RICH INTERNET APPLICATIONS IN EDUCATION

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Abstract

Different technologies that enable Rich Internet Applications will be given and compared. In the last part of the paper the possibility of simulation of natural phenomena, mostly in physics is demonstrated. As a practical example the already known xyZET authoring tool which enables creation and simulation of physical experiments will be considered. The current java version of this program was converted to ActionScript 3 and the results of such conversion will be analyzed and explained.

1. Introduction

The concept of Rich Internet Applications (RIA) is known for several years but the technologies that represent the basis of RIA are still in violent development. Rich Internet Applications are WEB applications which have some positive features of popular desktop applications but we usually access to them through WEB browser with appropriate plug-ins or through sandboxes and virtual machines.

RIA are usually (but not necessarily) running on user's computer (client computer) and this decreases the load of a server. At the same time the user interfaces gain better responsiveness.

One of the major benefits of RIA is platform independent delivery of contents. Some Rich Internet Applications are running inside a WEB browser and this permits the access to them from anywhere. They are frequently HTML and JavaScript based and such technology is known as Ajax.

On the other side desktop Rich Internet Applications decrease the gap between classical desktop applications and WEB technologies and in such a way offer more functionality.

There are different approaches how to implement RIA in educational processes. Some concepts are already well known to young people from the everyday experience and WEB entertainment: Facebook, YouTube and MySpace. RIA technologies augment the flexibility of learners and improve their workflow in the classroom and outside it. In the classroom the learning techniques could be improved. One example could be represented by collaboration games which diminish the gap between the abstract and real world. The learners can get a better control on data by using intuitive interfaces. In such a way they get a better “feeling of ownership” on what are they doing.

2. Used technologies

Development of Rich Internet Applications is mostly achieved with Ajax, Flex and Microsoft Silverlight. The development effort is similar in all these cases.

Flex is based on popular Adobe Flash player which is in usually already installed on most computers. The applications are programmed in ActionScript 3 and with development tools like Flex Builder and Flash Develop.

Silverlight is a Microsoft technology independent from a particular browser. The compatibility with .NET enables an easy development and usage. In analogy to Flex also SilverLight runs on a browser’s plug-in. This avoids compatibility problems however its popularity is currently

smaller. Silverlight contents can be created with known and popular development tools, first of all with Visual Studio.NET. A very interesting development tools is Microsoft Expression. The same project can include the code for server's components and for corresponding players.

When comparing Flash and Silverlight we can conclude that Silverlight is more oriented in developers of applications and that Flash has origins to support animations. Open source Flex could be the step into the right direction.

3. Examples of RIA technologies in education

Rich Internet Applications can support educational processes in various ways.

WEB based education and collaboration is more and more prevailing. An example of collaborative technology is Office Live Workspace. It represents an environment which merges WEB and desktop and enables collaboration between teachers and learners.

Learning Laboratory in Wharton School developed several classroom simulations, in fact collaborative games based on Flex technology. One such simulation entitled "Tragedy of Tuna" (Orts 2009) is a typical example of "tragedy of common resources". Such common resources (for example air, water...) could be exploited by everybody and nobody is responsible for their conservation. As people are not responsible for comfort of future generations this leads to tragedy. The mentioned example of Tuna Tragedy puts students in such position: every group of students represents a particular country with its tuna fishing fleet. They should balance their decisions that impact commonly shared resource.

We could raise the question how RIA could be used in particular subjects. Such good examples are still missing. Flex and Silverlight offer an environment which could use 2D – and 3D graphics for better visualization. This could be particular useful for various simulations of natural phenomena. Figure 1 shows a simulation for Brownian motion, developed with Silverlight.

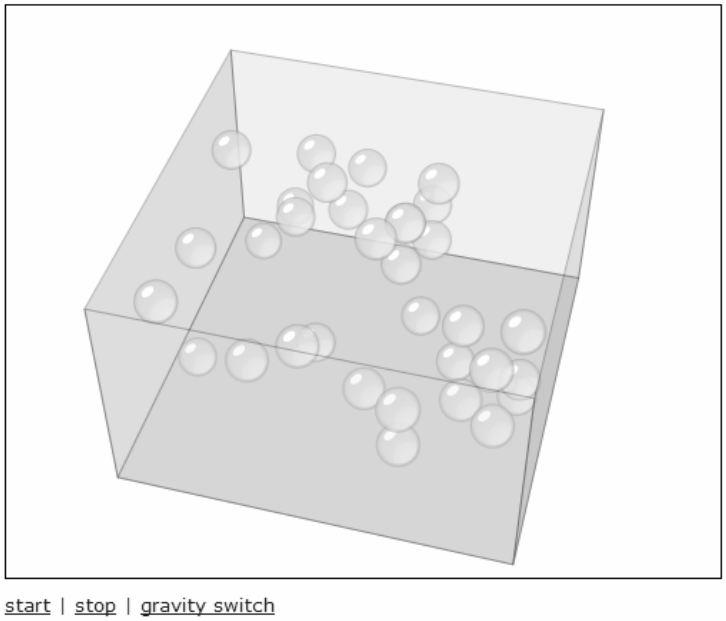

Figure 1: Simulation of Brownian motion prepared with SilverLight

Figure 2 presents a screenshot from a program for interactive visualization of vectors and geometric shapes in 3D space. Similar programs offer visualization of different functions.

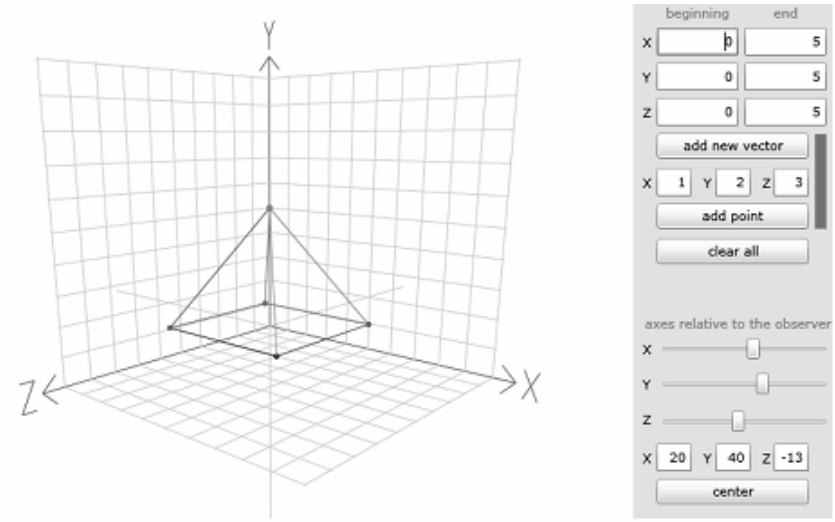

Figure 2. Visualization of geometric shapes in 3D space

4 Case study: Conversion from Java to AS3

As a practical example of a complex simulation tool the known xyZET was considered. This program was first developed at IPN, University of Kiel for UNIX systems. Currently it was re-engineered in java (javaXYZ). The same program was now converted in ActionScript 3 (shortly AS3). Figure 3 presents a comparison of both versions. JavaXYZ was converted to AS3 with J2AS3 converter

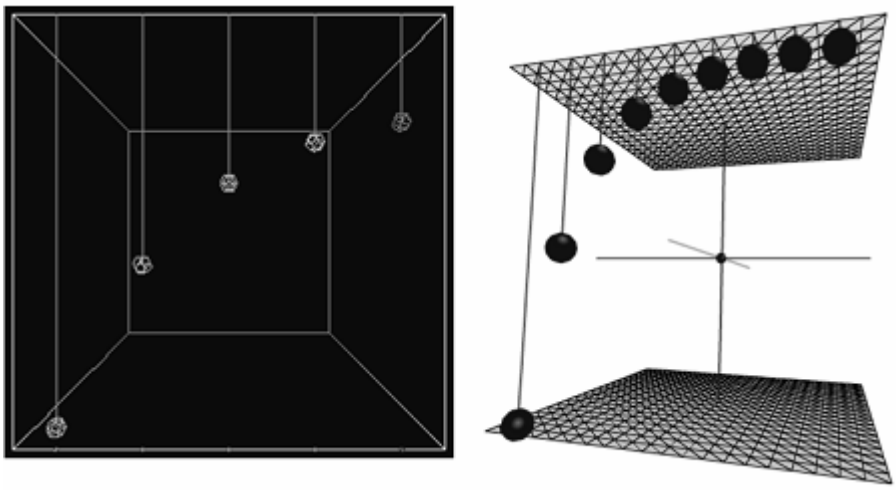

Figure 3: Comparison of javaXYZ and as3XYZ

The “physical engine” was coded in ActionScript 3 while the 3D visualization of simulated experiment was achieved through appropriate 3D engine (Papervision 3D in our case). The first experiments offered a direct comparison of traditional “Java” approach versus ActionScript3 (as a representative of RIA technologies).

Although the algorithms on both cases were the same (the code was just converted) there were differences in execution times, in quality of 3D visualization and in the interactivity of the simulation model with JavaScript commands embedded in accompanying hypertext.

ActionScript3 with accompanying 3D engine (Papervision3D offers a better 3D visualization which resembles the rendering with Java3D. However the speed of the simulation can be decreased in particular when some complex 3D models are used.

The hypertext to simulation model interaction through JavaScript is possible in both cases. In the case of ActionScript3 such interaction is less natural since 2 really different technologies are mixed. A particular problem is when synchronization between ActionScript3 and JavaScript code is requested.

5 Conclusions

Rich internet applications offer better audio-visual capabilities and a more effective collaboration in the classroom and outside it. In distance learning a better collaboration and contacts between the teacher and learners are facilitated. The teachers could submit the educational materials in digital libraries in real time. The learners could collaborate in team projects and in different environments: using personal notebooks, in computer equipped classrooms, using computers of their friends etc. The conception to share our stuff on servers gives to our work and mobility new aspect. In a limited sense even our mobile phones could be used. As mobile devices become better and better new challenges will be in front of us. In the future we can expect mobile reach internet applications. And this will extend the concept of classroom from the school into a pervasive environment. The experimental conversion of traditional Java applets into ActionScript3 (as one of RIA competitors) demonstrated the feasibility of such re-engineering of old Java based simulations and the problems when different technologies are mixed.

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