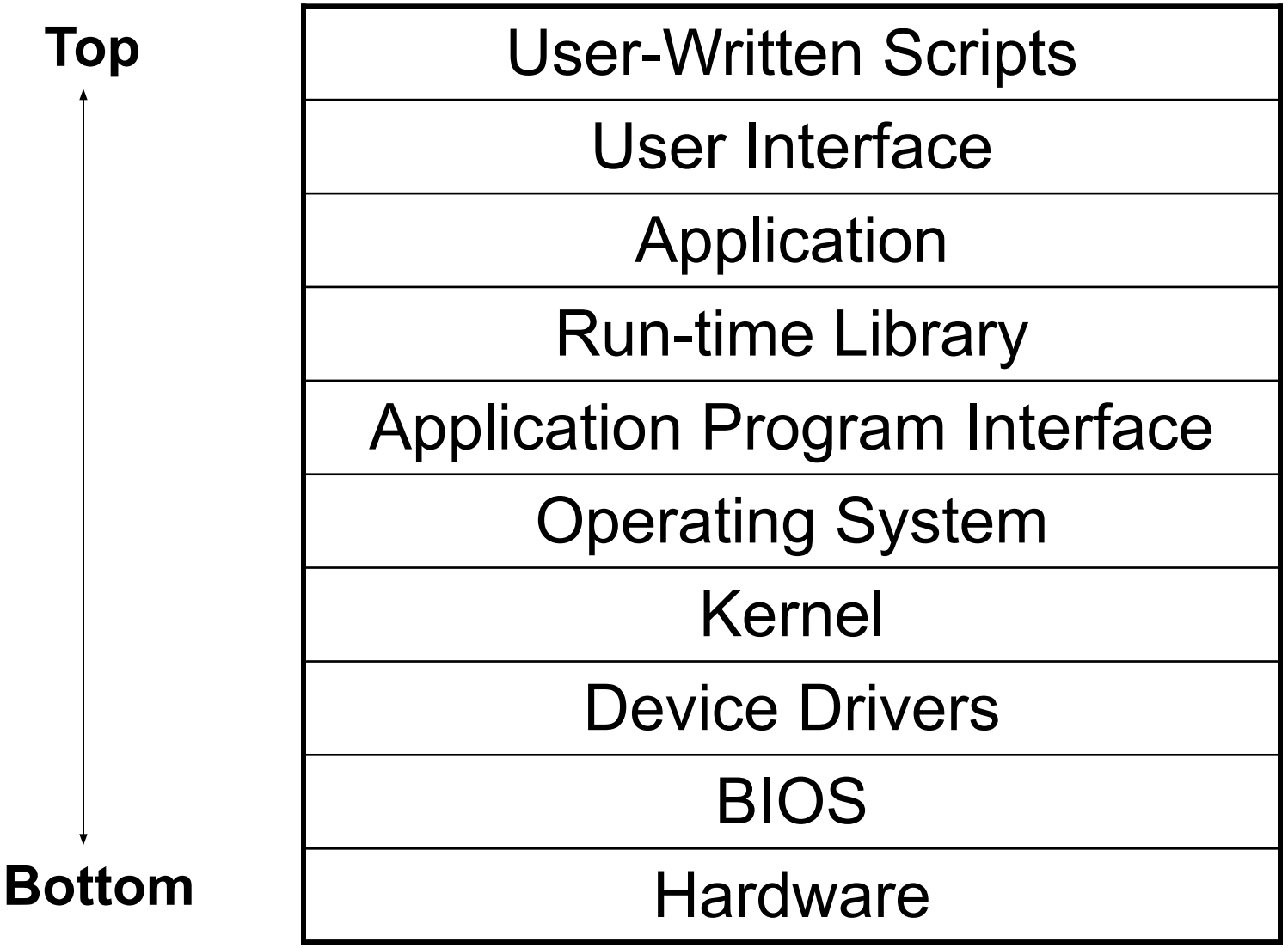
Lecture 3. Operating System Software

- 3.1 Structure
- 3.2 Device Management and Configuration

Encapsulation and Abstraction

- ***Encapsulation*** means that each layer needs only a limited amount of knowledge to do its job
  - Organizing software into layers that are relatively independent keep the entire system manageable, and afford greater efficiencies
- ***Abstraction*** means how the software layers communicate, beyond the view of the user

Layers of Software



Layers of Software (continued)

- ***Hardware***:
  - Lowest level of the computer
  - The physical components from which the computer system is constructed
- ***BIOS*** or ***Basic Input/Output System***:
  - Most primitive level of software
  - Deals directly with the signals that control each hardware component
  - Most of its work is done when the system first boots up

Layers of Software (continued)

- ***Device drivers***:
  - Helper programs used by Operating systems to control a device
  - In order to add new hardware, the appropriate device driver must be present.
  - Provided by the device manufacturer in floppies or other storage media
  - Instructions are to be followed to install the device and its drivers.
  - Windows OS may sometimes have such drivers stored.

Layers of Software (continued)

- ***kernel***:
  - Performs functions that are critical to maintaining the operating system
  - The kernel is responsible for
    - Memory management
    - Process and task management
    - Disk management. (File System)
    - Interrupt Handling
  - Resident in RAM at all times
  - Because space is a factor, kernel is kept small

Layers of Software: Operating System

- ***Operating System (OS)***:
  - Implements all other functions the OS is to perform
    - File system management
    - Communicates with the kernel when basic actions such as data transfer operation to a peripheral
  - Master controller of all the activities of the computer

Layers of Software: Operating System (continued)

- ***Operating System (OS) (continued)***:
  - Sets standards for all the application software used in a computer system
  - Different operating systems have different user interfaces and run compatible applications
    - Examples: Microsoft Windows, UNIX, LINUX, Mac OS

Layers of Software: Operating System (continued)

- External Services of OS:
  - Help users start programs
  - Manage stored data
  - Maintain security of the system
  - Provides ways to select an application program, find, rename and delete documents and other data stored on disk

Layers of Software: Operating System (continued)

- Internal services of OS:
  - controls input and output
  - Allocates system resources (e.g. memory, disk drive capacity, processor time)
  - Manages storage for programs and data
  - Detects equipment failures

Layers of Software: Operating System (continued)

- Operating systems can be classified into two categories.
- A ***server operating system*** is designed for computers that provide centralized storage facilities and communications capabilities for networks and Web sites.
- A ***desktop operating system*** is designed for a single-user microcomputer.

Layers of Software (continued)

- ***Application Program Interface (API)**:*
  - A set of routines, protocols, and tools for building software applications
  - Abstraction defined by OS to manage memory for applications
  - Application communicates with OS through the API.

Layers of Software (continued)

- ***Run time Libraries***:
  - A library of routines that are bound to the program during execution
  - Collection of Software routines which application programs rely on
  - Functions that make appropriate API calls needed to enable the OS to perform accordingly
- ***Application****:*
  - Layer where the routines perform tasks the application is designed to do.

Layers of Software (continued)

- ***User interface***:
  - Responsible for the communication between the application and the user
  - Typically it is a ***GUI***, composed of buttons and pull-down menus
  - The GUI passes the information on to the application

Layers of Software (continued)

- ***Scripts*** or ***macros***:
  - Routines that many applications use to allow users to create documents using the application's built-in commands.
  - Allow users to automate sequences of actions they perform frequently
  - Can perform any function that does not require additional user input

Layers of Software (continued)

- The computer industry relies on specialists in each layer of software.
- Some people make their living writing BIOS software. Others concentrate on improving GUI technology.
- The greatest number of programmers are found at the application level.

Windows OS

- Windows 95/98/NT/ME/2000/XP
  - Widely used in PCs
  - Supports a vast array of applications and peripheral devices
  - Provides icons, buttons, menus and various other graphical objects that can be manipulated by a mouse
  - Provides a command-line interface
  - Supports ***multitasking*** (running more than one program at a time)

Windows OS (continued)

- Designed to run high-end and complicated tasks such as video editing, scientific visualization, and computer aided design
- Provide reliability, security, and support for software applications

Mac OS

- Introduced By APPLE computers
- Contains graphical user interface featuring menus and icons
- OS interface through keyboard or mouse
- Software applications that are compatible with Mac OS are called Mac software.

Mac OS (continued)

- Fewer software are compatible with Mac OS than Windows OS.
- Mac OS has good graphical application software support.
- Some hardware and software add-ons enable Windows software to run on Mac OS.

Mac OS (continued)

- In 1984, Apple Computer introduced the revolutionary Lisa computer.
- The Macintosh computer, with its graphical user interface, ***Mac OS***, was a major factor contributing

The iMac computer

DOS

- ***DOS*** stands for **d**isk **o**perating **s**ystem.
  - Developed by Microsoft and introduced in IBM-PC.
  - Uses command-line interface. Has been incorporated into Windows OS.
  - Operates behind the scenes so Windows users do not have to memorize and type complex commands

Windows Server, NetWare, UNIX and LINUX

- Computer providing centralized storage and communications services requires Server OS
- User interface and appearance similar to Desktop OS
- Differs in managing large flow of data on large networks and web sites
- Novell NetWare: developed for micro computer network
  - Used to access documents and data files in a centralized storage
  - Handled by network managers rather than by average computer users

Windows Server, NetWare, UNIX and LINUX (continued)

- UNIX and LINUX:
  - Developed for mini and micro computer networks and web servers of all sizes.
  - Variation of UNIX is LINUX, which is has a stable and secure OS.
  - UNIX and LINUX are suitable for servers and high-end workstations.
  - A GUI environment is provided in UNIX and LINUX for ease of operation.

Utilities

- Subcategory of system software to augment OS
- Allow users to control the hardware resources and allocation
- Some Utilities comes with OS such as
  - Providing information about files on the disk
  - Preparing disk to hold data
  - Copy files from one disk to another

Utilities (continued)

- Norton Utilities:
  - Retrieves data from damaged disk, encrypt it and helps troubleshoot the problem
- Utility Software protects computer from viruses that erase or damage your data.
- OS provides disk formatting utility to format disks.
- Formatting disk:
  - Creating electronic storage shelves for data
- It is safe to format even a pre-formatted disk or a disk formatted for another OS.

The Roles of the BIOS

- The BIOS performs three major functions
  - initializes the hardware when the computer is first turned on,
  - loads the O/S,
  - provides basic support for devices such as the keyboard, mouse, and serial ports.

The Roles of the BIOS (continued)

- The ***BIOS*** resides on a ROM chip
  - Non-volatile
  - Slower than DRAM
- Loads itself into DRAM
- Uses CMOS
  - CMOS is powered by battery, therefore, it is volatile
  - Contains BIOS parameter settings for hardware and memory speed

BIOS (continued)

- The ***BIOS*** initiates the ***POST*** (Power-On Self Test) sequence
  - Enables the video card
  - Counts and tests memory
  - Checks for expansion cards and adapters and initializes them
  - Follows a search order to find the ***Master Boot Record***
    - A program is invoked to load the operating system once the **MBR** is found

Bootable Floppy

- Boot disk is a floppy containing bootable copy of OS.
- Used in the case of hard drive corruption when the system crashes.
- Computer that can be booted by a floppy is not fully secure.
- Anyone can boot their version of OS, which ignores the file protections and can access any file on the system.
- MBR(Master Boot Record) viruses affect the Boot disk.

Process Control

- Keeps track of all the processes running
- Process is an instance of a running program
- Process can be in three states:
  - Running
  - Runnable
  - Blocked
- Kernel maintains a queue of processes

Preemptive Multitasking

- Preemptive multitasking is used to create an illusion that all processes are running at once.
- Uses a real-time clock that can generate interrupts at regular rate. At each interrupt, another process may be run.
- Kernel checks whether a process should be given a chance to run.
- Kernel requires a context swap for switching processes.
- Context switching places some over head on the processor.

Context Switching

- Current running process is demoted from running to runnable.
- The steps occurring in context swap are:
  - Processor flushes the pipeline of executing instructions.
  - Its execution process is noted.
  - Register contents are saved.
  - Kernel loads a new page table.
- Context Swaps are done often to ensure that all the process are given an opportunity to run.

Interrupts

- A signal informing a program that an event has occurred.
- Interrupt signals can come from a variety of sources.
  - Hardware interrupts
  - Software interrupts
- To avoid losing of data, interrupts are handled in less than a thousandth of a second.
- PCs support 256 types of software interrupts and 15 hardware interrupts.

Interrupts (continued)

- Processor receives an IRQ(Interrupt ReQuest)
- When the processor receives a interrupt, it
  - Stops executing the current application
  - Saves the address of the last instruction executed
  - Jumps to a fixed memory location (e.g. address of keyboard interrupt handler)
  - Starts executing the instructions it finds there in the new memory location
  - Processor's registers contain data the user program was manipulating at the time.

Interrupts (continued)

- Interrupt Handler saves contents of registers before it saves the register for its own purposes.
- Examines the state of the keyboard interface
- Accepts the byte of incoming data
- Places the byte in a storage area
- The byte is checked by the keyboard driver the next time it runs.
- The keyboard interrupt handler restores the contents of the saved registers .
- Transfers control back to previous task.

Interrupt Priority and Nested Interrupts

- Processor assigns priorities to different types of interrupts.
  - Low speed devices have low priority.
  - High Speed devices have high priority.
- Interrupts cannot nest infinitely.
- Interrupt handler can only be interrupted by a higher priority interrupt.

Trap

- An event triggered by an external signal.
- Triggered by the execution of processor instructions
- Processor traps the errors similar to an interrupt but without time pressure.
- Trap handler responds to an error either by printing a message or continuing with the program.

Fault

- Occurs when:
  - The hardware is asked to perform a task that is not possible for the hardware devices
    - For example, non-existent memory location
  - Memory correction circuitry detects an uncorrectable error
  - Attempting to divide by zero
  - Program contains an illegal machine instruction

Installing Drivers

- Each device must have a device driver in the OS.
- Device Driver
  - manages the commands
  - transfer of data
  - error conditions that occur
- OS specifies an interface that a device driver must utilize
- Different versions of the same OS may use an interface requiring different drivers.

Installing Drivers (continued)

- Drivers are supplied with operating system's distribution files or from the manufacturer of the hardware device.
- In windows OS, new hardware devices are detected after a reboot by the Plug & Play (PnP) control mechanism.
- Use **Add New Hardware** utility if Windows does not recognize a newly added device.

Changing a Driver's Configuration

- Driver operate in a particular fashion.
- Can include operations to customize its functions for a specific user or system requirement
  - Transfer speed of a modem
  - Amount of data to buffer
  - Protocols to be used
- User Orientation
  - Screen resolution
  - Wallpaper to display

Changing a Driver's Configuration (continued)

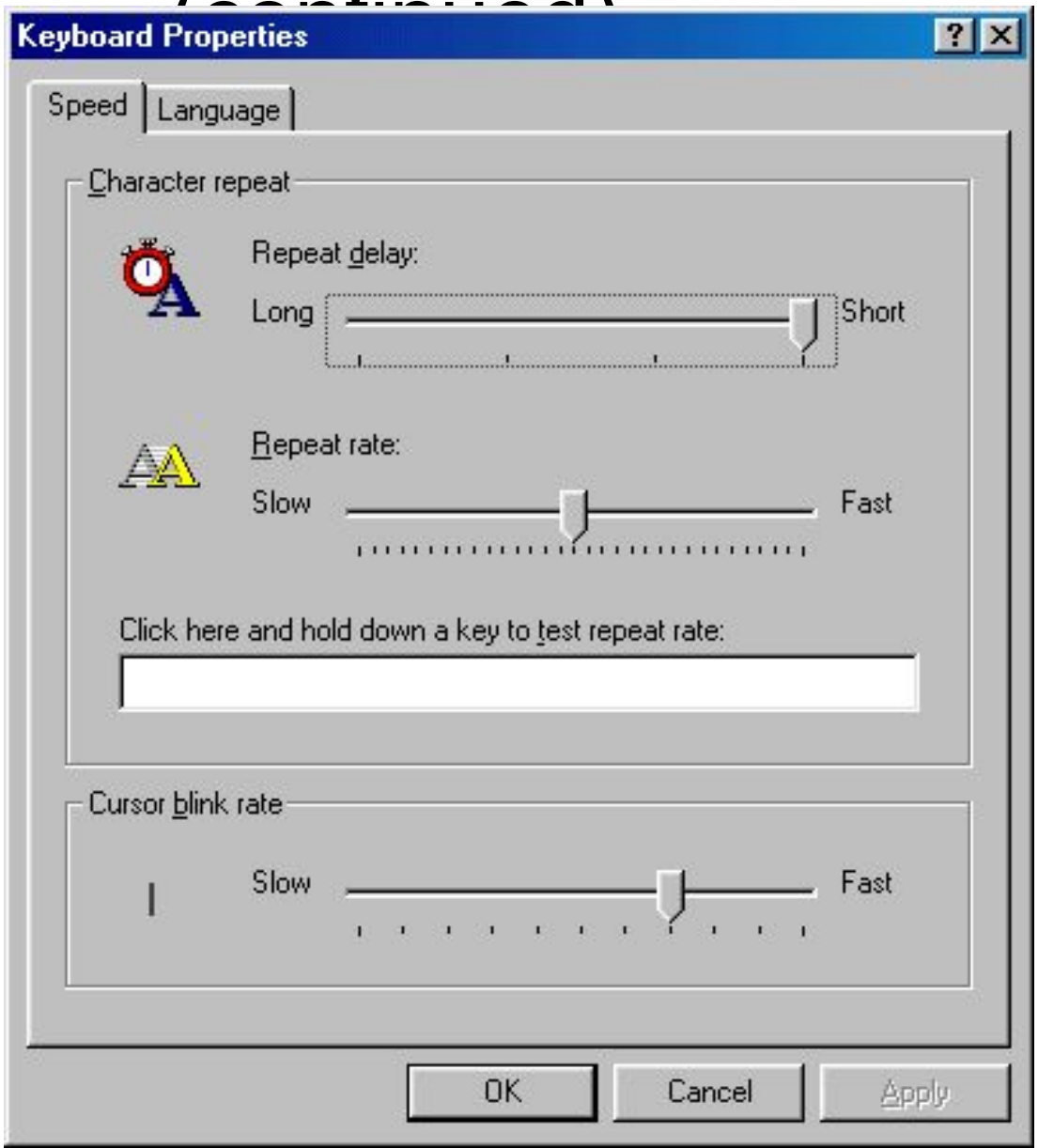
- OS like UNIX keeps all the configuration information in the form of text files.
- Present version of windows store configuration in binary files, (collectively known as Registry.)
- Registry has its own editor (either REGEDIT or REG32EDIT) for viewing and modifying the information.
- As it is cryptic in nature, novice users employ the control panel to modify contents of registries.
- Utilities exist for backup, restoring, or before changes are made to the hardware.

Changing Keyboard Options

Select Keyboard icon, then File, then Open

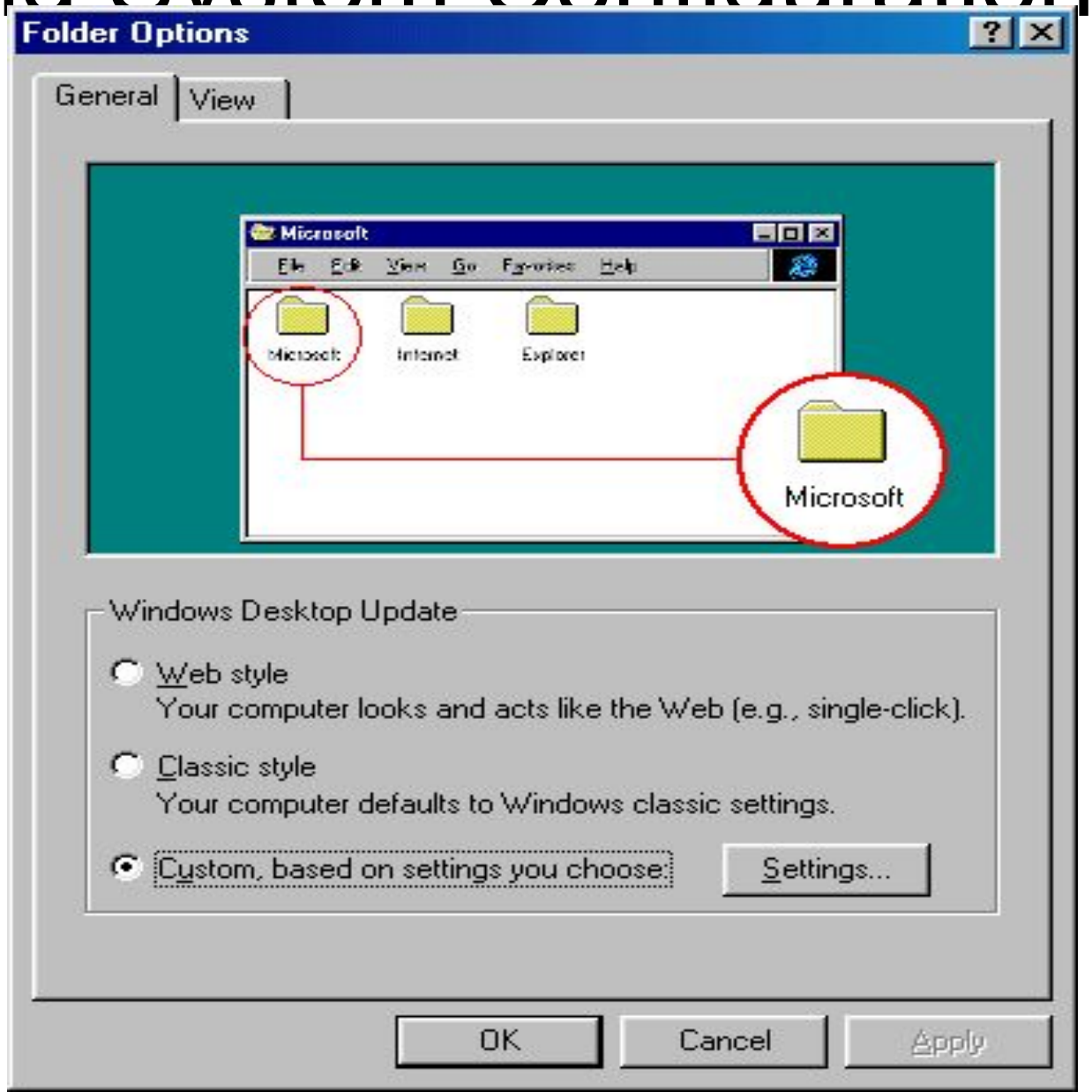
Changing Keyboard Options (continued)

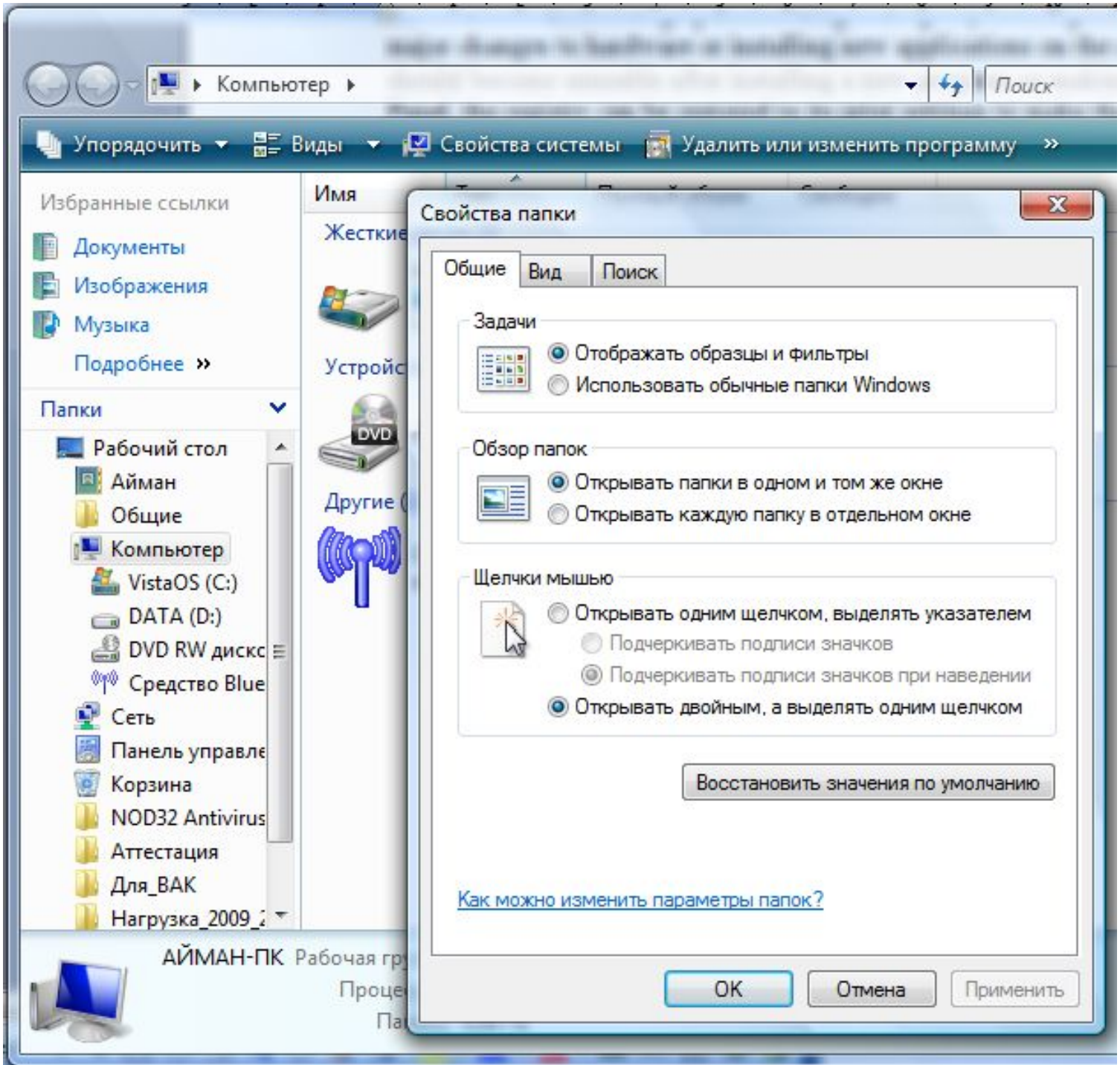
Changes can be made to keyboard speed and language



Operating System Configuration

Under folder options a change can be made to the Desk Top look and feel




Компьютер
Поиск
Упорядочить
Виды
Свойства системы
Удалить или изменить программу
Избранные ссылки
Документы
Изображения
Музыка
Подробнее
Папки
Рабочий стол
Айман
Общие
Компьютер
VistaOS (C:)
DATA (D:)
DVD RW дисковод
Средство Blue
Сеть
Панель управле
Корзина
NOD32 Antivirus
Аттестация
Для_ВАК
Нагрузка_2009_2
Имя
Жесткие
Устройс
DVD
Другие
АЙМАН-ПК
Свойства папки
Общие
Вид
Поиск
Задачи
Отображать образцы и фильтры
Использовать обычные папки Windows
Обзор папок
Открывать папки в одном и том же окне
Открывать каждую папку в отдельном окне
Щелчки мышью
Открывать одним щелчком, выделять указателем
Подчеркивать подписи значков
Подчеркивать подписи значков при наведении
Открывать двойным, а выделять одним щелчком
Восстановить значения по умолчанию
Как можно изменить параметры папок?
OK
Отмена
Применить