

# Good-Bye Localhost: A Cloud-Based Web IDE for Teaching Java EE Web Development to Non-Computer Science Majors

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**Abstract**—While cloud- and web-based Integrated Development Environments (IDE) are used in practice and education for some time, these are mainly intended for classical web development. Support for enterprise platforms such as Java Enterprise Edition (EE) is typically lacking. However, in higher education, web-based cloud IDE are particularly useful in software development courses for non-computer science major students, since they could help to overcome the participants' limited IT skills. Thus, a respective easy-to-use web IDE is required. Therefore, in this paper a software platform for a web-based cloud IDE for educational purposes is proposed and evaluated, which in particular supports Java EE and is suitable for non-computer science majors. The platform was evaluated in a classroom experiment. The results indicate that it is useful and beneficial for the students, allowing the lecturer and the students to focus more on the actual learning objectives.

**Index Terms**—Web Development Education, Java EE, Higher Education, Non-Computer Science Majors, Cloud Computing

## I. INTRODUCTION

Programming is increasingly becoming part of study programs that are not primarily connected with software development or computer science, so-called non-computer science majors [1]. Regardless of the programming language used, the main focus of these students should be on learning and understanding programming itself [2], [3]; dealing with complex development environments, including associated challenges like source code management and backups, can be a critical didactical challenge due to time constraints and a lack of basic knowledge about system administration in general [1].

When installing the development environment and components like the Java Development Kit (JDK), web servers or database management systems, heterogeneous devices regularly lead to various issues like inadequate permissions and individual device errors in combination with missing background knowledge. The time required for installation and configuration of the tools is lacking for teaching the actual content of the course [4]. Using cloud services [5] could be an option to overcome these difficulties. Nowadays, modern approaches of software engineering education often apply cloud services [3], [6]–[8] to get a quick and user-friendly

solution for specific needs and to save some of the time spent for preparation tasks.

Therefore, in this paper a software platform for a cloud-ready, web-based IDE for educational purposes is proposed, which supports Java EE development (and other platforms) and addresses the needs of non-computer science majors. By its evaluation in a classroom setting, the question is addressed, whether the proposed platform is suitable for this purpose and it is useful for students and lecturers to replace a local IDE by a web-based IDE.

## II. RESEARCH DESIGN AND ARCHITECTURE OF THE WEB-BASED IDE

According to the approaches of Design Science Research (DSR) [9], input by relevant target groups (students, lecturers and technical IT staff) was collected via interviews to elaborate requirements for the cloud-based IDE. Based on these requirements, first a system architecture for the intended web-based IDE was designed, which supports easy-to-use workspace deployment.

Second, a suitable existing cloud-enabled IDE was selected according to this architectural model, serving as the basis for a proof-of-concept implementation. Here, Eclipse Che<sup>1</sup> was selected, using the JBoss WildFly application server<sup>2</sup> for Java EE support. Figure 1 shows an overview of this proposed solution architecture.

This artifact was evaluated by means of a teaching experiment including a qualitative study using semi-structured interviews, with respect to the hypothesis that it facilitates Java EE web development education.

## III. EXPERIMENTAL EVALUATION IN THE CLASSROOM

The evaluation was performed at a German university of applied sciences in an undergraduate course on Business Information Systems in a lesson on Java EE-based SOAP web service development using Enterprise Java Beans (EJB). Nineteen of the twenty students in the class returned the

<sup>1</sup><https://www.eclipse.org/che/>

<sup>2</sup><http://wildfly.org/>

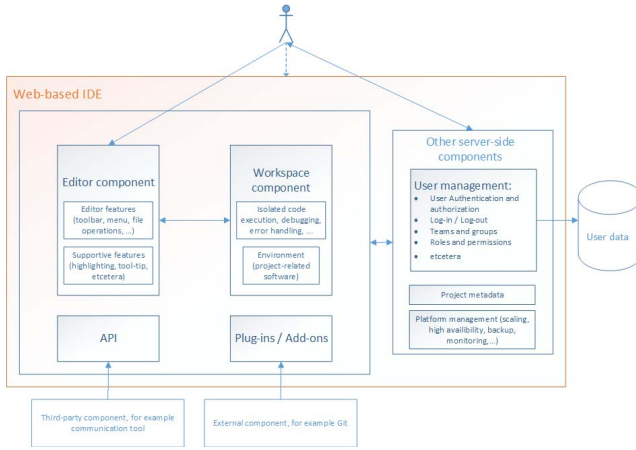


Fig. 1. Architecture overview of the proposed web-based IDE for learning Java EE development in higher education.

completed questionnaires at the end of the lecture, containing questions regarding their previous programming experiences and their perceptions of Eclipse Che and its integration in the lesson. Workspaces provided to the students contained everything required to start working on the programming exercises instantly by making use of Eclipse Che's *Factories* feature. The students accessed their ready-to-use workspace simply by opening an URL.

#### IV. RESULTS

The self-assessment of the general programming experiences and specifically Java EE knowledge confirmed the assumption that most of the participants have very little experience so far. Nevertheless, students seemed to be interested in the course and claimed to enjoy programming exercises.

Majority of the students felt confident using the system. Besides, there were only very few questions about the operation of the IDE during the lesson. The workspace generation process in Eclipse Che was considered very positive.

Participants were asked on what they particularly liked or disliked about the approach. They considered the web IDE as fast, easy and simple to use, and emphasized that no download was needed and the system provided a user-friendly plug-and-play experience. The device independency was also mentioned as an advantage. There were no relevant disadvantages named.

In order to receive a more in-depth feedback, interviews with a convenience sample of three students and the lecturer were conducted after the lesson. Some advantages and disadvantages mentioned during these interviews were the improved focus on the content, the significant time savings, the possibility to hide unimportant complexity of installation tasks but also the dependency on the network availability and the preparation time needed by the lecturer in advance of the lesson.

#### V. CONCLUSION

In conclusion, in this paper a software platform for a cloud-ready, web-based IDE for educational purposes has been

proposed and evaluated, which in particular supports Java EE development. The solution is intended to provide an easy-to-use solution suitable for teaching core concepts of Java EE development also to non-computer science major students with limited technical knowledge.

Both, the expert interviews as well as the students confirmed the usefulness of a web-based solution. The feedback of the students and the lecturer indicates that the web-based IDE represents a significant benefit. Eclipse Che has proven to be a suitable solution, which offers many possibilities, but also requires extensive initial adjustment by the administrator.

There were no significant drawbacks during the experiment, but it turned out that much more effort had to be made by IT staff to operate and prepare the platform. However, a cloud-IDE could also be purchased on-demand, as some public providers exist. Since systems like Eclipse Che can be run entirely on open source software, there is at least the option to operate it on-premise.

While the results indicate the feasibility of the approach in general, further work is needed to set up a production-quality environment usable in university education on a larger scale, and to evaluate it further in a comparative evaluation. In particular, the impact of different IDE or plugin configurations needs to be further investigated, e.g. with respect to specific database settings or network connections.

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