



LINKEDTV



Deliverable 3.7 LinkedTV User Interfaces Selected and Refined

Michiel Hildebrand, Daniel Ockeloen, Lilia Perez Romero, Pieter van Leeuwen

02/10/2014

Work Package 3: LinkedTV Interface and Presentation Engine

LinkedTV

Television Linked To The Web

Integrated Project (IP)

FP7-ICT-2011-7. Information and Communication Technologies

Grant Agreement Number 287911

Dissemination level ¹	<i>PU</i>
Contractual date of delivery	<i>30th September 2014</i>
Actual date of delivery	<i>2nd October 2014</i>
Deliverable number	<i>D3.7</i>
Deliverable name	<i>LinkedTV User Interfaces Selected and Refined</i>
File	<i>LinkedTV_D3.7.doc</i>
Nature	<i>Report</i>
Status & version	<i>Final</i>
Number of pages	<i>29</i>
WP contributing to the deliverable	<i>WP 3</i>
Task responsible	<i>CWI</i>
Other contributors	<i>Noterik S&V RBB Condat</i>
Author(s)	<i>Michiel Hildebrand (CWI) Daniel Ockeloen (Noterik) Lilia Perez Romero (CWI) Pieter van Leeuwen (Noterik)</i>
Reviewer	<i>Lampis Apostolidis (Certh) Lyndon Nixon (Module)</i>
EC Project Officer	<i>Thomas Küpper</i>
Keywords	<i>User interfaces, companion applications, second screen, HbbTV information needs</i>
Abstract (for dissemination)	<i>This report describes the LinkedTV user interfaces. Based on the results user studies and the initial evaluation of the year 2 prototype we selected and refined the interfaces. We selected a single screen application that uses HbbTV technology to provide additional information about a TV program as an overlay on the TV broadcast. In addition, we worked towards TV program companion applications that are tailored for two domains: news and cultural heritage. With these applications</i>

¹ • PU = Public

• PP = Restricted to other programme participants (including the Commission Services)

• RE = Restricted to a group specified by the consortium (including the Commission Services)

• CO = Confidential, only for members of the consortium (including the Commission Services)

	<p><i>we demonstrate different types of interaction modes, such as synchronized content on a second screen, and bookmarking chapters combined with the exploration of related content after the program. The interfaces are built on top of the Multiscreen Toolkit. We created a component-based infrastructure that allows us to quickly create tailored companion applications by reusing and configuring interface components. In the final part of the project we finalize this approach and test it by applying it to a new domain.</i></p>
--	---

Table of Contents

1	Introduction	6
2	Information needs and requirements	8
2.1	Information needs in Cultural Heritage domain.....	8
2.1.1	Information about the artwork	8
2.1.2	Background information.....	9
2.1.3	Related artworks.....	9
2.1.4	Navigating between chapters	9
2.1.5	Program information	9
2.2	Information needs in News domain	9
2.2.1	Objects in the news	9
2.2.2	In other media	10
2.2.3	Background	10
2.2.4	Timeline.....	10
2.3	General functional requirements.....	10
2.3.1	Television controls	10
2.3.2	Bookmarking	10
2.3.3	Personalization	10
2.3.4	Passive and synchronous.....	10
2.3.5	Active and asynchronous.....	11
3	Initial user interfaces.....	12
3.1	Single screen	12
3.2	From second screen to companion applications.....	12
4	Single screen	14
5	Companion application for Cultural Heritage domain	16
5.1	Selecting episodes and chapters.....	16
5.2	Enriched video player.....	17
5.3	Enrichment dimensions	19
5.3.1	About.....	19
5.3.2	Background	20
5.3.3	Related works.....	21

5.3.4	Related chapters	22
5.4	Personalization.....	23
6	Companion application for News domain.....	24
6.1	Second screen	24
6.2	Enrichment dimensions	25
6.2.1	In other media	25
6.2.2	Background	26
6.2.3	History	26
7	Outlook.....	28
7.1	Evaluation	28
7.2	Personalization.....	28
7.3	Component-based design of companion applications.....	28
8	Bibliography	29

1 Introduction

This report describes the design and functionality of the LinkedTV user interfaces. The designs are guided by the results of the user studies conducted in the second year of the project and the evaluation of the initial prototype in the third year of the project. The first interface that we selected is used for applications that run on a TV. The development of this interface is a joint effort of Noterik, RBB and Condat. We refer to this interface as the single screen solution. Using HbbTV technology the interface is provided as an overlay over a TV broadcast. The interface provides a straightforward way to access background information generated by the LinkedTV system. The interaction with the interface is done through the remote control of the TV, or the remote control of a set-top box. The interface and the way that information is presented are purposely designed to be simple and basic. The TV is not suited for reading long texts and the remote control is not suited for advanced interaction. The interface supports basic control of the video by selecting chapters, and provides access to basic information about the persons, organizations and locations that occur in the video. The generic concept of the interface makes it suited for any type of TV program.

The second interface we selected is used for so-called companion applications. A companion application is a Web application that is tailored to a specific TV program. It can serve multiple functions, including a second screen during the broadcast, selection of episodes or fragments for on-demand viewing, and exploration of additional information after watching a TV program. To be more precise, we designed a set of interface components that can be combined into a companion application for a specific TV program. This approach is motivated by the results of the user studies and evaluations, which indicated variations in the information needs and the functional requirements for a news program and a program in the cultural heritage domain. The Netherlands Institute for Sound&Vision, CWI and Noterik together developed a companion application for a cultural heritage program. This application was demonstrated at the International Broadcasting Convention (IBC) 2014².

In the second year of the project CWI already developed a prototype companion application for a news program, as described in deliverable D3.5. For this prototype the content shown in this application was manually selected. In the third year of the project CWI worked together with Eurecom to automatically generate the content for this application using the LinkedTV entity extraction and enrichment algorithms. The resulting application was presented at the Extended Semantic Web Conference 2014 [1] and the ACM International Conference on Interactive Experiences for Televisions and Online Video 2014 [2]. The application is also a finalist for the Digital Design prize of the Ibero American Biennial 2014³. It will be shown in the Central de Diseño in Matadero Madrid⁴ from November 2014 to February 2015 and next

2 <http://www.ibc.org/page.cfm/Link=932/>

3 <http://www.bid-dimad.org/>

4 http://www.mataderomadrid.org/central_de_diseno.html

year it will itinerate to several Latin American countries being shown in design and art museums and venues.

The single screen application and the companion applications are built on top of the Multiscreen Toolkit developed by Noterik. The toolkit provides the infrastructure for the communication among screens, e.g., the communication between a second and main screen. It also provides data management functionality. Finally, the toolkit provides a level of abstraction to access data from the LinkedTV platform. This makes it easier for developers to access information about the video, such as the chapters that were detected, or the entities that were extracted from the content. During the third year of the project Noterik worked together with CWI and Condat to provide the functionality in the toolkit that was needed for the development of the single screen and companion applications. The toolkit is documented in D5.5.

In the next section we first summarize the results of the user studies and evaluations. In Section 3 we provide a recap of the initial user interfaces and motivate the approach taken to update these interfaces in the third year. In Section 4 we describe the single screen solution, while the following sections present the companion applications for cultural heritage (Section 5) and news (Section 6). Finally we wrap up with an outlook for the final half year of the project.

2 Information needs and requirements

TV companion applications provide viewers, access to background information or related content. The information that is granted in existing companion applications varies between television programs, ranging from applications that provide behind the scene material of a television show⁵, to the biographies and stats of players in the sports genre⁶. Creating this program-specific content is a time-consuming process. A pilot study with a companion application for the BBC wildlife show, Autumnwatch⁷, and the experiment conducted in Basapur et.al. [3] illustrates the laborious effort needed to create genre-specific content for a companion application manually. One of the aims of LinkedTV is to reduce this effort by automatically generating metadata from the video content and automatically finding related and background information from the Web.

To determine how the LinkedTV techniques should be applied for a specific TV program or domain, we need to understand the user's information needs and tasks in this domain. In the second year of the project CWI conducted user studies in the News domain and CWI and S&V together studied the Cultural Heritage domain. The user studies consisted of focus groups and individual interviews. In the news domain we the studies used a news program from the BBC. This was chosen over the news video from the German RBB, as we did not have access to German speaking subjects. In the cultural heritage domain the Dutch TV program "Tussen Kunst en Kitsch" of the AVRO⁸ public broadcaster was used. The outcomes of these studies were reported in deliverable D3.5 for news and D6.2 for cultural heritage.

During the third year of the project an initial evaluation of the generic second screen application was conducted by the project and reported in D6.3. The results of this evaluation confirmed several observations from the user studies. In the following we summarize the main observations from the user studies and evaluations, in a combined fashion. We describe the information needs per domain and list the generic requirements on the functionality.

2.1 Information needs in Cultural Heritage domain

2.1.1 Information about the artwork

The viewers of the cultural heritage shows indicated that they would like to have more information about the artifact that is discussed in the program. More specifically, they are interested in the person or artist who made the object and how their work evolved over time.

5 <http://apps.channel4.com/app/4now/>

6 <http://www.nba.com/tvc/>

7 <http://www.bbc.co.uk/blogs/researchanddevelopment/2011/04/the-autumnwatch-companion---de.shtml>

8 <http://avro.nl>

They also want to know more about the location where the object is from, the object's art style and art period, topics incorporated in the object (e.g. fables), and the object's value.

From the evaluation we learned that the number of concepts presented to the user should not be too large. During the evaluation the participants mentioned that there were too many concepts and that they would rather see only the main concepts related to the artwork.

2.1.2 Background information

In the evaluation the participants indicated that basic information about individual concepts is only in some cases interesting. For example, general information about the year "1820" was not considered useful. However, they would be interested in background information about topics, which could be expressed by a combination of concepts; for example, to find information about watches in 1820.

2.1.3 Related artworks

Besides background information in a descriptive form, the participants in the evaluation pointed out that they would also like to see other visual works, such as other artworks created by the same artist.

2.1.4 Navigating between chapters

The chapters in the program are an important concept for the users. In the program "Tussen Kunst en Kitsch" each chapter covers a single artwork. Users want to be able to navigate between chapters, e.g. skip a chapter, while they would also like to receive recommendations of related chapters.

2.1.5 Program information

The users are also interested in additional information about the program itself. They want to know more about the host and the experts, but also about the location where it was recorded.

2.2 Information needs in News domain

2.2.1 Objects in the news

Users are interested in information about the main people and organizations taking part in the news event. The type of information mentioned is, however, very diverse. It ranges from biography, general information, relation to the event, occupation, opinion, political tendencies, occupation related information such as: books written, movies, awards, presidential term, etc.

2.2.2 In other media

Besides information about individual persons and organizations, viewers of the news shows mentioned that they want to have more in-depth information about the news event or the headline that is discussed.

2.2.3 Background

The users showed interest in more in-depth information about the news item as well contextual information about the news setting.

2.2.4 Timeline

An overview of past events that are related to the current one and possible outcomes, is also desirable by the users.

2.3 General functional requirements

2.3.1 Television controls

In the user study in the News domain the participants expressed that they would like a second screen application to include extended remote control functions, and one of the most frequently mentioned desires regarding the application, was to be able to skip the part of the news that they don't like or go back to what they think is interesting. Web-related functions like electronic transactions, getting alerts, or sharing information, that are possibly inspired by the Internet, were also mentioned, although more sparingly.

2.3.2 Bookmarking

In the user studies, bookmarking was mentioned as an interesting feature. In the evaluation with the second screen demo the importance of this function became even more prevalent.

2.3.3 Personalization

Personal recommendations of related content were mentioned as a useful feature in both news and cultural heritage domain. In the evaluation of the prototype this was also mentioned, specifically, when the number of results became large. Participants also suggested that the personalization could be based on their preferences for specific topics and types of objects.

2.3.4 Passive and synchronous

Some participants were reluctant to adopt a technology that will require them to be active during TV watching, because they considered this activity as mainly relaxing. Integrating different levels of engagement through the second screen, including some that are almost linear (not interactive), could be a strategy to promote smooth adoption.

2.3.5 Active and asynchronous

At the other hand, a number of participants indicated that they miss the interaction of the traditional TV-only settings. Integration between media, mainly television newscasts and online newspapers, could be a suitable solution for providing an enriched and hyperlinked news experience, because it would incorporate activities that users currently perform and it is potentially simplifying them. However, participants in the user studies in both domains as well as in the evaluation reported that they prefer to explore in-depth information after the TV broadcast.

3 Initial user interfaces

During the first two years of the project several interface concepts were explored. We briefly review the two main concepts and motivate how we extended upon them in the third year of the project.

3.1 Single screen

In the first year of the project a prototype application was developed to show how additional information about a program can be directly presented on the TV. The prototype is described in D5.2. We refer to this approach as the single screen solution. This initial approach supported the users with access to information about the entities occurring in a TV program. In the third year of the project the application was integrated with the LinkedTV platform and extended to meet more functional requirements. The initial prototype did not yet operate on a real TV, and the functionality was mimicked in a Web browser. Using the Multiscreen Toolkit, the application was redeveloped to run on HbbTV compatible devices, while it was further extended to support basic video controls in the form of chapter navigation and bookmarking.

3.2 From second screen to companion applications

In the second year of the project a second screen application was proposed, as described in D3.6. This application presented the information about the TV program on a tablet device. It was integrated within the LinkedTV platform, allowing it to show content that was automatically extracted from the program and/or manually curated. The application provides a generic solution that illustrates the potential of the LinkedTV approach. The results of the user studies and the first evaluation, however, revealed that the application did not support all information needs and functional requirements. The application focused on access to the entities occurring in the TV program, similarly as the single screen solution. It did not yet provide a way to explore the other additional information that the LinkedTV solution can generate. The application operated solely as a second screen, whereas the studies exhibited that users also want to actively explore information when the TV program was finished. Furthermore, the studies showed that the presented content and the mode of interaction need to be tailored to the specifics of a TV program. In the third year we worked on such tailored companion applications in the News and Cultural Heritage domains.

We developed a companion application in the Cultural Heritage domain. Most participants in the user study explained that they are not interested in a second screen application that provides background information during the broadcast. Instead the participants expressed that they like to explore more information about the artworks when the chapter or episode is finished. In addition, the participants expressed the need to choose other chapters from the program in a nonlinear fashion. Therefore, we decided not to enhance the traditional linear broadcast, but instead start the experience on the tablet. On the tablet the user selects and

plays episodes or chapters from the TV program and optionally beams the video to the TV. When a chapter is finished the user can explore rich background information about the artwork provided by different enrichment services provided by the LinkedTV system. The LinkedTV system also suggests chapters that the user can watch next.

In the second year of the project we already proposed a companion application in the News domain based on the information needs and functional requirements identified in the user studies (D3.5). The application operates as a second screen when used in synchronization with the TV broadcast. It provides information about the entities that occur in the TV program. In addition, the application can be used when the TV broadcast is finished, addressing more advanced information needs that require active exploration. This mode is similar as the companion application for cultural heritage, but in this case the enrichment dimensions are tailored to the news domain. We worked together with WP1 and WP2 to adapt the LinkedTV solution to the requirements of the application. This effort resulted in the development of a news specific enrichment service by WP2, where the results of this service are now integrated with the application. Moreover, a second version of the editor tool of WP1 was developed, that allows curation of the content shown about the entities in the second screen and curates the content that is shown in the specific enrichment dimensions.

Furthermore, the development of the companion applications in the cultural heritage and news domains has resulted in a component-based infrastructure. We believe that this infrastructure enables us to compose more quickly new companion applications for different domains. We will test this approach in the final part of the project by tailoring a companion application for a TV program in a new domain.

4 Single screen

HbbTV technology enables overlays of information on top of video broadcasts. We used this technology to present content from the Web directly on the TV. The user accesses the provided information using a remote control. Figure 1 shows a screenshot of the first overlay. This overlay contains the chapters of the TV program that is currently playing. The user navigates between the chapters with the left and right arrows of the remote control. This chapter bar initiates two types of functionality. First, the user can select another chapter to watch on the TV, by pressing the enter key on the remote control, which seeks the video to the starting point of that chapter. Second, the user can see information about the entities occurring in the chapter, by pressing the up key and activating the second overlay, as shown in Figure 2. This overlay presents basic information about the entities. The descriptive text and image of an entity are taken from DBpedia. Using the arrow keys the user navigates through the different entities.

This interface is suited for the News and Cultural Heritage domains to provide information about the main entities in the program.



Figure 1: Screenshot of the HbbTV single screen application, showing the chapters of an RBB News program. The user activates the overlay with the remote control and navigates and selects the chapters with the arrow and enter buttons.



Figure 2: Screenshot of the HbbTV single screen application, showing information about a person occurring in the TV program. The user activates and navigates the information about the entities with the arrow buttons of the remote control.

5 Companion application for Cultural Heritage domain

The companion application for the program “Tussen Kunst en Kitsch” provides a novel way to experience the TV program. The user starts the application on the tablet and selects an episode or chapter to watch, optionally the video is beamed to the TV. When a chapter is finished the user explores rich background and related information about the artwork discussed in the chapter. Finally, the user chooses the next chapter to watch from the suggestions provided by the LinkedTV system.

A link to the demo and a video of the application are available from:

<http://linkedtv.project.cwi.nl/>

5.1 Selecting episodes and chapters

When the user starts the application on the tablet he/she first logs in, and then goes to the overview screen to choose which episode or chapter to watch. Figure 3 shows a screenshot of the overview screen. This screen consists of three tabs that are navigated using the buttons at the bottom of the screen: Popular, Episodes and Bookmarks. The screenshot shows the three episodes in the popular tab. For each episode the title and date is shown and a list of all the chapters within the episodes. The user can decide to either view the whole episode by clicking the title, or directly jump to a specific chapter by selecting the corresponding thumbnail. If the user is not interested in one of the popular episodes, the full list of episodes is available on the Episodes tab. The Bookmarks tab lists all the chapters that the user has bookmarked before.

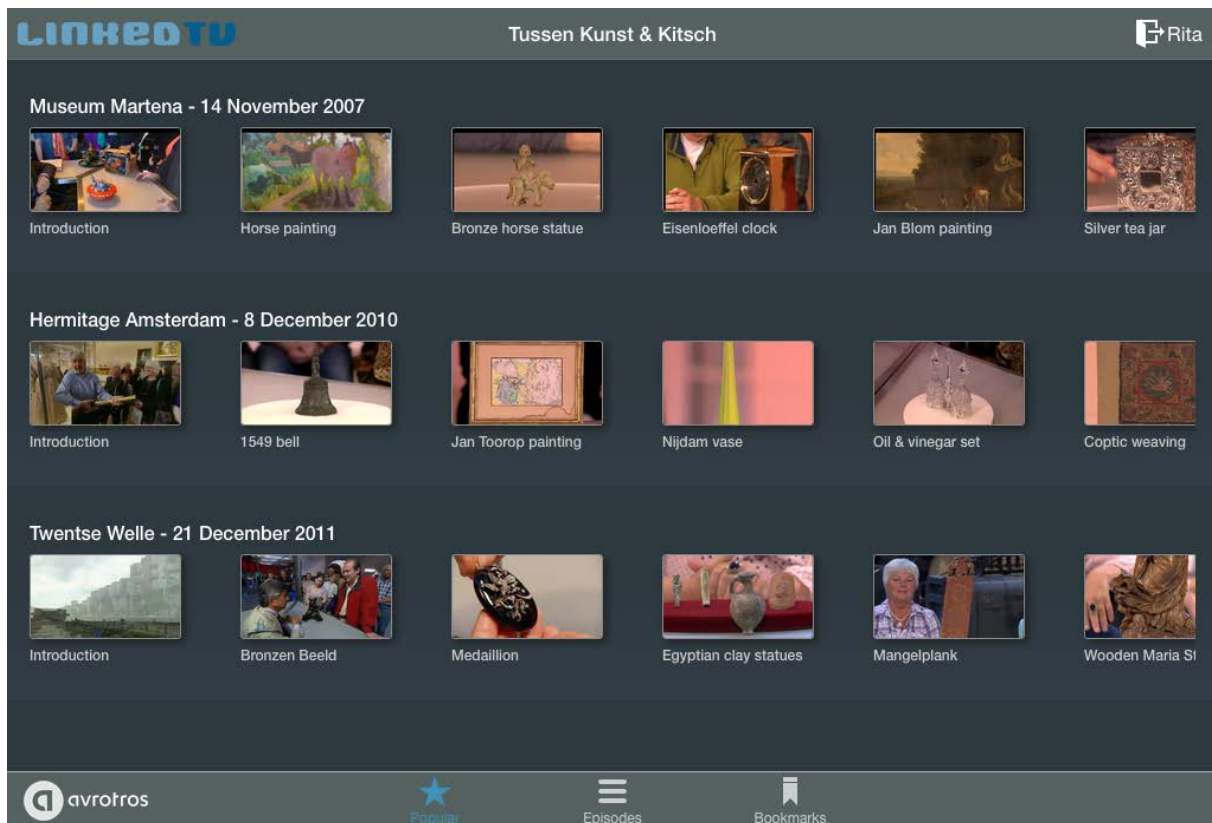


Figure 3: Screenshot of the companion application of cultural heritage with the episode and chapter selection screen.

5.2 Enriched video player

When the user selects an episode or chapter, the application starts a video player on the tablet. As presented in Figure 4, the player consists of four parts. At the top, the header (A). This contains a button (1) to navigate back to the episode selection screen, it contains the title and date of the current episode (2), and an icon (3) that indicates if the application is tracking the user's behavior.



Figure 4: Screenshot of the player screen from the Linked Culture application.

The left side of the application contains a list of the chapters in the episode (B), while the chapter that is currently playing is highlighted (4). Each chapter can be bookmarked by clicking the icon next to the thumbnail (5), which turns into blue when a chapter is bookmarked (6). The chapter list allows the user to quickly navigate through the video, i.e., by selecting a chapter the video seeks to the starting point of that chapter.

The video itself is shown in the main part (C). The controls for the video are at the bottom of the screen (D). The application contains the standard controls found in most video players, including volume control, seekbar and full screen toggle. In addition, there are two buttons that trigger LinkedTV functionality. The button with the screen icon (7) toggles if the video is shown on an external screen. The functionality is powered by the Multiscreen Toolkit. The video controls and the chapter selection remain active while the user is in beam mode, controlling the video playing on the TV. Currently the TV player requires an application to run on the TV. In the final part of the project we intend to integrate this with the HbbTV solution that is utilized in the single screen application.

The button with the info icon (8) toggles the display of the enrichment panel. Figure 15 shows a screenshot of the player with the enrich panel activated. The user can activate the panel at any time, which pauses the video. However, the default behavior is that the panel remains hidden until the chapter is finished. The panel then automatically appears, triggering the user to further explore the artwork and the topics that were discussed. If the user also does not want to be disturbed when a chapter is finished this behavior can be disabled.

5.3 Enrichment dimensions

The design of the enrichment panel is shown in Figure 6. The left column (D) presents the list of chapters, which were already available in the video player. The center column (E) provides the navigation of the four enrichment dimensions, represented by the menu tabs (1). The article list in a dimension (2), is revealed by clicking the menu tab. The third column (F) presents the articles and media content. This column has a title area (3) for the name of the article and a link to the article in its original source (4). The source link at the top right indicates where the information is taken from. Selecting this link opens the source to allow the user to investigate information in more detail. The content in the article varies per dimension. The dimensions in the middle column and the display of the items in these dimensions are each implemented as separate components. By choosing different dimensions the application is tailored to a specific TV program.

The content for the different dimensions is provided by the various services provided by WP2 and curated in the editor tool (D1.5).

5.3.1 About

The direct information about the artwork, i.e., the metadata, is shown in the About dimension. Figure 5 shows a screenshot of the video player with this dimension opened, for a chapter about a silver tea jar from the Dutch province Friesland. The user can select the different metadata properties, such as the location where the artwork is from, the material that is made of and the subject matter that is depicted or related to it. In the screenshot the user selected the location property.

The information for this dimension is based on the entities extracted from the video content, in combination with the manual curation of the multimedia fragment, using the editor tool.

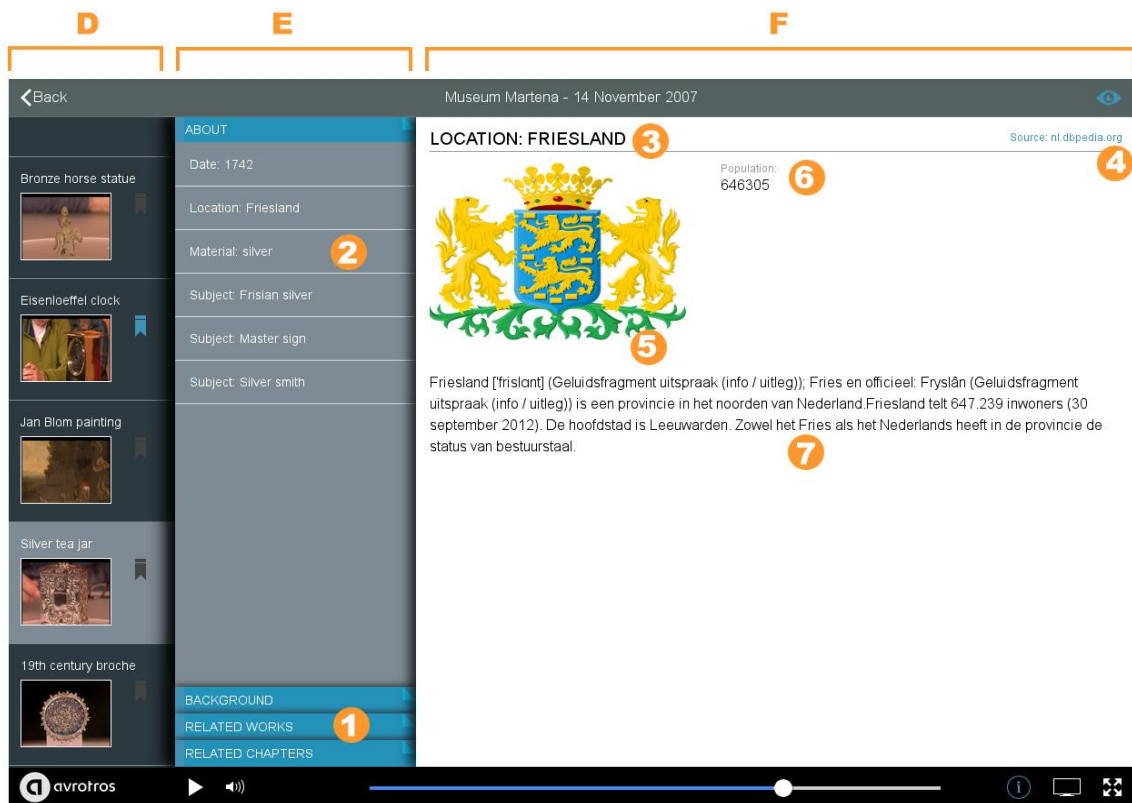


Figure 5: Screenshot of the video player with the enrichment panel activated. The panel provides information in different enrichment dimension. Here the “About” dimension is opened, and the user selected to see information about the location of the artworks, Friesland.

5.3.2 Background

The background dimension lists articles found on the Web, which cover the topic of the current chapter. Figure 6 shows a screenshot of the enrich panel of the video player, with the background dimension selected. The current chapter is about an artwork from the Dutch painter Jan Altink. This painter is a member of the artist collective “De Ploeg”, which is based in the Dutch city Groningen. The background dimension contains various articles about this artist collective, while the user has selected a page from the Groningen Museum, that (Museum. The page) lists the artists that were part of the “De Ploeg”.

The articles in this dimension are retrieved using LinkedTV’s IRAPI service (D2.6). This service maintains a collection of crawled websites from the whitelist specified for this TV program. The information for this dimension is taken from the LinkedTV platform after it was curated in the editor tool. In case the platform does not contain the information in this enrichment dimension the application provides a fallback mechanism by sending a query directly to the IRAPI service for each metadata property extracted from the current chapter, e.g. Jan Altink, Groningen, De Ploeg.



Figure 6: Screenshot of the enrich panel of the video player, with the background dimension opened. The current chapter is about a painting from Jan Alting a member of the artist collective “de Ploeg”. The background shows various articles about “de Ploeg”. The user selected a page from the Groninger Museum listing the members of this artist collective.

5.3.3 Related works

The “related works” dimension allows the user to view other similar artworks. Figure 7 shows a screenshot of the enrich panel, with content in this dimension. It contains several silver objects. The user has selected a silver tea jar from the Amsterdam Museum. Again the user can navigate to the source to inspect the artwork in more detail.

The related artworks are retrieved from Europeana (D2.6). Again, the information is taken from the platform after it is curated and has a fallback mechanism the application directly queries the Europeana service.

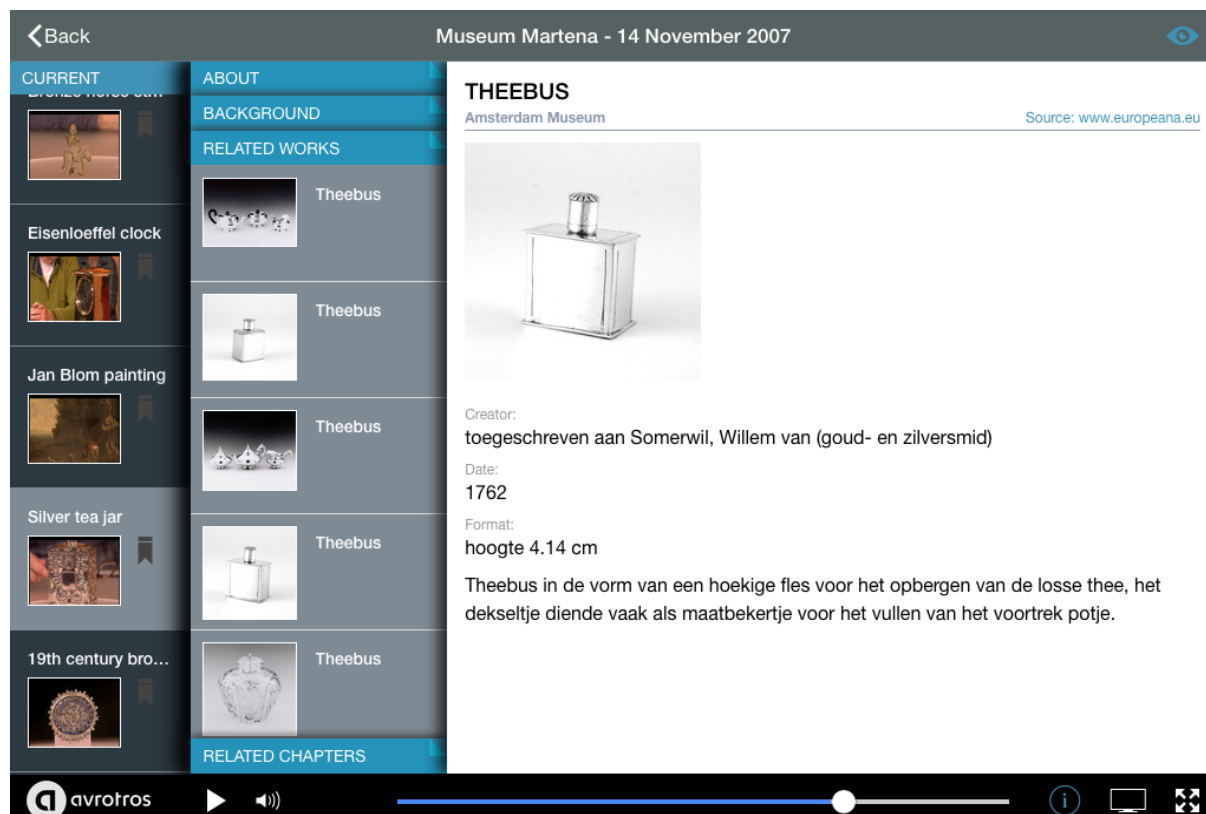


Figure 7: Screenshot of the enrich panel of the video player, with the related works dimension opened. The user selected another silver tea jar.

5.3.4 Related chapters

The related chapters dimension enables the user to choose an alternative path through all the chapters that are available for this TV program. The default behavior is to view the next chapter in the episode that typically is completely unrelated to current chapter. If the user is interested in the artwork and instead wants to see more of the same, this dimension allows the user to select a chapter that is semantically related. Figure 8 shows a screenshot of this dimension. The current chapter is about a Delft plaque. The dimension contains a chapter about a plate from the same Delft style porcelain. By clicking the play button this chapter is played.

The analysis of the chapters by the LinkedTV system enables the suggestion of related chapters. For this purpose we use the dedicated Web service described in D2.6. This service is based on the techniques that were successfully used by LinkedTV team, in the Search and Hyperlinking task of the MediaEval 2014 benchmarking activity.

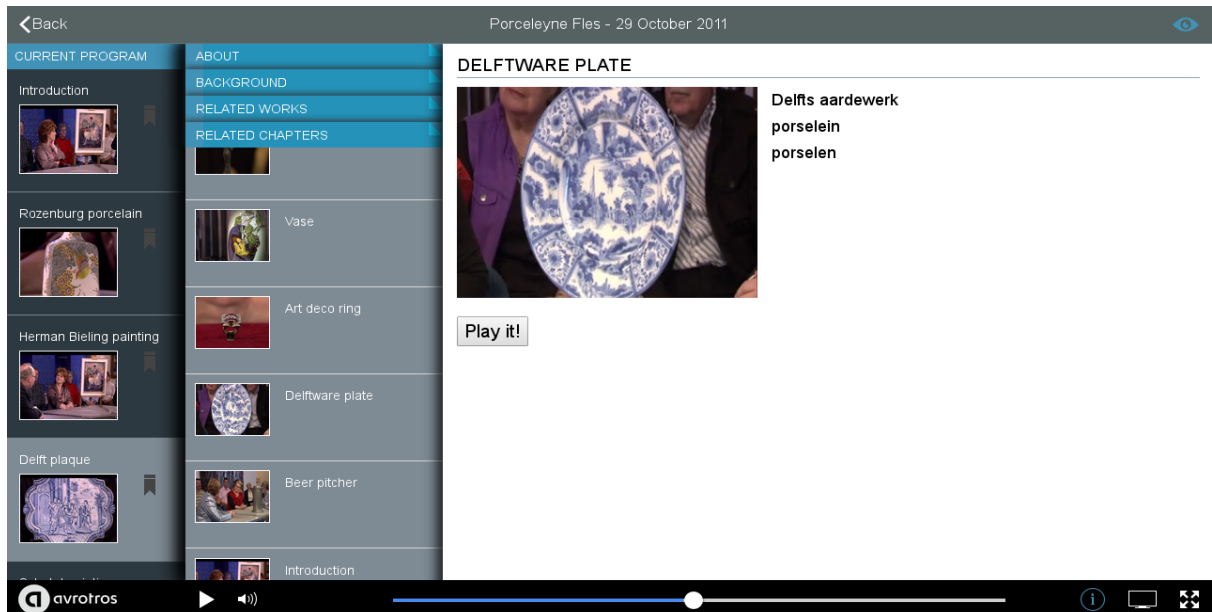


Figure 8: Screenshot of the enrich panel of the video player, with the related chapters dimension opened.

5.4 Personalization

The application tracks various aspects of the user behavior. For example, which chapter a user watches, when the player is paused and which chapters are bookmarked. This information is sent to GAIN, which constitutes the user tracking service developed in LinkedTV and described in D4.4. The GAIN service is itself the input for the personalization mechanism developed in LinkedTV. We are currently working on the integration of the personalization back into the application, and planned approach is described in the following outlook section.

6 Companion application for News domain

The companion application for News uses the same infrastructure as the application for cultural heritage. In this case the enrichment dimensions are tailored to the news domain. In addition the application provides a second screen mode that is synced with the TV broadcast and shows basic information about the entities that occur in the news.

A link to the demo and a video of the application are available from:

<http://linkedtv.project.cwi.nl/>

6.1 Second screen

The interface of the second screen mode is designed to unobtrusively complement the lean back TV viewing experience by requiring little interaction from the user. It gives access to factual information about the named entities (persons, organizations and locations) mentioned in the news. Figure 9 shows a screenshot of the passive mode. The thumbnail strip at the top of the application shows the entities related to the news item (or chapter) that is currently playing on the TV. The entity that is currently active is highlighted and the slide in main part of the screen provides information about this entity. The slide contains the title, an image, a textual description and selected properties, such as the birth date. The entity slides change automatically in synchronization with the video. When a new chapter in the video starts the interface is automatically updated and the entities for this chapter are shown.

The entities that are shown for each news item are provided by the LinkedTV system. Initially this included only entities extracted from the subtitles of the video, as described in D2.4. However, we observed in the user studies and evaluations that in some cases the users wanted to know more about entities that did not occur in the subtitles. Therefore, Eurecom extended their approach to find additional entities from related documents on the Web (deliverable D2.6). The approach starts with the entities extracted from the subtitles and then uses the most important ones to query Google for related documents. From the top articles returned by Google the entities are again extracted. The combined set of entities extracted from the subtitles and related documents are the candidate set which are ranked by importance. Finally, the editor selects the entities that should be displayed in the application using the editor tool, as described in deliverable D1.5.

The passive mode of the application also contains the basic video controls and chapter selection. In addition, the user can manually select an entity from the thumbnail bar or swipe through the slides with a touch gesture. Finally, the user can bookmark a news item. This one click interaction forms the bridge to the active mode of the application.

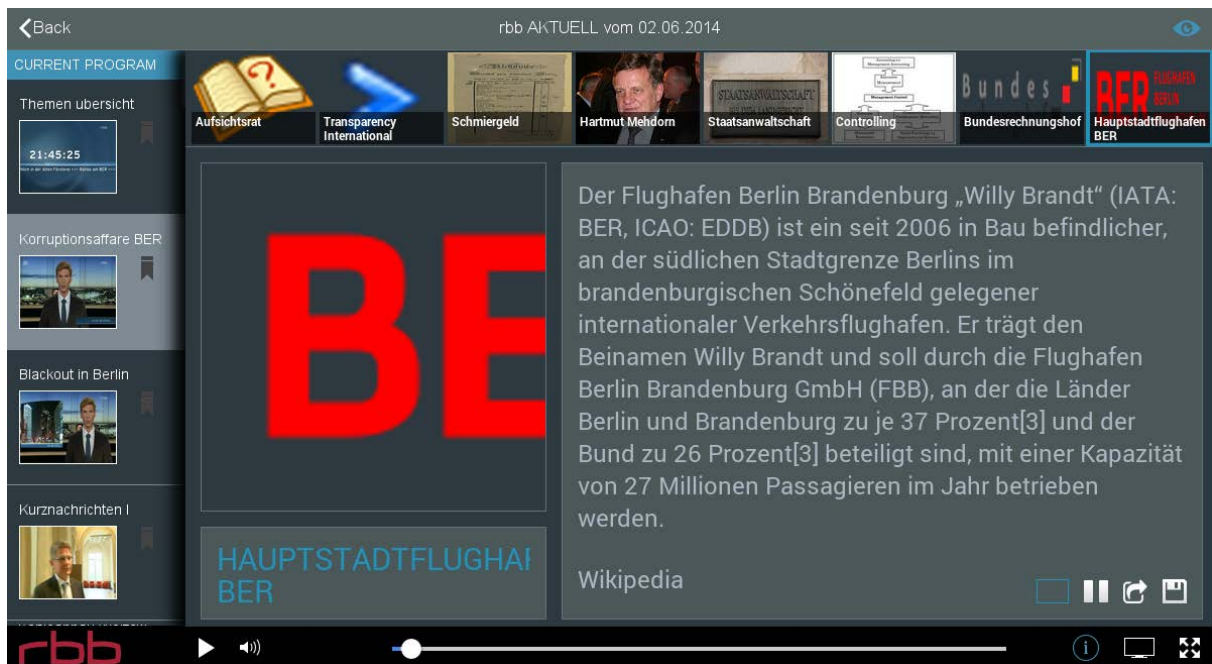


Figure 9: Screenshot of the second screen mode from the companion application for news. It shows basic information about the entities that occur in the news item playing on the TV.

6.2 Enrichment dimensions

Through the different enrichment dimensions the user can explore more in depth information about a specific news item. The user can enable the enrichment panel during the broadcast. If the user prefers a lean-back experience during the broadcast he/she can wait until the program is finished to start the exploration. To content for the enrichment dimensions is provided by the various enrichment services (D2.6) and curated in the editor tool (D1.5).

6.2.1 In other media

The “in other media” dimension of the interface is dedicated to showing the selected news as they are reported in other newspapers, radio, or TV programs. Figure 10 shows a screenshot of the enrichment panel with this dimension activated. In the middle column it shows the same news item from other news sources. In this case the user selected the German N-TV. The right column shows the main content of the article provided by N-TV.

For this dimension we use the TVNewsEnricher service that is configured with the news sources that are relevant for RBB. To retrieve articles relevant for this dimension we use the most frequent entities from the news item and limit the date of the results to be same as that of selected news item. The strict date filter forces the results to be close to the selected news item.

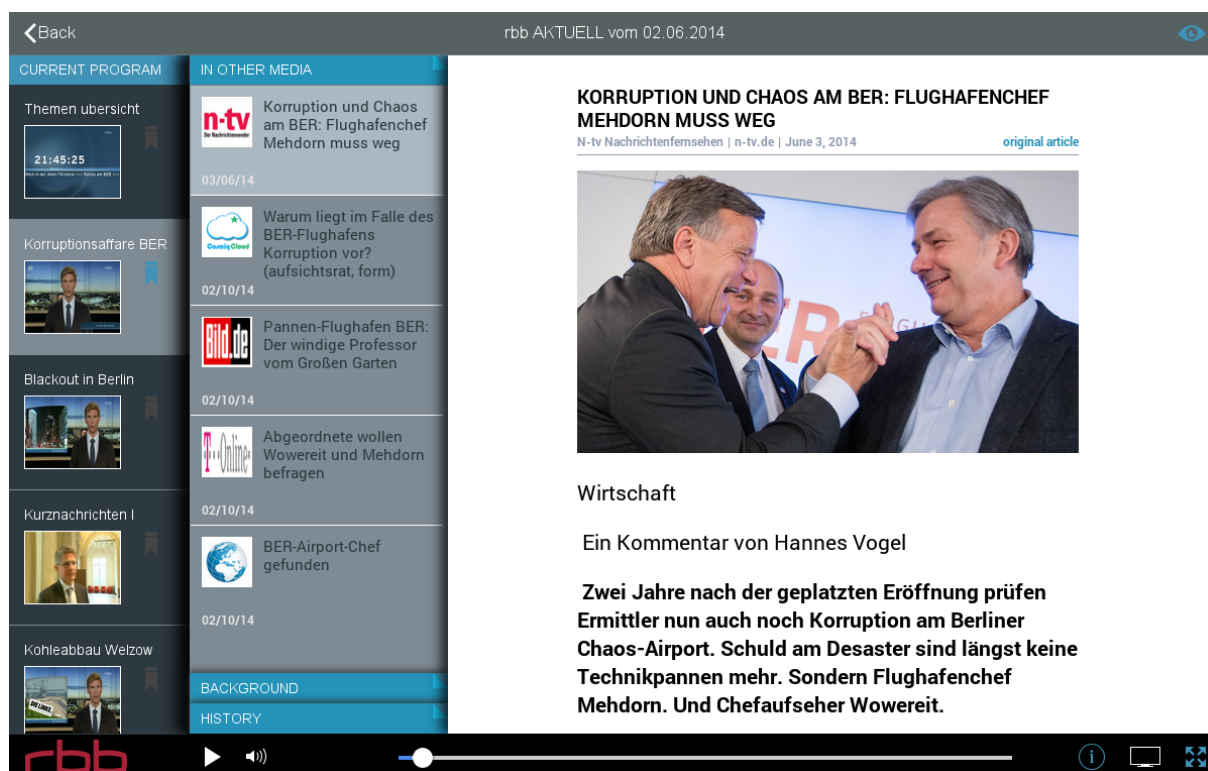


Figure 10: Screenshot of the companion application for news with the "in other media" dimension activated.

6.2.2 Background

Figure 11 shows a screenshot of the enrichment panel with the "background" dimension activated. The user has selected one of the suggested documents. In this case an article from the political section of RBB. The content for this dimension is generated by the IRAPI service that has indexed the sources from the RBB whitelist. The articles are retrieved using the most important entities as the query without a date filter.

6.2.3 History

The "history" dimension provides an overview of the news item as it has been covered by RBB. It suggests other chapters from RBB news shows. This dimension is similar as the "Related chapters" in the cultural heritage application (section 5.3.4). It also uses the dedicated Web service that is based on the techniques that were successfully used by LinkedTV team, in the Search and Hyperlinking task of the MediaEval 2014 benchmarking activity.

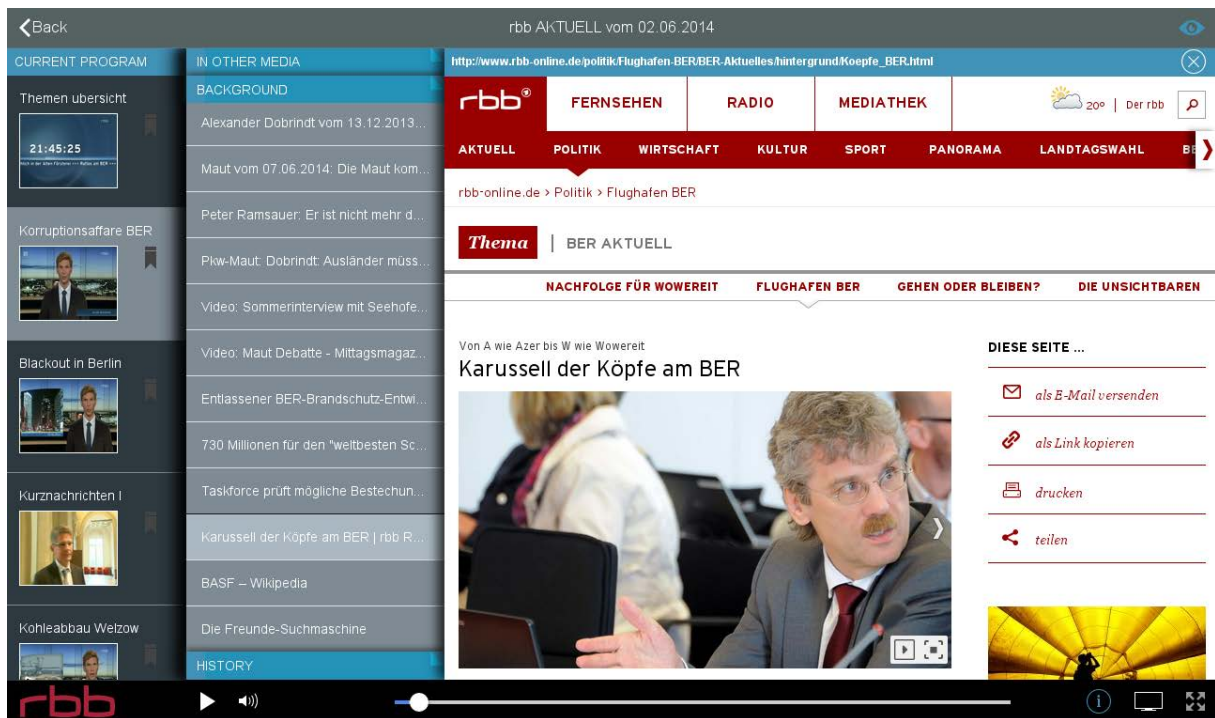


Figure 11: Screenshot of the companion application for news showing the background articles for a news item from RBB

7 Outlook

In the third year of the project we created three prototype applications: a single screen application that runs directly on the TV, and companion applications for news and cultural heritage shows that are accessed on a tablet before, during, or after the TV program. In the final half year of the project we plan to improve these applications in three ways. Firstly, we will work together with project partners to evaluate the entity extraction and enrichment dimensions that are required to generate the content for the applications. Secondly, we will integrate the final step in the personalization cycle, feeding the personalized content back into the application. Thirdly, we will further develop the interface components into parts that can be easily reused, configured and combined for tailored applications in new domains.

7.1 Evaluation

We are currently studying at a larger scale which entities are most relevant for users and which sources (subtitles, experts). The results of this study will be reported in the final WP3 deliverable D3.8. Together with WP2 we intend to evaluate the services for the specific enrichment dimensions.

7.2 Personalization

The companion application for cultural heritage tracks the user's behavior and sends information to the GAIN interface, which is then used by the personalization engine to update the user model. The personalization engine can then use this model to recommend personalized content. We are currently working together with WP4 to integrate the personalized content back into the companion application. We focus on applying personalization to specific enrichment dimensions in the news and cultural heritage applications.

7.3 Component-based design of companion applications

The development of the companion applications in news and cultural heritage domain has resulted in various components, such as entity slides, bookmarking, chapter selection, various enrichment dimensions and result visualizations. We like to test the component-based approach by creating a companion application that is tailored to a different TV program, outside the news or cultural heritage domains.

8 Bibliography

1. José Luis Redondo García, Michiel Hildebrand, Lilia Perez Romero and Raphaël Troncy. Augmenting TV Newscasts via Entity Expansion. 11th Extended Semantic Web Conference - Posters and Demos Track, Anissaras, Crete, May 2014.
2. Lilia Perez Romero, Michiel Hildebrand, José Luis Redondo Garcia and Lynda Hardman. LinkedTV News: A dual mode second screen companion for web-enriched news broadcasts. ACM International Conference on Interactive Experiences for Television & Online Video (TVX), Newcastle University, UK , June 2014.
3. Basapur, S., Harboe, G., Mandalia, H., Novak, A., Vuong, V., and Metcalf C. Field Trial of a Dual Device User Experience for iTV. In *Proc. EuroITV2011*, 9 (2011), 127-135.