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## ANALYSIS OF CLOUD INFRASTRUCTURE AS A SERVICE-IaaS

АНАЛИЗ ОБЛАЧНОЙ ИНФРАСТРУКТУРЫ КАК СЕРВИС-IaaS

*Muradova Alevtina Aleksandrovna, Zaynobiddinov Shoxjahon  
Ziyodillaevich*

*TUIT named after Muhammad al-Khwarizmi, Department of Telecommunication  
Engineering, Email: [a.muradova1982@inbox.ru](mailto:a.muradova1982@inbox.ru), +998946126948*

**Annotation.** The article presents an analysis of cloud infrastructure as a service-IaaS. The features, operating principles and advantages of IaaS technology are discussed. Examples of the use of this technology by companies and business organizations are given. The main differences from PaaS and SaaS technologies are shown.

**Keywords:** *cloud infrastructure, infrastructure as a Service (IaaS), reliability, big data and analytics, IaaS service providers, platform as a service (PaaS), software as a service (SaaS).*

**Аннотация.** В статье представлен анализ облачной инфраструктуры как сервис-IaaS. Рассматриваются особенности, принцип работы и преимущества технологии IaaS. Приведены примеры использования этой технологии компаниями и бизнес-организациями. Показаны основные отличия от технологий PaaS и SaaS.

**Annotatsiya.** Maqolada bulutli infratuzilmaning IaaS xizmati sifatida tahlili keltirilgan. IaaS texnologiyasining xususiyatlari, ishlash tamoyillari va afzalliklari muhokama qilinadi. Kompaniyalar va biznes tashkilotlari tomonidan ushbu texnologiyadan foydalanishga misollar keltirilgan. PaaS va SaaS texnologiyalaridan asosiy farqlar ko'rsatilgan.

**Introduction.** By migrating to the cloud, a business can solve various problems. Some companies need to quickly host a website in the cloud, others need to get a ready-made environment for developers, and others need to organize remote access for employees to the ITSM system from any device. Cloud models are similar at first glance, but in fact they offer different levels of services. When a company delegates certain tasks to an IaaS provider, it frees up human and

financial resources for business development, creating new directions and innovative services [1].

Cloud infrastructure is the collection of hardware and software resources that make up the cloud. Cloud service providers maintain global data centers with thousands of IT infrastructure components, such as servers, physical storage devices, and networking equipment. They configure physical devices using all types of operating system configurations. They also install other types of software needed to run the application. Your organization can rent cloud infrastructure on a pay-as-you-go basis, allowing you to significantly save on the cost of purchasing and maintaining individual components. Every cloud hardware and software component helps developers provision virtual resources and deploy workloads in the cloud. There are many different types of cloud services that perform specialized cloud computing at different levels. The following components simplify cloud deployment. Servers are powerful computers installed by the cloud service provider in different data centers. Each server can be equipped with multiple processor cores and large memory storage, providing reliable computing capabilities. Cloud service providers use groups of interconnected servers to provide a wide range of cloud computing services [2].

Infrastructure as a Service (IaaS) is a business model that provides IT infrastructure, such as computing, networking, and storage resources, on a pay-as-you-go basis over the Internet. IaaS can be used to request and configure the resources needed to run applications and IT systems. You are responsible for deploying, maintaining, and supporting the applications, and the IaaS provider is responsible for maintaining the physical infrastructure. Infrastructure as a service allows you to cost-effectively provide flexibility and control over your IT resources.

You can use IaaS to scale your computing power while reducing your IT costs. Traditionally, enterprises purchased and maintained their own computing devices in an on-premises data center. However, this often required a significant upfront investment to handle high workloads only occasionally. For example, an e-commerce company triples its application traffic during the holiday season. To cope with this traffic, they have to purchase additional server machines, which remain idle until the end of the year [3].

**Research object and methods.** To solve this problem, cloud service providers such as AWS maintain highly secure data centers with a large number of hardware devices. They give you access to this cloud computing infrastructure on a pay-as-you-go basis. You get flexible and secure access to virtually unlimited resources to meet all your business, legal and regulatory requirements.

IaaS offers the following benefits to modern businesses. Speed. You can allocate any amount of resources in minutes, test and launch new ideas to market much faster. You can focus on your core business activities because others manage the entire IT infrastructure and computing resources. Performance. Cloud service providers have geographically distributed data centers that can be used to scale applications in locations that are physically closer to your customers. This may not be possible on your own if you have limited server capacity and geographic coverage. IaaS solutions provide many more capabilities that can be used to both improve computing performance and reduce network latency [4,5].

Reliability. IaaS providers such as AWS offer a highly reliable environment in which new virtual machines can be brought into production quickly and predictably. The service runs on Amazon's time-tested network infrastructure and data center. For example, the Amazon EC2 SLA guarantees 99.99% availability for each Amazon EC2 region. Backup and recovery. IaaS providers give you access to unlimited backup and disaster recovery infrastructure. For example, you can duplicate your applications across multiple servers so that if one fails, another will take over. Likewise, you can automatically and frequently synchronize data backups to ensure redundancy and business continuity. Competitive prices. IaaS is a cloud computing model in which customers pay only for the resources they use. This setup facilitates more efficient management of IT resources and encourages innovation by making cloud services accessible to small businesses [6].

**Research results and their discussion.** Cloud infrastructure can be used to improve operational efficiency and prioritize solution delivery over infrastructure management. An IaaS provider can help you improve the customer experience with high-performance, fully managed infrastructure. Let's look at some usage examples below. High performance computing. Complex tasks, such as analyzing large amounts of data or solving physics and chemistry equations, require significant computing power. Solving these problems in an IaaS infrastructure is more efficient and cost-effective than managing your own resources.

Website hosting. Organizations use cloud infrastructure to host high-performance web applications that are secure, scalable, and fully customizable to suit their content delivery needs. For example, Amazon Web Services (AWS) offers low-cost web hosting solutions that can be used to create a range of websites, from simple information sites to complex data delivery systems.

Big data and analytics. Companies analyze data to obtain business intelligence and actionable information. Cloud infrastructure includes storage technology for integrated storage of large volumes of data. The IaaS provider

supports big data analytics by providing cloud computing services that can be used to manage data more efficiently [7].

**Application Development.** Cloud infrastructure can be used to quickly set up separate testing and development environments. You can experiment and test new ideas in isolation or create shared development environments for the entire team.

IaaS works on the principle of virtualization. The IaaS platform allows you to select the type and configuration of the required infrastructure. The system then automatically creates digital versions of the underlying infrastructure. These virtualized computing resources mimic the behavior of physical resources. Everything works the same for you and your apps as it does on a physical device.

IaaS service providers also offer additional services to support infrastructure management. For example, you can use the services to perform the following tasks. View system logs and monitor performance. Implement consistent security controls across your entire infrastructure. Configure policies that automate common infrastructure tasks such as backups and load balancing. Examples of IaaS: Amazon Web Services (AWS); Cisco Metacloud; Microsoft Azure; Google Compute Engine (GCE) [8].

**How IaaS works.** All characteristics of the service, rights and obligations of the parties are recorded in the SLA - service level agreement. But the basic principle of interaction between the customer and the contractor can be described as follows: the client gets access to the provider's cloud resources, uses them and pays according to the pay-as-you-go model, that is, only for the amount of resources that he actually used; The cloud provider deploys the client's infrastructure on equipment in its or a partner's data center. It provides a ready-made cloud environment for full-fledged business operation and takes full responsibility for maintaining hardware and software.

The cloud provider is responsible for the stable operation of all IaaS elements, including: virtual servers. Servers on which you can install the necessary software; network settings. With its help, virtual servers communicate with each other, external servers and the Internet; user access control. Helps grant or restrict access to specific VMs; backup services. They help to quickly restore work without data loss if some element fails; cloud storage. Thanks to their large capacity and quick access, they are convenient for storing files, data or backups.

Cloud service providers offer a range of IaaS infrastructure resources for use as cloud computing services. These infrastructure services can be divided into three broad categories. Computing. Cloud computing resources include central processing units (CPUs), graphics processing units (GPUs), and internal memory (RAM) that computers need to perform any task. IaaS users request computing

resources in the form of virtual machines or cloud instances. Cloud services then provide the required capacity and you can perform your scheduled tasks in this virtual environment.

**Storage.** IaaS providers offer three types of storage resources. Block storage stores data in blocks, such as an SSD or hard drive. File storage stores data in the form of files, like a NAS. Object storage stores data in the form of objects, similar to object-oriented programming [9].

IaaS infrastructure also includes network resources such as routers, switches, and load balancers. IaaS models work by virtualizing the network functions of these devices in software. For example, you can use cloud services such as AWS Networking to run secure, high-performance cloud computing networks in your organization.

IaaS providers take full responsibility for securing the infrastructure provided for cloud applications. They manage security at all levels, such as the following. Physical security of the data center premises through measures such as CCTV cameras, security guards and surveillance. Infrastructure security through limited access and regular maintenance of the provider's infrastructure. Data security with very strict control, encryption and third-party auditing to ensure compliance with all compliance requirements [10].

**Scientific research results and conclusion.** There are three main cloud service models. Infrastructure as a service. Platform as a service. Software as a service.

Platform as a service (PaaS) provides hardware and software infrastructure that can be used to develop and maintain applications. The cloud service provider hosts hardware and software development tools in its data center. With PaaS, you can build, test, run, and scale applications faster and more cost-effectively than on-premises infrastructure.

Software as a service (SaaS) provides the entire software application over the Internet. You can use it to perform various tasks. The cloud service provider hosts the hardware, software tools, and application itself in its data center. You have more control over the configuration of cloud resources in IaaS than in PaaS and SaaS. PaaS and SaaS virtualize more infrastructure functions and you need to manage fewer components compared to IaaS. Cloud service models in practice. Let's say you want to implement an email application in your organization. If you decide to manage your own infrastructure, you must follow these steps: Purchase a physical server. Install all the necessary software and operating systems on it. Write the email application code and install it on the server. Perform hardware and



software maintenance on a regular basis. On the other hand, if you switch to a cloud computing service, you can choose from the options below.

IaaS. You provide Amazon EC2 virtual cloud servers with operating systems pre-installed on them. The application code and associated software must be installed on the virtual machine.

PaaS. AWS Lambda is used to run application code without provisioning or managing infrastructure. For example, you can simply write and download the application code as a ZIP file.

SaaS. Amazon WorkMail is used as a secure, fully managed business email and calendar service. You don't have to write your own application code or even worry about provisioning cloud servers and cloud storage infrastructure. Your team can directly create WorkMail accounts and send and receive email [11].

Choosing between IaaS, PaaS, and SaaS offerings depends on your application requirements. One option is not necessarily better than the other. It depends on why you're running the application, your performance and configuration requirements, and who your users are and where they are located. You can implement IaaS by selecting the right IaaS provider and training your team members to use the cloud computing services offered by the IaaS provider. Follow the steps below to achieve a successful IaaS implementation. It's important to understand your company's basic infrastructure requirements for the use cases you want to start with. For example, hosting web applications places different demands on server and network resources than big data analytics. If your organization is new to digital transformation, it's best to start with a small core team that will lead the change moving forward. The team can solve a small problem and share their findings to increase awareness and enthusiasm for cloud computing.

Different cloud providers have different levels of capabilities. Do your due diligence so you don't run into problems later. It is always better to go with a well-established IaaS provider that offers a wide range of services so that you can easily manage even changing requirements. Migration is a gradual process that requires planning to avoid disruptions. You can also run hybrid clouds, in which some applications, or even components of one application, run on on-premises infrastructure and other components run on the IaaS provider's infrastructure.

AWS is the world's most widely used cloud platform, delivering more than 200 full-featured services to data centers across the planet. Millions of customers, including fast-growing startups, the largest corporations, and leading government agencies, use AWS to reduce costs, increase agility, and accelerate innovation.

AWS offers many more services and capabilities within them than any other cloud solution provider. With them, the client will be able to move current applications to the cloud faster, easier and cheaper and implement any possible projects in it. For example, you can use the services listed below. Amazon EC2 offers the most comprehensive and advanced computing platform, allowing you to choose your processor, storage, network, operating system, and purchasing model. Amazon S3 offers the industry's leading object storage service that can be used to store and protect any amount of data for virtually any use case, such as cloud applications, data analytics, and mobile applications. Amazon VPC offers a logically isolated, fully customizable virtual network that you can use to define and run AWS resources, as well as secure and monitor connections.

**Final conclusion.** The choice of a cloud model depends on business objectives. Each cloud model offers specific features and capabilities. When a business has a set of specific tasks and an understanding of the benefits of different types of cloud services, it is easier for them to choose the right one. IaaS solutions enable businesses to use computing power without having to purchase expensive hardware. PaaS allows specialists, based on a ready-made platform, to quickly develop new IT services and release them to the market. With SaaS, employees can work from anywhere in the world, while software support is handled by the service provider.



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