STAGES OF DEVELOPMENT, DIRECTIONS AND COMPARATIVE ANALYSIS OF CLOUD TECHNOLOGIES

Shukurov Akmal Uktamovich
Karshi Engineering Economics Institute, **UZBEKISTAN**
E-mail: specialist0202@mail.ru

ABSTRACT

The article reviews the technology of cloud computing, which is considered a revolutionary change in the field of information and communication technologies. The main models of cloud computing services and development trends are considered. The analysis of the development of cloud technologies in Uzbekistan and providers of services in this field was carried out.

Keywords: Cloud computing, grid computing, private cloud, public cloud, hybrid cloud, Internet of things, cloud services, data center.

INTRODUCTION

In the last short period of globalization, one of the main driving forces in the field of information and communication technologies (ICT) is the creation of new technologies that meet the requirements of the times. While these technologies differ significantly from the classic models of computer networks, they sometimes operate on exactly the same principles. Although the idea of cloud computing emerged in the 1960s, it has become popular since the first decades of the 21st century as a result of the rapid development of communication channels and the steady growth of user demand.

Cloud computing typically provides the user with computer resources and power in the form of an Internet service. In this way, the user is provided with computing resources in a “pure” form, and the user may not be able to answer questions such as how the computer is handling its problems, what type of operating system it is running, and in fact there is no need to seek answers.

Purpose

By finding similarities and commonalities in workflow, cloud technology can be compared to mainframes. However, there are fundamental differences between the "cloud" and the mainframe, in particular, the "cloud" is theoretically unlimited computing power.

Among the data processing technologies that first emerged, grid computing (in the 1990s) had somewhat widespread relationship. Initially, this direction was considered as an opportunity to develop a system of efficient use of idle resources of the technical processor and the voluntary leasing of computing power. Cloud computing and cloud computing have many similarities in terms of architecture as well as the principles used. At the same time, the cloud computing model has been recognized as the most promising technology because it has a flexible enough platform to use remote computing resources.

Scientific novelty of the article

Today, large cloud computing consists of thousands of servers located in data processing centers (MIBMs). They provide thousands of users with thousands of application resources at

the same time [1]. Cloud technology is a convenient tool for businesses that find it costly to maintain a variety of servers that require the purchase and configuration of a custom ERP, CRM system, or hardware. Many cloud services, such as Documents and Calendar, provided by Google for their convenience, have become popular among private users.

The reason for the continued success of the use of cloud technologies is simple: their application has a wide range of capabilities and saves on infrastructure, services and staff costs. The hardware that allows data processing and data storage in a remote data center can be simplified sufficiently. Almost all such problems are borne entirely by the service provider. This approach allows you to standardize enterprise computers even if they have different operating systems (OT) installed (Windows, Linux, MacOS, etc.). It makes it easy to provide equal access to company data for employees and customers who walk outside the office but have access to the Internet.

Despite its many ease of use, it also has a number of drawbacks. In particular, the user can be fully connected to the service provider. Indeed, according to the principle of creating a cloud service, the activities of the enterprise will depend on how the service provider and the Internet provider work.

Modern cloud technologies are rapidly entering the market not only of ready-made network and server devices, but also of embedded cloud systems. The idea of connecting and managing various district devices to the global network is called the Internet of Things (IoT). According to Kevin Dallas, general manager of Microsoft Windows embedded, the idea of an Internet of Things has existed for many years, but the reason for not implementing such a network was the lack of a single link - cloud technology.

According to the distribution models, cloud computing technologies are divided into private, mass and hybrid technologies.

Private cloud - is the internal cloud infrastructure and service of the enterprise. Such a cloud is located within a corporate network. The organization can manage the private cloud independently or delegate the matter to an external contractor. The infrastructure can be located in the customer's building or in the external operator, or partly in the customer and partly in the operator's building.
Public cloud - cloud computing services in such infrastructure can be used by the general public, provided by suppliers, and hosted outside the corporate network. Such cloud users will not be able to manage or service the data in the cloud, all the information will be uploaded to the cloud owner. The customer pays for the resources used.

Users are offered a business system or website (distribution) method with a large-scale scalability that is not possible in other solutions, easily and at as reasonable a price as possible. Examples of such providers are Amazon YEC2 and Amazon Simple Storage Service (S3), Google Apps / Docs, Salesforce.com, Microsoft Office Web online services. It should be noted that in a mass cloud, it is not always appropriate to implement processes that require strict security measures and compliance with regulatory requirements, as the user has very little or no noticeable control over the infrastructure.
Hybrid cloud - this includes all models of infrastructure distribution (private, public). Typically, a hybrid cloud is created in an enterprise, and the responsibility for managing them is shared between the enterprise and the mass cloud supplier. A hybrid cloud provides services that are partly public cloud and partly private cloud.

Here are a few key criteria to help you get a clearer idea of a private cloud:
The cloud is just virtualization. While server and infrastructure virtualization is the foundation of private cloud computing, virtualization and virtualized environment management do not automatically become private cloud. For a technical environment to be a cloud technology, it must have components consisting of a virtual machine, OT or binding software (DT) container, high-robust OT, grid-computing DT, storage resource analysis DT, scaling and clustering tools.
The cloud does not have to be a source of savings. Looking at the cloud as a money-saving tool is the biggest and fundamental misconception. It can be economical, but it is not a mandatory attribute.
A private cloud does not have to be introduced only at the customer. The term private cloud does not define location, but rather features of this technology such as confidentiality, resource ownership, or independent management. Many suppliers offer non-local private clouds, i.e., allocate resources to a single customer despite having multiple clients merged in the cloud. The cloud is private because of its privacy, not because of where it opens, who owns it, and who is responsible for managing it. For example, private data processing centers (MIBM) can be hosted on a hosting provider, or different customer resources can be combined and separated from each other via private virtual networks (Virtual Private Network - VPN).
Private cloud (like public cloud). Server virtualization is a large line and therefore a powerful driving force of private cloud computing. The Service Quality Infrastructure (IaaS) provides MIBM in a simple form that is easy to use with the lowest level of resources without radically changing the operating principles.
A private cloud may not be private. On the one hand, private cloud has the advantages of rapid reconstruction, scalability and efficiency, overcoming real and potential security threats that are characteristic of mass clouds. On the other hand, the level of service, security, and compliance control that businesses demand is increasing over time in mass cloud services as well.

RESULTS AND PRACTICAL APPLICATIONS

The NIST Definition of Cloud Computing (NIST National Institute of Standards and Technology, USA) defines the following classifications of clouds:

- On-demand self-service.
- Broad network access.
- pooling of resources (Resorce pooling).
- Rapid yelasticity.
-Measured service.

It is now accepted to divide cloud technology services into three main models, sometimes referred to as cloud layers. These three layers reflect not only the structure of cloud technologies, but also information technologies as a whole.
Infrastructure as a Service (IaaS) consists of a set of physical resources, such as servers, network equipment, and storage devices, that are provided to the customer as services. Solves the problem of correct and efficient equipment of the data processing center, providing computing power as needed by infrastructure services.

Advantages. Reduces capital investment in maintenance. In general, savings can be achieved through more efficient use of resources because virtualization methods are used in this model. Reduced investment risk and implementation time, automatic scalability.

Disadvantages. Business efficiency and labor productivity depend on the capabilities of the supplier. It is likely to require potential costs in the long run. Centralization also requires new approaches to security measures.

Examples of infrastructure services include IBM SmartCloud Yenterprise, VMWare, Amazon YEC2, Win-dows Azure, Google Cloud Storage, Parallels Cloud Server.
Platform as a Service (PaaS) is a service model that provides applications to a user as a set of services (created or purchased). In particular, the service includes intermediate DT as a service, messaging as a service, integration as a service, information as a service, communication as a service and other similar services. For example, Workplace as a Service (WaaS), Data as a Service (DaaS), Security as a Service (SaaS).

Advantages. New versions are noticeably-easy to deploy. Invisibility-Ease usually means that the user feels the effects of software changes in the cloud imperceptibly or ideally does not feel absolute.

Disadvantages. As with the previous service model, centralization requires reliable security measures.

Examples of platform services include IBM SmartCloud Application Services, Amazon Web Services, Windows Azure, Boomi, Cast Iron, Google App Engine.

Software as a Service (SaaS) takes into account access to applications as a service, i.e., the provider's applications are launched in the cloud and run as a service according to the user's requirements. The consumer does not control the basic infrastructure of the cloud, including the network, servers, operating systems. The end user is solely responsible for the security of access settings (login, password, etc.) and for following the provider's instructions on how to securely configure applications.

The app service is very familiar to users who work a lot on the internet. The most common examples of this type of application are GMail, Mail.ru, Yahoo Mail mail services. In total, there are thousands of SaaS applications, and their number is growing day by day thanks to Web 2.0 technology.

Advantages. Reduction of investment in hardware and labor resources; reduction of the risk of investment loss; imperceptible-easy update.

Disadvantages. As with the previous two models, centralization requires reliable safety precautions.

Examples of SaaS include Gmail, Google Docs, Netflix, Photoshop.com, Acrobat.com, Intuit QuickBooks Online, IBM LotusLive, Unyte, Salesforce.com, Sugar CRM and Webex. A major part of the growing mobile app market is the result of the effective implementation of SaaS.

There is an opinion that cloud computing, which is currently considered to be the highest development of information technology, will become a thing of the past in the near future. In the future, cloud applications are expected to prioritize not only the infrastructure and platform of a single supplier, but also the aggregate infrastructure and platform of different suppliers. Perhaps cloud computing could eventually lead to the emergence of the concept of everything as a service (Yeverything as a Service - YeaaS).

Development of cloud computing technologies in Uzbekistan. In August 2016, the national telecommunications operator Uzbektelecom launched a new data transmission center UZCLOUD. According to experts, the data center is of great importance for local companies, whose activities are directly related to the continuous provision of fast and efficient processing of large information flows. The current configuration of the data center storage capacity consists of 160 blade servers of 1 petabyte, and the number of servers can be expanded to 10 petabytes.

The main advantages of the created data center are great tolerance to various errors and labor productivity. Designed and developed for the conditions of Uzbekistan. The following table provides information on companies that have set up operations in the data center established in Uzbekistan.
Companies and services provided with servers in the data center in Uzbekistan:

Table 1.

№	Name and e-mail address of the service provider.	Year of operation, type of services.	Tariff price.
1.	Billur COM http://billur.com	In business: since 2003. Previous Active Cloud. Linux and Windows, IaaS, SaaS, SSL certificates, server rental services. The servers are located in Uzbekistan and Russia.	PHP / MySQL hosting: from 18,600 soums. Control Panel: Plesk Panel 12.5 2
2.	@Host http://ahost.uz	In business: since 2010. The servers are located in the TAS-IX network in Uzbekistan.	PHP / MySQL hosting: from 14,000 soums.
3.	UzScinet https://micros.uz/internet/hosting/web-hosting/	In business: since 2009. SCINET INFO SYSTEMS provides virtual hosting, co-location services on the Unix platform.	PHP / MySQL hosting: from 87,000 soums per year
4.	Arsenal D http://arsenal-d.uz	In business: since 2004. Linux operating system hosting services. The minimum term of the contract is 1 year.	PHP / MySQL hosting: from 3,000 soums.
5.	Regname http://regname.uz/	In business: since 2012. Karakalpak Computerization Center State Unitary Enterprise.	PHP / MySQL hosting: from 3,000 soums
6.	Uzhosting http://uzhosting.com	In business: since 2009. Uzhosting offers hosting services from ARS-Inform. Uzhosting hosting on the Unix platform, dedicated VPS virtual server and co-location services.	PHP / MySQL hosting: from 80,000 soums
7.	BCC http://new.bcc.uz/ru/provider/domen-hosting.html	In business: since 1995. BCC hosting on Unix and Windows platforms. The servers are located in Tashkent.	PHP / MySQL hosting: from 2,000 soums
8.	Megahosting http://megahosting.uz	In business: since 2007. Megahosting hosting, co-location services on the Unix platform.	PHP / MySQL hosting: from $ 5
9.	TuronCloud https://tcloud.uz/	In business: since 2015. TuronCloud - Hosting from TuronTelecom internet provider.	PHP / MySQL hosting: 12,000 soums
10.	Uzinfocom Data-markaz http://dc.uz	In business: since 2009. Uzinfocom data center virtual hosting on Unix platform, dedicated VPS virtual server and co-location services.	PHP / MySQL hosting: from 4,000 soums.

11.	Sarkor Telecom http://hostim.uz/	In business: since 2005. Hoster hosting services from Sarkor Telecom. Hoster Unix provides virtual hosting on the platform.	PHP / MySQL hosting: $ 12 per year.
12.	Uztelecom DataCenter http://uzdc.uz	In business: since 2010. Uztelecom (Uznet) data center provides virtual hosting, dedicated VPS virtual server and co-location services on the Unix platform.	PHP / MySQL hosting: from 3,000 soums
13.	Sharq Telekom http://st.uz/hosting	In business: since 2003. The company provides virtual hosting, dedicated VPS virtual server and co-location services on the Unix platform.	PHP / MySQL hosting: from $ 4 per month
14.	vClouds https://vclouds.uz	In business: Since 2016. It provides innovative solutions to optimize, develop and reduce IT infrastructure costs for the client.	MySQL, PHP, Perl, Python hosting: up to 5000-20000 soums per month

In November 2016, the international conference "Summit of Cloud Computing Uzbekistan-2016", organized by Huawei Tech Investment Tashkent, was held in this direction.

On September 21, 2017, the Ministry of Information Technologies and Communications signed a memorandum of cooperation between Microsoft and the company, which sets out promising cooperation in the field of ICT.

IaaS cloud technologies are already used in Uzbekistan, which eliminates the problems of client and network IT infrastructure, data processing infrastructure, which require resources for organizations. Using IaaS infrastructure outsourcing, the consumer of services gets rid of unnecessary costs.

PaaS cloud technologies are used in the implementation of projects by a small number of development companies in Uzbekistan, which have a sufficient material base.

SaaS cloud technologies are just being introduced in Uzbekistan. In our opinion, this is primarily due to the low quality of Internet access, especially in the regions. However, in the coming years, SaaS services will become the most in-demand service, as the global market for cloud solutions has been growing rapidly in recent years, and worldwide growth rates are observed in the SaaS direction.

CONCLUSIONS AND SUGGESTIONS

According to experts, the world experience shows that the most stable demand for SaaS services is formed in the public sector, because the large amount of information in government agencies requires the most advanced approaches [6].

Thus, it can be concluded that the main interrelated components of the information-learning environment based on cloud technologies are: education, assessment, communication. One of the opportunities for the practical implementation of the information-educational environment, which allows to combine traditional tools and methods of teaching, is a set of tools provided by Google.

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