

# *Introduction to Computer Science*

## **PC software**

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## *Classification*

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*PC software can be divided into:*

- *systems software*
- *applications software*

*or more precisely:*

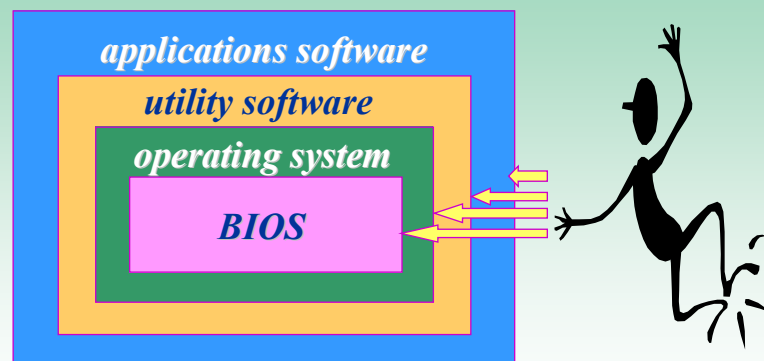
- *systems software*
- *utility software*
- *applications software*

**Systems software** are: operating system, BIOS and utility programs (utilities) for the system management and maintenance.

**Utility software** are programming tools, that simplify creating and maintenance of applications programs, e.g. translators.

**Applications software** performs specific user tasks, e.g. user programs developed in C++, Office Package, etc.

## Structure of PC software



*Layers of computer software*

## Operating system

It is a set of programs and procedures, *that manage all the computer internal resources: hardware, software and data.*

**Operating system** *interacts with the applications software and the computer and operates from computer switch on until switch off.*

Operating systems consist of **layers** that perform different functions, e.g.:

- the **low level** layer responsible for hardware control and maintenance,
- **kernel** - performs its main tasks,
- **shell** - external system layer that provides **user interface**.

## Operating system tasks

- **Management of hardware resources** – ensures optimal use and control of the computer memory and devices. Special programming control modules – **drivers** allow applications for programming the devices in a unified way - **interface**.
- **Management of files in secondary storage** - gathering the data on disks and their management by means of programming module – a file manager. The **file system** is a disk data structure, which helps in logical data ordering, by organizing them into files and directories.
- **Creation and maintenance of virtual machines** – simplified computer representations accessible for applications.

- **Multi-tasking** – allows to run many simultaneous applications at the same computer. Each application gets its own virtual machine and can operate in this way, as if it was the only application running on the computer.
- **User interface** – system shell allows the user to run the applications and to interact with the computer. User can communicate with the system by the command line user interface or by the graphical user interface – **GUI**. User writes **system commands** or **points and clicks** and reads system **messages**.
- **Communication with the other computers** – modules responsible for network services, Internet access, etc.

## Operating Systems

- **MS - DOS** ( *Disk Operating System*),
- **Windows 95/ 98/ Millenium**,
- **Windows NT/ 2000/ XP**
- **Unix**,
- **Linux** - open source adaptation of **Unix** system for microcomputers,
- **Solaris**,
- **OS/2 Warp 3**,
- **QNX**,
- **BeOS**

## Utility software

**Utility software** is a set of programming tools, for creating and maintenance of application programs, e.g. *translators*.

**Translator** tasks:

- checks the formal program correctness,
- reserves a space in memory for program variables,
- translates the user's program from the programming language into machine language.

## Translators

The simplest **translator** is **assembler**, which is low level programming language and translates program from symbolic language into binary machine code.

Translators can be divided into two main groups:

- **compilers** (e.g.: *Pascal, C, C++*),
- **interpreters** (e.g.: *Basic*).

Translator that is equipped with utility programs, such as: editor, debugger, linker, etc. is called an **integrated programming package**.

## Applications software

Application programs can be divided into :

- **text editors** (*Word, WordPerfect, LaTeX, AmiPro*),
- **graphic packages** (*Corel Draw, PhotoShop, Designer*),
- **spreadsheet programs** (*MS-Excel, Lotus1-2-3, QuatroPro*),
- **database managers (DBMS)** (*dBase, Clipper, Paradox, MS-Access, FoxPro, Oracle*),
- **presentation packages** (*PowerPoint*),
- **personal information managers (PIMs)** - (*MS Outlook*),
- **communications programs:**
  - **e-mail** (*Outlook*), **web browser** (*Internet Explorer*),  
**telnet**, **FTP client**, **news client**,
- **web-authoring programs** (*FrontPage, Skryba, Pajaczek*),
- **sound-reproducing programs** (*MS Media Player, WinAmp*),

- **computer aided design packages** (*AutoCad*),
- **calculating packages** (*MATLAB, Mathematica, MapleV*),
- **measurement and automation software** (*TestPoint, LabVIEW*),
- **accounting and financial packages,**
- **educational programs and tutorials,**
- **computer games,**
- **integrated programs,**
- **other applications.**

Software classification is not very strict. Some of the application programs, e.g. **spreadsheet programs** or **calculating packages**, can be classified into **utility software**, if they have an open structure and allow to develop user's programs (e.g. MATLAB).

## *Office Packages*

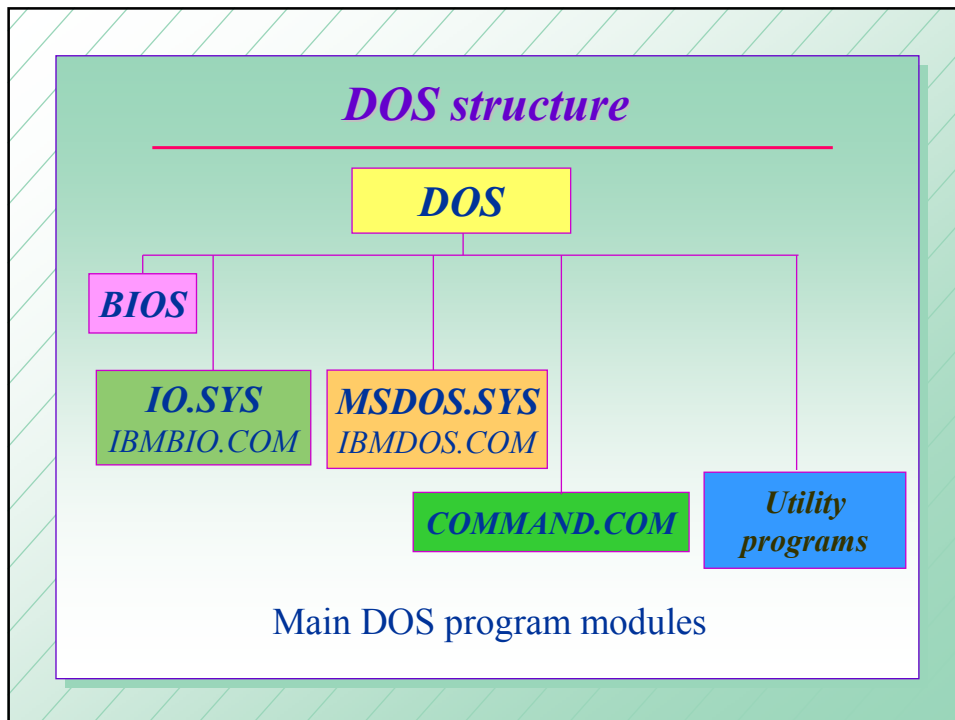
- **MS Office 2000/ XP** (*Word, Excel, Outlook, PowerPoint, Access, Publisher, FrontPage, Internet Explorer*)
- **Corel WordPerfect Office 2000**  
(*WordPerfect, QuatroPro, Corel Presentations, CorelCENTRAL, Paradox, Trellix, NetPerfect, VBA - Visual Basic for Applications, Dragon NaturallySpeaking*)
- **StarOffice 5.2 PL**

## *DOS operating system*

**DOS** (*Disc Operating System*) is a **16-bit** single tasking operating system.

Main system tasks are: file management by the use of **FAT-16** file system and support for **Terminate and Stay Resident (TSR)** programs.

DOS does not provide majority of tasks of the modern operating systems.



***BIOS***

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**BIOS** (*Basic Input Output System*) is a set of low-level programs and procedures stored in **ROM** (currently **EEPROM** or *FlashROM* are used) provided by producers of computer hardware. BIOS code issues the first commands to the system at computer power-up.

**Main BIOS programs:**

- The **bootstrap loader** – program, that **starts up** the computer, when it is turn on. It also fetches the **operating system** from the hard or floppy disk, loads it into memory and starts it up;



- **POST (Power On Self Test)** – **diagnostic program** that runs the following checking procedures for: processor, ROM & RAM memories, interrupt drivers and other circuits on the **motherboard**, peripherals, finally it searches and initialises **BIOS expansions** on the **expansion boards**, complementing or replacing the system BIOS code for the given component and starts them up;
- **BIOS service programs**, that access fundamental **input-output** devices (keyboard, monitor, disks, printer). These programs enable e.g. to interpret keyboard characters or transmit characters to the monitor or to a disk.
- **Setup** – program interfacing CMOS battery supplied memory; this memory holds **user-customisable configuration data** (date, time, password, hardware configuration, etc.) accessed by BIOS code.

### *Memory division in DOS system*

#### **Primary storage (1MB)**

##### ROM (384 KB)

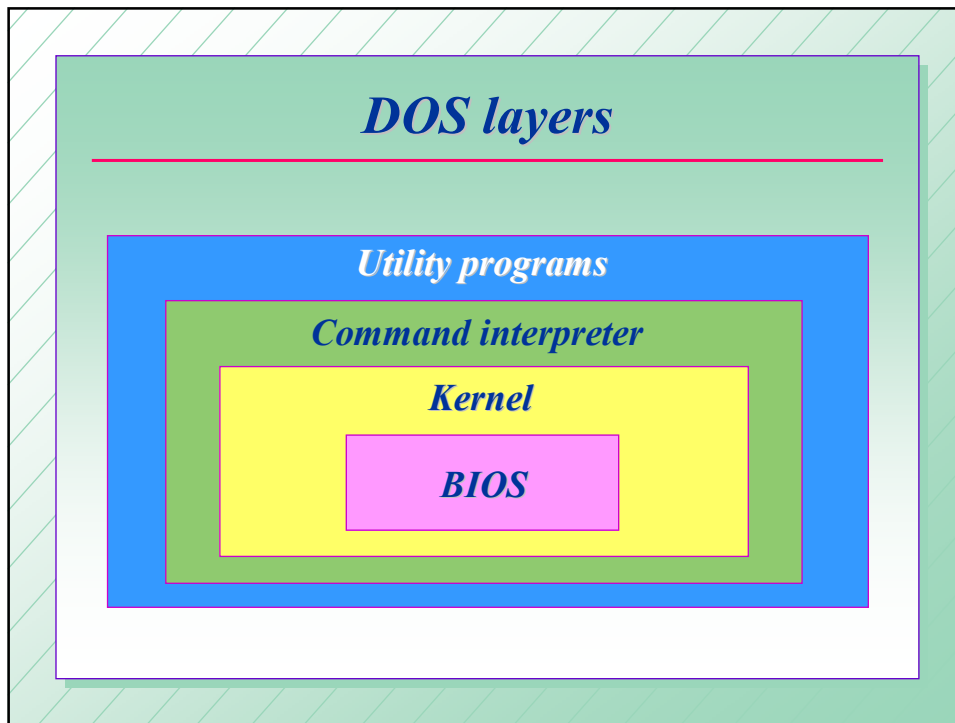
- BIOS
- HD BIOS
- Graphics card ROM

← Upper memory

##### RAM (640 KB)

- operating system
- user's programs and data

← Conventional memory

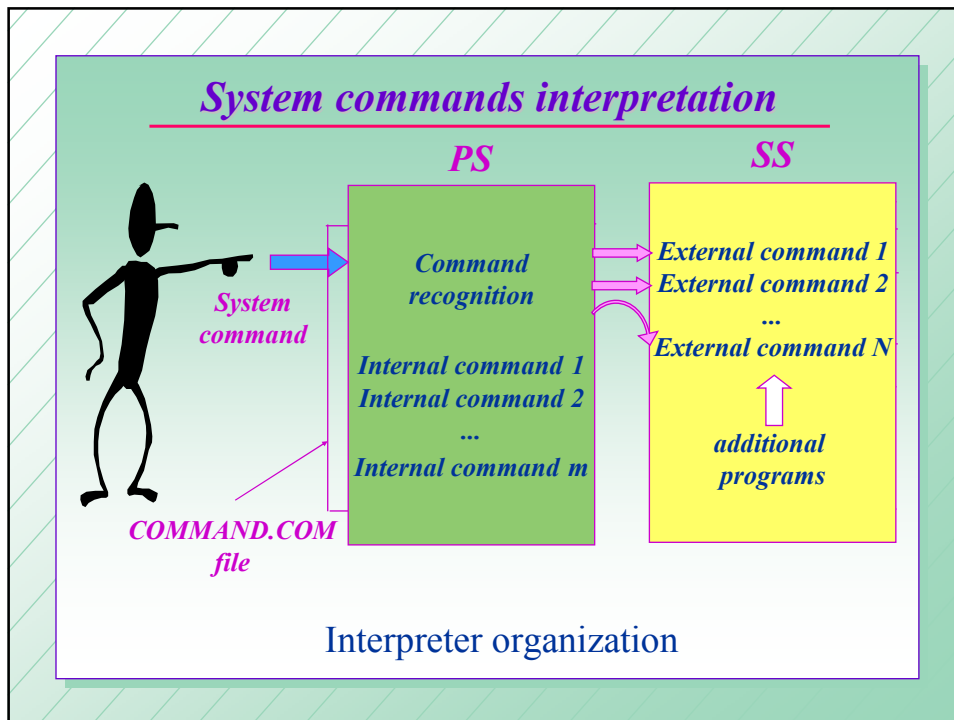


**Programs from three upper DOS layers** are stored on the **system disk** and are loaded into RAM.

**Operating system kernel** consists of two files IO.SYS and MSDOS.SYS, that are called **system files**.

**Command interpreter** is divided in two parts:

- COMMAND.COM file,
- set of extra additional programs.



*System commands*

**System commands** is a set of predefined instructions, that the operator sends to the system.

System commands can be divided into:

- **internal commands** – interpreted by COMMAND.COM program,
- **external commands** - executed by the programs called from the secondary storage.

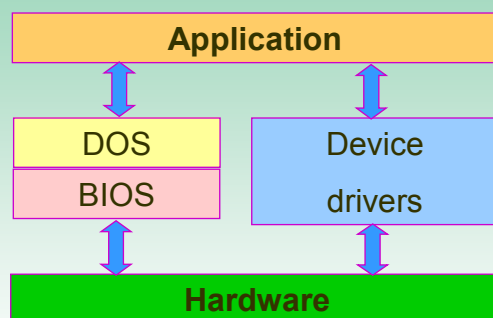
### Programs stored in secondary storage

execute mainly external commands ordered by COMMAND.COM.

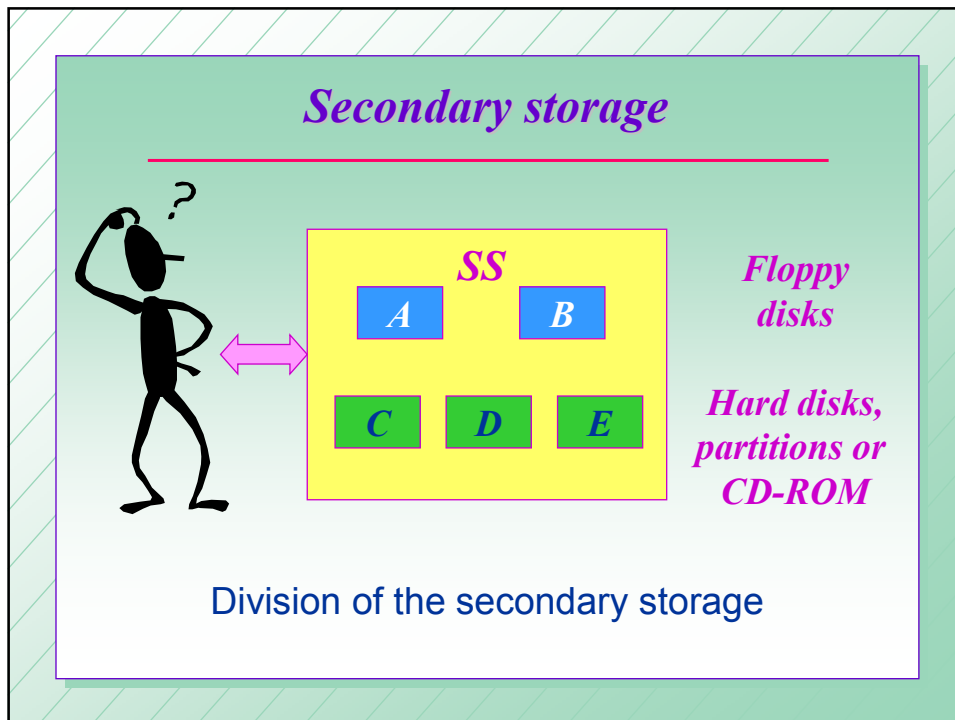
Other group of this programs are **device drivers** and **utility programs** (virus checker, disk defragmentation, file compression, etc.).

System responses for the user's commands are **system messages** or **alerts**.

### *DOS architecture*



Application access to the hardware

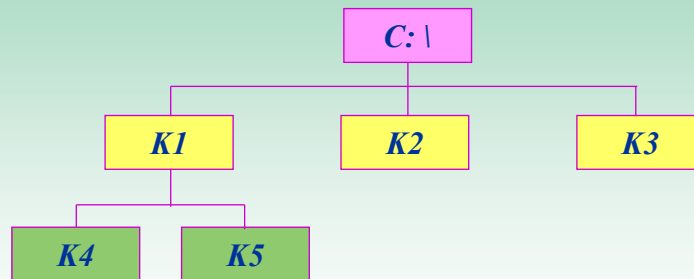


### *Files extensions recommended in DOS system*

- COM** - binary unrelocatable file, of a size up to 64kB, with an executable program,
- EXE** - binary relocatable file, of any size, with an executable program,
- BAT** – batch file, containing DOS commands,
- SYS** – system file,
- TXT** – text file,
- PAS** - Pascal program file,
- C** - C program file,
- BAS** – Basic program file,
- ASM** – Assembler program file,
- DAT** – data file.

## *Directories and their structure*

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Directories tree

## *Path*

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**Path** is a sequence of directories, that the operating system has to search, to access the chosen directory or a file.

*Path examples to K4 directory:*

*C:\ K1\ K4 - start from disk C,*

*\ K1\ K4 - start from the main directory,*

*K1\ K4 - start from the current directory,*

*K4 - start from the K1 directory,*

*.. \ K4 - start from the current K5 directory.*

## *System commands*

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Format:

COMMAND\_NAME [arguments] [options]

Examples:

*DIR C:\K1\K5 /W*

*COPY C:\K2\file1.prn PRN /b*

## *MS WINDOWS 3.1*

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**Windows 3.1** operating environment is often thought of as just a **graphical user interface** or **desktop** for **MS DOS** operating system.

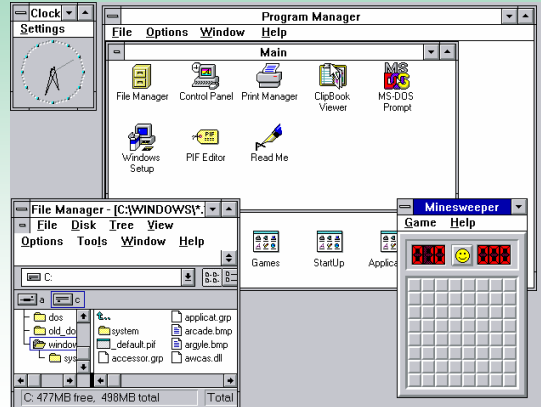
Windows 3.1 features:

- eliminates limitations of DOS operating system and allows to use capabilities of processors 286 & 386 and new computers, that appeared on a market in that time,
- provides new system services, that were not accessible in DOS.

## Graphic User Interface

- System of **windows and icons**,

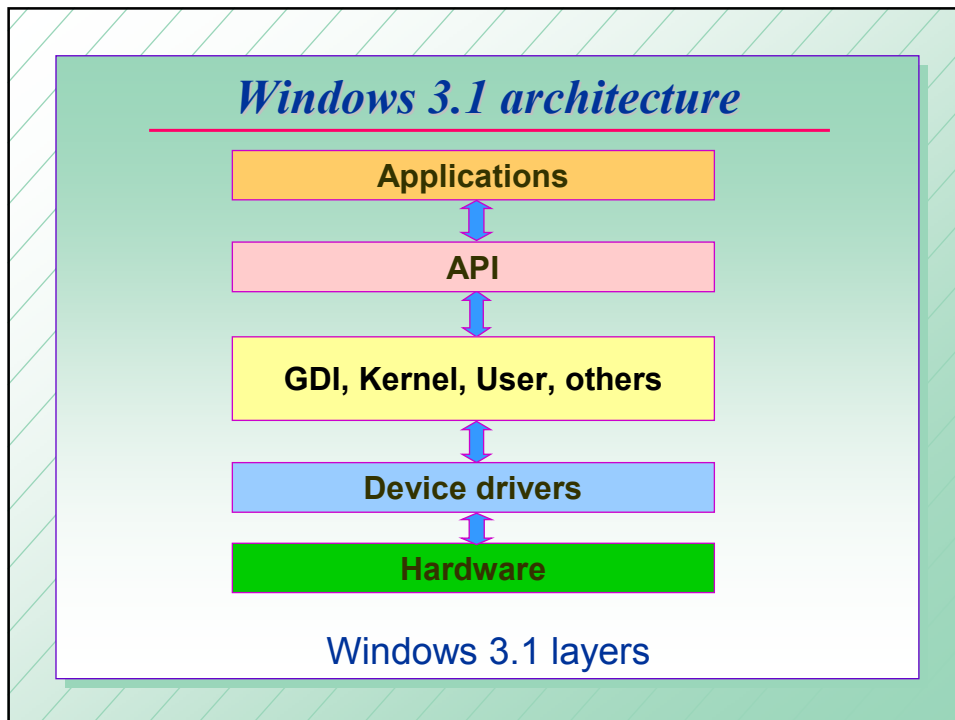
- User can work with a **mouse** in graphical mode ('**point-and-click**', double click, pull & drop)



## System features

- **multitasking** (apparent),
- **clipboard** allows to exchange data between different Windows applications,
- basic **applications programs** (text editor, graphical editor, calculator, clock, database, etc.),
- **Dynamic Link Libraries (DLL)** common for the applications,
- **Application Programming Interface (API)**,
- **multimedia** support,
- **network communication** support in Windows 3.11 (Windows for Workgroups).





- ### *Windows 3.1 core*
- **Kernel** performs memory management, task scheduling, **DLLs** access and uses new capabilities of 286 & 386 processors;
  - **GDI** – Graphic Device Interface – set of function for low-level graphical services;
  - **User** – performs user interfacing - keyboard, mouse and high-level graphical services.

## *Windows 3.1 modes*

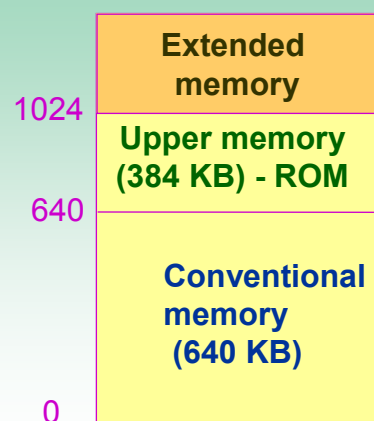
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Windows 3.1 operating environment could run in any of the **three modes**:

- **Real** – desktop for DOS,
- **Standard** – access to the whole system RAM (beyond 640 kB, up to 16 MB),
- **386 Enhanced** – allows to use **virtual memory (Swap File)** and multitask multiple MS-DOS environments in separate windows.

## *Memory division in standard mode*

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## WINDOWS 95

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**32-bit** operating system with graphical interface, that allows also to run MS DOS programs.

### New system features:

- ◆ **pre-emptive multitasking** – provided by Virtual Machine Manager, the main system module;
- ◆ **paging** – memory management, that allows running many large programs simultaneously;
- ◆ **FAT 32** file system (OSR2);

- ◆ 256-character mixed-case **long filenames**;
- ◆ new graphical interface – **folders & objects**, context menu;
- ◆ *ring „0”*- additional layer between the system core (**KERNEL, GDI, USER**) and device drivers;
- ◆ new model of loadable Virtual Device Driver - **VxD**,
- ◆ **hardware profiles & user profiles** – save information about hardware configuration and user's configurations;

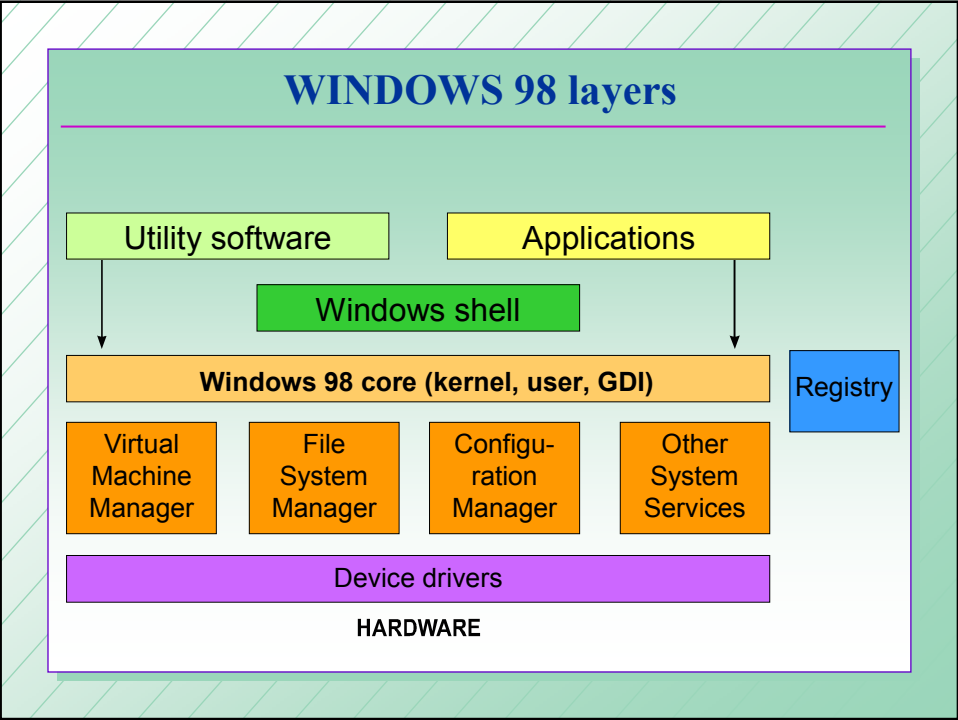
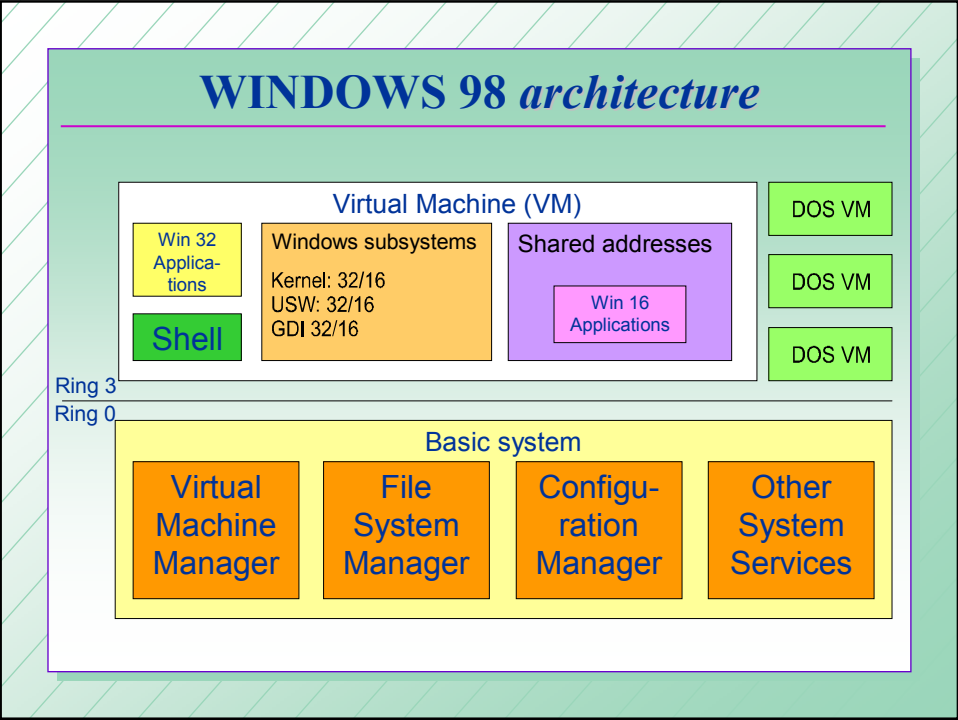
## ***Windows 98 & Millennium***

Systems architecture is based on Windows 95 architecture.

### Improvements:

- better memory management,
- optimisation of application running time,
- faster system running & closing,
- **support for new technologies**  
(**AGP, USB, HID, DVD, IEEE-1394** etc.)  
new Win32 Driver Model (**WDM**),
- support for **WebTV** etc.,

- extended network services (Winsock 2.0),
- Active Desktop, significantly faster and lighter  
**Internet Explorer 5** & Internet Connection Sharing (Win 98 SE),
- **Direct X 5**. - extended multimedia support,
- **MultiMon** - support for multiple monitors,
- **ACPI** - Advanced Configuration and Power Interface
- **Plug & Play**.



## *Windows NT & 2000*

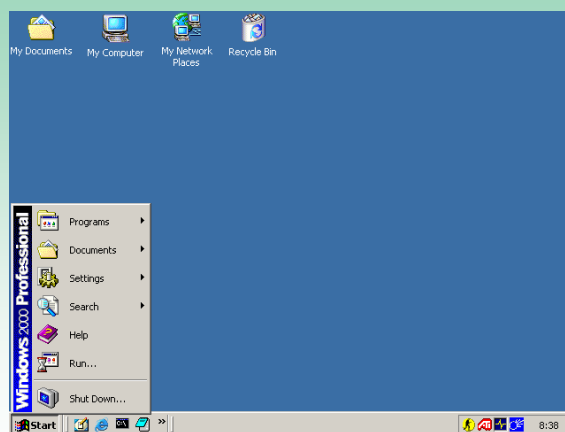
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### System features:

- ◆ pre-emptive multitasking,
- ◆ server services,
- ◆ operates on computers with Intelx86, Alpha, MIPS or Power PC processors and on **multi processor** platforms,
- ◆ Win32 API interface,
- ◆ **NTFS** file system

## *Windows NT & 2000*

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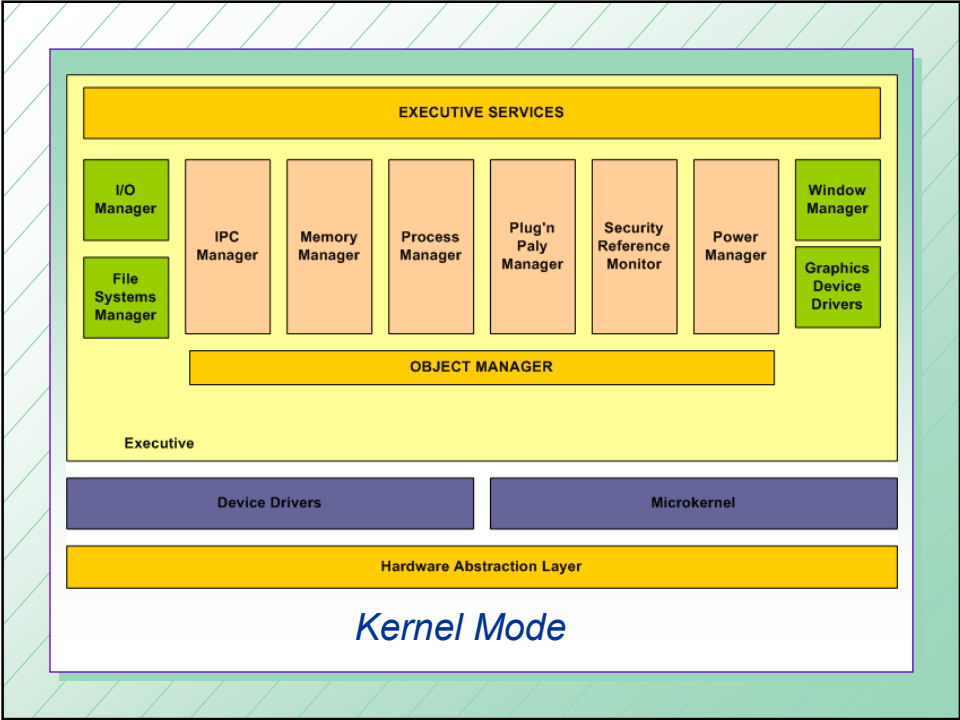
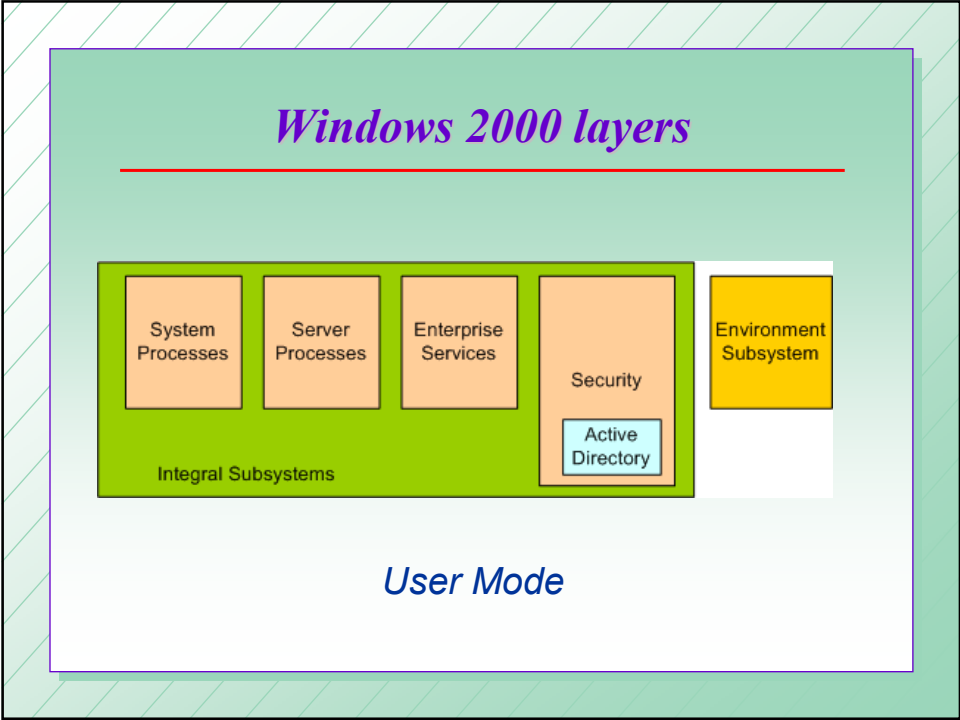
Windows 2000 Desktop

### System features:

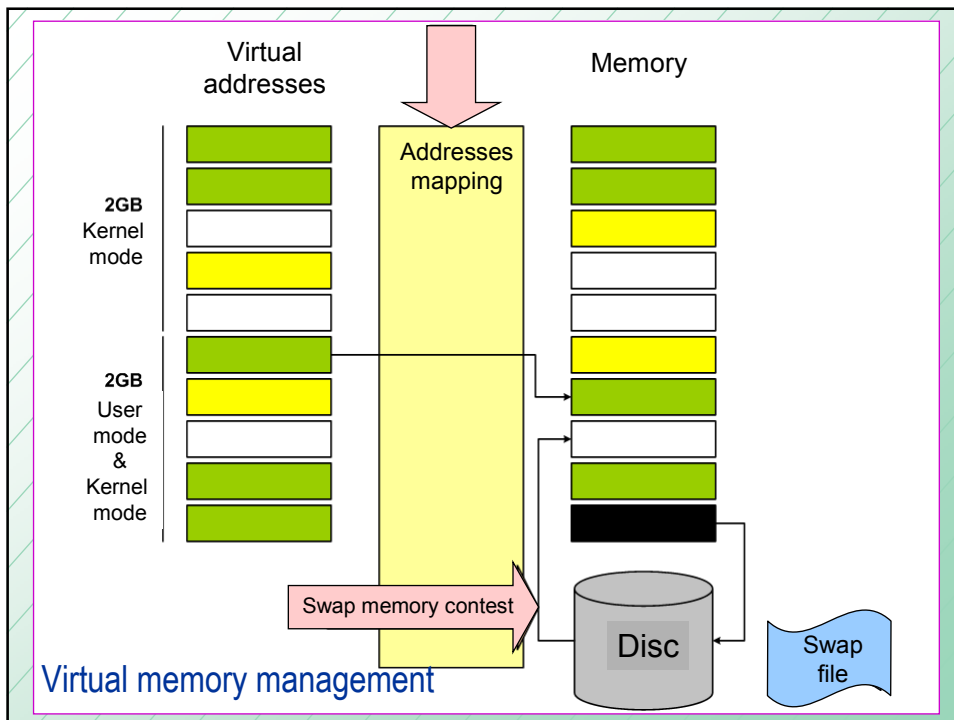
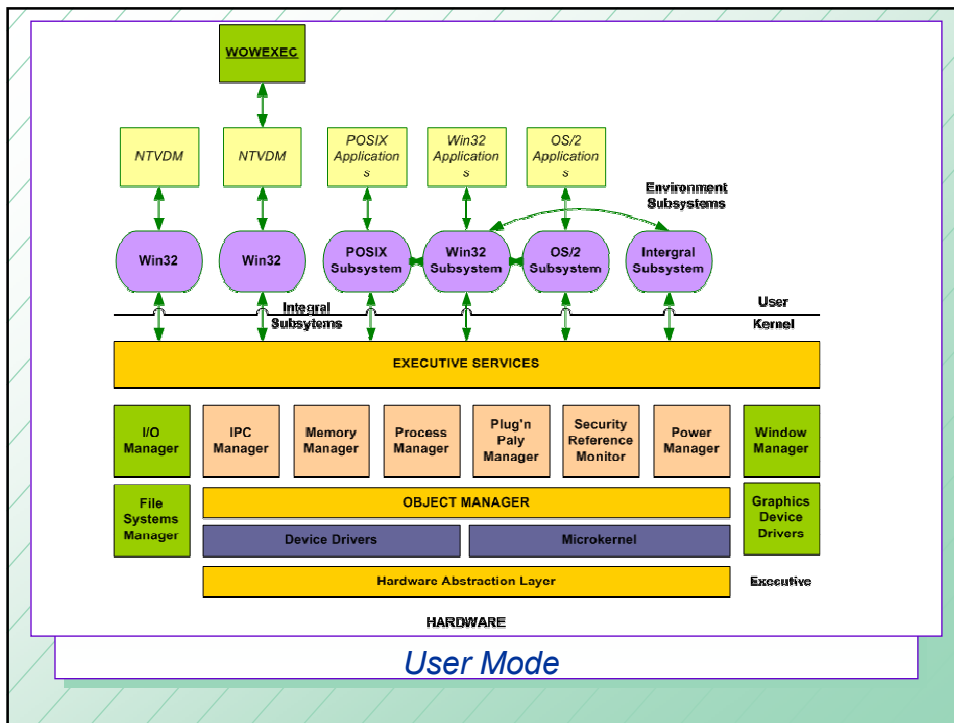
- ◆ **stable, multitasking** system,
- ◆ each running application (**process**) works independent from the other processes,
- ◆ process, which do not works correct is removed without the influence for the other processes,
- ◆ object oriented system management,

### Windows 2000 Improvements:

- support for (**USB, DVD, PC Card, AGP, etc.**),
- **Plug & Play**,
- **NTFS5** file system (encrypting File System),
- **ACPI** - Advanced Configuration and Power Interface.







## *Windows XP:*

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### System features:

- improved stability and efficiency over previous versions of Windows
- extended support for network services,
- „user friendly” system,

### The most common editions:

- Windows XP Home Edition, which is targeted at home users,
- Windows XP Professional, which has additional features such as support for Windows Server domains and dual processors, and is targeted at power users and business clients.

## *Features of Windows XP Professional*

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- **Remote Desktop**, software which lets users control a PC over the Internet,
- **Offline Files** and Folders allows a PC to automatically store a copy of files from another networked computer and work with these files while disconnected from the network,
- **IPv6** protocol,
- possibility of system „**hibernation**”,
- IFC - Internet Connection Firewall - an integrated Firewall,
- data flow history – tracing the data flow between the computer and the network.

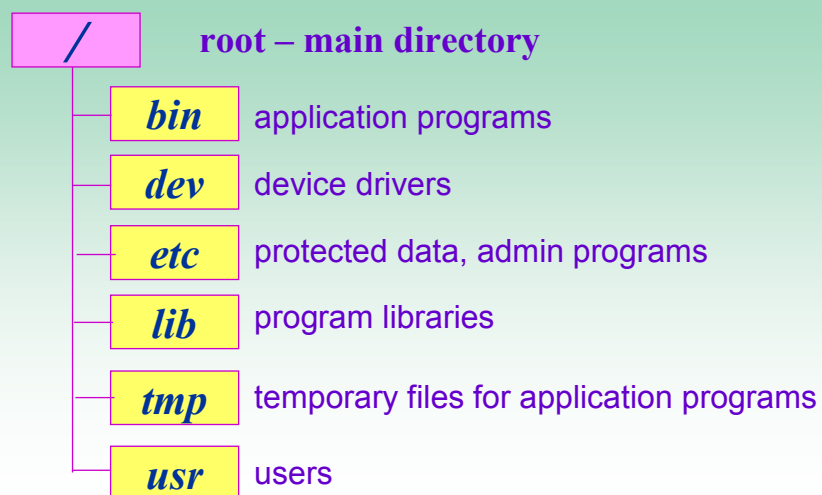
## *Unix operating system*

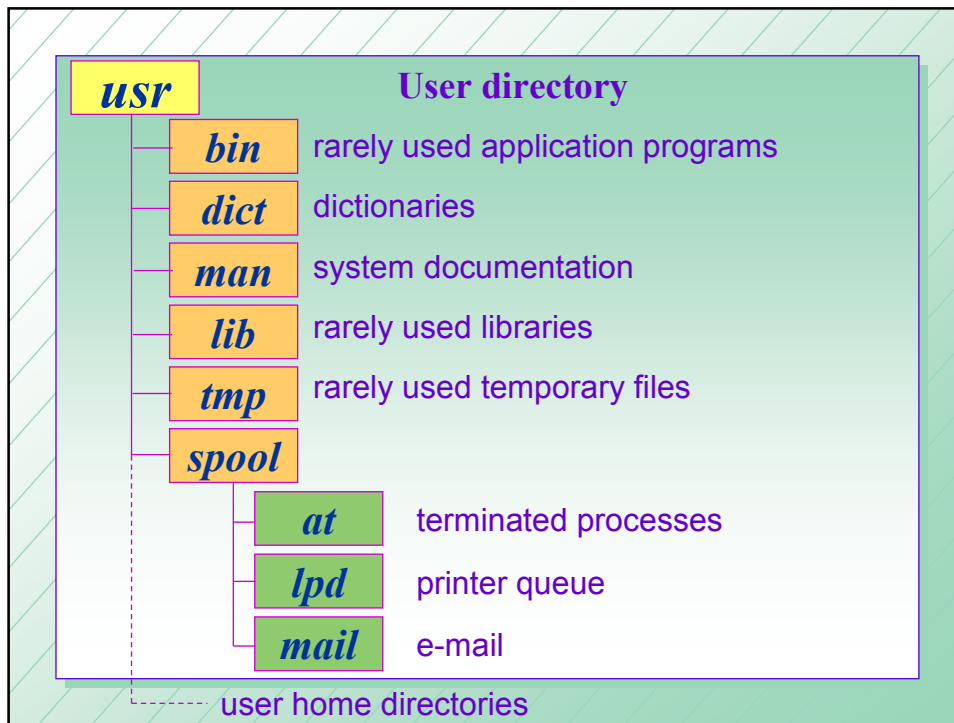
UNIX is a popular multi-tasking and multi-user operating system.

### Main system features:

- simple and compact commands,
- rich selection of programming tools for systems, utility and applications software,
- portable operating system,
- widely used in both servers and workstations.

## *Directories structure in BSD Unix*





## *UNIX features*

- Each user has his own **home directory**, **identifier** and **password**,
- Users are joint in **groups**,
- Each file has its **owner**,
- **Permissions** are managed in three distinct classes: **user**, **group**, and **others**,
- There are four types of file or directory access rights (**permissions**):
  - access denied (**-**), execute (**x**), write (**w**), read (**r**).

- The **kernel** provides services to start and stop programs, handle the file system and coordinates the whole system work; i.e., schedules access to hardware to avoid conflicts if two programs attempt to simultaneously access the same resource or device.
- The **shell** is the primary user-interface and the centre of the command environment.
- Popular UNIX shells are : Bourne shell (**sh**), C-shell (**cs**h), Korn shell (**ks**h).

- Devices and certain types of inter-process communication (IPC) are treated as files.
- The access to files on another device (hard disc, floppy disc, CD-ROM, e.a) is possible after mounting a file system. The disc is **mounted** to an existing directory, called the mount point.
- After the work with the device is finished, it should be **unmounted**.

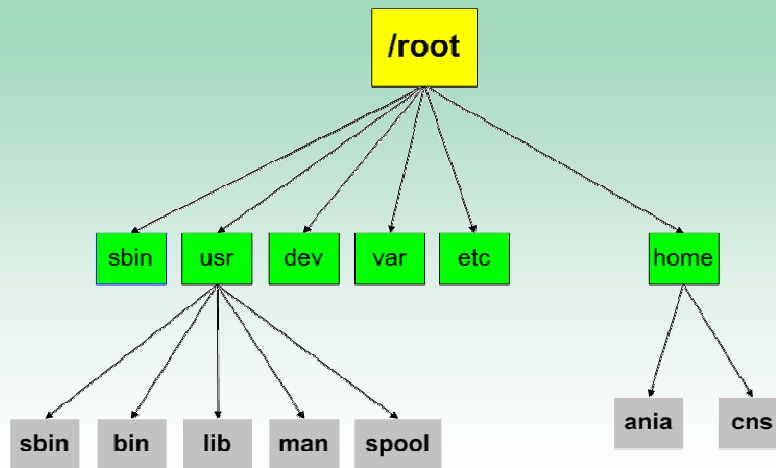
- UNIX is portable, multi-tasking and multi-user system using a time-sharing configuration.
- each running application with its data and environment is called a **process**,
- process may run interactively, or in the background,
- communication between processes and input/output devices is realized by the use of **STREAMS**,
- inter-process communication (IPC) is realized by the use of **named pipes** (also **FIFO**).

## *Linux*

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- A freely-distributable open source operating system that runs on a number of hardware platforms.
- The Linux kernel was developed mainly by Linus Torvalds.
- Because it's free, and because it runs on many platforms, including PCs and Macintoshes, Linux has become an extremely popular alternative to proprietary operating systems.

# Linux



Directories structure