3

X-term

X-term

X-term

Ethernet – 1,000,000 chars/sec

MiniComputer

Memory

Disk

CPU

Memory

ISA/PCI Bus (5-132MB/sec)

Serial Interface

Graphics Adapter

CGA/VGA

Disk Controller

Disk
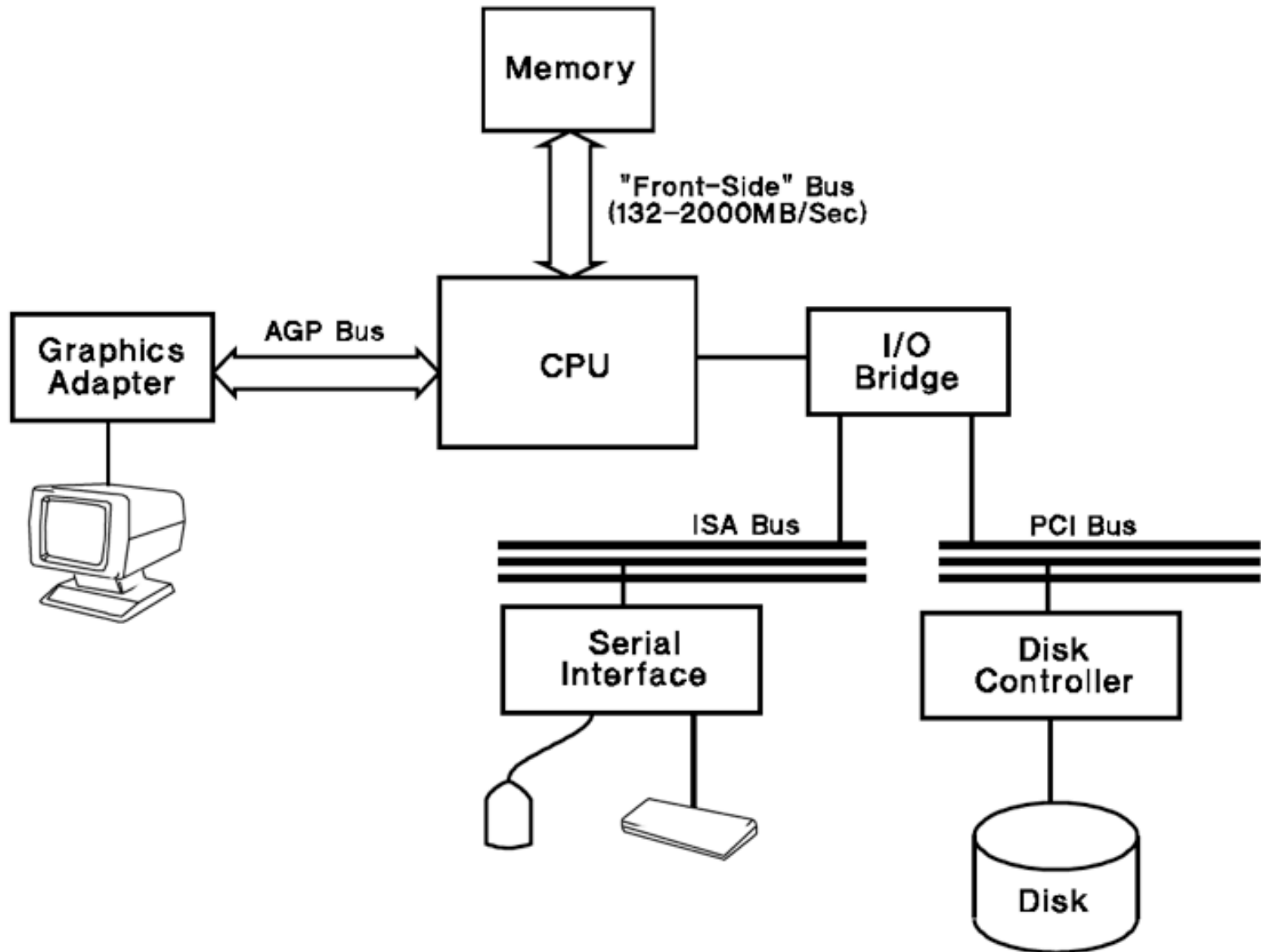
Operating System

- Exploits the hardware resources of one or more processors

- Provides a set of services to system users

- Manages secondary memory and I/O devices

Operating System

- Many different OSs
  - UNIX, Linux, OpenVMS, MacOS, Windows, DOS, ...

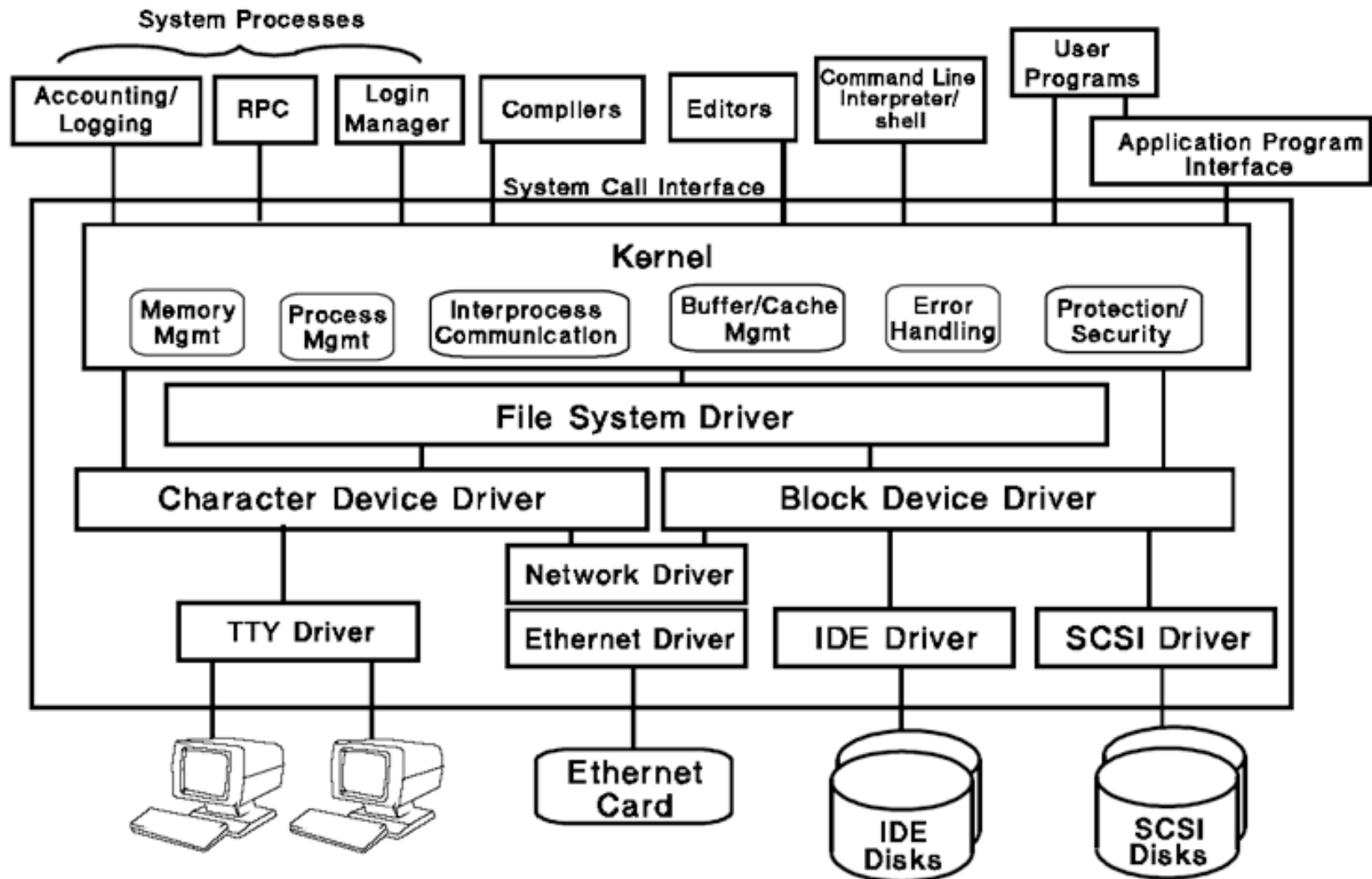- Different OS environments, e.g.
  - general purpose
  - real time
  - distributed

Operating System

- Linux kernel

  - part of the OS that is running

  - provided core capabilities and interfaces

- Running separately from kernel code

  - commands, editors programs, windowing system, etc.

Operating System Overview

System Processes

| Accounting/ Logging | RPC | Login Manager | Compilers | Editors | Command Line Interpreter/ shell | User Programs |

Application Program Interface

System Call Interface

Kernel

| Memory Mgmt | Process Mgmt | Interprocess Communication | Buffer/Cache Mgmt | Error Handling | Protection/ Security |

File System Driver

| Character Device Driver | Block Device Driver |

| TTY Driver | Network Driver |
| | Ethernet Driver | IDE Driver | SCSI Driver |

Ethernet Card

IDE Disks

SCSI Disks
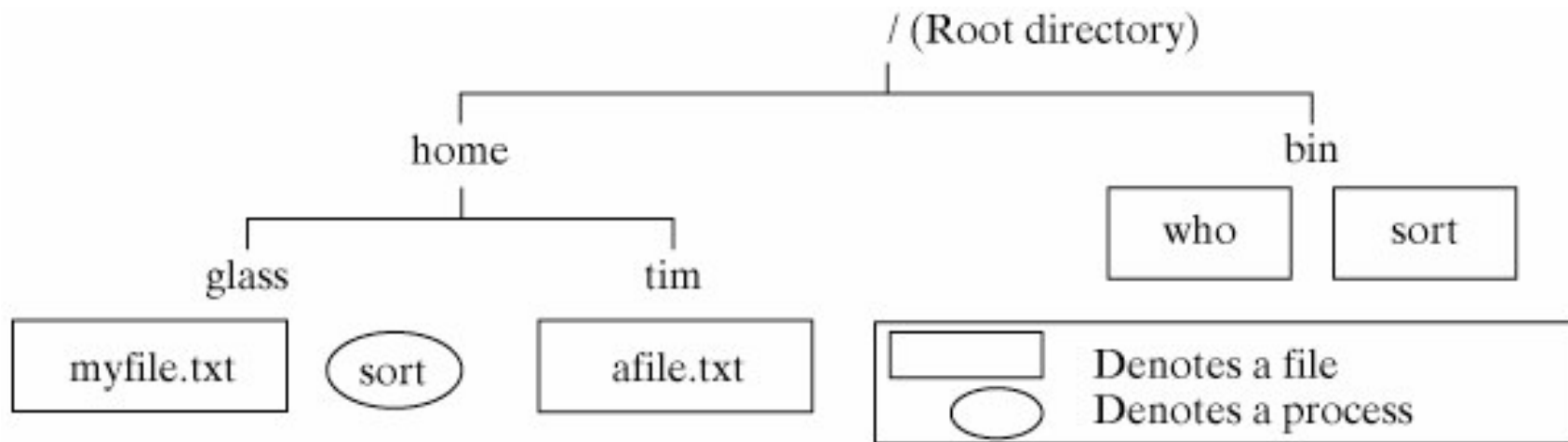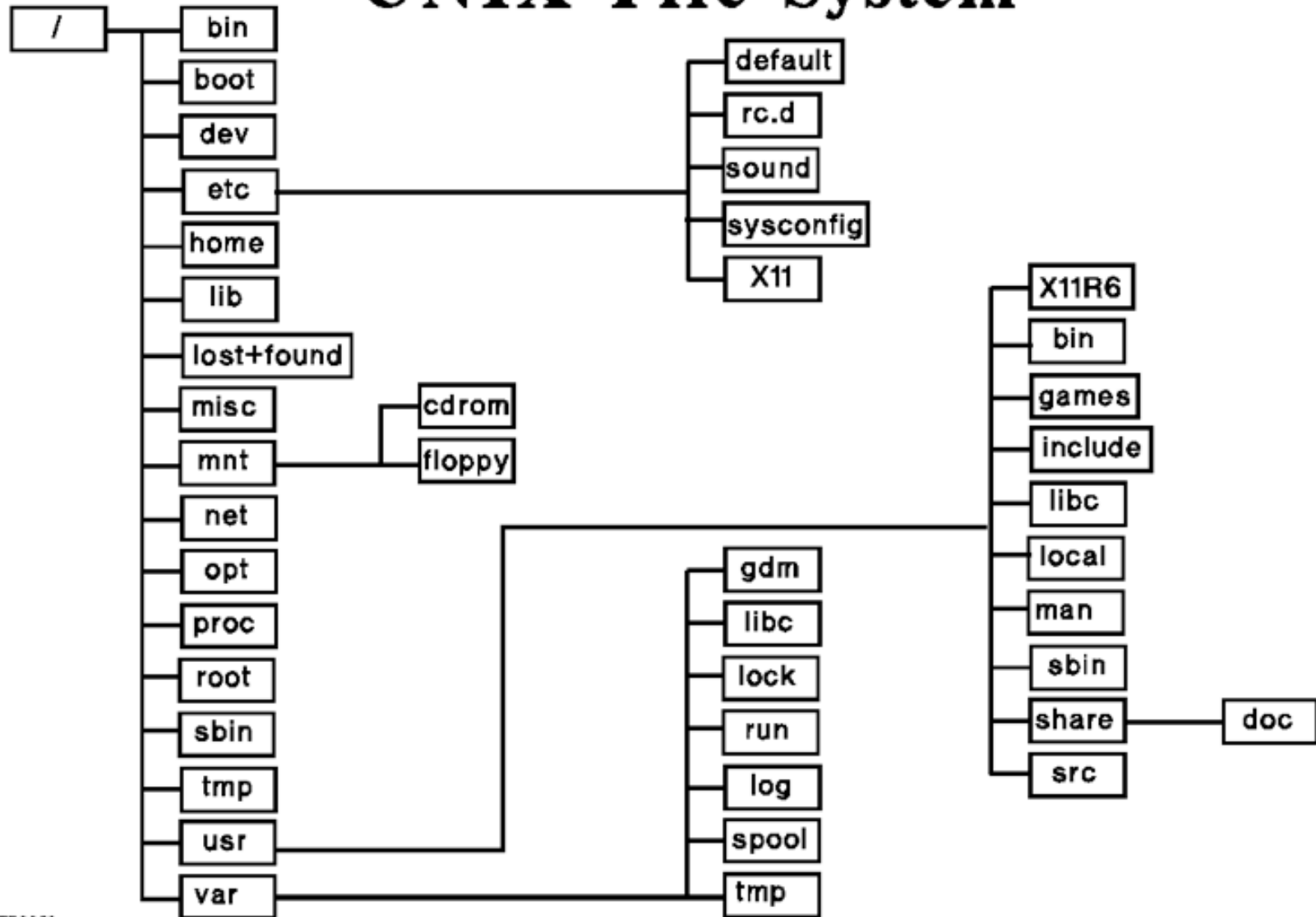
Software

- Hardware provides framework for executing programs and storing files

  - files, directories

  - program

  - start a program -- process

  - owner of file and process

  - protection against unauthorized access
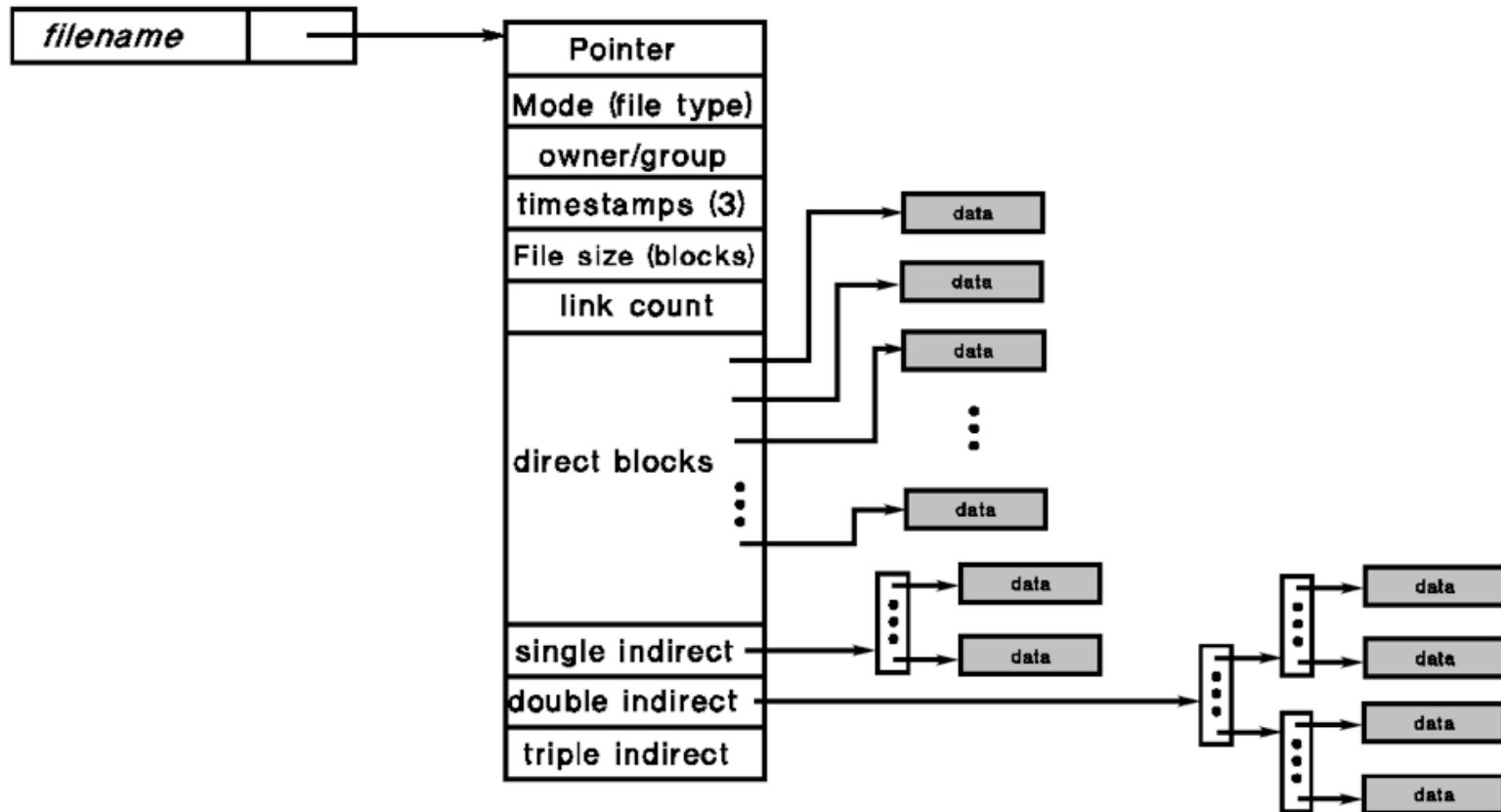
  - attributes

Directory Hierarchy

/ (Root directory)

home

glass

myfile.txt

sort

tim

afile.txt

bin

who

sort

Denotes a file
Denotes a process

UNIX File System

```
/ ─┬─ bin
   ├─ boot
   ├─ dev
   ├─ etc ──────────┬─ default
   ├─ home          ├─ rc.d
   ├─ lib           ├─ sound
   ├─ lost+found    ├─ sysconfig
   ├─ misc          └─ X11
   ├─ mnt ──┬─ cdrom
   ├─ net   └─ floppy
   ├─ opt
   ├─ proc
   ├─ root
   ├─ sbin
   ├─ tmp
   ├─ usr ──────────┬─ X11R6
   └─ var           ├─ bin
                    ├─ games
                    ├─ include
                    ├─ libc
                    ├─ local
                    ├─ man
                    ├─ sbin
                    ├─ share ── doc
                    └─ src

   var ──┬─ gdm
         ├─ libc
         ├─ lock
         ├─ run
         ├─ log
         ├─ spool
         └─ tmp
```

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UNIX i-node

Resource Sharing

- CPU
  - time-slicing
- Memory
  - paging
- Secondary Memory (disk)
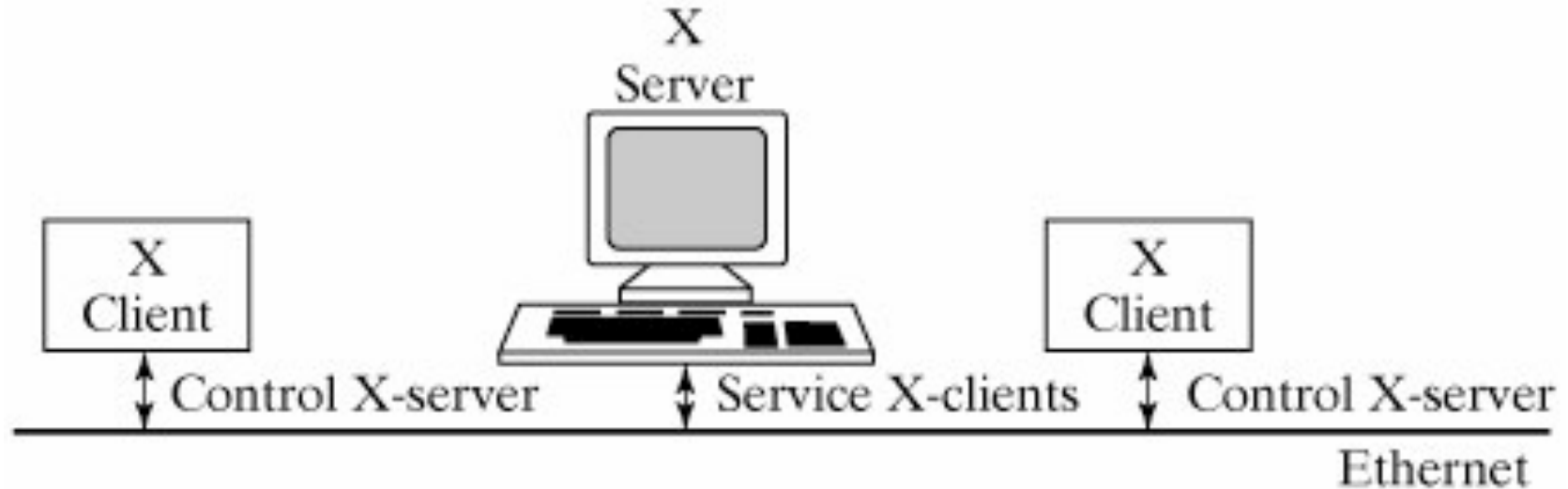 - blocks of equal size

Communication

- Not practical to work in isolation: communicate!

  - displaying: process to graphics card

  - input: keyboard or mouse

  - network: email, ftp

  - interprocess communication

  - ...

Communication

- Different mechanisms, e.g.,

  - pipe: from one process to another

  - socket: two-way high-speed data channel

X-server and X-clients

Standards

- Why do we need standards?

  - portability, portability & portability

  - POSIX 1003.1 is Unix and Unix-like OSs, maintained by IEEE and The Open Group

  - Linux implements POSIX standards

    - http://www.ieee.org

    - http://www.opengroup.org

    - http://www.unix.org

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