Analysis, specification and verification
requirements for control systems cloud training platforms

Elvira Faridovna Matveeva

Astrakhan State University, 20a Tatischev Str., Astrakhan, 414056, Russia

EF.Matveeva@gmail.com

Rainer Unland, Martin Gröger, Dietrich Brandt, Torsten Brinda,
Vardan Surenovich Mkrttchian

HHH University, P.O. Box 759, Lane Cove, Sydney, 1595, NSW, Australia

hhhuniversity@hotmail.com

Abstract. Digital control systems are now an essential and critical part of Cloud Training Platforms. Numerous methods, tools and standards have been developed to ensure that such systems will comply with their requirements. However, the development of such requirements often does not receive the same level of attention. Indeed, in the case of highly reliable, mission-critical or safety-related control systems, operating experience shows that problems due to inadequate requirements tend to outnumber those due to incorrect design and implementation. This paper proposes an approach to the analysis, specification and verification of Sliding Mode control systems requirements for Bus Cloud Triple H-Avatar.

Key words: control system; sliding mode; cloud training platform; digital system; analysis; specification; verification.

Э. Ф. Матвеева[*]**, Р. Унланд**[#]**, М. Грогер**[#]**, Д. Брандт**[#]**, Т. Бринда**[#]**, В. С. Мкртчян**[#]**. Требования к анализу, спецификации и верификации систем управления облачных обучающих платформ**

Аннотация. В настоящее время цифровые системы управления являются неотъемлемой и важной частью облачных обучающих платформ. Многочисленные методы, инструменты и стандарты были разработаны для того, чтобы такие системы будут соответствовать их требованиям. Тем не менее, разработка таких требований часто не получают тот же уровень внимания. Действительно, в случае высокой надежностью, критические или системы управления, связанные с безопасностью, опыт эксплуатации показывает, что проблемы, связанные с неадекватными требованиями, как правило, больше, чем тех, из-за неправильного проектирования и реализации. В докладе предлагается подход к анализу, спецификации и верификации требований для системы управления Bus Cloud Triple H-Avatar, которая эксплуатируется в скользящем режиме.

Ключевые слова: система управления; скользящий режим;

образовательные облачные платформы; анализ; спецификация; верификация; цифровая система.

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Университет управления и информационно-коммуникационных технологий – HHH University, аб. ящик 759, Лейн Ков, Сидней, 1595, Новый Южный Уэльс, Австралия[#].

E-mail: Ef.matveeva@gmail.com[*], hhhuniversity@hotmail.com[#].

Digital control systems are now an essential and critical part of Cloud Platforms. Numerous methods, tools and standards have been developed to ensure that such systems will comply with their requirements. However, the development of such requirements often does not receive the same level of attention. Indeed, in the case of highly reliable, mission-critical or safety-related control systems, operating experience shows that problems due to inadequate requirements tend to outnumber those due to incorrect design and implementation. This paper proposes an approach to the analysis, specification and verification of control systems requirements for Bus Cloud Triple H-Avatar. The semantic center of the HHH University Cloud Serviced Bus is a cloud-based platform and environment of distance learning for the implementation of the cloud approach are used for the Xeon hypervisor and IaaS cloud platform Eucalyptus, providing load sharing capabilities between virtual machines, and add the output of cluster resources of use and other Cloud infrastructure wraps educational environment "hhh" Education technology that provides tools to create and deploy a variety of services for online learning that can be seen as a cloud-based educational platform as a service (PaaS), creating educational platforms, need to consider the peculiarities of the student audience and, as a rule, limited opportunities for IT professionals, universities, maximum ease of access and use of the solution, and administration, expansion and maintenance. To access environment "hhh" Education technology on the target device requires only a browser, meaning users do not need to acquire special skills to work with system administrators to monitor only the centralized cloud part of the solution, since no software updates to client workplace is not required. The platform is supports the work with personalized curriculum, the creation of interactive manuals in various formats, including support for audio and video, implementation of laboratory works, testing, and launch various applications. The system also includes special modules for Dean and rector, allowing obtaining the statistics of different level of detail on the use of the various courses, forming schedules and performing tests. Such a view of the

system «bird's eye», which provides an opportunity to dig into the data up to the individual teacher or student, allow the management of the University, on the one hand, to analyze the performance of faculty and students, and on the other, to evaluate the effectiveness of the application of the platform in the educational process.

The platform provides tools for creating new educational services; SaaS included five Russian Software Patents from Astrakhan State University and HHH University license. Creating a virtual platform with the ability to access from anywhere, with any device to a variety of educational services is determined HHH University is not just a desire to be at the forefront of information technology, that is also present, but also a vital necessity associated with a number of features of operation and development of the University..All of these demands were pushed to the establishment of a centralized virtual environment with guests universal remote access, sufficient potential for scaling and adaptable to support a wide variety of educational resources and means of educational process management in the online mode. In fact task was to build a private cloud University. The semantic center of the HHH University Cloud Serviced Bus is a cloud-based platform and environment of distance learning for the implementation of the cloud approach are used for the Xeon hypervisor and IaaS cloud platform Eucalyptus, providing load sharing capabilities between virtual machines, and add the output of cluster resources of use and other Cloud infrastructure wraps educational environment "hhh" Education technology that provides tools to create and deploy a variety of services for online learning that can be seen as a cloud-based educational platform as a service (PaaS), creating educational platforms, need to consider the peculiarities of the student audience and, as a rule, limited opportunities for IT professionals, universities, maximum ease of access and use of the solution, and administration, expansion and maintenance. To access environment "hhh" Education technology on the target device requires only a browser, meaning users do not need to acquire special skills to work with system administrators to monitor only the centralized cloud part of the solution, since no software updates to client workplace is not required. The platform is supports the work with personalized curriculum, the creation of interactive manuals in various formats, including support for audio and video, implementation of laboratory works, testing, and launch various applications. The system also includes special modules for Dean and rector, allowing obtaining the statistics of different level of detail on the use of the various courses, forming schedules and performing tests. Such a view of the system «bird's eye», which provides an opportunity to dig into the data up to the individual teacher or student, allow the management of the University, on the one hand, to analyze the performance of faculty and students, and on the other, to evaluate the effectiveness of the

application of the platform in the educational process. The platform provides tools for creating new educational services; SaaS included five Russian Software Patents from Astrakhan State University and HHH University license:

1) Russian Patent # 2011613106 "Adaptive test module for distance education Moodle";

2) Russian Patent # 2011614922 "Module Virtual University for distance education Moodle";

3) Russian Patent # 2011614923 "Electronic payment module for distance education Moodle";

4) Russian Patent # 2012619459 "Program for online cloud laboratory in applied science worked in sliding mode";

5) Russian Patent # 2013614793 "System optimization of the course and its adaptation to the user".

Workstation supports various possibilities of forming a new learning content, from simple making online access presentations or PDF files to their arrangement in the interactive training courses, creation of test tasks, etc. All of this work, according to Professor Vardan Mkrttchian, can be mastered by any teacher, so HHH University, received at the first stage of the project a specific set of educational services is an opportunity to expand the ENPI in accordance with their needs, not resorting to the help of external consultants. The more difficult task is to deploy cloud applications, but it is in most cases can be resolved by IT-specialists. As a result of the project will create a cloud platform, which will be presented as a service in the automatic mode most modern and innovative learning technologies Chemistry and laboratory for modeling and design of new Poly-functional materials (see learning model in fig. 1)
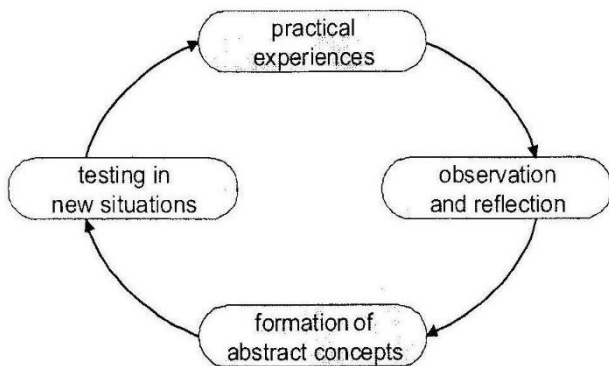

Fig. 1. Learning model