Telebuddies: Social Stitching with Interactive Television

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Abstract
In this paper we report on our work to enable "laid-back" social interactions using television as a primary interaction medium. By integrating semantic web techniques with interactive television we were able to create smart applications that can run as extensions of television shows and stimulate groups of users to communicate. Groups are based on the shared characteristics that can be found for subsets of spectators. Communication between spectators is brought about at two levels: direct communication like instant messaging and indirect communication like cooperating in a team to win a quiz. Our system does not necessarily require a new television format, but is able to *reuse existing television shows and to "socialize" them* so they can be re-broadcasted with support for group interaction.

Keywords
Interactive television, semantic web, common ground, cooperative user interfaces.

ACM Classification Keywords
H5.2. Information interfaces and presentation: User Interfaces; H.5.3 Group and Organization Interfaces

Figure 1: Question shown in overlay with the television screen. The viewer's input is restricted to answering the question.

Introduction

Interactive Digital Television is becoming a widely spread medium that enriches everyday lives of millions of people. Although creating new television formats that explicitly use the new technologies and support viewer interaction is necessary to exploit all possibilities, we demonstrate many existing “traditional” formats are suitable for group interaction. Existing formats are more accessible for the wide range of viewers with different backgrounds and standard television sets; in general usage of existing material is much cheaper. A television show that has already been broadcasted can be broadcasted again easily without any extra production costs. Even in case the producers want to add viewer interaction to an existing television show, it will be cheaper to rely on existing production methods and add interaction afterward in comparison with using a new production method including interaction.

The Telebuddies system presented in this paper allows *annotating existing television shows*, *turning them into interactive shows*, and it *exploits similarities and social relations between spectators* to make the interactive television experience more exciting. We rely on several techniques often used to build semantic web services [2, 7].

Scene 1: Legacy scenarios lower the threshold

The approach presented here starts with a recorded television show and adds viewer interaction to this show. For this purpose we create an *interaction script* that includes different types of events that require interaction with the viewer on different timestamps. Depending on the type of television show, this interaction script can have a different vocabulary. In the remainder of this paper we use a typical television quiz that can be turned into an interactive quiz as a proof-of-concept of our approach. This means our interaction scenario has to allow the viewer to participate in the quiz and basically answer questions within the appropriate time spans. When the participants in the studio have to answer a question, solve a riddle... the viewer gets the same time to find an answer. In addition, since many quizzes incorporate teams that compete with each other the Telebuddies system also supports collaboration of different remote viewers as team members in the quiz.

Each question in the interaction scenario is timestamped and has a predefined duration so our software can present the question to the viewer at the required time and the viewer has limited time to respond. The interaction scenario that enriches an existing television format is the foundation of our system. Depending on the format, the interaction scenario could incorporate elements that are defined in an ontology associated with the format. The usage of ontologies to annotate formats provides us with a powerful tool to add new types of functionality to existing formats.

Figure 1 shows the interface for the viewer when a question is retrieved from the interaction scenario and presented during the television show. The question is shown in overlay with the normal television image to create an immersive user experience. When a question is presented, the input the user can give is constrained according to the type of answer that is expected and the focus of the user interface is automatically shifted to the part of the user interface presenting the input possibilities. For example, figure 1 shows at the bottom

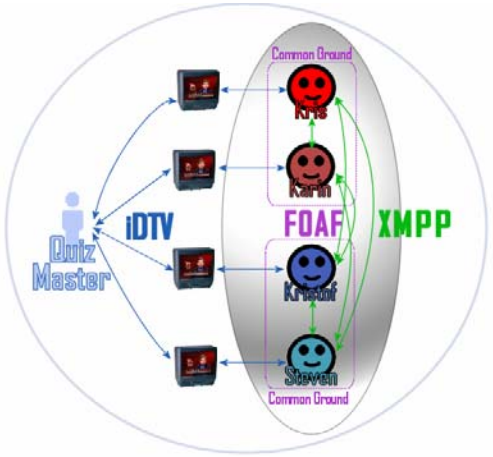

Figure 2: Using common ground to define manageable user groups

```
<rdf:RDF xmlns:foaf="http://xmlns.com/foaf/0.1/" xmlns:swn="... >
    <foaf:PersonalProfileDocument rdf:about="">
        <foaf:maker rdf:nodeID="me"/>
        <foaf:primaryTopic rdf:nodeID="me"/>
    </foaf:PersonalProfileDocument>
    <foaf:Person rdf:nodeID="me">
    <foaf:name>Kristel Clijsters</foaf:name>
    <foaf:title>Miss</foaf:title>
     <foaf:interest>
        <rdf:Class rdf:about="http://del.icio.us/tag/Puppies">
        <rdf:Class rdf:about="http://del.icio.us/tag/winnie the pooh">
        ...
        <rdf:Class rdf:about="http://del.icio.us/tag/clouseau">
        <rdf:Class rdf:about="http://del.icio.us/tag/skydiving">
     </foaf:interest>
      <swn:yearOfBirth>1979</swn:yearOfBirth>
     <foaf:birthday>22-11</foaf:birthday>
     <vCard:ADR rdf:parseType="Resource">
          <vCard:Locality>Borgloon</vCard:Locality>
          <vCard:Pcode>3840</vCard:Pcode>
          <vCard:Street>De Tieckenstraat</vCard:Street>
      </vCard:ADR>
      <foaf:givenname>Kristel</foaf:givenname>
     <foaf:knows><foaf:Person> <foaf:name>Kris Luyten</foaf:name>
     <rdfs:seeAlso rdf:resource="http://www.uhasselt.be/kris/kris.foaf.rdf"/>
      </foaf:Person></foaf:knows>
      <foaf:knows>...</foaf:knows>
  ....
</rdf:RDF>
```

Listing 1: Foaf profile.

left that the user can only use “A”, “B”, “C” or “D” during the time the question is shown on screen. Alternatively the input can automatically be constrained to free form text, dates, numbers... according to the answer the user has to give. The available time to provide an answer is also limited and indicated in the user interface.

Scene 2: FOAF for Common Ground

To enable spectators to participate and collaborate at a distance in a television show, the content and process of the activity must be coordinated. In this case the content is described in the quiz scenario, and the process is coordinated by the interaction scenario. The Telebuddies server loads both and communicates with the spectators’ settopbox to deliver the correct content at the required time. However, people cannot even begin to coordinate on content, without assuming a vast amount of shared information or common ground, e.g. mutual knowledge [4]. Using profiles enables us to find shared characteristics of spectators. Shared characteristics are used to create a common ground between spectators. In combination with the context of the television show this results in the most appropriate common ground for that specific television show: e.g. Family Feud implies family connections between participants. Spectators can be subdivided into smaller groups by incrementally adding more characteristics if required.

Techniques originating from the semantic web initiative as proposed by Tim Berners-Lee [2], [7] are used to both enrich the interactive television experience for the viewer and to make participation more comfortable. A viewer is identified by a Friend-Of-A-Friend (FOAF, [1]) profile. This profile contains information about the social relations of the user next to traditional information that identifies the user (such as name, address, hobbies, hair color...). Listing 1 gives an example of a FOAF profile that is used by the Telebuddies system. This example shows that FOAF is a Resource Description Framework vocabulary (RDF, http://www.w3.org/RDF/) for describing people and social networks. Its RDF syntax allows us to easily query relations between different FOAF files and build a graph of related FOAF profiles. In this example we use the del.icio.us social bookmarking[1] tags to specify the interests of a person: because of the fussiness of what human interests exactly are we use this folksonomy since it is a list of terms created by the end-users themselves. Even if the tags do not exactly match, an algorithm can be used to calculate how closely related two tags are (e.g. in the case of del.icio.us how many URLs they have in common) and use a threshold to determine whether or not the two tags indicate the same interest. Of course, other categorizations could also be used for this purpose.

Once all viewers have such a profile, we can exploit these to find a common ground between the viewers and create viewer subgroups accordingly. Examples of a common ground are whether people exercise in the same sports club, are family, live in the same street or have common friends. Because of the RDF-based syntax we can exploit arbitrary relationships between different FOAF profiles. The type of relationships and

[1] http://del.icio.us allows users to share and tag bookmarks online.

properties that are used to determine the common ground between different viewers is constrained by the type of television show. For example; the quiz *Family Feud* requires the participants in one group to have a family connection to a certain degree.

Our implementation uses the Jena[2] library to query the RDF graph of the viewers. The RDF graph is actually a graph that contains the FOAF profiles as nodes and relationships with other FOAF profiles as edges. To query this graph we use RDQL [6], a query language for querying RDF graphs. RDQL allows us to select a number of FOAF profiles that fulfill a set of predefined criteria and are related with each other (e.g. have a family connection).

We are also aware that the usage of such profiles requires a system to protect the privacy of a user. Currently, our implementation does not include security and privacy management except for a user login. The user is free to fill in the data she/he wants to expose.

Intermission: A Backstage Tour

The system we describe in this paper is implemented on the MHP platform [5], a commonly used software platform for IDTV settopboxes. Since the software platforms for IDTV settopboxes are in constant evolution right now, it is hard to select the most appropriate platform for developing IDTV applications. We chose MHP because it is a widespread and standardized software platform, but also because it is probably the most limited one compared to other upcoming iDTV platforms. This assures us our application can be easily ported to newer and more extensive platforms.

For data communication we use the XMPP [3] protocol, which can be considered as a "ubiquitous" protocol because it does not require anything from the client except being network-enabled and being able to process XML.

In addition to the traditional broadcasting service, there are also two separate services provided by the Telebuddies system. One service is responsible for scenario execution (i.e. synchronization with the "application logic" of the specific television show) and another one to process the FOAF profiles and create spectator groups.

Scene 3: Let's Play!

In this section we describe how the system works using a specific example. "Test the Nation" or in Dutch "De Nationale Test", was broadcasted on Flemish television in September 2004. It is a television show exploiting groups of people with shared characteristics to compete against each other.

On the website[3] of the show we can find the following description:

...Test the nation is the world's largest simultaneous I.Q. test. After watching the show every participant will know his or her I.Q. score. In the studio, groups of participants will include: Celebrities, Blondes, Garbage Men, Unemployed, Lawyers... At the end of the show, the different groups in the studio will be

[2] http://jena.sourceforge.net/

[3] http://www.testonfox.com/home.htm

compared, as well as different states, republicans vs. democrats, etc. ...

With emerging interactive television technologies, the quiz experience will not be limited to participants inside the studio. Spectators watching the show can play along. In contrast with existing interactive television games, the spectators play together with other spectators, just as the participants in the studio compete or collaborate with each other.

The quiz television show and the quiz application can be broadcasted together, to create an integrated experience. When the quiz show starts, spectators are invited to sign up and participate. When the broadcaster signals the game to start, groups of spectators are formed, based on their FOAF-profiles and using the techniques described earlier. Spectators are moved in a chat room where they can communicate with other members of the same group. The maximum and minimum number of members in one group is dependent on the television show. Members in the same group have profiles with shared characteristics. In this case a team could be composed out of members that fulfill three criteria; live in the same village, like to play computer games and are students.

When the participants in the studio are presented with a question, the same question is sent to all spectators. Figure 1 shows a question being shown on overlay of the original TV-image. The user can answer the question, and between questions it is possible to communicate with other group members.

Afterwards, an evaluation of the quiz is shown, winners and losers are proclaimed and different viewer groups are compared against each other. In following shows, the same groups can be reused, extended or reduced. This gives the possibility to form micro-communities of viewers that often play together and compete against other micro-communities.

Scene 4: The road ahead

Before the Telebuddies system can be widely deployed, some issues need to be resolved. First the *scalability* of the system is not tested. Because of the number of viewers some shows have (up to millions), the systems needs to be extremely scalable. The second issue to resolve is to find new, safe and convenient *ways to gather social metadata* of different persons: the usefulness of the FOAF profiles for finding a common ground depends on this. The third issue is probably the most important one: sustaining a suitable *privacy* policy to store, maintain and process the FOAF profiles.

The usability of the system is currently being investigated by experts in social behavior and communication science. A comparison of the support for social interactions of the Telebuddies system with other IDTV approaches is now being conducted.

Final: Conclusions

We believe the Telebuddies system can lower the threshold to make watching television a social experience by exploiting common grounds. People that can interact with each other through television are carefully selected by using their user profile and existing social relationships with other viewers. This provides a more accessible way to use participative interactive television. Although our system has not yet been tested in real-life settings, the examples discussed in this paper are fully supported by our system and

tested in lab settings. The functionality was tested with smaller groups of up to 6 persons playing together in a team or competing against each other in separate teams. We hope to make interactive television a less individual activity and make participation an easy and reassuring activity. Semantic web technologies help us to accomplish this.

The Telebuddies system adds social interaction to existing television shows. Instead of creating new and expensive formats to allow viewers to participate, we have shown that given an existing traditional television show this can be enhanced with interactive participation and even collaboration among spectators.

Additional material, including screenshots, are provided on the following website:
http://research.edm.uhasselt.be/kris/research/projects/telebuddies/

Credit Titles

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