I233E Operating Systems

PRELIMINARY INFORMATION

RAZVAN BEURAN

About the Course

Topic

- Operating System (OS) concepts

Goals

- Understand typical problems in OSs
- Master essential mechanisms in OSs
- Become familiar with resource management

What it is NOT!

- How to use X or Y operating system
- Crash course in hacking

Course Overview

Concurrency

- Processes & threads
- Scheduling
- Resource sharing & synchronization

Memory management

- Main memory & virtual memory

Storage

- Mass storage & I/O
- File system

Other topics

- Security & protection
- Virtual machines

Contact / Resources

Instructor

- BEURAN Razvan (Information Science Bldg. 2, 7F, Room I-74b)

Teaching assistants

- NGUYEN Huynh Phuong Thanh & TAN Zheyu (**tutorial hours**)

Email

- i233e@ml.jaist.ac.jp

Online resources: JAIST-LMS

- Log in and select the course “I233E 2024 Operating Systems”
  - https://dlc-lms.jaist.ac.jp/moodle/course/view.php?id=3159
- View lecture slides, assignments, lecture recordings, discussions, etc.
- Materials on how to prepare the programming environment

Evaluation

Midterm exam

- Date: Tuesday, November 12, 13:30-15:10
- Topics: Concurrency (Lectures #1 – #6)

Final exam

- Date: Tuesday, December 3, 9:00-10:40
- Topics: All lectures

Assignments

- Every 1-2 weeks

Participation

- E.g., discussions, debate

60%	30%	*Midterm exam*
	30%	*Final exam*
40%	30%	*Assignments*
	10%	*Participation*

Policies

Tutorial hours: Tuesdays, 13:30 – 15:10

- Mandatory presence (part of the course)
- Interactive teaching & practical exercises

Absence

- With valid reason (job hunting, sickness, etc.)
- Must notify us in advance
- Presence at exams is compulsory

At exams

- All paper material is authorized (slides, books, your hand notes, etc.)
- PC/tablet OK only for looking at the lecture slides
  - No Internet browsing, no running your programs, no smartphone!

Policies (2)

Assignments

- Individual work (no collaboration with your colleagues)
- Use of generative AI is NOT allowed for any purpose

Plagiarism/Cheating

- No plagiarism of assignments is allowed
- All cheating will be dealt with harshly
  - Reduction of assignment score
  - Canceling of course grade
  - Other disciplinary measures

Lecture 1 Introduction

I233E OPERATING SYSTEMS

RAZVAN BEURAN

Today's Topics

Operating systems

- What they are
- Why they exist
- How they work

OS structure

- Process tree
- File system
- System calls
- Services

Questions

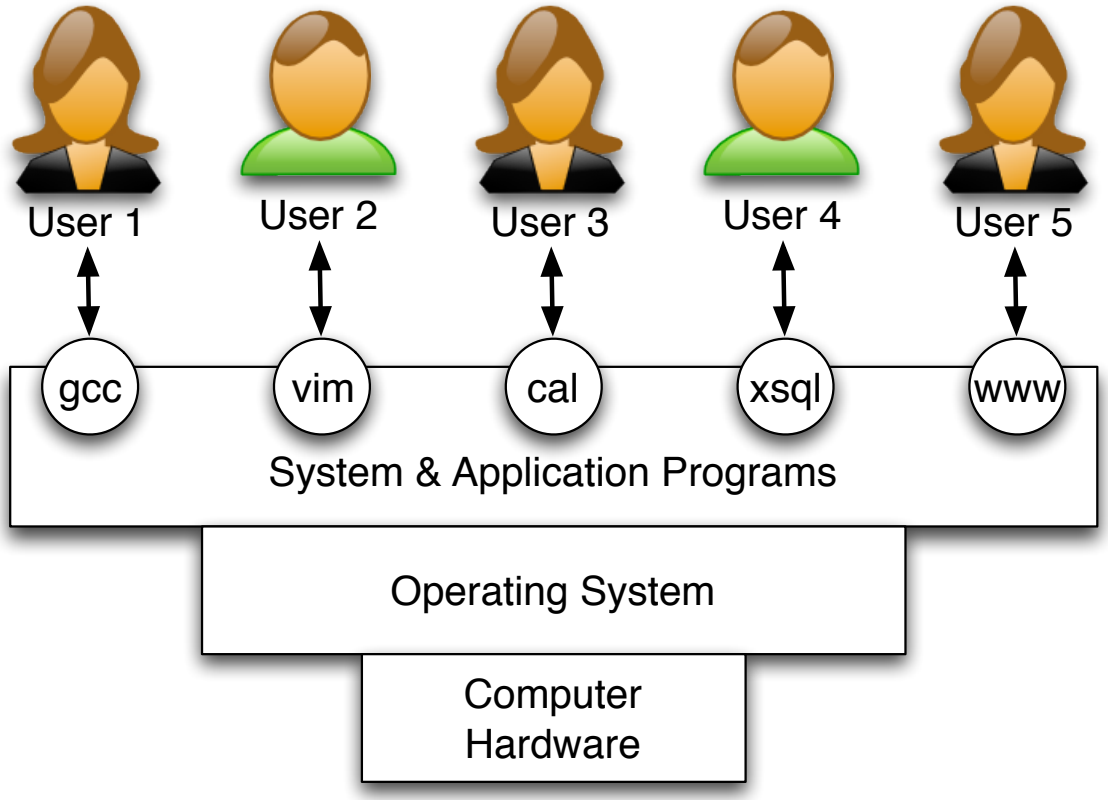
What operating systems do you know?

What is your favorite operating system (and why)?

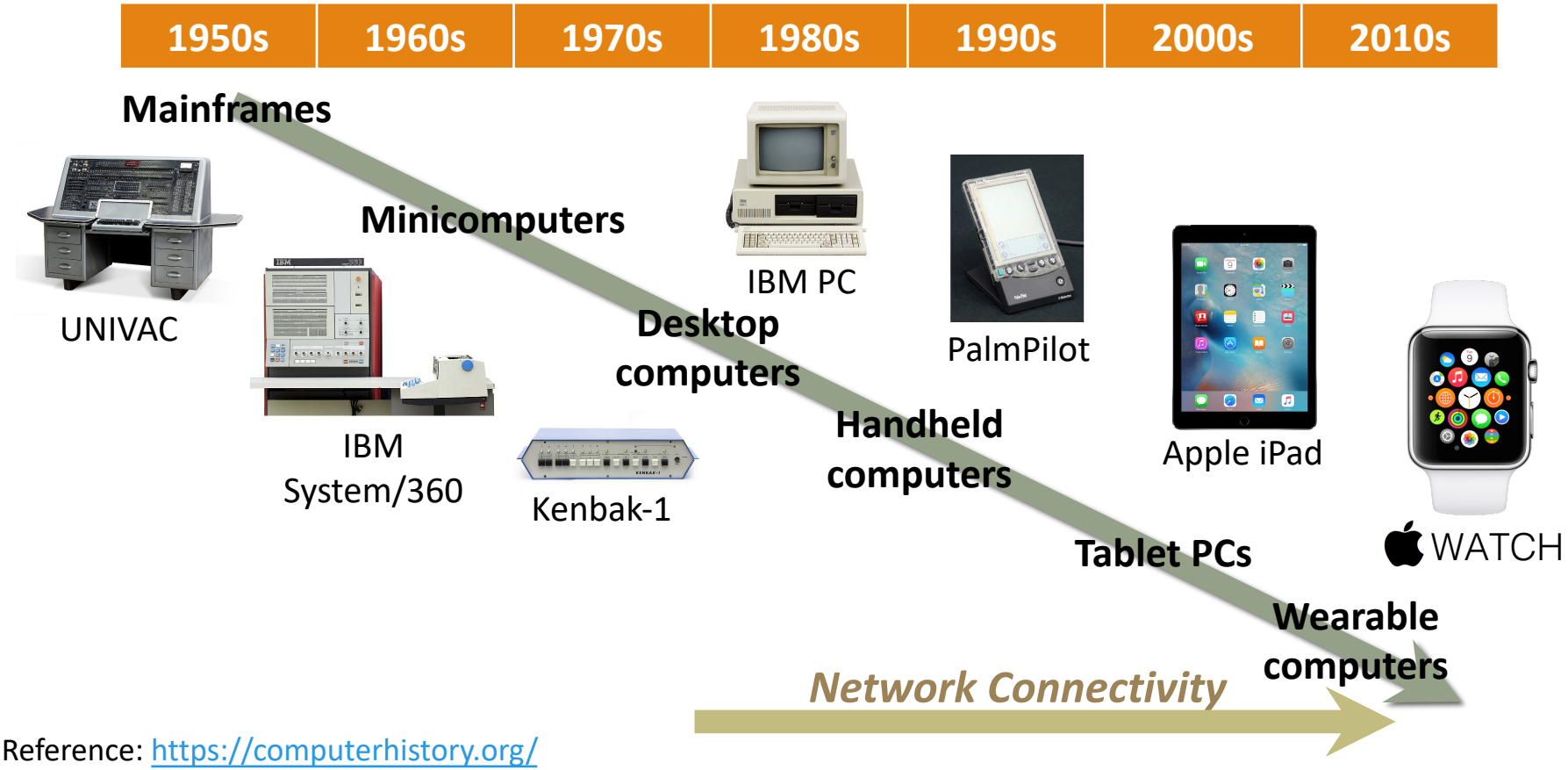
What is an operating system?

What do operating systems do?

Computer Components

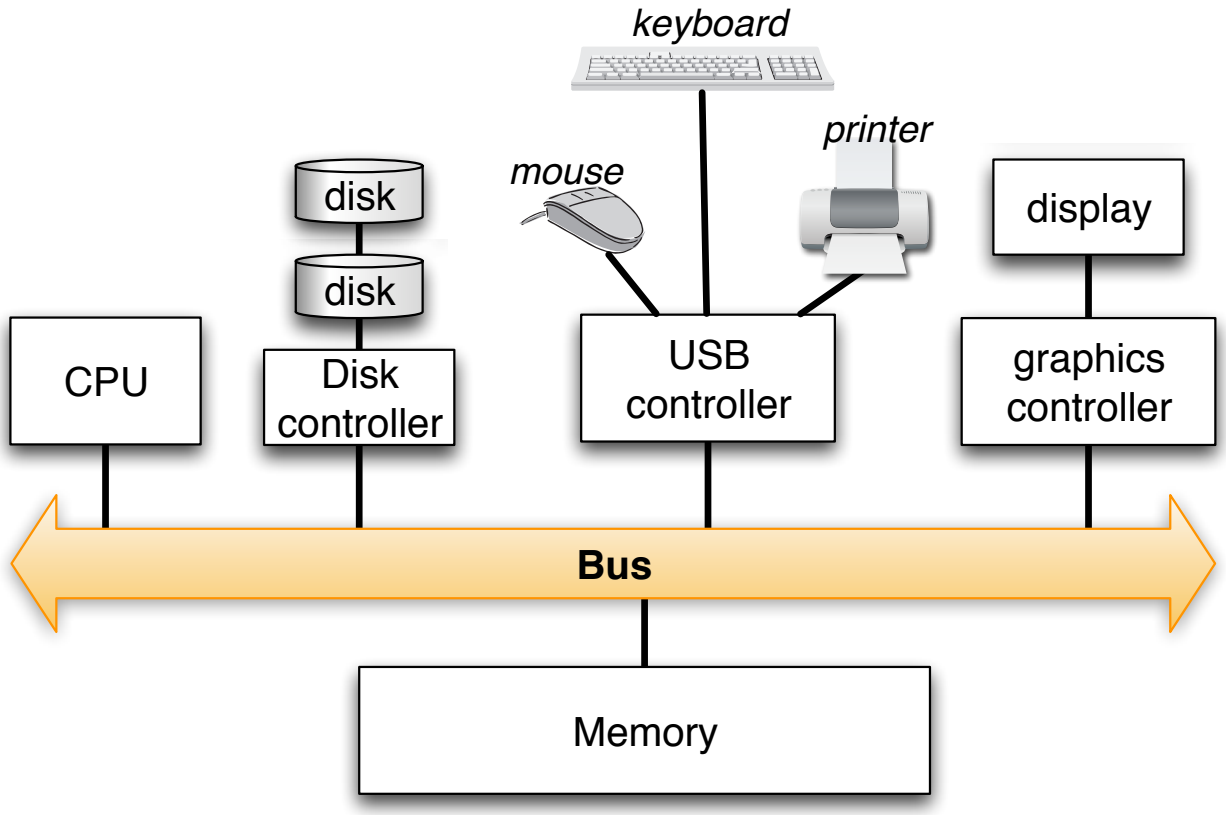


Feature Migration



Reference: https://computerhistory.org/

Computer System



Memory Hierarchy

Typical access time		Typical capacity
.25 nsec	Registers	<1 kB
2.5 nsec	Cache	<16 MB
100 nsec	Main memory	<64 GB
25 μs	Solid State Disk (SSD)	<1 TB
5 ms	Magnetic Disk (HDD)	<10 TB

Computer Operation

Step 1. Bootstrap

Step 2. Initialize devices

Step 3. Load OS

Step 4. Start “init” process

Step 5. Run-level programs

Step 6. Wait for events

Computer Events

Events are called interrupts

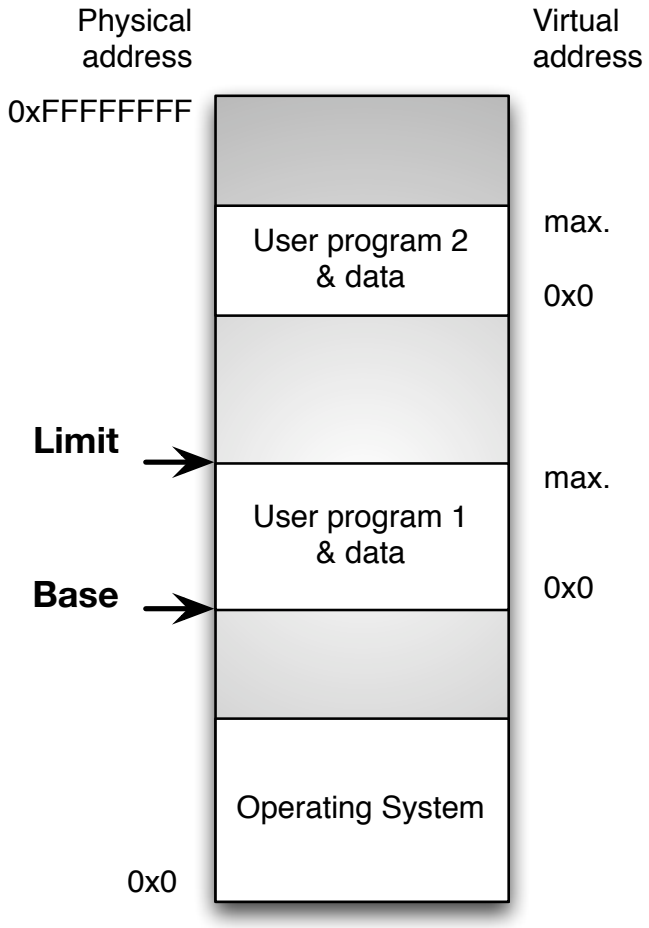
Hardware interrupts

- Events triggered by devices

Software interrupts

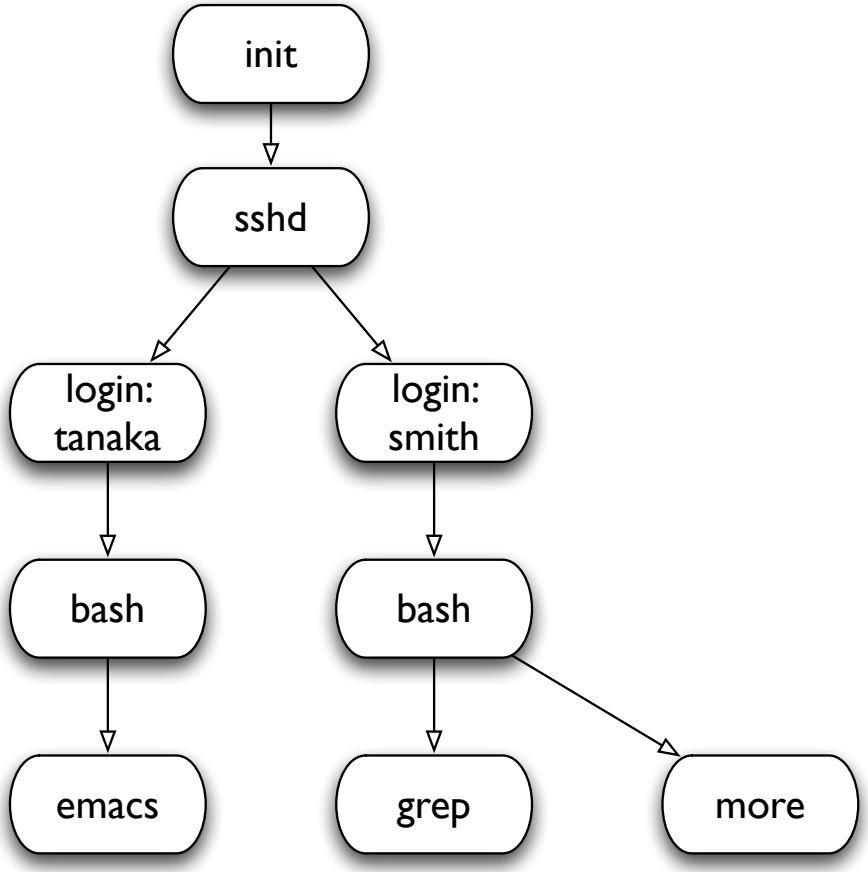
- CPU error
- Unauthorized operation
- System call

Memory Mapping

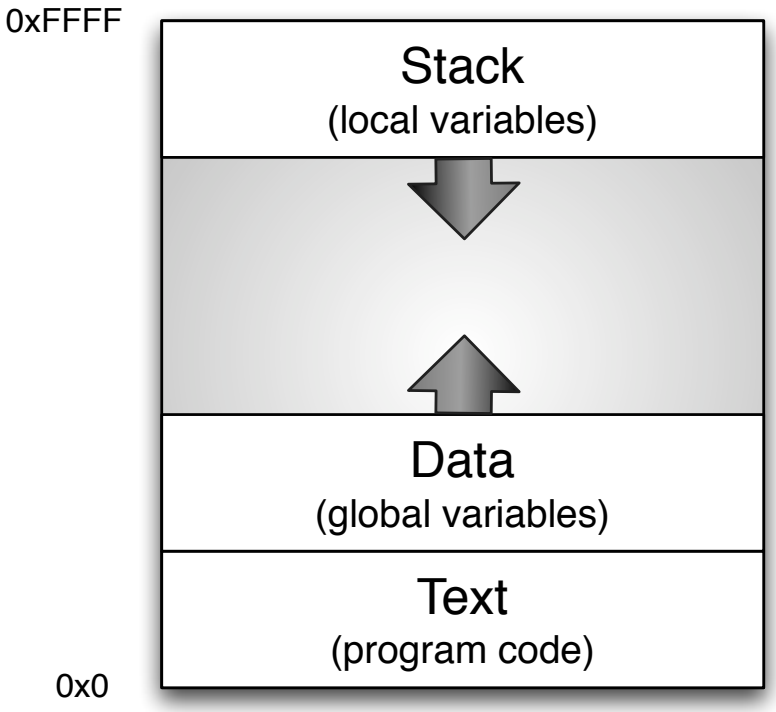


Operating System Structure

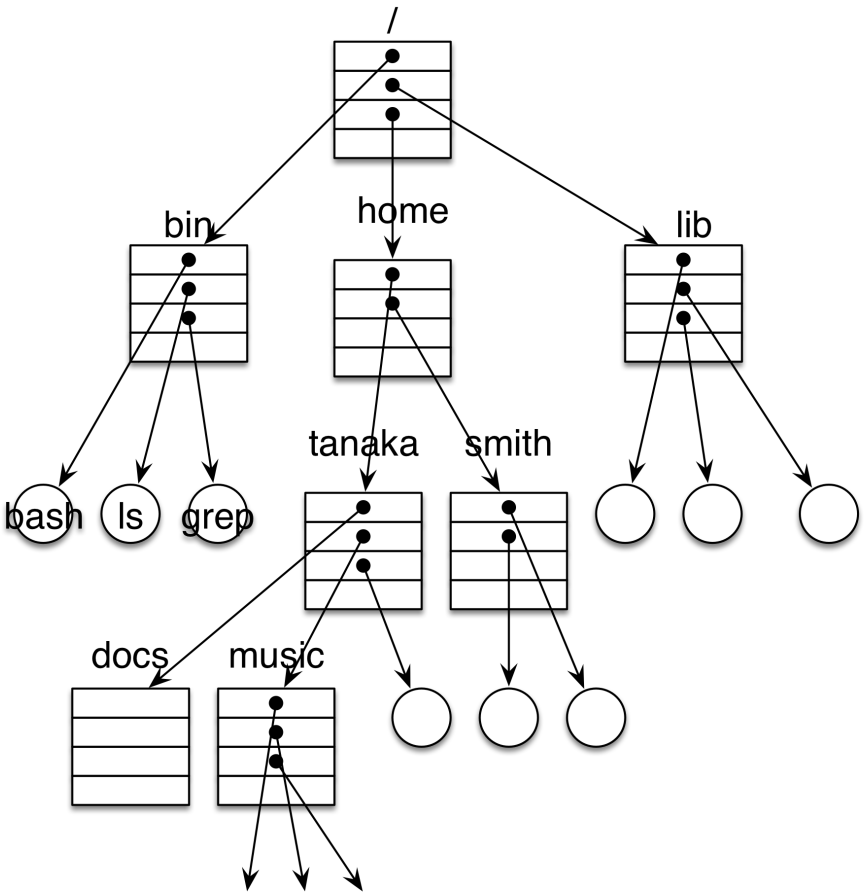
Process Tree



Process Memory Structure

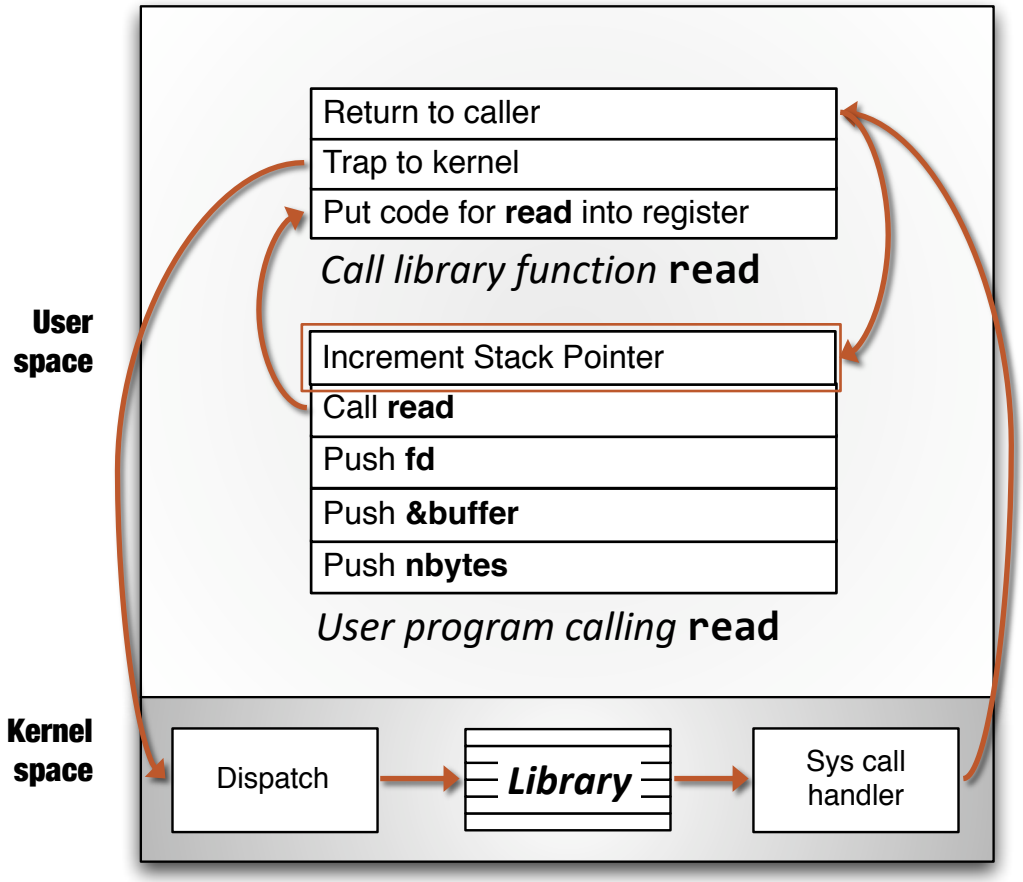


File System

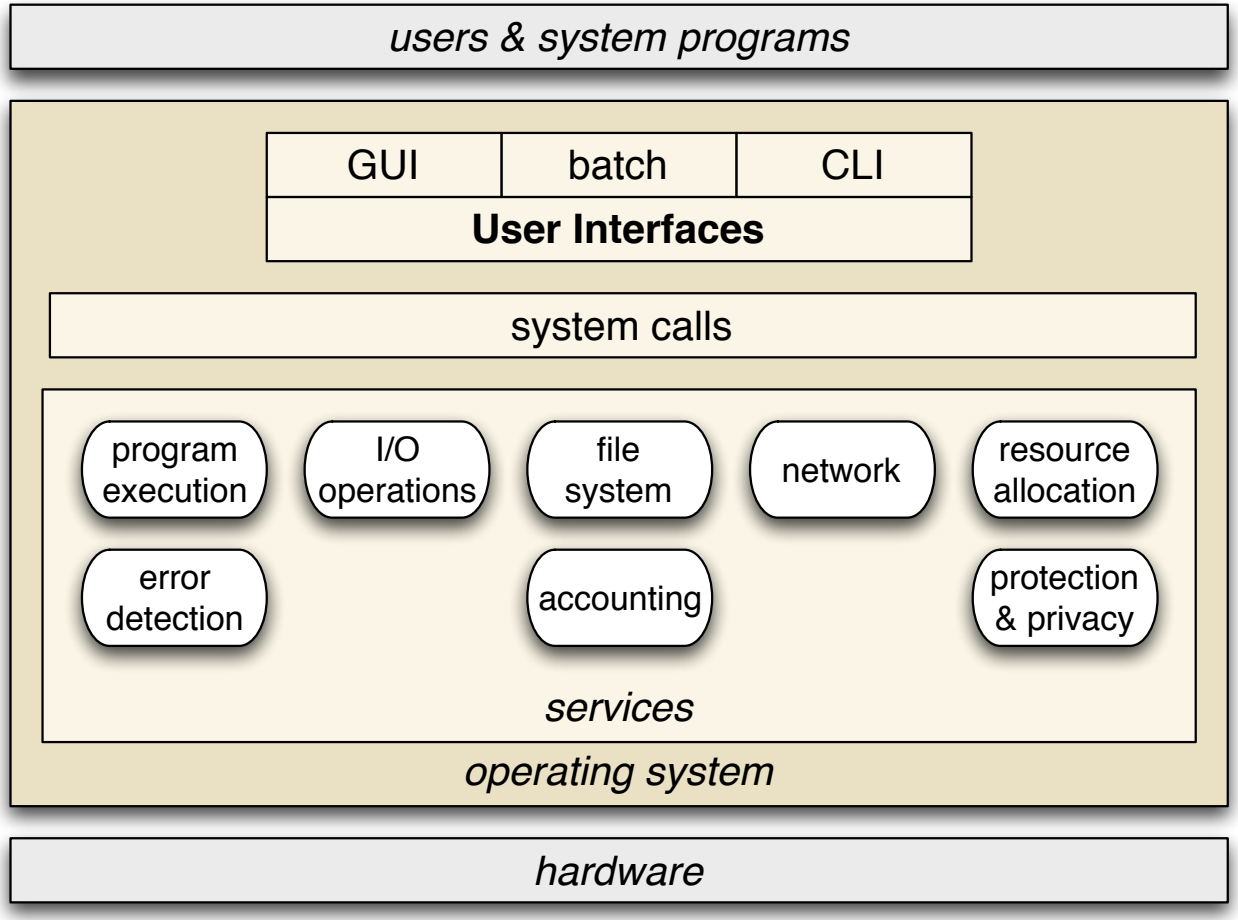


System Call

```
count = read(fd, &buffer, nbytes)
```



Operating Systems Services



Summary

Operating systems

- Needed to manage computers so that they can “serve” users
- Manage various components, such as CPU, memory, peripherals, etc.

OS structure

- Process tree to handle processes
- File system to handle files
- System calls serve as interface for user programs
- Services provide the desired functionality to user programs

Next Time

Processes

Operations on processes

Inter-process communication