OPERATING SYSTEMS: PAST, PRESENT AND FUTURE

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Abstract: This article addresses some major aspects of operating systems (OSs) by looking at current OS developments and their future. Various hardware, such as desktops, laptops, smartphones and other devices on the market, have been analyzed in terms of: operating systems, development environment, programming languages, access to web-based training applications with different browsers, for to reach trends in the future development of operating systems - introduction of artificial intelligence, outsourcing of OSs functions in the cloud, security of work, convenience for interactive work with a computer, open source OSs projects.

Keywords: Operating System (OS), Desktop Versions OSs, Mobile Versions Oss, OS used by Tablet Versions, The future of Oss, artificial intelligence (AI) in the Oss, the OSs to the Cloud.

INTRODUCTION

In the logical structure of a typical computing system, the operating system occupies a position between devices with their microarchitecture, machine language and, possibly, their own (built-in) microprograms (drivers), on the one hand, and application programs, on the other.

The OS allows developers of software to abstract from the details of the implementation and operation of devices, providing the minimum necessary set of functions (see: application programming interface), see Pic.1.

In most computing systems, the operating system is the main, most important (and sometimes the only) part of the system software. Since the 1990s, the most common operating systems have been the Windows, Unix, and Linux-like systems.

Definition 1. Operating system is a general part from the computer system software, which controls and coordinates the working of processor and other devices in the system. It maintains the work of application software and separate the necessary hardware recourses, also manage the access of the different applications to them.

Definition 2. Operating system is a special kind of software, which cares about the managing of all devices in one computer and interacts between them and the user programs.
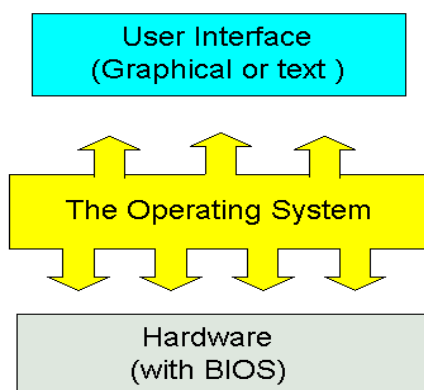
Pic 1. OS position

DESCRIPTION
History and basic principles [1]
Historical development

The programs, foreran the researching of OS, are official programs (for loading and monitoring), and libraries of often used programs, which start elaborating with the appearing on first stage computers in the end of 40es. The first operation system has been only a command row, such as DOS, UNIX. During 50es, and 60es the leading part in the researches of OS is IBM, which is a leader in the market for mainframe computers. In this period are set up and realize the general ideas, forming the functionality of OS: package conditions, separating during multitask, separating power of attorneys, real time scale, work with file structures and fail systems.

1) Package condition. The necessity from optimal using of the expensive calculating recourses leads to raising the conception „package condition" of executing programs. The packet condition supposing having a definite way for executing programs, on which OS can load the program in the Operating memory from peripheral data carriers, without waiting to end executing of the previous program and on this way, is escaping from not unwanted processor pause.

2) Separating by time and multitask. In its developed variant, the package condition needs the time of processor to be separated between executing of several programs. The necessity of sharing by time (multitask, multiprogramming) reveal more stronger, when during 60es in the quality of the input – output devices are integrated electro-mechanical. The dividing by time allows to be created „multiuser" systems, in which the central processor and the operating memory block are connecting with many terminals. During this operation one part of the tasks (as Multitask of redacting the operator's data) can be executed in dialogue regime, and the rest (as exchangeable calculations) – in package condition.

The history of multiuser and multitask OS starts in the end of 1960 with the research team of Bell Laboratories and their OS called MULTICS. Unfortunately, the final product is too slow and very big. Ken Thompson and Dennis Richie rewrite the program and make an experiment with a lot of the conceptions, used in MULTICS. The already done system is called UNIX. This is the first multiuser operation system in the world.

The first operating system, which uses multitask, is UNIX. Other systems like UNIX are GNU/LINUX, Windows NT and afterwards, Mac OS, OS/2 Thesis are also the first real 32 bit OS.

The first operating system of Microsoft and Apple appears in 80-es and are not multiuser. Firstly, the OS has been 8 bit type and difficult to use. A little bit later 16 bit OS shows up.

3) Separating by authority. The distributing of multiuser systems make the task for separating by authority, and solving this task prevents the possibility for changing the executable program or its data, situated in the memory, from other program (incidental or not) and also prevents from changes on the OS in which is applied the particular program. The realizing of principle for separating by authority meets the support of the processor developers and they offers structures with two processor working regimes – „real" (in which the executable program has access to the whole address space) and „protective" (in which the access to the address space is limited in size saved during the start of the executable program).

4) Real time dimension. The applying of computers for managing of production processes demands realizing the principle for work in real time – synchronization of executing of the programs with external physical processes.

The turning on of real time functions in OS allows to be created systems, serving at once the production processes and also solving other tasks (in package regime and/or in condition of separating by time)

5) File systems and structures. According to the modern OS, the whole hard disc is a combination of clusters with size 512 bites and more. The drivers of the file system organize the clusters in files and directories (which in fact are also files, consisting lists with files). The drivers are carrying on which clusters are using at the moment, which are free and which are marked as damaged.

The different OSs have different way of work with the file systems.

Structure of OS
The OS consist two general parts. It shows on Pic 2.
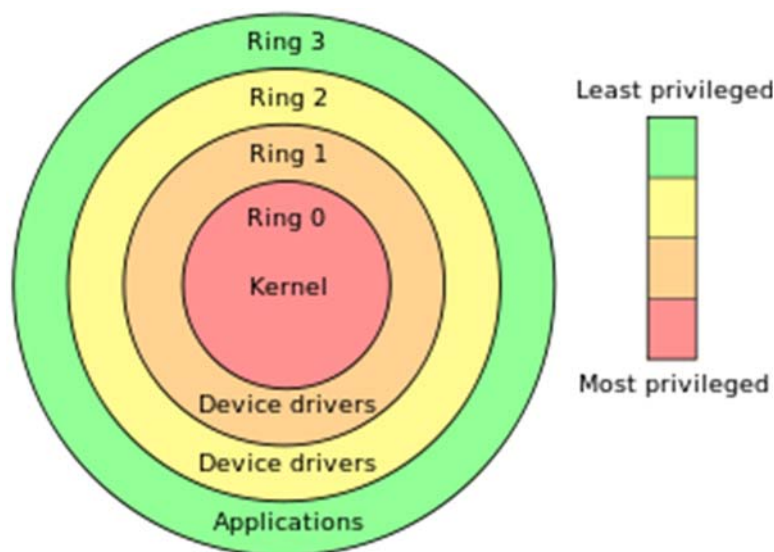
Pic 2. Structure of OS

1) Kernel.
2) Shell.

The kernel takes care for all processes, which are executing, and also for the communication with the available devices. It provides the work of the shell and the application programs.

The shell is using for a link between the user and the kernel. It can be graphical and command row also. The OS uses and another type of system software, which is not a part of the operating system –the drivers. They serve as a link between the kernel of the operating system and the corresponding devices. The OS has its own integrated drivers for definite devices as processor, temporal memory, hard disc etc. which provides its working.

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Functions
Basic functions
1) Programs for executing of a task (input and output data, on and off other programs, distributing and releasing of additional memory etc.
2) Downloading programs in the memory and their executing.
3) A standard access to peripheral devices (input-output).
4) Managing of a RAM (distributing between processes, virtual memory).
5) Control of database access for energy dependable carriers (as hard disc, optical drives etc., organized in particular file system.
6) Providing user interface.
7) Saving information for errors in the system.

Additional functions
1) Parallel task and multitask.
2) The effective distribution of recourses between the processes and a computer system.
3) Limiting of access to the recourses of the different processes.
4) Organizing of trust computers (impossibility of one calculating process on purpose or not to touch calculating of another process), on the base of delimiting between the access to the recourse.
5) Interaction between the processes of data exchange, common synchronization.
6) Security of the system and user data and program, actions or applications.
7) Multi playing mode and access rights.

Types of OS
Depending on the access
1) The multiuser system is a system with multi-access to the system (multi-access system), computer system or a part of it (as operating system), which allows too many users to have access at one time on computer from terminal (local or remote). The multiuser work type is achieved with time separating, which is very fast switching between different computer terminals and programs which provides a fast connection with every user. Into the last is not spotted any delay in the connection of service for other users. Examples for this kind of work can be pointed: Windows OS, NetWare built and elaborated from Novell (USA) for the local computer information systems, UNIX of AT &T Bell Laboratories in USA; REAL/32 etc.
2) Single user system – operating system, which do not have a multiuser functions. Examples for this are MS DOS created by Microsoft Company; OS/2 made by Microsoft and IBM.
3) Network Operating system – operating system, made for computer network work covering. Examples for network OS are: Windows NT, Windows 2000, Novel Netware, UNIX, Linux etc.

Basic types of OS
1)Graphical (with having of graphical user interface GUI) – text is only the command row.
2)Free – paid.
3)Open (with the possibility for redacting of the exit code).
4)Closed (with no option for redacting of the exit code).
5)Client – server.
6)16   it – 32 bit – 64 bit (in the past there were 8 bit).
7)With high data securing – with low level of securing.

Graphical interface [2]

The operating systems start their existence from the 60s and 70s years of XX century. Firstly they were 8 bits, and difficult to use. The first operation systems have been only with command row such as DOS, UNIX. Afterwards appears 16 bits OS. A key factor in the history is, when IBM appoints Microsoft to create their own OS, which they have to use in their personal computers. Microsoft buys the QDOS system from a company in Seattle and modifies it, calling it MS-DOS. Later the founder of Apple – Steve Jobs start works over a graphic interface. He takes a elaboration from the Xerox company, which they seem it as futureless and he start integrate it in the first 16 bit computers Apple. The first operating system with graphical interface is installed on computer Lisa of Apple, and the first computer with mouse use is Macintosh again from Apple. This system is firstly called just „system", but made decision to be called Macintosh Operating System (shorter Mac OS) because of computer's name, which are using it. On this time the company of Bill Gates manages to integrate similar graphic interface in MS-DOS and Windows appears, which firstly a system of programs is, constructing a Graphic Interface in DOS. Since then starts the developing of operating systems in other aspects.

What are the most used operating systems in today's environment?
User statistics for Desktop Versions OS for 02.2019 - 01.2020 [13] [14]
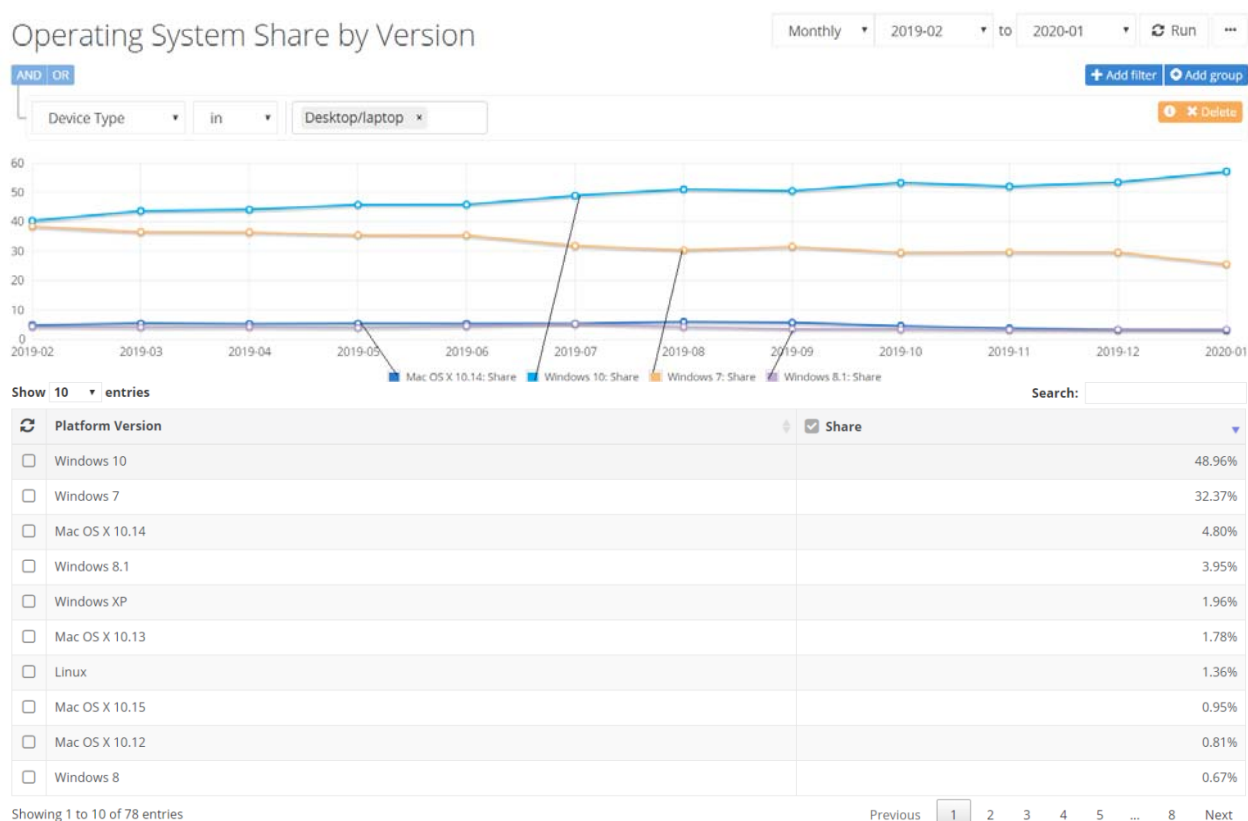
Pic 3. Desktop Versions OS for 02.2019 - 01.2020

Desktop Versions of operating systems, see Pic 3, for the period 02.2019-01.2020 shows at first glance that MS & Windows XP, 7, 8, 8.1 and 10 have a currently leading share of OS sales in computer systems by 87.91%, with five versions are in the top 10 most used OS in the world.

In second place are MAC OS with 8.34%, ranking 4 versions of this product in the top 10 most used OS in the world.

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The third and last place in the top 10 most used OS in the world is Linux with 1.36%.

In total, the three most used OSes in the world are 97.61% of the netmarketshare.com ranked by the leading site in this field, the rest up to 100% are shared by other of the observed and reported 78 OSes.

The conclusions are drawn from the data presented alone that:

1) Undoubtedly in this direction of development of computers the lion's share in the operating systems servicing these machines is on MS & Windows.

2) Apparently the company traditions, its long-lasting and long-standing presence on the market give the required results very good.

3) The second position of MAC OS confirms the first two conclusions, namely "that the companies with the most experience in the industry have the largest market presence in it with a total share of 96, 25%".

Statistics of OS used by Mobile Versions for 02.2019 - 01.2020 [15]
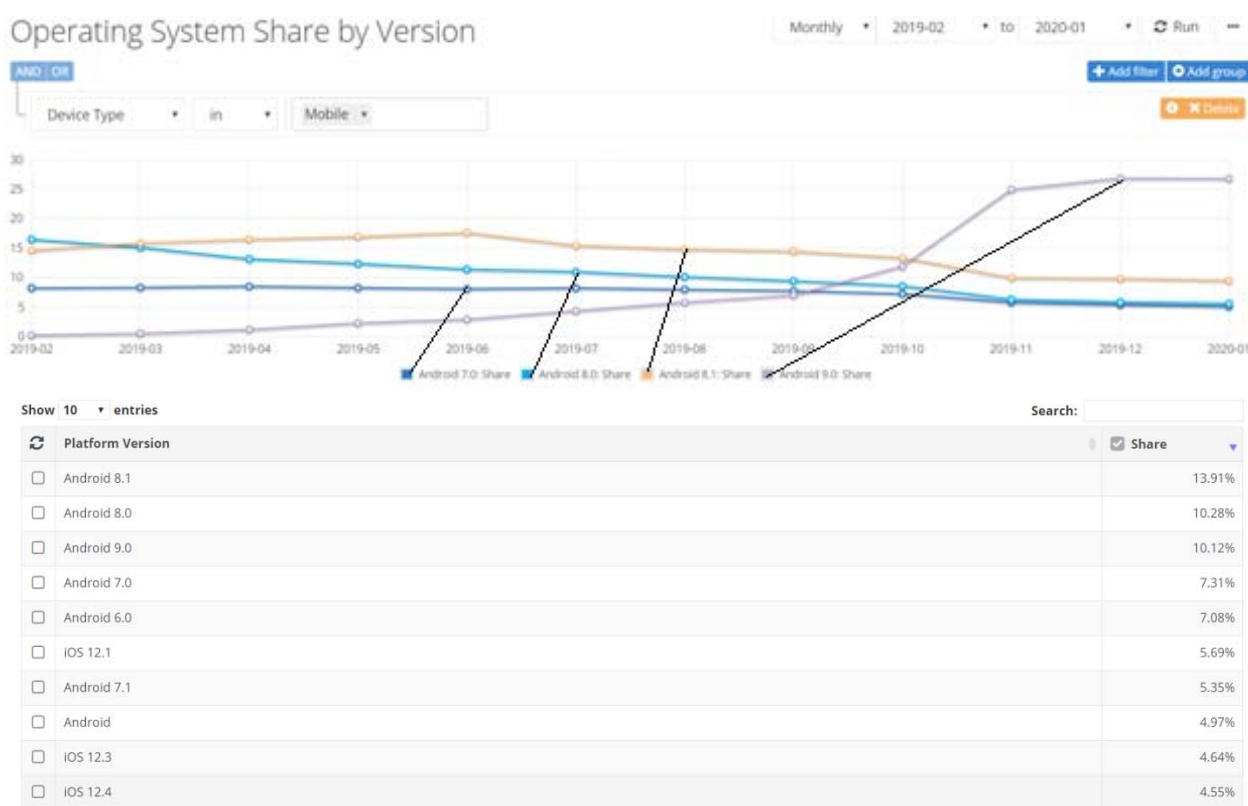
Pic 4. Mobile Versions for 02.2019 - 01.2020

Mobile Versions of operating systems, see Pic 4, for the period 02.2019-01.2020 shows that Android 8.1, 8.0, 9.0, 7.0, 6.0, 7.1 and versions have a leading share of OS sales on PC systems by 59.02%, like 7 versions are in the top 10 most used OSes in the world.

In second place are iOS versions 12.1,12.3,12.4, which is Apple Inc.'s mobile operating system. Originally developed for the iPhone, it is also used on iPod touch, iPad and Apple TV mobile devices by Apple inc. Its market share is 14.88%, ranking 3 versions of this product in the top 10 most used OS in the world.

In total, the two most used OSes in the world are 73.9% of those ranked by the leading netmarketshare.com site, the rest up to 100% are shared outside the top 10 OSes, with a total of 78 OSes monitored and reported.

The conclusions are that:

1) Undoubtedly in this direction of development of computers the major share in the operating systems running these machines is on Android.

2) Apple Inc.'s second position confirms the first two conclusions, namely "that the companies with the most experience in the industry have the largest market presence in it with a total share as indicated by 73.9%".

Interesting is the position of Windows Phone 10.0, which is in the top 50 with a market share of 0.04%.

Statistics of OS used by Tablet Versions for 02.2019 - 01.2020 [16]
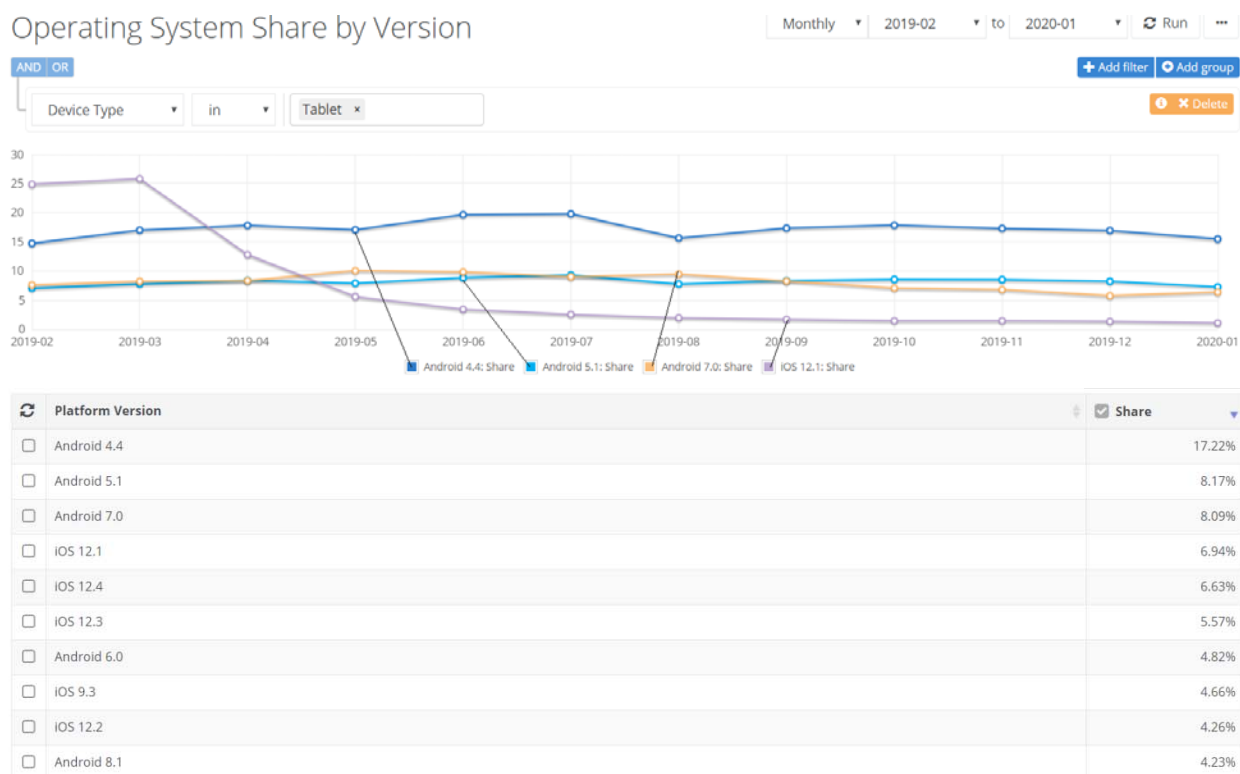
Pic 5. OS used by Tablet Versions for 02.2019 - 01.2020

Tablet Versions of operating systems, see Pic. 5, for the period 02.2019-01.2020 shows that Android 4.4, 5.1, 7.0, 6.0 and 8.1 have a leading share of OS sales on PC systems by 42.53%, with 5 versions in the top 10 of the most used OS in the world.

In second position are iOS with versions 12.1, 12.4, 12.3, 9.3 and 12.2. Its market share is 28.06%, ranking 5 versions of this product in the top 10 most used OS in the world.

In total, the percentage of the two most used OSs in the world is 70.59% of the netmarketshare.com ranked sites. The remaining up to 100% are divided by those ranked outside the top 10 OS, with a total of 78 OS being monitored and reported.

The conclusions are that:

1) Undoubtedly in this direction of development of computers the major share in the operating systems running these machines is on Android.

2) Apple Inc.'s second position is in support of the first two conclusions, namely "that the companies with the most experience in the industry also have the largest market presence in it with a total share as indicated by 70, 59%".

3) Notice the catch-up of Android OS from iOS.

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The future of operating systems [9-11]
What are the most popular OSs right now?

The most popular operating systems are Windows, Linux / Unix, OSX, iOS, ChromeOS and Android.

Pic 6. The operating systems of the Future [11]

The three most common operating systems for personal computers are Microsoft Windows, Mac OS X and Linux, see Pic. 6.

Interesting modern trends in the development of the OSs are:

1) Introduction of artificial intelligence (AI) as a guiding moment in the OSs.

Although operating systems are often updated, they essentially do not change much. It's time to take a fresh look at what they can be and what functions they can offer so that we can enjoy all the benefits of the Internet.

This is your most basic, fundamental interaction with the computer.

Today, the Internet and AI have expanded our ability to interact with technology - now we can use our voice or movements for this.

AI capabilities are gaining momentum every day.

Even mobile operating systems like Android and iOS are equipped with AI-based voice assistants and can connect to the Internet of things.

Voice assistants are becoming serious competitors to smartphones. And all this is due to the fact that a person wants even greater amenities, which is the driving factor in the formation of a new OS.

2) Outsourcing the work of the OSs to the Cloud.

According to the MIT Technology Review, the AI of the future is the cloud of the future [12], [17].

Amazon, Microsoft, Alibaba, Google, Salesforce, IBM, Cloudify, Oracle (the list can be continued for a long time) are actively working in this direction.

The OS of the future is a neural network that will cover smart power supply networks, IoT (Internet of things), Big Data convergence, AI, machine learning, which are modulated by smart contracts on the block chain, decentralized nodes, where additive manufacturing and robotics serve the needs planets in fully sustainable ecosystems.

The new generation OSs will not be the property of one company, for example, Amazon, Tencent, Alibaba or Alphabet. It will be a harmonious whole, where corporate decisions work together with new models of how people will interact and live with AI, which takes part in everything we do.

CONCLUSION

Finally, it should be pointed out which, according to the leading authors, as well as the opinion of the author, will be the main directions for the development of the OSs.

According to some leading authors and websites, the main prospects for operating systems are [4-8]:

- Nowadays, the development of operating systems has come to the forefront of security. An increased level of threats that exist when transmitting data over networks, especially over public ones, such as the Internet. Many modern operating systems today have sophisticated information protection tools based on data encryption, authentication and authorization.

- In recent years, the long-term trend of increasing the usability of a person with a computer has been further developed. The effectiveness of a person becomes the main factor determining the efficiency of the computing system as a whole.

- The convenience of interactive work with a computer is constantly being improved by incorporating developed graphical interfaces into the operating system that use sound and video along with graphics.The user interface of the operating system is becoming more intelligent, directing human actions in typical situations and taking routine decisions for it.

- Modern OSs include virtualization tools that allow you to run applications for other platforms in isolated virtual machines into which other operating systems can be installed.

- Support for cloud computing is a completely new trend in the development of the OS.

- A further trend for open source OS projects; this is understandable, since the development companies need new ideas, a great opportunity to prove themselves to young programmers.

According to the author, there may be other perspectives which is on the development of operating systems.

ACKNOWLEDGMENTS

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