Media convergence: An architecture for iTV and mobile phone based interactive language learning

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Abstract

This paper explores the potential of convergent media, in this case interactive TV and mobile phone, for delivering interactive language learning. We propose an innovative and workable cross-media solution architecture that uses the power of the Digital Video Broadcasting (DVB) stream, the Java programming environment and Bluetooth technology. We discuses the advantages that this architecture might have over current methods of delivering interactive content.

Keywords

Interactive television; Mobile phone; Interactive learning; Language learning; Media convergence; Cross-media architecture, Adult learners.

Introduction

Many technologies, such as language lab, radio, TV, audio tapes, video tape, CD-ROMS, DVD, computer software, Internet[1], email, mobile phone [Sharples, 2000; Ultralab, 2003] and most recently interactive television (iTV) have been recognised as language learning media [Atwere & Bates, 2003; Pemberton, 2002]. Conventional television programmes can be beneficial for language learning, but adding interactivity could facilitate learning and increase learner interests and motivations [Demetriadis, 2003; Lytras et al., 2002; Bagui, 1998]. Interactivity can be provided in the forms of vocabularies for broadcast programmes, subtitle choices in different languages, multiple audio channels, multiple choice questions to support comprehension, and so on. To be most effective, such interactivity needs to fit well with the learner's motivation, interests, age and learning style. [Luckin & du Boulay, 2001; Underwood, 2002; Masthoff & Pemberton, 2003; Bates, 2003]

However, the way interactivity is delivered causes problems which are predominantly associated with content availability and technical scalability of the current iTV set up. Interactive content is only available during certain time slots, mainly during a broadcast programme, though sometimes beyond it. Telephone modem, ADSL and broadband cable are the only ways to request interactive content and establish two-way point-to-point communications [Gawlinki, 2003; Whitaker, 2001; O'Driscoll, 2000]. Accessing interactive content without any time-constraints and possibly through other media technology might be of great benefit to learners enhancing mobility and flexibility, which are seen as important attributes of lifelong learning [Vavoula & Sharples, 2002].

Recently, mobile phone devices have begun to be used for interacting with television

[1] *For example, BBCi provides a service for learning English through the Internet. The service enables learners to access vocabulary for the current news, plus grammar and vocabulary for a range of subjects such as sport, health and so on. Learners can also subscribe to e-mail and newsletter services. (BBC World Service: http://www.bbc.co.uk/worldservice/learningenglish)The BBC also offers a mobile phone service for teaching English to Chinese people which enables them to receive a daily text message on their mobile containing an English phrase together with the Chinese translation (BBC World Wide press release, 2003) http://www.bbc.co.uk/pressoffice/commercial/worldwidestories/pressreleases/2003/03_march/elt_sms.shtml*

programmes[2]. In the UK, 98% of population have television and 68% of UK adults own/use a mobile phone [Oftel, 2002]. The convergence of these two media technologies will open up new horizons for learners, broadcasters and platform providers. Enabling learning in a ubiquitous way will add a new form of interactivity and flexibility to the learning experience. [Intill et al. 2003]

Despite the fact that the current 'via mobile phones' type of interactivity are relatively unexplored, the potential is clearly vast. In this short paper we propose an innovative cross media solution that delivers language learning material through broadcast mainstream to both set-top-box and mobile device using the power of the Java programming language and Bluetooth technology. Although our architecture is illustrated through the example of language learning materials, it is designed to be easily adapted for the provision of a range of educational or edutainment content.

ITV & mobile phone based interactivity

There are two ways to use the mobile phone for interacting with a television programme: as synchronous or an asynchronous interaction. Synchronous interaction or "participation interactivity" [Gawlinki, 2003, p.7] happens while watching a programme. For example: being able to play along with a quiz program, which allows viewer who are registered to receive questions based on the show and to reply using their mobile handsets in real-time (e.g. 'Who Wants to be a Millionaire', Celador International Ltd.). Asynchronous interaction happens during a defined time window prior to or after the television show. Current examples include getting an SMS of the latest news headlines, receiving weather forecasts, receiving gossip items[3], voting for a favourite character in a talent show (e.g. 'Fame Academy', BBC, 'Pop Idol', Fremantle Media, 'Big Brother', Endemol) or revising for your exams[4]. Mobile phones offer a form of interactivity that is the equivalent of 'red-button' without the need for a return path to a broadcast server. Furthermore, using mobile telephony guarantees the existence of the return channel two-way data services (SMS) and may ultimately provide an additional revenue stream.

For language learning services, we can also imagine both synchronous and asynchronous scenarios. In the synchronous scenario, the learner would be sitting in front of the iTV set watching news or soap operas. A graphical item (a "call to action") on the TV screen indicates that a language learning service is available via mobile phone or remote control (i.e. 'press red button on your remote control', or 'press 111 on your mobile phone'). The user decides to use a mobile phone device as a mean of interaction and keys in the required number. The client application running in the set-top-box detects a mobile interface and also checks the user authorisation. The mobile application should provide an easy to use graphical user interface enabling the user to interact with the service and request learning content. The learning content in this example is vocabulary related to the TV programme, categorised by subject, e.g. health, shopping, ordering food and so on. The learner uses the mobile's keys to select a category from the available options. The language learning service processes the request and generates the required vocabulary back to learner's mobile phone, where it is displayed on the screen and optionally integrated into the learner's own 'vocabulary bag' or personal dictionary for later use. The scenario using the remote control to interact with language learning service will be similar to the mobile phone. The only difference is that the user can use the remote control to make their choices and learning content will be displayed on the TV screen rather than on the mobile display. In the Asynchronous scenario, a learner will be able to use the mobile phone to request learning content for a defined period around the broadcast slot.

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[2] *Pop Idol, Big Brother, Who Wants To Be A Millionaire.* http://www.mobilestreams.com/show_industry_news.asp?link=1997

[3] *ITV.com, F1 fast text services,* http://www.itv-f1.com/sms

[4] *the BBC Bite Size service enables teenagers to revise exam subjects via ITV and mobile phone* http://www.bbc.co.uk/schools/gcsebitesize/

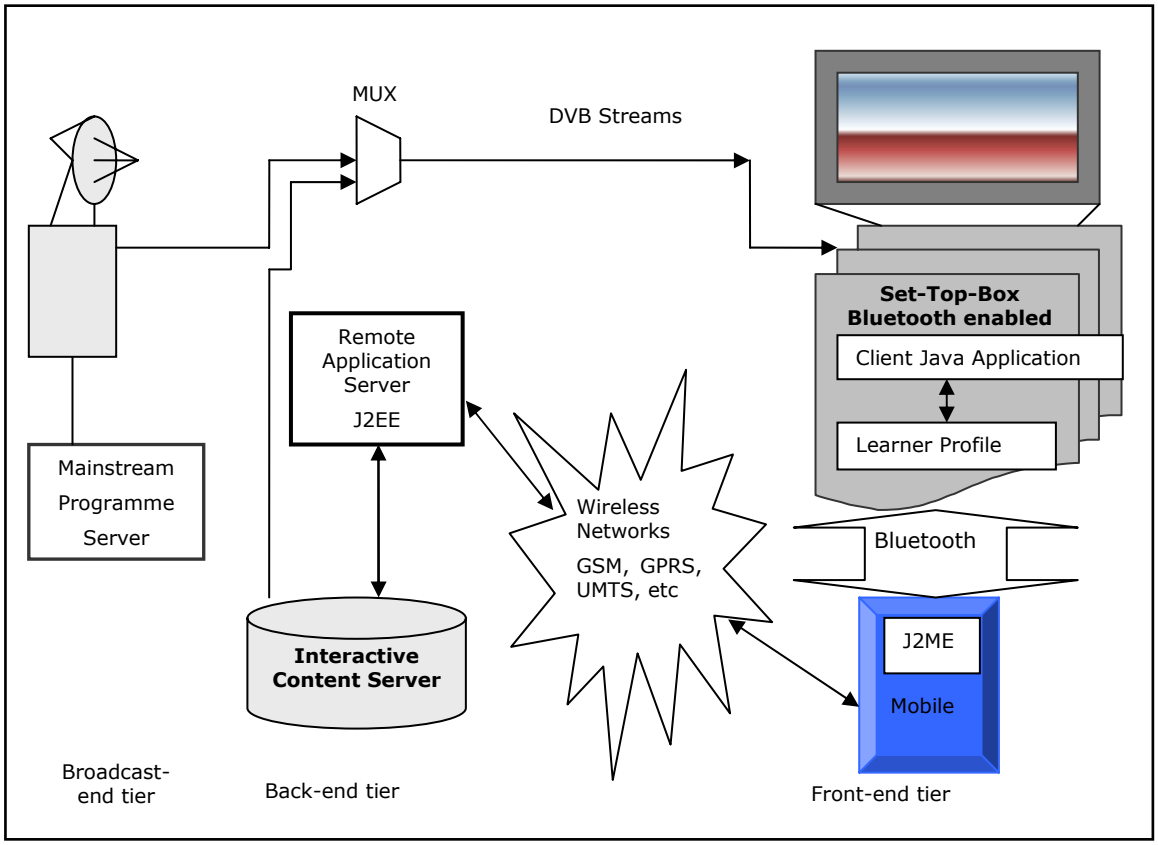

Figure 1. Cross-media architecture

Cross-media architecture

The end-to-end solution architecture for delivering language learning content to both set-top-box and mobile phones is illustrated in the following figure. This architecture makes use of the Digital Video Broadcasting (DVB) stream, the Java programming environment and Bluetooth technology. We propose a multi-tier architecture consisting of broadcast-end tier, back-end tier and front-end tier. The server-side architecture is based on the Java 2 Enterprise Edition (J2EE) and the mobile phone client-side development uses Java 2 Micro Edition (J2ME). Bluetooth technology allows set top boxes and mobile devices to communicate wirelessly and the J2ME development environment allows writing custom applications and deploying them on mobile devices (Figure 1).

The **Mainstream Programme Server** at the broadcast-end contains television programme genres like soap operas, news, documentaries, etc. that can be enhanced by incorporating additional information, learning content, retrieved from an interactive content server. The **Interactive Content Server** and **Remote Application Server** are located at the back-end tier. The Interactive Content Server is a data store that holds the language learning content/data such as relevant vocabularies related to each television programme in different languages. The language learning content/data and mainstream programme can be encoded and multiplexed before being broadcast via the DVB stream. The **Remote Application Server**, on the other hand, runs J2EE [Inscore & Kassem, 2002], which deals with the mobile requests that are routed through a wireless network (GSM, GPRS, UMTS, etc.). The **Remote Application Server** processes the request by interacting with the Interactive **Content Server**, mobile services, and user session information, and then generates and formats a response. The response is then sent back to the mobile phone device via the wireless network. The Java based TCP-IP stack can be used to establish communication over GSM, GPRS, UMTS, and similar network.

The **set-top-box** at the front-end tier is Bluetooth enabled, MHP based, with no return

channel to the back-end. The set-top-box can hold a **Client Java Application** and **Learner's Profile** component. The Client Java Application is developed to fetch and decode interactive content and provide an interface for content presentation and retrieval onto the TV and/or mobile phone devices. The link layer communication between set-top-box and mobile phone can be via a Bluetooth link. Learning Content is likely to be displayed as an overlay similar to a closed caption or subtitle on television screen. The J2ME application running on the mobile phone device retrieves and displays learning content provided from the set-top-box via a Bluetooth link [Mahmoud, 2003]. J2ME also enables learners to save and build their own personal dictionary for later use. Another option for the mobile device is to communicate directly with the J2EE server asynchronously when real time learning content is not required, to acquire the learning content prior to the programme broadcast time.

The (optional) **Learner's profile** component, in our architecture is designed to be located in the front-end tier. The Learner's profile component may contain learner's information, such as age, motivations, language of interest, preferences and language level of competence. The Learner model may also include interaction and viewing habits that are tracked automatically by the system. The Learner profile is stored in set-top-box in the front-end tier in case it is required for recommendation or personalisation services.

Typical Scenario

To give a more rounded picture of the services proposed, we present here a scenario derived from a focus group study that we conducted to elicit requirements for iTV based language learning services. [Fallahkhair et al., 2003]

Jayne is a medical student studying at Brighton University. She always wanted to improve her French to the degree that she could understand real conversation or watch and follow French soap operas. One of the reasons she agreed to pay for a satellite subscription was to be able to hear French language in context and to learn more about French culture. She found subtitles to be useful for learning word spelling and linking this to pronunciations. She sometimes writes a word that she does not understand to check it in a dictionary later. Most of the time she loses this piece of paper, or is too lazy to get the dictionary down from the shelf to check the meaning quickly enough to commit the words to memory. She just realised that a new language learning service is available via satellite and terrestrial that does not require the ADSL return path. The service enables her to learn new French words with their translation in English. It also enables her to use her mobile device to request language learning services. Vocabulary related to different subjects within each TV programme could be displayed on the TV screen or accessed via mobile phone. She likes the idea of using her mobile phone as she has found using the remote control rather difficult.

A message on the TV screen indicates that a language learning service is available by pressing a button from a mobile phone or remote control (i.e. 'press red button on your remote control, or 'press 111 on your mobile phone'). When she presses 111 on her mobile phone, the simple dialogue box will appear enabling her to choose a category for learning a vocabulary (i.e. health, shopping, greeting, etc.). She decided to learn about health related vocabulary. Therefore, the system highlights and displays health related vocabulary as an overlay similar to subtitles on her TV and mobile screen. For a few days before or after the programme she can download the entire vocabulary to her mobile phone. She also saves some vocabulary on her mobile dictionary. By default, the system shows the vocabularies on her TV screen. She usually turns the default option off especially when she is watching with her boyfriend **Jack**, who has no interest in her language learning. However, she enjoys watching with her friend **Merry** who is also interested in learning French. They both enjoy watching the French soaps and using their mobile device for language learning purposes. The best thing about using the mobile phone, as Jayne experienced, is that it facilitates learning individually while still allowing people to watch in a group. She could watch with Merry while they were each concentrating on learning different vocabularies. Jayne usually follows the health-related vocabularies and Merry learns shopping related ones, which are sent to them individually via their mobile

phone. Jayne also uses the service to learn and practice the vocabulary prior to the show when she is on the train, coming back from work. This enables her to enjoy watching the soap operas as well as giving her the sense that she has actually achieved something.

Conclusion

We have introduced an architecture for enabling enhanced TV learning content to be delivered over the TV or mobile phone. Some of the advantages of using the proposed architecture over the current way of delivering interactive content are listed below.

1. The main problem with using telephone modem or even a broadband connection for delivering interactive content is associated with the slow return path connection to the server side and back-end tier, which cause congestion problem if to deal with lots of simultaneous requests. The congestion problem happens when lots of people request information at the same time. The proposed architecture prevents this problem by sending interactive content through the DVB stream. Using the broadcast channel increases the speed of delivering interactive content to set-top-box and mobile phones.

2. Currently, interactive content is normally only available during a certain time slot (TV programme show time); however, using our architecture will allow it to be accessible even after the show time and from other media technologies, i.e. mobile devices.

3. The Data Protection Act and the learner's privacy are well respected in our architecture as we are locating the learner's profile component in the front-end tier (set-top-box) rather than as a separate component in the server.

4. Using the mobile phone for interacting with iTV adds more functionality, flexibility and mobility to the learning experience, in a number of ways. The mobile phone can be used as a means of communication to the back-end tier overcoming any necessity for a return path. Mobile handsets make it easy to differentiate between multiple users within households unlike interaction via the current generation of one-per-set remote controls.

Reference

Atwere, D. and Bates, P., 2003. Interactive TV: a learning platform with potential. *Learning and Skills Development Agency*. Available online:http://www.lsda.org.uk/files/PDF/1443.pdf

Bates, P.J., 2003. T-Learning Study: A Study into TV-based Interactive Learning to the Home. Available online: http://www.pjb.co.uk/t-learning/contents.htm

Bagui, S., 1998. Reason for Increased Learning Using Multimedia, *Journal of Educational Multimedia and Hypermedia*. 7(1), 3-18

Demetriadis, S., Triantafillou, E. & Pombortsis, A., 2003. A phenomenographic study of student's attitudes toward the use of multiple media for learning, Proceedings of ITiCSE2003.

Fallahkhair, S., J. Masthoff & L. Pemberton. In press. Learning Languages from Interactive Television: Language Learners Reflect on Techniques and Technologies. Proceedings of EdMedia 2004.

Gawlinksi, M., 2003. Interactive Television Production. London: Focal Press

Inscore, J. and Kassem, N., 2002. Designing Enterprise Applications with the J2EE™ Platform, Second Edition, Available online: http://java.sun.com/blueprints/guidelines/designing_enterprise_applications_2e/introduction/introduction.html

Intille, S., Lee, V. and Pinhanez, C, 2003, Ubiquitous Computing in the Living Room: Concept Sketches and an Implementation of a Persistent User Interface. MIT Media Lab Publications, Available online: http://web.media.mit.edu/~intille/papersfiles/IntilleLeePinhanez03.pdf

Luckin, R. & du Boulay, B., 2001. Imbedding AIED in ie-TV through broadband user modelling (BbUM). AIED Proceedings.

Lytras, M., Lougos, C., Chozos, P., and Pouloudi, A., 2002. Interactive Television and e-learning convergence: examining the potential of t-learning. Available

online:http://www.eltrun.aueb.gr/papers/tlearning.pdf

Mahmoud, Q.H., 2003. Wireless Application Programming with J2ME and Bluetooth. *Sun micro system resource for developers*, Available online: http://developers.sun.com/techtopics/mobility/midp/articles/bluetooth2/

Masthoff, J. and Pemberton, L., 2003. Adaptive learning via interactive television: one size fits all? In Proceedings of PEG 2003, St Petersburg.

O'Driscoll, G., 2000. The Essential Guide to Digital Set-top Boxes and Interactive TV, London: Prentice Hall

Oftel, 2002, Consumers' use of mobile telephony, Available online: http://www.oftel.gov.uk/publications/research/2002/q10mobr1002.pdf

Pemberton, L., 2002. The Potential of Interactive Television for Delivering Individualised Language Learning, Paper delivered at workshop on Future TV as part of the ITS 2002 conference in San Sebastian, Available online http://www.cmis.brighton.ac.uk/Research/ITRG/C%20&%20W%20papers.htm

Sharples, M., 2000. The design of personal mobile technologies for lifelong learning. Computers and Education, 34, 177 - 193.

Ultralab, 2003. m-learning project. Available online: http://www.ultralab.ac.uk/projects/m-learning

Underwood, J., 2002. Language Learning and Interactive TV. Proceedings of the Future TV: Adaptive Instruction in Your Living Room. Available online: http://www.it.bton.ac.uk/staff/jfm5/FutureTV/Underwood.pdf

Vavoula, G.N., and Sharples, M. (2002). Requirements for the Design of Lifelong Learning Organisers. In Anastopoulou, S., Sharples, M., and Vavoula, G. (eds.), MLearn 2002: Proceedings of the European Workshop on Mobile and Contextual Learning, pp 23-26.

Whitaker, J., 2001, Interactive Television Demystified, New York: McGraw-Hill