An Open Service Infrastructure for Enhancing Interactive TV Experiences

Cristian Hesselman[1], Wijnand Derks[1], Joost Broekens[1], Henk Eertink[1], Mark Gülbahar[2], Remco Poortinga[1]
[1]Telematica Instituut, the Netherlands, [2]Institut für Rundfunktechnik GmbH, Germany
{cristian.hesselman, wijnand.derks, joost.broekens, henk.eertink, remco.poortinga}@telin.nl, guelbahar@irt.de

Abstract
We argue that enhancing TV experiences with community and interactivity elements ("Web 2.0"-style) requires an open service infrastructure that allows third parties from outside the iTV domain (e.g., web service providers, telco operators, and end-users) to easily integrate such services into an iTV service offering. We have developed a set of service enablers that form the basis for this infrastructure.

1. Introduction

Today's landscape of networked multimedia consists of a few principal "technology domains", such as the Web, IPTV, in-home networks, and mobile telecommunications. Each domain is designed to provide specific types of multimedia services and to operate in specific environments. For example, the Web typically provides best-effort on-demand multimedia services that operate on the public internet, whereas IPTV services usually focus on high quality professional multimedia content and operate in tightly managed environments. As a result, each domain uses its own set of technologies (e.g., metadata formats, protocols, and user identities) that do not interoperate. This creates a multimedia landscape that is organized in a vertical manner, as illustrated by the four "silos" in Figure 1 (iTV is usually based on a managed IPTV environment).

Previous work has shown that this fragmented situation limits the user experience for iTV, but that this experience can be enhanced by integrating media elements, end-user services, and devices from other technology domains into an iTV session (e.g., by adding web content to a DVB broadcast [1]). The underlying rationale is that these other technology domains have their own strengths and that they can be used to complement the weaknesses of iTV solutions. Table 1 illustrates how we rate the characteristics of several technology domains relative to one another.

Our work focuses on enriching iTV experiences by seamlessly integrating community and interactivity services ("Web 2.0"-style) from various technology domains into an iTV session. Our position is that these cross-domain sessions require an *open service infrastructure* that enables third parties from outside the iTV domain (web service providers, telco operators, and end-users) to seamlessly add their services to an iTV session. Besides improving end-user experience, this
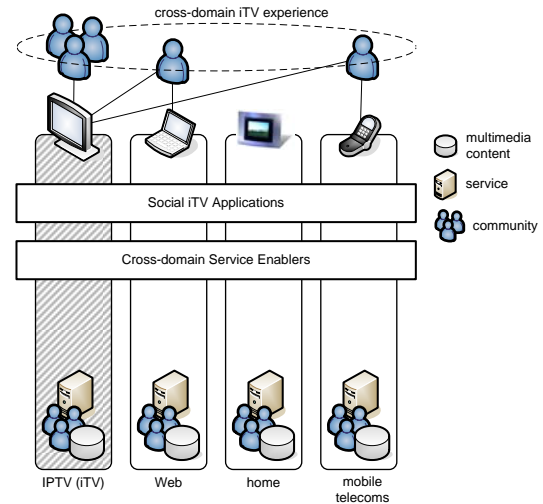

Figure 1. Vertically organized media landscape.

infrastructure will also allow service innovations in other technology domains to quickly flow into the world of iTV, in turn fuelling new iTV experiences.

2. Service Enablers

The infrastructure we envision consists of a set of service enablers, which are building blocks that can be operated by different parties in different technology domains (e.g., by telco operators or service providers on the web) and allow developers to create social iTV concepts, for instance by adding services for user-generated content from the Web to an iTV session (e.g., when a certain celebrity appears on TV). Service enablers essentially form a horizontal layer across the technology domains we distinguished in Figure 1.

We designed and developed four enablers that are crucial for cross-domain iTV experiences:

- *A metadata integration service* that translates domain-specific metadata formats into a domain-neutral format;
- *An identity management service* that supports user profile management and allows users to be authenticated while remaining anonymous;

	IPTV	Web	Mobile	Home
Advanced interactivity	-	++	+	++
User-generated content	-	++	-	+
Perceptual quality	++	-	+/-	+
Communities	-	++	-	-
Services/media choice	+	++	-	-
Billing & accounting	++	-	+	NA
Secure/trusted	++	-	++	+

Table 1. A few technology characteristics.

- *A session management service* that controls the establishment and release of cross-domain iTV sessions; and
- *A personal recommender service* that provides per-user recommendations.

The identity management service could for instance be operated by a telco operator with whom a certain iTV viewer has a subscription (trust relation). The system can then use this identity management service to, say, provide personal information to a service on the web in a privacy-neutral way and integrate that service in an iTV session. Similarly, the session management service could be running on someone's home gateway, but could also be operated by a telco provider.

We implemented the enablers as web services, except for the session management service, which is an OSGI bundle with a Java API. The identity management service provides a SAML 2.0 interface. The interface of the recommender service abstracts away from specific recommender systems.

3. Value Networks

The open service infrastructure of Section 2 also opens up the value network for iTV because service providers can more easily play a role in the (cross-domain) iTV market. To get an indication of what these value networks might look like, we carried out a scenario analysis using end-user value as the main driver. We used an expert panel [2] and identified four end-user types:

- *Consumers*. The system is used as a medium to reach large user groups that interact relatively anonymously with professional broadcast content.
- *Cocooners*. The system is used to optimize customer intimacy and provide personalized content and services to the end-user, based on behaviour and recommendation.
- *Club members*. The system is a platform for groups centered around a common interest that contribute actively with user generated content and services.
- *Friends and relatives*. The system is used by close friends and relatives to share personal content in an intimate context.

These user types are a predictor for what the value network for cross-domain iTV will look like. For example, to serve "club members", community services such as MySpace or Hyves may have to cooperate with IPTV aggregators and mobile network operators to realize a service that enables the group "Fans of The Simpsons" at MySpace to watch the latest Simpsons movie together.

4. Prototype

We have developed a prototype based on a scenario in which groups of friends play along with a TV quiz and buy products related to the quiz afterwards. We used a DVB IP server for streaming the TV quiz (managed IPTV domain) and web services for generating questions for viewers at home and for an e-shop (Web domain). The viewer's friends are available through an IMS presence server (mobile telecoms domain).

When a viewer logs onto the system (using NFC), a client application on the TV uses the identity management service to log that person onto the quiz web service. Next, that viewer can invite a friend to play along using a TV-based presence client that interacts with the IMS presence server. The session management service sends an IMS-based invitation to the friend's TV, who can then choose to accept it and play along with the quiz. The system uses VLC for rendering and shows the questions for the viewers at home as an overlay on the game show. The questions are triggered by cue points in the DVB IP stream, which are handled by an MHP client on the TV. After the show, the system shows recommended items from a web shop. Recommendations are based on preferences built up during the quiz based on the answers of the user. Every question and web shop item has associated TV-Anytime metadata. The recommendation service assumes that correctly answered questions express interest in that topic and vice versa. The shop interacts with the identity management service so that the user does not have to log on again. The metadata integration service translates the DVB IP metadata into a domain-neutral format (TV-Anytime) and makes it available to other services, for instance to support content discovery or profile based filtering.

5. Future Work

We believe that we have only scratched the surface of cross-domain iTV. We are currently extending our work in the EU project iNEM4U (www.inem4u.eu) to investigate topics like cross-domain communities, context-awareness, and business models. We will also investigate the existing enablers in more detail and will carry out small-scale user studies.

References
[1] Synchronised and scalable AV content Across NeTworks (SAVANT), http://dea.brunel.ac.uk/project/savant/
[2] Van der Heijden, K. (1996). Scenarios. The art of strategic conversation. John Wiley & Sons.