MULTIMEDIA ACTIVITIES AS REINFORCEMENT TO THE LEARNING IN SUBJECTS RELATED WITH COMPUTER NETWORKS

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Abstract
Since the Communications and Information Technology appearance, and specially the multimedia applications, educators have started to use them to improve their classes. This paper deals with the use of multimedia applications, concretely Flash activities, to reinforce the knowledge of the students in the matter that have been taught in the previous sections. We have distinguished several types of multimedia activities and, in this paper, we are going to classify them according to the way they have to be solved. Different type of exercises will teach students several points of view to solve a problem. These multimedia activities have been used in the subjects “Redes de Área Local” and “Integración de Redes” that can be taken in the third course of the Telecommunications Technical Engineering in the “Escuela Politécnica Superior de Gandía”. These activities have been used in the course 2006-2007 in a class with more than 20 students, obtaining excellent results.

Keywords
Multimedia activities, Flash for education, reinforcement to the learning, computer networks.

1. INTRODUCTION
One of the greatest problems for the university lecturer is to consolidate what has been taught in the theoretical class. Although the didactical methodologies used in the class could be very different (masterly class, active learning class, participative class, collaborative class, and so on) to propose several exercises after finishing the class reinforce the acquired knowledge. Many type of exercises exist that can be proposed to the students. Between them we can find the following ones:
- Tests
- Short questions
- Problems
- To do a part of a global Project

These exercises could be also used to evaluate the students about the matter that have been done till that moment. Although these exercises use to be presented to the students using black- or white-boards, transparencies or slides, we present them using fash [1] as a multimedia activity.

Multimedia applications have started to be one of the most used activities in the classrooms because their attractive format (with video and sound), their ease-to-use, their visual impact and their unlimited possibilities to show or ask what is wanted. There are appearing many multimedia activities to improve the learning of the students [2][3]. They are widely deployed and it is demonstrated that the use of multimedia applications give many benefits to the educational methodologies [4][5] and to the engineering education [6]. Moreover, multimedia applications versatility allow to apply them in many disciplines such in Anthropology [7], Finnish Arts [8], physical education [9], electromagnetics [10] or computer graphics education [11] with very good results.

The multimedia was introduced in education by the use of CD-ROMs [12]. In few years, educational resources such as videodiscs, videotapes and photos, were changed by computer-based animated sequences, video streaming, Photo CDs and so on [13]. But, with the use of Internet for learning platforms and distance education, there has appeared new multimedia systems and applications for the education [14][15].
Multimedia can be used in different parts of the teaching:

- Presentations [16].
- Demonstrations.
- Problem solving [17].
- Practices [18].

But nowadays, the multimedia development platform which is being used to deploy multimedia activities is the Adobe Flash software [19]. It is versatile and allows us to deploy high quality activities that can be used in our theoretical classes as presentations, demonstrations and even for exercises.

In this article, we are going to show a new type of exercises that students have to do when every chapter of the index of the subject is finished. This new type of multimedia activity can be done in a class where every student has a computer or in a class using the computer of the university lecturer.

2. FLASH

Macromedia was founded in 1992 by merging three enterprises. With the growing of Internet, in 1996 Macromedia developed several desktop applications to design web pages. These software applications were Dreamweaver, Fireworks, Flash and Shockwave. In 2005, Adobe bought Macromedia and owns Adobe Flash, which is widely used to create Flash animations. Actually, there are more than 700 millions of users using Adobe Flash Player [20] to view these animations.

Adobe Flash is an edition tool that allows the designers and developers to create presentations, applications and much type of contents to interact with the users. Flash projects can cover from simple animations to video content, complex presentations, questionnaires or other related utility. Independent fragments of content created by Flash are called applications. All Flash applications allow a great variety of multimedia content such as images, sound, video and special effects.

Flash is the most used technology used in web pages for the creation of animations. One of the greatest benefits is that the files used to do it are not too much larges in size, so it is not needed so much time to download them by the Internet navigator. In order to provide files with low size it uses vectorial graphics because that type of graphics does not need too much memory and storage sizes that bitmap images (images are represented by mathematical formulas instead of large sets of data).

Till the second version (developed in 1997), Macromedia Flash is able to support stereo sound and it is ease to integrate with bitmaps. Its language has instructions that are able to do actions. Macromedia Flash version 3, allow the developer to create HTML files to be included in web pages. In the fourth version (in 2000) appeared the ActionScript language, which gave the possibility to create striking animations, fill questionnaires or to jump to other web pages. The fifth version allowed to included transparencies, morphing, and higher reduction in the size of the files. In 2002 appeared Macromedia Flash MX with a more attractive and easy-to-use develop environment. It had more compatibility with other programs such as ColdFusion. Actually, ActionScript is object oriented programming and supports video, dynamic load of images and sound, a colour mixer and new tools for graphic design. Lasts versions have been changed their instructions to allow to program without deep knowledge of programming. Macromedia Flash actually has new effects to soften objects, texts and bitmaps and allow creating a transparent layer for the video.

A Flash application is created by jeans of drawing tools and then additional multimedia elements are imported to the Flash file. Next, the Developer has to decide how and when these elements are used to create the application that is wanted. Vectorial graphs allow enlarge the images in the application easily and optimized the size of the files that have these animations. It can be done while the web page is shown in the navigator giving visual elements to the web page.

Flash can work with many types of archives. Every type of archive has a different purpose. The following list gives the type of archive and what it is used for:

- FLA files. They are the main Flash files. They have the basic information about the elements, timeline and the scripts.
- **SWF files.** They are the compressed versions of the FLA files. They use to be used in web pages.
- **AS files.** They are the ActionScript files. They can be used when all or partial code is wanted to be stored out of the FLA file. It could be used to organize the code for the developers.
- **SWC files.** They have the reusable components of Flash. Every file includes a compiled videoclip, ActionScript code and any other required component.
- **ASC files.** They are used to store ActionScripts that will run in a Flash Communication Server. They allow server implementations combined with ActionScripts in a SWF file.
- **JSFL files.** They are JavaScript files that can be used to add new functions to the Flash edition tool.
- **FLP files.** They are Flash projects. They allow grouping several files to create complex applications.

Because of the number of functions in Flash, multiple type of applications can be created. The following are the main ones:

- Animations such as commercial advertisements, congratulation e-cards, cartoons, etc.
- Games. They use to combine Flash animations with ActionScript.
- User interfaces such as navigation bars, buttons, etc.
- Flexible message areas. They are areas in the web pages used to show information that can vary over the time.
- Dynamic Internet applications. They are a large scope of applications that provide a very elaborate user interface design to show and manage the data stored remotely through Internet. Some examples are a schedule, a catalogue, an educational application and so on.

### 3. MULTIMEDIA ACTIVITIES

In order to develop a Flash activity, a developer must follow the following steps:

1. Decide which basic tasks the application must do.
2. Create and import the multimedia elements such as the images, video, sound, text and so on.
3. Organize the multimedia elements in the Macromedia Flash software environment and in the timeline. The developer has to define when and how they are going to appear in the application.
4. Apply special effects to the multimedia elements as it is wanted.
5. Write ActionScript code in order to control the behaviour of the multimedia elements and their response to the user interactions.
6. Test the application in order to determine how it works and to find possible errors.
7. The edited flash document is in .fla extension, so it is needed to create the compressed version in a .swf file in order to show it in a web page and to play it using the Flash Player.

The Flash Player is free. It can play any .swf file in any platform, navigator and devices (mobile devices included). Flash Player is distributed with the main software companies such as Microsoft, Apple, Netscape, AOL, Mozilla Firefox and so on.

We can classify the multimedia activities we have developed in 8 main types. They are explained in the following sub-sections.

#### 3.1 “Moving Blocks” activities

They are multimedia activities where there are several blank spaces and there are several blocks with the correct answers that have to be moved to the right space. Usually there is the same number blocks that spaces, but it could be more blocks. Students must find the correct block reading the information inside and relating it with the information near the blank spaces.

Figure 1 and figure 2 shows two examples. In the first example, Figure 1, students have to choose which block in the right side has to be placed in every step in order to perform the CSMA/CA
algorithm. In the second example, Figure 2, students have to choose which block in the right side has to be placed in every step in order to perform the MACA algorithm.

Figure 1. Multimedia activity to learn how runs CSMA/CA algorithm.

Figure 2. Multimedia activity to learn how runs MACA algorithm.

3.2 “Single choice” activities

They are multimedia activities with a question and a draw. The student has to choose the answer between multiple options. There is a list with several options that has only one correct answer. Figure 3 has an example. In this case, students have to write the IP of a device and, by means of observing the results, have to choose what is wrong or fails in the network.
3.3 “Click-on-Blocks” activities

They are multimedia activities where there is a question about the main features of something that has many features, such as a standard. The student has to click on the blocks that have a correct feature. Figure 4 shows an example. It asks which the main features of 10BaseT are. The student can choose the correct answer between different types of wires, different types of bandwidths, different types of plugs, and so on.

<table>
<thead>
<tr>
<th>Tipo de cable</th>
<th>Tipo de cable</th>
<th>Distancia</th>
<th>Topología Física</th>
<th>Velocidad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coaxial grueso</td>
<td>Coaxial grueso</td>
<td>100 metros</td>
<td>Bus</td>
<td>10 Mbps</td>
</tr>
<tr>
<td>UTP CAT5</td>
<td>UTP CAT5</td>
<td>185 metros</td>
<td>Estrella</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>Coaxial delgado</td>
<td>Coaxial delgado</td>
<td>500 metros</td>
<td>Ring</td>
<td>1000 Mbps</td>
</tr>
</tbody>
</table>

Figure 3. Multimedia activity to learn what is wrong or fails in the network.

Figure 4. Multimedia activity to learn the main features of the 10BaseT standard.
3.4 “Correlative Blocks” activities

They are multimedia activities where the student has to complete correctly a part of the activity before he/she can pass to the next step or algorithm. In this case, several parts of the activity are not shown before the previous parts are not completed. Figure 5 shows an example where the students have to place the blocks in the correct place before to complete the whole activity, which can be done by completing the second part in the next step.

![Diagram](image)

Figure 5. Multimedia activity to learn how is the algorithm to solve a computer network problem

3.5 “Area Selection” activities

They are multimedia activities where an area of the draw has to be selected. It allows the student distinguish parts of a network and identify network components, network devices or areas. Figure 6 shows a network topology and the student has to identify the collision domains and the broadcast domains of the network. Figure 7 shows the solution of the multimedia activity shown in figure 6. Collision domains are in red and broadcast domains in blue.
Figure 6. Multimedia activity to distinguish collision domains and broadcast domains in a computer network.

Figure 7. Solution of multimedia activity shown in figure 6.
3.6 “Checking” activities

They are multimedia activities where there is a table that has in the columns several mediums, standards or protocols and in the rows a list of features of them or vice versa. The student has to click on the box that matches the medium, standard or protocol with that feature. Figure 8 shows an example of routing and routed protocols. The student has to click in the correct box (for example, IPX is a routed protocol).

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Protocol enrutado</th>
<th>Protocolo de enrutamiento</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIP</td>
<td></td>
<td></td>
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<td>IP</td>
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<tr>
<td>AppleTalk</td>
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<td>IGRP</td>
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<td>OSPF</td>
<td></td>
<td></td>
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<tr>
<td>EIGRP</td>
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</tr>
</tbody>
</table>

Figure 8. Multimedia activity to learn the difference between routing protocols and routed protocols.

3.7 “Animation” activities

They are multimedia activities that have an animation which shows something that is happening in a network. Students have to say what will happen when the lecturer plays the animation. Figure 9 shows a picture of an animation with a bridge. When the student clicks on the play, there happens something. Then the student has to write in the table in order of appearance which MACs are stored in the memory of the bridge.

Figure 9. Multimedia activity to learn how a bridge works.
3.8 “Dynamic” activities

They are multimedia activities where the student has to do something in the topology of a network and has to observe its effect. Figure 10 shows the picture of a network where the student has to troubleshoot the failure. The student has to ping the devices of the network till he finds out which device has failed.

![Diagram](image)

Figure 10. Multimedia activity to troubleshoot a computer.

4. CONCLUSIONS

We have described several multimedia activities that have been developed to reinforce the learning of the students. The activities shown have been used in “Local Area Network” and “Integration Systems” subjects. They are taught in the speciality of Telecommunication Systems of the Telecommunications Technical Engineering. The grade of satisfaction of the students, due to the realization of these types of activities, when every chapter is finished, has been very high. All of the students (20 students) are happy with this type of activities and they consider that these activities have helped them to understand the content of the subject. Future works will develop new activities to reinforce their hands on skills.

References


