Configuring the Information Environment of Microcomputers with the Microsoft Windows 10 Operating System

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Abstract. Since 2015, microcomputers have appeared in the information environment, which are a compact system unit with minimal functionality without peripherals. The article published the results of the analysis of the use of 6 different microcomputers in various fields of activity. The purpose of the study is to determine the limiting factors affecting the efficiency of the targeted use of microcomputers. It has been established that for scientific and educational presentations, office and trading activities, it is cur-rently advisable to use fanless microcomputers with a perforated case and an internal WiFi antenna, at least 4 GB of operational and 64 GB of permanent memory, and a microSD (TF) memory card slot, at least 128 GB, NTFS file system), Intel HD Graphics, USB3.0 and HDMI interfaces. Based on comparative experiments, methodological recommendations were created on optimizing the configuration of the hardware-software environment of microcomputers in stationary and mobile conditions. The problems of major updates to Windows 10, as well as the compatibility of Microsoft Store software and third-party manufacturers, are analyzed. It is recommended to specialize individual microcomputers for working with 32-bit applications; accounting and cryptographic programs; as well as conducting presentations with their video. Options for optimal configuration of the Start menu of the Windows 10 desktop are suggested. It is concluded that specialization in the hardware-software configuration of modern microcomputers allows you to increase the efficiency of using single de-vices and their paired systems in accordance with BYOD (Bring Your Own Device).

Keywords: Microcomputer, MicroPC, Windows 10, Configuration, Science, Education, Business, Trading, BYOD, Specialization.

1 Introduction

1.1 Microcomputers

Microcomputers are one of the classes of information processing devices that have been actively evolving since 2015. Unlike other mobile devices (laptops, netbooks, ultrabooks and smartphones), microcomputers, like stationary desktops, easily specialize by varying peripherals and software. Currently, there are microcomputers with

operating systems Windows 10, Android and Linux. As a rule, BIOS tinctures provide for the selection of the priority operating system used. Analysis of use cases showed that the widest range of applications is provided by the Windows 10 operating system, and devices on the above platform were chosen for experiments on the specialization of microcomputers for different applications.

Since its release on July 29, 2015, the Windows 10 operating system [1] has been in the phase of active adaptation to polymorphic user devices (servers, desktops, laptops, ultrabooks, netbooks, mini-computers, microcomputers (microPC), mobile phones and other wearable personal devices) in accordance with the BYOD paradigm [2]. This is evidenced by the adaptation of all elements of the Windows 10 interface to use on mobile devices, the introduction of a system for monitoring and saving energy consumption by hardware and software components, the comprehensive use of telemetry to monitor the operation of components in order to fix system defects, and cloning their software products into the spaces of other operating environments (Apple and Android devices).

1.2   Microcomputers Specialization

Currently, the development of miniature computers for various fields of application is in the phase of an active experiment, when updated device models appear in small batches and include the official Windows 10 license. During the first half of 2019, two microPC models became unavailable (BBen [3], MeLE [4]) and one new one appeared (ACEPC [5]). The first smartphones with full Windows 10, oriented to use in professional activities, are already available [6].

The cost of a microPC is comparable to the purchase price of Windows 10 Home OS [1] for installation on any computer without an operating system. The current pricing policy for the distribution of Windows 10 with innovative devices ($ 5) allows initiative researchers to actively experiment with the use of computer innovations in various fields, bringing the moment of the official release of smartphones with full Windows 10, intended for a wide range of users.

For the MASTER-MULTIMEDIA project, it turned out to be relevant to conduct an experiment to replace the traditionally used office and personal computing equipment (desktops, laptops and ultrabooks) with microcomputers, which are a personal computer system unit in a case the size of a pair of matchboxes. This interest was due to historical practice. Over the past 10 years, all laptops have been used exclusively as computer system units, and the interface peripherals (monitors, keyboards, mice, graphic tablets, webcams, microphones, speakers) were in common use and connected to each of the devices as needed. Thus, all the components of the input-output interfaces of laptops, except for the components of the system unit, turned out to be practically unclaimed.

The choice of microPCs for experiments on the modernization of the information environment of the MASTER-MULTIMEDIA project was due to their mobility according to the BYOD standard [2], in contrast to mini-computers the size of an A5 format book [7]. Some microPC models are positioned as entertainment Internet media players for home theaters [8], others are recommended for office, public (online

help systems), as well as special applications (monitoring security systems) [4], and some models are supposed to be used in scientific and educational activities when giving lectures and reports [3, 5]. The purpose of this study was to determine the minimum hardware and software configuration of modern microPCs for use in scientific, educational, office and trader spheres of activity.

2 Hardware Configuration of Microcomputers Used in Experiments to Specialize Their Applications

The experiments on configuring the information environment were carried out with 6 microPCs of 4 models, which differed in the basic hardware configuration (see **Table 1**): central processor (Intel CPU), RAM size (RAM LPDDR3) and permanent memory (eMMC); type of cooling (active / passive); the presence of a CMOS battery, an external antenna (Ext WiFi), connectors for connecting an Internet cable (LAN Rj45) and audio peripherals (Audio jack 3.5 mm). It should be noted that in devices without a CMOS battery, it is necessary to immediately correct the system date and time immediately after switching on to avoid data synchronization conflicts with cloud storages that are connected at the final stages of loading the computer's operating system.

Table 1. Microcomputer hardware specifications.

Name	Manufacturer	CPU	RAM, GB	eMMC, GB	CMOS	Ext. WiFi	LAN Rj45	Audio jack
FOKWSR08	Rombica [8]	Z3735	2	32	No	Yes	No	No
FOKWSB09	BBen [3]	Z8350	4	64	Yes	No	No	No
FOKWSM10	MeLE [4]	N3450	4	32	Yes	Yes	Yes	Yes
FOKWSA11	ACEPC [5]	Z8350	4	64	Yes	No	No	No
FOKWSA12	ACEPC [5]	Z8350	4	64	Yes	No	No	No
FOKWSA13	ACEPC [5]	Z8350	4	64	Yes	No	No	No

2.1 Operational, Permanent and Expandable Memory of Microcomputers

Currently, the minimum size of microPC RAM is 2 GB. The experiments showed that 2 GB of RAM is not enough for comfortable operation: Rombica model [8] was distinguished by delays in invoking the Start menu, slowing down while simultaneously opening more than half a dozen browser windows with pages of Internet sites and displaying recommendations to increase the size of RAM to 3 GB when working with 1C-Enterprise databases. A microPC with 2GB of RAM copes with the single-task playback of content (broadcasting Internet TV, playing media files, PowerPoint slide shows, process monitoring). All other microPCs with 4 GB of memory functioned with sufficient speed when working in a multitasking scientific, educational and business information environment (multi-window opening of several browsers, associative maps, spreadsheets and word processors, accounting databases with cryptographic providers). At the moment, there are microPC models with 6GB of RAM [9] and

they can be recommended for working with resource-intensive programs for multi-track video editing. The cost of RAM at the beginning of 2019 was about $ 25 / GB.

In 2019, microPC models with 32 GB data storage devices began to give way to devices with 64 GB of permanent memory due to lack of space for regular procedures for updating the Windows 10 operating system, requiring at least 15 GB of free space, while the basic set of operating system modules and the minimum software can be about 25 GB. The cost of permanent memory for microPC (eMMC) at the beginning of 2019 was about $ 2.5 / GB.

All tested microPC models had one slot for microSD memory cards (TF with a maximum capacity of 128 GB), into which separately purchased microSD cards were inserted. At the time of writing, the best microSD cards for use in microcomputers were Kingston Canvas React microSDXC 128Gb UHS-I U3 V30 A1 + ADP (100/80 Mb / s), allowing real-time 4K video recording.

Experiments have shown that the connection between a microPK and a memory card may be lost due to malfunctions of the operating system and exposure to strong electromagnetic fields. The reliability of the microSD card depends on the specific microPC model (there are frequent failures with MeLE device FOKWSM10 and rare failures with other experimental microPCs). To restore the operation of microSD cards, turning off, de-energizing and turning on the microPC is enough. In addition to saving space in the main drive, organizing the storage of programs and user files on the removable microSD-card makes it easy to use them in emergency situations of damage to the unrecoverable main drive.

2.2   Graphic Subsystem of Microcomputers

All tested microPC models had graphic coprocessors with declared support for 4K resolution ULTRA HD 60 fps: Intel Gen8 HD Graphics (BBen [3]) Intel HD Graphics 400 GPU (ACEPC [5]) Intel HD Graphics 500 GPU (Rombica [8] and MeLE [4]). In practice, it turned out that all microPC models except BBen [3] reproduced Internet video and on-air broadcasting with HD resolution without problems.

The output of micro-PC audio-visual signals is carried out via the HDMI interface, the stability of which may depend on the high quality of the cables and adapters used. If there is an appropriate HDMI connector in the monitor, the microPC can be connected directly to it using the bundled extension cable (BBen [3] and ACEPC [5]) or an adapter for the HDMI cable (Rombica [8], MeLE [4]) Experience has shown that the Rombica device [8] was successfully connected to any monitors through a variety of cables and adapters (HDMI, DP, DVI. VGA); to connect other devices, high-quality switching was required, and BBen [3] and ACEPC [5] turned out to be incompatible with VGA monitors. When organizing the connection of monitors to microcomputers using an HDMI-DP converter, it should be borne in mind that signals are transmitted in only one direction, and for better compatibility, choose a device with active storage of EDIO information on the converter and the ability to transfer uncompressed two-channel LDPCM audio via HDMI and support for graphics resolutions up to 3840x2160 P / 30 Hz.

2.3   Communication Interfaces of Microcomputers

For network data exchange, microPCs are equipped with dual-band WiFi modules (802.11 a / b / g / n / ac, 2.4 GHz & 5 GHz) with an internal (BBen [3], ACEPC [5]) or external antenna (MeLE [4] , Rombica [8], Azulle [9]), and the MeLE [4] and Azulle [9] models are complemented by the Rj45 Gigabit LAN connector. The experiments showed that antenna localization does not affect the WiFi data transfer rate (of the order of 20 Mbit / s for input and output), but mounting an external antenna can break off without disrupting useful functionality after 2 months of operation, requiring a change in the position of the antenna to access the USB port below it (Rombica [8]).

All microPCs had a Bluetooth 4.0 wireless module, which was often turned off by the system to save power, which made it impossible to use tested mice (SONY VGP-BMS15, Logitech MX Master, Logitech MX Master 2S, Logitech MX Anywhere 2S) and keyboards (SONY VGP-BKB1, Logitech K375s, Logitech K480, Logitech K810) with Bluetooth interface due to reaction delays and loss of communication. Changing the Bluetooth settings in the BIOS did not help fix this problem. Connecting Bluetooth dongles via USB ports was also ineffective due to system locks. At the moment, the problem with connecting the Bluetooth peripherals to microcomputers remains unresolved.

A reliable peripheral connection for all tested microPCs was provided by 2 USB connectors (the Rombica device [8] was equipped with USB 2.0 and microUSB 2.0 connectors, while the rest had one USB 2.0 and USB 3.0 connector). Obviously, to transfer large amounts of data it is efficient to use models that can use the USB 3.0 protocol. One can activate or deactivate the USB 2.0 and USB 3.0 protocols for each port in the BIOS settings.

2.4   Power Supply and Cooling of Microcomputers

Power supply of all microcomputers was carried out through a specialized microUSB connector (5V / 3A), which was very demanding on the high quality of the switched cable. During the operation, all the power supplies from the microPC supply set had to be replaced by higher-quality network devices (Rock T14 Travel Charger 3xUSB3A), each of which provided simultaneous power to one microPC and a peripheral USB splitter connected to it (see section 2.5) If it is necessary to get rid of acoustic noise during the work with sound (recording from a microphone, playing), it is recommended to power the sound equipment (receivers, transmitters, sound cards, mixers, amplifiers and acoustic systems) from power supplies that are not electrically connected with microcomputers.

The BBen model [3] was distinguished by the presence of active cooling (Internal Intel Mute fan), the launch problems of which prevented the use of this device in the frequent on-off mode. Keep in mind that the sound of a fan-cooled computer cooling system interferes with the performance of work related to sound recording. For this reason, it is advisable to choose fanless microcomputers to work in sound recording studios. It was found that the fanless Rombica device [8] with the smallest size of the

closed case overheats in multitasking mode with the subsequent shutdown of the operating system. The largest MeLE device [4] with a closed case during multi-tasking heats up significantly, but functions smoothly, and the BBen [3] and ACEPC [5] models with perforated cases heat up weakly and function stably in all modes.

Thus, for scientific, educational, business and entertainment purposes, we recommend using fanless microcomputers with a perforated case and an internal WiFi antenna, at least 4 GB of operational and 64 GB of permanent memory, a Micro SD memory card slot (TF, not less 128 GB), Intel HD Graphics, USB3.0 and HDMI. Since each interface module (Rj45, Audio, Card Readers, etc.) is a source of additional heating, it is advisable to minimize the microPC hardware functionality and to specialize the properties of the information environment with connected peripherals. To prevent the occurrence of acoustic noise, it is recommended to organize power supply to the microcomputer and its associated speaker systems through different power supplies.

In the field, microcomputers and connected peripheral devices (USB splitters and storages, audio devices, screens, etc.) can receive power from batteries (power banks) with USB outputs (5V / 2-3A) and a capacity of at least 10000 mAh. In stationary conditions, the power supply of microPCs and peripherals from USB energy banks, permanently connected to the electric network, can be considered as an alternative to uninterrupted power supplies. Compact power banks are currently available, providing simultaneous power to 3-4 devices. When organizing long-term work in stationary conditions using energy banks as uninterrupted power sources, preference should be given to models that allow their own charging during the power supply of connected devices.

2.5 Microcomputer Peripherals

In accordance with the BYOD standards [2], microPCs can be connected via the HDMI connector not only to computer monitors, but also to TVs, displays with touch interfaces, etc. For sound monitoring, it is convenient to use the built-in speakers of graphic monitors that receive a signal via HDMI or Display Port (DP) using a special converter [12]. The sound output to high-quality acoustic systems is advisable to be carried out by means of an external USB sound card connected to the microPC [13].

When choosing touch screens for working with microPCs in the field, it is advisable to give preference to models (Kenowa, etc.) that receive power from the microPC via USB port simultaneously with the exchange of multi-point positioning data (support for a 10-finger input method of information) and 1024 gradations of pressure. Experience has shown that for the stable operation of such a monitor with a microcomputer, a single power supply is sufficient.

In the absence of a touch screen, cursor positioning and text entry are carried out using computer mice and keyboards. As a result of experiments with connecting wireless mice and keyboards to microPCs, it was found that in polymorphic information environments with a different electromagnetic background, Logitech devices with the Unifying receiver connected via USB are most stable. For an information environment of 2–3 microcomputers, it is advisable to use mouse and keyboard models with

support for Logitech Flow technology, as a result of which computers equipped with Unifying receivers are controlled by a single set of mouse and keyboard without the use of hardware buttons for switching focus (see section 9).

To control microPC during lecture and presentation activities, it is recommended to use a special miniature keyboard with its own USB receiver, touch panel, as well as ergonomic homologue buttons of the left and right mouse buttons [10].

In conditions of intensive multi-tasking, the operation of the receivers may be disrupted due to overheating, as a result of which it is advisable to connect USB-receivers through USB-extension cords or splitters (hub's). Experiments have shown that it is most efficient to use USB 3.0 splitters with additional connectors for connecting a gigabit LAN (Rj45) and external power supply [11]. If necessary, data storage devices, graphic tablets, webcams, microphones, USB hardware dongles, carriers of qualified electronic signatures, etc. can be connected to the microPC through such a USB splitter. For high-speed data exchange (up to 1 Gb / s) between External media SSD drives with an NVMe interface that can be connected using USB 3.0 can be used efficiently with media devices.

3 Windows 10 Operating System and Problems of Updating it in Microcomputers

When one turns on the computer for the first time with a licensed Windows 10 operating system, the license is activated with its binding to the email address of the Microsoft user account and phone; selection of telemetry parameters of the system; formation in the c: \ Users \ folder of the user's personal directory (automatically named in accordance with the first five letters of the user's registration email address), as well as connecting the OneDrive cloud storage (starting from build 1809) to the folder of the same name inside the user directory. To save space in microPC drives with 32 GB of RAM, it is recommended to turn off advanced telemetry at the stage of basic system installation. It should be emphasized that the policy of using Windows 10 makes updating the system inevitable and can be turned off for a period of not more than a month, after which it is carried out forcibly. Major Windows 10 updates are released twice a year (in March and September). It should be borne in mind that updating of local Enterprise versions of the Windows 10 operating system may occur with an annual lag phase.

Experience has shown that after installing Windows 10 with assemblies from 1507 (Rombica [8]) to 1803 (BBen [3]), the installation procedure for all updates takes a long time (up to 2 days), requires operator control and free space of about 15 GB of permanent memory. For microPCs with 32GB of permanent memory, large updates cause the need to connect an external USB-drive and leave 2-6 GB of free space at the end, which is critically small for the stable operation of the system. Switching to Windows 10 build 1903 under such conditions was not possible (Rombica [8] and MeLE [4] devices) even when an external USB hard drive was connected. Releasing 8 GB on drive C: allows one to proceed to build 1903, after which the problems with Windows 10 updates stop: starting with build 1909 (September 2019), large updates

are carried out successfully even on devices with 6 GB of free space on the system drive.

An indication of the need for major updates is the User License Agreement, dated 2015-2017. It was found that it is advisable not to upgrade computers with outdated Windows 10 assemblies, and immediately after the first login to the system, subject it to the recovery procedure from the section (Settings / Update and security / Recovery / Restore the computer to its original state). Experience has shown that as a result of a process called in this way, the last Windows 10 assembly is installed in the device in a minimum amount of time, bypassing intermediate updates, which saves about 10 GB of permanent memory space. The system recovery procedure is impossible on systems in which, after installing the software environment and downloading user data, less than 8 GB of free space is left (MeLE [4]).

It was noticed that the background image of the lock screen is replaced with a new one during system updates, and after failures and component recovery, it returns to the old version. This feature can be used as an indicator of the previous state of the system when it boots. One should avoid conditions that interrupt the operation of the microPC (power failure, freezing in multitasking mode, etc.) during a lengthy procedure for cleaning previous installations and unnecessary Windows 10 update files. As a result of abnormal completion of the cleaning procedure, the memory space is removed from the further turn.

4   Microsoft Store Software Applications

In the basic configuration options for microcomputers, the Windows 10 operating system is delivered in a request state to automatically install a set of 30-40 software applications from the Microsoft Store online store, which begins after the first login. After the installation is completed (about 1 GB of space in permanent memory), these applications are updated automatically, which causes an increase in the consumption of the space they occupy. Many of these applications are shareware and are used based on regular subscriptions. The set of shareware applications of the Microsoft Store depends on the manufacturer of the microcomputer. Enterprise versions of the operating system may ship without the Microsoft Store application.

From the basic set of free applications, we recommend paying attention to Microsoft Edge (browser); Microsoft OneDrive (cloud storage, the size of which depends on the user subscription); OneNote and Sticky Notes (services for creating multimedia and text notes synchronized on all user devices, respectively); as well as a set of programs inherited from Windows 10 Mobile (Alarms and clocks, Voice recording, Calculator, Camera, Maps, Cinema and TV, People, Groove music, Weather, Mail and Calendar, Skype, and Photos). The databases of some of the listed applications (OneDrive, People, Mail and Calendar, Photos) increase as they are used, which must be taken into account when configuring the microPC information environment with a limited amount of read-only memory. In emergency cases, the Photos application database and OneDrive backup database can be deleted with the release of sever-

al GB of space (photos in user folders are saved and the databases will subsequently be automatically restored).

The set of Microsoft Store applications installed in the system should be varied in accordance with the specifics of user work and the use of a computer in a distributed information environment (see section 9). The basic set for the creation of a unified information environment for the microPC of the Infocontinuum of the MASTER-MULTIMEDIA project includes four dozen Microsoft Store applications, including the "Microsoft ToDo: List, Task and Reminders Task Manager", "Snip & Sketch", "Microsoft Whiteboard", and graphic application "Microsoft Office Lens". The latest HEVC video codecs required for playing and editing audio-visual recordings made on modern smartphones are purchased separately ($ 0.99). After installing the codec using the free Video Convertor (V3TApps) application, one can convert the new audio-visual recordings to a format compatible with most software video editors.

5   Third Party Software Applications

The functionality of the information environment of microcomputers can be enhanced by installing third-party software applications that can conflict with each other, provoke malfunctions of the operating system or help to overcome them. For example, the installation of a workable vector graphics editor CorelDraw 13 forbidden by the Windows 10 operating system in forced administrative mode is possible, but the result is an irreversible failure of the functioning of all Microsoft Store applications and the Start menu. In an information environment with such defects, Internet access is possible using the classic Internet Explorer application or through browsers of third-party software vendors, among which Google Chrome has the highest performance / resource ratio.

Since 1993, Total Commander [14], formerly known as Windows Commander, has been used as a multifunctional file manager in the information space of the MASTER-MULTIMEDIA project. Five years of experience in use allows us to recommend the Safe-in-Cloud program [15] as a reliable and utility password manager for all devices in the information environment. To ensure the information security of the system, it is recommended to replace the standard Windows Defender with the Norton Internet Security antivirus complex [16], which is characterized by low resource capacity and effective speed, and also does not cause malfunctions in the databases of 1C-Enterprise platform programs (violation of consolidation new data with old). It should be noted that the standard 1C database archiving mechanism does not work reliably and archives created by it should be checked for readability, and the databases recovered from them should be tested for data integrity in the configurator mode. It is noted that cryptographic providers and modules for working with qualified electronic signatures that integrate not only in specialized applications, but also in browsers, reserve system resources and slow down the operation of third-party applications. Telemetry modules that collect information about failures of the software and hardware functionality (Logitech Options, etc.) can also slow down the operation of microcomputers with limited resources.

6   Configuring the Windows 10 Start Menu

In Windows 10, the Start menu was updated, which appeared back in Windows 95. In addition to the buttons for accessing the User Account, Explorer, System Settings and the Alphabetical Application Menu, so-called "tiles" were also included in the Start menu – potentially multi-format interactive animated elements for calling selected applications of the Metro interface [17]. Initially, the tiles were grouped into two blocks: "Events and Communication" and "Entertainment and Rest".

The Metro interface turned out to be extremely effective in the Windows Phone Mobile OS developed for smartphones, but it is not much needed in the information environment of desktop computers and laptops. Options for configuring the Start menu that are offered in Windows 10 builds for the 2018-2019 release include the "Create", "Play", and "Explore" blocks. In distribution assemblies of Windows 10, starting from 1903 (May 2019), the Start menu was reduced from a two-column version to a one-column one, and for updated configurations, the blocks of the second column are automatically moved to the lower region of the first column when changing orientation of the screen from landscape to portrait. Given the emerging convergence of the information environments of mobile devices and other computers, it is advisable to configure the Start menu in a unified style for all computers in the common information space and fill it in accordance with the specifics of each device (see section 9). For example, in the Infocontinuum of the MASTER-MULTIMEDIA project, all devices have common Start menu tiles: Organize, Play, Explore. Depending on the purpose of the computer, the Start menu is supplemented by specialized blocks: "Create", "Finance", "Use". The properties of blocks and tiles, as well as their mutual arrangement, are configured by the user in accordance with their preferences and the specifics of frequent actions, including changing the orientation of the connected screen. Practical experience shows the advisability of including the display mode of the "Frequently used applications" section in the Start menu settings.

7   Optimization of the Use of Long-Term Memory of Microcomputers

Control over the use of long-term memory in Windows 10 is carried out in a special section (Settings / System / Device memory), where the information on the use of local storages and media connected to the device (SD-cards, disk spaces, etc.) is concentrated), and also there are adjustments to the memory monitoring functional and its automatic release. To save scarce space on the main memory storage, it is advisable to change the location for saving new content (applications, documents, music, photos and videos, films and TV shows, offline maps). To do this, it is practical to connect to the device a reliable, capacious and fast microSD-card (see section 2.1), previously formatted in NTFS format, and immediately after the first login to indicate this card as a new storage location. As a result, all Microsoft Store applications loaded at the request of the installation script will not occupy space in the main storage, and the user directory will be moved from the c: \ Users \ folder to the root of the microSD

card. Theoretically, the Windows operating system has the usual mechanism for translating applications between different carriers for smartphones, but to use it, you need to stop the portable application, which in some cases is impossible.

In Windows 10, starting with build 1809, OneDrive cloud storage is associated with a user account in a state of accessibility of all files on demand, which allows you to connect data volumes exceeding its capacity to a local drive. For example, in a multi-user computer configuration (see section 12), up to 6 cloud storages with a total capacity of 6 TB can be connected to its 32 GB drive. Prior to requesting access to OneDrive storage files, only database data that control the synchronization state are stored on the computer. The size of the local database is about 1 GB / 1 TB of data in the cloud. After downloading files from the cloud and their modifications, the updated versions automatically replace the predecessors in the cloud and are deleted from the local medium in accordance with the schedule of the Memory Control settings: daily, weekly, monthly, etc. However, if you need to work with large files at the same time, there is a chance of running out of space in the system drive, where the OneDrive folders are located by default (see section 2.1). For this reason, during basic system configuration, it is advisable to move the OneDrive folder from the user directory in the c: \ Users \ folder to the microSD card (only NTFS format is acceptable, whereas the original microSD card format is ExtFAT). To ensure the possibility of changing the location, you should agree to the OneDrive default setting, after which immediately delete the formed connection with the user's cloud storage and create a new connection with the directory on the microSD-card. For single-user computer configuration, it is advisable to place the OneDrive folder in the root directory of the microSD card, and in the case of multi-user configuration, inside the user directories of the microSD card. The internal folders of the OneDrive directory are created in accordance with the recommendations for creating a distributed storage system and media content [18].

It should be borne in mind that in a paused state of OneDrive synchronization (no connection to the Network or connection with limited traffic), the creation and modification of descript.ion file comments is blocked in the local file storage. For this reason, files with comments (archives with verification protocols, distributions with annotations, etc.) in an unsynchronized state should be accumulated in the OneDrive.new buffer directory [18], and when synchronization is resumed, moved to a place of permanent storage inside OneDrive folders.

8   Multi-User Microcomputer Configuration

Starting in 2019, it became possible to create multi-user computer configurations without significantly consuming storage space for each new user. This is due to the features of connecting devices to OneDrive.com cloud storage and the new Microsoft application sharing policy. For third-party applications, permission for their use for each user may be required, as occurs during the process of restoring the functions of Microsoft Office with the adoption of a usage policy for users whose configurations did not carry out its initial installation.

One should keep in mind that the configuration of connection to OneDrive repositories for each user is independent and users do not have access to view each other's directories. The directories of all users can be located on a microSD-card, which reduces the likelihood of irreversible data loss in emergency situations (see section 2.1). The configuration of the Start menu for each user and the modification of the contents of the Desktops is carried out individually. Experience has shown that the "On-Demand Access" mode for user data allows organizing and using multiuser configurations stably, even on microcomputers with a minimum size of the system disk's permanent memory.

9   Organization of a Distributed Information Environment from Multiple Microcomputers

In the course of performing scientific, educational and office tasks, situations often arise when simultaneous work on several computers with different configurations is required in order to avoid software conflicts and a lack of system resources. For example, the efficiency of working with databases of the 1C-Enterprise platform is higher in a 64-bit environment, but many forms of reports with two-dimensional barcodes can be printed out only from 32-bit versions. It turned out that the presence of crypto providers in the information environment negatively affects the possibility of multitasking with databases, associative cards and graphic applications in the demo mode of the desktop and audio-visual recording of its contents during Skype video conferences. For this reason, it is advisable to use specialized computers for activities in the areas of distance learning and accounting and management accounting, in which it is necessary to ensure that cryptographic service providers work with qualified electronic signatures, USB hardware HASP keys, etc. A special configuration of computers is required to process massive audio-visual data and simultaneously monitor the kinetics of many processes (tools for technical analysis of the state of financial markets, etc.). When conducting videoconferences (consultations, scientific and educational activities), it is convenient to use one computer to demonstrate the desktop, and use another for reference and organizational purposes.

Several computers with different hardware and software configurations (up to 3 pcs.) Can be combined into a single environment using Logitech Flow technology [19], when the mouse cursor moves to the paired information space of a neighboring computer when crossing the screen border with corresponding automatic keyboard focus switching. In the general information space of Logitech Flow, direct copying and moving files between the desktops of all connected computers is available, which significantly increases the efficiency of operational work.

The information environment of each computer can be individualized by creating multiple desktops, the timeline that preserves the history of working with all files helps to control the change in the contents of which. To facilitate on-screen identification of shared computers, it is recommended to assign the names of the corresponding computers to microSD cards, and place a shortcut with the name of the computer and

a link to the root directory of the microSD card in the upper left corner of each desktop.

10   Conclusion

The hardware-software configuration of modern microcomputers allows you to use them individually in accordance with BYOD standards [2] or to specialize in the addition of software and peripheral hardware devices for use as service components of a distributed information environment [21], which provides a solution the tasks of scientific, educational, office, managerial and trading activities in stationary and mobile conditions.

At the level of philosophical generalizations, specialized computers of a single information environment can be likened to cells whose combined action takes the system to a qualitatively new level of functioning of a single multicellular organism in accordance with the paradigm of infocentrism [20, 21].

References

1. Windows 10: The best Windows ever to help you achieve more, https://www.microsoft.com/store/b/windows?icid=TopStripe-windows-cat-page, last accessed 2019/12/07.
2. Ballagas, R., Rohs, M., Sheridan, J., Borchers, J.: BYOD: Bring Your Own Device. In: UbiComp 2004 Workshop on Ubiquitous Display Environments. Nottingham, UK, September 2004, http://www.vs.inf.ethz.ch/publ/papers/rohs-byod2004.pdf, last accessed 2018/09/07.
3. BBen MN9 Mini PC Stick Windows 10 Ubuntu Intel X5 Z8350 Quad Core 2G 4GB RAM Mute Fan WiFi Smart TV Stick PC Mini Computer Micro, https://www.aliexpress.com/item/32767461014.html, last accessed 2019/12/07.
4. Fanless Mini Computer Mini PC Stick 4GB 32GB MeLE PCG02 Apo Quad Core Intel Celeron N3450 Windows 10 HDMI 4K LAN WiFi, https://www.aliexpress.com/item/32857950812.html, last accessed 2019/12/07.
5. ACEPC T6 Pocket Computer stick pc mini fanless 4GB 64GB 2GB 32GB Windows 10 Home licenced Intel Atom x5-Z8350 BT4.0/WiFi/USB 3.0, https://www.aliexpress.com/item/32974950520.html, last accessed 2019/12/07.
6. 2018 Pocket PC Mini PC Mobile Computer Windows 10 6 inch Intel Cherry Trail Z8350 Bluetooth Single SIM GPS Shockproof Tablet PC, https://www.aliexpress.com/item/32854798966.html, last accessed 2019/12/07.
7. Mini Desktop Core i7 7500u Fanless PC 7th CPU Kabylake Architecture HD Graphics 620 Max 3.5GHz Windows 10 Gaming PC 300M Wifi, https://www.aliexpress.com/item/32815422763.html, last accessed 2019/12/07.
8. Rombica WinStick v01, https://rombica.ru/product/winstick-v01/, last accessed 2019/12/07.
9. Access 3 / Azulle, https://azulletech.com/product/access3/, last accessed 2019/12/07.
10. Original iPazzPort 19s Russian Keyboard 2.4G Mini Wireless Keyboard Air Mouse with Touchpad for Google Android TV Box, Mini PC, https://www.aliexpress.com/item/32952092637.html, last accessed 2019/12/07.

11. Ugreen USB Ethernet USB 3.0 2.0 to RJ45 HUB for Xiaomi Mi Box 3/S Set-top Box Ethernet Adapter Network Card USB Lan, https://www.aliexpress.com/item/32401431234.html, last accessed 2019/12/07.
12. HDmatters Active 4K HDMI to Displayport 1.2 converter cable 6ft 1.8M HDMI in Displayport out, https://www.aliexpress.com/item/1859873621.html, last accessed 2019/12/07.
13. Vention USB Sound Card External 3.5mm USB Adapter USB to Microphone Speaker Audio Interface for Computer Audio Card Sound Card, https://www.aliexpress.com/item/32950973632.html, last accessed 2019/12/07.
14. Total Commander, Version 9.22a, is a Shareware file manager for Windows® 95/98/ME/NT/2000/XP/Vista/7/8/8.1/10, and Windows® 3.1, https://www.ghisler.com, last accessed 2019/12/07.
15. SafeInCloud Password Manager for Android, iOS, Windows and Mac, http://safe-in-cloud.com, last accessed 2019/12/07.
16. Protection from Viruses – Norton™ Internet Security, https://ru.norton.com/internet-security, last accessed 2019/12/07.
17. Design in The Metro Style, https://www.ixbt.com/soft/wp7-interface-donahue.shtml, last accessed 2019/12/07.
18. Kasparinsky, F.O., Polyanskaya, E.I.: Optimizatsiia raspredeleniia dannykh, informatsii i mediaresursov mezhdu lokalnymi i oblachnymi khranilishchami. In: Nauchnyi servis v seti Internet: trudy XVIII Vserossiiskoi nauchnoi konferentsii (19–24 sentiabria 2016 g., g. Novorossiisk). pp. 170–181. IPM im. M.V. Keldysha, Moscow (2016), https://doi.org/10.20948/abrau-2016-13, last accessed 2019/12/07.
19. All Systems Flow. Introducing Logitech Flow – cross-computer control and file sharing, https://www.logitech.com/en-us/product/options/page/flow-multi-device-control, last accessed 2019/12/07.
20. Kasparinsky, F.O.: Internet-servis kak zavisimost. In: Nauchnyi servis v seti Internet: trudy XIX Vserossiiskoi nauchnoi konferentsii (18–23 sentiabria 2017 g., g. Novorossiisk). pp. 170–182. IPM im. M.V. Keldysha, Moscow (2017), https://doi.org/10.20948/abrau-2017-24, last accessed 2019/12/07.
21. Kasparinsky, F.O.: Obrazovatelnye funktsii seti Internet // Nauchnyi servis v seti Internet: trudy XIX Vserossiiskoi nauchnoi konferentsii (18–23 sentiabria 2017 g., g. Novorossiisk). pp. 183–193. IPM im. M.V. Keldysha, Moscow (2017), https://doi.org/10.20948/abrau-2017-25.