

2BeOn - Interactive Television Supporting Interpersonal Communication

Jorge Abreu, Pedro Almeida, Vasco Branco

Department of Communication and Art, University of Aveiro
3810-193 Aveiro, Portugal
{jfa, almeida, vab}@ca.ua.pt

Abstract. Interpersonal communication mediated by computer services supports the reinforcement and emergence of new communities brought together by leisure or work interests. This paper presents a workbench system that aims to study how the same principle can be applied in interactive television. The main objective is to allow TV users to be online (2BeOn) through the integration of basic and advanced communication services, enabling them to reinforce their interpersonal communication. The 2BeOn system is based on four core components: user tracking, communication services, interface engine and collaboration content/interaction tracing. In addition to the social and behavioural context of the system, its conceptualisation, prototyping and evaluation are addressed.

1. Introduction

The interconnection of networks, on which the Internet was based, had the major objective of linking individuals from separate networks, enabling them to ‘talk’ with each other and to share information. This last goal was the first to become largely implemented through development of the World Wide Web. Also, through the diversity of supported applications, interpersonal communication services have now established major significance by complementing or even substituting other traditional communication practices. One example of this is the mass adoption of Instant Messaging (IM) services that have probably grown faster than any communication medium in history; AOL claims 100 million registrations [1], ICQ reports an identical number [2] and other providers such as Yahoo and Microsoft also contribute to a huge number of connected users.

The development of network access technologies has enabled a wide use of communication services through a broad range of devices, such as mobile phones, palm tops, handheld PCs and even television in its interactive format. The increasing adoption of online interpersonal communication services, through different access devices, may reflect the user’s eagerness to be able to tele-communicate anytime and anywhere.

The 2BeOn name emerges from this context, reflecting the general purpose of the system and expressing the idea of enabling TV users ‘To Be Online’, communicating through TV mediated communication tools. The aim is to use the system, as a work-

bench, to study several technological, communicational and social topics related to the use of interpersonal communication processes and services, in interrelation with broadcast TV.

Despite all the hype surrounding Interactive Television (ITV), there is a considerable research gap in this specific area. Jaaskelainen [3] states that the main academic research streams are concerned with technical issues of delivering video-on-demand and with the field of interactive instructional television. Loes de Vos also supports this idea when she refers to ITV research reports [4] '*... those that do have value are hardly made public and not readily shared with other producers of ITV*'.

The system is being developed by a multidisciplinary team with different but intersecting research areas: ITV¹ and telework. However, the purpose of this paper is to highlight and focus on ITV. Nevertheless, section 5 demonstrates how the core conceptualisation of the system, complemented with targeted features, is applied to the telework area.

2. Interactive Television Context

TV users are more and more confronted with a myriad of information sources due to the higher number of digital channels and to the availability of on-line data.

In such a scenario, television is losing its role as a promoter of social ties [6], since users, when absorbed by this overload of information, may neglect their interpersonal relationships. This problem does not seem to be directly related to the surplus of information, but mainly to the absence of a common reference point usually associated with the establishment of a conversation between peers. The lack of this common referential is connected to the information on demand paradigm: when the information on offer is so widely segmented, the probability of seeing what the other person saw permanently decreases [6].

Nevertheless, this issue can be seen from another point of view, where the segmentation of the information, namely in the television arena, may promote a deeper relationship between members of micro communities that share the same interests and, thus, consume the same type of information.

These two perspectives can be understood as a paradoxical situation: from one side the interpersonal relationships could be fragmented and, for the other, intensified [7].

However, it seems there is a valid solution that applies to both approaches, reducing the negative aspects and enhancing the positive ones: the convergence of communication services and television. This blend can offer people the opportunity and the possibility to discuss at any time a common theme, such as a TV program that is being watched.

In this context, a system like 2BeOn is expected to promote communication in existing communities or to create new ones (supported by common references such as TV programs or by sharing specific video contents owned by each user).

¹ Although the definition of interactive television is not yet stabilized, our proposal considers the supply of basic and advanced communication services via TV, so it fits one possible format of interactive television [5].

2.1 Research Objectives

In a broad sense, our research in the ITV arena aims to design and integrate online communication services and to understand how users can exploit them when watching TV, engaged in leisure or information activities. The selection of the basic and advanced communication services and their interrelation is oriented towards the promotion of interpersonal communication.

The research also seeks answers to the following questions:

- What is the best approach for integration of communication services in order to cope with the technical limitations of TV as an output terminal?
- What is the role of TV content as a common reference point in the establishment of conversations?
- What is the impact of the proliferation of communication services on TV consumption from the perspective of the user's involvement between these two types of activities?
- How can the availability of mass communication services help to counteract the tendency of TV audiences to fragment and to reinforce socialisation between communities of interest?

2.2 Practical Applications Scenarios

The emerging platforms of ITV are basically oriented towards the supply of information on-demand (video, TV background information, news) and the access to dedicated services (like home shopping or home banking), but not to the promotion of interpersonal communication. Nevertheless, solid discussion centred on real time television viewing, or even on last night's show, can be maintained through these new formats of television, leading to a reinforcement of our sense of community. This principle is even more important in scenarios where tens or even hundreds of TV channels are available, where the paradoxical situation (fragmentation/intensification of interpersonal relationships) tends to be more accentuated.

It is in this context that the 2BeOn system applies to the ITV domain, by integrating adaptable means of transmission of typical forms of communication, enabling people to be in live contact during a TV show (either by IM, chat, voice and video communications) and allowing collaborative TV program recommendations.

The field of application of the system is very wide; nevertheless it seems appropriate to describe two main practical applications:

1. One of the core components of the system (see section 3) is the user tracking module, which enables users to check if other peers are online and if they are watching the same TV program (for example, a talk show). Such information can be an added incentive to establishing personal contacts; it will be more likely that people comment on a TV program as they watch it. Thus, if the user wants to contact a friend, he or she only has to click on that person's name and choose the required service via an opened mini-menu. If the communication service is based on the interchange of text messages, the system can continuously adjust the size of the TV and text areas. This feature can be used to measure the degree of the users' involvement in the dialogue.

2. A user is watching a TV program that he thinks would be interesting for a certain friend, who is not online or is watching a different channel with his or her status configured to 'please do not disturb'. The user can then decide to send a TV Program Recommendation (TVPR): so he or she simply clicks on the friend's name and chooses this option. Automatically, a segment of that program is recorded, sent and attached to a predefined message. In addition, it is also possible to add a text or voice annotation. The addressee is warned (by a clip-email) of that TV program recommendation, either immediately or, if off line, the next time he or she logs in.

The 2BeOn system is not considered by itself as a full ITV platform. The system is being developed as a workbench to test the conceptualisation of solutions that may eventually be applicable to and integrated within an existing ITV system.

3. System Conceptualisation and Prototyping

For the purpose of this research, commercial ITV solutions that could provide platforms for studying the topics referred to above were taken into consideration. However, these did not have the required functionality and flexibility to support the desired integration of communication services into TV. This established a strong need to prototype and develop the 2BeOn system.

For conceptualisation of the system, several contributing factors were taken into consideration:

- The identification and parameterisation of the users' communication mechanisms and the methodology that enables their transmission for such convergent environments;
- The technical limitations of the output devices and the social constraints associated with the home as the primary place for their use;
- The definition of the software agents which allow automatic correspondence between the implemented communication services in order to provide specific answers to the user's needs or requests.

The prototype in development involves interdisciplinary research contributed by complementary work teams: services and systems engineering (set side box prototyping, database and network communication support), interaction design and communications studies.

Some specific features, such as particular information supplied from user tracking (see section 3.1), the TVPR (included in the set of communication services), automatic adaptation of the interface and interaction tracing, underline the differences between 2BeOn's and existing commercial ITV platforms. Another distinction is that 2BeOn can lead us to a new television experience, even without the need to modify the TV content or produce special web sites to enhance it.

From a schematic point of view, the 2BeOn prototype comprises the following main blocks.

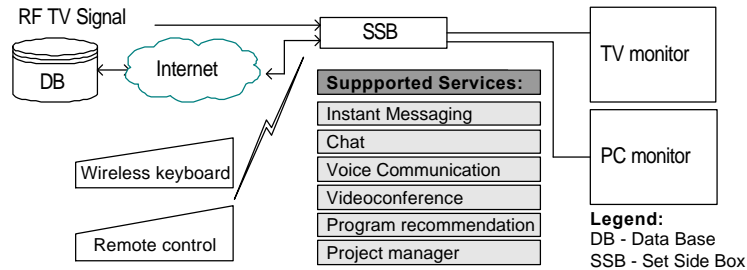


Fig. 1. 2BeOn's Block Diagram

3.1 Core Components

2BeOn integrates general communication and management features that can be applied to different areas. This section describes them from the perspective of ITV.

User tracking. 2BeOn's user tracking module is the main system's core component, dealing with the status of users (who is online, who is in a break, who is watching TV and which channel is tuned – *a user can know what their pals are watching and, if in the mood, start a conversation based on the program they are watching, instead of postponing or even losing that chance*). Because this feature may raise privacy concerns, the system allows users to block all or part of their accessible information. For instance, if users do not want their buddies to know that they are watching a specific channel, they can set up the system to block that information.

Communicational Services. As the main objective of 2BeOn in an ITV scenario is to promote interpersonal communication, synchronous and asynchronous communication services such as voice phone, IM, videoconference, clip-email, e-mail and TVPR are provided. The clip-email feature used in 2BeOn consists of unidirectional or one time bi-directional messages that act as warnings to other users, like SMS in mobile phones, or quick questions with closed answers (yes or no).

The incorporation of synchronous communication services in television is already used by at least two of the main commercial ITV platforms [8, 9]. Nevertheless, they do not supply information about the channels that each buddy is watching. 2BeOn will help to prove if this type of information can be an added value to stimulate the establishment of interpersonal communication. In this context, those services should be considered as having, not only the potential to be used in their traditional way (to put users in contact to discuss whatever they want) [10], but also to start a conversation based on the channel/buddy information supplied by the user tracking module.

Interface engine. The interface engine (InE) aims to enhance the human-computer interaction and deals with automatic features like: prioritisation of icons, based on the frequency of use, organisation of friends/colleagues top lists and tracking of the communication services the user most frequently selects to contact other peers.

In a more dynamic way, the interface agents may influence the communication process by emphasising the services that appear to have more interest to the user. For example, in a chat session, while the user is watching TV and simultaneously is engaged in a text based communication service, the InE monitors the intensity of participation of the user (based on the number of written words per minute) and dynamically shrinks or expands the TV window. This feature can be turned off if the user finds it annoying or if the TV content requires a full screen viewing mode.

Collaboration via content/interaction tracing. The success of a communication-oriented system also depends on the capacity to promote collaboration [11]. The system can contribute to this goal by analysing topics of interest. To identify these topics it uses information from the user's profile and complements it with patterns of interaction with the system: peers contacted, channels viewed or intensity of use of communication services. The user can turn to a search tool to find other users with the same interests or with interests in defined criteria. He or she can also start a conversation based on a query to the system that gives an alert signal when another user with the same interests tunes in to a common TV channel.

3.2 SSB Prototype

The 2BeOn central unit is called Set Side Box (SSB), instead of the traditional concept of Set Top Box (STB), since it is a device that integrates the hardware of a standard Personal Computer (PC), which can still operate in its normal way, and the functions of a typical STB.

The SSB is implemented using off-the-shelf components like a PC, a TV tuner card, a Dual Head Graphic Board (that allows output to TV and also to PC screens) and internal modem, Ethernet card or cable modem to the Internet connection. The client application runs under the Windows Operating System and controls several modules, such as: TV card, user interface (graphic and interaction), wireless input devices, network and database communication, core components and the user's interaction register mechanism.

3.3 Database and network communication

In order to maintain overall access to the system, all users' information and profiles are stored in an online relational database controlled by SQL.

User access is granted by a client application made in Macromedia Director™. This program has considerable multimedia capability, so it is used to implement 2BeOn's interface and interaction front-end. All the interoperability and interrelationships between communication and management services are controlled by this application.

The transmission of information is supported by *Active Server Pages (ASP)* using the POST method (from HTTP Protocol) through Open Database Connectivity. The model *Director<->ASP<->SQL Server* allows communication to be established between the user interface, supported by Director, and the centralised information in the

relational database. Alongside this, peer-to-peer communication is implemented to allow direct exchange of messages between users, releasing the server from unnecessary traffic. For a server-client type of communication the system makes use of Macromedia's proprietary multi-user server.

3.4 Interface Design

The interface design process is being undertaken in parallel with the technical implementation phase. Figure 2 shows some drafts of the 2BeOn interface.



Fig. 2. 2BeOn interface draft

Graphic Design. The resolution limitations associated with the TV screen affect the direct use of web design techniques [12]. In this context, special attention must be given to all screen information (text, graphics distortion, colors) that overlap or surround the video content [13].

Interaction Design. The following considerations have influenced the interaction design.

- Navigation – in contrast to other ITV systems, 2BeOn uses a remote control with a pointing device that works like a wireless mouse. In addition, a set of shortcut keys whose colors match those of the active icons can be used.
- Options – in a broad sense, options are displayed as lists, pop-ups and icons. They are mainly activated by means of Direct Manipulation techniques, as defended by Shneiderman [14]. The aim is to give the users the capacity to visually access and interact with information and objects by drag and drop operations.

3.5 Interoperability of Software Agents

The system goes further than simple usage of the communication services discussed here. It aims to take advantage of the interrelation of those services through customised and customisable software agents. By dealing with information from different

services and from the online database, these can provide a more complete answer to user needs or requests. For example, when a clip-email is sent, different formats and output devices (PC, TV or mobile) can be used at the destination, depending on the user's status. The system always tries to deliver the message through the communication device that should reach the recipient in a more efficient and direct way. This implies constant interaction with the database in order to get updated information on users' profiles and status.

4. System evaluation

System evaluation made so far been informal was based on personal interviews supported by interactive demos. This has shown that the concept of integration of communication services is pleasing to those users interviewed. The option to allow users to opt for privacy in certain circumstances is seen as a desired/obligatory feature. Users foresee that the ways they will use the system will depend on a variety of factors, namely if they are tired or relaxed and if the friends found online are the ones with whom they want to correspond.

Research topics identified during the article will be evaluated by two main procedures:

- online questionnaires supported by multimedia demonstrations of the system's features;
- qualitative and quantitative testing of the working prototype in domestic environments, followed up by personal interviews.

Two sets of users will be questioned: domestic users, with different levels of technological literacy, and experts on the field.

Register mechanisms built into the system to monitor users' interactions (clicked icons, actions performed and mean time spent) will aid the research team to identify changes needed to the inner structure of the system.

Such system adjustments aim to improve effectiveness of the application taking into account the heuristics proposed by Jakob Nielsen [15] or the interface characteristics identified by Shneiderman: ease of learning, high speed of usage, low user error, user satisfaction and user loyalty [16].

5. Parallel Research - Telework

As referred, the 2BeOn system through its core components is also being applied to the telework research area, where the PC is the main output device, although TV and mobile devices are also addressed. The telematic services and collaborative features of the 2BeOn system also give it the ability to support communication and management activities needed for mobile work.

Remote workers face the challenge of using different communication services to keep in touch with their work team and organisational culture. Despite recent progress in communication technologies and protocols *'the poor convergence towards a user*

model [17] is still noticeable. A strategy of interrelation between services integrated through a common interface can lead to reduction of usage difficulties². Olsen notes that the limitations of human learning force us to aim for a convergence of interactive styles [19]. Such integration is not limited to the interface, it may be exploited by software agents to give users more assistance in situations such as automatic management of messages and tasks or tracking competencies.

Furthermore, users may want to access virtual communities anytime, anywhere and independently of the input/output devices used. For that, a strategy of server centred profiles must be adopted. A unique individual login allows a user to access all his or her updated information (profile, buddy list, messages or tasks) from any device.

Through the development of the 2BeOn system for remote work scenarios, answers to the following research concerns are sought:

- The need for teleworkers to have an equal level of communication with their co-workers as the one they had before teleworking [20]. This requires identification of the best integration metric for communication and management services. The research field of Computer Supported Cooperative Work has mainly focused on the development of independent communication services, without considering their interrelation and integration in a uniform interface [21];
- How the integration of communication and management services within the same system, complemented with automatic support mechanisms, is able to improve communication between co-workers;
- The impact of a tool for dynamic creation of work groups, available in 2BeOn, on the promotion of work communities;
- How the system supports work progress by synchronising processes and helping users to find information, tracking competencies or controlling users' personal or other tasks?

6. Future Research

During the current phase of prototype development, an increasing number of potential applications of the system to entertainment have been identified. Among them, it is planned to try out a TV Interactive contest that makes use of the collaborative features of 2BeOn. The contest, a kind of mystery game, is 'played' by distributed teams represented by a leader at the TV studio. Each leader is faced with local challenges and helped in his mission by the exchange of messages with his team peers, watching the contest at home. Spectators can see the TV broadcast of the contest, monitor the exchange of messages and even play along by participating in a polling system.

In the present scenario of proliferation of TV channels, it is possible to house large affinity groups (such as sailing fans, history lovers, fashion devotees) but it will be difficult to address other more specialist groups which correspond to relatively small TV audiences. Nevertheless, some web procedures that support niche groups, like information sharing and discussion forums, could be translated to the Television arena

² The Groove project, www.groove.net, is an example of this effort. However, interface adaptive features still need to be implemented as stated by Herring [18].

using suitable interactive technologies that facilitate peer-to-peer communication. 2BeOn, through some of its proposed features, is already a start-up base to further research in this area.

References

1. <http://www.aol.com/aim/home.html> (03-06-2001)
2. <http://web.icq.com/> (03-06-2001)
3. Jaaskelainen, K.: Strategic Questions in the Development of Interactive Television Programs, Publication series of the University of Art and Design Helsinki UIAH A 31, Ph.D. Thesis, Media Laboratory of University of Arts and Design, Helsinki (2001)
4. Voes, L.: Searching for the Holy Grail - Images of Interactive Television, MSc. Dissertation, University of Utrecht, Department of Media and Communication, Amsterdam (2000)
5. Stewart, J.: Interactive television at home: Television meets the Internet. In: Interactive Television. TV of the Future or the Future of TV?, Aalborg University Press - Media & Cultural Studies 1 (1999) 232-233
6. Wolton, D.: Penser la communication, Paris: Flammarion (1997)
7. Abreu, J., Silva, L.: Televisão Interactiva: do imaginário à realidade – Interactive Television: from the imaginary to the reality. IV Lusocom, S. Vicente, Brasil. In: Eptic online, vol. II nº1, (<http://www.eptic.he.com.br/revista/rv2.htm>) (2000)
8. <http://www.aoltv.com/> (29-07-2001)
9. <http://www.opentv.com/interactive/> (29-07-2001)
10. Nardi, B., Whittaker, S. and Bradner, E.: Interaction and Outeraction: Instant Messaging in Action. In: Proceedings CSCW'2000, ACM Press (2000)
11. Hagel, J., Armstrong: Net Gain, Expanding Markets through Virtual Communities. Boston: Harvard Business School Press. ISBN 0-87584-759-5 (1997)
12. Green, M., Senders, J.: The Killer App is TV - Designing the Digital TV Interface; Ergo/Gero - Human Factors Science (1999)
13. Jorgensen, P.: BRAINS - The details of iTV production, in EUROPEMEDIA.NET, <http://www.europemedia.net/showfeature.asp?ArticleID=2691> (18-04-2001) (2001)
14. Shneiderman, B. and Maes, P.: Direct Manipulation Vs Interface Agents. In: Interfaces, ACM – 1072-5520/97/1100 (1997)
15. Nielsen, J., and Molich, R.: Heuristic evaluation of user interfaces. In: Proc. ACM CHI'90 Conf. (Seattle, WA, 1-5 April 1990) 249-256
16. Shneiderman, B.: Designing the user interface: strategies for effective human-computer interaction. 3rd edition – Addison-Wesley (1998)
17. Almeida, P., Mealha, Ó.: Conceptualising a telework environment. In: Proceedings from The 5th International Telework Workshop - Telework 2000, Sweden (2000)
18. Herring, Charles Edward: Groove: A Case Study in Adaptive Architecture. In: proceedings of 5th SCI, Orlando, Florida (2001)
19. Olsen, D. R. Jr.: Interacting in Chaos. Computer Science Dep., Brigham Young Univ., USA (1998). In: <http://icie.cs.byu.edu/papers/Interactinginchaos> (22-03-2000)
20. Nilles, J.: Telework: enabling distributed organisations. In: Information Systems Management 124(4):7-14 (1997)
21. Cartensen, Peter H., Schmidt, Kjeld: Computer Supported Cooperative Work: New Challenges to Systems Design. Handbook of Human Factors, Kenji Itoh (ed.), Tokyo (1999)