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INFORMATION AND COMMUNICATION TECHNOLOGIES

Synopsis of lectures
for students majoring in specialty
5B100200 – Information security systems

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The present synopsis of lectures contains learning material on the course «Information and communication technologies». The basic concepts of information systems, telecommunication technologies, as well as methods of building databases and creating multimedia applications, main protocols of networks interaction and means of data protection are described in the lectures.

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Olga Alexandrovna Manankova

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Editor S. Bukhina

Specialist of standardization N. Moldabekova

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Introduction

Nowadays the question of applying modern information and communication technologies in different fields of professional, scientific and practical activities, for self-educational and other purposes is widely considered.

The area of information and communication technologies makes it possible to realize processes of collection, storage, transmission and use of different data, methods of its processing, delivery, receiving and uses.

The objective of the lecture synopsis on «Information and communication technologies» is intended at mastering basic concepts of information technologies, methods and means for database construction, creation of multimedia applications, main protocols of networks interaction and means of information protection.

Along with the practical purpose, the synopsis of lectures realizes educational and pedagogic purposes, providing the extension of students' outlook, as well as the increase of their general culture and education.

1 Lecture №1. ICT role in key sectors of society development. Standards in the field of ICT

Lecture purpose: to study basic concepts and definitions of information and communication technologies.

Lecture content: determination, purposes of ICT as a subject. ICT role in key sectors in the development of human society. Standards in ICT field. Relation between ICT and achievement of objectives of sustainable development in the Millennium Declaration.

Information and communication technologies (information technologies, IT) is a set of processes, methods and ways of research, collection, storage, processing, provision and information distribution. According to ISO/IEC 38500:2008 standard there is a definition of information technologies that it is the resources necessary for collection, processing, storage and distribution of information.

Information and Communication Technologies (ICT) have essential difference from other fields of science and production. This difference consists in rapid development of means of the computer equipment and telecommunication networks. Today it is already impossible to speak simply about information technologies; it is possible to call it rather modern information technologies, which cover all areas of the modern life.

The purpose of information and communication technologies is the production of information, which will satisfy information needs of man.

The subject of information and communication technologies is the information in this or that form presented depending on a source. It can be a text, data, speech, multimedia or web application.

The information technology shall meet the following requirements:

- to divide all processing information into stages, operations, actions;
- to consist of a full range of elements necessary for achieve a goal;
- to be a standardized and unified system for effective implementation of purposeful control of information processes.

Today the role of information and communication technologies extends at the expense of a demand to information resources of society.

An information society is a society, which is occupied by creation, storage, processing and realization of information. The higher form of such information is knowledge. For advance development of a society it is necessary to arrange production of not material but information product.

Thus, the transition to the information society is followed by the change of production of material goods to rendering services. Such transition, for example in economy, involves considerable cost reduction of production and processing of raw materials, and also power consumption. In certain cases, one or several stages generally can be excluded.

Within the orders of the President of Kazakhstan described in article «Social upgrade of Kazakhstan: twenty steps to society of universal work» of July 23, 2012 № 961 approved the new program «Information Kazakhstan – 2020». The purpose of this program is creation of such conditions, which could provide transition of the country to information society. The program is aimed at providing the system effectiveness of public administration, accessibility of innovative, information and communication infrastructure, creation of the information environment for social, economic, and cultural development of society, and development of domestic information space.

The ICT role in industry consists in providing modern telecommunication services, production of electronic equipment, more powerful ADP equipment and software.

The sphere of ICT considerably changed the education process. Thanks to access to a wide area network the Internet the possibility of using a large amount of free information appeared. The number of users of e-mail, different educational web sites, virtual classrooms and libraries increases in geometrical progression.

The application of ICT advantages in health care increased its efficiency owing to enhancement of sharing information and closer contact between doctors and patients. Today the electronic health care was widely adopted in the developed countries. However, it is implemented in developing countries too. That is important especially for the remote, backward and poor regions where even basic medical care has been unavailable for a long time.

Thanks to ICT development, doctors get the free access to medical records of patients; have an opportunity to estimate immediately the results of laboratory analyses and to write out necessary recipes. Patients with heart troubles can use permanently special monitors, which transfer information to attending physicians in case of deterioration in their status.

Information technologies found a wide application in the sphere of providing state services for business and population. In many countries, more than 70% of taxpayers fill in tax declarations in electronic form. A large number of other operations – from updating driving license to parking payment is carried out online.

1.1 Standards in ICT field

In the Republic of Kazakhstan, there is a set of the state and interstate standards in the field of information technologies.

ICT is responsible for further development of the society. An effective state regulation of innovative development of ICT is a basis of increase in efficiency and competitiveness of national economy of the Country.

The main acts, which regulate legal relationship in the field of IT are:

- 1) The enterprise code of the Republic of Kazakhstan of October 29, 2015.
- 2) The code of the Republic of Kazakhstan about administrative offenses of July 5, 2014.

The Laws of the Republic of Kazakhstan are:

- 1) «On communication» of July 5, 2004.
- 2) «On informatization» of November 24, 2015.
- 3) «On TV and radio broadcasting» of January 18, 2012.
- 4) «On technical regulation» of November 9, 2004.
- 5) «On support of unity of measurements» of June 7, 2000.
- 6) «On natural monopolies and regulated markets» of July 9, 1998.

In the branch of information and communication of RK there are two technical committees on standardization:

1) TC 34 «Information technologies» on the basis of «Kazakh Association of IT –companies».

2) TC 63 «Systems, means and services of information and communication» on the basis of «National Telecommunication Association of Kazakhstan».

Technical committees on standardization take part in the development of national, preliminary national, international, regional, interstate standards, and in the development of the program of national standardization.

Also in Kazakhstan, national standards in the field of SmartCity are approved. Also the ISO standards are used, among which there is ISO/IEC 27031:2011 «Information technologies. Protection support methods. Guidelines on readiness of information and communication technologies for business» which describes concepts and the principles of readiness of the information and communication technologies (ICT) for the support of a continuity of business (CB), and provides system of methods and processes of readiness of ICT of any organization for support of a continuity of business.

1.2 Relation between ICT and achievement of objectives of sustainable development in the Millennium Declaration

The Millennium Declaration is the white paper accepted by UN members in 2000, in which the heads of state and government assumed liabilities in achievement of objectives of development of the millennium in the field of peace and safety; development; environmental protection; human rights, democracy and control; protection of vulnerable; needs of Africa; reinforcement of the UN.

The relation between the information and communication technologies (CT) and achievement of objectives in the field of development formulated in the Declaration is evident. For example, the use of ICT in case of fight against poverty can be concentrated on the organizations of opportunities of obtaining the income. Also at the same time, it is possible to provide the involvement of women into the economic activity.

In case of implementation of the purpose on improving the education level by means of ICT, one can use digital technologies for increasing accessibility with simultaneous advance of a possibility of interactivity among trainees, between teachers and pupils in case of smaller expenses.

The influence of ICT is most noticeable in the sector of small and medium business by means of which small enterprises had an opportunity to improve the

quality of the operation reducing the expenses connected to the organization of internal and external communications.

While achieving the goals on lowering the level of child mortality ICT plays an indirect role, allowing to provide the modern equipment for analyses, laboratory on a research, on HIV / AIDS and output of results in the mildest periods. In addition, the pollution of environment causes concern. Here the relation with ICT is also obvious and is indirect as the tool in goal achievement.

1.3 Control questions

- 1 What is ICT?
- 2 What is ICT purpose?
- 3 What requirements are imposed to ICT?
- 4 How does the ICT influences our society?
- 5 What standards are applied in ICT?
- 6 What represents the ISO/IEC 27031:2011 standard?
- 7 What is the Millennium Declaration?
- 8 What are the main objectives of the Millennium Declaration?
- 9 How are ICT connected to the Millennium Declaration purposes?

2 Lecture №2. Introduction into computer systems. Architecture of computer systems

Lecture purpose: to study the architecture of existing computer systems; classification, models and methods of creation of modern computer systems.

Lecture content: review of computer systems. Evolution of computer systems. Architecture and components of computer systems. Use of computer systems. Data representation in computer systems.

2.1 Concept and classification of computer systems

A computer system is, of course, a computer itself with system and application software. In addition, a computer system is a set of devices participating in process of information transferring to a long distance. Such a system is also called a computer network.

If to tell about a computer system as one device (computer), then it is more reasonable to call such a system as a computer network. If to consider a computer system as a set of devices, then one can select:

- a local computer network as a set of computers limited by a building, office, room;
- a wide computer network, in which computers are remote from each other and data are connected by wires or wirelessly.

In addition to the mentioned types, it is possible to select the following characteristics for classification of computer networks:

- as technology (common type of a network displaying physical placement of computer systems in a network and connections between them);
- as architecture (specification of communication developed for determination of functions of a network and establishment of standards of different models of the computer systems intended for exchange and data processing);
- as used protocol (a protocol defines a general set of lines and signals, which computers use in a communication network).

2.2 Evolution of computer systems

Telegraph, phone and radio became the beginning of telecommunication systems in 40s of the last century. The component of computer systems began to develop a bit later, with the appearance of punched cards, which then became ancestors for modern computers. A punched card is a cardboard information medium, on which some information is presented in the form of existence or absence of holes in certain places of a card. Further, the equipment for operation with such punched cards was created. The attempts of creation of a computer belongs to Atanosov and Berry, as well as German inventor Tsuza.

However, the ancestor of modern computer is considered to be the computer ENIAC (Electronic Numerical Integrator and Computer). Such scientists as J. von Neumann and J. Mauchly took part in its development. The computers were not widely used because of complexity and high cost, but they made a significant contribution to the development of Computer engineering.

Further, there comes an era of, so-called, mainframes – big, high-performance, powerful computer, with considerable resources of data input-output and a large volume of memory. All information was contained on punched cards, which were transferred manually. It took a lot of effort and work. At that time there were no computer networks. That is why the access to a mainframe was complicated.

Some terminals were created to solve this problem. They allowed providing access to a mainframe, without leaving workplaces. Such systems were called multiterminals. Computers and systems created at that period had a dissimilar character; they had different architecture and operation systems.

For standardization of all computer systems the first wide area network of ARPANET which provided effective use of resources was created. This network used telephone lines for information transfer. Further, this technology received the name X.25 and was standardized as the data transfer protocol on the telephone networks. The frequent use of telephone communication lines as a transmission medium served as a transition to digital transmission of a voice.

Personal computers appeared at that period, and the increase of their number leads to creation of local area networks and devices interfacing between them.

Creation of local area networks and standardization of network technologies becomes a new stage. Ethernet (1980), Token Ring (1984) and FDDI (1985) technologies appear.

In the 90s the Internet and stack of protocols of TCP/IP were developed. The number of users and volume of betrayed information increased and with it resource requirements increased. Telephone lines are succeeded fiber optic, which allow not only to transfer a huge number of information, but also to provide high speed and reliability.

2.3 Architecture and components of computer systems

The architecture of computer systems consists of the following components:

- computing and logical opportunities (instruction set, data formats, algorithms of execution of operations);
- hardware (organization of memory, control, the organization of actions with external devices);
- software (operating systems, programming systems, application software).

The computer takes the central place in computer systems.

A computer is the programmable electronic device capable to process information, make computation and carry out different tasks. Computers are subdivided into two main types:

- digital ones, evaluating data in the form of number binary codes;
- analog ones, that analyze continuously changing physical quantities, which are analogs of calculated values.

Currently, the word «computer» means only a digital computer.

The basis of computers is made by an equipment (Hardware) formed by electronic and electromechanical elements and devices. The principle of operation of computers consists in running programs (Software), which are given in advance and accurately defined by the sequence of arithmetical, logical and other actions.

The structure of any computer is caused by general logical principles, based on which there are following principal devices:

- memory consisting of the renumbered cells;
- processor including a control unit (CU) and the arithmetic-logic device (ALD);
- input equipment;
- output device.

Communication channels transferring information connect these devices.

Computer systems are used in many spheres of human activities. To support the normal activity of dwelling one can use security automatic equipment: fire-prevention systems, control of luminance, electric power consumption, heating system, control of a microclimate; electric stoves, refrigerators, washing machines with built-in microprocessors.

Such an equipment is widely used to support people's information needs, for orders of goods and services; training activities; communication with databases and knowledge; data collection about the health state; support of leisure and entertainments; e-mail, teleconferences; Internet. In addition, it is not all list where computer systems are applied.

2.4 Data representation in computer systems

Computer systems use a binary numeral system, i.e. all numbers in the computer are represented by means of zero and units, which are called binary figures (binary digit – in abbreviated form bit) therefore the computer can process information provided only in a digital form.

The conversion of numerical, textual, graphic and sound information to digital is carried out due to coding – process of data transformation of one type through data of another type.

To submit textual information one can use a table of numbering characters or a table of character encoding in which an integral number (sequence number) corresponds to each character. Eight binary positions can encode 256 different characters.

The existing ASCII standard (American Standard Code for Information Interchange – the American 8-bit system of coding) contains two tables of coding – basic and extended. The first table contains from 0 to 127 main characters, there are codes of characters of the English alphabet in it; the second table of coding contains from 128 to 255 extended characters. Windows-1251 is used to encode Russian characters. There is also a universal system UNICODE based on 16-bit coding characters where characters of languages of the majority of the countries can be placed.

Such encoding technique as a raster is applied to coding graphic data. Coordinates of points and their properties are described by means of integral numbers, which are encoded by means of the binary code. So, black-and-white graphic objects can be described by a combination of points with 256 gradation of gray color, i.e. a 8-bit binary number would be sufficient for coding brightness of any point. The mode of representation of color graphics is provided in RGB system with a 24-bit binary number and is called a full-color mode.

For coding a sound one can use an FM method (Frequency Modulation) based on a decomposition of a difficult sound into the sequence of elementary harmonic signals of different frequencies, each of which represents the correct sine curve, and, therefore, can be described by numerical parameters, i.e. a code. In addition to FM, one can use the method of Wave-Table synthesis, which corresponds to the modern level of technology development. Samples of sounds of different musical instruments are stored in advance prepared tables. In technique, they are called samples. Numeric codes express an instrument type, number of its model, tone height, duration and intensity of a sound, dynamics of its change, some parameters of a medium, in which sounding occurs, as well as other parameters

characterizing features of sounding. Because of real sounds are executed as samples, their quality turns out very high and approaches to the quality of sounding of real music instruments.

There is a number of different formats of representation of video data. In Windows medium Video for Windows format, which is based on the universal files with AVI extension (Audio Video Interleave), and also multimedia Quick Time format is applied. However, the compression MPEG format (Motion Picture Expert Group) is used even more often. More details about data representation in a digital format will be presented in lecture 11.

2.5 Control questions

- 1 What is a computer system?
- 2 What is a classification of computer systems as technologies?
- 3 What are principal components of computer system?
- 4 What is a construction of a computer?
- 5 Which are main stages of development of computer systems?
- 6 Where can computers be used?
- 7 What are standards of representation of textual information on a PC?
- 8 What are standards of representation of the graphic information on a PC?
- 9 What are standards of representation of video of information on a PC?

3 Lecture №3. Software. Operating systems

Lecture purpose: to study basic concepts of operating systems and their classification.

Lecture content: types of software, its purpose and characteristics. Basic OS concepts. Evolution of operating systems. Classification of operating systems, including for mobile devices and desktop applications.

3.1 Software types

The software is a set of programs of information processing system and program documents necessary for operation of these programs (GOST 19781-90) or a set of programs, procedures and rules, as well as documentation relating to functioning of a data processing system (ST of ISO 2382/1-84).

According to the destination, the software is divided into system, application-oriented and instrumental; according to the method of distribution and use – into closed (paid, or limited by access rights) and open, i.e. free which can be distributed, installed and used on any computers without restrictions.

System software represents a complex of programs providing effective control of components of a computing system –processor, random access memory, input-output channels, network equipment, being an intermediate interface between

the equipment and applications of a user. The system software does not solve specific application-oriented objectives, but only ensures functioning of other programs; it controls hardware resources of the computing system, etc.

Application software is software which consists of separate application programs and application program packages intended for the decision of different tasks of users; automated systems which are created on the basis of these (packets) of application programs.

The application software can include databases, e-mail servers, network and safety management, text editors, electronic spreadsheets, client programs for e-mail and blogs, personal information systems and media editors, as well as media players, web browsers, auxiliary browsers, etc.

The instrumental software is intended for the development of new programs and program complexes. The set of different applications on the computer is created by means of languages and programming systems. A programming language is the formalized language of algorithms description, which are used for the decision of different problems on the computer. During the formation and development of an ADP equipment programming languages were also developed. Some of them were changed, transformed, integrated with others. Some disappeared at all. Today, there is a rich arsenal of programming languages: Assembler, Basic, C ++, Delphi, Fortran, Java, Pascal, etc. Each of these programming languages has a number of modifications (for example, Basic, Q-Basic, Visual Basic, etc.), which differ significantly in their capabilities and properties.

3.2 Basic Concepts of Operating Systems

An operating system is an interface between a user and a computer. In addition, OS allows controlling all components of the computing system, realizing the ordered and controlled distribution of resources between programs.

The evolution of OS had several stages:

1) 1945-1955. Appearance of electron tubes, cross-connect patch panel. Libraries of mathematical and system programs were applied as the system software.

2) 1955-1960. Appearance of transistors. OS is a batch processing system.

3) 1960-1980. Appearance of integrated microcircuits and multiprogramming. Multiprogramming systems included implementation of protective mechanisms between programs, use of exclusive programs, memory protection, and interruptions.

4) 1980-up to nowadays. Appearance of big integrated circuits and systems for operation in networks and distributed OS.

The basic concept of OS consists in John von Neumann's principle i.e. the program consisting of a command set, and its basic data are stored in a total memory each cell of which has the unique address; each command together with data is extracted from the memory and executed by the processor. The selection of the command is carried out by means of the special instruction counter, which

comprises the address of the command executed at present; the commands are located in memory one by one, at the expense of what the sequential selection of a chain of commands from the memory is organized. Therefore, there are three principal components of a computer system: processor, basic memory and input/output devices (figure 3.1).

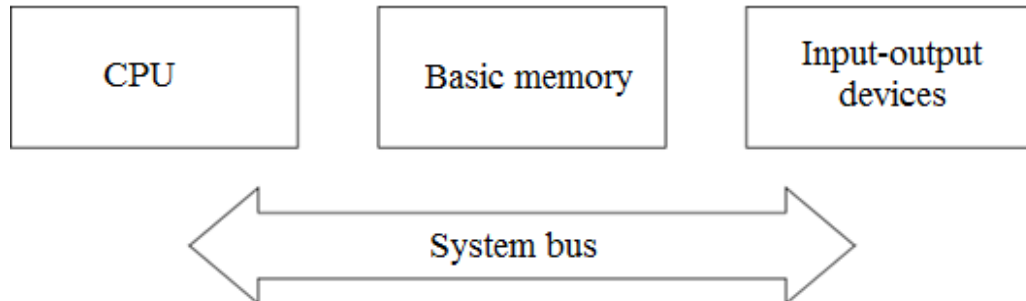


Figure 3.1 – Components of computer systems

The processor controls computer operations and performs the function of data processing according to the program. In modern systems there can be one and more central processors.

The basic memory stores programs and data. As a rule, it is temporal (information is saved while powering).

Input/output devices serve for data transfer between the computer and an external surrounding consisting of peripheral devices including external bulk memory, communication equipment and terminals.

The mentioned components of a computing system are grouped together with the help of a system bus. These are structures and mechanisms providing interaction between the processor, basic memory and input/output devices.

Operating systems are divided into:

- single-task (for example, MS-DOS, MSX);
- multitask (OC EC, OS/2, UNIX, Windows 95);
- single-user (MS-DOS, Windows 3.x, early OS/2 versions);
- multi-user (UNIX, Windows NT);
- non-preemptive multitasking (NetWare, Windows 3.x);
- preemptive multitasking (Windows NT, OS / 2, UNIX);
- multi-threaded OS;
- multiprocessor (Solaris 2.x, Open Server 3.x, OS / 2, Windows and NetWare 4.1).

3.3 Classification of operating systems for mobile devices

Symbian is an open OS, refers to multitask OS, supports Java, and has good implementation of packet data transmission, as well as high reliability, resistance to

falling and separate errors. It has also a completely object-oriented architecture and API demarcation.

Windows Mobile is an open, multitask OS, has great opportunities for extension, oriented to the operation with multimedia applications. It is compatible with Windows and basic set of applications, developed with Microsoft Win32 API usage; it is demanding of operational memory

Linux/Android is a free OS, has general availability of a code, but also poor multimedia opportunities.

PalmOS (development is stopped, Palm on Linux kernel now): low needs for a random access memory and energy consumption. Poor multimedia opportunities, is a single-task and has a closed API. Palm OS was used by many companies among which there is Lenovo, Legend Group, Janam, Kyocera and IBM.

Apple iOS is a multitask OS; there is no Flash and Java support.

Blackberry OS is developed by RIM Company for Blackberry line of smartphones. It has the stylish interface, original design of phone and keypad QWERTY. As well as at Apple, BlackBerry OS is not available to any other manufacturers. Is very a reliable OS having immunity to many viruses.

Bada is a convenient and effective operating system of Samsung Company, but is not used in wide scale; there are only 3 phones which work at Bada OS, they are: Samsung Wave, Samsung Wave 2 and Samsung Wave 3.

3.3 Classification of desktop applications

The desktop application is the computer program intended for daily user tasks. Such an application is started usually directly from a desktop of the computer or a notebook and does not require access to the network therefore, it is not the web application (i.e. does not work in the browser or via the browser). Any word processor or graphics editor, many games can serve as an example of such application. The browser itself is the desktop application.

To create desktop applications it is possible to use the following programming languages and technologies:

- C/C ++, Delphi, C ++ Builder, SQL, etc.;
- Java. NET/WPF;
- Adobe AIR;
- Windows Forms.

3.4 Control questions

- 1 What is an operating system?
- 2 What is software?
- 3 How can software be classified?
- 4 What types of software exist for mobile applications?
- 5 What are principal components of operating systems?
- 6 What is a programming language?

- 7 What is a desktop application?
- 8 What does the principle of multitasking of OS consist of?

4 Lecture №4 Human-computer interaction

Lecture purpose: to study types of interfaces, development stages and perspectives of their development.

Lecture content: user interface as means of human-computer interaction. Usability of interfaces. Types of interfaces. Physical and mental characteristics of the user. Development stages of user interface. Types of testing interfaces (testing users). Perspectives of interface development.

4.1 Concept of Human-computer interaction

Human-computer interaction is a modern scientific direction, which allows studying the interaction between the person and the computer, and creating perfect development methods, estimates and implementations of interactive computer systems, which are, in their turn, intended for use by the person.

An interface is a set of methods, ways, and means of interaction of two systems with each other.

The user's interface, or the user interface, UI, is a type of an interface, between a person (user) and a machine/device (computer). Most often, the user interface serves as a means and method of interaction of the user with different, most often complex machines, devices and equipment. Usually this term is used with regard to interaction between the operator of the computer and software with which he works.

To create the user interface usability design is used, i.e. a level of convenience of this or that interface.

The UI design is a set of interactive elements, which are intended for optimization, most often, of the Internet resource under needs of the user that in a consequence, contributes deeper immergence of an Internet visitor into the offered content.

The creation of UI design is a rather complex task as it is not easy to optimize the website under needs of millions of visitors. In that case, it is optimized for specific target audience. Examples of resources with a high level of convenience, usability are Google Play Store, Tribal Media, Mozilla, Towfiqi, Apple.

There are three groups of user interface, depending on the type of a used OS:

- command;
- WIMP;
- SILK.

The command-line interface serves for an invitation output on the display screen for a set of a command or a window to start up this or that program.

WIMP interface – when a user interaction is carried out by means of graphic images, such as Window, Image, Menu and Pointer.

SILK interface (Speech, Image, Language, Knowledge) – the interaction of this interface is carried out by means of normal «conversation» of a person and a computer. The computer finds commands, analyzing the human speech by key phrases.

By the nature, a person has several features: he can be mistaken, eventually he will be tired, involuntarily he can be distracted during the work, and he can react to external irritants. After a break, he needs adaptation (what did I do before, what did I mean), he is impatient and inertial. All these features can influence his interaction with machine.

One can select some physical characteristics of the user, they are: sight, color perception, accuracy of hand movements by means of this or that pointing device (for example, mouse) and response speed.

Temperament, memory and its qualification belong to psychological or mental characteristics of the user.

4.2 Development stages of user interface

The development of user interface is an integral part of any project on creation of new software or application. The user interface has a sophisticated functionality as it connects the operation of a machine and a person. The success of a created product will depend on the convenience of a developed user interface. The design of the user interface is such factor, which influences on three basic indicators of software product quality: functionality, esthetics and productivity.

The functionality is one of the main factors because the developers try to create programs by means of which users could carry out the tasks with maximum convenience.

The esthetic appearance is very important for the positive opinion about a developed application. However, esthetic characteristics are rather subjective and it is very difficult to describe them quantitatively, unlike functional requirements or performance indicators.

The productivity or reliability of application also influences the perspective of program usage. If an application looks good, has simple and convenient control, but works slowly, «gets locked up» for several seconds or, gives error messages in case of incorrect actions of the user, then such application will have few chances of long operation. In its turn, fast and stable operation of an application can compensate for its not the most stylish design or the absence of any secondary functions.

For epy development of user interface it is necessary to realize several stages:

1) Design.

– functional requirements: determination of the purpose of development and initial requirements;

– user analysis: determination of user needs, development of scenarios, assessment of compliance of scenarios to users' expectations;

– conceptual design: modeling the process for which application is developed;

- logic design: determination of information flows in the application;
- physical design: choice of a platform on which the project and development means will be realized.

2) Implementation.

- prototyping: development of paper and/or interactive prototypes of screen forms;
- designing: creation of the application taking into account the possibility of change of its design.

3) Testing.

- usability testing: application testing by different users, including users with disabilities (Accessibility testing).

The process of testing can be classified by the following parameters:

a) possibilities of access to the source code:

- testing of «a white box»;
- testing of «a black box».

b) on a level of execution of the source code:

- dynamic testing;
- static testing (analysis of the source code).

c) on spanning of the tested application:

- modular testing (unit-tests);
- integration testing;
- system testing;
- alpha and beta testing;
- acceptance tests;
- pilot testing.

d) on the tested areas of application operation:

- «smoke» testing;
- functional testing;
- load testing;
- safety testing;
- usability testing.

4.3 Perspectives of development of interfaces

The development of digital technologies allows integrating the real world with a virtual one. In this, an important role is played by the user interface, as the interaction of the person with the digital world opens a way to further progress. Today, developers face a complex challenge: The appearance of a variety of mobile devices requires a rethinking of the approach to interface creation. Displays of devices show a tendency to reduction and it becomes more difficult for designers to create a convenient and user-friendly interface. «Smart» houses in «smart» cities are equipped with the instruments; the interaction with such devices is carried out by an intuitive way and does not require any qualification. The typewriter was the first

technical invention very simple to be used. More than in 150 years touch screens opened for us new ways of interaction with the digital world, but even their opportunities are restricted.

Today the area of touch screens development, which will allow providing the access not only by one finger, but also all hand, and also Voice actuation, gestures, tactile contact – they all are modern methods of access to the content.

World kit is a digital interface on any surface; it allows turning any surface into the digital interface. Desktops, doors and walls, anything can become a touch-screen.

The devices allowing blind people to read books just running a finger over lines are created. Such a device is called Fine Reader, it reads out the text and makes its acoustic processing.

In addition, an active work in the development area of three-dimensional perception of space is being carried out.

4.4 Control questions

- 1 What is a user interface?
- 2 What is the usability?
- 3 How are user interfaces classified?
- 4 What types of interfaces testing exist?
- 5 What means can provide the access to WIMP interface?
- 6 What means can provide the access to SIIK interface?
- 7 What does the process of creation of user interface include?
- 8 What is the principle of system testing?
- 9 What new tendencies exist in the field of creation of user interfaces?
- 10 What does modular testing represent?

5 Lecture № 5. Database systems

Lecture purpose: to study fundamentals of database systems.

Lecture content: concept, characteristic, architecture of databases. Data models. Normalization. Restricting Data Integrity. Query tuning and their processing. SQL bases. Design and development of databases. Technology of ORM programming. Distributed, parallel and heterogeneous databases.

5.1 Basic concepts of a database system

Data is the information, which is presented in a certain form that allows automating its collection, storage and further processing by a person or an information device. For computer technologies, data is the information in discrete, fixed form, convenient for storage, processing on a computer, and for transmission over communication channels.

Database (DB) is a concrete data set, which reflects a status of objects and their relations in a considered data domain. A database consists of a set of connected files.

A Database Management System (DBMS) is a set of language and software means, which are intended for creation, guiding and sharing a database by a great number of users.

A designed database shall have the following properties:

- integrity, which is reached owing to introduction of integrity restricting, in particular, the restrictions are connected to DB normalization;
- DB restorability after failure of the system or separate types of system damage;
- DB safety, which assumes data protection from intentional and unintentional access, modification or damage and fraud. Prohibition of illegal access, protection against copying and cryptography protection are applied.
- efficiency: minimum time of response to the user's request; minimum needs for memory.

One of the most important aspects of DBMS development is the idea of separation of a logical structure of a DB and data manipulations necessary for users, from physical representation, which is required for a computer hardware. One can distinguish one-, two- and three-level systems according to the number of levels of data description supported by DBMS. Nowadays the three-level architecture of the DB description is supported most often.

The three-level architecture includes:

- external level, at which users or separate user groups have their own idea on a created database;
- internal level, at which DBMS and an operating system perceive data;
- conceptual level of data presentation, which is intended for the display of external level onto internal level, as well as for the support of their necessary independence from each other; it is connected to the general concept of users.

Structure declaration of data at any level is called a diagram.

Data model is called a formalized structure declaration of information units and operations over them in the information system. The data model is a certain abstraction reflecting the most important aspects of functioning of the selected data domain, whereas the minor ones are ignored. The data model includes a set of concepts for the description of data, relations between them and restrictions, which are superimposed on data.

In a data model, one can distinguish three principal components:

- a structural part which defines the rules for generating data structures that are valid for a given DBMS;
- a controlling part, which defines possible operations over such structures;
- classes of restricting data integrity, which are implemented by means of this system.

Each DBMS supports this or that data model. In essence, the data model supported by DBMS mechanisms completely defines a set of specific databases, which can be created by means of this system, and modification methods of DB status aiming to display of those changes, which occur in data domain.

Today, many various models are described and their creation pursues different aims. From a set of published data models, it is possible to select three categories:

- object data models (ER model, API);
- data models on the basis of records (network, hierarchical);
- physical data models (generalizing model and memory model of frames).

Normalization is the process of data structure in the database including the creation of tables and establishment of relations between them according to the rules, which provide data protection and make the database more flexible, removing redundancy and uncoordinated dependences. Data redundancy leads to an unproductive use of an empty place on a disk and complicates database maintenance.

Data integrity restricting is a set of special means limiting access in databases for inadmissible data (for example, warning errors of users in the case of data entry).

Integrity restricting are divided into three categories:

- a) the first category is the means of ensuring of domain integrity;
- b) the second category is the entity integrity;
- c) the third category is the referential integrity, it is provided with the system of primary and foreign keys.

The means of ensuring of integrity can also be divided into two more big categories; these are means of a declarative and procedural character. Means of declarative character are created as components of objects in case of their determination in the database (for example, a condition on value in case of determination of the table in the database). The means of procedural character (triggers and stored procedures) are implemented as separated software modules. Generally, declarative restrictions are less functional, but they are more economical from resources point of view and vice versa.

The request is a language expression describing data, which are subjected to selection from the database. In the context of request optimization, it is understood that requests are expressed in a manner that is based on content (in most cases oriented on sets) that gives to the optimizer the chance of a choice between possible procedures of computation.

Requests optimization is aimed at minimizing the response time for a given request and a mixture of request types in a given system environment.

Request processing assumes the use of a heuristic method and the method of execution of a request consisting in comparative estimation of cost of different options and a choice of a minimum one using resources.

There are several DB types among which:

1) A distributed database (DDB – distributed database) is a set of logically interdependent databases distributed in a computer network. A distributed DB control system is defined as a program system, which allows controlling a distributed database, so that its distribution was transparent for users.

2) A parallel DBMS is implemented on the multiprocessor computer using large-scale parallelism. Such a determination implies the existence of a set of alternatives, which range varies from direct transfer of the existing DBMS with the interface reconstruction only for the operating system up to sophisticated combinations of algorithms of parallel processing and functions of databases bringing to new hardware-software architectures.

3) Heterogeneous DBMS is a distributed DBMS consisting of different DBMS types.

5.2 SQL bases

SQL language (Structured Query Language – the structured language of requests) represents a standard high-level language of data description and handling them in database management systems (DBMS) constructed based on a relational data model.

SQL language is oriented for operation with data sheets and has no sufficient means for implementation of sophisticated programs. Therefore, it is used in combination with languages of high level, such as, for example C++, Pascal, or is included into a specially developed DBMS language.

The «program» created in SQL language represents a simple linear sequence of SQL language operators. SQL language in its «pure» type does not have operators for managing the order of query execution to the database (like cycles, branching, and transitions). SQL language operators are built using:

- reserved keywords;
- identifiers (names) of tables and columns of tables;
- logical, arithmetical and line expressions used for formation of search criteria of information in a DB and for computation of values of cells of resultant tables;
- identifiers (names) of operations and functions used in expressions.

7-bit characters of ASCII coding (in other words - Latin letters) represent all keywords, names of functions and names of tables and columns. There is no difference between uppercase (big) and lowercase (small) letters in SQL language, i.e., for example, the lines «SELECT», «Select», «select» represent the same keyword. For designing the names of tables and their columns it is possible to use letters, digits and sign «_» (underlining), but a letter shall be the first character of a name. It is forbidden to use keywords and names of functions as identifiers of tables and column names. The complete list of keywords and names of functions (it is very extensive) can be found in documentation on a specific DBMS. An operator begins with the key word verb (for example, «CREATE», «UPDATE», «SELECT», etc.)

and comes to an end with the sign «;» (semicolon). The operator is written in free format and can hold several lines.

There are several stages to design a DB:

- 1) Specification of tasks.
- 2) Sequence of tasks execution.
- 3) Data analysis.
- 4) Determination of data structure.
- 5) Development of a prototype of application and user interface.
- 6) Creation of the application.
- 7) Testing and enhancing.

5.3 Technology of ORM programming

ORM (Object-relational mapping) is a technology of programming that integrate a programming language creating «a virtual object database».

ORM task is to manage the translation of object types in database record and back. The main problem consists in that the objects have a hierarchical structure, and databases –a relational one.

Using ORM in a project eliminates the need for the developer to work with SQL and write a lot of code. All generated ORM code is presumably well checked and there is no need to test it. ORM disadvantage is the reduced productivity because the system processes a wide range of scenarios of data usage, much bigger, than any stand-alone program will be able ever to use.

5.4 Control questions

- 1 What is a DB?
- 2 What is data?
- 3 How are DB types classified?
- 4 What is a request?
- 5 What data models are there?
- 6 What is ORM?
- 7 What are the bases of SQL language?.
- 8 What is query optimization?
- 9 What is a normalization?
- 10 What requirements should a DB meet?

6 Lecture №6. Data analysis. Data management

Lecture purpose: to study data analysis bases.

Lecture content: methods of collection, classification and prediction. Decision trees. Processing large volumes of data. Methods and stages of Data mining. Tasks of Data mining. Visualization of data.

6.1 Data analysis

Data analysis is a process of data research, filtration, conversion and modeling to extract the useful information and decision-making. Data analysis has a set of aspects and approaches, covers different methods in different fields of science and activities.

To create the plan of data collection it is necessary to:

- 1) Define problems and formulate research objectives.
- 2) Realize a preliminary study of an interesting subject.
- 3) Develop concepts of research.
- 4) Make detail planning of a research.
- 5) Make a selection of information sources and collection of secondary data.
- 6) Estimate the obtained data and to make a decision how primary data are needed.
- 7) Define a method of collection of primary data – inquiry, observation, experiment.
- 8) Carry out directly the collection of primary information.
- 9) Provide results of the research (presentation).

Forecasting methods of data are divided into:

- intuitive, which deal with opinions and estimates of experts;
- formalized which are already described in literature and based on which are already built forecasting models.

Decision trees are widely used in data slicing pane.

Decision trees – it the method of rules representation in hierarchical, sequential structure where a single node giving a decision corresponds to each object there.

All problems, which are solved by a tree method, can be integrated in the following three classes:

1) *Data description*: Decision trees allow storing information about data in the compact form, instead of them we can store a decision tree, which contains the exact description of objects.

2) *Classification*: Decision trees perfectly cope with tasks of classification, i.e. reference of objects to one of in advance known classes. The target variable shall have discrete values.

3) *Regression*: If a goal variable has continuous values, decision trees allow setting the dependence of the goal variable on independent (input) variables. For example, the tasks of numerical prediction (prediction of values of a goal variable) belong to this class.

There are many algorithms, which realize decision trees, among them CART, C4.5, NewId, ITrule, CHAID, CN2, etc. However, the following ones are most widespread:

CART (Classification and Regression Tree) – an algorithm of creation of a binary decision tree – dichotomizing classification model. Each node of such a tree

in case of partition has only two descendants. The algorithm solves problems of classification and regression.

C4.5 is an algorithm of creation of a decision tree, in which the number of node's descendants is not restricted.

6.2 Data Mining Bases

Speaking about processing large volumes of data, you face the use of the term Data mining, which implies that there is a huge number of data.

Data Mining is a process of support of decision-making, which it is based on the search of hidden regularities (information templates) in data. It is such a technology intended for the search of regularities unobvious, objective and useful in practice in large volumes of data.

Tasks of Data Mining are sometimes called regularities or techniques. The main objectives of Data mining are: classification, clustering, prediction, association, visualization, analysis and detection of deviations, estimation, analysis of relations and summing up.

Methods and Data mining algorithms:

- artificial neural networks;
- decision trees;
- character rules;
- methods of the closest neighbor and the k-closest neighbor;
- method of reference vectors;
- Bayesian networks;
- linear regression;
- correlative regression analysis;
- hierarchical methods of cluster analysis;
- not hierarchical methods of cluster analysis, including algorithms of k-averages and k-median line;
- methods of search of the associative rules, including algorithm Apriori;
- method of limited search, evolutionary programming and genetic algorithms, various methods of data visualization and a lot of other methods.

Data Mining can consist of two or three stages.

Stage 1. Detection of regularities (free search).

Stage 2. Use of revealed regularities for prediction of unknown values (prognostic simulation).

Stage 3. Analysis of exceptions is the stage intended for detection and explanation of anomalies which are found in regularities.

6.2.1 Visualization of Data Mining tools.

Each of Data mining algorithms uses a certain approach to visualization. During the use of each of each of Data mining methods, to be exact, of its program implementation, we are viewers, by means of who it is possible to interpret the

results, which are received because of operation of the appropriate methods and algorithms.

For decision trees such a viewer is a decision tree, list of rules and contingency table.

For neural networks, depending on the tool, it can be network topology, the diagram of change of error value showing training activity.

For Kekkonen's cards: cards of inputs, outputs, other specific cards.

For the linear regression, the regression line appears as a viewer.

For clustering: dendrograms scatter diagrams.

Diagrams and graphs of dispersion are often used for an assessment of quality of operation of this or that method.

All these methods of visual representation or data mapping can execute one of the functions:

- are an illustration of creation of a model (for example, representation of a structure (graph) of a neural network);
- help to interpret the received result;
- are means of an assessment of quality of a constructed model;
- combine the mentioned above functions (a decision tree, dendrograms).

Before using Data mining technology, it is necessary to analyze carefully its problems, restrictions and critical questions, connected with it, as well as to understand what this technology cannot do.

The analytics cannot replace Data Mining!

The technology cannot give answers to those questions, which were not asked. It cannot replace an analyst, and only gives him the powerful tool for facilitation and improving its operation.

The complexity of development and operation of Data mining application.

As this technology is a multidisciplinary area, for application development including Data Mining, it is necessary to involve experts from different areas, and to provide their high-quality interaction.

6.3 Control questions

- 1 What is data analysis?
- 2 What is data?
- 3 How can forecasting data methods be classified?
- 4 What is the regression in data analysis?
- 5 What is data visualization?
- 6 What is Data Mining?
- 7 What are data mining methods?
- 8 What is a decision tree?
- 9 What are the tasks of Data mining?
- 10 What are the algorithms of creation of a decision tree?

7 Lecture № 7. Networks and telecommunications

Lecture purpose: to study bases of creation of telecommunication networks, stacks of protocols, technologies of connection to the Internet.

Lecture content: final devices, data transfer devices, transmission media. Types of networks. Stack protocols: TCP/IP, OSI. IP addressing. Wire and wireless network technologies. DHCP protocol. Technologies of connection to the Internet. Telecommunication technologies.

Computer networks provide the interaction of devices connected to the information transfer over long distances and its processing. Such interaction became possible when for the first time in 1969 between two nodes of ARPANET network the successful communication session came to the end. In recent years, computer networks were implemented into all spheres of socio-political life, extended worldwide and even went into space. Thousands of satellites provide inhabitants of the earth with continuous communication.

A computer network is a set of nodes (computers, terminals, peripheral devices) interacting with each other by means of transmission channels.

By scale computer networks are divided on:

- LAN (Local-Area Network) – the local computer networks (LCN) representing the combination of computers located in a limited area. For LAN the specialized cable system is usually used, the wireless communication is sometimes used;

- CAN (Campus-Area Network) – campus networks integrating local area networks of buildings located next to each other;

- MAN (Metropolitan-Area Network) – computer networks of urban scale;

- WAN (Wide-Area Network) – large-scale computer networks;

- GAN (Global-Area Network) – wide computer networks, the most striking example is the Internet.

For larger networks, specialized wire/wireless communication lines can be also used or infrastructure of the existing public communication lines, first, the telephone is applied.

The information stream transferred over a network is called a network traffic. The network traffic in addition to the useful information contains the service data necessary for implementation of communication sessions.

The existing networks function in one of two modes: the single-sideband mode and broadband (usually single-sideband) one.

In the single-sideband network all communication bandwidth in each moment of time is used for transmission only one signal. Broadband networks allow transmitting several signals at the same time over one communication line (similar to how several television channels arrive simultaneously) over TV cable to the TV set.

To provide accuracy and maximum convenience of information transfer network operations are regulated by a set of rules and the agreements called protocols and interfaces. Protocols and interfaces define the types of connectors and cables, signals, data formats, error checking methods, algorithms of operation of network interfaces and nodes and so forth.

Though there is a large number of devices and architectures for creating a network, all networks consist of similar hardware and software components including: servers; workstations; hubs; network interface cards; network ports; communication equipment (switches, routers, gateways); transmission media (wire/wireless); software drivers; network operating systems; network services; network applications.

The topology of physical and logical connections in networks differs on many signs, among which:

- transmission rate (high speed, low-speed);
- type of used cable (coaxial, optics, twisted pair cable);
- physical layout of cable (ring, star, point-to-point, bus, dots, mesh);
- format of packets (frames) (Ethernet, Token Ring, FDDI, IP);
- transmission media (wire/wireless, RRL). Topology of physical and logical relationships on networks differs on many signs among which:

- transmission rate (high speed, low-speed);
- type of the used cable (coaxial, optics, the twisted pair cable);
- physical layout of a cable (ring, star, point-to-point, bus, dots, mesh);
- format of packets (frames) (Ethernet, Token Ring, FDDI, IP);
- transmission media (wire/wireless, RRL).

7.1 Stack protocols: TCP/IP, OSI. IP addressing

A protocol is a set of rules and specifications defining the sequence and format of messages lying at one level of different nodes and which the network components exchange.

A set of protocols hierarchically organized and sufficient for the organization of communication of nodes in a network is called a stack of communication protocols. Communication protocols can be realized both software and hardware. The protocols of low levels are often implemented by a combination of software and hardware. While the protocols of high levels, as a rule, are purely software.

Protocols are implemented not only by computers, but also other network devices – hubs, bridges, switches, routers, etc. because, generally, the communication in a network is carried out not directly, but via different communication devices. Depending on the type of a communication device, the means realizing this or that set of protocols shall be built in it.

The OSI model (Open System Interconnect) is the most known standard of the beginning of 80s offering to network developers a set of rules and instructions

for the development of OSI. The OSI model is divided into 7 levels enumerated bottom up:

1) *Physical layer* is responsible for conversion of electronic signals into the signals of data transmission medium (impulse of voltage, radio waves, and infrared signals).

2) *Data link layer* controls synchronization of two and bigger number of adapters connected to a uniform data transmission medium. For example, EtherNet protocol.

3) *Network layer* is responsible for the system of unique names and packet delivery in name that is for packets routing. For example, IP Internet protocol.

4) *Transport layer* is responsible for delivery of big messages over packet-switched lines. Transport protocols in the Internet can be UDP and TCP protocols.

5) *Session layer* is responsible for the procedure of establishment of the beginning of a session and confirmation (answerback) of arrival of each packet from the sender to the receiver. In the Internet, a session layer protocol is TCP protocol (it is placed at both the 4 th and 5th levels of OSI model).

6) *Presentation layer* of data transforms messages of the user to the form used by low levels by overcoming syntax distinctions (data compression or their encoding). An example of the protocol is Secure Socket Layer (SSL) providing confidentiality of data transfer in TCP/IP stack.

7) *Application layer* is responsible for ensuring access of application programs to different services and resources of a network. Examples of tasks of this level are: file transfer, e-mail, network management, etc. Examples of protocols – NCP of a stack Novell; SMB in Windows NT stack; NFS, FTP, SNMP, Telnet of TCP/IP stack (figure 7.1).

TCP/IP stack from system architecture point of view corresponds to OSI reference model and allows exchanging data on a network to the applications and services working practically at any platform including Unix, Windows, Macintosh and others. TCP/IP implementation of Microsoft corresponds to a four-layer model instead of a seven-layer model, as shown in figure 7.1.

Depending on the service type, one can use two protocols - TCP or UDP. TCP is responsible for reliable data transfer from one node of a network to another one. It creates a session connection-oriented, in other words, a virtual link between machines. Unlike TCP, UDP does not create connections.

Internetwork layer is responsible for data routing in a network and between different networks. Routers, which depend on a used protocol, operate at this level and they are used for sending packets from one network (or its segment) to the other (or other network segment). In TCP/IP stack at this level IP protocol is used.

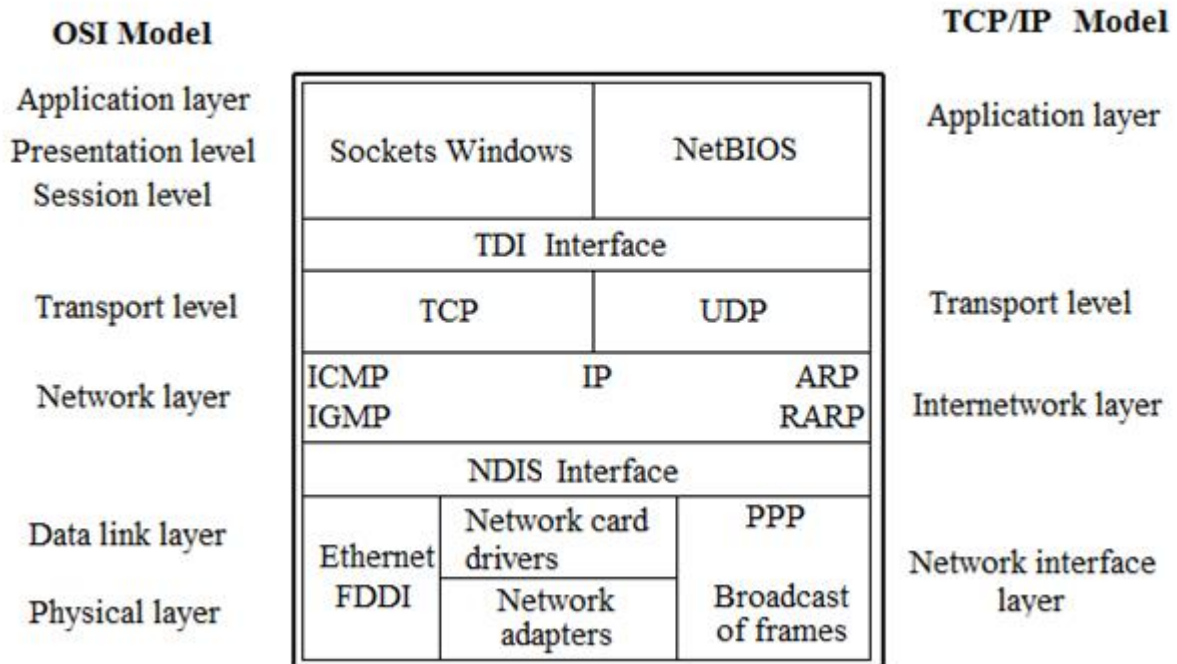


Figure 7.1 – Correspondence of OSI model and four-level TCP/IP model

Each computer in TCP/IP networks has addresses of three levels: physical (MAC address), network (IP address) and character (DNS name).

Physical or local node address is determined by a technology by means of which the network containing the node is built. For nodes, being in local area networks this is a MAS-address of a LAN adapter or router port, for example, 11-A0-17-3D-BC-01. These addresses are assigned by hardware manufacturers and are unique addresses as they are controlled centrally. For all existing technologies of MAC local area networks – the address has a format of 6 bytes: high 3 bytes - the identifier of firm of the vendor, and low 3 bytes are assigned in a unique way by the vendor.

Networking or IP-address consists of 4 bytes, for example, 109.26.17.100. This address is used at the network layer. It is assigned by an administrator during configuring computers and routers. IP address consists of two parts: network numbers and numbers of a node.

A character address is DNS name, for example, SERV1.IBM.COM. This address is assigned by an administrator and consists of several parts, for example, of a name of the machine, name of the organization, domain name. Such an address is used at the application layer, for example, in FTP or Telnet protocols.

To determine a local address by IP address, ARP protocol of address permission is used. In local area networks, ARP uses broadcast frames of the link protocol for net search for a node with a given IP address.

7.2 Wired and wireless networking technologies. DHCP. Technologies of connection to the Internet. Telecommunication technologies

Characteristics of main wire technologies are provided in table 7.1.

Table 7.1 – Characteristics of popular wire network technologies

Network type	Transmission rate, Mbit/s	Cable type	Topology
Ethernet	10	Coaxial, UTP, Fiber optic	Star, bus
Token Ring	4 or 16	UTP, STP	Star, ring
Arcnet	2.5	Coaxial, UTP	Star, bus
FDDI	100	Fiber optic	Star, ring
CDDI	100	UTP, STP	Star, ring
ATM	155-622	UTP, STP, Fiber optic	Star
100VG-AnyLAN	100	UTP, STP	Star
100Base-X	100	UTP	Star
Gigabit Ethernet	1000	UTP кат.5	Star

7.3 Control questions

- 1 What is the concept of OSI reference model?
- 2 What are OSI model levels and what functions do they perform?
- 3 What are the protocols, which are used at the transport layer?
- 4 What are the main access methods in the Internet?
- 5 What protocols are used at the network layer?
- 6 What attacks can occur on each of the levels?
- 7 What technologies belong to wireless technologies of the last mile?
- 8 What is an IP address?
- 9 What is a MAC address?
- 10 What is a DNS address?

8 Lecture №8. Cybersecurity

Lecture purpose: to study basic principles of cyber security, threats to information security, security measures and means.

Lecture content: threats to information security and their classification. Cyber security industry. Cyber security and control of the Internet. Malicious applications. Measures and means of information protection. Standards and

specifications in information security field. RK acts governing legal relations in the sphere of information security. Digital signature. Encoding.

A security threat can be understood as a potentially dangerous impact on the system, which directly or indirectly harm the user. Direct implementation of threat is called an attack.

Knowledge of possible threats and weak spots in the security, which these threats usually exploit, is necessary for the selection of most economic means of security.

There are unintentional and deliberate or intentional threats.

Unintentional threats are connected to errors of the equipment or software; errors of the person; force majeure circumstances.

Intentional threats are aimed at harming users of information systems and are divided into active and passive. The passive threat is an illegal access to the information without state change of system, the active one is connected to attempts of interception and change of information.

Illegal access consists in receiving the access to a resource on which the user has no permission according to the trust relationships policy admitted in the organization.

Also common are threats such as «denial of service», which is a deliberate blocking of legal access to information and other resources as well as the illegal use of privileges. «Virus» is a program capable to infect other programs, by means of their modification so that they included the copy of the virus. «Trojan horse» is a program containing hidden or explicit program code, in the performance of which the functioning of the security system is violated. «Worm» is a program that is distributed in systems and networks over communication lines. Such programs are similar to viruses: they infect other programs, and differ from viruses in that they are not able to reproduce themselves. «Loopholes» - the entry point to the program, which allows access to some system functions. They are found by the analysis of program performance analysis, etc.

To the class of malicious programs can be attributed sniffers (programs that intercept network packets), programs for selecting passwords, attacks on buffer overflow, in some applications - disassemblers and debuggers.

One can classify the threats of information security as follows:

- theft (copying) of information;
- destruction of information;
- modification (distortion) of information;
- violation of accessibility (blocking) of information;
- denial of the authenticity of information;
- imposing false information.

According to Recommendation MSE-T X.1205: «Cybersecurity is a set of means, strategies, security principles, security guarantees, guidelines, approaches to risk management, actions, training, practical experience, insurance and technology that can be used to protect the cyber media, organization and user resources. The

organization and user resources include connected computer devices, personnel, infrastructure, applications, services, telecommunication systems and the entire set of transmitted and / or stored information in the cyberspace. Cybersecurity consists in trying to achieve and preserve the security properties of the organization or user resources, directed against the corresponding security threats in the cyberspace.

Common security tasks include the following:

- availability;
- integrity, which may include authenticity and non-repudiation;
- «confidentiality».

WGIG Working Group, in the light of a comprehensive discussion, developed a definition of Internet governance: Internet governance is the development and use by governments, the private sector and civil society, in carrying out their respective roles, common principles, norms, rules, decision-making procedures and programs, regulating the evolution and use of the Internet.

WGIG working group has formulated the major problems, which require fixing and solution at the international level:

- administration management by a root zone of the Internet and root servers of domain name system (DNS);
- order of assigning network IP addresses and distribution of address space in conditions of transition to a new IPv6 network protocol;
- clarification of the procedure for joining information and telecommunications networks at the international level and their interaction;
- stability and security of the global network and its users;
- prevention of illegal dissemination of information on the Internet, including spam;
- ensuring the basic human rights and freedoms while using the Internet, including, first of all, freedom of speech and expression of one's opinion;
- ensuring the constructive participation of everyone who wants to develop a state policy on Internet governance;
- protection of information and rights to privacy;
- observance of consumers' rights when providing network services;
- expanding the practice of multilingualism and multiculturalism.

The following methods of information safety in information systems are applied to ensure security: hindrance; access control; encoding mechanisms; counteraction to attacks of malicious applications; regulation; enforcement; motivation.

Treat security protection means are:

- technical (systems of security and fire warning, digital video of surveillance, SKUD, use of screened equipment and cable);
- hardware (devices for encoding, storage of passwords, measuring personal characteristics of the person (voice, prints, etc.));
- software (anti-virus program, VPN, fire-walls, Proxy-servers);

– organizational (national acts and norms, rules of operation developed by administration of a specific enterprise or state).

One of widespread measures of protection is encoding and use of the electronic digital signature (EDS).

EDS is it is an analog of a manual signature, the props of an electronic document obtained as a result of cryptographic information transformation using the Electronic Registration Certificate (hereinafter - the Certificate) and a private EDS key. The certificate and the private key of the EDS are issued on a SMART-card, which excludes the violation of the integrity of this information and the copying of the private EDS key. The SMART-card is protected by a PIN-code, which guarantees its use only by the owner of the Certificate. In order to identify the owner of the Certificate, the EDS helps protect the electronic document from forgery, and also determines the absence of distortion of information in it.

Common algorithms for encryption of digital signatures include the algorithm RSA, GOST R 34.10-2012, El Gamalya, DSA.

Some standards and specifications allow describing measures and methods to ensure the security of information systems. Recommendation X.800 regulates the information security of distributed systems. The criteria for assessing the security of information technology are described in ISO / IEC 15408.

ISO/IEC 17799:2005 «Information technologies. Technologies of safety. Practical rules of management of information security».

ISO/IEC 27001. «Information technologies. Safety methods. Management systems information security. Requirements».

ISO/IEC 17799:2005. «Information technologies. Technologies of safety. Practical rules of management of information security».

The first Concept of information security of Kazakhstan was accepted in 2006 and it was based on a number of regulations:

- Constitution;
- law «On National Security of the Republic of Kazakhstan»;
- «On state secrets»;
- «On the fight against terrorism»;
- «On the electronic document and the digital signature»;
- «On informatization»;
- «On counteraction to extremism»;
- the concept of development of competitiveness of information space of the Republic of Kazakhstan for 2006-2009;
- the concept of information security of the CIS member states in the military sphere.

In 2011, the second Concept was adopted, in which the NPA list was supplemented by the laws «On Technical Regulation» (2004), «On Licensing» (1995), «On Mass Media, «On Communications» (2004). The provisions of the Agreement between the governments of the SCO member states on cooperation in the field of ensuring international information security (2010) and the Concept of

Cooperation of the CIS Member States in the field of providing information security (2008) were also used.

8.1 Control questions

- 1 What is data cryptography?
- 2 What is the EDS?
- 3 How can methods of data protection be classified?
- 4 What is cybersecurity?
- 5 What are the main purposes of cybersecurity?
- 6 What are threats of information security?
- 7 What are the main objectives of information security?
- 8 What are the main standards regulating information security?

9 Lecture №9. Internet technologies

Lecture purpose: to study basic concepts of the Internet and its technologies.

Lecture content: the universal resources identifier (URI), its purpose and components. DNS Service. Web technologies: HTTP, DHTML, CSS, JavaScript. E-mail. Message format. SMTP, POP3, IMAP protocols.

9.1 System of the universal resources identifiers URL/URI

The information space of documents is characterized by another addressing system, based on the concept of URL-address. Each document stored on the World Wide Web has its own unique URL (Uniform Resource Locator).

Each file located on any computer on the Internet and in any folder also has a unique address called a URL (Uniform Resource Locator). URL is a universal resource locator or a unique address of files on the Internet, stored on a host computer connected to the Internet.

The complete URL of the document on the network consists of the following parts:

- a protocol prefix consisting of a protocol name, a colon, and two «/» characters;
- a domain name of the computer or its IP address instead of the domain name;
- a port number through which the server interacts. The colon is put in front of the port number. From the user point of view, the indication of a port happens to be useful, for example, for «forced» code conversion of the document. The addresses `http://www.newmail.ru:8100` and `http://www/newmail.ru:8101` indicate the same server, but in the first case, the document is read in coding KOI-8, and in the second one – in Windows coding;

– a file name on this computer, which can include the path from the root directory of the server. The path entry in the server tree of the server uses the character '/', rather than '\', as is accepted in Windows.

It is necessary to remember that URL is sensitive to the register of characters.

```
protocol://host [: port] / path/filename  
http://www.nsv.ru/official/index.xml  
http://193.124.215.195/official/index.xml  
ftp://sim.df.ru/drives/intel/100disk.exe
```

protocol – the protocol of access to a resource
host – domain name of a host according to DNS
port – Web server port number
path – a way to the file
filename – the file specification
http – the protocol of access
www – type of a network resource
nsv – the domain of the 2nd level
ru – the domain of the 1st level
official – the directory
193.124.215.195 – IP address

9.2 Domain name system

This system separates addresses on hierarchy of different domains (domain is an area) representing a certain group of computers.

The DNS platform is represented by 13 special computers – root servers which contain IP addresses of all registered TLD. Except root servers, there are thousands of DNS servers subordinated to them on all the Internet. Each server is responsible for a zone, i.e. its part of a tree of domain names. The responsibility on domains of lower levels is delegated to other DNS servers.

Rules of compilation of domain names are less rigid, than in case of IP assignment, but also there is a certain structure here. So, the domain name of the ZNTU www.zntu.edu.ua server includes the following parts:

a) www – the prefix specifying server accessory to «World Wide Web» of World Wide Web is optional, but is widespread in domain names.

b) zntu – the domain of the third level in this case containing a name of the organization;

c) edu – the domain of the second level – in this case one of organizational domains of Ukraine integrating all educational organizations of the country.

d) ua – the domain of the top level – in this case the territorial domain of Ukraine.

Domain names are converted into computer-understandable IP addresses using the Domain Name System (DNS), which consists of a hierarchy of DNS

servers. At the top of the hierarchy are the servers of the root zone with the names a.root_server.net, b.root_server.net, etc., duplicating each other's information. The local server receives a request from the client machine to connect to a certain address, passes it to the local DNS server, which will allocate a domain name from the request and either find the corresponding IP in its database or access one of the servers in the root zone. The latter returns a pointer to the DNS server of the domain known to it, which includes the requested address, and completely disappears from the process. Such nested queries can be repeated, and each time the DNS server will access the lower-level name server. Only after the completion of this multi-stage process, the DNS server will return the converted address to the computer that made the request, and the user can finally see on his monitor what is behind the information located at the address he entered. Domain names are not only more understandable than IP addresses, but they are also universal, they are easier to reassign and reuse.

9.3 Web technologies

HTML is a hypertext language for filling information Web servers. The description on HTML is a text in ASCII format and the sequence of commands included in it. These commands are placed in the right places of the text, defining fonts, hyphens, appearance of graphic images, links, etc. In WWW browsers, inserting commands is done by pressing the corresponding keys. So, in Internet Assistant, included as an add-on in the MS Word editor, the text and commands are typed in a single process. The commands have the form «___», where instead of «___» the command name is written.

DHTML (Dynamic HTML) is a set of means that allow you to create more interactive Web pages without increasing the server load. DHTML is built on the Document Object Model (DOM), which extends the traditional static HTML document. DOM provides dynamic access to the contents of the document, its structure and styles. In the DOM, each element of a Web page is an object that can be modified. DOM does not define new tags and attributes, but simply provides the ability to software manage all tags, attributes, and cascading style sheets (CSS).

CSS (Cascading Style Sheets) is a style language that defines the display of HTML documents. CSS works with fonts, colors, fields, lines, height, width, background images, positioning elements, and many other things.

The difference between CSS and HTML is that HTML is used to structure the content of a page, and CSS is used to format this structured content.

Javascript is a programming language with which web pages are given interactivity. It creates applications that are included in the HTML-code (for example, questionnaires or registration forms that are filled in by the user). Using Javascript, you can change the page, change the element styles, delete or add tags. With its help, you can find out about any manipulations of the user on the page (scrolling the page, pressing any key, clicking with the mouse, increasing or decreasing the working area of the screen ...). Through it you can access any

element of the HTML-code and do a lot of manipulations with this element. You can download data without reloading the page, displaying messages, reading or setting a cookie, and performing many other actions.

The e-mail service is designed to enable the exchange of personal messages. This service consists of client service objects (client access programs) and e-mail servers. Each user of the network is assigned to his server and has an electronic «mailbox» in it under a certain name. To send a message it is enough to send it in a certain format to your mail server with the address of the recipient. The mail server, after analyzing the address of the recipient, will send a message through the network of mail servers to the server containing the recipient's mailbox, where this message will be delivered. To receive their messages, the user must contact their mail server and read them from the mailbox.

There are several types of e-mail services based on different communication protocols: X.400, UUCP, SMTP, POP3, etc.

On the Internet, the most widespread is the e-mail service, based on the SMTP and POP3 protocols.

The main task of the Simple Mail Transfer Protocol (*SMTP*) is to ensure the transmission of electronic messages (mail) by creating a TCP connection between the client and the server via port 25. Then the client and the SMTP server exchange information until the connection is closed or interrupted. The main procedure in SMTP is mail transfer. Next, there are Mail Forwarding procedures: checking the names of the mailbox and displaying the lists of mail groups. The first procedure is to open the transmission channel, and the last is to close it.

POP3 (Post Office Protocol Version 3) is a post office protocol version 3 is a network protocol that is used by the email client to receive e-mail from the server. Typically it is used in conjunction with the SMTP protocol. POP3 is installed on the 110th TCP port of the server, which is in idle mode of incoming connection. When a client wants to use the POP3 service, he simply establishes a TCP connection with port 110 of this host. After the connection is established, the POP3 service sends a greeting message to the connected client. After that, the client and the server begin to exchange commands and data. Upon completion of the exchange, the POP3 channel closes.

IMAP4 (Internet Message Access Protocol, Version 4) is an Internet e-mail access protocol that allows clients to access and manipulate e-mail messages on the server.

A significant difference between the IMAP4 protocol and the POP3 protocol is that IMAP4 supports working with the directory system (or folders) of messages. The IMAP4 protocol works on top of the transport protocol, providing a reliable data transfer channel between the client and the IMAP4 server. When using TCP, IMAP4 uses the 143 port. IMAP4 commands and data are transmitted using the transport protocol, in the form in which the server or user send them.

9.4 Control questions

- 1 What are the concept and structure of language of hypertext link?
- 2 What is URL, its structure?
- 3 What is a domain name system?
- 4 What are the ranges of each class of network addresses?
- 5 What do domain names differ from network addresses in?
- 6 What parts does the URL document on the Internet consists of?
- 7 What protocols are necessary to transmit electronic messages?
- 8 What ports do transfer protocols of electronic messages work at?
- 9 What is Javascript?

10 Lecture №10. Cloud and mobile technologies

Lecture purpose: to study the basis for the development of cloud solutions and technologies.

Lecture content: tendencies of development of modern infrastructure decisions. Principles of cloud computing. Technologies of virtualization. Web service in the Cloud. Main terms and concepts of mobile technologies. Mobile services. Standards of mobile technologies.

With each passing day, the user's requirements for the continuity of service delivery are increased. To ensure proper quality and smooth operation is almost impossible using the obsolete equipment. In this regard, the largest IT vendors produce and implement more functional and reliable hardware and software solutions. Among such basic trends in the development of infrastructure solutions are the appearance of multiprocessor and multi-core computing systems, the development of blade systems; the appearance of storage systems and networks; consolidation of infrastructure.

Nowadays there are Cloud Platforms among the most developing storage systems. A large number of options can determine the terms «cloud computing» or «cloud platform». This is because of various suppliers trying to emphasize the uniqueness of their proposals and choose different names, which often do not quite accurately reflect the real essence of offered services. Speaking about a cloud platform, they usually use the terms such as «infrastructure as a service» (IaaS), «platform as a service» (PaaS) or «applications as a service» (SaaS).

Cloud computing has many advantages in comparison with traditional solutions for creation of infrastructures of enterprises, as well as offer of services, etc. Among such advantages are:

- flexibility;
- scalability;
- payment for actually used resources;
- high reliability.

Virtualization is a technology, which provides abstraction of processes and their representation from computing resources. It is possible to select the following types of virtualization.

Server virtualization involves running several virtual servers on one physical server (VmWare (ESX, Server, Workstation) and Microsoft (Hyper-V, Virtual Serer, Virtual PC).

Virtualization of applications involves emulating the resources of the operating system (registry, files, etc.). This technology allows you to use several applications that are not compatible with each other on the same computer (more precisely, in the same operating system) (Microsoft Application Virtualization (AppV)).

Virtualization of views implies emulation of the user interface, i.e. the user sees the application and works with it on its terminal, although in fact the application is running on a remote server, and the user is only transferred a picture of the remote application.

Operating system level virtualization involves isolating services within a single instance of the operating system kernel. This is implemented on the basis of Parallels (SWsoft) Virtuozzo and is used more often by hosting companies.

«Web service» in systems with service-oriented architecture (SOA) is used as service programs that provide services through programming interfaces (SOAP and REST) to other web services or applications (client programs) that requested this service. As for the cloud computing models: IaaS, PaaS, SaaS, they are provided to users as services via user interfaces.

Cloud applications using SaaS model with open APIs (SOAP and REST) can be used as web services for systems with SOA architecture. As for network services or services on the Internet, for example, applications: VoIP, Telnet, messengers, etc., they are provided as services to users who have activated these applications and use them.

A web service is a special kind of application or program module with well-defined functionality that has its own URL (web address), a public program interface, and which provides its functionality to other modules or applications through messages.

SOA or service-oriented architecture is the concept of creating distributed applications based on the integration of remote and loosely coupled Web services.

SOA is seen as a collection of web services, which, as a rule, are separated by large distances and operate on different platforms. Web services are used as modules when creating distributed information systems or applications with a service-oriented architecture. Web services can interact with each other, or with applications built based on SOA, through messages. These messages are transmitted by standard protocols that are most widely distributed: SOAP and REST, and the format (markup language) of the data in the message body: XML and JSON.

As a transport for messages, HTTP protocol is used. Web services are based on open standards, and these standards are widely supported on all Unix and Windows platforms.

Cloud storage is an online storage model in which data is stored on numerous, distributed servers on the network, provided for use by customers, mostly by a third party. In contrast to the data storage model on its own dedicated servers, purchased or rented specifically for such purposes, the number or any internal structure of the servers to the client, in general, is not visible. Data is stored, as well as processed, in a so-called *cloud*, which is, from the client's point of view, one large virtual server.

10 free and paid cloud storage services are: Google Drive; Dropbox; Mega; Cloud@mail.ru; OAmazon Web Services; ADrive; Bitcasa; iCloud Drive; 4shared; SugarSync; Box.net; OneDrive (ex. SkyDrive); iDrive; OpenDrive; Syncplicity; MediaFire; Cubby.com.

Today, mobile devices have become a critical and strategic channel for sales, marketing, etc. However, when an enterprise manages its brand through a web application, it faces the problem of delivering a variety of information both from the server to mobile devices and from mobile devices to the server. The basic concept of the mobile hybrid application is the joint operation of the server-side web application and the client mobile (native application shell) application. The main advantage of their collaboration is the ability of the server to gain access to such capabilities of client mobile devices as a camera, an accelerometer, contacts, file system or geo-positioning.

Hybrid mobile applications belong to the class of RIA-applications (Rich Internet Applications). The main difference between the work of hybrid mobile applications and mobile websites is leaving client-server architecture, in which the browser was a thin client. In this case, a full-fledged mobile application is launched, for which the interaction with the server is only of an auxiliary nature. In fact, these are applications working across the network and provide Web server with resources of the mobile client, but having the functionality of full-fledged desktop applications. To exchange data between web applications and native code of mobile devices, there are software structures (frameworks) that act as a bridge and provide a common interface that allows access to resources of mobile devices. Examples of popular technologies for the development of mobile RIA are Microsoft Silverlight, Flash / Flex from Adobe, JavaFX from Sun and Apache Cordova (the old name is Phone Gap), which is based on HTML5.

In addition, many mobile services are created that help a person to use various services without leaving home. Among the most common one can identify Viber, mobile services on the government website, map application, and many others. Mobile services are available to both paid and free users; these services are launched by sending SMS-messages (for some mobile services, you must first activate your mobile phone number in the settings).

To date, there are many standards of mobile communications, through which you can implement any mobile services.

Table 10.1 – Standards of mobile communication

Generation	Standards
1G	NMT, AMPS, Hicap, CDPD, Mobitex, DataTAC, TACS, ETACS
2G	GSM, iDEN, D-AMPS, IS-95, PDC, WiDEN
2.75G	EDGE/EGPRS, CDMA2000
3G	UMTS(WCDMA), CDMA2000, FOMA, GAN/UMA
3.5G	UMTS(HSDPA), CDMA2000, HSUPA
3.75G	UMTS(HSPA+), EV-DO, Rev.B,
4G	WiMax, OFDM, 3GPP LTE

10.1 Control questions

- 1 What is the concept of cloud computing?
- 2 What cloud services are there?
- 3 What do you know about a cloud storage?
- 4 What are the principles of operation of cloud storage?
- 5 What is virtualization?
- 6 What web services are there and what are they built on?
- 7 What are the platforms for web applications?
- 8 What are the standards of mobile technologies?

11 Lecture №11. Multimedia technologies

Lecture purpose: to study means and methods of information representation in a digital format, as well as technologies to create Business-processes.

Lecture content: representation of textual, audio, video and graphic information in a digital format. Basic technologies for information compression. Animation and 3-D representations of the virtual world. Tools for developing multimedia applications. Use of multimedia technologies for planning, descriptions of business processes and their visualization.

When working with a digital video signal, it becomes necessary to process, transmit and store very large amounts of information. On modern media such as a CD-ROM (CD-ROM, 650 MB) or a hard disk (about a thousand megabytes), it is not possible to save a full-length video clip recorded in an element-by-element format. On the other hand, video information should be transmitted with the speed of its playback on the computer screen. For example, a full-color (24 bit / pixel) image of 720×576 pixels at a rate of 25 fps requires a video data transfer rate of 240 Mbit / s. However, the bandwidth of FDDI LAN channels is of the order of 100-200 Mbit / s, and Ethernet is only 10 Mbit / s. Therefore, the use of video data as a part of electronic products becomes impossible.

The development of technologies for converting video information into digital format and their further application in digital TV put the problem of

compressing video data into a range of the most important ones. Its positive solution was possible only because of developing effective methods and algorithms for compressing video data.

It should be noted that traditional lossless data compression algorithms are practically inapplicable here, since they give a very insignificant gain for real video information. For example, algorithms based on compression due to encoding by the length of the series and address-position coding (RLE, LZ, LZW, etc.) do not give the proper effect.

For frame-by-frame compression of video data, one can use compression algorithms for static graphics - lossy compression (JPEG). In this case, the restored image of a frame, as a rule, does not coincide with the original. However, the implementation of such algorithms is rather complicated and decoding processes require considerable time. Video information imposes specific limitations on the decoding speed of the data: the decoder (hardware / software device for decompressing data) must be able to decompress the image in 1/25 s, while the previous frame is displayed. This limitation does not make it possible to implement algorithms with a higher compression ratio.

Another limitation is the complexity of the hardware implementation of decoding devices. In real applications (digital video cameras, videophones, etc.), the optimal solution to the problem is the implementation of the algorithm on a custom-made set of microcircuits with a limited number of transistors in the chip. Therefore, the implementation of such high-speed decoding hardware-software devices is not always possible.

The real solution to the problem was the compression of the complete video sequence, including the sequence of video frames.

The standard method of digital coding by a computer is PCM (Pulse Code Modulation). The most popular format used to store uncompressed audio data is Microsoft PCM (WAV). For video clips, Microsoft Audio / Video Interleaved (AVI) is the standard for a computer. Compressing audio or video data as a process involves converting an uncompressed WAV or AVI file to another format using a compression algorithm (therefore, programs for compression / decompression of data are called converters). Any format (even WAV and AVI) can be used if it supports this algorithm.

An important role in solving the problem of video data compression was played by the results obtained by the MPEG Standards Committee Group (Motion Pictures Experts Group). This group proposed a technology for compact presentation of digital video and audio signals. The basic idea was to convert a stream of discrete digital data into a stream of some records that required less memory. This transformation is based on the use of statistical redundancy and features of human perception. The encoded independent audio and video streams are subsequently linked by a system stream that synchronizes and combines a plurality of different data streams into one code sequence.

The compression method developed by this group and the corresponding MPEG family formats inherited much in its structure from JPEG. However, the

opposite of MPEG graphics formats used encoding the differences of subsequent frames from some frame reference images. In 1990, the MPEG-1 format was created, which focused on the compression of video and audio information.

After the development of the first compression standard for video and audio information, the same group created a format and corresponding technology that is oriented towards application to higher resolution video data and streams, including the effective presentation of SDTV (Standard Definition Television). The effective presentation of interlaced (broadcast) video signal has proved to be more difficult than direct (non-interlaced) signals defined by MPEG-1. MPEG-2 introduced a decorrelation scheme for a multichannel discrete dimensional audio signal using a higher redundancy factor.

Later, the formats MPEG-3, MPEG-4, MPEG-7, MPEG-J were created.

Today, MPEG is a single format for the presentation of the United States Grand Alliance HDTV specification data, the European Digital Video Broadcasting group and the Digital Versatile Disc (DVD).

In the literature, MPEG can be subdivided into phases (MPEG-1, MPEG-2, MPEG-4, etc.), and in the field of audio information - layers. The phases are indicated by Arabic numerals, the levels are Roman ones. Some MPEG phases have not been completed. For example, the development of MPEG-3 for high-definition television (HDTV) with 1920×1080 frames at 30 fps and compressive strengths of 20-40 Mb / s has not been completed, as it turned out that this area is supported by the format MPEG-2. There is no information on the development of MPEG-6, which was intended for wireless data transmission; MPEG-8, the purpose of which is a four-dimensional description of objects.

Multimedia and hypermedia expert group MHEG (Multimedia Hypermedia Expert Group) has defined a standard for the exchange of multimedia objects (video, sound, text and other arbitrary data) between applications and their transmission in various ways (local network, telecommunications and broadcasting networks) using MHEG object classes. This standard allowed software objects to include any encoding system (for example, MPEG), which is defined in the base application. The Council adopted MHEG for Digital Video and Sound (DAVIC - Digital Audio-Visual Council). MHEG objects are created by multimedia applications.

MHEG is believed to be the future international standard for interactive TV, since it works on any platforms and its documentation is freely distributed.

Along with these standard formats, there is a finite number of video and audio information encoding formats proposed by firms producing various software applications. They include RealAudio format developed by RealNetworks for storing compressed voice audio data (speech); SoundVQ audio data format, developed by Yamaha. The format Windows Media Technology 4.0 presented by Microsoft supports streaming data to the Internet and has an advanced system for compressing audio and video data. Apple's QuickTime format was developed for the use in multimedia applications on Macintosh computers, and so on.

Three-dimensional models of real or abstract objects are created using specialized computer programs. 3D-modeling can be of the following types:

1) Create photorealistic images, projected onto a conventional computer monitor or screen. Individual programs allow you to print the created model on a 3D printer.

2) Creation of stereo images for viewing on a conventional computer monitor (screen) through special polarizing glasses or on a specialized 3D-monitor with stereoscopic effect.

3) Creation of computer holograms.

Multimedia finds its application in various fields, including advertising, art, education, entertainment industry, technology, medicine, mathematics, business, scientific research, space-time applications, and other information processes involving people: education, technology, industry, mathematical and scientific research, medicine.

11.1 Control questions

- 1 What is a concept of 3-D visualization?
- 2 What are the compression standards of speech?
- 3 What are the compression standards of video?
- 4 What are the compression standards of audio?
- 5 What is the field of application of Multimedia?
- 6 What are the types of three-dimensional simulation?
- 7 What is codec?
- 8 What are the program standards of interactive television?
- 9 What method of numeric coding on computer is standard?
- 10 How many phases does MPEG standard have?
- 11 What is animation?

12 Lecture №12. Smart-technologies

Lecture purpose: to study bases of use of Smart technologies for the development of society.

Lecture content: Internet of things. Big data. Block chain technology. Artificial intelligence. Use of Smart-services. Green technologies in ICT. Teleconferences. Telemedicine.

Internet of things (Internet of things, IoT) is a certain concept of the computer network of physical objects («things»), which are equipped with built-in technologies to interact with each other or external environment. «Smart houses», smartphones, tablets and almost any «things» can serve as an example of such a concept. These «things» are equipped with sensors: cars, industrial equipment, jet

engines, oil derricks, wearable devices and much more. All these «things» collect data and exchange them with each other.

This concept is associated with the development of two technologies: radio frequency identification (RFID) and wireless touch networks (WSN).

A *wireless sensor network* is a distributed, self-organizing network of a plurality of sensors (sensors) and actuators interconnected by a radio channel. In addition, the coverage area of such a network can be from several meters to several kilometers due to the ability to relay messages from one element to another. This technology is used to solve many practical problems related to monitoring, management, logistics, etc.

RFID (Radio Frequency Identification) – a method of automatic identification of objects in which by means of radio signals the data stored in so-called transponders, or RFID-marks are read or registered. This technology is well suited for tracking the movement of certain objects and obtaining a small amount of information from them.

Big data in information technology is a set of approaches, means and methods for processing structured and unstructured data of huge volumes and significant diversity. They are used to obtain human-readable results that are effective in the conditions of continuous growth, distribution over numerous nodes of the computer network formed at the end 2000s, alternative to traditional database management systems and solutions of Business Intelligence class. This series includes the means of massive parallel processing indefinitely structured data, primarily with NoSQL solutions, MapReduce algorithms, software frameworks and Hadoop project libraries.

Blockchain is a technology of distributed storage of information, which concerns any vital questions.

With respect to the crypto currency, Blockchain guarantees the recording of information about the money transfers made between the system participants during the whole period of the existence of the alternative monetary unit and the Bitcoin payment system. Also it allows you to store information about the rights to real estate, loans granted earlier, violation of traffic rules, marriage and so on .

According to the structure of Blockchain, there is a chain of blocks containing certain information. All the blocks of the chain are connected with each other. The block is filled with a group of records, and the newly emerging blocks are always added to the end of the chain and duplicate the information contained in the previously created structural units of the system, adding a new one to it.

The construction of Blockchain chain is based on three main principles: distribution, openness and protection. Users of the system form a computer network. In this case, each of the PCs stores a copy of each of the blocks. Information Blockchain (the blocks and information in them) is available to everyone. All data in the system is protected. The Chain of the Block is securely encrypted, which opens the way for obtaining reliable and open information. A special key is used for confirmation. It depends on it if the user will be identified by the system or not. This is Blockchain technology, and this is its main feature.

Artificial intelligence is one of the sections of informatics, within the framework of which the problems of hardware and software modeling are posed and solved. These problems concern those types of human activity that are traditionally considered intellectual (creative).

Modern intelligent information technologies are technologies of processing information and solving problems with the help of computers that rely on achievements in the field of artificial intelligence. In general, artificial intelligence systems are oriented towards the solution of a large and very important class of problems called informalized (difficult form of realizability). They include the problems that have one or more of the following features (properties): algorithmic solution of the problem is unknown (although it probably exists) or cannot be used because of limited computer resources. The task cannot be defined (specified) in a numerical form (a symbolic representation is required). The objectives of the solution of the problem cannot be expressed in terms of a precisely defined objective function. The dimensionality of the solution space is great. data and knowledge are changing dynamically. As a rule, difficultly formalized problems have incompleteness, ambiguity and / or inconsistency of the initial data and knowledge about the subject area.

In researches on artificial intelligence, it is possible to determine two main directions:

1) Software-pragmatic - is engaged in the creation of programs with the help of which it is possible to solve those problems, the solution of which was previously considered to be exclusively prerogative of a person. This includes recognizing and game programs, programs for solving logical problems, searching, classifying, etc. This direction is focused on finding algorithms for solving intellectual problems on existing computer models.

2) Bionic - deals with the problems of artificial reproduction of those structures and processes that are characteristic for the living human brain and which are at the base of solving human problems. Within the framework of the bionic approach to the problem of artificial intelligence, a new science of neuroinformatics was formed, the practical output of which was the development of a neurocomputer, sixth generation computers.

Use of Smart-services. The basic equipment of modern TVs offers the following set of functions:

- display of analog and digital (DVB-C) broadcasting;
- display video from external sources (TV set has analog inputs and HDMI ports v1.4), including in 3D format;
- convert any conventional video into 3D video;
- showing films and IPTV broadcasts (network broadcasts);
- playback of various media files - video (including MKV HD), music, photos - from a USB drive connected to the TV, or from a remote storage, over a network;
- internet surfing (built-in browser);

- almost instant access to various network services, such as Facebook, Twitter, YouTube, Picasa or Yota Play;
- Widgets;
- support for Skype video calls (if there is an optional web camera);
- download additional applications through the company's online store.

In addition, smart services are available on devices such as smart phones, laptops, PCs for viewing television content.

Green technologies in ICT, like in other areas, are aimed at achieving the main goal - reducing the negative impact on the environment.

According to the classification of the Organization for Economic Cooperation and Development (OECD), green technologies cover the following areas:

- general environmental management (waste management, water pollution, air pollution, land restoration, etc.);
- energy production from renewable sources.

The indicator of the impact of the ICT sector on the environment is one of the lowest in the structure of the world economy - about 2 percent of total carbon dioxide emissions. Among the main areas of development of green technologies, the key is energy. The main directions of its «greening» are to increase energy efficiency and develop new energy sources, primarily renewable ones.

Teleconference (forum) is an organized thematic exchange of messages between network users.

Messages are sent not to private addresses of users, but to the address of the teleconference, i.e. the recipient is a server that provides access to the received message to other network users.

Teleconferences can be classified according to several parameters:

- how to organize the exchange of information - conferences in a deferred mode (newsgroups, mailing lists) and conferences in real time (via IRC servers - Internet Relay Chat);
- by the method of teleconference management - moderated (managed) and non-moderated (without a leader);
- in terms of access to teleconference materials - open and closed (for registered participants).

Telemedicine is one of the directions of medicine, based on the use of modern communication technologies for remote provision of medical care and timely consultations.

Among the main telemedicine directions are the following: telemedicine consultations, tele-education, on-line translation of operations, remote bio monitoring and home telemedicine. All this is supported by means of telecommunication technologies.

There are many different standards for the transfer of all types of medical information: ASTM, ASC X12, IEEE / MEDIX, NCPDP, HL7, DICOM, etc. Therefore, the question of creating a single standard for the exchange of medical data is thrown into sharp relief. Each standardization group has some specialization:

ASC X12N deals with external standards for the exchange of electronic documents, ASTM E31.11 - standards for the exchange of laboratory tests, IEEE P1157 standards for the exchange of medical data («MEDIX»), ACR / NEMA DICOM standards associated with exchange of images, etc.

12.1 Control questions

- 1 What is a concept of smart services?
- 2 What are the standards of a telemedicine?
- 3 What is a teleconference?
- 4 What is the role of green technologies in ICT?
- 5 What is artificial intelligence?
- 6 What is the principle of the Internet of things?
- 7 Technologies of realization of Internet and things?
- 8 What is Blockchain?
- 9 What is big data?

13 Lecture №13. E-technologies. Electronic business. Electronic learning. Electronic government

Lecture purpose: to study main tendencies of creation of electronic technologies.

Lecture content: electronic business. Main models of electronic business. Information infrastructure of electronic business. Legal regulation in electronic business. Electronic learning: architecture, structure and platforms. Electronic textbooks. Electronic government: concept, architecture, services. Formats of realization of electronic government in the developed countries.

13.1 Electronic business

The appearance and development of the Internet, the improvement of information technologies, systems and standards of their interaction led to the creation of a new line of modern business - e-business as a special form of business, which is realized to a wide extent, through the introduction of information technologies into the production, sale and distribution of goods and services.

Electronic business (e-business) is the implementation of business processes using the capabilities of information and telecommunication technologies, systems and networks.

The most important component of e-business is e-commerce. E-commerce refers to any form of transaction in which the parties interact with the use of information and telecommunications technology capabilities of systems and networks.

E-commerce is a means of doing business on a global scale. There are five directions of e-commerce:

- business - business (business-to-business, B2B);
- business - consumer (business-to-customer, B2C);
- consumer - consumer (customer-to-customer, C2C);
- business - administration (business-to-administration, B2A);
- customer - administration (customer-to-administration, C2A);

Infrastructure is the base that ensures the operation of any electronic business. The concept of «infrastructure» covers all the basic elements that ensure the operation of IT system: servers, applications, middleware, routers, storage devices, etc.

The use of Intranet technologies to ensure the access to any information resources implies the existence of the following components:

- IP networks with support of a basic set of services in data transfer with a uniform policy of addressing, routing and supported service of symbolic names (DNS);
- standard protocol of interaction between the information server and universal client to provide an access to the information content of the server (HTTP protocol);
- information server {Web server) providing storage of hypertext documents and access to them according to the standard protocol through IP network;
- universal client (browser) – the user program providing viewing of hypertext documents on the available hardware-software platform.

The rights to regulate e-commerce in Kazakhstan operate in accordance with the Law of the Republic of Kazakhstan dated April 12, 2004 «On the Regulation of Trade Activities», which is supplemented in the form of the Rules for the Implementation of Electronic Commerce in the Republic of Kazakhstan «On approval of the rules of electronic commerce» of November 25, 2015, No. 720. The order introduced the concepts of electronic commerce, e-commerce participants (seller, buyer and intermediary), as well as regulates the procedure for electronic commerce.

In addition, the concepts of electronic business are based on the laws «On Electronic Document and Electronic Digital Signature», «On Informatization», «On Technical Regulation», «On Licensing», «On Mass Media», and «On Communications».

13.2 E-learning

In recent years the term «e-Learning» has been widely used in the West, meaning the process of learning in electronic form via the Internet. Schematically stages of the development of training using computer technology can be represented as follows:

- CD-ROM-based courses;

- distance learning;
- e-Learning.

The system of electronic education is a software and hardware complex that is distributed between servers and client computers. Data exchange in the educational subnet is carried out, via Internet channels and local network communications. The management of this multi-level hierarchical system is performed using special software platforms, which in English-language publications are called virtual learning environment (VLE) or learning management systems (LMS). In Russian publications, such platforms are usually called distance-learning systems (DLS).

Let us enumerate some platforms used today: LON-CAPA, Moodle 2.4, Sakai 2.3, TeleTOP, WebTutor.

Main opportunities of DLS are:

- 1) Creation and loading of training and auxiliary materials.
- 2) Creation and implementation of online tests.
- 3) Output and verification of assignments.
- 4) Operating control of progress.
- 5) Forums, chats, video conferences, etc.

One of the sources of knowledge in the DLS is an electronic textbook - this is an electronic educational publication. It contains a systematic presentation of an academic discipline, its sections, parts, corresponding to the curriculum, supporting main links in a didactic cycle of the learning process, which is an important component of the individual active educational environment and officially approved as the type of publication.

The functional structure of an electronic textbook has to correspond to its purpose in educational process and contain the following components:

- main material;
- additional material;
- explanatory texts;
- apparatus of organization of mastering educational material;
- navigation apparatus.

Decisions for creation of an electronic textbook can be divided into the development of electronic textbook on the base of web technologies and that of native application.

To develop elements of the user interface of an electronic textbook, you can use ready-made JavaScript libraries with open source code, HTML5 and CSS3, based on the iPhoneGap framework, and compiled as installation packages for Android and iOS in the development environments of Eclipse with Android SDK and Xcode respectively. A possible technological solution in the development of the electronic textbook is the use of AdobeAIR platform. When developing the electronic textbook for the iPad (AppleiOS 4.x and higher), it is recommended to use the software shell - Objective-C using ARC and Storyboard technologies (allows to reduce the amount of code associated with transitions between screens).

13.3 Electronic government

The electronic government is a change of internal and external relations of public authorities on the basis of the use of opportunities of information and communication technologies (further - ICT) for the purpose of automation and optimization of provided state services, increase in an involvement of society into public administration and improvement of internal business processes. The architecture of the «electronic government» is one of key mechanisms of the strategic leadership in the state informatization.

Main objectives of formation of the electronic government are:

- providing state services using ICT;
- increase in extent of citizens participation in the process of public administration;
- increase of internal efficiency of state activity.

There are three main models of formation of «electronic government» in the experience of various regions and countries in the world: in America, Europe and Asia.

The main purpose of the American model of «e-government» is simplification, accessibility and low costs in the interaction of citizens and legal entities with state bodies.

The European model is characterized by such supranational institutions as the European Parliament, the European Commission, the European Court, whose recommendations are mandatory in the development and regulations of activities of «e-government» for all countries of the European Union.

The Asian model is based on the Asian type of corporate culture and a multi-layered system of public administration, organized on the principle of a hierarchical pyramid. So, the government of South Korea in the formation of «e-government» focused on the needs satisfaction of the population and introduction of ICT primarily in the field of culture and education.

13.4 Control questions

- 1 What are E-technologies?
- 2 Purposes of electronic learning?
- 3 What is the ICT role in DLS?
- 4 What is the electronic textbook?
- 5 What is the concept of the electronic government?
- 6 Technologies of realization of SDO?
- 7 International experience of creation of the electronic government?
- 8 What is e-business?
- 9 What is e-commerce?

14 Lecture №14. Information technologies in the professional sphere. Industrial ICT

Lecture purpose: to study perspectives of ICT development in professional activity.

Lecture content: software to solve problems in specialized professional sphere. Modern IT trends in the professional sphere: medicine, power engineering, etc. Use of search systems and electronic resources in professional purposes. Safety issues in industrial information and communication technologies.

A package of information technologies as the most developed of modern technology packages pretends to control function in all spheres of development. ICT in many ways form, define and change the world around us. Information technologies in one way or another will be significant for all components of world technological development, and the global information infrastructure created on their basis will be present in any development option.

The following components are necessary to create an intellectual society based on information and knowledge:

Systems of communications «at any time, from any place:

- intelligent sensor telecommunication networks;
- internet of things;
- high speed multimedia;

Cognitive technologies of robotizing:

- coexistence of people and robots;
- robotizing;
- manipulative technologies;
- robots in entertainment system;
- cyborgization, exoskeletons, built-in medical sensors;

New sensor and cognitive technologies of the computer and person interface:

- technologies of reading emotions;
- new generation of displays;
- machine translation into all languages;
- technologies of monitoring poses and movements;
- technology of monitoring movement;
- development of chip technology of mood recognition;
- technology of the next generation of computers with android interface.

The virtual world:

- experimental training systems based on virtual reality;
- virtual avatars;
- virtual systems of life;
- automated system of personality identification;
- network economy and life in network.

Smart-city, smart production, smart transport:

- supercomputers, including quantum ones;
- digital factories;
- global robotic distributed system of production; production, with the use of 3D printing;
- transition to cloud computing of a new generation;
- cloud mobile enterprises.

In addition to information and communication technologies, world technological development will be defined by the development of following technological packets connected to ICT:

- technologies of creation of new materials, including nanotech industry;
- biotechnologies (including technologies of nature management).

Today the main megatrends with ICT involvement are:

- internet of things;
- new digital era of production, introduction of hi-tech equipment into the sphere of production (robotizing, sensors, 3D-printers);
- orientation of production to personal requests of customers;
- universal access to information and knowledge;
- network communities and network structures developing with the growth of urbanization;
- industrial automation;
- convergence of sciences and technologies.

14.1 Use of search engines and electronic resources in the professional purposes

All search systems are united by the fact that they are located on special powerful servers and connected to effective communication channels. The number of simultaneously served visitors of the most popular systems reaches many thousands. Powerful search systems of universal type are designed to work in all major languages of the world. Each country tries to create at least one own search system. Let us get acquainted with main domestic and foreign search systems.

Yandex is the single Russian search system indexing documents in PDF, DOC, RTF, SWF, PPT and XLS formats. Updating the basis is carried out weekly.

Rambler (<http://www.rambler.ru>) is open in 1996. Now the volume of an index makes about 150 million documents. For compilation of advanced queries, it is recommended to use the Detail Request mode, which gives many opportunities for compilation of the retrieval instruction by means of menu items.

APORT (<http://www.aport.ru>). Today the volume of its base makes more than 20 million documents. The system possesses a wide range of search opportunities, a function of built-in translator. It gives to the user the chance to state requests, both in Russian and in English. Besides, APORT has special modes for search of illustrations and audio files.

The search system of Mail.ru started working in 2007. The volume of the index file in the spring of 2009 was more than 1.5 billion pages located on Russian-language servers. In addition to searching for texts, the system searches for illustrations and video clips placed on specialized «self-filling» Russian servers: Photo@Mail.Ru, Flamber.Ru, 35Photo.ru, PhotoForum.ru, Video@Mail.Ru, RuTube, Loadup, Rambler Vision and the like. Gogo.ru allows you to limit the search area to commercial sites, information sites, as well as forums and blogs. The «Advanced Search» form also allows you to limit the search to certain types of files (PDF, DOC, XLS, PPT), the location of the search terms in the document or defined domain.

The most popular foreign search systems are Google, Alta Vista, Scirus.

Google (<http://www.google.com>). The volume of its base makes more than 560 million documents. The distinctive feature of the INFORMATION RETRIEVAL SYSTEM of Google is the technology of definition of degree of relevance of a document by the analysis of references of other sources to this resource. The more links to a page are on other pages, the higher its rating in the INFORMATION RETRIEVAL SYSTEM of Google.

AltaVista (<http://www.altavista.com>) - more than 350 million. AltaVista allows simple and advanced searches. «Help» allows even unprepared users to correctly compose simple and complex queries.

Information resources are all the totality of information received and accumulated in the development of science and people's practical activities, for their multi-purpose use in social production and management. Information resources reflect natural processes and phenomena recorded during scientific research and development or other types of purposeful activity in various kinds of documents (reports on research, patents, data sets, etc.), concepts and judgments, and others.

At present, information resources are a complex and diverse object, characterized by a multitude of parameters, the most significant of which are

- contents (themes) of information;
- form of ownership on information: public property, state ownership, property of public organizations, property of the legal entity (private);
- property of a private individual (personal);
- accessibility of information: opened, closed, secret, confidential, trade secret, official secret, professional secret;
- data representation form: text documents – primary, secondary, reviews; structured data – databases, databanks; representation language.

In the system of interrelations of ICT and national security, a special place is occupied by the problem of information security, generated largely by the processes of rapid development of ICT and the formation of the information society. Information security, being an independent component of national security, takes a special position in relation to its other areas in the information society. This provision is determined by the fact that information, information resources and ICT become a system-forming factor in all real spheres of society in the information society and largely determine and influence the state of economic, defense, social

and other components of national security. Therefore, it can be argued that information security can be considered as an important component of national security, «piercing» all other components.

14.2 Control questions

- 1 What are the main directions of ICT development?
- 2 What are electronic resources?
- 3 What is ICT role in safety of information?
- 4 What are the main search systems?
- 5 What role do the search systems play in search of professional information?
- 6 What is the concept of creation of information society?
- 7 What are the world tendencies of ICT development?
- 8 What are the trends in ICT?
- 9 What are the trends in economy?

15 Lecture №15. Perspectives of ICT development

Lecture purpose: to study the development perspectives in the sphere of IT market.

Lecture content: development of free software. Formation of an ecosystem of IT business and support of small startup companies. Programs of acceleration and incubation. Development of necessary infrastructure of electronic payments and logistics.

With the growth and development of ICT industry, the phenomenon of mass software has developed significantly. Along with this, the software has become both free and commercial.

Free software is a model in which a basic set of property rights is transferred («licensed») to the owner of each copy. Thus, the creation and introduction into the economic and civil circulation, both additional copies of the software, and copies of modified software, or a composite one including original, are possible without obtaining the additional consent of the author (or other right holder), mandatory cash deductions or others.

Free software forms a public market (marketplace). Any service at the market (copying, reproduction, modification (correction of an error, addition of functionality, etc.) can be sold and bought in a competitive market by a free contract of the two parties - the supplier and the purchaser of the service, without appeals to a third party (the author or other rights holder of the software).

Technologically, the possibility of providing such services is provided by availability of the source code of programs (for many programs different from the executable one). Legally, software freedom is ensured by the transfer of an author's

contract («free license») with each copy of the program, which takes effect when concluding actions (such an act may be the introduction of additional copies into circulation).

Free software is widely used in professional use. First, it is tools (programs used in the software process itself, including writing, debugging, modifying programs). Then server programs, and especially as a special case of the latter, network (Internet) services in which free operating systems (such as GNU / Linux and FreeBSD) and application programs (such as the Apache Web server or the Postfix mail program) are now leading by a wide margin.

Non-free programs are widely distributed in the home and office use segments (for example, more than 90% of personal computers today work completely (MS-DOS, Microsoft Windows, Microsoft Windows NT, MacOS 9) or partially (as MacOS X) non-free OS; the proportion of non-free software applications for PCs is close to this figure).

The state policy of IT market development in Kazakhstan 2020 is aimed at forming a competitive domestic IT industry by forming an ecosystem of IT entrepreneurship and supporting small start-up companies through contests, accelerations and incubation programs. The main task of creating an IT cluster ecosystem is to provide in-kind support to existing and potential participants of the IT cluster at all stages of their life or project cycle.

This task includes both the creation of information and communication platform for all IT cluster enterprises, the deployment of an expert community, and debugging mechanisms for interaction of cluster enterprises with investors - investment companies, banks, venture funds, business angels, etc.

In the Concept of an IT cluster within the framework of creating a cluster ecosystem, it is proposed to form the service and technological infrastructure for the development of IT direction of innovation companies, taking into account their technological, organizational and logistical features. For example, service companies that are not accredited as residents of an IT cluster (non-residents) will offer various business services. In the development of IT cluster, the process of acceleration plays an important role - it is a time-limited process of accelerating the development of start-up. Startup is usually an early stage, because it is at an early stage that acceleration can have the greatest result and show the highest development speed, and also because it is much easier to accelerate from 0 to 1 than from 1 to 2.

An accelerator is a venture organization (working with high risks), investing in the company early stage of resources in exchange for shares of this company. Resources are money, experts, communications, infrastructure, and the shares range from 3 to 15%, depending on the accelerator's work format.

Another process is incubation, which differs from acceleration in that it provides infrastructure, rather than expert support to start-up. For example, a workplace, participation in events or legal support. In addition, incubation is a much longer process, allowing people to ripen first, rather than specific projects.

The process of incubation does not work without acceleration; more precisely, it works within the framework of creating an entrepreneurial ecosystem, but does not solve the problem of creating successful companies. For successful results, the incubator must cooperate with the accelerator.

The creation of the necessary infrastructure for the development of payments and logistics plays an important role in the strategy of the state program «Innovative Kazakhstan-2020».

The logistics infrastructure of a commodity market is a set of all types of retail and wholesale enterprises and organizations (trade structures) that are part of this industry of their activities designed to create conditions for normal functioning of commodity producers and the sphere of circulation of goods, as well as for trade services for all groups of population. The subjects of logistics infrastructure of the commodity market perform such important functions as packaging, storage of goods in warehouses, in refrigerators, determination of optimal volumes of supplies, transportation and delivery of products and information support for the promotion of goods from producers to consumers.

In many respects, the level of development of the logistics infrastructure of commodity markets in Kazakhstan in general and in regions does not correspond to the conditions of free movement of goods. During the implementation of reforms the process of commodity circulation and the communications existing between economic partners were disrupted, costs, prices and volumes of inefficient transportation increased, wholesale trade was disrupted as well.

The development of modern logistics trade infrastructure is hampered by many reasons of objective and subjective nature (lack of financial resources, unacceptable credit system, lack of co-operation in trade and transport organizations, shortage of warehouse space, lack of clear strategies in regions to form a structure of retail and wholesale trade, etc.).

In 2016, through the e-government infrastructure, Kazakhstan citizens were provided with nearly 40 million public services. At the same time, the total number of services rendered exceeded 160 million in all the years. In addition, the electronic payment infrastructure is associated with the following payment providers:

Bank Internet Payment System (BIPS) - protocol developed by financial services technological consortium (FSTC) for implementation of interbank Internet payments.

BidPay - system of micropayments of P2P class. Transaction is carried out by the reception of payment with use of credit card and transfer of funds to the beneficiary's account.

BillPoint - system of micropayments of P2P class. Transaction is carried out by the reception of payment with use of credit card and transfer of funds to the beneficiary's account.

Checkfree-payment service provider and solution of billing level.

Credit Card Network - payment service provider with authorization of credit cards based on SSL certificate.

eCash - anonymous system of Internet payments on the basis of digital cash developed by David Chaum.

E-coin - payment service provider based on the use of counters executing a smart card role.

eMoneyMail - system of micropayments of P2P class developed by BankOne.

Java Electronic Commerce Framework - payment decision from Sun Corporation. It supports SET protocol, smart cards, micropayments, electronic checks and «jetton» diagrams.

Mondex - payment service provider based on the use of smart cards.

Mon-e - payment service provider based on the use of prepaid cards.

MovilPago - payment service provider for the market of a Spain mobile commerce running in GSM standard.

NetChex - processing center of debit cards.

Netfare - payment service provider based on the use of prepaid cards.

NewGenPay - system of micropayments on payment of the viewed content, developed by IBM.

Proton - payment service provider based on the use of digital cash.

TeleCheck - system that allows realizing electronic transactions between check accounts.

Tipster - service of payment of a multimedia content.

TransPoint - payment service provider of EBPP class. Now it is merged by CheckFree.

WebCharge – system that allows realizing electronic transactions with the use of SSL certificate for request protection.

WorldPay - system of micropayments of P2P class with the support of credit and debit cards and multicurrency.

Yahoo! PayDirect - system of micropayments of P2P class.

15.1 Control questions

- 1 What is free software?
- 2 What demands is the free software made on?
- 3 What is state policy of IT market development directed to?
- 4 What are the systems of electronic payments used in RK?
- 5 What is acceleration?
- 6 What is incubation?
- 7 What is a startup project?
- 8 How is free software connected to the development of professional activity?
- 9 What processes influence the development of IT market?

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