

THE USER INTERFACE OF CURRENT OPERATING SYSTEMS

UŽIVATELSKÉ ROZHŘANÍ SOUČASNÝCH OPERAČNÍCH SYSTÉMŮ

Prof. Ing. Imrich Rukovanský, CSc

Department of Logistics and technical disciplines, College of Logistics in Přerov
imrich.rukovansky@vslg.cz

Ing. Libor Kavka, PhD

Department of Logistics and technical disciplines, College of Logistics in Přerov
libor.kavka@vslg.cz

Abstract:

We are currently witnessing an unprecedented boom in the development of operating systems, whether for desktop or smart phones, that consistently brings new possibilities of usage for computer operators. In order the users are able to apply the maximum extent of the provided computers functions, tools - called user interface - are embedded between the user and operating systems (OS). The user interface enables clear and effective utilization of computational resources of the machine and it differs for the individual operating systems.

Abstrakt:

V současné době jsme svědky nebývalého rozmachu rozvoje operačních systémů ať již desktopových, nebo smartphonových, které trvale přináší nové a nové možnosti využití pro uživatele počítače. Aby uživatel byl schopen v maximální míře uplatnit operačním systémem nabízené funkce počítače, jsou zpravidla mezi uživatele a OS vloženy prostředky - zvané uživatelské rozhraní - umožňující přehledné a efektivní využití výpočetních kapacit stroje. Uživatelské rozhraní se u jednotlivých operačních systémů liší.

Keywords:

User interface, operating system, WIMP, Metro, Aero, Aqua, Symbian OS, Android, Windows Phone

Klíčová slova:

Uživatelské rozhraní, operační systém, WIMP, Metro, Aero, Aqua, Symbian OS, Android, Windows Phone

1. INTRODUCTION

User interface – UI on the PC is usually a set of certain displays and controls that the user uses for clearly control of the course of the entire system. The operating system provides the basic services of the user interface for communication with the user.

Communication in relation with the human being – the computer running through the user interface is interactive in nature, as the user enters inputs which are to be executed by the computer (tasks, requirements) and the computer evaluates the optimal outputs which are presented through the user interface towards the user (executing of the action, starting / closing applications).

The user interface significantly affects how the system will be successful and useful. Within the text UI, interaction takes place through the commands of the defined language that the user must master (e.g. a command line). Graphical UI facilitates the user work with the program through the graphical presentations such as windows, dialog boxes, icons, menus, and other graphical elements; the user does not have to know the commands and their syntax to communicate with a computer.

The voice user interface uses a user's voice input through a natural language and the system responds to them by the output in the audio form. The Braille line is one of the output devices which are used by blind users working by touching and hearing. The information is displayed using the Braille alphabet and the most commonly used variant is the eight points one (this is due to the single character compatible with one byte). There are still a number of other specific interfaces which hereafter will not be analysed.

2. TYPES OF USER INTERFACES

2.1 The graphical user interface

The Graphical User Interface (GUI) is a user interface that allows you to control the computer using interactive graphical controls. The user uses the keyboard, mouse, touchpad input and graphical elements such as menus, icons, buttons, scroll bars, forms and others. Through the use of icons and other auxiliary elements the device on which the interface is, can comfortably be used by any user.

GUI is usually used in computers, mp3 players, portable multimedia players, mobile phones, digital cameras or cameras, gaming devices and navigation devices, etc. GUI provides a consistent visual language that represents information stored on your computer. It enables the users with less computer knowledge to use the computer software and even the entire operating system in an easy way. WIMP (Windows Icons Menu Pointing device) is the most common combination of these elements in a graphical user interface technology. These elements are usually embedded in the system by widgets.

The basis of today's user interface is the concept of the main means of interaction between the user and the computer abbreviated WIMP - which is a technology that allows controlling the computer using the elements.

Window (s). In computer terms, with this expression, we call the area that shows the output data from the computer and at the same time they allow the user to control running processes. The term window is mainly used in conjunction with a graphical computer output that makes it possible to communicate with the computer using a cursor controlled by a computer mouse or other pointing device.

Pointing device (s). Commonly, this involves a computer mouse or touchpad. Sometimes the letter P is used for the word „program“.

Widget (s) - is the basic element of the computer for the interaction of the program with the user. The control element is visually designed and is typically used to manipulate the data in the program. Various implementations of these basic elements are usually bundled in the widget toolkit that programmers use to create the user interface. A similar concept (but in a different way) provides desktop widget which is a small specialized GUI application that provides some visual information or offers easy access to frequently used features and applications, such as displaying a clock, calendar, news, calculator, weather forecast, etc.

Nowadays, the GUI is known to most people primarily as a system of Microsoft Windows family or Mac OS X used on computer systems, notebooks, or like Symbian, BlackBerry OS, Android, Windows Phone, Palm OS / Web OS used for mobile devices. [7, 8, 9]

2.2 Text user interface

Text User Interface (TUI) is the user interface that represents an intermediate step between a command line interface (CLI) and graphical user interface (GUI). It works in the text mode, where the screen is divided into a fixed grid (columns and rows), while in each

position at most one character from a given set (ASCII, EBCDIC, etc.) can be displayed. Using special characters (parts of the frame, the mouse pointer) the similar control elements as in the GUI are designed, so the environment contains windows, menus, buttons, sliders, scrolling lists, and more common elements in the GUI. [10]

2.3 Command line interface

Command Line Interface (CLI) is the interface in which the user communicates with programs or operating system by writing commands in the command line. Unlike a text user interface and a graphical one, it does not use a mouse or menu and it cannot work with the whole screen (terminal). The users type the command, which should be executed, and then they press the key “Enter“. After the key “Enter” has been pressed the command will be executed and the computer will display the result. [11]

3. THE USER INTERFACE MICROSOFT WINDOWS

Windows 1.0 – provided a simple graphical interface in which most programs originally designed for DOS could have been run.

Windows 2.0 emerged later.

Windows 3.0 and 3.1 - brought an improved user interface and CPU utilization. The programs written for MS-DOS could have been run in the window. The opening of applications with the help of the command line has been replaced by the opening of programs via File Manager based on icons, which resulted in an easier start of programs. The system includes a simple applications such as Word, Painting and Calculator.

Graphical superstructure for Microsoft Windows 3.1x provides a graphical user interface that allows to represent programs as icons and to ensure that they are easy to run by users. The programs present their output in windows and there are buttons, input fields, menu controlled by a computer mouse.

In 1995, Windows 95 comes and brings the change of the appearance of the graphical interface, which brought more intuitive control and the higher interest of users. Windows 95 also included support for TCP / IP, which meant direct access to the Internet without auxiliary installations and the ability to detect and to configure new hardware connected to the PC automatically. (Plug and Play - used till nowadays).

The next release of the Windows 98 (1998) added support for USB, automatic updating of the computer, Internet Explorer 4.01, the Quick Launch toolbar and more.

Windows ME (Millennium Edition) - It is more or less improving existing Windows 98 and it is the last system running as an extension of the MS-DOS. It assumes the new look of Windows 2000 and some new functions such as Universal Plug-and-Play, System File Protection and Automatic Updates. In order to make the user interface more pleasant it contains (compared to Windows 2000) some other application or functions (Internet Explorer 5.5, Windows Media Player 7, Windows Movie Maker ...)

Windows XP - (2001). It is designed for general use at home or business personal computers, laptops and media centers. The acronym "XP" refers to experience. Windows XP have the modified appearance of the graphical user interface and a redesigned Start menu. Number of other items (different control panels, the login screen) was also adapted. The possibility of fast switching of users, function of remote assistance, integrated support for burning CD / DVD and others were included. [12]

Windows Vista - (2007). The designation „vista” means views (one of the definitions is a mental view of a succession of remembered or anticipated events). In the basic structure

of the operating system there were implemented major substantial adjustments, which include, inter alia, new graphics and audio subsystem, better support for software installation. The completely redesigned graphical interface called Aero appears in Windows Vista and it uses 3D computer graphics. It supports transparency of windows and menus, three-dimensional animation, icons tailored to a higher resolution, etc. In Windows Vista the completely new implementation of a set of computer network protocols is covered. It contains more complete IPv6 support, the built-in support for burning DVDs, enhanced file encryption, etc. [1, 2, 13]

The operating system Windows 8 is the successor to Windows 7; it was introduced in 2012 as the newest OS from Microsoft. It is designed for use in desktops and portable computers including tablets. The version of 32-bit and 64-bit for the processors x86 and version for ARM processors used in mobile devices have been released. The Windows 8 is based on Modern User Interface Metro. It is an environment that seems to be rather more for the control of mobile devices - mobile phones and tablets. As a result, it is often the target of criticism

because it does not enable to work with more applications simultaneously (multi-tasking) as comfortably as it is in the Aero. In the system applications the pull-down menu Ribbon has been extended and it is to replace the classic text menu and it has already been used in some applications of Windows. [4, 14, 15]

4. LINUX OPERATING SYSTEM

This is an operating system based on the principles of Unix systems. It is freeware so you can freely use, modify, and distribute it. There are many Linux distributions such as Suse, Ubuntu, Fedora, Redhat. According to the chosen distribution it is necessary to apply the specific installation.

Most distributions, however, offer both textual and graphical installation.

With installation we usually install not only the operating system itself, but also all the software needed to use the computer. The installation usually takes place in a few steps.

The programs installation in Linux (in general) is fundamentally different from the way of installing programs in Windows. You do not have to browse through the websites of the programs and look for the installation files. In Linux there are some sort of central software libraries and programs that can work with these libraries.

Software Centre is an essential tool for installing and removing programs. Its interface is very simple and easy and even the novice will learn to work with it very quickly.

The installation package (in Ubuntu suffix is .deb). It is similar to the setup of exe file in Windows and it contains the programs of the file.

Source repository is mostly on the Internet and it contains hundreds of thousands of packages (Ubuntu contains several tens of thousands). Sources are designed to suit a specific issue and allow the system easy to install and update all the installed programs.

In Linux there is the super user called the root. An administrator in Windows is a version of the root as the administrator of the computer can do absolutely anything, its routine use is very dangerous; just misspell a command may crash the whole system. In some cases it is necessary to use the root account but in most cases –for the classic work the ordinary user is enough. By default, the root account is locked. Computer Management can be performed by a user created during the installation (that is the first created user) using the sudo command.

The user interface in Linux is based on commands. Almost every guide you find here contains instructions to run a command. To run the commands, there is a program called Terminal. The terminal is also often called the command line, shell or console.

To work with the command line does not require any special knowledge; it's like any other program. In Linux, most things can be done from the command line. Although most applications have a graphical interface, sometimes it is just not enough. Using the command line is often faster and easier than a graphical interface.

It is worth installing a file manager (Midnight Commander-MC), which runs in text mode. It contains a lot of functions, including a built-in text editor, support for FTP, SSH, browsing files, etc. It can also be useful in the case that you are unable to start the graphical interface.

A graphical file manager (Nautilus) serves for the work with files. It can be run immediately after installation with double-click the icon on its home folder in the sidebar. Working in Nautilus is very intuitive as you are basically just dragging the icon with the mouse and clicking. Nautilus creates live previews of text files, images, videos and documents. It can work with bookmarks, can connect and disconnect the archives, restore files from the bin. It supports intelligent selection and copy files, plugins and others. [3, 6]

5. USER INTERFACE MAC OS X

Apple's Mac OS X has been the latest operating system for Macintosh computers since 2001. Earlier - since 1984 Apple had used Mac OS for its Macintosh computers.

The current system originated as a combination of several different technologies. The base of the system is called Darwin (OS of UNIX mode with open source code from Apple Inc.) and it is composed by a hybrid core Unix-like type XNU along with BSD (Berkeley Software Distribution), GNU and other open source tools. Above the core there is a set of libraries, services and technologies that are taken mostly from the previous operating system Mac OS.

The graphical user interface is called Aqua and it was developed by Apple Company. Mobile phone Apple iPhone, multimedia handheld iPod touch and iPod tablet use the corrected version of Mac OS X named iOS.

Mac OS X is fully adapted to Macintosh computers. Although the Mac can run Windows, the reverse is not possible. The Apple policy - the development of the hardware and software eliminates the problem of incompatibility. Apple does not intend to allow running Mac OS X on a PC (x86-based computer that is not electronically identified as a Mac). However, it is possible to run (illegally) operating system Mac OS X on some PC. [16]

6. OPERATING SYSTEMS FOR MOBILE PHONES

The first operating system in mobile phones Symbian was from the same named company, which was later taken over by Nokia. It appears in several versions for touch phones. In the newer touch phones the version Symbian Anna was widespread and it was then replaced by another version under the name Nokia Belle.

Approximately five years later after Symbian, the platform Android developed by Google comes into the world. This is an operating system designed for mobile phones and also for the tablet computer. The mobile phones use most widely the version 2.3 called Gingerbread and 4.2 Jelly Bean. The versions are particularly dependent on the hardware of the phone.

The newest currently available operating system for mobile phones is Windows Phone. It was released in late 2010 by Microsoft.

Each operating system has its advantages and disadvantages as well as supporters and opponents. [17, 18, 19]

6.1 Symbian

The actual operating system Nokia Belle came after a big revolution and the entry of Android, which is largely reflected in its arrangement. While previous versions of Symbian Anna and the older ones inherit properties and approach of the original contactless version of Symbian, Nokia Belle approached rather the form of Android, both with a drop down menu similar to Android and the layout of the main menu and other features. However, it regards only the visual aspects of the interface, the gestures and methods of control are typically "Symbian like".

Symbian was harmed by his initial standoff; development of application was available only to those who purchased an expensive license and development kit. Opening the system in 2010 came too late and the market share declined in favour of Android and Apple. Despite of that, it is a good operating system and it still has its place in the mobile market, although it was crossed by the entry of Windows Phone as the main operating system for Nokia smartphones.

Currently Nokia Belle is available on phones Nokia N8, E7, 603, 701 and 808 PureView. [20, 21]

6.2 Android

Android is a comprehensive open source platform, which was created especially for mobile devices (smart phones, PDA, navigation, tablets). It includes an operating system based on Linux kernel, middleware, user interface and applications.

Android has been developed by the consortium of Open Handset Alliance, whose members include software companies such as eBay Inc., Google Inc., Myriad, telecom operators: China Telecommunications Corporation, Sprint Nextel, T-Mobile, Telefónica, TELUS, Vodafone and also manufacturers of mobile devices, such as Acer Inc., Dell, FUJITSU LIMITED, HTC Corporation, Lenovo Mobile Communication Technology Ltd., LG Electronics, Inc., Motorola, Inc., Samsung Electronics, Sony Ericsson and others.

Android OS has five-layer architecture. The lowest layer of the architecture is the kernel of the operating system, which forms a layer between the hardware and the software. Because of the relative easy applications on different devices the Linux was selected for the kernel and it uses many of its properties, the support for the memory management, the network management, the built-in control or management processes.

The lowest layer of the architecture is the operating system kernel, which forms an abstraction layer between the used hardware and the rest of the software in higher layers. The core of Android is based on Linux version 2.6; its features, such as support for memory management, network management, built-in control or management processes, such as running parallel applications that run as separate processes with permissions set by the system.

The next layer are libraries that are written in C or C++ code and they use the various components of the system. For example, Media Libraries that supports playback of video and audio formats as well image files such as MPEG4, H.264, MP3, AAC, AMR, JPG, and PNG.

The next layer contains the application virtual machine that has been developed specifically for the Android by the team at Google. The basic libraries of the Java programming language are also included in this layer.

Application Framework layer is the most important for developers. It provides access to a large number of services that can be used directly in applications. These services enable to access data in other applications, user interface elements, advisory status bar, and the applications running in the background, the hardware of the used equipment and many other services and features.

Basic applications that the ordinary users use to create the highest layer of the system. The application may be pre-installed or subsequently downloaded from the Android Market. For example, e-mail client, SMS program, calendar, maps, browser, contacts, and other applications of the "third" parties, too.

OS Android is currently available on many devices of different manufacturers; the most significant are Samsung, HTC, LG, Sony Ericsson, Google, ZTE and many others. Moreover, it also occurs on computer tablets and further expansion of market share is expected in the future. [22, 23, 24]

6.3 iOS

The seventh version of the operating system for Apple devices, called iOS7 has been launched and for the testing partners even the third beta version of iOS is introduced.

Originally, this system was called iPhone OS till its fourth version. It is a UNIX-like type that does not have all the functionalities of OS X, but adds the support of touch control. The system consists of four layers. The first is Cocoa Touch with frameworks for development of applications. Media layer, which is the second layer, allows creating complex graphics and audio applications. The third layer Core Service offers high-level services to make payments within the application for additional content, or cancelling ads, to track the current location of the user. The last layer Core of OS provides the low-level functions to other technologies.

Design of the Apple's mobile system was based on the assumption that graphics applications should be as the real objects. Are application of calendars so far in the iOS looked like a real leather calendar, application for notes management looked like a block, contact management looked like a traditional machine directory.

Apple kept this approach for a long time. In the version iOS7 it got rid of all shadows and other graphic fancies and succumbed to the spirit of minimalism. Apple has improved its multitasking; new intelligent grasp of several concurrently running applications and according to the application allocates the processing power.

Most users say that Apple is more intuitive and easier to learn. It looks after the standard of design, which is reflected for example through the icons of the same size, as if they match one another. It offers immediately high functionality. On the other side, Android is suitable for those who like playing with the phone. It offers a lot of possibilities for experimentation and adjusting so that each user can create a system according his/her imagination.

With iOS you are sure that nearly 85 % of users are using the latest version of the operating system, so there are no problems with backward compatibility. The disadvantage is the need to learn the programming language Objective-C which has hardly any utilization except iOS application. The programmer must also consider the rules and approval process for each application. [25, 26, 27]

6.4 Windows phone

It is the youngest of the mentioned operating systems. Like other operating systems from Microsoft, it is a system with a proprietary license and the source code therefore is not accessible for free. On the other hand, the Microsoft released the development environment and distribution of application goes through Microsoft's certification process. This increases the security of the system and also ensures a certain level of applications quality.

Regarding the actual user interface, you can see a large degree of unification. All the control elements are the same across all phones and the user can adapt only a few properties of the phone. On the one hand, it is advantageous since the user can pick up any phone with Windows Phone and he/she will be able to use it instantly. On the other hand, it is basically restricting his freedom in modifying the interface to own image. [5, 28]

7. CONCLUSION

As already mentioned, the user interface gives the user the means to take full advantage of the possibilities of the computer system. The efforts of all manufacturers, both laptop and mobile device, is to get as many customers as possible. Competition and continuous comparison will continue in the future. The field where these actions take place will also expand. The car industry may be the examples of the combat of various platforms. Apple announced a partnership with BMW, Mercedes, Honda, GM and others to develop a system for dashboard computer that would take care of multimedia, maps and communication. Audi is planning a similar activity, although it chose the Android platform. Hyundai plans the use of smart glasses from Google to unlock or start a car.

BIBLIOGRAPHY

Books:

- [1] BITTO, O.; JANEČEK, V.: Windows Vista. - Praha: Computer Press, 2010. 336 s. ISBN 978-80-251-1724-8.
- [2] CAFOUREK, B.: Windows 7. - Praha: Grada, 2010. 326 s. ISBN 978-80-247-3209-1.
- [3] JELÍNEK, L.: Jádru systému Linux, Komplettní průvodce programátora. - Praha: Computer Press, 2008. 688 s. ISBN 978-80-251-2084-2.
- [4] PACINOVSKÝ, J.: Windows 8. - Praha: Grada, 2012. 128 s. ISBN 978-80-247-4338-7.
- [5] VÁVRŮ, J.: iPhone. - Praha: Grada, 2012. 179 s. ISBN 978-80-247-4457-5.
- [6] WELSH, M.; KAUFMAN, L.: Používáme Linux. - Praha: Computer Press, 1997. 680 s. ISBN 80-722-6698-5.

Website:

- [7] Wikipedie otevřená encyklopedie. Uživatelské rozhraní. [online]. - 2012 [cit. 2012-12-30]. Dostupné z: http://cs.wikipedia.org/wiki/U%C5%BEivatelsk%C3%A9_uzivatelskeho-rozhrani
- [8] Root.cz Seriál Historie vývoje grafického uživatelského rozhraní. [online]. 2012 [cit. 2012-12-30]. Dostupné z: <http://www.root.cz/serialy/historie-vyvoje-grafickeho-uzivatelskeho-rozhrani/>
- [9] Wikipedie otevřená encyklopedie. Grafické uživatelské rozhraní. [online]. 2012 [cit. 2012-12-30]. Dostupné z: http://cs.wikipedia.org/wiki/Grafick%C3%A9_uzivatelskeho-rozhrani
- [10] Wikipedie otevřená encyklopedie. Textové uživatelské rozhraní. [on-line]. 2012 [cit. 2012-12-30]. Dostupné z: https://www.google.cz/?gws_rd=cr&ei=nprfUs_TMZL3yAOy3oGoCg#q=textov%C3%A9_uzivatelskeho-rozhrani
- [11] Wikipedie otevřená encyklopedie. Příkazový řádek. Wikipedie otevřená encyklopedie. http://cs.wikipedia.org/wiki/P%C5%99%C3%ADkazov%C3%BD_%C5%99%C3%A1dek

- [12] Wikipedie otevřená encyklopedie. Windows XP. [online]. 2012 [cit. 2012-12-30].
Dostupné z: http://cs.wikipedia.org/wiki/Windows_XP
- [13] Wikipedie otevřená encyklopedie. Windows 7. [online]. 2012 [cit. 2012-12-30].
Dostupné z: http://cs.wikipedia.org/wiki/Windows_7
- [14] Wikipedie otevřená encyklopedie. Windows 8. [online]. 2012 [cit. 2012-12-30].
Dostupné z: http://cs.wikipedia.org/wiki/Windows_8
- [15] Microsoft. Windows 8 [online]. 2012 [cit. 2012-12-17]. Dostupné z WWW: <
<http://windows.microsoft.com/cs-CZ/windows-8/meet>>.
- [16] Wikipedie otevřená encyklopedie. Mac OS X. [online]. 2012 [cit. 2012-12-30]. Dostupné
z: http://cs.wikipedia.org/wiki/Mac_OS_X
- [17] Mobilmania. Smarthphony. [online]. 2013 [cit. 2013-12-21]. Dostupné z:
<http://www.mobilmania.cz/smartphony/sc-319/>
- [18] Android. [online]. 2012 [cit. 2012-12-11]. Dostupné z: <http://www.android.com/>
- [19] WindowsPhone.[online]. 2012 [cit. 2012-12-11]. Dostupné z:
<http://www.windowsphone.com/>
- [20] Wikipedie otevřená encyklopedie. Symbian OS [on-line]. 2012 [cit. 2012-12-11].
Dostupné z: http://cs.wikipedia.org/wiki/Symbian_OS
- [21] Wikipedie otevřená encyklopedie. Symbian Ltd. [on-line]. 2012 [cit. 2012-12-11].
Dostupné z: http://cs.wikipedia.org/wiki/Symbian_Ltd.
- [22] Wikipedie otevřená encyklopedie. Android operační systém [online]. 3. 1. 2014 [cit.
2014-01-08]. Dostupné z: http://cs.wikipedia.org/wiki/Android_%28opera%C4%8Dn%C3%AD_syst%C3%A9m%29#Z.C3.A1kladn.C3.AD_.C4.8D.C3.A1sti_aplikace_Android
- [23] Zdnet: How android works big picture [online]. 28. 1. 2008 [cit. 2014-01-08]. - Dostupné
z: <http://www.zdnet.com/blog/burnette/how-android-works-the-big-picture/515>
- [24] Svetandroida. Smartphone. [online]. 2013 [cit. 2013-12-21]. Dostupné z:
<http://www.svetandroida.cz/smartphone-roku-2013-201305>
- [25] Wikipedie otevřená encyklopedie. iOS [online]. 6. 11. 2013 [cit. 2014-01-08]. Dostupné
z: http://cs.wikipedia.org/wiki/IOS_%28Apple%29
- [26] Root: Bezpečnost iOS a Android [online]. 14. 10. 2013 [cit. 2014-01-08]. Dostupné z:
<http://www.root.cz/zpravicky/google-os-android-je-bezpecnejsi-nez-ios/>
- [27] Blog.Applause: Android or ios [online]. 18. 4. 2013 [cit. 2014-01-08]. Dostupné z:
<http://blog.applause.com/android-or-ios-a-multi-stat-head-to-head-battle/2013/04/>

Reviewers: Doc. RNDr. Vladimír Homola, CSc., VŠB-TU Ostrava,
Doc. Ing. Vladimír Kebo, CSc., VŠB-TU Ostrava