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The experience of deploying a virtual computer lab in education —running failover clusters in a virtualized environment

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When training highly skilled IT professionals, it is an important challenge for the university to teach professional competencies to graduates that they will be able to use to successfully solve a broad range of substantive problems that arise at all stages of the lifecycle of corporate information systems. Such information systems in practice, as a rule, are used for enterprise management, workflow management in technological processes, IT infrastructure management, creating web-solutions for high availability, data collection, and data analysis and storage. It is obvious that in order for students to learn these professional competencies, they need to master a large amount of theoretical material and to carry out practical exercises and research on the development of modern information systems, their deployment and support, the effective implementation of solutions for problem-oriented tasks, etc.

The organization of an effective process for the goal-directed training of IT experts has demanded a speedy solution to the following problems: an often insufficient number of classroom hours for students to cover a necessary and sufficient set of practical exercises that help students learn complex information systems; on a typical personal computer with average capabilities it is impossible to get real practical experience working with multi-component information systems because the hardware requirements for such systems often go beyond what is offered on typical home, office and laptop computers; sometimes there are difficulties installing and supporting some information systems, and these problems cannot be solved without gaining experience about how to use such systems; the single-user license cost is too high, and in most cases, such a license is required only for the duration of the learning process.

The main way to solve these problems has been to create a virtual computer lab that is able to solve the problem of insufficient computing and software resources and to provide an adequate level of technological and methodological support; to teach how to use modern technologies to work with distributed information systems; to organize group work with educational materials by involving users in the process of improving these materials and allowing them to communicate freely with each other on the basis of self-organizational principles.

The virtual computer lab provides a set of software and hardware-based virtualization tools that enable the flexible and on-demand provision and use of computing resources in the form of "cloud" Internet services for carrying out research projects, resource-intensive computational calculations and tasks related to the development of complex corporate and other information systems. The service also provides dedicated virtual servers for innovative projects that are carried out by students and staff at the Institute of System Analysis and Management.

The presentation (master class) will demonstrate the deployment of a failover cluster in a virtual computer lab environment. It will emphasize the service's features that have been adapted to the needs of the educational process at the university. We have chosen to highlight this use case deliberately. The task of designing and deploying failover clusters forms the topic of several special courses, which are designed to satisfy the demand for these skills by modern companies. When designing corporate information systems and ensuring the availability of critical applications that are independent of a particular hardware and software environment, it is critically important to ensure the successful implementation of many key business processes. Downtime, including for scheduled maintenance, leads to additional costs and the loss of customers, and the long outages are simply unacceptable for modern high-tech enterprises. In learning such practical skills, students

must independently master the requirements for creating a failover cluster; determine the critical components that require redundancy; configure virtual machines; become familiar with advanced data storage tools and technologies, the principles for creating distributed systems, different types of server operating systems (Windows and Unix), and ways for ensuring their interoperability; learn about communication protocols on the basis of iSCSI; set up computer networks; draft security policies; and solve the problem of integrating system components.

The task of deploying failover clusters demonstrates the capabilities of the virtual computer lab. It also illustrates how it can be used as part of practical lessons and extracurricular work, making it possible to train IT professionals in accordance with the requirements of the most advanced educational and professional standards.

The implementation of a virtual computer lab makes it possible to implement innovations, and it represents a significant leap forward over traditional educational approaches.

It should also be emphasized that the virtual computer lab has helped us provide an optimal and sustainable technological, educational-organizational, scientific-methodological, and regulatory-administrative environment for supporting innovative approaches to computer education. It promotes the integration of the scientific and educational potential of Dubna State University and the formation of industry and academic research partnerships with leading companies that are potential employers of graduates of the Institute of System Analysis and Management.

The results that the Institute of System Analysis and Management has achieved in improving the educational process represent strategic foundations for overcoming perhaps one of the most acute problems in modern education: the fact that it tends to respond to changes in the external environment weakly and slowly.

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