

Ginga Edutainer: A Framework for the Development of T-Learning Applications on Ginga – The Brazilian Digital Television

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ABSTRACT

The aim of this study is to propose a framework for developing educational applications for Digital Television, thus simplifying the process of developing applications by abstracting the execution platform. The arrival of digital TV in Brazil offers a range of possibilities in the field of education. The availability of television sets in 95.1% of households in Brazil indicates that studies on television as a form of teaching and learning can be adapted to this medium. The proposed tool incorporates entertainment and education and aims to make the task of producing educational software simpler, and consequently reducing the time needed to develop applications that can be used to educate and promote digital inclusion in the country. When implemented, the project will integrate interactivity in education, creating educational applications that can motivate the user in an environment of teaching and learning.

Categories and Subject Descriptors

D.3.3 [Programming Languages]: Language Constructs and Features – abstract data types, polymorphism, control structures. H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems—Artificial, augmented and virtual realities; J.7 [Computers in Other Systems]: Consumer products; H.5.2 [Information Interfaces and Presentation]: User Interfaces – graphical user interfaces, input devices and strategies, interaction styles, screen design, training, help and documentation, user-centered design.

General Terms

Design, Human Factors, Standardization, Languages.

Keywords

T-learning, Interactive Digital TV, Ginga, Middleware, Frameworks.

1. INTRODUCTION

The arrival of digital TV in Brazil took place in June 2006 when the Brazilian government announced the selection of ISDB-T, developed in Japan, as the basis for the development of the system adopted in Brazil ISDB-TB, also called SBTVD. In the Brazilian version, technologies developed by the Catholic University of Rio de Janeiro (PUC-Rio) and the Federal

University of Paraíba (UFPB) were added. The start of SBTVD transmissions occurred on 02 December 2007, in Sao Paulo. Peru, Argentina, Chile and Venezuela have announced the adoption of the Brazilian standard of digital TV ISDB-T. [1]

The television is a largely available device that most individuals are very accustomed to. The National Household Sample Survey – carried out by IBGE (Brazilian Institute of Geography and Statistics) in 2008, found that 95.1% of Brazilian households possessed at least one television.

Table 1. The number of Brazilian households and Brazilian Household with TV (%) from 2004 to 2008

%	2004	2005	2006	2007	2008
Television	90.3	91.4	93	94.5	95.1
Households*	51753	53114	54610	55770	57557

*households in thousands Source: PNAD (IBGE)

People usually trust what they receive through the television set and the quality of the content assures a richer experience for the user. Television can perfectly cope with generating very rich content and high levels of motivation for the user, these are among the factors that work in advantage of the television as an educational tool. [5]. The main advantage of digital TV is that hundreds or thousands of programs can be offered in parallel, which means that personalized applications can be offered to specifically defined user groups. With respect to education, this means that it is possible to customize the delivered educational content according to the needs of different classes of learners such as age, learning styles, level of formal education or personal interests.

A few years ago when Digital TV was conceived, the range of possibilities was limited by technology, mainly the unavailability of a return channel that is essential for feedback and disk space limitation in set-top-boxes for optional storage of the digital content for later re-viewing.

2. DIGITAL INTERACTIVE TV IN LEARNING

2.1 What is Digital TV?

Digital Television (DTV) is an advanced broadcasting technology that has transformed television viewing experience. DTV has enable broadcasters to offer television with better picture and sound quality. It also offers multiple programming choices, called multicasting and interactive capabilities. [15]

Digital transmission in Brazil is gradually spreading from city to city. The analogue transmission will continue to occur, simultaneously with the digital, for a period of 10 years until 29/06/2016. As from Jul/2013 only digitally transmitted channels will be granted transmission licenses. Today, a large number of TV channels are transmitted digitally via satellite, cable and terrestrial (over - the-air). Most TVs can only receive analog signal therefore require a set-top box to receive the digital signal using a digital tuner and then convert the signal to an analog format for display on the TV sets. The set-top box is connected between the TV and the signal source. Although some television makers already have TV models marketed with an integrated structure of the STB.

2.2 What is interactive TV?

Interactive Digital Television is a two-way interactive service provided through television, enabling audiences greater choice, control, and customization over their viewing experience. Through new digital technologies, interactive television services such as video-on-demand, enhanced television, interactive program guides, and email are just some examples of the next generation of digital programming over cable, satellite and terrestrial broadcast television. [6]

2.3 Interactivity through digital TV

2.3.1 Navigation

Because of the large number of channels available through interactive TV, an electronic program guide (EPG) is essential for the viewer to find and select programs. The service provider is responsible for this guide, and has the liberty to organize it to suit his own needs. Selecting a program through an on-screen EPG is the most commonly used form of interactivity by form of remote control.

2.3.2 Enhanced TV

A number of options are available for enhancing the viewing experience through the use of interactivity of existing TV programs. Selecting options from a menu to get to additional information can be achieved by pressing one of the four colored buttons on the remote control. In 2009 during one soap opera, a local broadcaster offered interactive services that detailed previous episodes and cast information. The same services could also be seen during the Brazilian Carnival.

2.3.3 Channel independent interactive services

Interactive services are also available independent of TV video channels. These services tend to be accessible via the interactive

services button on the remote control or an infrared keyboard when the interactive services icon is displayed on the screen. The child is taken to the interactive area with various activities to interact based on a popular children's program like "Sitio do Pica Pau Amarelo" or "TV Xuxa." The arrow keys or the four color coded buttons on the remote control are used to select items and navigate around the screen. The method used is really an advanced form of the method used to access teletext. Upon selecting a particular option, a module is downloaded into the very limited memory of the set-top box. This usually takes a few seconds, as the viewer has to wait until that particular option becomes available from the broadcaster.[4]

2.3.4 Interacting through the return channel

Another way of interacting is through the return channel. In the case of satellite and terrestrial transmission this is through a telephone connection to the set-top box. For digital cable this is through the cable network.

Utilizing the return channel enables viewers to respond to questions through yes or no or multiple choice questions and also enables viewers to vote. This same method can provide access to TV Internet – a more limited version of the Internet that has been modified for easier viewing on the TV. It is also possible to send emails usually without the ability to attach documents. An infrared keyboard can be used to type in messages instead of the remote control. Data from the last National census shows that less than 30% of Brazilian homes have internet access. The government has plans to provide internet coverage countrywide although many consider this a long shot.

2.4 What is t-learning?

The term "t-learning" was adopted as an abbreviation to mean TV-based interactive learning. T-learning is about having access to interactive video-rich learning materials especially at home through a TV.

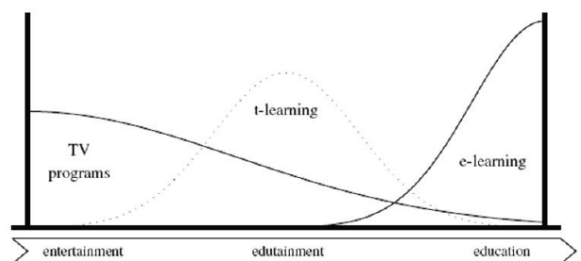


Figure 1. The scope of t-learning: between pure entertainment and formal education. [12]

While e-learning currently tends to be used to mean learning over the Internet using a personal computer, it could be used to refer to any form of learning using a connected digital electronic device. Thus, t-learning is really a subset of e-learning - with access through a home-based TV. T-learning could significantly improve the learning experience in a way that Internet-based e-learning is currently unable to. [4]

2.5 Role of interactive TV in learning and digital inclusion in Brazil

Developments in interactivity are raising awareness that the TV can start to be used actively rather than just a passive mode. Broadcasters and service providers are still experimenting with the interactive services. Despite, slow developments towards personalized TV, the time is right to start focusing more attention on this area as a means of creating new, more personalized learning opportunities at home. This is likely to be a more fruitful way of widening access and participation in learning in the medium term scenario (within the next five years) rather than focusing on just the interactive TV available through broadcast tv. Value can be aggregated to the learning experience when these programs are available in a video-on-demand mode rather than in a broadcast mode – assuming that all the enhanced features are available.

Unless there are some significant advances in the technology, broadcast or scheduled TV interactive learning opportunities are likely to be always limited. Since internet access for all still remains a dream, Digital TV can rise up to fill the digital divide seen in Brazil on present day. Interactive TV can reach almost every home in the country at lower costs thereby helping to have digital inclusion countrywide.

3. GINGA MIDDLEWARE

Ginga is the name of Open Middleware for the Brazilian Digital TV (SBTVD). Ginga is composed of a set of standardized Brazilian technologies and innovations that make the specification advanced and the best middleware solution suiting the requirements of the country. [1]

Ginga open middleware is divided into two main integrated subsystems that enable the development of applications following two different programming paradigms. Depending on the functionality of the design of each application, one paradigm is more appropriate than the other. These two subsystems are called Ginga-J (for Java applications) and Ginga-NCL (for declarative NCL applications). The links above have specific information about the two systems.

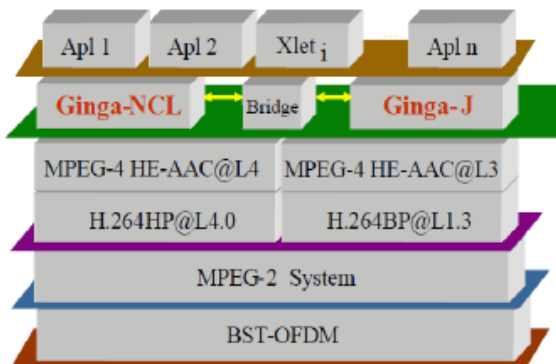


Figure 2. Ginga Architecture [8]

3.1 Ginga – NCL

Ginga-NCL is the Ginga subsystem responsible for the view of NCL documents and was developed in order to provide an infrastructure for submission declarative applications written in the NCL language. NCL is an XML application language with facilities for specifying aspects of interactivity, timing-space between media objects, adaptability, support for multiple devices and support the production of live interactive non-linear.

The Nested Context Language (NCL) is a declarative language for authoring hypermedia-based documents on the conceptual Nested Context Model (NCM) and was developed using a modular structure, following the principles adopted by the W3C. Thus, the modules for the specification of connectors and templates for composition, called XConnector and XTemplate respectively, can be incorporated into other existing languages, such as XLink, XHTML and SMIL, used for document authoring on the Web.

3.2 Ginga- J

Ginga-J (execution machine) is a logical subsystem of the Ginga system that processes procedural applications (Java Xlets). A key component of the application environment is the procedural mechanism for implementing the procedural content, which is based on a Java virtual machine.

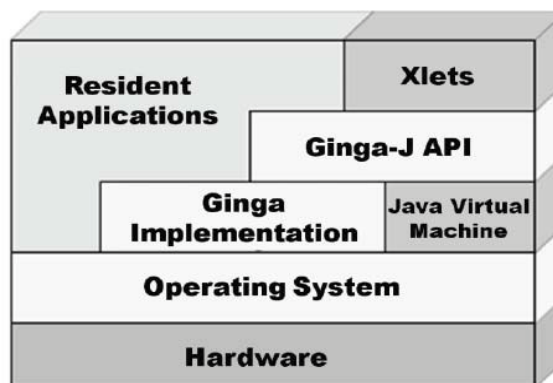


Figure 3. Ginga-J architecture and execution environment [ABNT/CEE-85 3º PROJETO 85:000.00-006/4 MAR 2010]

The resident applications can be implemented using non-standard functions provided by the operating system of the Ginga device, or by a particular implementation of Ginga. Resident applications can also incorporate the functionality provided by the standard Ginga-J API. Transmitted applications (Xlets) should always use standard API provided by the Ginga-J.

4. METHODOLOGY

To achieve the proposed objectives, the work was divided into two parts. Firstly, several studies have been carried out so as to have a better understanding of existing technologies, of how Ginga is structured, and how T-learning applications will work and what characteristics will be passed to the new framework. In the second part, the implementation of the work will take place, where the framework will be developed and the functionalities proposed implemented.

5. GINGA EDUTAINER FRAMEWORK

Ginga Edutainer is a Digital TV application development framework proposed in this paper. The main aim is to provide a structure that facilitates the development of content that is not only educative but also entertaining for the Brazilian Digital TV.

The purpose of creating a software framework for application development is to avoid the monotony in implementing common tasks over and over again every new application is produced. Valente (2005) present a similar approach, but focuses on the reuse of software components for computer game development. Software development auxiliary tools has great importance and the creation of frameworks that allows greater code reuse and reduces the needing to rewrite code for common tasks may help to make the process quicker and more intuitive.

The Ginga Edutainer technical framework will consist of a list of features identified within the framework and for each feature there will be an agreed definition of the scope and purpose of the feature, a list of applicable standards and specifications, general guidance on creating, exhibiting and consuming this. The framework aims to support creation of multiuser t-learning applications.

6. RELATED WORK AND DISCUSSION

There is no published work on T-learning on the Ginga platform but Diego *et al.* [11] report having created a Ginga Game framework that is a framework for construction of Games. In Europe however three projects can be cited as related to this project, Kamila Olševicová *et al.* [2] present a T-learning approach enhancing video with active content. Lytras M. *et al* [5] talk about interactive TV and e-learning and try to model the convergence point of the two. While Arias *et al.* [12] present ATLAS: a framework to provide multiuser and distributed t-learning services over MHP. Francesco Bellotti *et al.* [13] talk of designing a Constructionistic Framework for T-Learning.

The Ginga Edutainer framework promises to revolutionize learning as we know it. Helped by the fact that every home in the country has a Television set education has the opportunity to reach every household. The benefits are uncountable. With the framework, language learning applications can be created and distributed countrywide through television. The framework will be able to produce applications that integrate on-demand content with ongoing broadcast.

Currently the execution of this project is delayed because the approval of JavaDTV specification is in voting stage and the binaries are therefore unavailable currently and will be out in the second semester of the year. Besides this setback other problems face a full scale implementation of T-learning, although it is probably accepted that the television in its traditional format is a very powerful medium, the body of research into its role for learning is rather more limited. Research has tended to focus on the impact that TV makes on individuals. There appears to be limited research into the importance of informal learning as a means of drawing people into formalized learning. Despite some evidence to suggest that more people wish to learn from home, there appears to be limited work into understanding the conditions and requirements that are needed in order to make the home a conducive learning environment.

Understanding the role of interactivity is a very complex process with most, but limited, research focused on interactivity in computer-based environments. Unsurprisingly, there has been little research into using interactive TV for learning purposes.

The costs of accessing learning through interactive digital TV should also be considered. The framework will only be responsible for the creation of applications, needing ways to distribute content. This requires funds as minimum as that may be.

7. CONCLUSIONS

After completing research studies which comprise of the first part of the work and acquiring the knowledge required, the second part will be initiated with the intention of implementing the Ginga Edutainer framework. The development of educational applications for Digital TV in Brazil, using Ginga middleware (Ginga-J or Ginga-NCL) is possible. The creation of Ginga Edutainer aims to make the process of creating applications for Digital TV simpler, providing an environment that abstracts the execution platform leaving the creators to focus only on the creation process and not the production.

8. ACKNOWLEDGMENTS

Our thanks to PPGMC for allowing us to use their establishments to perform this research.

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