# **Computer Architecture**

The term “computer” is used to describe a device which can get data in one form, proccess it and give the processing result in other specified form.

A computer system is a combination of five elements: hardware, software, people, procedures and data or information.

The electronic, magnetic, electrical and mechanical parts that make up a computer system are called hardware.

Software is a set of instructions that tell the hardware how to perform a task.

People who creates the computer software instructions combined into procedures and respond to those instructions execution result.

Hard- and software process information or data, the last component of computer system, which is numbers, text, images, documents and also software itself or its code.

Computer architecture is now understood as hardware structural organization and the relationship between its components. So lets talk more about hardware.

And so, the main component or “brain” of computer is central processing unit or CPU which functions are instruction executing and coordination of all other devices.

The instructions are held by main memory which are divided into RAM (random access memory) and ROM (read only memory).

Others computer devices is called the peripherals and is connected to computer in order to expand its abilities.

The basic peripherals are I/O devices because computer without the ability to change input data and give the result in people understandable form became either disposable or useless at all.

Next in the line of priorities storage devices can be placed. Unlike RAM this devices is used to permanently store documents, programs and much more.

Also different cards to work with specific systems should be mentioned, for example, video cards is used to work with graphics, sound cards — to play audio and network cards — to network connect.

Peripherals is connected with main computer components and with each other through special devices for data and signals transmission called buses.

Thus, we have listed a large set of computer components. This indicated the complexity of computer architecture allowing us to select components for specific tasks.

**My Specialty**

At the moment I am studying to become a programmer at BMSTU.

This university is one of the best in the country for training specialists in technical specialties.

Every year BMSTU graduates about 2.5 thousand highly qualified and in-demand specialists.

The faculty that prepares specialists in information technology is the Faculty of Informatics and Control Systems.

This faculty is the most popular choice of applicants.

This contributes to high competition for admission and high passing scores.

High competition is ensured by the relevance of the educational programs of the faculty.

Courses on automatic control systems, computer systems and networks, also programming, information security and much more are taught here.

There are 11 departments in this faculty. One of them is the department of "Computer Software and Information Technology", where I study.

After studying in this department I will receive a degree in software engineering.

This profession implies knowledge of many disciplines in mathematics, physics and computer science.

So the knowledge of mathematical analysis, linear algebra, probability theory, mathematical statistics and general physics allows to write programs in different areas: from banking services and websites to computer graphics and aircraft control programs.

The study of different computer sciences, such as operating systems, databases, types and data structures, analysis of algorithms, computer networks, etc., gives the programmer the knowledge of different approaches to writing programs and the ability to choose the best approach to the problem.

Technical disciplines are not all that a highly skilled programmer should know.

Softskills are also important for my specialty, because programmers are mostly tasked by people who have a poor idea about the work and features of the computer, which requires from a programmer patience, skills of business dialogue and the ability to take a stand.

Also due to the rapid development of information technology a programmer must constantly learn something new and develop in different areas, in which books, online courses, communication with colleagues, etc. can help.

All this: the combination of technical knowledge and the ability to communicate with people, the possibility of applying your knowledge in different fields, the constant growth and movement forward, that's what attracts me to the software engineering profession.

**Operating Systems**

Operating system is a basic set of computer software which provides an interface between user and hardware.

OS includes common system services, services to interact with device drivers, libraries and Application Program Interfaces (API) used by developers.

Operating systems are there from the very first computer generation and they keep evolving with time.

Batch operating systems were one of the first. Only operator collecting all users programs and grouping them by the same need to simultaneously execute interacted with computer with batch OS.

The main disadvantage of these systems is slowly and not interactive communication between user and computer.

So, time-sharing operating systems have been created. In these systems several programs of one or more users can run simultaneously with minimal response time.

It is clear that progress has not stopped there, distributed (located on several computers or processors connected to each other), network (provided access for many users to one network devices) and real-time systems began to develop.

So, every OS is mediator between user programs and hardware.

It is important to understand that OS works with programs in execution or processes.

OS holds info about process in special data structure called Process Control Block, control process allocating memory and guiding it through the life cycle.

All of this is operating system functions, the main of which is resource allocation.

One of the important resource is processor time. It is the OS that decides which process when and how long will take up the processor .

In terms of scarcity on a par with the CPU time is the RAM, the allocation of which is also monitored by the operating system.

Programs can also interact with files and devices accessed by the operating system through the file system and drivers.

The OS functions also include security, error detection, performance control, etc.

So the operating system is the most important part of the computer system and is present in all computing devices, even those that you do not know about, such as phones or game consoles.

**Networks**

A computer network is a set of computers that are connected together so that they can share information.

The CNs began to develop in the 1960s and have since undergone many changes and are still developing today.

Computer networks are used to carry out a large number of tasks through the sharing of information (e.g., exchanging email, sharing devices, files, or programs)

Different types of networks are used depending on the purpose of the network.

A network connecting computers within a limited area is Local Area Networks, used in schools, offices and homes.

Subtypes of LANs are PAN (personal workspace network with a human device as the central node and other devices connected to it), HAN (home environment network connecting PCs, TV, printers, etc.) and CAN (organization network accessible from its buildings, for example our university network)

WAN (wide), on the other hand, is a network that covers a large geographical area, such as a city (MAN (metropolitan) network of a number of local city connections), highways (BNN, Backbone) or the whole world (GAN, global).

In this case, small networks often use a peer-to-peer design where there is no main central node, and large networks use client-server design, where there is main computer through which all the other communicate.

Different kinds of computer network connections can be used: by the way the network is connected, it can be wired or wireless, by the form of connection it can be star topology (the central node is connected to each network member), bus topology (each computer is connected to one cable) and ring topology (the network member is connected to two neighbors, information is transferred from computer to computer until it reaches the destination).

Also, computers can be networked with different protocols — special languages for communication between computer devices.

To conclude networks have become widespread in the modern world, so the development in this area will continue.

**Data Bases**

Database is any collection of data, or information, that is specially organized for rapid search and retrieval by a computer.

Databases are structured to facilitate the storage, retrieval, modification, deletion of data and various data-processing operations.

A database is stored as a file or a set of files.

In this case, the format of the content of files, the logical and physical organization of the storage of these files depends on the type of database.

There are quite a few types of databases, but each of them can be attributed to one of the three basic types.

Pre-relational databases are built on relatively simple data structures: lists in alphabetical or other order, hierarchical structures, references, etc.

These databases are the beginning of the development of modern databases but are not adapted to the current huge volumes of data.

So, relational databases based on the mathematical theorems of relational algrebra and relational calculations were created.

In these databases, any entity or relationship is represented as a relationship or table, which are linked together using keys: primary (identifiers of rows in any table) and external (links from other tables to primary keys)

Relational databases are adapted to work with big data, but with a large number of entities and relationships can slow down the work with the data, so non-relational databases, which are adapted to work quickly with unstructured or complex-structured data.

A special program that adds, deletes, edits, and searches data in the database is called a DBMS.

To start the DBMS queries, that is short texts in a specialized programming language describing in a form understandable to the DBMS what needs to be done, are used.

However, even writing queries requires special knowledge, so the user is provided with an interface that abstracts him from what is happening "inside”.

Thanks to this database is used in many public and private companies, and can also be used for personal data, such as the home library, for example

At the same time to create a DBMS, its maintenance, database security and programming the connection between the interface and the DBMS requires deep knowledge in the structure of the database and algorithms and data structures, so many companies are looking for qualified specialists in this area and pay high prices for their work.

**Programming Languages**

Computers can solve different problems if they are given the right instructions for what to do.

Instructions are first written in one of the programming languages.

A programming language is a machine-readable artificial language designed to express computations that can be performed by a computer.

There are many languages because they are designed for specific tasks.

A universal language for all possible tasks has not yet been developed but there is universal mechanism of program execution.

A program written in high-level language is called a source program, and it cannot be directly processed by the computer until it has been compiled, which means interpreted into machine code.

There are several ways to translate high-level code into machine code.

According to these methods, high-level languages are divided into several types:

Compiled languages is the most conventional kind of language.

They get translated into executable files of binary machine code by a special program called a compiler and can be run without looking at the source code again.

Compiled languages are difficult to program but give excellent performance.

An interpreted language depends on an interpreter program that reads the source code and translates it on the fly into machine code each time the code is executed.

Interpreted languages are slower than compiled but easier to program.

The last type is p-code languages encapsulated the advantages and disadvantages of compiled and interpreted languages.

They are called p-code languages because program source code is not translated into machine code but into pseudo code which is already interpreted.

The program converted into machine code is called an object program. A set of object programs can be linked into one executable file which is executed by system.

Object and exe files are the sets of ones and zeros which can be called the lowest level of programming languages.

But there are low-level languages whose instructions are close to the real work of the processor.

So, there are many programming languages which can be used for different, specific tasks