

The Operating System

Computer Literacy1 Lecture 6
02/10/08



Topics

- Firmware
- Operating System
- Applications and Plug-ins
- Examples for Operating Systems
- Function of Operating System
- Virtual Memory
- Bootstrapping
- GUI
- Configuration



Essential Firmware



- Essential Firmware = Software stored on chips
- Exists somewhere between hardware and software
- meaning it's not really either of them but links them
- Example: BIOS

Basic Input/Output System



- BIOS = **B**asic **I**nput/**O**utput **S**ystem:
 - Stored on Motherboard, usually Flash memory chip
 - Identifies and initializes system component hardware like e.g. the hard drive
 - Makes hardware accessible to software → booting
 - The brain in otherwise dumb hardware

Operating System



- OS = Operating System
- Software you need to run applications
- Makes computer system accessible to applications, assisted by:
 - File system → allows application to read and write files
 - Device drivers/Software drivers → act as translator between device and application or operating system, is hardware-dependent and software specific
 - GUI → **G**raphical **u**ser interface

Applications



- When OS is computer software to run computer itself
- Applications are software to run a task on a computer
 - E.g. Mediaplayer, spreadsheets etc...

<http://computer.howstuffworks.com/bios.htm>

Plug-in



- Applications are assisted by Plug-ins:
 - Add-on software provided by application author or a 3rd party to increase functionality of applications used by
 - Email clients to decrypt and encrypt email
 - Web Browsers to play video and presentation formats

Source and more examples in Wikipedia:
Plug-in (computing)

Examples for OS (Windows)



- Windows family
 - 95, 98 (very old) Home and small businesses
 - NT, 2000 (old) Networked businesses
 - All based on MS-DOS (1981 - 2000 when Microsoft stopped developing it)
 - XP, Vista (present) available in 2 variations: Home and Pro (merger of 95, 98 and NT, 2000)



Examples for OS (Mac)

- Mac OS from 1984 -2001
- Mac OS X from 2001 - present
 - X because Unix-like based operation system
- Different versions - different predator :
 - Mac OS X v10.2 = “Jaguar”
 - Mac OS X v10.3 = “Panther”
 - Mac OS X v10.4 = “Tiger”
 - Mac OS X v10.5 = “Leopard”



Examples for OS (Unix)

- Unix family
- Used mainly by specialists and businesses
- Solaris (by Sun Microsystems), HPUX, AIX
 - license needed
- Linux
 - Different distributions: Redhat, SUSE
 - Ubuntu: easier to handle for people used to Windows and Mac interface
 - Free Software Foundation
http://en.wikipedia.org/wiki/Free_Software_Foundation

Short overview Unix, Linux



- First there was Unix (1970s)
- Then came Richard Stallman Linux (version of Unix):
 - Software source free
 - GNU (OS) entirely composed of free software
 - Since free many thousands of people are producing Linux software
 - Secure, reliable but clunky user interface
 - Used to miss Killer apps like Photoshop and Office but now there's Gimp and soffice

Function of the OS



- Basic control of hardware
- Task management and scheduling
- Event handling like e.g. mouse clicks
- Resource management
- Startup (bootstrapping) and shutdown
- Protection and security
- Configuration

Starting and running tasks



- Applications (Word, Photoshop etc...)
 - Started by you
- Finished when you close them
- Resident programs
 - Started by operating system, never terminate
 - Application stubs (e.g. anti-virus watchdog)
 - Lower level daemons = computer program running in the background, not under direct control of user
- All require resources
 - Memory, access to screen, keyboard, mouse...

Scheduling



- Scheduling = Process of ensuring that multiple tasks can run and share one set of resources
 - Each program gets “fair” share
 - One program can’t lock out another
 - Priority activities get through
 - Individual program performance is optimised
 - Overall performance is optimised

Events



- An event is a message generated within the operating system and sent to a program
- It could be the result of hardware activity or generated by another program, e.g.:
 - “mouse has entered the window you’re running”
- Program will act then waits for next event

Virtual Memory - VM



- Program run in computer’s RAM (Random access memory)

What happens when sum of program memory required exceeds available RAM?

- Idle programs are copied to disk and RAM re-used
- When swapped-out program wakes up OS goes and gets it again (maybe swipes out something else)

Virtual Memory - VM



- If more memory is required: Computer thrashes
- Thrashing = increasing resources are used to do a decreasing amount of work

[http://en.wikipedia.org/wiki/Thrash_\(computer_science\)](http://en.wikipedia.org/wiki/Thrash_(computer_science))

- Symptom → Lots of disk activity
- Fix it by increasing RAM
- Exhausting VM can cause computer to hang/freeze

Protection and lack thereof



- Operating System protects programs from each other with help from the processor
 - Rogue program that tries to write over another or access another's resources
 - Program grabs resources and won't let go
 - Program can request additional VM e.g. for large task such as image resizing
 - If program never lets go of resources it can freeze

The bootstrap process



- To start the OS requires files
BUT → access to files requires the OS
 - Getting a computer started is like lifting yourself by pulling yourself up on your own bootstraps, hence booting
- Computer has enough support in BIOS to run a small bootstrap program → can load enough of OS → can run the rest
- Part of bootstrap process are also consistency checks

Graphical User Interface - GUI



- Allows you to interact with computer
- Window move, resize, close, iconise
- Mouse click handling and tracking
- Cut and paste
- Locating correct files associated with icons
- BUT → you can't see a record of what you just did
- Alternative is to use shell/terminal (more next week)

File System



- Interpreting file names and finding files
- Allocating space for files
- Reclaiming space from deleted files
- Maintaining hierarchy of files and directories
- Handling file access permissions
- Resilience to crashes (anyway - always back up)

Configuration and Security



- Installed hardware
 - Hardware parameters
 - Support for adding new hardware and software
- Date, time, timezone
- User names, password, privileges
- Window look, feel, background, colour scheme
- Network protocols, addresses, names
- Database of configuration information called registry

Key Points



- Key specs of software in a computer system
- Layered structure of systems software
- Principal functions of operating system and associate components
- Virtual memory and Thrashing
- Functions of a file system

Next week



- Shell/Terminal commands
- Text-file formats (what's out there next to Word)
- Excel
- Games (starts with a retrospective from Atari (Pong) to Nintendo Wii)