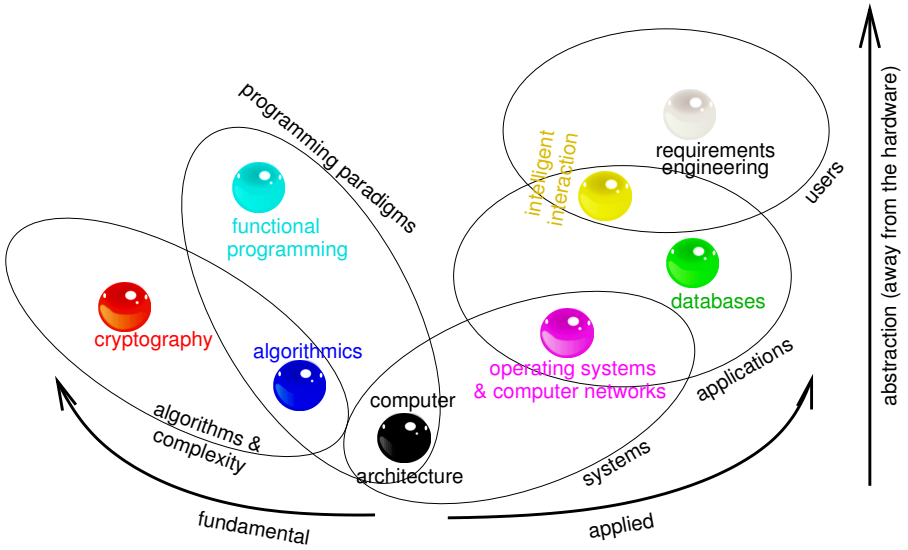
Pearls of Computer Science

Introduction to operating systems

(and networks)

Pieter-Tjerk de Boer

Pearl 101: operating systems and networks



Pearl 101: operating systems and networks

What are we going to do this week?

- Operating systems
  - 1h lecture (now)
  - 1h movie (later today; about Linux and open source)
  - pearl assignment: measuring multitasking
- Networks
  - <2h lecture (tomorrow)
  - 2h tutorial: delay calculations (Thursday 1+2)
  - pearl assignment: observing network traffic
- test (Friday afternoon)

This week's pearl assignments are not about *building* or *designing*, but about *researching*.

A bit of history

- At the dawn of the computer age: "jobs" were fed to the computer by a human, one after the other.
- Later: working interactively, with a screen (or printer) and a keyboard. One person at a time!
- Later again: multitasking. Multiple persons simultaneously, interactively.

Simultaneously??

Can a computer run multiple programs at the same time?

- If it has multiple processors (or “cores”): yes, 1 per processor.
- If it has only one processor: not really, but almost:
  alternately execute instructions of one and of the other program.

This switching back and forth between programs, is done by yet another program: the *operating system*.

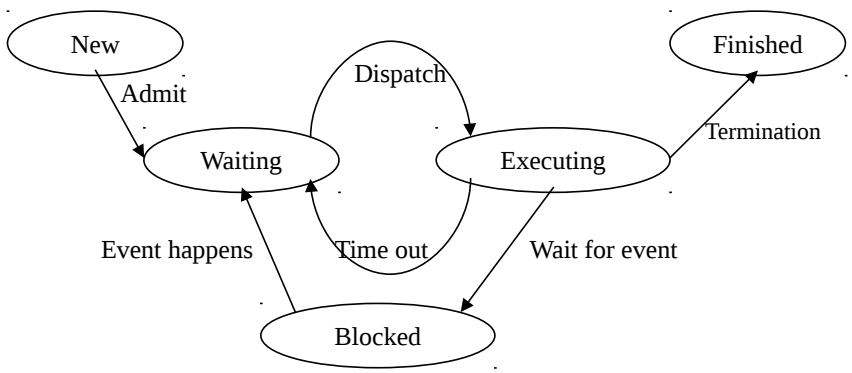
Tasks

Main tasks of the operating system:
managing computer hardware and connected peripheral equipment.

Some aspects of this:

- process management
- memory management
- file management
- input and output
- protection
- communication (via the network/Internet)

Process management



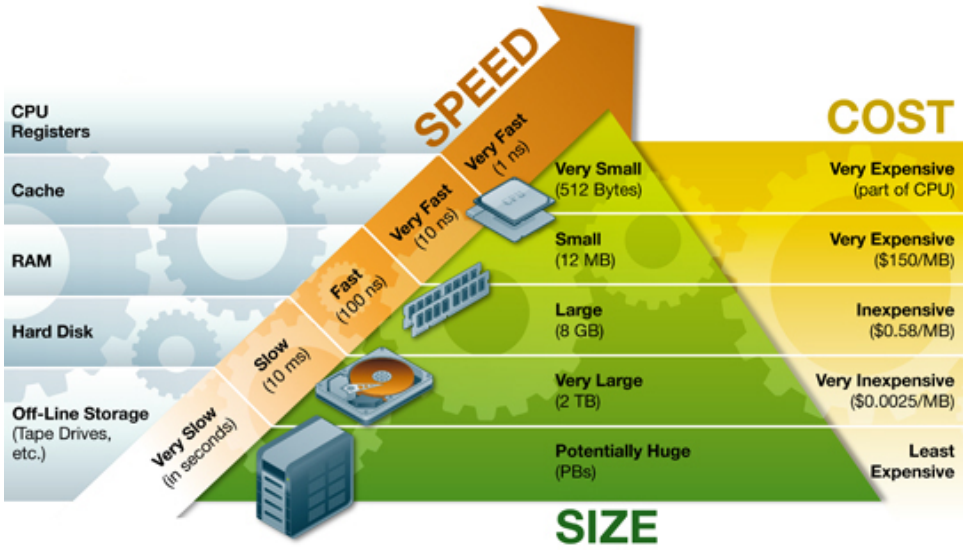
Memory management

- assigning parts of memory to programs
- “swapping”: storing the contents of memory which momentarily is not needed (because its process is currently not running) on hard disk, so the memory can be used by another process.
- “virtual memory”: using the hard disk to “pretend” that there is more memory than there physically is.

File management

- Data on hard disk, USB sticks etc. is in the form of “files”: long sequences of bits or bytes.
- Bookkeeping is needed to keep track of which part of which file is stored in which sector of the hard disk.
- Meta-information is stored: name, size, owner, creation date.
- Files are organized hierarchically into “directories” (popularly also called “folders”).

A sidenote: the “memory hierarchy”



http://www.ts.avnet.com/uk/images/StorageHierarchy.jpg

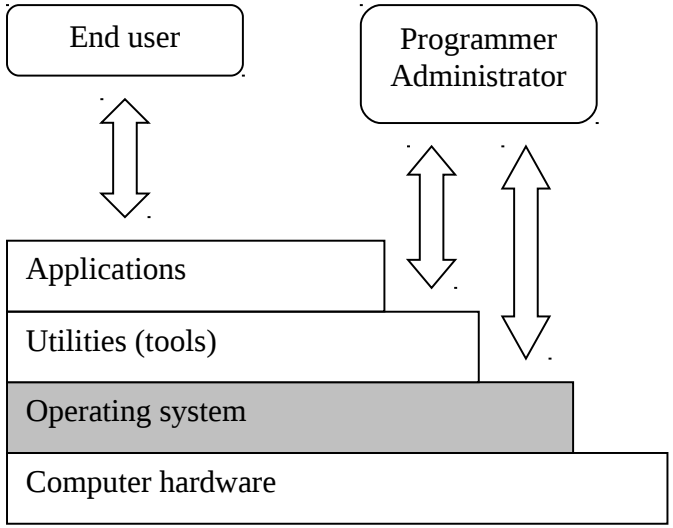
Input/output (I/O)

- controlling the peripheral hardware: keyboard, mouse, screen, hard disk, sound, printer, etc.

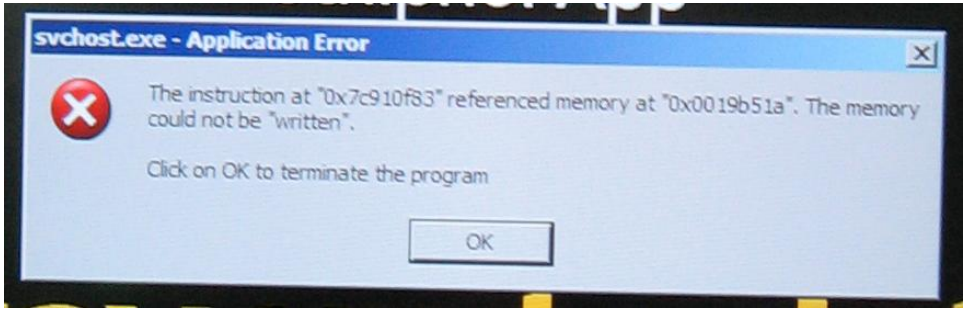
Protection

- distinguish between users
- authentication of users
- which user can do what with what?
  (e.g., reading/writing files, accessing I/O equipment)

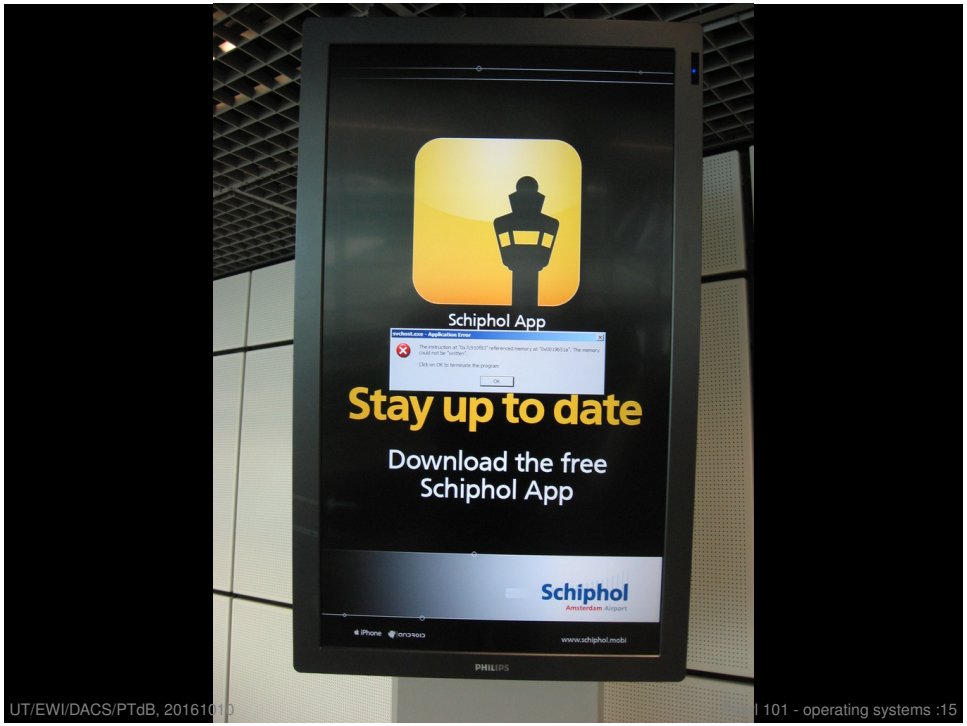
Positioning



What is this?



Where does this belong:
A - process management?
B - memory management?
C - file management?
D - input/output?
E - protection?



Examples of operating systems

- Microsoft Windows (for desktop/laptop PCs)
- Linux (for desktop/laptop PCs)
- MacOS (for desktop/laptop computer made by Apple)

- iOS (for iPhone, iPad e.d.)
- Android (for other smartphones and tablets)
- etc.

http://www.revolution-os.com/ https://www.youtube.com/watch?v=jw8K460vx1c

Questions about the movie

Put tick marks ✓ where appropriate:

	closed source	open source
MS-Windows		
Linux		
Free software		
Was there first		
Make money		
Copyright		
Most popular web server		
Cathedral		
Bazaar		
Security		