Introduction and History

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COP 4610 Operating Systems

Who am I?

- Xin Liu
  - Assistant Professor in Computer Science, Florida State University
  - PhD in Computer Engineering, University of Maryland Baltimore County, 2022
  - Post-doctoral Research, Ohio State University, 2 years

  - **Research Focus**
    Next generation of edge networks (6G and beyond)

  - **Experience**
    Over 10 years of embedded system development experience

First Operating System

Window 1
1985

Window 3.1
1992

Window 95
1995

Window XP
2001

Window Vista
2006

Window 7
2009

Window 8
2012

Window 10
2015

Window 11
2021

...

Which was the first version of Windows you ever used?

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Reliability:
1. System Stability
2. Software Compatibility
3. Security
4. Data Integrity
5. Fault Recovery
...

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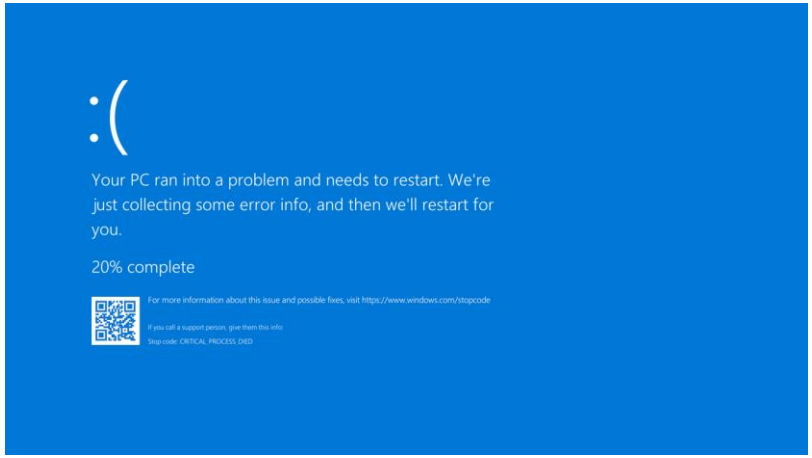

Blue Screen of Death

Other Classic Operating Systems

macOS

Linux

Windows

iOS

Android

Which operating systems are you using right now?

More Operating Systems

Which are the operating systems you are using right now?

What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware

- **Key Characteristics**:

  - **Program, Not Hardware**: The operating system is software that manages the hardware, not a physical component itself.

  - **Acts as an Intermediary**: It serves as a bridge between the user and the computer hardware, facilitating communication and resource management.

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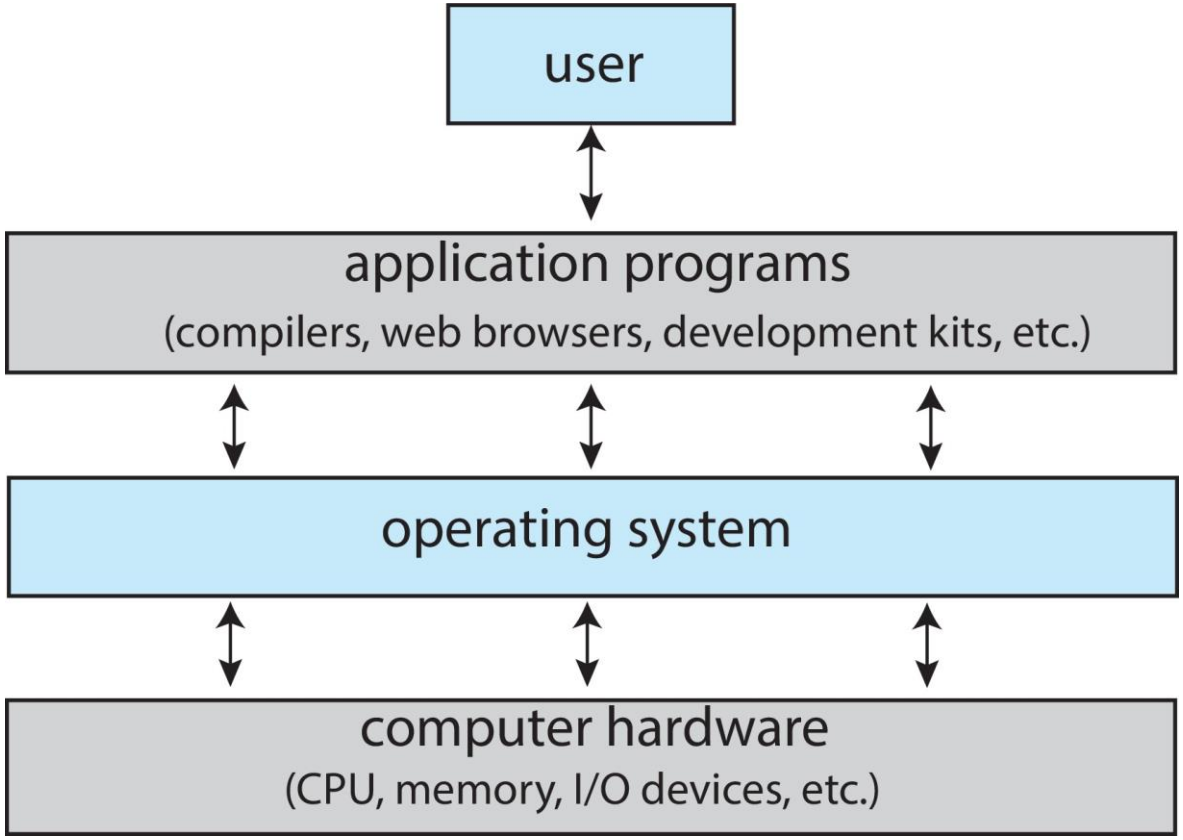
4. Users
   - People, machines, other computers

Abstract View of Components of Computer



Operating system goals:

- Execute user programs and make solving user problems easier
- Make the computer system convenient to use
- Use the computer hardware in an efficient manner

History Phase I: Hardware Expensive, Humans Cheap

- Hardware: mainframes
- OS: human operators
  - Handle one ***job*** (a unit of processing) at a time
  - Computer time wasted while operators walk around the machine room

IBM System/360

OS Design Goal

- Efficient use of the hardware
  - ***Batch system***: collects a batch of jobs before processing them and printing out results
    - Job collection, job processing, and printing out results can occur concurrently
  - ***Multiprogramming***: multiple programs can run concurrently
    - Example: I/O-bound jobs and CPU-bound jobs

History Phase II: Hardware Cheap, Humans Expensive

- Hardware: terminals

- OS design goal: more efficient use of human resources
  - ***Timesharing systems***: each user can afford to own terminals to interact with machines
  - The operating system could support multiple users simultaneously, each with their own terminal
  - Each user had an efficient and responsive experience, without the need for dedicated machines for each person

History Phase III: Hardware Very Cheap, Humans Very Expensive

- Hardware: personal computers

- OS design goal: allowing a user to perform many tasks at the same time
  - ***Multitasking***: a single user can run multiple programs on the same machine at the same time

  - ***Multiprocessing***: the ability to use multiple processors on the same machine

History Phase IV: Distributed Systems

- Hardware: computers with networks
- OS design goal: ease of resource sharing among machines
- E.g., cloud computing

History Phase V, VI, VII?

- AI As Operating System?

History of OS: Change!

		1980	2020	Factor
Speed	CPU	1 MIPS	88K MIPS	8.8×10^4
	Memory	500 ns	0.6 ns	8.3×10^2
	Storage	18 ms	300 ns	1.8×10^5
	Network	300 bits/sec	100 Gb/s	3.6×10^8
Capacity	Memory	64 Kbytes	3 TB	5.0×10^7
	Disk	1 Mbytes	16 TB	1.6×10^7
Cost	Per MIP	$100K/MIP	$0.0066/MIP	1.4×10^7
Other	Address bits	8	64	8
	Users/CPU	10s	0.01	1.0×10^{-3}

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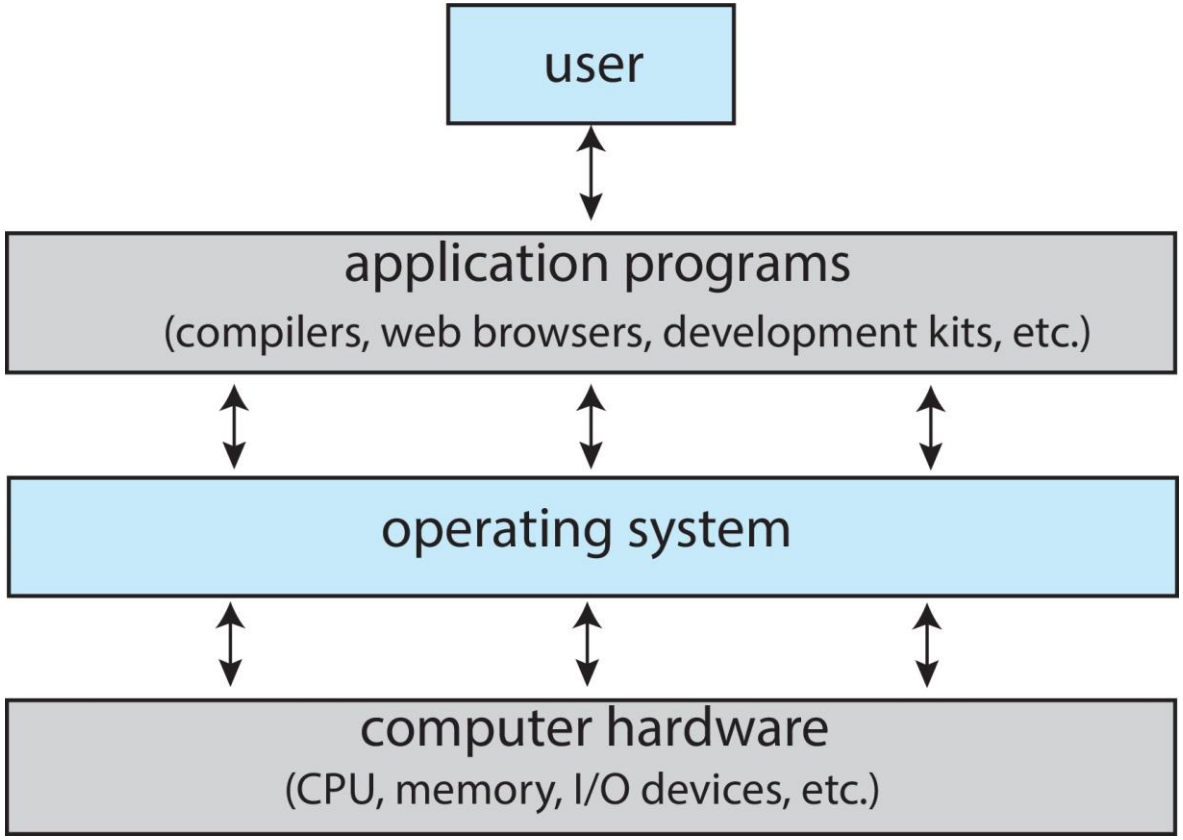

Hides the complexity and limitations of hardware from application programmers

Takeaways

- OS is a program that acts as an intermediary between a user of a computer and the computer hardware

- OS hides the complexity and limitations of hardware from application programmers

Syllabus Time

https://xinliulab.github.io/cop4610.html