Developing a second screen application for TV broadcasts enriched via Linked Open Data

Contributor names and short CVs

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Type of the presentation proposed

In-use contribution: Presentations with a practical, industry- or user-oriented focus by representatives of technology providers, adopters, and user organizations.

Summary of the presentation

Increasingly, European citizens consume television content on, or with, devices connected to the Internet where they can look up related information. In parallel, Europe is publishing growing amounts of Linked Open Data, including rich metadata about its cultural heritage. The LinkedTV project's goal is to seamlessly interlink TV and Web content to enrich the user's experience of both. Linked Data and semantic technologies enable broadcasters to achieve added value for their content at low cost through the re-use of existing and extracted metadata. We present two user studies (on Interactive News and the Hyperlinked Documentary) and the end-user interface for a second screen application for Linked Television.

Extended abstract of the presentation

Introduction

More and more consumers will have SmartTVs at home[1], complemented by laptops or tablets which can function as "second screens", e.g. to explore related objects (from broadcaster's archives and other online resources) alongside a TV programme. Multitasking while watching TV is a significant consumer trend, with 88% of TV viewers online in parallel, and 40% using their second screen to get more information on what they are watching [1]. Broadcast companies want to provide their viewers with richer interactive television experiences, and are becoming increasingly interested in enriching television content with hyperlinks to data sources that could enhance the attractiveness of watching their content and keep viewers from switching to other content sources online. The European project LinkedTV (http://www.linkedtv.eu) believes that a "true TV ecosystem must functionally integrate the apps with the television programming"[2]. Thus it develops an end-to-end workflow that automates the process of enriching TV programmes with content, which significantly enhances the user experience. For this, semantic technologies and Linked Open Data (LOD) datasets are used to lower the cost of annotation, which is not scalable in a completely human curated enrichment. In order to get an insight into what potential end-users want to see and do, we conducted user studies. Based on this, a second screen application was developed that allows viewers to get extra information on the topics discussed in their favourite TV programmes while watching, which they can bookmark and share. In our presentation we will talk about 1) the technical process, 2) the user studies we conducted for the LinkedTV use cases (Interactive News, Hyperlinked Documentary) and 3) the (development of) the user interface itself.

Technical process and workflow

The end-to-end platform chain of LinkedTV starts with automatic analysis of the audiovisual material and its metadata, applying shot and scene segmentation, visual analysis for concept detection [2], and entity extraction from subtitles [3]. Media Fragments[3] are generated which refer to specific temporal and spatial parts within the analysed television show that present a particular topic or object. For example: an art expert mentions the Greek goddess Hebe, and a Media Fragment corresponding to the utterance is created, e.g. using subtitle information. These Media Fragments are annotated with *named entities* extracted from the text or visual classifiers. For this, LinkedTV has developed a dedicated ontology[4] and re-uses Linked Data URIs for the entity identifiers. For example, the concept Hebe (ancient Greek goddess) can be found in DBpedia with the URI http://dbpedia.org/resource/Hebe_(mythology). LinkedTV uses "white lists" of Web content sources trusted by the media owner to contain high-quality links that can be used for enrichments. Distinct Web services provide link matches in these "white list" sources for entities, e.g. recent media shared via social Web channels, structured databases of media resources such as the European digital library Europeana, and HTML-based Web sites via a dedicated crawler for embedded media items. A programme editor has access to a dedicated Editor Tool to curate which of these links they want to show to their end users, since usually many more potential targets are found than are reasonable to show. Finally, the LinkedTV Player displays the curated results using HTML5 technology on the second screen.

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[1] 54 million SmartTVs sold in 2012 will grow to 170 million in 2017; by then 64% of West European households will have at least 1 SmartTV -- „Smart-TV device forecasts", Informa Telecoms & Media
[1] https://commerce.informatm.com/reports/smart-tv-device-forecasts.html

[2] TVs can't be smart. Stop trying to make it happen. - WIRED Opinion, Gary Myer, Oct 2013

[3] Using the W3C media fragment URI specification http://www.w3.org/TR/**media**-frags/

[4] http://linkedtv.eu/ontology reusing parts of the W3C media ontology and the Open Annotation Model

Use cases and user studies

Two scenarios were used to inspire the second screen development: Interactive News and Hyperlinked Documentary. The Interactive News scenario is based on the local news show RBB Aktuell by Rundfunk Berlin Brandenburg; the Hyperlinked Documentary scenario is based on Tussen Kunst en Kitsch (similar to the BBC's Antiques Roadshow, henceforth TKK) of Dutch public broadcaster AVRO[5]. Both programmes contain distinct chapters about specific topics, e.g. Obama's Berlin visit in June 2013 or a 19th century gold watch by famous watch maker Breguet. These specific topics, being linked to open data from the Web, can be enriched with further Web content which offers more information and context about the topics in these chapters. For example, the watch chapter is supplemented with links to the Wikipedia article and Europeana images relating to the figure inside the watch - the Greek goddess Hebe - thanks to the DBpedia URI in the video annotation and the ability to SPARQL query Europeana. To understand what news and TKK viewers really want, we conducted user studies with representative audiences. We focussed on current second screen habits, and information needs and requirements on how viewers want to access this desired information. Two focus groups were held; one with news viewers (11 participants, age 20 - 58) and one with TKK viewers (8 participants, age 54+). Face-to-face interviews were held with nine news viewers.[6]

Current habits

Of the eight TKK viewers, five look up extra information about something on the show they find interesting. Four always do so afterwards, only one person actually does so while watching. This is different for the news viewers, who indicate they always look up extra information.

Figure 1: Information on **how** often news viewers look up news-related information (left), and **when** (right)

Both TKK and news viewers indicate their first source to find information is Google, followed by Wikipedia. Furthermore, TKK viewers also look on specific museum websites, the Internet Movie Database and Europeana. Unsurprisingly, the other sources that news viewers use are different and much more geared towards news, such as the BBC News and Associated Press websites.

Information needs and user requirements

We asked the viewers which types of information they would like to see related to TKK and the news. These can be clustered in WHO, WHAT and WHERE categories. Some examples are:

- **WHAT**. Hyperlinked Documentary: Object type (e.g. painting), material type (e.g. silver), art style (e.g. Jugendstil). Interactive News: in-depth specific information from various sources, overview of related events, local effect of global news, opinion, follow a story through time.

[5] http://avro.nl

[6] Read more in D3.5 - Requirements Document for LinkedTV User Interfaces (Version 2) (http://www.linkedTV.eu/wp/wp-content/uploads/2013/12/LinkedTV_D3.5.pdf). Lilia Perez Romero, Lynda Hardman, Michiel Hildebrand, October 2013.

- **WHO**. Hyperlinked Documentary: Creator, Art expert, Historical person. Interactive News: more information about a person person appearing or being mentioned in the news.
- **WHERE**. Where episode is recorded, where the object is from, what's on in the museum / planning museum visit. Interactive News: location information, e.g. geographical localisation and general contextual information about the place where the news happens.

Both TKK and news viewers alike would like to see these enriched concepts presented per chapter, i.e. a part of the programme in which a specific art object is discussed. Besides this, **bookmarking** concepts and the related information sources is a key requirement for all viewers, so they can read it back whenever they want. Furthermore, viewers want **social features** that allow them to **share** and discuss both chapters and enriched concepts with others. Being able to **control the TV** was a requirement mostly mentioned by news viewers. They want to use a second screen almost as a catch-up device, e.g. to browse through a programme's archive, play and pause, and to select chapters and send them to the TV. Finally, users want to make use of **personalisation features**, based e.g. on sources, topics and categories they like.

Realising a second screen for enriched television content

Since it was not possible to incorporate all information needs and requirements at once, we chose to focus on specific 'personas' from both the TKK and news scenario that were the most representative for real-life second screen users. The focus for development therefore was on bookmarking, sharing, and presenting the various enrichments in WHO, WHAT and WHERE layers in the interface.

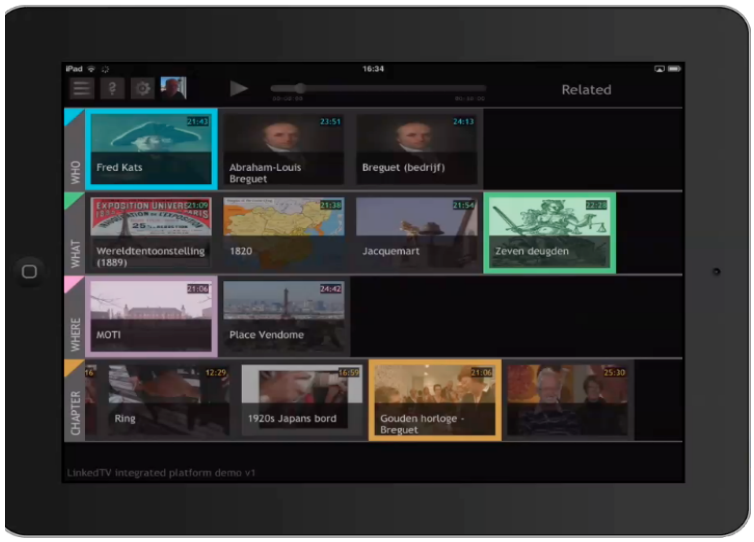

Figure 2: Who, What, Where layers in LinkedTV second screen demo, the various enriched concepts in these layers, plus the chapter overview.

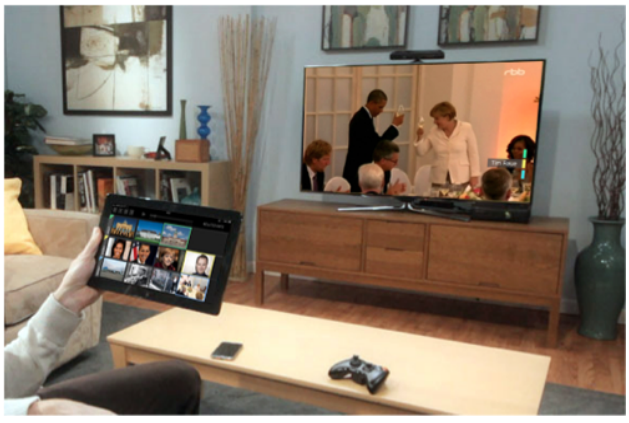

Figure 3: Close up of the TKK demo and living room setting for the RBB news demo.

Furthermore, since users indicated specifically that they want to see the enrichments per chapter, this was also incorporated in the interface. The player highlights the relevant entities during the plackback of the TV programme, thus ensuring synchronisation of the viewing experience and enrichments related to this experience (see Figures 2 and 3 above).

To support viewer access to LinkedTV enrichments, project partner Noterik developed the Springfield Multiscreen Toolkit (SMT). It supports application developers by abstracting away the low-level details of the synchronization and distribution of content between screens. Developers can create a single application that is independent of how many screens are involved and such an application can dynamically react to changes in the amount and types of screens attached to it. Applications are developed using standard technologies, such as HTML5 and Java. The first prototype allows companion screens to control video playback on the main screen and synchronise the associated LinkedTV enrichments to the main screen video. Besides touchscreens, the system also allows main screens to be controlled by gesture and remote control.

Future work

LinkedTV plans in 2014 to continually refine the annotation and hyperlinking workflow, expanding the LOD sources it uses and how the available metadata from those sources can be increasingly used in guiding the system to select more relevant links to enrich TV programming. A new, larger cycle of user trials using the scenario demonstrators will help validate further the usefulness of the selected enrichments for viewers, acceptance of personalisation functionality when it requires modelling of user preferences or tracking viewer behaviour, as well as the intuitiveness of the user interface. Furthermore, the cognitive load for end users that a dual screen set-up demands will be explored. The results of the evaluations will be used to improve the added value of using Linked Open Data in the enrichment process for our broadcast partners, namely: greater automation leading to lower costs for providing added value services around their content, which in turn helps keep viewers connected against the competition from Internet video and (OTT) TV providers.

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