

VIRTUALIZATION TECHNOLOGY: ENHANCING EFFICIENCY AND RESOURCE UTILIZATION

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Анотація

У даній роботі досліджується використання технології віртуалізації з метою підвищення ефективності та використання ресурсів.

Ключові слова: віртуалізація, серверна віртуалізація, обчислювальні ресурси.

Abstract

This work explores the use of virtualization technologies to improve resource utilization and efficiency.

Keywords: virtualization, server virtualization, computing resources.

Virtualization technology has existed since the 1950s. At that time, IBM wanted to improve computer efficiency through time-sharing. Today, businesses seek fast access to information, flexible and easy IT infrastructure management, and the ability to store increasingly large amounts of data. All of this is possible only thanks to virtualization.

Virtualization is a technology that can be used to create virtual representations of servers, storage, networks, and other physical devices. Virtual software emulates the functions of physical hardware, allowing multiple virtual machines to run simultaneously on a single physical machine. A hypervisor, which can be either software or hardware-based, is used to enable virtualization. Businesses utilize virtualization to efficiently manage hardware resources and maximize returns on their investments. Additionally, it supports cloud computing services, helping organizations effectively manage their architecture. [1] Virtualization technologies are used across various fields to enhance efficiency, flexibility, and security of IT infrastructure.

One of the most significant directions is server virtualization, which allows running multiple virtual servers on a single physical device. This significantly reduces hardware costs, simplifies administration, and ensures system scalability. Examples of platforms for such solutions include VMware ESXi, Microsoft Hyper-V, and Proxmox. Another crucial aspect is the use of virtualization in cloud computing. Modern platforms such as AWS, Azure, and Google Cloud leverage this technology to create flexible and scalable environments where applications can be quickly deployed and managed. A separate area is containers and their orchestration, which provide even higher levels of efficiency. Docker and Kubernetes enable the running of isolated environments without the need to deploy full virtual machines, making application development and management faster and more convenient.

In software development, virtual machines also play a significant role. They allow testing various operating systems and configurations without modifying the developer's main environment, significantly simplifying development and debugging processes.

Another important technology is desktop virtualization (VDI), which allows users to work in remote environments. This is not only convenient but also enhances security and simplifies IT infrastructure management.

Equally important is network virtualization. Technologies such as SDN (Software-Defined Networking) enable the creation of virtual networks, providing flexible traffic management and improving corporate system security. In cybersecurity, virtualization is used to create isolated environments where

potentially malicious programs can be analyzed without risking the main system. This is implemented, for example, through sandboxes in antivirus solutions.

Virtualization also finds applications in gaming and emulation. Virtual machines enable the running of older games or software that is no longer supported by modern systems. Platforms such as VirtualBox and VMware are commonly used for this purpose.

For example, one of the most widespread forms of server virtualization allows running multiple virtual servers on a single physical machine. This reduces hardware costs, simplifies administration, and improves scalability. Such practices are widely used in the IT industry.

In the traditional (non-virtualized) server setup, each server runs a single OS, and the applications tied to it. This often results in underutilized resources, as the entire server's CPU, memory, and storage might not be fully consumed by the tasks it's running.

With so much emphasis on technology selections, deployments, maintenance, and support, it's easy for front-line administrators to forget that IT is there to serve the business - not the other way around. Today's businesses need and expect more agility from the IT department. New workloads must be brought online sooner, stay online longer, and have fewer user disruptions, even as budgets shrink or underlying hardware fails. Server virtualization technology and consolidation can provide much-needed flexibility, allowing administrators to meet business needs more promptly and efficiently. [2]

Server hardware virtualization has revolutionized computing resource management. It allows multiple operating systems (OS) to run concurrently on a single physical server, with each OS behaving as if it's running on dedicated hardware. This is achieved by abstracting the physical hardware from the operating systems using a hypervisor or virtualization software. [3]

Thus, virtualization is a key technology that promotes efficient computing resource utilization, cost reduction, and enhanced IT infrastructure security. It is applied in numerous areas—from server virtualization and cloud computing to cybersecurity, software testing, and gaming. Thanks to virtualization, businesses gain greater flexibility, and administrators can respond more quickly to changes and company needs. In today's world, where speed and scalability play a crucial role, virtualization remains an indispensable tool for IT development.

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