

Digital Educational Resource to Support the Computer Networks Course

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Abstract

This paper presents an educational game developed in three dimensions using a software for modeling and animation (Blender). The thematic that this development encompasses aims at providing students of computer networks with a tool that helps them to have a more meaningful learning in the process that involves identifying the type of a network address, both for public and private types, given that the precise knowledge of this concept is very important in every networking environment.

Keywords: *Digital Educational Resource, IP Address, Public IP Address, Private IP Address, Computer Network.*

1. Introduction

Nowadays many teachers and students are using computer programs, or software, as educational resources in a variety of learning activities; and the use of these software varies depending on the context in which they are, their different educational levels, ages, and the different areas or classrooms [1].

These programs often referred to as educational software, are computer programs or software made with the purpose of being used as facilitators of the teaching process and consequently, of the learning one. Hand in hand with the above, they have some special characteristics such as: easy to use, interactivity, and the possibility to customize the learning speed, among others [2].

According with Marques, the educational software also complies with: easy to use, capacity to motivation, curricular relevance, versatility, pedagogical approach, orientation toward students, and includes evaluation [3].

As proposed in [2], a feasible classification of programs could be the following: tutorials, simulators, programming environments and authoring tools; in this context what is presented in this paper is a simulation program which exercises the inductive and deductive learning of students through decision-making and acquisition of experience in situations impossible to achieve in reality, facilitating discovery learning.

2. IP Addresses

By definition, each host that wants to access Internet needs an address, this paper focuses on the IP (Internet Protocol) addresses of the IPv4 protocol, which are a portion network and portion host combination; this combination is unique which means there are no two machines with the same address, because its unicity is guaranteed. An IP address is a number whose human readable representation is in the form of four decimal numbers separated by dots, where each one of these four numbers can range from 0 to 255 (see Figure 1), as well as by its equivalent in the binary format, which is the representation that computers and network equipment use. The IP address is formed of 32 binary digits (also called bits) divided into 4 groups of 8 bits where each group can range from 00000000 to 11111111 (0 - 255 in decimal) [4].

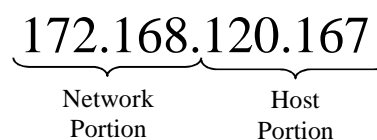


Figure 1. Example of an IP address.

IP addresses are used to identify, in a logic and hierarchical way, an interface of a device in a network that uses the IP protocol; this type of addressing corresponds to the network layer or layer 3 of the reference model OSI.

One of the classifications of all the previous range focuses in dividing them into public and private; being the first group the only one of the two that can go out to the Internet, while the other only have validity inside a LAN, without the capacity to go out to the Internet. Given this situation it becomes important to know whether an address is public or private at the time to use it in a network.

There are three ranges of addresses reserved for private addressing, which are:

- 10.0.0.0 – 10.255.255.255/8 (16,777,216 hosts)
- 172.16.0.0 – 172.31.255.255/12 (1,048,576 hosts)
- 192.168.0.0 – 192.168.255.255/16 (65,536 hosts)

The remaining addresses within the range 0.0.0.0 to 255.255.255.255, are public [5].

3. Digital Educational Resource

One of the factors involved in the evolution of game design is the progress in the technology that supports them. You can easily illustrate this by following the evolution of design alongside the evolution of graphics in video games: they began by being extremely simple, text-based or with very low resolutions (highly limited vector graphics), they evolved over time to be capable of expressing two-dimensional shapes and increasingly complex animations up to expressing three-dimensional forms and making a progression in terms of the complexity of these forms [6].

We also know that games can be a great tool for promoting learning by providing alternative methods to help us overcome the barriers imposed by traditional learning. Studies in Chile, Mexico and Spain show the results of applying this technology to the learning process [7].

Bearing in mind these studies, we decided to make use of this technology, in particular we proposed the design of games to help students to make the learning of the subjects more entertaining and dynamic, and to help them achieve the central purpose of the game: practicing, identifying and the expediting of the diverse activities that will lead to mastery of the subjects mentioned above. [8]

The digital educational resource presented here uses the theme of the division of IP addresses into public and private, and translates it into a computer game with an attractive approach for students.

This game was developed to support the learning process in the area of computer networks for the Bachelors of Computer Science at the Tizimín Multidisciplinary Unit (Mexico). The intention is that the game will be as attractive as possible for the students, we thought about creating a kind of casino using games as slot machines, target shooting, cards and billiards [8]. The game consists of 4 different components which are described below:

- *Game 1 Binary-Decimal Converter*: allows the player to enter a decimal number and a binary number to help him verify whether the entered decimal number corresponds to the binary number. This procedure is

also done in reverse and its design corresponds to a machine similar to a casino slot machine. [9]

- *Game 2 Clases*: allows the player to pick an IP address and choose its corresponding kind of network through target shooting game, which displays a result of right or wrong. [10]
- *Game 3 Public or Private*: gives the player an IP address using a random function. He must choose whether the address is public or private through cards like in poker.
- *Game 4 Network-Host-Broadcast*: allows the player to pick an IP address and choose its address type (network, host or broadcast) by hitting billiard balls to their corresponding holes.

These games can be chosen from a main menu. Each of them has its own options that allow the player to start the game, see the help, know about the game, or exit. See Figure 2.



Figure 2. Main menu.

When the option Addressing (*Direccionamiento*) is selected from the Main Menu indicated in Figure 2, a submenu is presented as can be seen in the Figure 3 named Addressing Games (*Juegos de Direccionamiento*), which allows us the access to three different games, *Clases*, *Public or Private*, and *Network-Host-Broadcast*, however the one here presented corresponds to the game 3 described briefly in the section as “*Game 3 Public or Private*”.



Figure 3. Submenu of the Addressing option.



Figure 5. Scene of the game.

3. Game: Public or Private

To start the game from the Main Menu shown in Figure 2, the Addressing option (Direccionamiento) must be selected, that deploys a submenu entitled Addressing Games (Juegos de Direccionamiento), which gives access to the game named “Public or Private”. On choosing this a screen as the one shown in Figure 4 is deployed, which is the main screen of the game.



Figure 4. Main Screen of the game Public or Private.

The game Public or Private has four options which are: Play, Help, About and Exit.

Play option.

Selecting the Play option gives direct access to the game Public or Private; once inside a table similar to those used in casinos is presented, with two hands of cards on the same, one at the right and one at the left; the right one labeled with the word “Public” and the left one with the word “Private”; at the top of the table is the game’s name and below it there is a space to deploy an IPv4 address, with four spaces, separated by dots, just as described previously in this paper. This can be appreciated in Figure 5; the figure also shows that there is an option to return to the previous menu identified in Figure 4, which is carried out with the selection of the letter M.

In Figure 6 we can appreciate the scene of the game previously described, with the IP address 195.233.200.215 displayed in the upper space allocated for this purpose. The ENTER key is used to deploy the IP address to evaluate.



Figure 6. Scene of the game showing an IP address.

Once deployed the address, the user must indicate if this is of type public or private by selecting one of the two hands of cards deployed on the game’s table, to make the choice of Public the key ← is used, the key → is used to select Private, and to check results the key ↑ is used. If the user makes a wrong selection an image as that shown in Figure 7 will be deployed; if a correct selection is done an image as shown in Figure 8 will be deployed instead.



Figure 7. Wrong selection of the type of the address.



Figure 8. Correct selection of the type of the address.

Help option.

Selecting this option displays a help screen about the keys allowed inside the game, this screen also includes an option to return to the menu shown in Figure 4. See Figure 9.

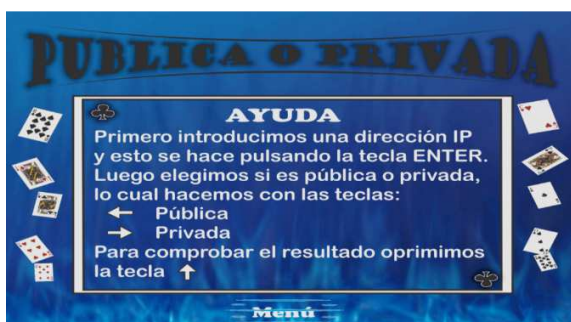


Figure 9. Help Menu.

It is important to mention that this game is part of the project “Development of a graphic tool for addressing learning”, which was integrated by professors and students of the Faculty of Mathematics of the Tizimin Multidisciplinary Unit.

4. Conclusions

A software with a user-friendly and attractive interface was developed to facilitate to a user the learning of an ability to identify the type of an IP address. The software has already been tested by several users who provided comments favorable for both the GUI and the results obtained during the learning process, although it is important to mention that the game has not yet been tested

on a large scale as in environments like courses of the field, to obtain user’s observations and comments.

This development is only a part of the project “Development of a graphic tool to the addressing learning”, focused in the computer networking field, specifically in the area of addressing, it is expected to conclude with its development in a near future.

Besides, this tool will be used in incoming students of the Bachelor of Computer Science (LCC) held at the Tizimin Multidisciplinary Unit of the Autonomous University of Yucatan, that start the computer networks’ courses and optative subjects of this same field. This will allow to analyze in a more reliable way the usability factors of the system, as well as the learning level on the topic treated.

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References

- [1] Squires, D; McDougall, A. Cómo elegir y utilizar software educativo. Ediciones Morata. 2ª. Ed. 2001. España.
- [2] Cataldi, Z. Metodología de diseño, desarrollo y evaluación de software educativo. Tesis de Magister en Informática, Facultad de Informática UNLP. 2000.
- [3] Marquès, Pere: (1998a): La evaluación de programas didácticos. Comunicación y Pedagogía, N° 149, p. 53-58. Barcelona.
- [4] Dye, M; et al. Aspectos básicos de networking. Guía de estudio de CCNA Exploration. Cisco Press. 2008.
- [5] Tanenbaum, A. Redes de Computadoras. Pearson Prentice Hall. 2003.
- [6] Roldán Martínez David. Comunicaciones inalámbricas. Un enfoque aplicado. Alfaomega Ra-Ma, 2005.
- [7] Guezuraga Yon. Infraestructuras comunes de telecomunicación: nuevos servicios y tecnologías emergentes. Universidad politécnica de Catalunya. Enero, 2005.
- [8] Ciau, M, et al. Design of an interactive game-based application for improving the resolution of common Computer Network issues. International Journal of Computer Science Issues, Vol. 9, Issue 6, No 1, November 2012.
- [9] Alonzo, K, et al. Software Educativo para Conversión de Sistemas de Numeración. Congreso Internacional de Sistemas Computacionales Administrativos, Veracruz, México, Noviembre, 2011.
- [10] Narváez, L, et al. Address Classifier: A Game-Based Educational Application for Computer Networks. International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 6, June 2013.

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