D2.4.2

ADDITIONAL APPLICATION PROTOTYPES 2ND EXPERIMENTATION CYCLE AVAILABLE

October 2014

ABSTRACT

This document keeps record of the development of the Social Connected TV Platform. Implementation of scenarios as defined in D2.1 and platform specific enablers are documented. The state of maturity is estimated on the basis of the fulfilment of functional requirements for each of the scenarios and specific enablers.

DISCLAIMER

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EXECUTIVE SUMMARY

This document keeps track of the development of the Social Connected TV Platform. This release includes previous and additional prototypes resulting from ongoing work and the inclusion of new partners in WP2 as a result of the FIcontent 2 open call process. Implementation of scenarios as defined in D2.1 and platform specific enablers are documented. The state of maturity is estimated on the basis of the fulfilment of functional requirements for each of the scenarios and specific enablers. The following scenarios are part of the second release of the Social Connected TV Platform:

- Rich Content
- Multi-Screen Experience
- Search and Discovery
- Personalized Media

The following platform Specific Enablers are part of the second release of the Social Connected TV Platform:

- Audio Fingerprinting
- Audio Mining
- Content Optimisation
- Second Screen Framework
- TV Application Layer
- Content Enrichment
- Content Similarity

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ABBREVIATIONS

AKSW	Agile Knowledge and Semantic Web
API	Application Programming Interface
Apple HLS	Apple HTTP Live Streaming
AWS	Amazon Web Services
CE-HTML	Consumer Electronics-HyperText Mark-up Language
DLNA	Digital Living Network Alliance
DNS	Domain Name System
DoW	Description of Work
DRM	Digital Rights Management
EPG	Electronic Program Guide
GE	Generic Enabler
GUI	Graphical user interface
HbbTV	Hybrid Broadcast Broadband Television
HTML	HyperText Mark-up Language
HTTP	Hypertext Transfer Protocol
IaaS	Infrastructure as a Service
iOS	Mobile operating system developed and distributed by Apple Inc.
IPTV	Internet Protocol Television
MySQL	My Structured Query Language
NER	Named-Entity Recognition
NLP	Natural Language Processing
NSD	Network Service Discovery protocol
QoE	Quality of Experience
QR-code	Quick Response code
REST	Representational State Transfer
SCTVP	Social Connected TV Platform
SDK	Software Development Kit
SE	Specific Enabler
SEO	Search Engine Optimization
SME	Small and Medium Enterprises
SML	Service Modelling Language
SOAP	Simple Object Access Protocol
Solr	Open source enterprise search platform from the Apache Lucene project

TAL	TV Application Layer
UGC	User Generated Content
UK	United Kingdom
UPnP	Universal Plug and Play
URL	Uniform resource locator
VoD	Video on Demand
XML	Extensible Mark-up Language

1 - INTRODUCTION

1.1 - Overview

The Social Connected TV Platform is a toolbox offering powerful instruments to enhance connected TV services and TV-related services for second-screen devices. This document keeps track of the development of the Social Connected TV Platform. This release includes previous and additional prototypes resulting from ongoing work and the inclusion of new partners in WP2 as a result of the FIcontent 2 open call process. It describes the implementation of the platform's Specific Enablers and provides further information including a development roadmap.

Please be aware that this document is generated from the FIcontent Wiki [1]. Thus the document may sometimes refer to the FIcontent Wiki. All information in this document is also available online. We suggest using the online version of this deliverable [2] for an advanced reading experience.

1.2 - Terminology

The following table contains terms, which are used in multiple deliverables. Therefore, we provide their shared definitions to ensure consistency across several documents.

Term	Definition
Application or Application software	Software layered on top of one or several platforms for realizing various useful tasks for end-users
Architecture	A structure of functional elements organized in a given way and presenting well defined interfaces
Capability	The ability of a component to satisfy a functional requirement
Conceptual Model	An abstract view with written description of the organization of the FIcontent infrastructure to offer services
Enabler Software	Module or web service providing well-specified functionality, accessible and usable by application developers through clearly-described APIs (Application Programming Interfaces)
Experiment or Experimentation	Concrete test with actual users of one scenario in one of the experimentation sites in a given time frame
FI-WARE Tools	The tools put in place by FI-WARE to send requests for Generic Enablers are based on a backlog list in the frame of an agile methodology
Functional requirement	Either calculations, technical details, data manipulation, processing or other specific functionality that define what a system is intended to accomplish
Generic Enabler (GE)	An enabler realized by the FI-WARE project or its follow-up sustainability project
Platform	A comprehensive combination of technology infrastructure and Generic Enablers as well as Specific Enablers capable of hosting and supporting development of application software
Point of Interest (POI)	A POI is a place, an area or a journey (short distance) which are geo-located. For example: a place (a restaurant, etc.), an area: a public garden, a journey (a hiking trail, etc.). A POI has possibly features such as : static features (opening hours, address, name description, etc.), dynamic features (price, menu, number of

	available places, the delay before the next bus, etc.), and event features (a beginning and an end)
Scenario	Description of foreseeable interactions of users with one or several applications
Specific Enabler (SE)	An enabler realized by the FIcontent project. Specific Enablers may be layered on top of, or otherwise make use of, Generic Enablers. Please refer to the definition of a FIcontent Specific Enabler from deliverable D6.1 Architecture specification [3]
Interface	The connections between domains (or sub domain or functional elements) serving the actor's actions by exchanging information
Interoperability	The capability of two or more networks, devices, applications to exchange and use information
Technology	A standard or industry specification that has the capability of addressing requirements

2 - SOCIAL CONNECTED TV PLATFORM ARCHITECTURE

The figure below illustrates the Social Connected TV Platform architecture. In the figure four layers are depicted. These are:

- Layer 1 (red): Scenarios
- Layer 2 (yellow): Applications
- Layer 3 (blue): Specific Enablers (SEs)
- Layer 4 (green): Generic Enablers (GEs)
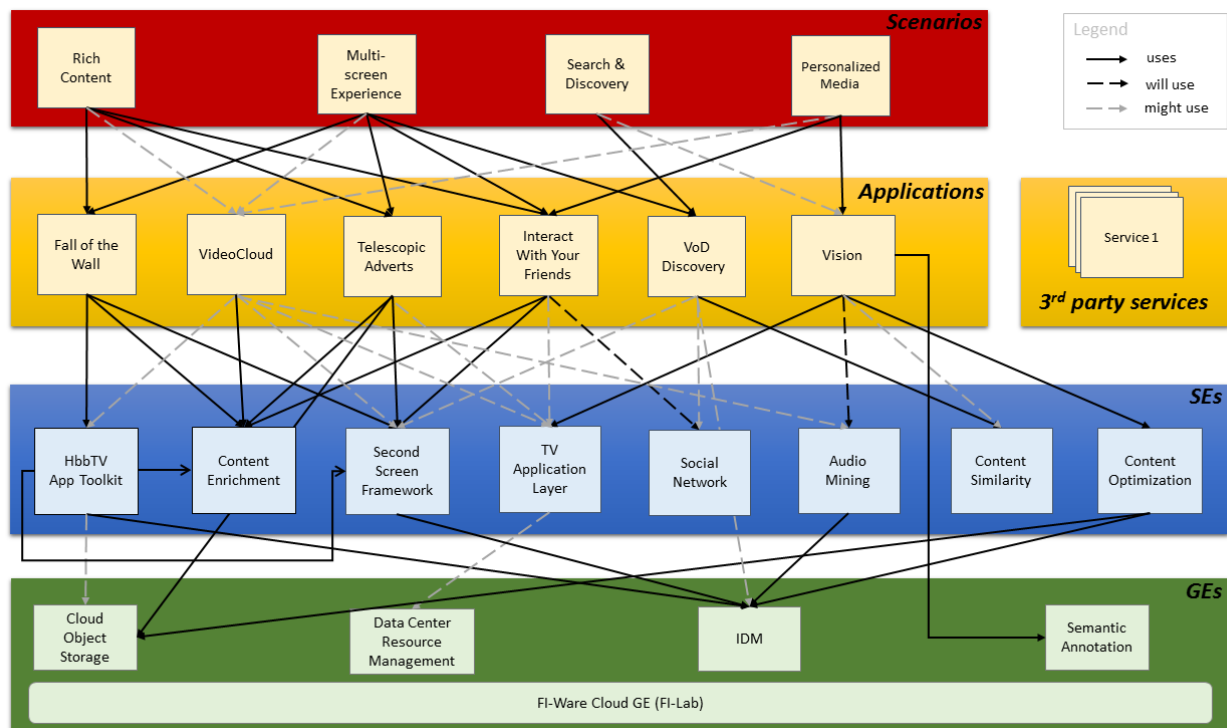
Figure 1 Up-dated high-level architecture of the Social Connected TV Platform

Scenarios describe what users will be able to do with the Social Connected TV Platform. Scenarios are defined in **Deliverable D2.1 Scenarios, functional and technical specifications**. SEs and GEs are technological components that are used to implement the functional requirements of the scenarios. GEs are provided by the Core Platform of FI-PPP developed by the FI-WARE project. SEs are developed by FIcontent in order to complement GEs where domain specific features are needed. SEs are exposed to 3rd party developers and SMEs via the Social Connected TV Platform API.

Applications are pieces of software built on top of SEs and GEs that make certain scenario features available to end-users. There are two kinds of applications. The first group is built on those applications that are implemented by FIcontent partners with the goal of validating the scenarios and the SEs and GEs. The second group is built on those applications that are developed by third parties that are involved through the Open Call, Competitions and Phase 3 of the FI-PPP programme.

The arrows in the diagram indicate dependencies between scenarios, applications and Enablers:

- A solid black arrow indicates that a certain link is already implemented, e.g. the Fall of the Wall is currently used for testing the Rich Content scenario, and the application integrates the Content Enrichment SE and the Second-Screen Framework SE.
- A dashed black arrow indicates a planned usage, e.g. Vision will use the Audio Mining SE, but the SE is not yet (fully) integrated.

- A dashed grey arrow indicates that the use of a component is under consideration, e.g. we are considering the use of the Data Center Resource Management GE to implement session management authentication mechanisms in the TV Application Layer.

There is one GE in the diagram that has no arrow-connection, the FI-Ware Cloud GE (FI-Lab). This GE is used by almost all SEs and a number of applications for web hosting. We did not explicitly indicate the dependencies for this enabler to avoid the picture ending up as a dense mesh of arrows. A detailed overview on the use of the FI-Ware Cloud GE (FI-Lab) is given in Deliverable D6.5.

The diagram above has changed from previous versions following the inclusion of new partners Fincons and Bittubes into WP2 and a general review of the use of enablers. This has resulted in new applications, for example telescopic adverts, that addresses two scenarios and uses two Se and one GE.
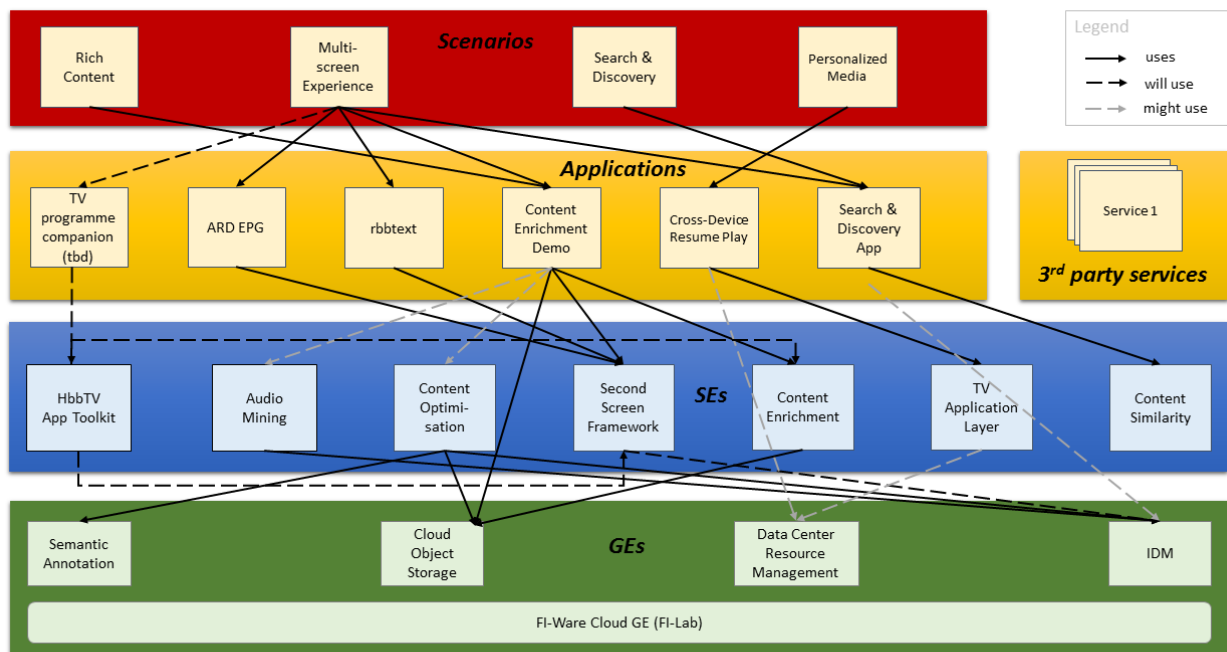
Figure 2 Previous high-level architecture of the Social Connected TV Platform

To improve the readability of the Figure 1, the applications rbbtext and ARD EPG have not been included as these are now considered operational and at his stage it is not planned to include them in further experiments. However description of the applications is provided below in section 4.

2.1 - Architecture Description

Experiments conducted on the basis of the Social Connected TV Platform aim to gain findings on four major topics. These are:

- Rich Content
- Multi-Screen Experience
- Search & Discovery
- Personalised Media

This section introduces how the components of the Social Connected TV Platform are used to augment TV services with features of the above mentioned domains. Moreover we provide a more detailed description of the Specific Enablers [4].

2.1.1 - Rich Content

The goal of the Rich Content scenario is to gain information on the consumption, annotation and sharing of interactive TV content and related additional media.

Media/Text Annotation (Content Augmentation) is handled by the Content Enrichment SE [5]. The implementation covers the HbbTV-enabled TV set as well as the second-screen application, which allows the user to edit and receive content-related supplementary information. We are currently focussing on TV implementation to allow the display and utilization of enriched content via the HbbTV application based on the Content Enrichment metadata model. This includes the time-synchronized display of additional information for objects in the video scene and enables user interaction with them. Functions for receiving and editing and content on the companion device will be implemented later in order to extend the interactive content experience across multiple devices.

Object database and storage functions for additional information such as video, text, images, are handled by the Object Storage GE [6] as provided by FI-WARE. The GE is installed on a XIFI node based in Berlin.

The Audio Mining SE [7] and the Content Optimisation SE [8] can be used to pre-process audio-visual data and to automatically generate corresponding metadata. The Audio Mining SE detects speech segments in a video and then transforms the spoken words of these segments into text (speech-to-text). The generated text can then be used to either search for themes and identify specific locations within the video or to link keywords with additional content using the Content Optimisation SE. This Enabler allows users to perform a Named Entity Recognition (NER) on the generated text transcripts and to store the linking information in an object database.

2.1.2 - Multi-Screen Experience

The Social Connected TV Platform supports the creation of TV-programme-related companion applications on connected mobile devices such as tablets, PCs or smartphones.
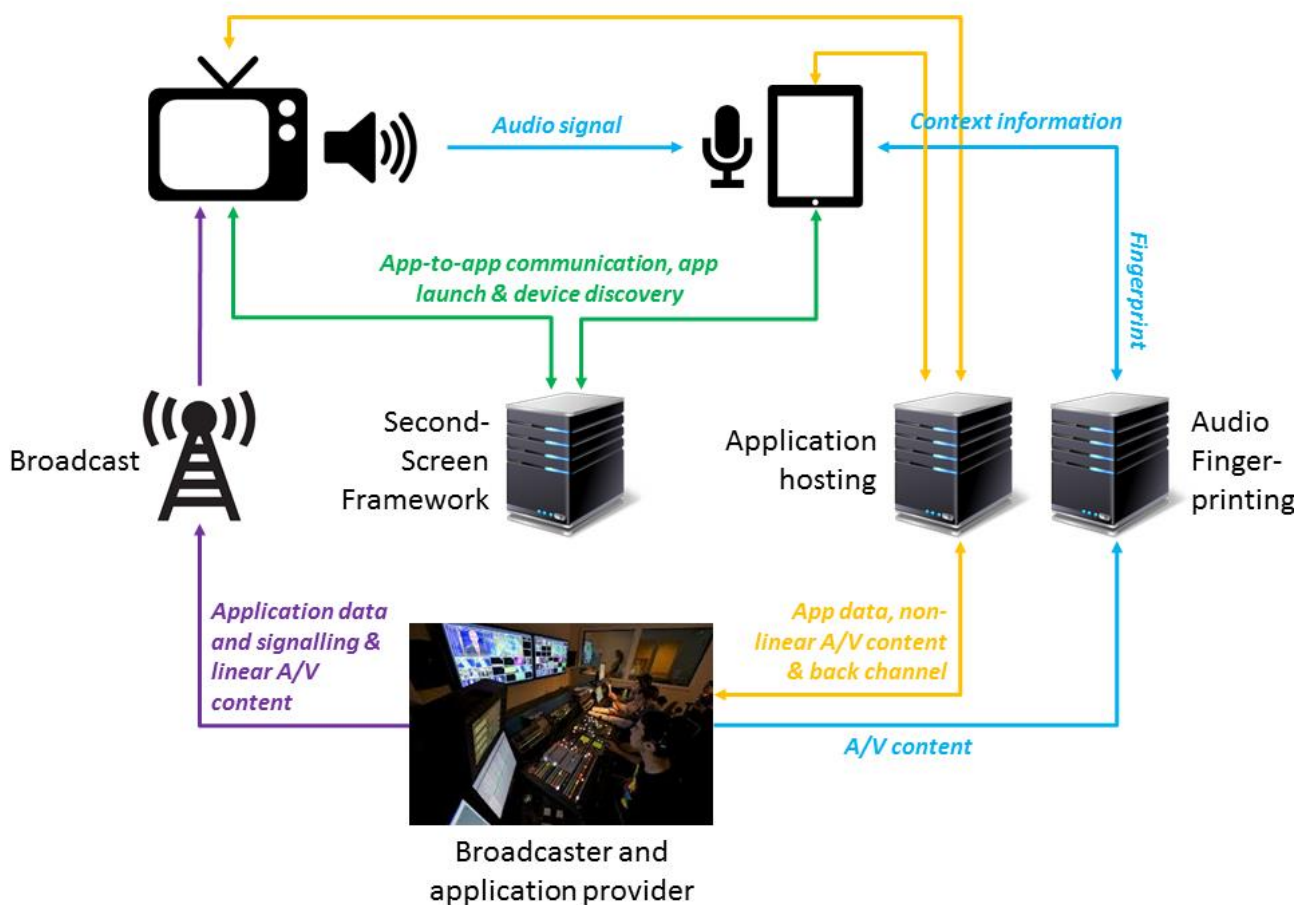
Figure 3 Realisation of Multi-Screen Experience applications

The Second-Screen Framework [9] SE allows the creation of web apps for mobile devices able to exchange information with a web application running on a connected TV. Connected TVs that implement the HbbTV standard can interpret application data that is sent with the broadcast signal. This allows broadcasters to provide connected TV applications to accompany programmed content. The bi-directional communication path and the mechanism for automatic application launch ensure that the second screen is in contextual sync with the hybrid TV application.

The development of the Audio Fingerprinting [10] SE, which was part of previous platform releases, will be discontinued following the recommendation of the commission. However, this Enabler will be released as Open Source software in the coming weeks and will be available for Phase 3 projects.

The above described set-up, also depicted in Figure 2, allows broadcasters to offer interactive programme-accompanying content on second screens to a broad audience. This enables allow broadcasters to create a comprehensive multi-screen experience.

2.1.3 - **Search & Discovery**
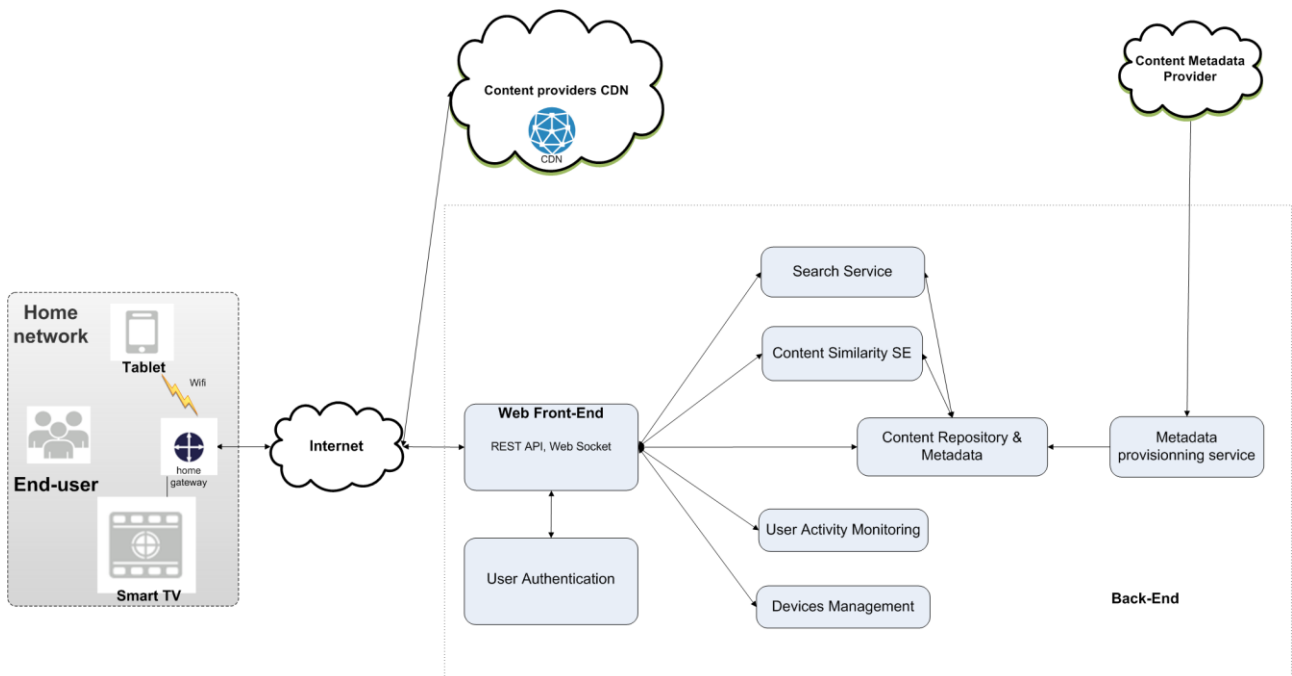
Figure 4 Realisation of Search & Discovery applications

Today, searching for interesting content to watch is time-consuming for the majority of commercial VoD offers. This scenario intends to explore several ways to explore, search and discover new interesting content for users. This scenario includes the following functionalities running on a tablet:

- An advanced search, with auto-completion, handled by "search service" component.
- A discovery function based on similarity, handled by the "Content Similarity" component. Starting from a movie a user likes, he is able to navigate inside a graph to discover other movies with common aspects, such as same actors, same director, or similar movies proposed by a content to content recommendation engine.
- A discovery function enabling movie selection by indicating multiple criteria such as genres, people, countries, production years, handled by "Content Repository and metadata" component.
- A discovery function based on the combination of genres, handled by both "Content Similarity" component and "Content Repository & metadata" component. A predefined list of cocktails is proposed to the user. User is also invited to create his/her own cocktail by combining favourite genres.
- A discovery function based on screenshot, handled by "Content Repository and metadata" component: five lists of screenshots are proposed to the user without any additional information. Each list proposes screenshot of a single movie. When the user selects a list he/she gets the movie detail page and discovers which movie was behind these screenshots.
- A discovery function enabling movie selection for a group of users: each user can enter its own criteria and tastes; the application is helping the group to find a good compromise and to choose an adequate movie for the group.

Ingest of the VOD catalogues are handled by both the "Metadata provisioning service" component and the "Content Repository and Metadata" component.

The "Content Similarity" component has been introduced as a Content Similarity SE [11] with the June release (Release 06/14) of the Social Connected TV Platform. The development of the Content Atmosphere SE has been discontinued following the recommendation of the Commission.

2.1.4 - Personalised Media

Figure 5 Realisation of Personalised Media applications

Our goal in this scenario is to explore some of the different possible added values of personalised media in the context of an interactive IPTV service. We introduce a series of features that allow users to manage their usage via different devices, and also to combine their consumption with that of others. One such feature is Pause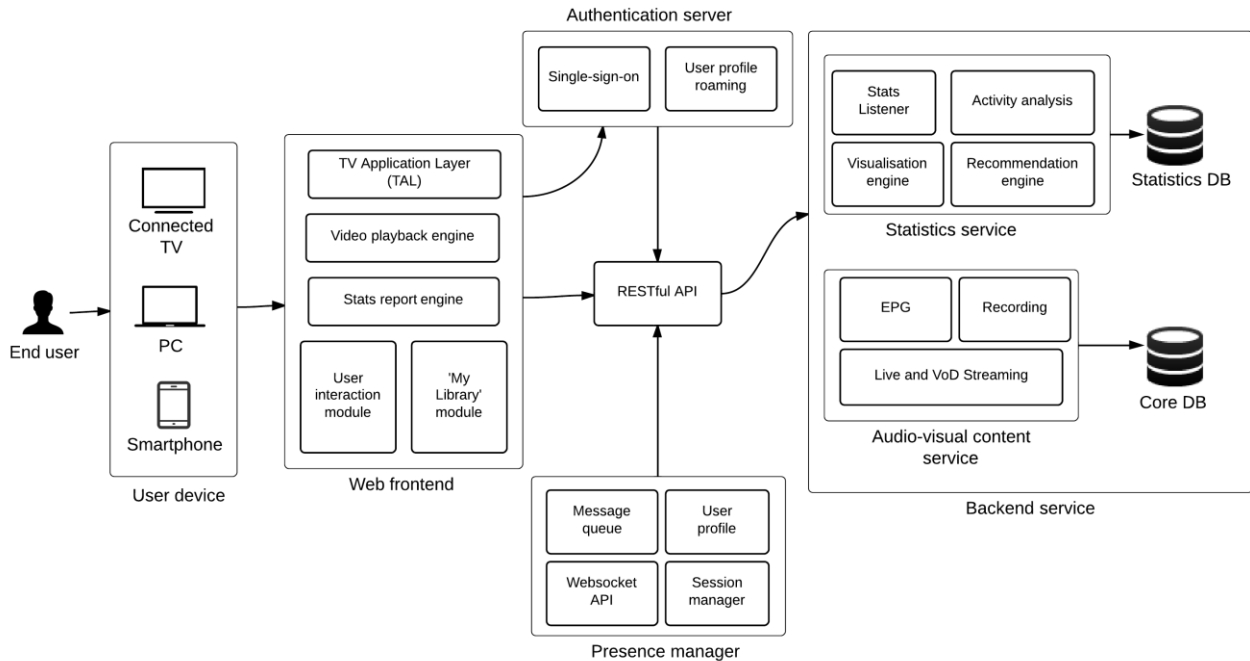-Resume that allows users to view their watching history and resume playback regardless of the current or previous devices used. This is not only limited to devices capable of rendering the rich web interface, such as desktops, laptops, tablets, and smart phones), but also gaming consoles and smart TVs. This is made possible through an application we developed using the TV Application Layer (TAL) SE [12] along with the DataCenter Resource Management (DCRM) GE [13].

The Vision IPTV system provides programme information, live and on-demand TV/Radio streaming as its core service. Users can log in to Vision on desktop, laptop, smartphone or tablet and view their TV [and radio] history including any programmes part-watched [and flagged for resume viewing], regardless of which device they last watched on. The single-sign-on and user profile roaming features of the authentication server support the log in function. The Stats report engine of the web frontend keeps track of play back position of a user session using heartbeat mechanism. Statistics service at the backend receives user stats reports from user devices via RESTful web service and provides features such as user activity analysis, visualisation and recommendation. After playback is paused on one user device (through the User interaction module), users can then resume play on a different device from the point at which they stopped viewing, [or from any other point]. The Presence Manager maintains user session, user profile and interacts with user devices for session transfer and synchronisation. A DCRM-based infrastructure is used to host the Presence Manager, gathering their session information and watch history to facilitate seamless cross-device functionality. This provides tailored user experiences and allows the infrastructure to scale by creating a distinction between video content and user-specific data. TAL is used as a common framework to build applications for divergent platforms, such as smart TVs and gaming consoles from different hardware manufacturers. Suitable metadata is made available using the My Library module to the user about programmes displayed in this way so they can quickly identify what to watch [or listen to]. Users are also able to delete items from their history.

2.2 - Specific Enablers

We will provide the following Specific Enablers through the Social Connected TV Platform.

- Audio Mining SE [7] (Release 06/14)
- Content Optimisation SE [8] (Release 06/14)
- Second Screen Framework SE [9] (Release 09/13)
- TV Application Layer SE [12] (Release 09/13)
- Content Similarity SE [11] (Release 06/14)

We utilise the following common Specific Enablers for the Social Connected TV Platform.

- Content Enrichment SE [5]
- Social Network SE

2.3 - Generic Enablers

We take advantage of the following Generic Enablers from FI-WARE within the Social Connected TV Platform.

- DataCenter Resource Management (DCRM) GE [13]

We already actively use the following Generic Enablers as part of the Social Connected TV Platform.

- Identity Management GE [14]
- Semantic Annotation GE [15]
- Object Storage GE [6]

3 - SOCIAL CONNECTED TV PLATFORM - RELEASE 10/14

The Social Connected TV Platform is a toolbox of SEs that offers powerful instruments to enhance connected TV services with:

Multi-screen interaction

- Intuitive interaction for advanced TV services
- More versatile content presentation across screens

Personalized TV experience

- Connected TV services tailored to single and multiple users
- Social interaction between users
- Search and discovery of content

User tracking and privacy

- Visualizing personal content consumption
- Tracking implicit and explicit user interaction
- Providing users with simple control over personal data

The features of the Social Connected TV Platform SEs address developers as well as providers of connected TV services. The following Specific Enablers are included in the September 2014 release of the Social Connected TV Platform.

3.1 - Audio Mining

3.1.1 - What you get

The Audio Mining SE is based on Fraunhofer IAIS' Audio Mining software and consists of a number of analysis services (called iFinder services), a media asset management framework including a persistence layer, a search engine and a SOAP/REST interface. The component is a backend application, without having end-users interacting directly with the system. Tests have so far been conducted with German- and English-language video/audio content.

iFinder services

- Structural analysis: The audio is segmented according to speaker changes or variations in the acoustic environment. Afterwards, every segment containing human speech is subject to further processing.
- Speaker identification: For every segment containing speech, the most probable speaker is determined based on features derived from the voice's sound.
- Speech recognition: Uses optimized models for previously detected speakers to ensure highest accuracy.
- Keyword Extraction: The final step is a keyword extraction to identify the most significant, distinctive and important terms from the speech recognition transcript.

3.1.2 - Why to get it

The Specific Enabler "Audio Mining" targets multimedia indexing and search scenarios such as "Rich Content". The SE analyses a given audio/video file and returns textual information for indexing. Speech and speaker segmentation as well as speech recognition are performed in order to turn speech into text. It delivers segments, characteristic keywords and various metadata. Finally, the SE builds an index enabling multimedia search.

3.1.3 - Documentation

- Technical Documentation of the Audio Mining SE [7]

3.2 - Content Optimisation

3.2.1 - What you get

The Content Optimisation SE consists of various modules that can be used to enrich textual content. Currently two modules are implemented: Firstly, the recommendation module can be used to generate recommendations for textual content such as audio transcripts. Secondly, the enrichment module can be used to perform Named Entity Recognition on textual content. The recognition module uses the Semantic Annotation GE and DBpedia-Spotlight to find and link to entities.

3.2.2 - Why to get it

The Specific Enabler "Content Optimisation" targets at scenarios in the context of Multimedia Mash-ups. The SE processes incoming textual content (e. g. from the Audio Mining SE) and extracts characteristic keywords. Afterwards, a semantically enrichment based on NLP (Natural language processing) will be performed to connect the transcripts and keywords with contextual information. Therefore, the SE integrates and harmonises additional content from disperse sources. The SE is intended for SMEs that want to build Second Screen Applications, e. g. for TV documentaries.

3.2.3 - Documentation

- Technical Documentation of the Content Optimisation SE [8]

3.3 - Content Similarity

3.3.1 - What you get

Content Similarity SE is a software solution to provide content-to-content recommendations based only on content metadata. The object is to offer a solution that allows a list of similar movies to be obtained from an initial movie request. The technology is based on a Technicolor algorithm that computes distances between movies. The target customers for this solution are content providers and cinema Information providers in order to offer VOD discovery services.

3.3.2 - Why to get it

The Content Similarity specific enabler targets a scenario of VOD discovery. This SE is a component that analyses metadata of a VOD catalogue to compute weighting genre of each movie. Then thanks to this weighted genre, the SE computes distance between all movies. This enabler can enrich a VOD portal application by offering a "similar movies" feature.

3.3.3 - Documentation

- Technical Documentation of the Content Similarity SE [11]

3.4 - Second Screen Framework

3.4.1 - What you get

The Second Screen Framework SE provides web applications which are running on a TV with all the crucial functionalities to establish a persistent bi-directional communication path to a web application running in the browser of any second-screen device. This includes the possibility to launch applications from one TV on the second screen. All functionalities are provided via a slim JavaScript API and can thus be easily integrated into any web application.

3.4.2 - Why to get it

Since the solution is fully compliant with the HbbTV standard it enables content providers to create fully interactive applications with direct programme relation potentially targeting millions of already deployed devices on the market. Thus, the concept can be implemented without modifications of hardware and only minimal extensions to existing applications.

3.4.3 - Documentation

- Technical Documentation of the Second Screen Framework SE [9]
- Developer Guide of the Second Screen Framework SE [16]

3.5 - TV Application Layer

3.5.1 - What you get

The TV Application Layer (TAL) SE is an open source library for building applications for Connected TV devices. TAL is targeted specifically at developers working on TV applications for more than one target platform / user device. TAL works to abstract device functionality variations, relieving the developer from worrying about how her application would render on different devices. The bulk of the development can be done on a desktop browser that is built on the same origins as TV browsers.

3.5.2 - Why to get it

There are hundreds of different devices in the marketplace and they all use slightly different technologies to achieve the same result. The purpose of TAL is to allow you to write an application once, and be confident that it can be deployed to all HTML-based TV devices. TAL uses a simple JavaScript and CSS framework to achieve this.

3.5.3 - Documentation

- Technical Documentation of the TV Application Layer SE [12]

3.6 - Content Enrichment

3.6.1 - What you get

The Content Enrichment SE enabler provides the following capabilities

- **Media & Text Annotation** - allows any type of media (e.g. video, audio, photos or text) to be enriched with user-generated video content, add or edit comments, notes, enrich the media with custom drawings. Also to create custom mash-ups of media content and enable the retrieval of related information (e.g. via access to external resources, location & content sensitive metadata, object tracking etc.).
- **Object-based Media Discovery** - enriched media content contains metadata information on available objects within the media. Referenced information on available objects can be used to discover other object-related media content.
- **Cross-Video Navigation** - Allows user interaction to jump back and forth in-between video content.

3.6.2 - Why to get it

The Content Enrichment SE is useful for creating, distributing and playing interactive content video content across platforms and devices. It provides interfaces to incorporate web 2.0 capabilities and community functionalities as well. Thus the enabler acts as a common building block in future video and multimedia infrastructures, to allow seamless, platform independent and convenient enrichment of any type of video content using any type of device for a plurality of application cases covering User Generated Content (USG), professional content as well as edutainment.

3.6.3 - **Documentation**

- Technical Documentation of the Content Enrichment SE [5]

4 - SCTV PROTOTYPES AND APPLICATIONS

Based on the SCTV platform and their enablers, the following set of prototype applications have been built to demonstrate the capabilities of the SCTV platform:

4.1 - Fall of the Wall Live TV-Blog

The Fall of the Wall Live TV-Blog is a social TV application for HbbTV enabled TV sets. It enables TV viewers to follow social media posts related directly to the broadcast TV programme directly on the TV. The application demonstrates the type app that can be created using the HbbTV application toolkit. The HbbTV App Toolkit aims to enable fast and easy creation of programme-related HbbTV applications. It provides a CMS (HTML5-Editor) with a set of GUI templates that can be filled with content via an easy-to-use user interface. A REST-API to the content model of the HbbTV App Toolkit's CMS will allow its integration into the CMS used by content creators in their production environment. In addition to the CMS the HbbTV App Toolkit will support HbbTV developers by providing a library with solutions for recurrent tasks for developers, e.g. navigation through a button list, scrollable elements, channel change, etc.

Moreover the HbbTV App Toolkit will facilitate the integration of features provided by other Social Connected TV Platform enablers, such as the Second-Screen Framework SE and the Content Enrichment SE, into HbbTV applications.

4.1.1 - Screenshots

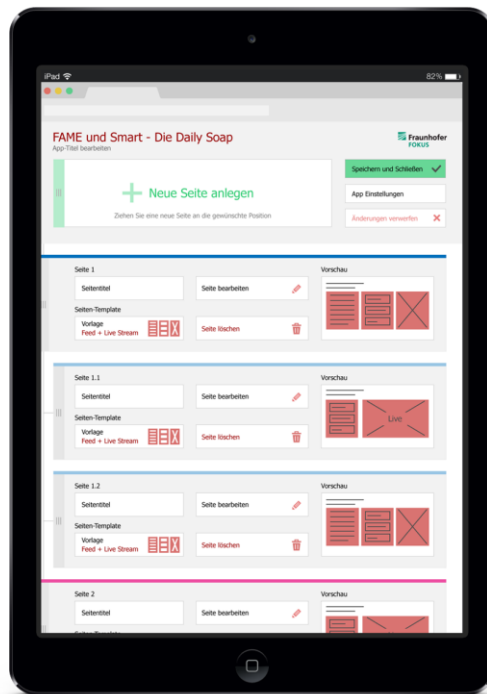*Figure 6 Overview of the HbbTV Application Toolkit - Editor and HbbTV App*

Editor

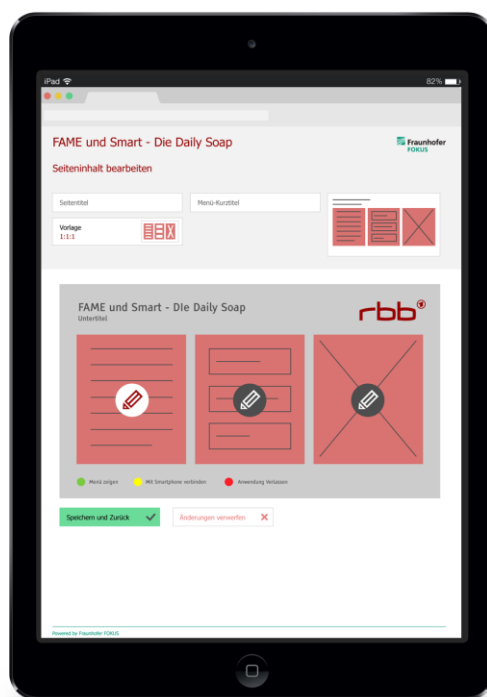*Figure 7 Toolkit Editor - app overview*

Figure 8 Toolkit Editor - editing a page

HbbTV App

Figure 9 Live TV-Blog combines live broadcast and social feeds

Figure 10 In the TV-blog posts can be focused and opened for larger view

4.2 - Interactive multi-screen content

The prototype shows an implementation of interactive multi-screen content for HbbTV. The application is based on RBB catch-up TV content and uses the Second Screen Framework SE as well as the Content Enrichment SE to enable an interactive content experience. The HbbTV application extends the TV experience to the second screen device by adding additional content with which the user can interact. All additional information and interactive video objects are available on the TV screen via the HbbTV app as well as on the second screen device. The second screen offers enhanced user features such as the ability to browse through a list of tagged interactive objects attached to the TV content while the content is displayed on the TV. Using the Content Enrichment SE, such additional media as pictures, related videos, websites and social media can be retrieved on the second screen and pushed to the TV, thanks to the synchronisation of the devices via the Second Screen Framework.

4.2.1 - Screenshots

Figure 11 Main and second screen devices

4.3 - Second Screen Synchronisation

Audio Fingerprinting provides an easy and user-friendly solution for synchronisation of first and second screens in non-HbbTV environments. It is a robust solution for developers implementing synchronised Second Screen applications.

Our application demonstrates how the synchronisation mechanism works and which use cases are possible. It is an Android application that allows the user to sync with one of the demo videos that are available through a website. When the synchronisation is finished, the application displays the current video, the playback position in the video and relevant keywords that were found in the video.

4.3.1 - **Screenshots**

Figure 12 Second screen device

4.4 - Full-text search in audio-visual content

This application demonstrates the capabilities of the Audio Mining Enabler. The user can access a video archive using a full-text search interface allowing him/her to search within the spoken content. If one of the search results is interesting, the user can then decide to share it with friends via Social Media platforms such as Facebook or Twitter. Additionally, the demonstrator offers a sharing functionality for editors or journalists reporting from live events: each search hit can be shared via ScribbleLive, a platform very commonly used for this type of sharing.
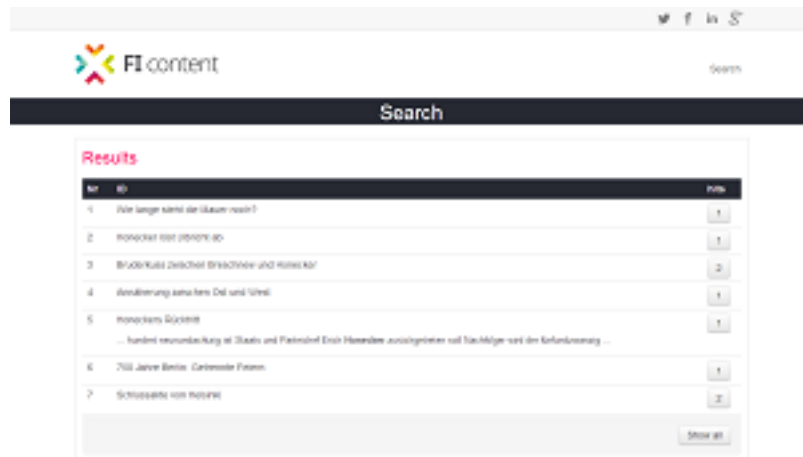
4.4.1 - **Screenshots**

Figure 13 Audio mining: full-text search

Figure 14 Audio mining: results

Figure 15 Audio mining: Scribble Live

4.5 - Vision platform

Vision is an IPTV platform that delivers both live and on-demand (VoD) content from 30 TV and 20 radio free-to-air channels to students and staff on the Lancaster University campus. Vision manages the full content lifecycle, starting from ingestion via satellite and terrestrial broadcasts through to HTML5-compliant video streams. By early October 2014, Vision had 1570 registered users.

Vision provides universal and easy access to content regardless of user device or locality (as long as it is within the boundaries of licensed content). Vision content is primarily delivered through its web interface. Further delivery options are available: an interface for smart TVs and gaming consoles is developed using the TAL enabler (open source implementation available), and native iOS and Android apps are under development (currently in beta release).

With its large content library and user base as well as its fully managed ecosystem, Vision offers a unique opportunity to carry out large-scale experiments to evaluate future TV technologies. One recent feature introduced was the Semantically-Enriched Social Annotation. This feature enables users to socially interact about media content and its events where messages are displayed to other users viewing the same content item, but only at the playback time at which the message was made. Furthermore, the Content Optimisation SE is used to automatically identify links to semantic entities in the media are automatically identified from the content speech, and added to the social discussion. This enables users to explore relevant links extracted from the media content.

4.5.1 - **Screenshots**

Figure 16 Semantically-Enriched Social Annotation feature on Vision
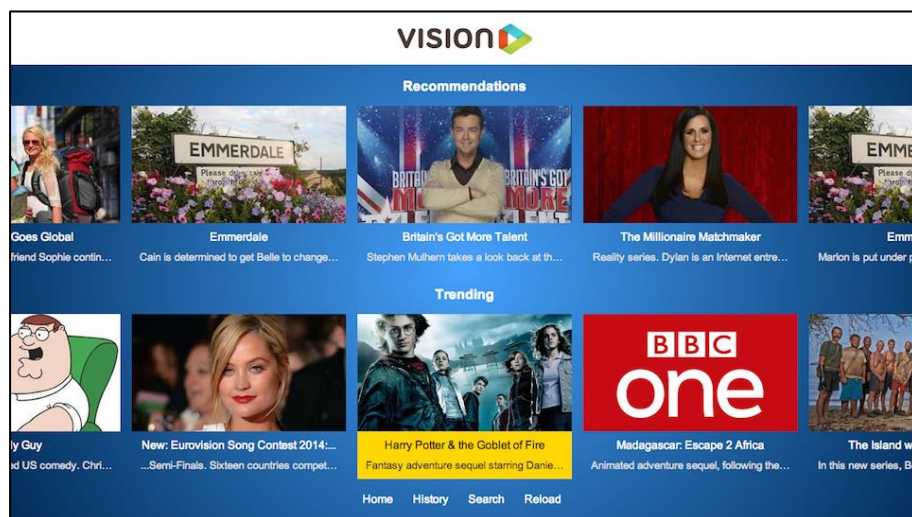

Figure 17 Screenshots of the TAL-enabled version of Vision for smart TVs and game consoles
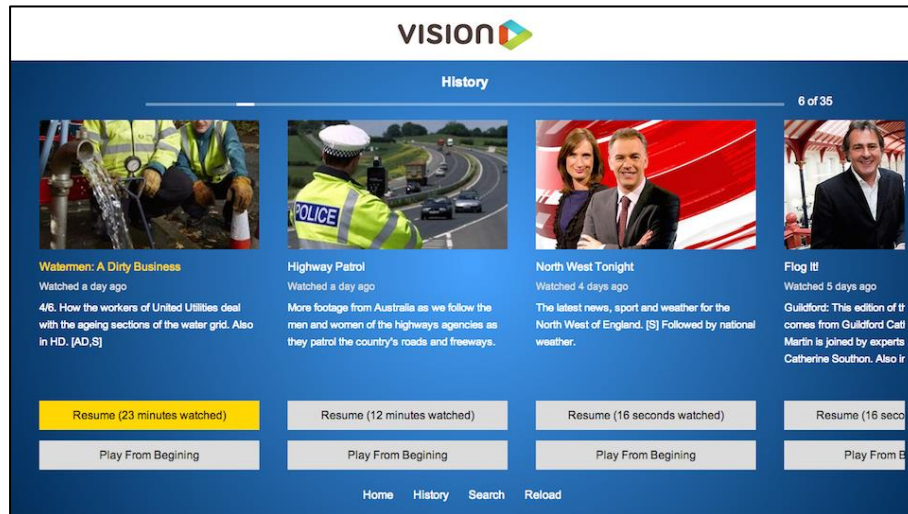
Figure 18 Screenshots of the TAL-enabled version of Vision for smart TVs and game consoles
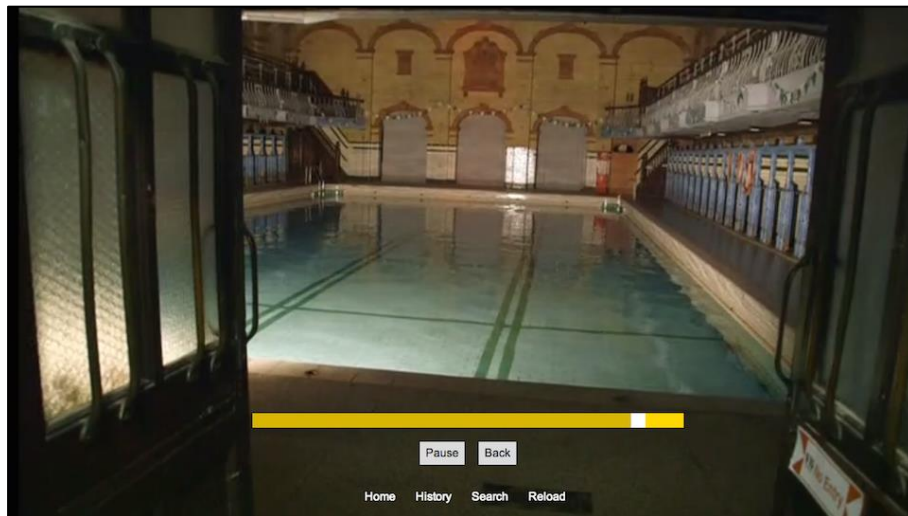

Figure 19 Screenshots of the TAL-enabled version of Vision for smart TVs and game consoles

4.6 - VoD Search & Discovery

The application demonstrates a method of using the Content Similarity SE to display movies similar to a given movie, based on analysis of the genre/s. An ingest of two French VoD catalogues has been made with a pre-processing of metadata.

Figure 20 Integration of Content Similarity SE

4.7 - rbbtext

rbbtext is an HbbTV application offered as part of the regular broadcasting services delivered by German public broadcaster RBB. It builds upon the classic teletext service and uses the functionality of the HbbTV standard for navigation and presentation of content and information. It provides an enriched version of information presented by teletext and is connected to the same content management system. Unlike teletext, users can navigate directly to a menu item by using the arrow keys on the remote control. Furthermore the improved graphical presentation of content with the help of HTML accesses the potential of today's high-resolution TV displays.

Using the Second Screen Framework Enabler, the second-screen version of the rbbtext HbbTV application contains a menu item which offers the option of connecting to a second device. Once the companion application is launched, the user can either choose synchronised navigation – what happens on one screen happens on the other screen as well - or can choose to use the application on the second screen only. This allows the user to continue watching the broadcast while browsing through additional accompanying information on the second screen.

A further use-case is the possibility of opening URLs on the second-screen in order to show content which is beyond the scope of HbbTV on the TV screen; rbbtext editorial staff includes such links in the HbbTV application.

4.7.1 - **Screenshots**

Figure 21 rbbtext in action

4.8 - ARD-EPG

The ARD EPG is an HbbTV application offered by the German public service broadcasting network ARD. The application provides information about current and upcoming TV programmes aired on channels of the ARD network. It offers a full text search to find specific programmes. In addition, the ARD EPG enables users to access previously-broadcast content. For all shows available in the ARD VoD catalogue, direct links to catch-up content are presented.

Using the Second Screen Framework Enabler, the companion app allows users to navigate the EPG on the second screen. Users can choose to use the app either on the main screen or on the second screen only, browsing EPG content using the more convenient touch interface of the tablet computer while simultaneously viewing the current broadcast on the TV screen. Users can also use the second-screen app to switch between channels of the ARD network and to initiate the playback of video clips from the VoD catalogue displayed on the main TV screen.

4.8.1 - **Screenshots**

Figure 22 ARD-EPG in action

4.9 - VideoCloud

Video Cloud is an application for sharing and exploring of interactive video content. By taking advantage of Content Enrichment SE, the application prototype enables interactive video on second screen devices (tablet

and smartphone) to enhance established content experiences from TV to personal devices where interactivity should ideally take place. The current prototype runs independently from the TV or STB application. For future releases, it is planned to integrate with the Rich Content scenario and adopt the Second Screen Framework SE to realize companion screen features directly coupled to broadcast content via HbbTV application. The Video Cloud prototype application gains access to available interactive video content that has been uploaded beforehand to the Video Cloud service e.g. through the Video Cloud editing tool. Current supported formats are MP4, WebM, as well as adaptive Formats HLS and MPEG DASH.

Via the user frontend on the smartphone or tablet, the user is able to explore the interactive content including comments, posts and related links from other users. Also editorial material can be integrated besides the user generated content. Personal posts and related content can be added to a section of the video in general or specific objects within the video, which are then turned into clickable areas within the video. The user can add images, textual information and links to other web content. It is also possible to link to other possibly interactive videos that were previously added to the system or create chapter and pause markers. The integration of meta-data from open encyclopaedias like Europeana or Wikipedia is currently being evaluated and is planned to be integrated in the application in a future release, potentially for the spring 2015 experimentations planned by BitTubes at the Berlin experimentation site.

We worked on an early prototype of an interactive video timeline, which uses video-timestamps of comments and interactive areas are used to automatically display e.g. images of the corresponding video frames and related posts or data. This preview timeline shows viewers what parts of the video were enhanced and what to expect in these scenes both video-content wise and enhancement wise. Users can click on the previewed sections to either jump right into the video scene or get a detailed list of the added comments and interactive zones.
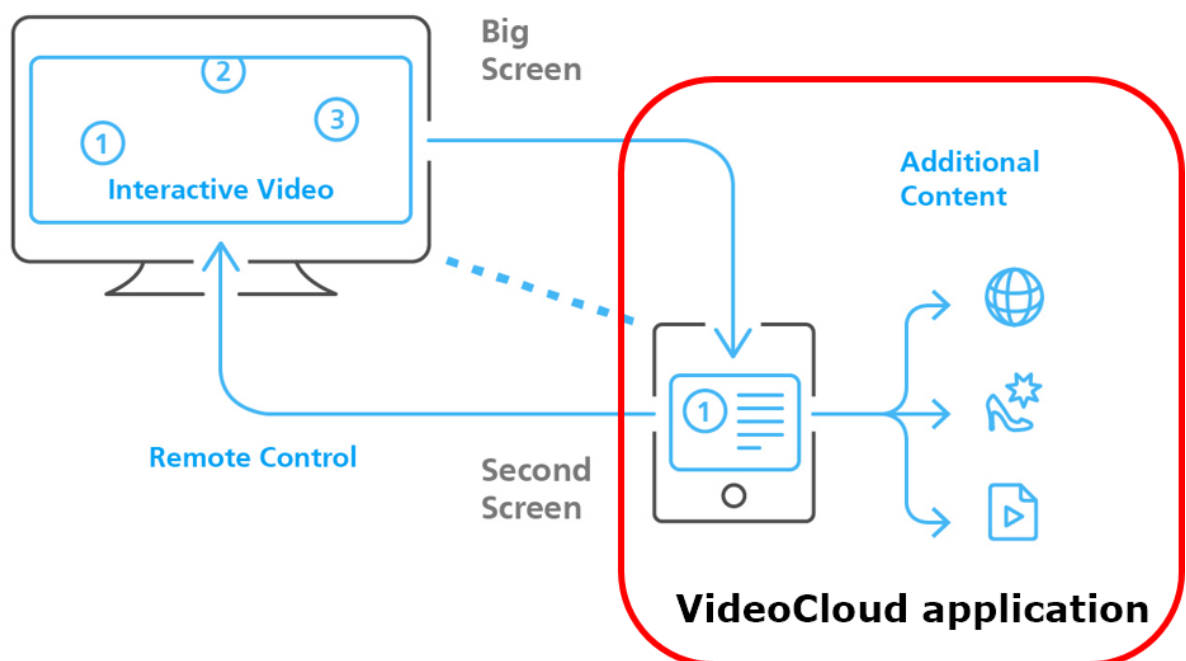
4.9.1 - **Screenshots**

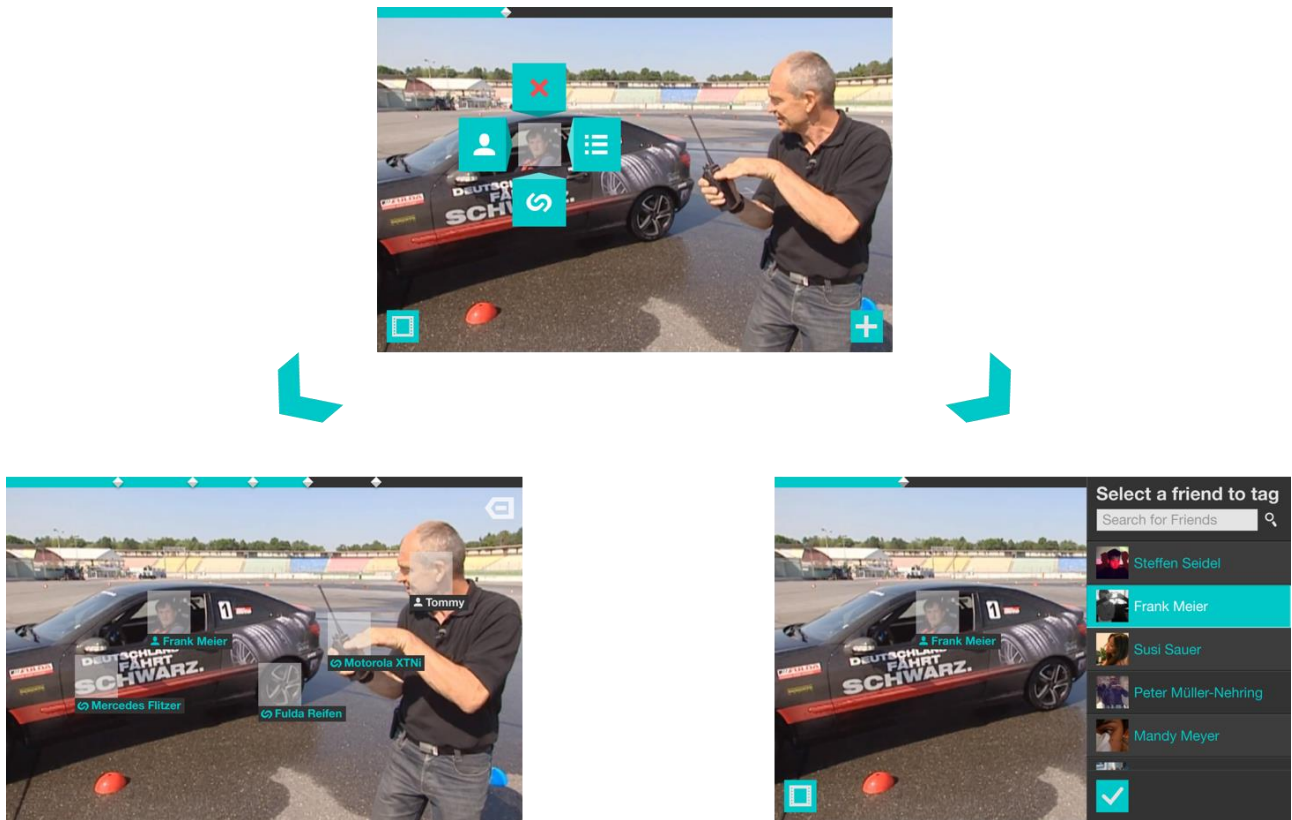*Figure 23 VideoCloud integration with Rich Content scenario*

Figure 24 VideoCloud UI samples from tests

4.10 - Interact with your friends and telescopic adverts

Fincons develops two applications (Interactive Football Match Application and Interactive Car Advertising Application) in order to offer an interactive multi-screen content experience extending the FI-CONTENT "Rich Content" scenario. In the area of the "Social Connected TV platform" the two solutions are targeted at: **Enriched Content sharing** and **Video Advertising**.

With the first solution **Enriched Content sharing** starting from TV screen content, the users can create enriched content on their second screen devices and share it with their friends in an interactive way; Inside this context our solution will cover the following main functionalities:

- **Second Screen Connection**: after the QR code recognition the connection between the Smart TV and Second Device is established. Thus device-to-device ncommunication is enabled and can be used to display extended information on the second screen.
- **Augmented Content Distribution**: the Smart TV will be able to intercept the enrichment metadata delivered with the streaming video by the Content Enrichment Framework and will then notify the connected device of the presence of enriched content. The user will be able to explore and consult the enriched content (audio, video, text, images, animation, PDF, contact information, links).on the second device
- **Social Sharing**: the user can share enriched content with a set of friends or extended contents on various social network platforms. The content will be published on the Social Network wall

and a message will appear on the Smart TV in the screen corner of the selected consignees to inform of new shared content.

- **User Generated Content**: the Second Screen App will provide a compilation form to the user in which he/she will be able to enrich the event with comments or notes, as well as a captured frame from the stream in order to share the UGC with friends.
- **Content Enrichment Submission**: users have the possibility of creating enriched content and disseminating it to other users following the same event.

With the second solution **Video Advertising** the second screen offers additional information like recommendations, comments, related video content: this content can be presented to users' second screen devices for interactive advertising purposes. The users can add their comments in the form of text, pictures on top of relevant element, and share them with other users (both using the Application or other social media platforms)

4.10.1 - Screenshots

Figure 25 Second Screen Connected

Figure 26 Augmented Content Scenario
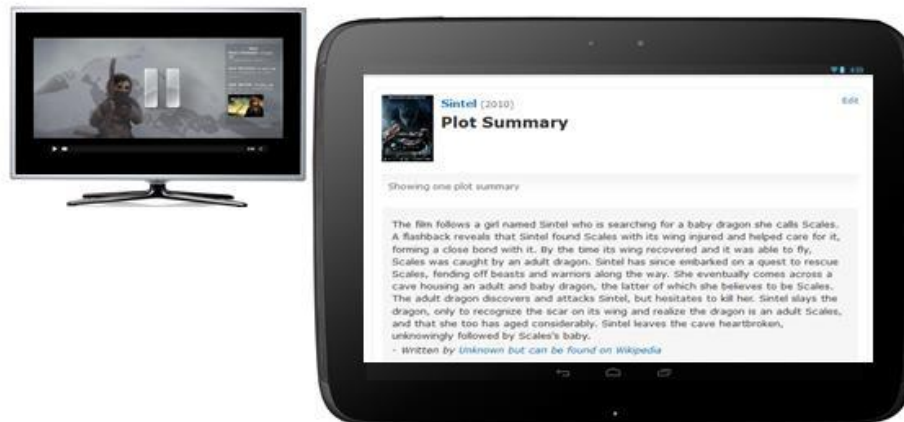
Figure 27 Augmented Content Solution
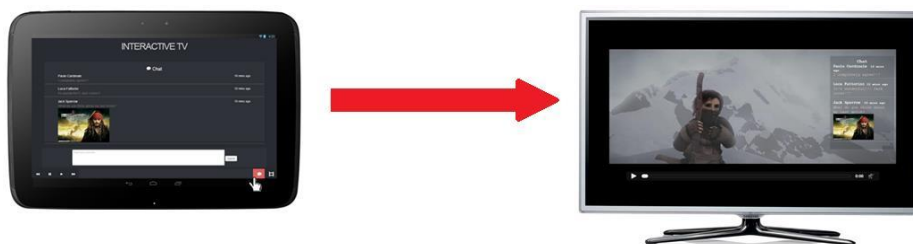
Figure 28 Extended Content

Figure 29 Add Comment Feature
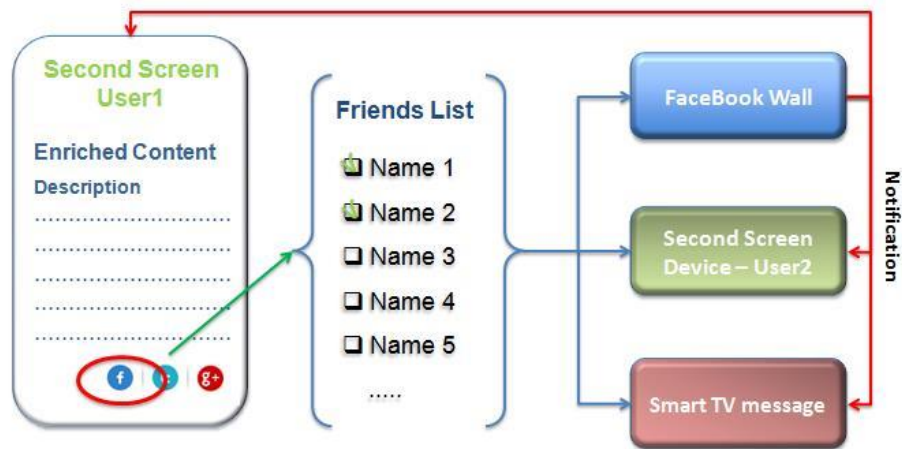

Figure 30 Add Comment to a Frame

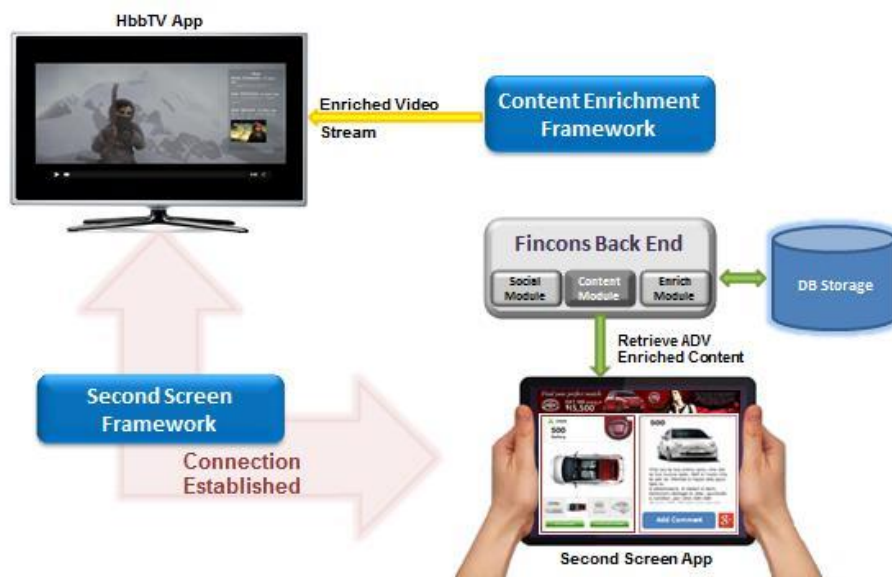*Figure 31 Social sharing*

Figure 32 Advertising Enriched Content

5 - INTERACTION AND COOPERATION WITH OTHER FICONTENT PLATFORMS

The Social Connected TV Platform uses the Content Enrichment SE [5], which was originally introduced by the Smart City Platform [17] and has been promoted as a Common Specific Enabler in FIcontent. The Content Enrichment SE enables the creation, distribution and play-back of augmented interactive video content. The original target runtimes for the playback of enriched A/V content were browsers of desktop and mobile devices. During the course of the project the enabler has been adapted to requirements of the Social Connected TV Platform. Since the Release 09/13 of the Social Connected TV Platform the Enabler allows the playback of enriched content on HbbTV devices.

Moreover lab trial applications have been developed on the basis of the Content Enrichment SE and the Second-Screen Framework SE to investigate how media experience can be enhanced with richer content and technology that allows making use of end-user devices core assets – namely the TV's large display for the presentation of content and the touch-gesture support of second-screen devices for the interaction with additional content.

6 - SOCIAL CONNECTED TV PLATFORM - UPCOMING RELEASES

For the upcoming releases of the Social Connected TV Platform, we will enhance our existing Enablers considering feedback gathered from third party developers and (large scale) trials. Moreover we will release new Enablers, that are crucial for realising our upcoming content experimentations and might also be of interest for other developers. These planned Enablers as well as significant changes in existing enablers are described below.

6.1 - Audio Fingerprinting SE

The development of this Specific Enabler is discontinued following the recommendation of the Commission. However, it will be released as Open Source software in the next release of the Social Connected TV platform. This will allow Phase 3 partners to use and adapt the software without licensing restrictions.

6.2 - HbbTV App Toolkit (HAT) SE

The HbbTV standard provides a powerful set of APIs for the creation of programme-related interactive TV applications. However, there are only few applications available today that exhaust the full potential. The existing applications are rather static TV-tailored websites, e.g. VoD portals or weather apps. They do not have a real contextual relation to a running TV show and do not provide much additional information on the currently running programme, although these kinds of applications are great media for viewer engagement.

The main reason for this shortage is that the development of HbbTV applications is still quite demanding due to the lack of proper tools for content creators and developers. Creating an HbbTV application just for one single show is simply too expensive.

The HbbTV App Toolkit SE aims to enable a fast and easy creation of programme-related HbbTV applications. It will provide a CMS with a set of GUI templates that can be filled with content via an easy to use user interface. A REST-API to the content model of the HAT SE's CMS will allow its integration into the CMS used by content creators in their production environment. In addition to the CMS the HAT SE will support HbbTV developers by providing a library with solutions for recurrent tasks for developers, e.g. navigation through a button list, scrollable elements, channel change, etc.

Moreover the HAT will facilitate the integration of features provided by other Social Connected TV Platform enablers, such as the Second-Screen Framework SE and the Content Enrichment SE, into HbbTV applications. This integration will support exploitation of project results.

The development of the SE will not open a new field of research within FIcontent. The approach is rather to harvest the insights gained during the development of the FIcontent trial applications and allow other developers and content creators to profit from these findings.

First tests will be conducted at the Berlin experimentation site with RBB content in Q4 2014.

6.3 - Skipped SEs

The development of the following Enablers will be discontinued following the recommendation of the Commission.

- Audio Fingerprinting SE [7] (Release 06/14). This Enabler will be available for Phase 3 as Open Source software.
- Content Atmosphere SE. After internal first year evaluation, it has been decided not to conduct second year experimentation for this component.

7 - DEPLOYMENT OF THE SOCIAL CONNECTED TV PLATFORM

The figure below illustrates where the Enablers of the Social Connected TV Platform are located, i.e. where they are installed and running. On the left side we list the cloud services that mostly have a RESTful API to be used by clients or other services. The centre line indicates Enablers that run code on both the client and the server side.
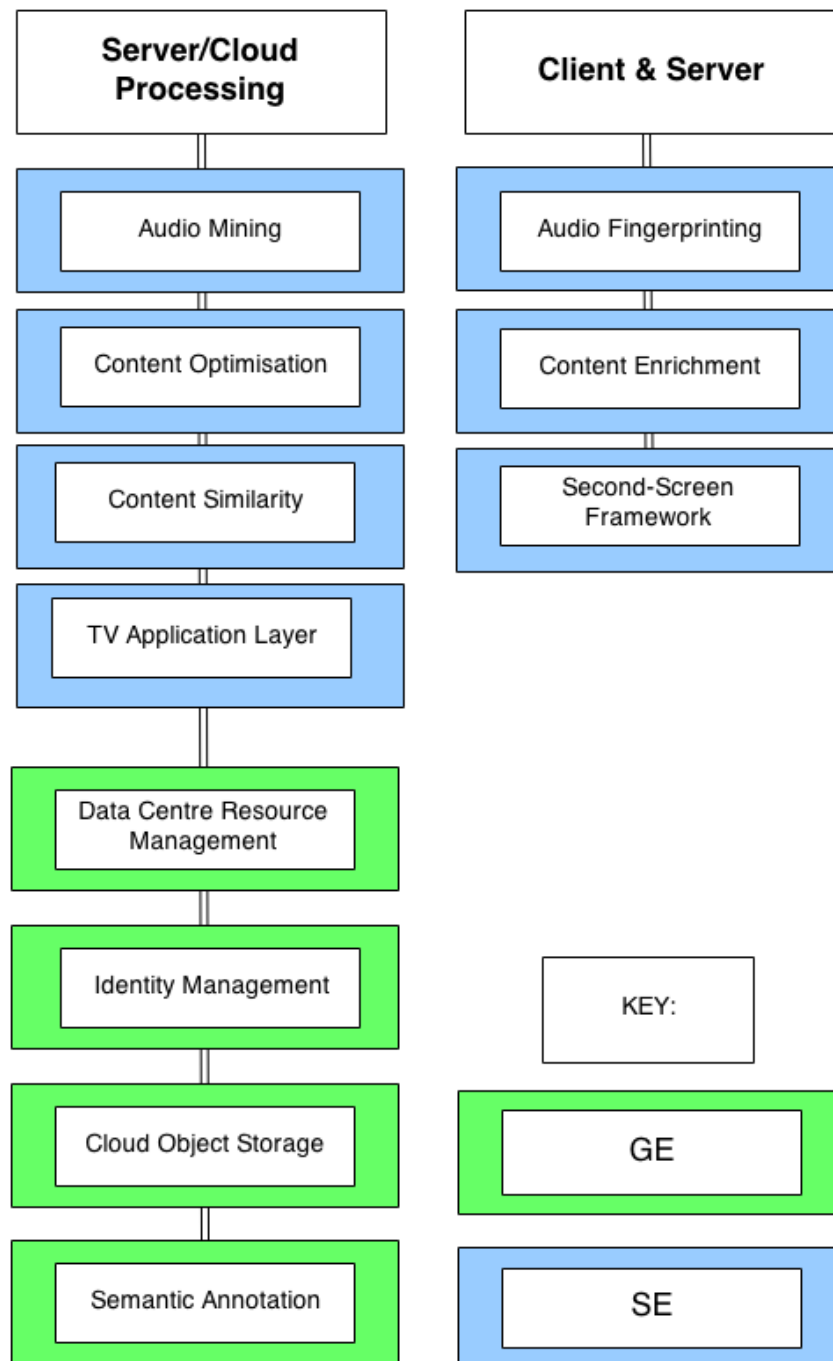

Figure 33 Deployment locations of the Social Connected TV Platform Enablers

7.1 - Server Side Enablers with a Shared Instance

Some GEs and SEs hold data that is used by multiple applications. These Enablers are provided as a single instance that is shared by different applications. These Enablers are:

- Identity Management GE [14]
- Object Storage GE [6]
- Semantic Annotation GE [15]

7.2 - Server Side Enablers with One Instance per Application

Some Enablers are web services that are specific for the application making use of it. These Enablers need to be installed on web servers or PaaS environments by the application provider. These Enablers are:

- Data Center Resource Management GE [19]
- Audio Mining SE [20]
- Content Optimisation SE [21]
- Content Similarity SE [22]
- TV Application Layer SE [18]

For most server side Enablers we use the XIFI FI-LAB test bed infrastructure. Three notable exceptions exist where dedicated servers might be used at the respective test sites:

- Latency-critical message handling for multi-user applications
- Ethical requirements regarding user data
- CPU computing power for high performance computing if not available on the XIFI FI-LAB test bed infrastructure

For these cases, the respective experimentation site provides its own server infrastructure for local experiments.

7.3 - Enablers on Both Client and Server Side

Some Enablers have components that are deployed on the client and on the server side. These Enablers are:

- Audio Fingerprinting SE [23]
- Content Enrichment SE [24]
- Second-Screen Framework SE [25]

7.4 - Infrastructure used in the 1st Experimentation Cycle

7.4.1 - Berlin Experimentation Site

The Infrastructure used for testing on the Berlin Experimentation Site is described in the wiki and in the chapter "Technical Infrastructure" in Deliverable D7.1.2.

7.4.2 - Lancaster Experimentation Site

The Infrastructure used for testing on the Lancaster Experimentation Site is described in the wiki and in the chapter "Technical Infrastructure" in Deliverable D7.1.2.

7.4.3 - Brittany Experimentation Site

The Infrastructure used for testing on the Brittany Experimentation Site is described in the wiki and in the chapter "Technical Infrastructure" in Deliverable D7.1.2.

8 - CONCLUSION

In this document, we present a technical description of the Social Connected TV Platform. We have presented the overall architecture of the platform, listing the groups of Specific Enablers and Generic Enablers that are involved, as well as describing how they interact with each other. We have updated the descriptions of the platform to reflect the work that has been achieved to date following the successful integration of FIcontent open call partners and the ensuing reassessment of scenarios, applications and enablers. Finally, we discuss the deployment of the platform and note the diversity of environments hosting the platform components.

In the course of the FIcontent project, technologies provided through the Social Connected TV Platform will be improved in an iterative approach. Information and feedback on the usability of developed applications and scenario concepts and the state of maturity of Enablers with regard to stability/security etc. are being collected via experimentations. Insights feed back into the implementation of scenarios and platform-specific Specific Enablers and ensure high quality of the development of future releases of the Social Connected TV Platform.

9 - REFERENCES

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[2]   http://wiki.mediafi.org/doku.php/ficontent:deliverables:d241

[3]   http://wiki.mediafi.org/doku.php/ficontent:deliverables:d61#definition_of_a_ficontent_specific_enabler

[4]   http://wiki.mediafi.org/doku.php/ficontent.socialtv.roadmap.release_06_14

[5]   http://wiki.mediafi.org/doku.php/ficontent.common.enabler.contentenrichment

[6]   http://wiki.mediafi.org/doku.php/ficontent.fiware.ge_usage#object_storage_ge

[7]   http://wiki.mediafi.org/doku.php/ficontent.socialtv.enabler.audiomining

[8]   http://wiki.mediafi.org/doku.php/ficontent.socialtv.enabler.contentoptimisation

[9]   http://wiki.mediafi.org/doku.php/ficontent.socialtv.enabler.secondscreenframework

[10]   http://wiki.mediafi.org/doku.php/ficontent:socialtv:enabler:audiofingerprinting:start

[11]   http://wiki.mediafi.org/doku.php/ficontent.socialtv.enabler.contentsimilarity

[12]   http://wiki.mediafi.org/doku.php/ficontent.socialtv.enabler.tvapplicationlayer

[13]   http://wiki.mediafi.org/doku.php/ficontent.fiware.ge_usage#datacenter_resource_management_dcrm_ge

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