

## ABSTRACT

Master dissertation: 116 pp., 17 fig., 7 tab., 1 app., 53 sources.

**Topicality.** The concept of data centers is embodied by many large corporations to provide access to a large number of users to certain resources. Effective management of the data center is connected with the need to solve a number of problems, first of all, creation of conditions for functioning of information and computing facilities of data centers, management of virtualized resources, maintenance of reliability and safety. By investing, hosting companies are hoping for profit and expecting a reduction in the cost of operating the data center, reducing the cost of customer service, which will eventually lay the foundation for effective business, both for the company itself and for customers.

Ensuring the level of user requirements by minimizing costs is the essence of the problem of managing the functioning of the data center. Typically, this complex problem is divided into a number of smaller tasks, but not so much simpler. One of them is the task of resources and load management in datacenter.

In this regard, it is important to develop a reinforcement learning algorithm [1] for managing virtualized resources that will help reduce power consumption and SLA violation time.

**Relationship of work with scientific programs, plans, themes.** The research was carried out at the Department of Computer-Aided Management And Data Processing Systems of the National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute» within the theme «Development and implementation of an IT infrastructure management system with consolidated information and computing resources» (№ 0115U000322).

**The aim of the research** is to improve the quality of virtualized cloud computing resources management by developing a management algorithm that reduces power consumption and SLA violation time.

To achieve this goal, the following tasks must be performed:

- analyze the object environment of the virtualized data center resources management;
- review the methods of computing resources management;

- choose the simulation environment of data center;
- develop a data center model in a selected simulation environment;
- develop models of power consumption by physical servers;
- prepare data for simulating the dynamic load of virtual machines in data center;
- develop a modified reinforcement learning algorithm for managing the virtualized computing resources of data center;
- develop the software implementation of the reinforcement learning algorithm;
- make a research of developed algorithm effectiveness.

**The object of research** is a process of virtualized computing resources management in data center.

**The subject of research** is a methods and algorithms for virtualized computing resources management in data center.

**Research methods** are methods of machine learning, which based on reinforcement learning.

**Scientific novelty of the obtained results.** The possibility of reinforcement learning usage for of virtualized resources management of cloud data centers is analyzed. The method of dynamic placement of virtual machines on the basis of reinforcement learning is developed, which, when choosing controlling influences, takes into account power consumption and SLA violation time. An agent algorithm is developed which takes into account the changes in the workload on resources for deciding whether to turn on or switch to sleep mode of underutilized physical servers in order to reduce the cost of electricity. The proposed reinforcement learning agent is based on the  $Q$ -learning method [**Ошибка! Источник ссылки не найден.**], which allows determining approximation to optimal policy of controlling the modes of the physical server operation without prior load information.

**Publications.** The materials of research are published in theses of the 10th All-Ukrainian Scientific and Practical Conference «Computer Intelligent Systems and Networks» [**Ошибка! Источник ссылки не найден.**]; published in theses of the 18th All-Ukrainian Students' Scientific and Practical Conference «Science and Technology of the XXI Century» [**Ошибка! Источник ссылки не найден.**]; published in theses of the

scientific and practical conference «Informatics and Computer Science-ICS-2018» [Ошибка! Источник ссылки не найден.]; published in journal «Scientific News of Dahl University» [Ошибка! Источник ссылки не найден.]; presented at the 14th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering – TCSET-2018, Lviv-Slavske, Ukraine and published in IEEE Xplore Digital Library [Ошибка! Источник ссылки не найден.].

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