GOCE DELCEV UNIVERSITY, STIP, NORTH MACEDONIA

FACULTY OF ELECTRICAL ENGINEERING

ETIMA 2023

SECOND INTERNATIONAL CONFERENCE

27-29 SEPTEMBER, 2023

TECHNICAL SCIENCES APPLIED IN ECONOMY, EDUCATION AND INDUSTRY

УНИВЕРЗИТЕТ
ГОЦЕ ДЕЛЧЕВ
ЕЛЕКТРОТЕХНИЧКИ
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FACULTY OF ELECTRICAL ENGINEERING,
GOCE DELCEV UNIVERSITY, STIP, NORTH MACEDONIA

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PREFACE

The Faculty of Electrical Engineering at University Goce Delcev (UGD), has organized the Second International Conference ***Electrical Engineering, Informatics, Machinery and Automation - Technical Sciences applied in Economy, Education and Industry-ETIMA.***
ETIMA has a goal to gather the scientists, professors, experts, and professionals from the field of technical sciences in one place as a forum for exchanging the ideas, strengthening the multidisciplinary research and cooperation, and promoting the achievements of technology and its impact on every aspect of living. We hope that this conference will continue to be a venue for presenting the latest research results and developments on the field of technology.
Conference ETIMA was held as online conference. More than sixty colleagues contributed to this event, from five different countries with more than thirty papers.
We would like to express our gratitude to all the colleagues, who contributed to the success of ETIMA'23 by presenting the results of their current research and by launching the new ideas through many fruitful discussions.
We invite you and your colleague to attend ETIMA Conference in the future as well. One should believe that next time we will have opportunity to meet each other and exchange ideas, scientific knowledge and useful information as well as to involve as much as possible the young researchers into this scientific event.

The Organizing Committee of the Conference

ПРЕДГОВОР

Меѓународната конференција ***Електротехника, Технологија, Информатика, Машинство и Автоматика-технички науки во служба на економија, образование и индустрија-ЕТИМА*** е организирана од страна на Електротехничкиот факултет при Универзитетот „Гоце Делчев".
ЕТИМА има за цел да ги собере на едно место научниците, професорите, експертите и професионалците од полето на техничките науки и да претставува форум за размена на идеи, да го зајканува мултидисциплинарното истражување и соработка и да ги промовира технолошките достигнувања и нивното влијание врз секој аспект од живеењето. Се надеваме дека оваа конференција ќе продолжи да биде настан на кој ќе се презентираат најновите резултати од истражувањата и развојот на полето на технологијата.
Конференцијата ЕТИМА се одржа online и на неа дадоа свој придонес повеќе од шеесет автори од пет различни земји со повеќе од триесет труда.
Сакаме да ја искажеме нашата благодарност до сите колеги кои придонесоа за успехот на ЕТИМА'23 со презентирање на резултати од нивните тековни истражувања и со лансирање на нови идеи преку многу плодни дискусии.

Организационен одбор на конференцијата

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CLOUD COMPUTING AND VIRTUALIZATION: CAN CLOUD COMPUTING EXIST SEPARATELY FROM VIRTUALIZATION?

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Abstract

Virtualization is a software technique that emulates the operation of the entire computer. Depending on the needs and the powers of the physical computer, several virtual machines can be installed at the same time. The resources of physical computers will be shared between all virtual machines and because of that, virtual machines will be working slower. A virtual machine uses a combination of software and an existing computer to provide additional computer machines, all in one physical device. Cloud computing involves delivering hosted services and cloud applications over the internet and enables users to obtain a shared pool of data from remote physical servers, databases, and computers. Although virtualization and cloud computing are seen as two different techniques, they are interconnected and cannot exist without each other. Virtualization in cloud computing can prevent the IT system from failing and can protect the IT environment from bugs and viruses. In IT infrastructure, cloud computing and virtualization are used together to build a cloud infrastructure. The aim of this study is to define and analyze what virtualization and cloud computing are. Then through a comparison to show how these techniques are related to each other and consequently a conclusion will be drawn.

Key words

software technique, services, IT infrastructure

Introduction

Virtualization can be defined as a software technique that emulates the operation of the entire computer. Depending on the needs and the powers of the physical computer, several virtual machines can be installed at the same time on one computer. A virtual machine uses a combination of software and an existing computer to provide additional computer machines, all in one physical device. Like any other program, programs for creating virtual machines need to be installed and then configured. The installation and configuration of this programs are a simple procedure, consisting of number of steps that need to be performed for the virtual machine to be properly used. Once the program has been installed on the hard drive and configuration has been performed, we can start creating virtual layers and installing operating systems. With this, we can work using more than one operating system on a single computer.
On the other hand, Cloud computing in these days is one of the most used technologies because of the major issues such as reducing costs, and its scalability and flexibility in computer services. Cloud computing allows using different pool of resources anywhere and anytime via Internet. It generally provides on demand IT services and products. This technology allows consumers and businesses to use applications without installation and access their personal files

at any computer only with using of internet access. Cloud computing also allows much more efficient computing by centralizing storage, memory, processing, and bandwidth [11]-[17].

1. Virtualization

Virtualization is a technology that combines hardware and software. It allows the same computer to run several different operating systems that share common resources. In this way, the system is divided into several separate virtual entities that act as independent computer systems. More precisely, virtualization is the possibility of using multiple operating systems on the same physical computer. There are existing various kind of virtualization: OS virtualization (Xen, VMware), storage virtualization (NAS, SAN), database virtualization and software virtualization (Apache Tomcat, Oracle App Server ...) [11].

Fig. 1 Architecture with virtualization

A virtual machine is a computing resource that uses software instead of a physical computer to run programs and deploy applications. Basically, it is a virtual environment in which we can install an operating system that can be used on the main operating system that is on the computer. These environments manage to mimic the hardware that the computer has, so that it behaves as if we are on a completely different computer with a different operating system installed. The main feature is that there are two users of the computer, namely:

- Host machine - the machine that represents the physical equipment and the main operating system.
- Guest machine - our installed virtual machine, running an operating system that corresponds to it.

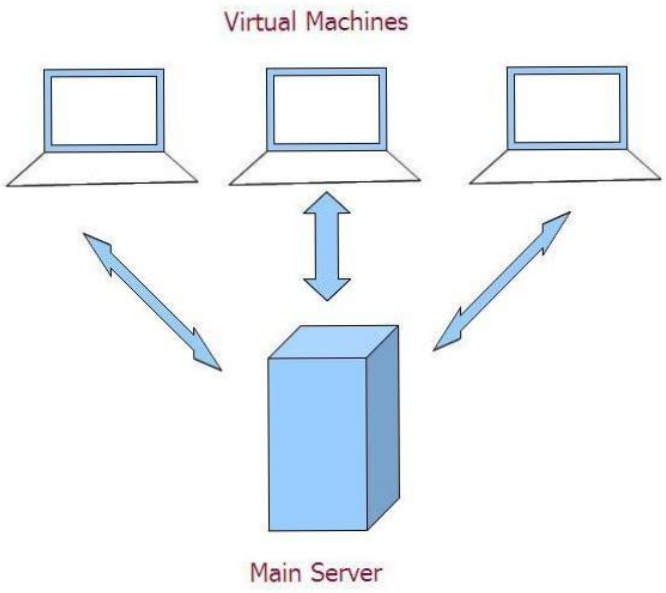

Fig. 2 Virtual environment

There are two different types of virtual machines, each with different functions:

- System virtual machines or also known as full virtualization virtual machines. They provide a replacement for a real machine. This virtual machine makes it possible to represent the physics between several virtual machines, using software called a hypervisor. A hypervisor allows multiple environments to be isolated from each other but still exist on the same physical machine. Modern hypervisors use virtualization-specific hardware, primarily from the host processor.
- Virtual machines processes designed to run computer programs in a platform-independent environment [1]-[10].

Advantages of virtual machines

- We have different operating systems that can exist simultaneously on the same machine, separated from each other.
- A virtual machine has a simpler instruction architecture than a real computer.
- It can be portable, as it can be used on any computer in a secure way.
- At the business level, they cause economic savings and space savings.
- Since there is no physical hardware, there is no need to worry about the damage that can be caused when installing a program.
- Different types of applications can be tried and if they are not right, we can just delete them.

Disadvantages of virtual machines

- Virtual machines are slower.
- They can consume a lot of resources.
- When there is a need to access the hardware, it is not very efficient.
- When multiple virtual machines are running at the same time, unstable performance occurs, depending on the scale of the system [1]-[10].

2. Cloud computing

Cloud computing helps to reduce IT costs, to improve agility and time to value and to scale more easily and economically [14, 17]. Cloud computing is some kind of Internet-based computing where application, storage and servers are given via internet connection. Cloud based services are ideal for companies that involve continuous network connectivity and bandwidth. Cloud Computing consists of several services: Infrastructure as a Service (IaaS), Software as a Service (SaaS) and Platform as a Service (PaaS) [17].

- SaaS: Users can get and use software with less money than buying and installing it. It offers web reliability and security using SSL (secure socket layer).
- IaaS: Infrastructure can be scaled up or down based on the requirement. Virtualization as service allows clients to run the virtual machines. Network as a service includes hardware for firewalls, routers, and load balancing.
- PaaS: Provides greater flexibility, speed and agility to the development process and it reduces server storage costs [13].

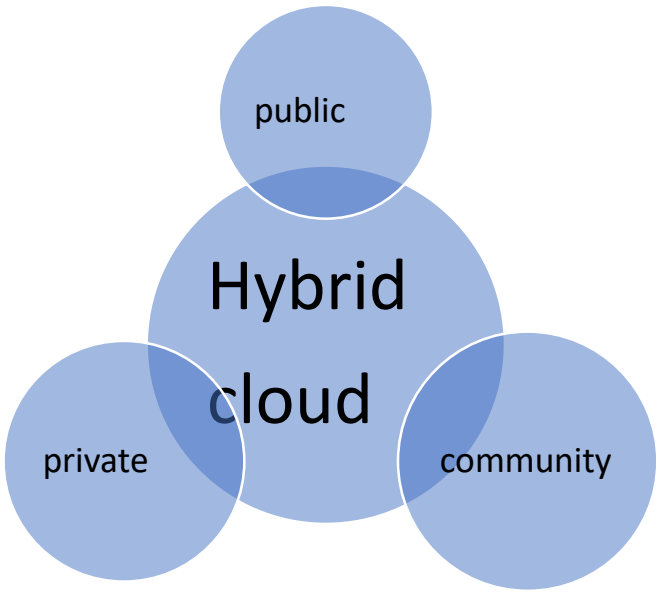

Fig. 3 Deployment models of Cloud computing

It represents an association of several terms like Application Service Provider, Grid Computing, Server Hosting, Virtualization and Utility Computing [13, 17].
There are four deployment models of Cloud computing: public cloud, private cloud, community cloud and hybrid cloud.

- Private cloud is aimed for businesses and used by single organization.
- Public cloud is aimed for software development and projects.
- Hybrid cloud is combination of two clouds (private, public or community) and is aimed for big businesses.
- Community cloud is collaborative platform used by more organizations for sharing same applications.

Cloud computing services first were offered by Amazon, Google, Microsoft, but now exist many more. These services are used in many areas like software industries, government sectors, health care sectors...
Architecture of cloud computing from the point of virtualization is given in Fig.4 [11].

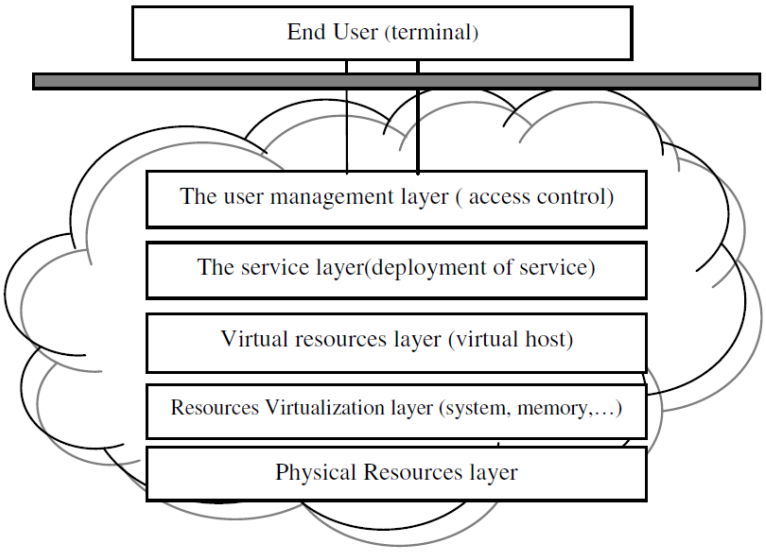

Fig. 4 Architecture of cloud computing

According to the paper [11] end users get service anywhere and anytime through terminal using computer or mobile phone.

- The user management layer is the relationship between user and cloud, and the user access "clouds" through it.
- The service layer converts the cloud resources into the services (such as storage, software as a service, platform, and services) which look after the end users.
- Virtual resources layer combines and handles virtualized resources.
- The second last layer handles the virtualization of all kinds of computing resources and ensures that users do not have to deal with problems such as the actual physical location of the machine, maintenance, and so on.
- The last layer is the base of the entire platform for cloud computing, storage of real physical resources.

3. Virtualization in cloud computing

Virtualization in Cloud Computing creates a virtual framework of the server operating system and storage devices. This will allow the same resource to be shared among multiple users at the same time. Cloud virtualizations reduce computational work and deliver a virtual environment in the cloud that can be software hardware or any other thing [17].
Main gains of virtualization in cloud are:

- Security (security is by means of firewalls that help keep data private. It can also virtualize the entire data store and can back up a server where the data can be stored),
- Flexible operations (technical errors can be resolved in physical systems. It eliminates the problem of recovering data from crashed or destroyed devices and thus saves time),
- Economical (saving money on physical systems, data is stored on a virtual server which is a much cheaper investment and reduces electricity and maintenance costs),
- Eliminates the risk of system failure (the system can stop working at any time and thus cause a disaster to the business. Therefore, data stored in the cloud can be retrieved at any time with any device),
- Flexible transfers of data (the data is located on a virtual server and no time is wasted to find it because it is easily accessible),
- Utilization of hardware efficiently (Cloud vendors deliver physical services without deploying any physical hardware system),
- Availability increases with Virtualization (Data migration from one server to another is safe. Also, we can access data from any location and at any time from any device),

- Disaster Recovery is efficient and easy (there is real time data recovery, backup of data and duplicate, data damage is impossible),
- Virtualization saves Energy,
- Quick and easy setup,
- Cloud Migration becomes easy [17].

Virtualization is the key component of cloud computing. With the introduction of virtualization, cloud computing enables users to not have to worry about the maintenance of the physical host, the problem of management and optimization [11]. With the use of virtualization, cloud computing brings not only benefits of convenience and efficiency, but also great challenges in data security and privacy protection. Virtualization is important in cloud computing because it abstracts compute resources and enables rapid scaling of resources [18].

Conclusions

Virtualization of computer systems is an old idea in a new edition. With the advancement of computer technology and the development of hardware-assisted virtualization technology, as well as the increase in power of today's computers, virtualization has taken a new dimension. It destroys the "one computer - one operating system" concept. As we have seen so far, a virtual machine is a computer within a computer.

Virtual machine can be used for everyday use even by people who do not have extensive knowledge of information services. But, of course, they also have a huge impact on IT companies, so they improve their IT efficiencies. Many IT departments spend more than half of their time managing routine administrative tasks, but with the help of virtualization, it is possible to split a single physical server into several virtual machines. So, administrators can manage multiple operating systems at once from a single physical server. They are independent of each other, making them hardware independent. So, when we need to use multiple applications and operating systems at the same time, the only thing to do is to properly install and configure the virtual machine and then work with it flawlessly for a long time.

Cloud computing helps to get over the problems of losing data, accessing data whenever needed and data security. This technology is mainly service oriented and focuses on cost reduction, hardware reduction and only service pay.

Virtualization in cloud computing is creating a virtual image of the storage devices (servers or network resources) so that they can be used on multiple machines at the same time [14]. Virtualization makes cloud computing environment easier to manage the resources.

With the many advantages and possibilities provided by these two technologies, we can say that these technologies will continue to reorganize and modify many fields of human venture for years to come [15].

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