Operating Systems

Will Scott

Logistics

Schedule / Course Materials:

https://wills.co.tt/os

Structure:

- Lectures / Reading
- Projects
- Homework / Exams

Logistics

Me

Background in Networks, Systems, Security

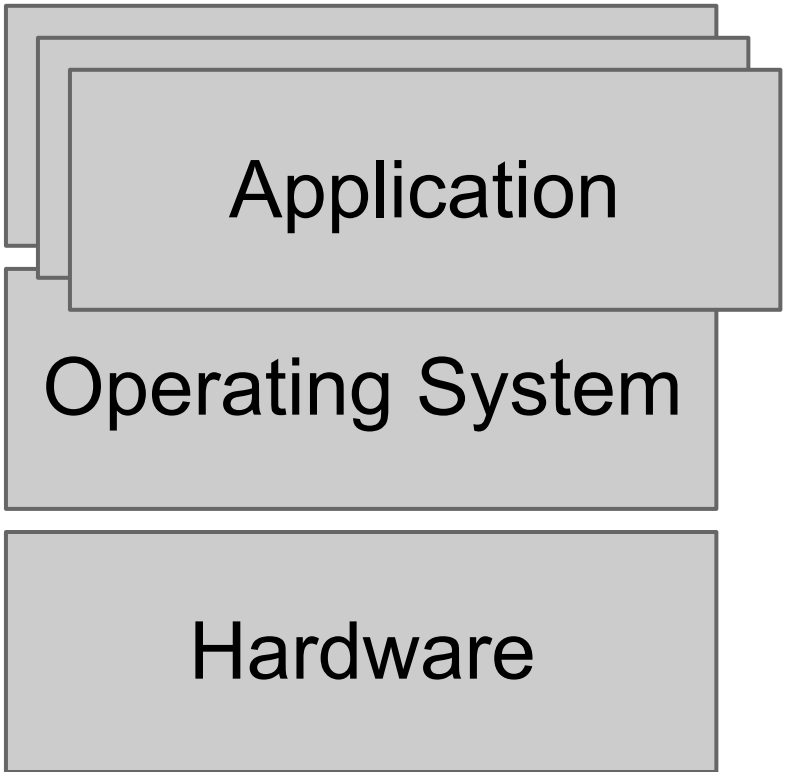
Worked at Google, Startups

Studied in China

Like to Bike, Ski

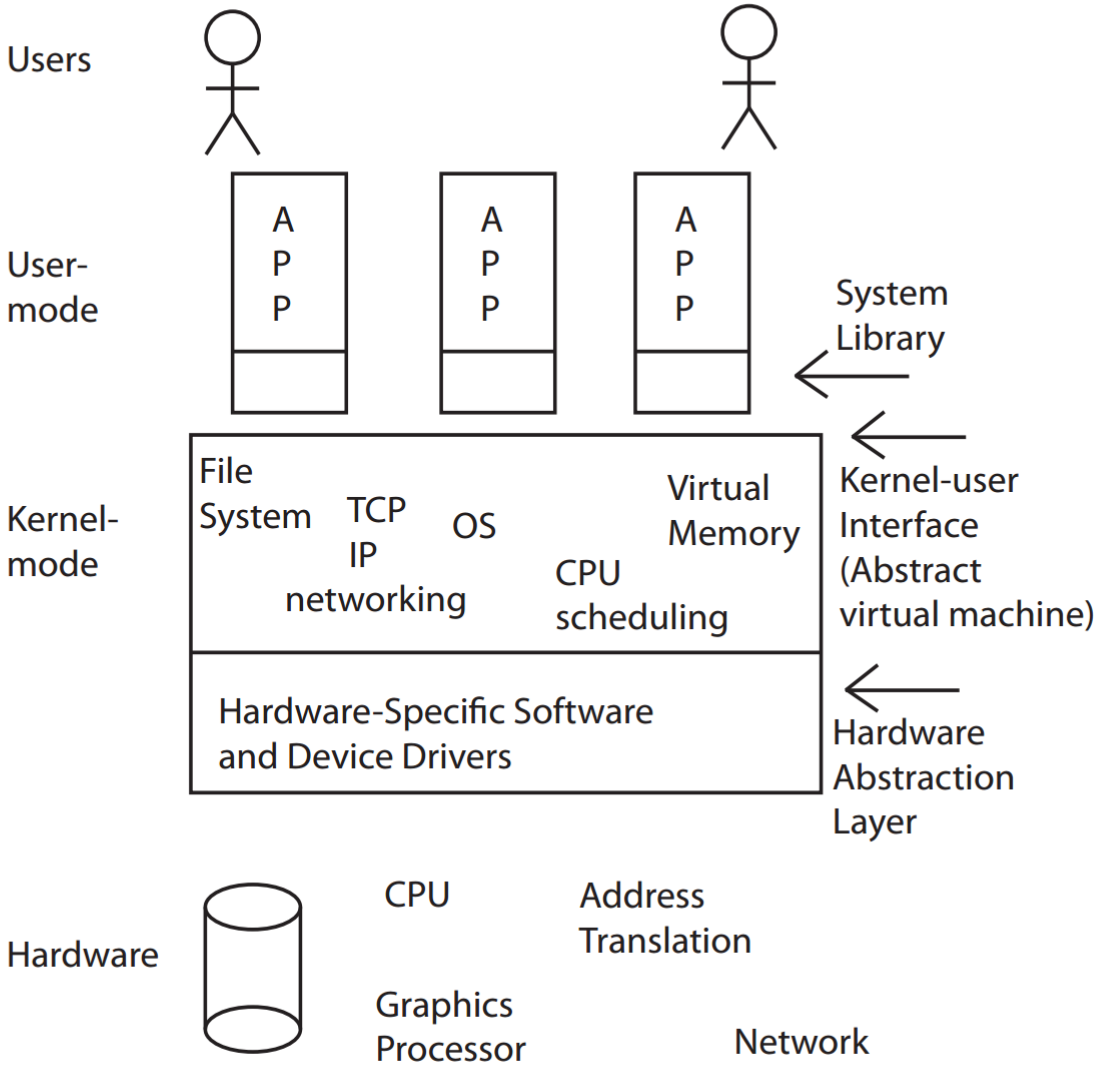
Operating Systems

Interface to the hardware



What is an operating system?

- Software to manage a computer's resources for its users and applications



Operating Systems

Referee

Illusionist

Glue

Thought Question

What do we need from the hardware to:

- Isolate applications from each other
- Isolate applications from each other's files.

Evaluation

How can we evaluate operating systems?

Linux

Started by Linus Torvalds in 1991

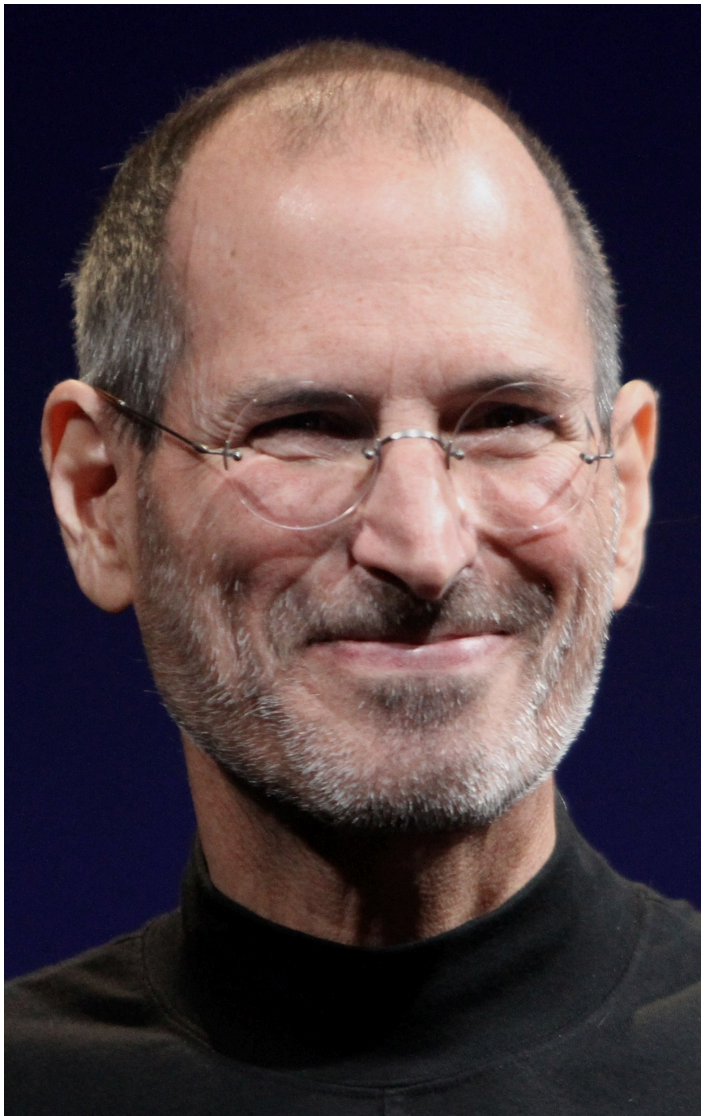
Most popular server and mobile operating system

Windows

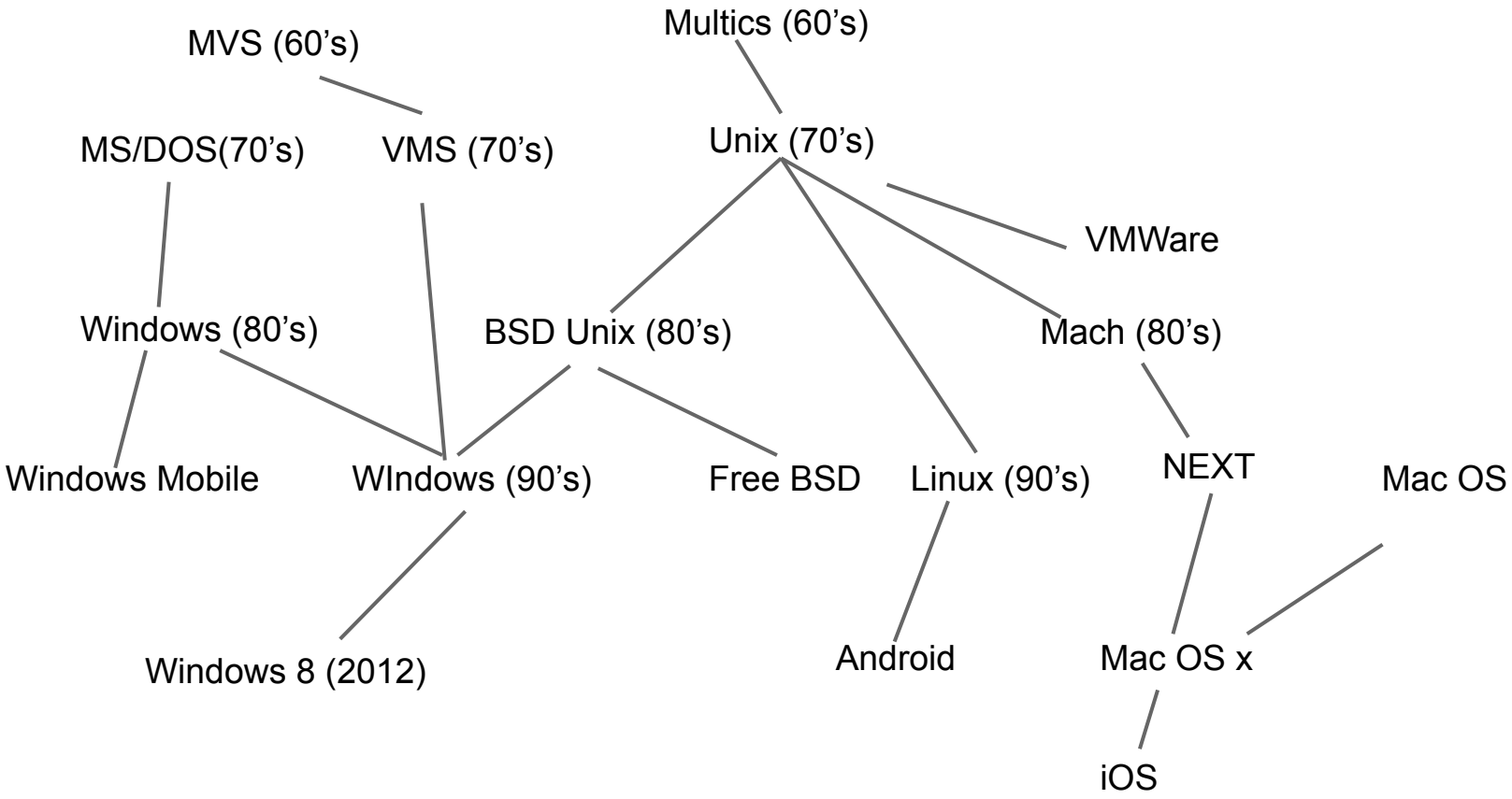
- Announced 1983
- A Windows NT core operating system remained largely stable from '90s until Windows 8 (2012)

MacOS

- Custom OS until Mac OS 9 (~2000)
- Mac OS X is derived from NeXT / BSD



OS Genealogy



What Has Changed?

	1981	1996	2011	Factor
MIPS	1	300	10000	10k
MIPS/$	$100k	$30	$0.5	200k
DRAM	10MB	128MB	10GB	100k
Disk	10MB	4GB	1TB	100k
Internet	9.6kbps	256kbps	5mbps	500
LAN	3Mbps	10Mbps	10Gbps	3k
Users/Device	100:1	1:1	1:several	100+

Part 2

OS Roles

- Referee
- Illusionist
- Glue

Other Domains

- Cloud computing
- Web Browsers
- Media Players
- Databases
- Parallel Applications
- Internet

Evaluation

- Reliability
  - Mean time to failure
  - Mean time to repair
- Security
- Portability
- Performance
  - Efficiency, Overhead
  - Fairness
  - Responsiveness
  - Predictability
- Adoption

OS Questions

- How should an operating system allocate processing time between users?
  - To the first to arrive?
  - To the one who needs the least resources?
  - The one who needs to most resources?
- What about allocation of memory?
- What about allocation of disk?

Taxonomy

- Desktops and Laptops
  - Single user. Many Applications
- Smartphones
  - Single user. Untrusted Applications
- Embedded Systems
  - Task Specific
- Servers
  - Single application. Hostile environment
- Virtual Machines
- Server Clusters

Shell Commands

ls - list (ls -l shows ‘long form’ listing)
pwd - present working directory (where am I?)
cd - Change Directory
mv - Move file or directory
rm - remove file
touch - create empty file
mkdir - make directory
file - show information about a file
vi / vim / nano / pico / emacs - edit a file

Homework for next lecture

1. Suppose you needed to design an extremely reliable Operating System. What techniques would you use? what tests would you implement?

2. Managing Resources is also a problem for societies. What techniques do we have for allocating resources, isolating misuse, and fostering sharing?