OS Examples

- Microsoft Family
  - MS-Dos
  - Windows 95
  - Windows NT
  - Windows ME
  - Vista
  - Windows Mobile
- Unix
- Linux
- Minix
- TinyOS
- PalmOK
- Symbian

Terminology

- Source
  - Closed source
    - Simple definition: no access to the source code
    - Only binaries of the s/w are released
  - Open source
    - Simple definition: access to the source code
    - peer production development of source code for s/w that is made available for public collaboration
  - Shared source
    - Can see the code (for developing related sl/w) but can't change it

Terminology

- Open source
  - Distribution terms of open-source s/w
    1. free redistribution
    2. source code
    3. Derived works
    4. Integrity of the author's source code
    5. No discrimination against persons or groups
    6. No discrimination against fields of endeavour
    7. Distribution of license
    8. Licence must not be specific to a product
    9. License must not restrict other s/w
    10. License must be technology-neutral
- www.opensource.org

Terminology

- Backward compatibility
  - New products can read, view or handle files or data from previous formats
  - When a product or technology is able to take the place of an older product, by inter-operating with products that were designed for the older product
- Graphical User Interface (GUI)

MS-DOS

- MS: Microsoft
- DOS: Disk Operating System
- Source model: Proprietary
- Kernel Type: Monolithic
- Working State: Discontinued
- Brief description:
  - Single-user OS for IBM PS and its successors
  - Only one process can be active but a process can create and execute child processes
  - Terminate and stay resident programs continue to exist even after they exit
  - Implementation is closely tied to the underlying architecture (Intel chips)
  - I/O is handled via device drivers

MS-DOS

- History
  - 64k, no hard disk => couldn't run Unix
  - Bought 86-DOS, hired Tim Paterson to 'fix' it
  - 1981: Version 1.0 MS-DOS
    - 12K, 4000 lines of assembly code
    - Disk and character I/O system, disk and file manager, command processor
    - Made use of IBM's BIOS (Basic Input Output System)
    - Info no file size, disk allocation algorithm, batch files (scripts)
  - Later releases:
    - Support for hard disk, more Unix-like, support for international users, supported networking, support for larger disks, DOS shell (menu-driven shell), use of extended memory

MS-DOS

- Overview
  - ~ a stripped down early version of Unix
  - A shell, a file system, system calls, utility programs
  - No login procedure and no password (*personal* computer use), no file owners or protection bits, no superuser
  - No case sensitive
  - Users can install their own interrupt handlers, can insert code into the kernel, install custom device drivers
  - National language support

MS-DOS

- Processes
  - Not a multiprogramming environment
  - Parent and child cannot run in parallel
  - Executable files
    - .com: text + data + stack segment
    - .exe: text, data and stack segment, relocatable
  - No form of swapping or paging
- Memory
  - Complicated memory model
  - Code, data and stack segments
  - Conflict between preserving 16-bit addressing (for backward compatibility) and the ability to address up to 1 megabyte of memory
  - > 1 megabyte => extended memory (only real mode is backward compatible)

MS-DOS

- File system
  - Initially only one single directory
  - Later hierarchical, with subdirectories
  - Absolute and relative paths
  - Names: 8 + 3
  - Component separator \
  - Case insensitive
  - No owners, groups or protection
  - No links
  - File attributes
- Input/Output
  - Can install custom device drivers

MS-DOS

- System calls
  - Made by trapping to the kernel
  - A system call interface library is provided by C
  - Sets of system calls for
    - Process management
      - No FORK and EXEC
    - Memory management
      - More complicated than Unix
    - Files and directories
      - Like Unix
    - Input/output
      - Large number of different calls

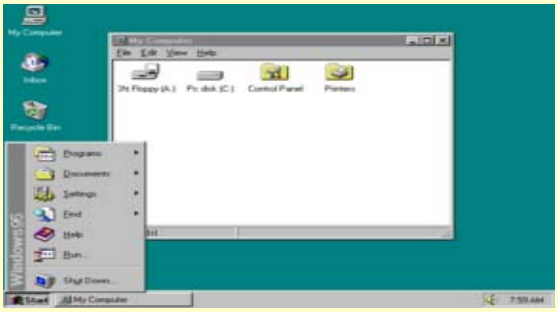
MS-DOS

- Implementation
  - BIOS (Basic Input Output System)
    - A collection of low-level device drivers that serve to isolate MS-DOS from the details of the h/w
  - Kernel
    - Contains the machine-independent part of the OS
    - Handles process management, memory management, the file system and the interpretation of all system calls
  - Shell (command.com)

Windows 95

- Released: August 1995
- Source model: Proprietary
- Kernel Type: Monolithic
- Technical improvements
  - long filenames
  - Premptively multitasked pseudo-protected-mode 32-bit applications
  - Plug and Play
- Aims:
  - Consumer-oriented graphical user interfaced-based OS
  - Integrate MS-DOS and Windows products

MS Windows 95



Windows 95

- Technical improvements
  - 255-character mixed-case long filenames
  - MS-DOS limited to booting up the system
  - Kernel can be used in Safe Mode to fix problems
  - Later versions shipped with Internet Explorer
  - Partial support for USB
- Current status
  - No longer officially supported (as of 2001)
  - Superseded by Windows 98 and Windows Me
  - But still around on older machines (e.g. schools)
    - Funds
    - Lack of knowledge/desire to upgrade

Windows NT

- Family of OS produced by Microsoft
- Original OS Design
  - Powerful high-level language based
  - Processor independent
  - Multiprocessing
  - Multiuser
  - Comparable features to Unix
- NT: New Technology but doesn't have any real meaning

Windows NT

- Released: August 1993
- Source model: Closed source/shared source
- Kernel Type: Hybrid kernel (a combination of microkernel and monolithic kernel architectures)
- Major features:
  - h/w and s/w portability
    - Kernel mode module Hardware Abstraction Layer (HAL)
  - Per-object (e.g. file) access control lists that allows a rich set of security permissions to be applied to systems and services
  - Supported Windows network protocols
    - LAN networking
    - TCP/IP networking

Windows NT

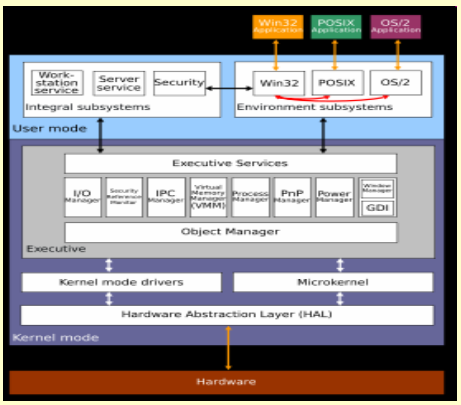
- Major features (cont.)
  - 32-bit "flat" virtual memory addressing on 32-bit processors
  - Core kernel with a system API running in supervisor mode
  - A set of user-space environments with their own APIs
  - Preemptive multitasking kernel
  - Initially, several I/O driver subsystems (e.g. video, printing) were user-mode subsystems, then moved to kernel
  - Secure file system

Windows NT

- Written in C and C++
- Hybrid kernel:
  - Monolithic kernel structured like a microkernel?
  - Simple kernel, Hardware Abstraction Layer (HAL), drivers and Executive (a range of services)
- User mode and kernel mode
- User mode
  - Environment subsystem runs applications written for many different types of OS
  - Integral subsystem operates system specific functions (security, workstation, server) on behalf of the environment subsystem

Windows NT

- Kernel mode
  - Full access to h/w and system resources
  - Stops user mode services and applications from accessing critical areas of the operating system that they should not have access to
  - Executive
    - Interfaces with all the user mode subsystems
    - I/O, object management, security and process management
  - Kernel sits between HAL and Executive
    - multiprocessor synchronisation
    - thread and interrupt scheduling and dispatching
    - Trap handling and exception dispatching
    - Initialises device drivers



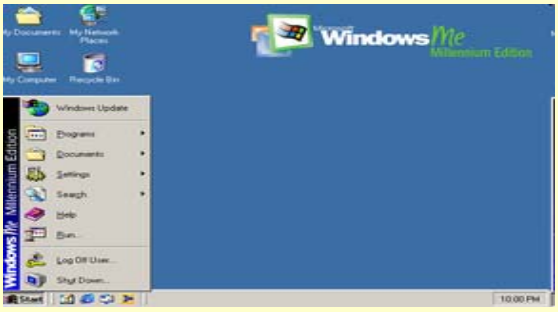
Windows ME

- Windows Millennium Edition
- Released: 2000
- A hybrid 16-bit/32-bit graphical OS
- Successor to Windows 98, for home users
- Features:
  - Internet Explorer
  - Windows Media Player
  - Updated GUI and Windows Explorer
- Short shelf life (replaced by Windows XP)

Windows Me

- New and updated features
  - System restore
    - Rollback and recovery feature
  - System file protection
    - Protect system files from modification and corruption silently and automatically
  - System configuration utility
    - Allow users to manually extract and restore individual system files
  - System monitor
  - Enhanced multimedia functions

Windows ME



Vista

- Released: 2006
- Source model: closed/shared source
- Kernel type: hybrid
- For PCs
  - Home, business, laptops
- 5 years after Windows XP (longest gap)
- Biggest aim:
  - Improve state of security in Windows OS
    - **Malware** (s/w designed to infilrate or damage a computer system without the owner's informed consent)
    - **Viruses** (a computer program that can copy copy itself and infect a computer without the permission or knowledge of the owner)
    - **buffer overflows** (is an anomalous condition where a process attempts to store data beyond the boundaries of a fixed-length buffer)
  - Trustworthy Computing initiative

Vista

- Features
  - Updated GUI (Windows Aero)
    - Authentic Energetic Reflective and Open
    - Backronym: a backronym is constructed by starting with a word and creating a new phrase using the letters in the word as the initial letters of the words in the phrase
  - Improved searching features
  - New multimedia creation tools
  - Redesigned networking, audio, print, and display sub-systems
  - Improved communication
    - Peer-to-peer (P2P) technology
  - .NET Framework
    - Makes it easier for s/w developers to write applications
  - Improve security

Vista

- Criticisms
  - High system requirements
  - restrictive licensing terms
  - the inclusion of a number of new digital rights management (DRM) technologies aimed at restricting the copying of protected digital media
  - lack of compatibility with some pre-Vista hardware and software
  - the number of authorization prompts for User Account Control

MS Vista

Windows Mobile

- For mobile devices
  - Pocket PCs, Smartphones, Portable Media Centers, on-board computers for cars
- Based on MS Win32 API
  - Microsoft's core set of application programming interfaces (API) available in the MS Windows OSs
- Design:
  - Somewhat similar to desktop versions of Windows
- 3rd party s/w development available for Windows Mobile
- Family: Windows CE
  - MS OS for minimalistic computers and embedded systems
  - Different OS and kernel (not a trimmed-down version of desktop Windows)

Windows Mobile

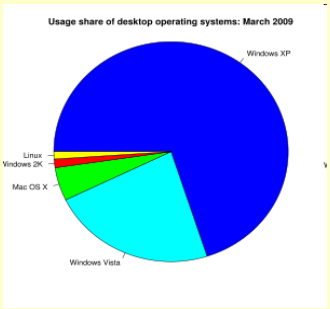
- Features
  - Today Screen
    - Current date, owner information, upcoming appointments, e-mail messages and tasks
  - Taskbar
    - Current time and volume
  - Office Mobile
    - A suite of Mobile versions of MS Office apps
  - Outlook Mobile
    - E-mail application, calendar, task manager, contact manager, note taking, journal and web browsing
  - Internet Explorer Mobile
  - Windows Media Player

Windows Mobile

- Features cont.
  - Client for PPTP VPNs
    - Point-to-point tunneling protocol (PPTN) is a method for implementing virtual private networks (VPNs)
    - VPN is a computer network in which some of the links between nodes are carried by open connections or virtual circuits in some larger network (e.g. the Internet) as opposed to running across a single private network
    - Does not provide confidentiality or encryption
  - Internet Connection Sharing (ICS)
    - Allows attached computers share internet connections via USB and Bluetooth
    - Bluetooth: an open wireless protocol for exchanging data over short distances from fixed and mobile devices, creating personal area networks (PANs)

Windows Mobile

Usage share of desktop operating systems



Source: Median values from Usage share of desktop operating systems (Mar 09)

Windows XP (68.59%)

Windows Vista (22.29%)

Mac OS X (4.78%)

Windows 2000 (1.24%)

Linux (1.05%)