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# Using of Cloud Technologies in the Process of Preparing Future Specialists for Professional Activity

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**ABSTRACT**

As part of the study, the specifics of the functioning of modern high-tech enterprises related to the organization and automation of production processes through the use of various types of information systems are analyzed, and the growing importance of cloud technologies as the optimal means of implementing these processes is determined.

***KEYWORDS:*** *cloud servers, cloud computing, data storage in the cloud, cloud technologies*

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## INTRODUCTION

An analysis of the research article in the field of training for high-tech industries showed that engineers are faced with the tasks associated with the formation of organizational and production structures that combine a high level of flexibility, mobility and automation, with the operational management of production and enterprise resources, based today on the use of information systems of various types that contribute to the automation of technological equipment management, design and preparation of production, interaction with customers, personnel management, finance, document management, etc. However, these studies do not fully take into account the features of the organization and functioning of information systems in enterprises related to collection, storage and analysis of large volumes of data ("Big Data"); (with ensuring access to data of information systems;); with the implementation of resource-intensive computing using cloud technologies - the most optimal means of implementing these processes.

The work of a modern high-tech enterprise requires solving problems associated with the automation of its activities. These tasks are realized through the use of enterprise information systems, which can be divided into a number of categories [2]:

- Enterprise Resource Planning (ERP) - information systems for planning and managing all enterprise resources: material, intangible, labor, financial, etc.;
- Computer-Aided Design (CAD) - computer-aided design information systems designed to carry out design work and create design and technological documentation;
- Customer Relationship Management (CRM) - information systems for interacting with customers (transaction management, collecting customer data, customer service);
- Enterprise Content Management (ECM) - enterprise content management information systems of various types and formats;
- Human Resource Management (HRM) - information systems for personnel management of an enterprise (personnel records, staffing, payroll, deductions, tax payments, etc.);
- Enterprise Asset Management (EAM) - information systems for managing the enterprise's production assets (equipment maintenance and repair, increasing the productivity of using technical resources, etc.);
- Electronic Document Management (EDMS) - information systems for managing electronic documents of the enterprise;
- Business Process Management (BPM) - information management systems for all business processes of the enterprise.

The above determines the increasing importance of the use of cloud technologies - the most optimal means of implementing these processes.

**METHODS AND RESEARCH**

Over the past few years, cloud technologies have been actively implemented and used in the practice of enterprises of various profiles, at the moment there are still no unified approaches to the definition of the concept of "cloud technology", as well as the accompanying terms "cloud computing", "cloud services", "cloud provider" ("Cloud service provider").

Based on the analysis of scientific and pedagogical literature and research in the field of information technology [3; 5-9; 10; eleven; 12; thirteen; fifteen; eighteen; nineteen; 22; 23] revealed, on the one hand, a different interpretation of the terms "cloud computing" and "cloud technology", on the other hand, their identification by some authors, while these concepts are different in meaning. In addition, the analysis showed the existence of various approaches to the definition of the concepts of "cloud services" and "cloud provider".

Based on these studies, we define the content of the above terms:

- cloud computing is a computer model based on technology of distributed computing and data processing;
- cloud technologies are a set of methods, methods and tools that allow for storage, management and distributed sharing of information resources, as well as software and hardware located on remote servers, in order to process large amounts of data and perform resource-intensive calculations.
- cloud services are applications (freeware or shareware) provided over the Internet that do not require users to have high-performance computers and install additional software;
- A cloud provider is a person, organization, company or enterprise that provides computing power, resources and other capabilities to the end user.

Thus, cloud computing allows storage and processing of data not on the user side, but on the side of the cloud provider that provides the relevant services. At the same time, such services are provided in the form of a cloud service that allows "transparent" use of resources (disk space, software, random access memory, etc.) of a group of servers in a network interacting as a single virtual server [1]. Cloud computing allows you to consolidate high-performance computing tools in a single technological solution, combine different classes of devices in order to store data and provide them on request to users. Today, large computing clouds can include several thousand servers, which are located in data centers around the world, allowing an unlimited number of users to access resources and applications [22].

Ideas about the possibilities of using remote data centers were proposed in the 50s of XX century. by IBM. However, the implementation of this concept for a long time was not possible due to the insufficient level of development of the telecommunications market (low bandwidth of Internet channels, high cost of network Internet traffic, insufficient memory capacity of Internet servers, etc.). The development of technologies and concepts such as virtualization technologies, grid technologies, service-oriented software architecture, multi-agent application development systems, WEB 2.0 services, open source software, etc., had a significant impact on the development of cloud computing [4].

A modern understanding of cloud computing began to take shape in 2006, when Amazon first introduced its own web services infrastructure, in which the client gained access not only to the hosting, but also the ability to use remote computing power. Amazon's experience was then used by leading vendor companies such as Google, IBM, Microsoft, and others.

The most complete idea of cloud computing was formulated in 2011 by experts from NIST (National Institute of Standards and Technology) USA [21].

This document highlights the main characteristics of cloud computing: self-service on demand, wide network access, resource pooling, computational elasticity, consumption accounting.

In addition, NIST examined cloud computing deployment models (public, private, public, hybrid cloud) that determine the circle of users who can access the cloud infrastructure (one or many organizations, unlimited number of people, exclusive use).

Private cloud - infrastructure designed for use by one organization, including several consumers (for example, units of one organization), possibly also by customers and contractors of this organization. A private cloud can be owned, managed and operated by both the organization itself and a third party (or some combination of them), and it can physically exist both inside and outside the jurisdiction of the owner.

The public cloud is an infrastructure designed for free use by a wide audience. The public cloud may be in the ownership, management and operation of commercial, scientific and governmental organizations (or any combination thereof). A public cloud physically exists in the jurisdiction of the owner - service provider.

A public cloud is a type of infrastructure intended for use by a specific community of consumers from organizations that have common tasks (for example, missions, security requirements, policies, and compliance with various requirements). The public cloud can be in the cooperative (joint) ownership, management and operation of one or more community organizations or a third party (or any combination thereof), and it can physically exist both inside and outside the jurisdiction of the owner.

A hybrid cloud is a combination of two or more different cloud infrastructures (private, public or public) that remain unique objects, but interconnected by standardized or private data and application transfer technologies (for example, short-term use of resources public clouds to balance the load between the clouds).

The provision of resources to the end user (data storage, computing power, system applications, application programs, etc.) is carried out in accordance with the logic of one of the following cloud services models:

- Infrastructure as a Service (IaaS) - a model that provides users with the ability to logically expand the information

space of an enterprise through the use of hardware resources and allows you to manage the resources (computing, storage, networks, etc.) of the cloud infrastructure (IBM Smart Cloud Enterprise, VMWare, Amazon EC2 , Windows Azure, Google Cloud Storage, Parallels Cloud Server, etc.);

- Platform as a Service (PaaS) - a model that provides users with a set of tools for creating and testing software under development, as well as its further deployment based on cloud infrastructure (IBM Smart Cloud Application Services, Amazon Web Services, Windows Azure, Boomi, Heroku, Cast Iron, Google App Engine, etc.);
- Software as a Service (SaaS) - a model that provides users with application software of a cloud provider without the need for system support of its performance, accessible from various classes of devices using the appropriate client software (Google Apps, Microsoft Office 365, Photoshop.com, Acrobat. com et al.).

The NIST classification, consisting of three models - IaaS, PaaS, SaaS - refers to 2011 and has already been expanded to date by a number of other models [7]:

- Communication as a Service (CaaS) - a model that provides users with the ability to transmit voice, video, instant messages, etc. over the Internet (Ekiga, iLBC, Speex, etc.);
- Database as a Service (DBaaS) - a model that provides users with a database of the necessary configuration (Amazon Relational Database Service, GenieDB, Microsoft SQL Azure, MongoDB Database as a Service, etc.);
- Desktop as a Service (DaaS) - a model that provides users with a ready-made workplace with the necessary software, access to which is possible from any device connected to the Internet (Citrix, Microsoft Windows Server, SITA, etc.);
- Hardware as a Service (HaaS) - a model that provides users with computing resources of equipment in the form of services - analogues of real computing systems using virtualization technologies (Apache Hama FreeVPS, GlusterFS Open Source Project, Linux-VServer, etc.);
- Monitoring as a Service (MaaS) - a model that provides users with software for monitoring and implementing network security (Ganglia, Zabbix, Hyperic HQ, etc.);
- Workspace as a Service (WaaS) - a model that provides users with access to software in order to create a working environment and perform calculations on the local client machine (Parallels Remote Application Server, VMware vSphere, Microsoft Hyper-V, etc.);

Based on the foregoing, as well as analysis of works [1; 14; 17], we can distinguish a number of advantages that the use of cloud computing provides:

- high speed of implementation due to the absence of the need for deployment;
- no need to install and use additional software on the client side;
- reducing the requirements for the computing power of the user's computer and saving disk space;
- independence from modifications to computers, hardware and software clients;
- distributed access to resources and the possibility of collaborative remote work.

Information systems based on the use of cloud technologies allow automating all areas of activity (production, finance, sales, etc.): manage enterprise resources; perform data processing on the side of the cloud provider; Provide remote access to the system interface. The choice of a particular cloud solution is determined by the profile of the enterprise, the specifics of the tasks being solved (data storage and exchange, modeling, calculations, information processing, etc.), the capabilities of maintaining local central data processing, as well as performance, security, and confidentiality requirements.

Thus, the features of the functioning of modern high-tech enterprises determine the need for students to have relevant competencies in the use of cloud technologies in the implementation of a set of work to implement all stages of the life cycle of information systems (from the pre-design stage to the operation and maintenance stage).

It should be noted that cloud technologies are actively used today not only in the industrial sphere, but also in education: a number of cloud providers (for example, Microsoft, Google, Amazon, etc.) provide cloud services (mainly in accordance with the SaaS model), the capabilities of which applicable in the training of future specialists. The use of cloud technology in the learning process allows students to adapt to future professional activities, reduce the costs of advanced training or retraining in the workplace, etc.

In this work, we will consider Google Apps cloud services, which is due to the wide range of functionality of these services for solving various types of tasks.

Researchers consider cloud-based Google Apps services as a set of tools that provide the possibility of implementing information exchange, electronic document management, managing an educational institution and the educational process using organizational and methodological support [20] .. Three levels are conditionally distinguished in the structure of the Google Apps domain [16]:

1. six basic services that make up the core of the package (Gmail, Google Calendar, Google sites, Google Drive, Google Chat contact and instant messaging service), the uninterrupted operation of which is guaranteed by the user agreement;
2. more than sixty services that can be additionally connected to the Google domain (YouTube video hosting service, social network Google+, Google Analytics, etc.), technical support and 24-hour guaranteed functionality of which are not regulated by the user agreement;
3. services developed by third-party developers - the external layer (the service of organized diagrams LucidChart, online graphic editor Aviary, etc.).

Consider in more detail the Google cloud services (first and second levels) and the possibilities of their use in the process of preparing students:

- Google Drive cloud storage (Google Drive), which provides the possibility of a structured organization of storage and constant access to educational content, which allows you to track the time changes to files, and also supports synchronization with a different class of devices;

- Google documents (Docs, Sheets, Slides), allowing to provide multi-user access and collaboration with educational content of various forms;
- Google Group groups that allow to differentiate access rights, unite users on a common basis, as well as implement feedback and joint work of subjects of the educational process;
- Gmail email, the presence of an account in which is a prerequisite for gaining access to other cloud services, as well as providing asynchronous user interaction with support for voice and video chat;
- Forms of Google Forms that implement the ability to organize automated control, testing and questioning of users, as well as processing and analysis of results;
- Google Calendar, the capabilities of which allow you to organize the planning of academic work, monitoring, etc., as well as implement appropriate notification mechanisms for planned training events;
- Hangouts with Hangouts, which allows you to simultaneously connect multiple users to organize webinars;
- Google Talk communication tools that allow you to organize instant messaging with support for voice chat and video chat modules;
- Google Sites sites, the capabilities of which allow you to organize a single information space for the placement of educational content (videos, images, documents, etc.).

In addition to the cloud services included in the core of Google Apps, we should also note a number of third-party cloud services that reflect the specifics of the professional activities of future specialists:

- editors for creating diagrams and diagrams (Draw.io, LucidChart, etc.) that allow you to create and collaborate on diagrams of various types: UML diagrams (modeling classes in UML - Unified Modeling Language), ER diagrams (Entity-relationship, entity-relationship model), Android and iOS application templates, site maps, etc .;
- Integrated development environments (IDEs) (Codebox, Cloud9, Codeanythere, ShiftEdit, etc.), supporting the most common programming languages, integrated with the main libraries and documentation, ensuring safe work on program code, as well as saving local computing resources and flexible management of developer jobs;
- version control systems (GitHub, SVN, Mercurial, Bazaar, etc.) that solve the problems of storing versions of project files, receiving previous modifications, viewing changes between given versions, saving and viewing authors comments on changes made;
- cloud platforms using the PaaS model (Google App Engine, Heroku, Microsoft Azure, etc.), focused on professional developers and allowing you to create your own dynamic applications that support the main modern technologies (programming languages with standard libraries, a data warehouse with support for queries and transactions, a full-featured set of development tools (software development kit, SDK), a set of services available through application programming interfaces (APIs, etc.).

**CONCLUSION**

Thus, cloud technologies, on the one hand, are the subject of study for future specialists, since they are associated with the future professional activities of graduates at high-tech enterprises in implementing all stages of the life cycle of information systems, and on the other hand, the capabilities of cloud technologies allow them to be included in the process of preparing students for as one of the learning tools.

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