

Class 1: Introduction

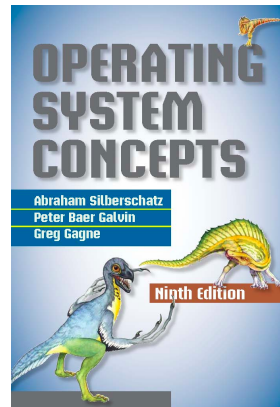
cs4414 Fall 2013
University of Virginia
David Evans

Image: Roger Halbheer

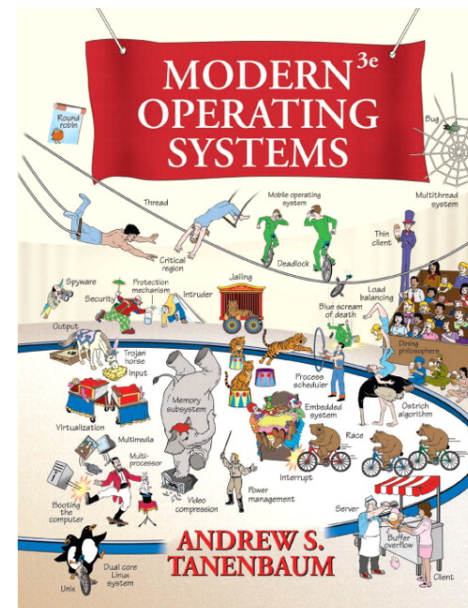
What is an Operating System?

1

An **operating system** is a program that manages a computer's hardware. It also provides a basis for application programs and acts as an intermediary between the computer user and the computer hardware. An amazing aspect of operating systems is how they vary in accomplishing these tasks. Mainframe operating systems are designed primarily to optimize utilization of hardware. Personal computer (PC) operating systems support complex games, business applications, and everything in between. Operating systems for mobile computers provide an environment in which a user can easily interface with the computer to execute programs. Thus, some operating systems are designed to be **convenient**, others to be **efficient**, and others to be some combination of the two.



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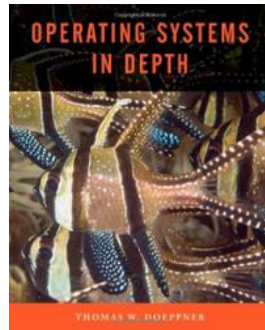


It is hard to pin down what an operating system is other than saying it is the **software that runs in kernel mode** – and even that is not always true. Part of the problem is that operating systems perform two basically unrelated functions: providing application programmers (and application programs, naturally) a clean abstract set of resources instead of the messy hardware ones and managing these hardware resources.

3

What's an operating system? You might say it's what's between you and the hardware, but that would cover pretty much all software. So let's say it's the software that sits between your software and the hardware. But does that mean that the library you picked up from some web site is part of the operating system? We probably want our operating-system definition to be a bit less inclusive. So, let's say that it's that software that almost everything else depends upon. This is still vague, but then the term is used in a rather nebulous manner throughout the industry.

Perhaps we can do better by describing what an operating system is actually supposed to do. From a programmer's point of view, operating systems provide useful abstractions of the underlying hardware facilities. Since many programs can use these facilities at once, the operating system is also responsible for managing how these facilities are shared.



4

An operating system (OS) is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is an essential component of the system software in a computer system. Application programs usually require an operating system to function.



5

cs4414 OS Definition

An **operating system** is a program that:

Manages Resources

How do you share processors, memory, and other hardware devices among programs?

Provides Abstractions

How do you provide programs with clean and easy to use interfaces to resources, without sacrificing (too much) efficiency and flexibility?

6

Does it have an Operating System?

7



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- ✗ Manage Resources
- ✓ Provide Abstractions

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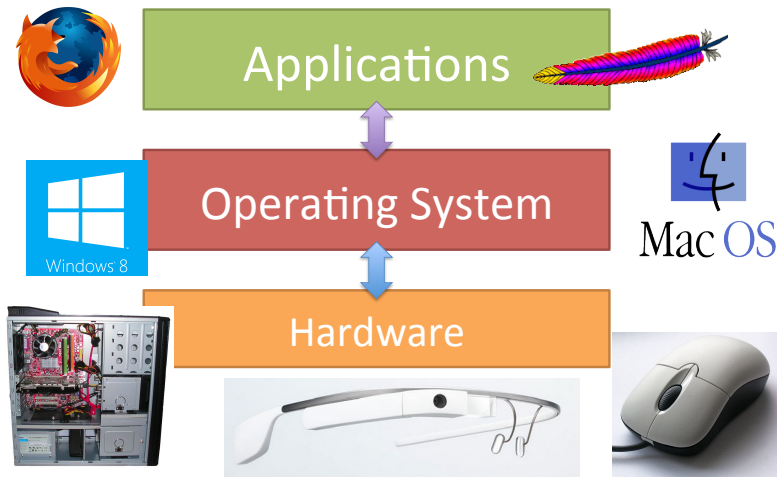


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Simplistic View of Computing Systems



More Realistic View

Main Ideas in cs4414

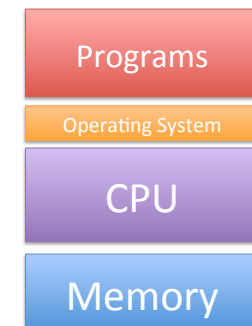
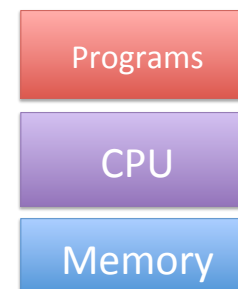
Managing Resources

How do you share processors, memory, and hardware devices among programs?

Providing Abstractions

How do you provide programs with clean and easy to use interfaces to resources, without sacrificing (too much) efficiency and flexibility?

What is the minimal hardware support needed for an operating system (that can manage resources)?



Content of the Course

Problem Sets: *systems* programming

Not in supervisor mode:

above the level of the “operating system”

Breaking into abstractions that are provided
by OS or libraries

Classes: understanding more of what is going on
underneath

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Charge

- Do everything on the Class 1 notes **Action Items** before midnight tomorrow
 - Student survey
 - Office hours poll
 - Setup your student github account
- Next class:
 - Brief history of operating systems
 - Introduction to Rust
 - Course syllabus questions

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