Introduction to Informatics

Piroska Biró

Course 06

MIDTERM

5th November 2014

Wednesday

10:00–12:00

F01

Operating System

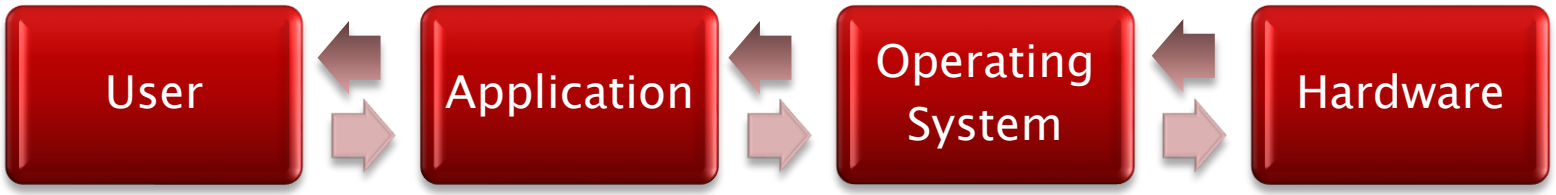
Definition

- the operating system is a system of programs which controls the executions of the programs in the computer system
- it schedules the executions of the programs, distributes the resources and ensures the communication between users and the computer system (hardware)
- **ISO** (International Standard of Organisation)

Operating System

- time-sharing operating systems
  - include accounting for cost allocation of processor time, mass storage, printing and other resources
- input and output and memory allocation
  - an intermediary between programs and the computer hardware
  - application code is usually executed directly

Operating System



Types of operating system

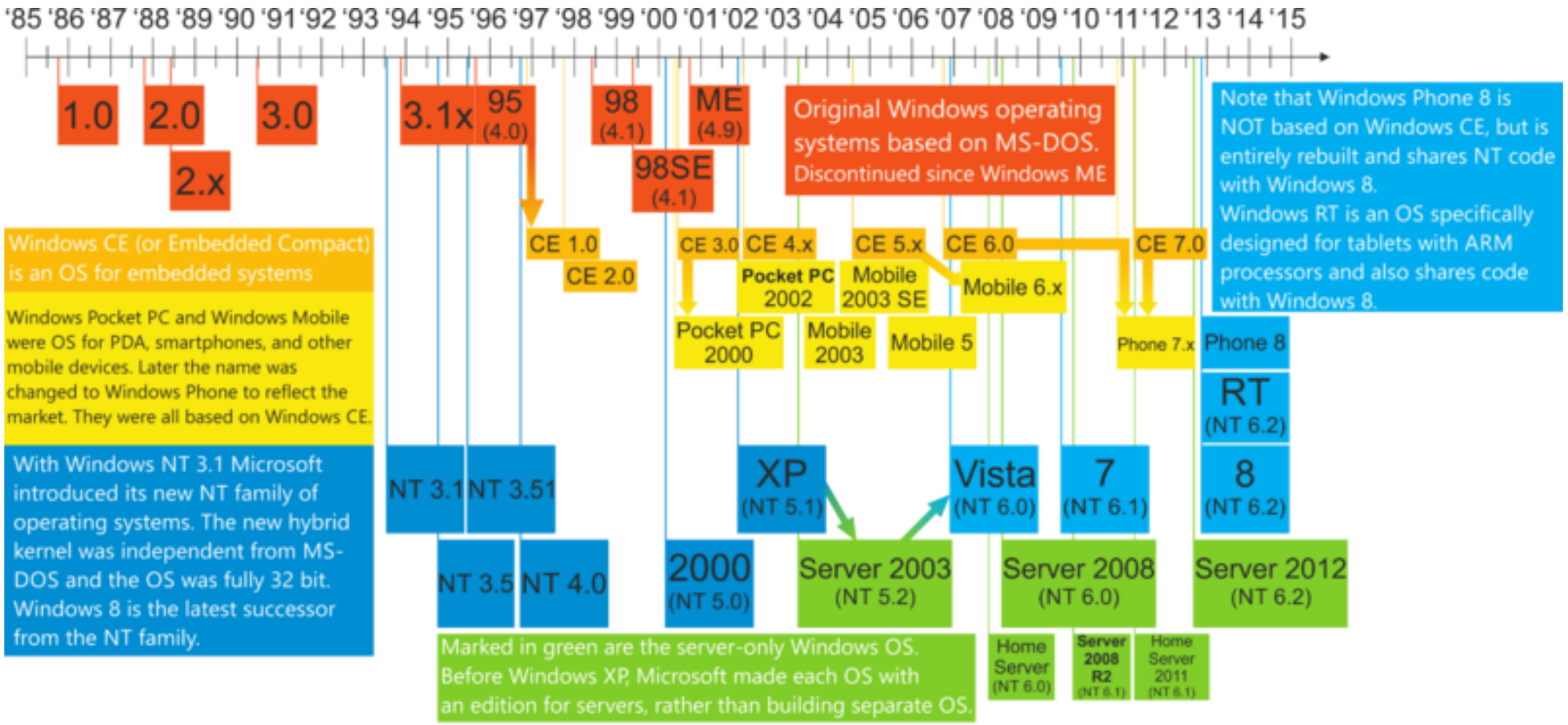
- The most popular:
  - Android
  - BSD
  - iOS
  - Linux
  - Mac OS
  - Microsoft Windows
  - Windows Phone
  - IBM z/OS

DOS (Disk Operation System)

- third generation developed **DOS** about 1965
- control languages were implemented to transmit instructions
- programming languages were implemented to code problems
- terminals
- communication remained textual
- menu controlled connection
- the longer command had to be typed
- the syntax had to be kept in mind
- **GUI** (Graphical User Interface)

Microsoft Windows

- graphical interface operating systems
- 20 November 1985
- Early versions: Windows 1.0, Windows 2.0, and Windows 2.1x
- Windows 3.0 and 3.1
- Windows 95, 98, and Me
- Windows NT family
- 64-bit operating systems
- Windows 7
- Windows CE
- Windows Server 2012
- Windows Phone 7.5
- Windows 8 – 26 October 2012

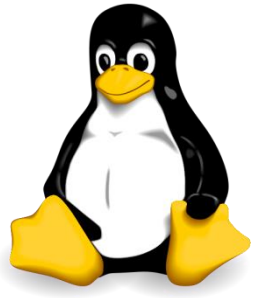


Explanation of arrows: I. Windows CE is based on code from Windows 95. II. Windows Pocket PC 2000 is based on Windows CE 3.0. III. Windows Mobile 6.x is based on Windows CE 5.x, rather than CE 6.0. IV. Windows Phone 7 is based on code from both Windows CE 6.0 and CE 7.0. V. Windows Vista was built on code from Windows Server 2003, rather than Windows XP.

Windows Phone

- mobile operating systems
- developed by Microsoft
- Microsoft created a new user interface
- sets minimum requirements for the hardware

Linux



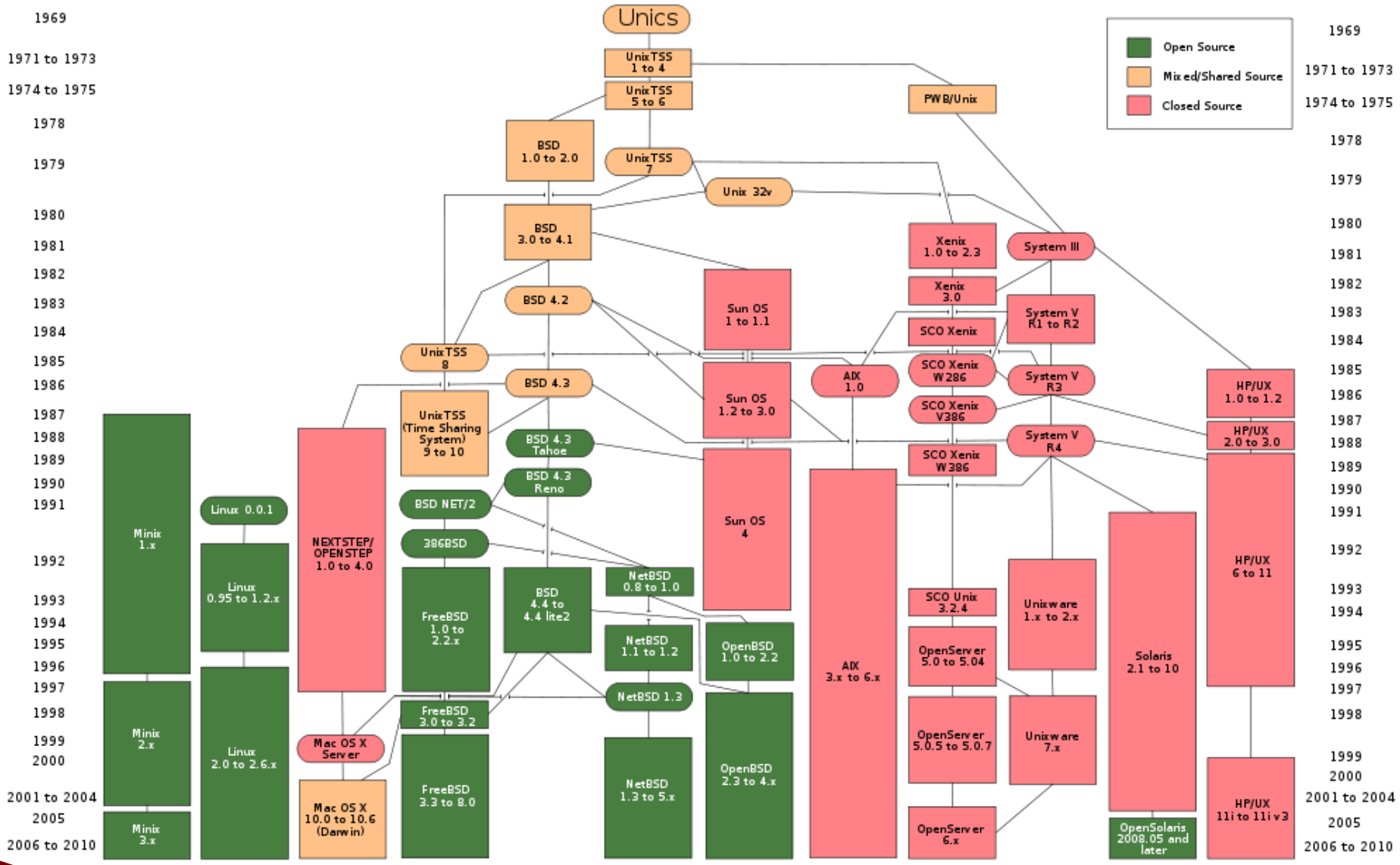
- free and open source software
- 5 October 1991 by Linus Torvalds
- **Unix** – implemented in 1969 at AT&T's Bell Laboratories in the United States by Ken Thompson, Dennis Ritchie, Douglas McIlroy, and Joe Ossanna
- 1971 – assembly language
- 1973 – programming language C by Dennis Ritchie
- 1984 – AT&T divested itself of Bell Labs

Linux

- free and open source software
- GNU – General Public License
- Linux distributions: Debian, Fedora, openSUSE
- C compiler Linux originated in GNU Project
  - GNU Project started in 1983 by Richard Stallman
  - 1985 Stallman started the Free Software Foundation
  - GNU General Public License (GNU GPL) in 1989

LINUX

- BSD
  - 1992 – 386BSD (NetBSD and FreeBSD)
- MINIX
  - Andrew S. Tanenbaum
  - version 3 in 2005
- Linux kernel – Linus Torvalds
- third-party non-GNU components
- distribute
  - the kernel
  - GNU components
  - non-GNU components


Unics
UnixTSS 1 to 4
UnixTSS 5 to 6
PWB/Unix
BSD 1.0 to 2.0
UnixTSS 7
Unix 32v
BSD 3.0 to 4.1
Xenix 1.0 to 2.3
System III
Xenix 3.0
BSD 4.2
Sun OS 1 to 1.1
System V R1 to R2
SCO Xenix
UnixTSS 8
AIX 1.0
SCO Xenix W286
System V R3
BSD 4.3
Sun OS 1.2 to 3.0
HP/UX 1.0 to 1.2
SCO Xenix V386
HP/UX 2.0 to 3.0
UnixTSS (Time Sharing System) 9 to 10
BSD 4.3 Tahoe
System V R4
SCO Xenix W386
BSD 4.3 Reno
BSD NET/2
Sun OS 4
386BSD
NetBSD 0.8 to 1.0
HP/UX 6 to 11
SCO Unix 3.2.4
Unixware 1.x to 2.x
BSD 4.4 to 4.4 lite2
FreeBSD 1.0 to 2.2.x
NetBSD 1.1 to 1.2
OpenBSD 1.0 to 2.2
AIX 3.x to 6.x
OpenServer 5.0 to 5.04
Solaris 2.1 to 10
NetBSD 1.3
FreeBSD 3.0 to 3.2
OpenServer 5.0.5 to 5.0.7
Unixware 7.x
OpenBSD 2.3 to 4.x
Mac OS X Server
FreeBSD 3.3 to 8.0
NetBSD 1.3 to 5.x
HP/UX 11i to 11i v3
OpenServer 6.x
OpenSolaris 2008.05 and later
Minix 1.x
Linux 0.0.1
NEXTSTEP/ OPENSTEP 1.0 to 4.0
Linux 0.95 to 1.2.x
Minix 2.x
Linux 2.0 to 2.6.x
Mac OS X 10.0 to 10.6 (Darwin)
Minix 3.x
Open Source
Mixed/Shared Source
Closed Source
1969
1971 to 1973
1974 to 1975
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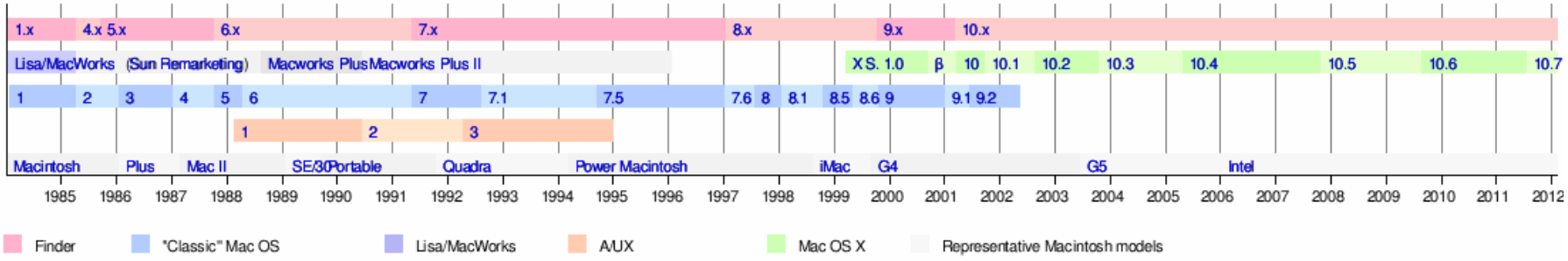
2001 to 2004
2005
2006 to 2010

Mac OS

- graphical user interface – based
- developed by Apple Inc. for their Macintosh line of computer systems
- now calls OS X
- first introduced in 1984 with the original Macintosh

Timeline of Macintosh operating systems



Android

- Linux-based operating system
- for touchscreen mobile devices such as smartphones and tablet computers
- developed by Google in conjunction with the Open Handset Alliance
- initially developed by Android Inc., whom Google financially backed and later purchased in 2005
- in September 2012, there were more than 675,000 apps available for Android
- the estimated number of applications downloaded from Google Play was 25 billion
- first Android-powered phone was sold in October 2008
- by the end of 2010 Android had become the world's leading smartphone platform

iOS (iPhone OS)

- mobile operating system
- developed and distributed by Apple Inc.
- January 9, 2007
- October 17, 2007, Apple announced that a native Software Development Kit (SDK)
- March 6, 2008, Apple released the first beta: iPhone OS
- January 27, 2010, Apple announced the iPad
- In June 2010, Apple rebranded iPhone OS as "iOS"
- September 12, 2012, Apple's App Store contained more than 700,000 iOS applications
- in June 2012, it accounted for 65% of mobile web data consumption

Characteristics of an Operating System

- multi-tasking
- multi-processing
- multi-user
- protected
- built-in support for graphics
- built-in support for networks

Some examples

- **Unix**: multi-tasking, multi-processing, multi-user, protected, with built-in support for networking but not graphics.
- **Windows NT:** multi-tasking, multi-processing, single-user, protected, with built-in support for networking and graphics.
- **Windows 95/98:** multi-tasking, multi-processing, single-user, unprotected, with built-in support for networking and graphics.
- **Windows 3.x**: single-tasking, single-processing, single-user, unprotected, with built-in support for graphics but not networking.
- **DOS:** single-tasking, single-processing, single-user, unprotected with no built-in support for graphics or networking.

Components

- Process Management
- File Management
- I/O System Management
- Secondary-Storage Management
- Networking
- Protection System
- Command Interpreter System

Process Management

- process – complete execution context (code, data, PC, registers, OS resources in use, etc.)
- activities
  - creation and deletion of user and system processes
  - suspension and resumption of processes
  - a mechanism for process synchronization
  - a mechanism for process communication
  - a mechanism for deadlock handling

Main-Memory Management

- Primary-Memory or Main-Memory
- activities
  - keep track of which part of memory are currently being used and by whom
  - decide which process are loaded into memory when memory space becomes available.
  - allocate and deallocate memory space as needed

File Management

- computer can store files on the disk (secondary storage), which provide long term storage
  - magnetic tape
  - magnetic disk
  - optical disk
- properties
  - speed
  - capacity
  - data transfer rate
  - access methods
- activities
  - the creation and deletion of files
  - the creation and deletion of directions
  - the support of primitives for manipulating files and directions
  - the mapping of files onto secondary storage
  - the back up of files on stable storage media

I/O Management

- I/O subsystem hides the peculiarities of specific hardware devices from the user
- only the device driver knows the peculiarities of the specific device to whom it is assigned.
- the operating system allows unification and control of access of programmes to material resources via drivers (also known as peripheral administrators or input/output administrators)

Secondary-Storage Management

- secondary storage consists of tapes, disks, and other media designed to hold information

- activities
  - managing the free space available on the secondary-storage device
  - allocation of storage space when new files have to be written
  - scheduling the requests for memory access

Networking

- distributed systems
- communication-network
- routing and connection strategies
- problems of contention and security

Protection System

- multiple users
- multiple processes
- Protection:
  - controlling the access of programs
  - processes
  - users

Command Interpreter System

- interface
- advantages
  - change the way the command interpreter looks, i.e.:
    - I want to change the interface of command interpreter, I am able to do that if the command interpreter is separate from the kernel.
    - I cannot change the code of the kernel so I cannot modify the interface.
  - the command interpreter is a part of the kernel it is possible for a malicious process to gain access to certain part of the kernel that it showed not have to avoid this ugly scenario it is advantageous to have the command interpreter separate from kernel

Operating Systems Services

- Program Execution
- I/O Operations
- File System Manipulation
- Communications
- Error Detection

Program execution

- execute programs
- operating systems provide an environment
- involves the allocating and deallocating memory, CPU scheduling (in case of multiprocess)

I/O Operations

- input and output
- operating systems hide the user the details of underlying hardware for the I/O
- operating systems by providing I/O make it convenient for the users to run programs
- for efficiency and protection users cannot control I/O so this service cannot be provided by user-level programs

File System Manipulation

- the output of a program may need to be written into new files or input taken from some files
- operating systems make it easier for user programs to accomplished their task
- this service involves secondary storage management

Communications

- processes need to communicate with each other to exchange information
- the messages need to be passed to processes on the other computers through a network it can be done by the user programs
- the user program may be customized to the specifics of the hardware through which the message transits and provides the service interface to the operating system

Error Detection

- operating system constantly monitors the system for detecting the errors
- it involves monitoring and in cases altering area of memory or deallocation of memory for a faulty process
- may be relinquishing the CPU of a process that goes into an infinite loop