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MODERN CONDITION AND DEVELOPMENT PERSPECTIVES OF CLOUD COMPUTING TECHNOLOGY

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In modern time, computing power of personal computers is not sufficient for solution of complex issues requiring large computing and memory resources arising in different fields of science such as physical-chemical processes, nuclear reactions, global atmospheric processes, modeling of economical development in real time patch, cryptography, geology, creation of new drug types etc. Supercomputers with a high computing productivity and a large volume of memory are widely used in solution of abovementioned issues [1]. Expensive price of supercomputers considered as strategic products, prevents purchasing these computers and using them in scientific-technical research works.

Considering above mentioned, development of cheaper distributed computing systems based on computer networks that perform functions of supercomputers, are widely applied in the world.
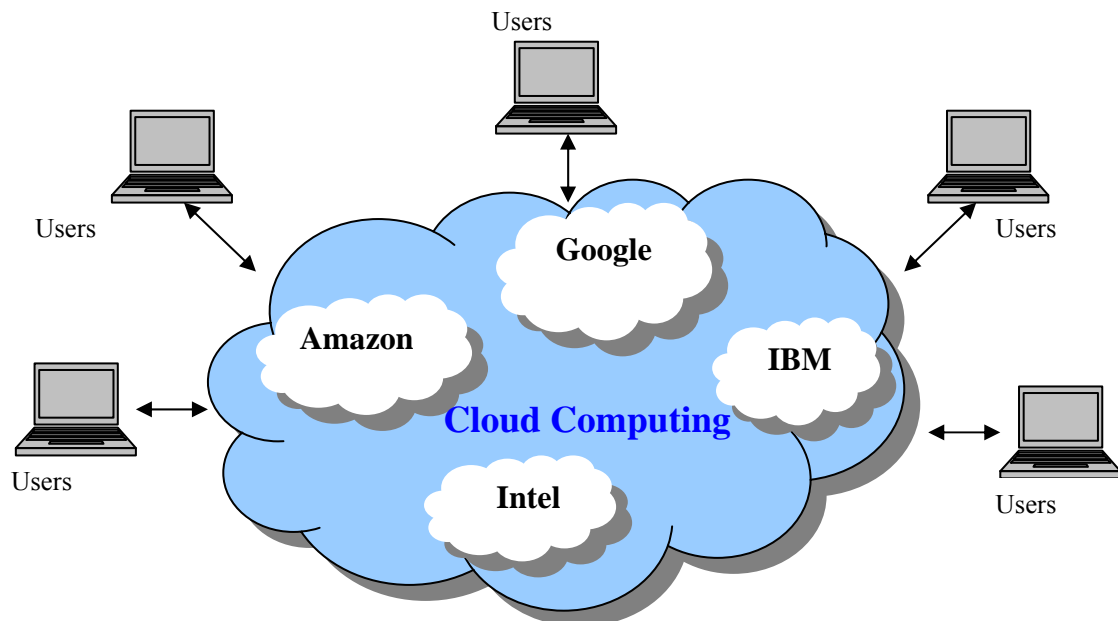
Several technologies were used for creation of distributed computing system for solution of complex issues based on computer networks; Utility Computing, Distributed Computing, Cluster Computing, Grid Computing [2].

- Utility Computing – is based on the principal of distribution of a single computer's resources (multi-terminal processing systems) among users.
- Distributed Computing – means conduction of subparts of the program in two or more computers. In this case, inter-computer relation is carried out through a network.
- Cluster Computing – is a computing system created through integration of multiple computer joints (microprocessor, computer etc) used for solution of a complex issue requiring large computing and memory resources, and located within the same organization.
- Grid Computing – is a distributed computing system created through integration of multiple computing joints (server, computer etc) used for solution of a complex issue with the assistance of communication technologies and located in different organizations.

Currently, intensive research works are being performed about distributed computing systems created based on Cloud Computing technologies which are cheaper than systems created via abovementioned technologies. Such systems with large computing and memory resources are created based on computer network with high-speed connection channel. Using the services of Cloud Computing system by users of different organizations and institutions through high speed connection channels, is economically advantageous. Thus, Cloud Computing – is a computing system serving for processing and memorization of user data by clustering and virtualization of computing and memory resources of multiple computers (server, computer etc) located in large organization with the assistance of communication technologies [3].

Cloud Computing technology allows to scale the computer resources (for example: Processor and disk memory space) and allow users to use these resources. In this case, information processing and storage process is considered as a type of service. Cloud Computing technology allows users to obtain strong computing and memory resources and at the same time, location and repair of these resources is out of users' interest.

Conducted researches show that, is institutions use cloud computing, there will be no necessity for purchase and installation of expensive server computers, memory systems and software inside the institutions. According to the opinions of experts, expenses spent on software and hardware supply, as well as electricity by large companies using this technology, will reduce by three times. Cloud Computing system blog scheme is shown below (picture 1).

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Picture 1. Block scheme of Cloud Computing system

Cloud Computing system providers its users with three types of services: IaaS, PaaS and SaaS [4,5]. First level service IaaS (Infrastructure as service) performs the process of infrastructure development. Briefly, on this level computer infrastructure (computing and memory resources) is developed for solution of issues. Amazon S3 (Simple Storage Service), Amazon Elastic Computer Cloud (EC2), İBM Blue Cloud etc can be listed as examples to existing IaaS service. In order to use these services, user installs the relevant web-browser on his computer and applies to computing clouds in order to obtain resources necessary for solution of issues.

Second type of service of titled as PaaS (Platform as a service). PaaS service allows users to use operation systems and specialized program additions (Apache, My SQL,etc.) located on virtual servers (consisting of physical servers). IBM IT Factory, Google App Engine, Force.com services can be listed as examples to PaaS service.

Finally, the last system is titled as software as a service (SaaS). Google Apps, Google Docs, Microsoft "Software Services" (e-mail, video conference), Salesforce.com (Customer relationship management system – CRM, Enterprise resource planning – ERP) etc be listed as examples for service programs used on this level. It is possible to directly compile and edit network files and tables with the help of web-browser in Google Docs service. Program additions work on the server of provider providing SaaS service and show the result of calculations to the user. Thus, the user doesn't receive any software and uses it when necessary and pays in accordance with usage (rent).

We can note three factors attracting the users of Cloud Computing technology [6]:
• very large capabilities of computing resources, i.e. users are free of pre-ordering and
  forecasting necessary resources;
• no significant expenses on initial stages of the projects;
• payment for actual service (pay-as-you-go).

Use of Cloud Computing technology is recommended to companies solving complex issues simultaneously. Cloud Computing technology can determine and form computing and memory resources necessary for solution of complex issues in a short period of time. Conducted

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researches demonstrate that computing systems created based on , computing clouds technology have following advantages:
• reduces requirements for computing and memory resources of personal computers connecting to internet;
• users are provided are unlimited computing and memory resources;
• payment for actual use of computing and memory resources;
• high speed data processing;
• reducing of expenses for hardware and software, service and electric power;
• provision of physical security of information storage;
• continuous refreshment of used programs.

In spite of abovementioned advantages, there are several problems in cloud computing that haven't found their solutions yet. Following can be listed as examples to the problems:
• dependence of storage of user data from companies providing Cloud Computing service;
• development of new clouds;
• issues related to reliability and security of connection channels;
• no methods and standards were developed for guaranteeing high-quality service in this field;
• user computer must be continuously connected to Internet network;
• if user information is lost in a computing cloud, its recovery is impossible;
• execution time of some programs may take longer than the execution of those programs on local computers.

Conducted researches show that, giant companies (Inter, IBM, Google etc) 60-70% of computing and memory resources of computers are used efficiently. But Cloud Computing technology allows using computing resources of computers of the companies' more efficiently.

Google, Amazon, IBM, Microsoft, SAP and Oracle companies can be listed as examples to companies serving in Cloud Computing network.

By creating Amazon Web Services (AWB) platform in 2006 y., Amazon company has offered services such as Amazon Simple Storage Service (S3) – data storage on servers and Amazon Elastic Compute Cloud (EC2) – usage of computing resources on scaleable multiple servers to internet users.

Amazon S3 service allows each user or organization to have 50-500Tb memory. Monthly price of 1Gb memory is in 0,15-0,18$ range. Hourly usage price of a virtual server is approximately in 0.1-0,8$ range. Alongside with that, payment is carried out for actually used resources.

Cloud Computing technology is very efficient for newly created institutions and small business companies that cannot find sufficient investments in order to develop their own information technologies (IT) infrastructure.

Many experts note that Cloud Computing technology will reform the information technology infrastructure in near five years. High preparedness of "Computing Clouds" and their wide coverage area provides advantages for their use. In accordance with forecasts provided by analytics center (IDS – International Data Corporation, USA) analyzing and researching the information technologies market, expenses spent for creation of "computing clouds" will rise from 16 billion (2008 y) to 42 billion (2012 year). In 2012, 8.5% of yearly expenses in IT field will be spent on "computing clouds" behalf [7].

There are also companies unhappy with development of "Computing Clouds". Giant computer producers such as Dell, IBM, and Hewlett-Packard and Sun companies are not interested in development of "computing clouds" system. Because, this technology directly damages their business interests. At the same time, "Computing Clouds" technology creates problems for hosting companies. Price of hosting services provided by Amazon, is 90% cheaper than prices of famous Rackspace and Equinix companies rendering hosting services.

Information stored in clouds can be used from any location in the world. This may be contrary to laws on protection of information confidentiality in some countries. For example: in accordance with laws existing in European Union (EU) countries, certain types of professional information cannot be transferred out of EU. In relation with this, Amazon and other companies

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have developed requirements and recommendations for users using the information storage services located in EU countries.

Thus, soon companies and individual users will be able to solve their issues without buying powerful and expensive computers, servers and software, but by renting computing and memory resources using the services of "computing clouds" at a cheap price.

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