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ANALYSIS OF PERFORMANCE TESTING OF IaaS CLOUD INFRASTRUCTURES

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ABSTRACT

The article presents an analysis of IaaS cloud infrastructure performance testing. It shows how to properly test a cloud before deploying the infrastructure. The main difficulties in cloud testing are considered. Effective tools used in testing and problems that arise during cloud testing are presented.

Keywords: *infrastructure as a Service (IaaS), scenarios for using IaaS, performance of a classic software system, SOASTA CloudTest, Load Impact, Blaze Meter, Smart Bear Load Complete.*

АНАЛИЗ ТЕСТИРОВАНИЯ ПРОИЗВОДИТЕЛЬНОСТИ ОБЛАЧНЫХ ИНФРАСТРУКТУР IaaS

АННОТАЦИЯ

В статье представлен анализ тестирования производительности облачных инфраструктур IaaS. Показано как правильно тестировать облако перед размещением инфраструктуры. Рассматриваются основные сложности при тестировании облака. Представлены эффективные инструменты, используемые при тестировании, проблемы возникающие при тестировании облака.

Ключевые слова: *инфраструктура как услуга (IaaS), сценарии использования IaaS, производительность классической программной системы, SOASTA CloudTest, Load Impact, Blaze Meter, Smart Bear Load Complete.*

INTRODUCTION

Infrastructure as a Service is a more complex service model. It involves leasing the computing resources a company needs on a subscription basis. Instead of purchasing expensive equipment that requires maintenance and is prone to rapid obsolescence, a company can use the computing resources it needs directly from the cloud. As part of the IaaS service, the client leases virtual servers (VPS or VDS), a network infrastructure that ensures their connection with each other and with the company, as well as protection of the communication channel using VPN, a load balancer, and, finally, access to an administrative panel in which you can manage access and user rights, as well as scale the capacities that are included in the subscription package. Along with the infrastructure, you can request related services from the provider: cloud data storage with fast access and a volume that can be increased as needed, as well as a data backup service [1].

RESEARCH OBJECT AND METHODS

There are many scenarios for using IaaS. Cloud infrastructure is relevant for those companies that, for whatever reason, do not want to maintain their own computing power or even want to get rid of it. Such a desire will allow you not to develop additional competencies that are not typical for the company's core business (infrastructure requires support and development), save on purchasing equipment and arranging premises, and optimizing staff. IaaS will come in handy when you need to quickly launch a business or a new project, with a lack of funds for capital investments, in cases where a sharp increase in the volume of computing power is needed (here we can recall the same seasonality that many companies and even industries face).

For example, seasonality is typical for many companies in the e-commerce segment, especially if they specialize in selling specific groups of goods. Online stores for construction or gardening experience peak loads in the warm months, clothing and footwear sellers - in the spring and autumn.

Finally, the entire e-commerce segment experiences a colossal load during sales. Very often, it is necessary to sharply increase the performance of your systems for literally several months or even weeks, and then return to normal consumption volumes. The IaaS service, which can be obtained from Rusonyx, is the optimal solution for such enterprises. Launching additional servers, increasing their performance, expanding access to the infrastructure for temporary personnel - all this is available from the Rusonyx client control panel. The administrator will only need to move a few sliders to get everything they need in a few minutes. In this case, you can select the required number of processors used by the servers, the amount of memory, and the operating system, and the drives used. When talking about a cloud structure

built on the IaaS model (infrastructure as a service), they do not mean a separate cloud server - a virtual machine instead of a physical one - but an interconnected pool of IT resources deployed on rented capacities. When choosing a cloud for hosting infrastructure, users often ask for a "test drive" to evaluate the ease of use and resource performance. Many, even experienced specialists, have a simplified idea of the testing process, so they limit themselves to running a set of synthetic or working tests. Similar tests are used for desktop computers. In practice, such researchers face difficulties due to the relative novelty of cloud technologies and the differences between virtual machines and "hardware" servers. Even experienced IT specialists often lack the knowledge and experience in testing cloud resources, and there are no generally accepted standards [2].

Here is the main reason: the performance of a classic software system is assessed under a certain workload for a fixed configuration. But it is impossible to ensure a stable load and resource configuration in a public cloud. To adapt to changing tenant conditions, providers automatically allocate and release resources "on the fly".

Instead of measuring the average performance of a static system under maximum load, it is more logical to evaluate other characteristics. For example, the ability of cloud services to adapt to changing loads in terms of performance and costs. An additional metric should cover the reliability of these services in the event of individual node failures, as well as in the event of a complete data center shutdown. This problem arises when it is necessary to compare the obtained results. Different providers offer services that do not match in content: with different capabilities; with different guarantees; with its service parameters specified in the SLA agreement.

What is important to remember before testing: distributed computing technologies are developing rapidly and there are many incompatible implementations; the cloud IaaS market is young and is in the development and experimental stage; the user does not have direct contact with the equipment, so he interacts with the rented resources remotely, through a web interface; professional software packages for testing are quite expensive [3].

RESEARCH RESULTS AND THEIR DISCUSSION

Can "hardware" tests be applied to the cloud? To evaluate the performance of a desktop computer, several sets of tests are used - separately for the central and graphic processors, RAM and disk memory, network adapters. The test results of the latest processors and video cards become the subject of discussions on the Internet. The skepticism that such tests cause is quite justified. The equipment is often switched to a mode that is not used for daily work in order to get record results. Before testing, processors and memory are often "overclocked" with additional cooling, risky

experiments with fine BIOS settings, beta versions of device drivers, etc. The winners may be pleased with the numbers they receive, but they are unlikely to be able to continue working stably with such hardware and software settings. As for the virtual environment, it is impossible to “overclock” the components there.

The operating principle of a VM differs significantly from that of physical hardware that users are accustomed to. If the processor core of a physical computer is uniquely localized on the CPU crystal, then in IaaS it is an imitation of a quota allocated from the total capacity of the cloud. This virtual quota is created using a hypervisor. Each user is provided with an ordered volume of resources, but the actual state and status of the cloud infrastructure is constantly changing: when adding and removing running “instances” - abstractions of runtime environments, virtual machines; after starting and stopping running applications; due to fluctuations in user load; during backups, data recovery [4].

Differences in the structure of the physical CPU and virtual machine

Thus, there is a high probability that when re-running the same test at different times, the results will not be identical. The answer to the question of the applicability of tests for physical equipment to cloud infrastructures can be as follows: it is possible to apply “hardware” tests to the cloud, but the practical benefit from this is small.

How to test cloud infrastructures? Basic tests for clouds should take into account the modern specifics of distributed computing and remote user work on resources that are provided on demand in automatic mode, with the ability to scale in both directions.

SCIENTIFIC RESEARCH RESULTS AND CONCLUSION

Testing the performance of individual subsystems (processors, memory, disks) for a comprehensive assessment of the cloud is clearly not enough, unlike similar tests of desktop computers. But they are still used for the very initial check of IaaS performance.

Economic feasibility for business is one of the main factors that stimulate the development of cloud computing. This includes service availability, stable operation under load fluctuations, security, backup and much more. These aspects are not always assessed by performance figures, but affect the comfortable and predictable use of the service by the user. Thus, you should not limit yourself to formal testing using even the most powerful software. A minimal (and sufficient, in most cases) testing scenario before starting work may look like this: measuring the performance of virtual machines in the cloud; testing the speed of data transfer between infrastructure nodes; checking the availability and scalability, elasticity of the cloud service at different times of the day; testing the functionality of backup and data recovery; assessing the response time of the provider's technical support to the request. For professional research and

assessment of the performance of cloud resources, you can use this test software: SPEC Cloud (TM) IaaS 2016 Benchmark; Hewlett Packard Enterprise StormRunner Load; LoadStorm; SOASTA CloudTest; LoadImpact; BlazeMeter; SmartBear LoadComplete; Spirent Blitz; SendGrid Loader.

These and similar packages require serious preparation and high user qualifications to use. This software is available by subscription or for a one-time fee; however, some of the listed packages are offered in a demo version with a limited validity period and limited capabilities [5, 6].

In any case, it is necessary to have a well-thought-out plan - a scenario for preparing and launching measurements, collecting and obtaining results (benchmarks). In this case, the concept of SUT (System Under Test) is used - a set of mandatory components for launching a measurement scenario. This set includes those cloud components whose parameters are of interest to the user and all the others, the functionality of which cannot be avoided during testing and whose parameters must be known in advance. In addition, the software package contains drivers that simulate the workload for the IaaS infrastructure being tested.

FINAL CONCLUSION

For cloud testing, it is worth using specialized tests, rather than using "hardware" ones due to significant differences in the principles of their operation. The best way to evaluate the capabilities of the cloud infrastructure is to use tests that simulate the real operation of systems. Moreover, it is not enough to evaluate the performance of the components. There are other factors that affect the efficiency of work in the cloud that cannot be assessed using hardware testing. These factors include the response time of the provider's support, fault tolerance, data protection, etc. When preparing for testing, discuss this with the provider's technical support. This way, you will receive qualified advice in advance, and avoid misunderstandings due to the incompatibility of the hardware resources or the provider's virtualization system with the test software package selected for the project.

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