# SAM: Socialising Around Media

## Context-driven content and dynamic social communities for TV second screen devices

Atta Badii, Marco Tiemann
School of Systems Engineering
University of Reading
Reading, United Kingdom
{atta.badii},{m.tiemann}@reading.ac.uk

David Tomás
Department of Software and Computing Systems
University of Alicante
Alicante, Spain
dtomas@dlsi.ua.es

Andreas Menychtas, Christina Santzaridou, Alexandros Psychas
School of Electrical and Computer Engineering
National Technical University of Athens
Athens, Greece
{ameny},{csantz},{alps}@mail.ntua.gr

Juan Vicente Vidagany Espert
TIE Kinetix
Breukelen, The Netherlands
juanvi.vidagany@tiekinetix.com

***Abstract*—This article introduces the EU-co-funded project "Socialising Around Media" (SAM). The project is developing an ecosystem for creating and presenting "second screen" experiences e.g. on smartphones to accompany "first screen" TV content. SAM second screen experiences can provide both additional supplemental content to users and allow them to engage in social media communities that already exist as well as ones that are dynamically created based on user interactions using the system. Based on contextual data extracted from user interactions, the selection of content to be provided to a user can also be changed based on social media data. This article provides a snapshot of the current state of the project at the 2-year mark of this 3-year project. It provides a general overview of the project and more detailed information on context management, dynamic community creation and social media analytics that are being developed as part of the project.**

***Keywords—content management; multimedia systems; social computing; social network services; context modeling***

## I. INTRODUCTION

The widespread adoption of connected devices such as smartphones has changed many facets of life including our interactions with and behaviours while watching television. In a project-internal initial questionnaire provided to evaluation participants, 65% of respondents stated that they often, very often or always used a smartphone while watching television. It appears that smartphone usage may have displaced other activities that TV viewers have tended to engage in before the arrival of the smartphone on the in-home sofa.

### *A. Socialising Around Media*

The EU co-funded research project "Socialising Around Media" (SAM) [1] is concerned with the connection of television viewing and smart devices. The main goal of SAM is to create an ecosystem in which content providers and broadcasters are able to provide TV viewers with enjoyable experiences for their smart device "second screen" that complement and extend their usage of the TV "first screen". While second screen applications are not in themselves novel and can be found for high-profile programmes such as TV talent shows and similar programme categories, the apps that are created for such programmes tend to be custom developments created by third-party developers in an expensive development process.

The aim of SAM is to provide broadcasters and similar content providers with an integrated ecosystem of a content marketplace, a content management and second screen experience creation environment and a presentation system for televisions and second screens.

This ecosystem will allow broadcasters to significantly reduce the costs that are currently associated with creating companion experiences for TV content to a level comparable with conventional web content management. At the same time, SAM is able to create a sophisticated experience that can combine manually curated content positioned on a video feature timeline with additional content that is automatically selected based on video content, user activities, contextual factors or combinations of these three, and that also integrates social media channel functionalities.

The social media system that is part of the SAM platform integrates relevant existing social media channels (e.g. Twitter, Facebook) and creates dynamic communities. These dynamic communities begin from communities focusing around a specific programme and from there expand to identifying both specific sub-communities for a programme community and to identifying communities interested in specific cross-programme topics (e.g. specific actors, topics or programme genres).

The SAM project is developing a prototype system that will be used to demonstrate and evaluate the usefulness of the described concept for business users and the attractiveness of second screen experiences created with SAM to "second screen native" end users. The research project is co-funded by the

European Commission; it involves a consortium of technical partners and end-user partners from the media sector and extends over a three-year period from late 2013 to late 2016.

This article provides a brief summary of the overall SAM system and of the social media, context integration and social media analytics functionalities that are of specific relevance in the context of this publication.

## II. Related Work

The SAM project is organised around three main pillars: content syndication, multi-screen interaction and social media. Since there is no directly comparable product or project to the best of the knowledge of the authors, related work in these three areas will be summarised briefly.

Content syndication in SAM is concerned with content management, content selection and content delivery of complementary content to end users. SAM applies state-of-the-art presentation standards for television by using the recently finalised HbbTV 2.0 specification [2] and HTML 5 presentation layer rendering on end user devices. Content syndication generally is a commercially focused development area; major actors in this business area include TIE Kinetix, Zift Solutions and WebCollage.

Multi-screen interaction involves the representation of multiple devices and the integration of first and second screens. While there is no explicit standard dedicated to second screen interaction, some standards, in particular HbbTV 2.0, and proprietary but widely used systems such as Google Chromecast and Miracast provide varying degrees of control and/or interaction in dual- or multiscreen environments. The SAM project applies technologies based on HbbTV 2.0 and delivers services using the underlying infrastructure specification of HbbTV 2.0.

Social media have become a very important component in the user interaction with media and television content. Generally, the majority of social media interactions around content that are recorded and analysed tend to originate from general-purpose social media channels such as Twitter, which appears to carry a heightened importance not least from the perspective of advertisers, since Twitter data can be analysed in order to extract quantitative indicators useful for advertisement decision making. As part of SAM, analytic algorithms are employed both in order to provide social media analytics and in order to identify users who may potentially want to join dynamic communities created around media content. The former is a very active field of investigation. The latter has not been addressed frequently, but is generally based on social network analysis methods to aim to identify clusters of users using in particular graph-based clustering methods.

## III. Features And Architecture

SAM combines technical delivery infrastructure, experience authoring and end user presentation and interaction functionalities as part of the overall SAM platform. Fig. 1 depicts the core topics of SAM that are of interest at a conceptual level. The most relevant system components related to social media are dynamic social communities, content discovery and delivery and social mining. These features will be covered in more detail in Section IV of this article. This section briefly summarises other core features of the SAM platform.

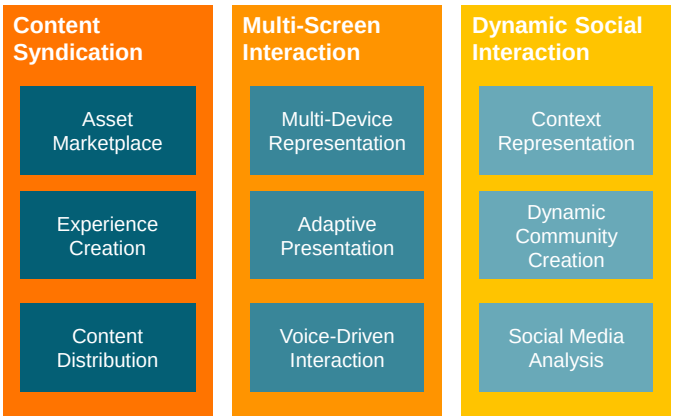


Fig. 1. Overview of SAM key features related to the main pillars of SAM and the application domain of digital marketing.

The SAM content syndication component integrates a marketplace where content providers of second screen content can publish assets that may be used for creating second screen experiences. Assets available in the SAM marketplace can be composed in a second screen experience creation workflow using both static definitions of second screen experiences and dynamic experience creation. Fig. 2 shows a user interface component where second screen assets can be organised on a video timeline.

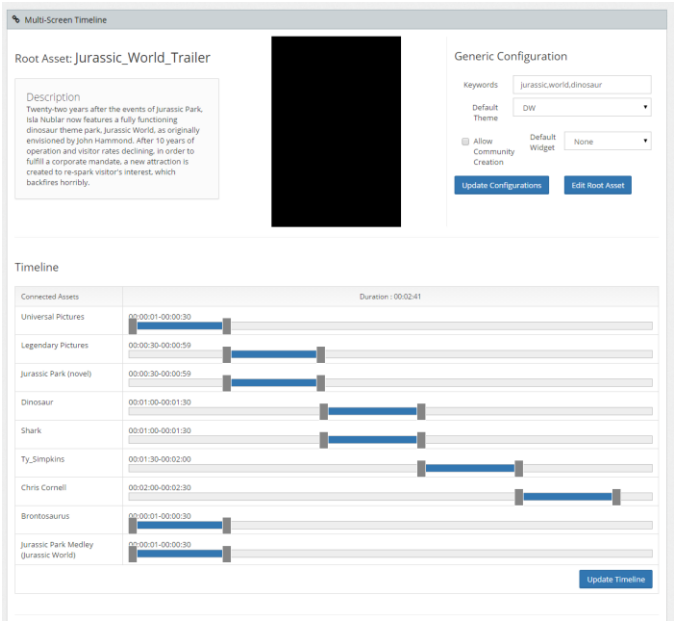


Fig. 2. Configuration interface for static second screen content on a timeline view in SAM.

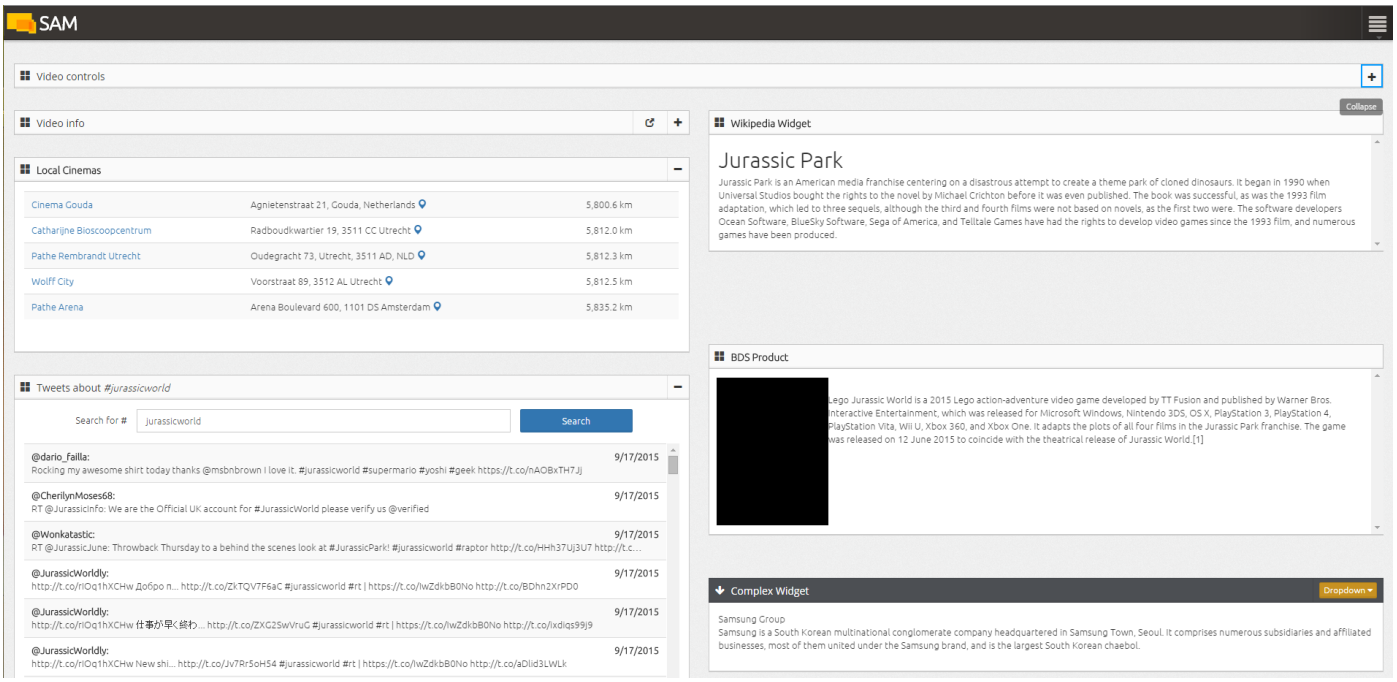


Fig. 3. Prototype end user second screen interface showing different widgets with second screen content.

A wide range of content asset types and sources can be associated with first screen video content. SAM supports text, image, sound, video and metadata asset formats. All of these formats can be integrated and managed through the SAM Marketplace. The system also facilitates the integration of third-party online sources such as Wikipedia or local cinema listings. The SAM infrastructure is modular and extensible so that additional widgets that support specific formats or applications (e.g. voting applications) can be added to the SAM platform with limited effort.

Once a second screen experience has been created following the workflow established through the SAM platform it can be published and made available to end users. End users can access second screen content using devices that are typically used as second screens while watching television content, such as smartphone devices or tablets. Fig. 3 shows a demonstration end user second screen interface with examples for widgets that provide second screen content. End users will also be able to control the SAM second screen application via a voice dialogue management system.

The SAM platform is organised as a set of loosely coupled system components that communicate through Web Services (server components) and Web Sockets (screen-to-screen). The SAM syndicator component for pushing data to clients, the interconnection bus and the identity and security management services provide the necessary system infrastructure and core functionalities to facilitate secure operation.

## IV. Context Representation

SAM incorporates a dedicated context representation component into the overall system architecture. This component essentially maintains contextual user profiles for the end users of the SAM platform and makes raw, aggregated and analysed data from these contextual user models available to other SAM system components. The context model representation uses an extended OpenSocial [3] context model to represent data about user interactions with media content and; it stores the model data in a Neo4j graph database that exposes commonly used functionalities as well as simple user model-based recommendation functionalities through a RESTful web service API.

The context representation component is continuously updated through input provided by listener components to which other SAM components submit data for integration. The submitted and integrated data can be grouped into the following three subgroups:

- Content delivery data: these data are provided by the content delivery component of the SAM platform; key data stored in the context model is data concerning which content items are provided to the end user; the data provided also includes the metadata available for the respective items.
- Device usage and interaction data: these data are gathered from the user interactions with the SAM second screen device. Basic data that is currently used includes typical context data such as the type of the device used and the geolocation of the device, but in principle the data gathered can also include data concerning user interactions with widgets and the like (assuming user consent to gathering such data).
- Social media data: these data include messages from and to external social media networks such as Twitter and Facebook as well as messages from SAM dynamic communities. Social media data will only be processed given prior explicit user consent and messages from

external users received by SAM users will not be analysed.

All of the above data can be stored in the SAM context representation model and may be used within SAM in order to recommend related content and in order to generate and update SAM dynamic communities.

Social media data and messages are not stored but processed using a natural language processing component that is part of the overall SAM platform. The SAM natural language processing system contributes to the contextual user model description by analysing social media messages and extracting named entities that relate to objects or persons that may be relevant in the context of the content that the user interacts with, and by performing sentiment analysis on the messages in order to determine attitudes of users towards identified entities and/or towards the content that is being consumed. The resulting [entity] - [estimated sentiment] data pairs are added to the relevant user representation data.

## V. Social Media Integration and Dynamic Social Communities

SAM integrates existing external social media services, specifically Twitter and Facebook, into the overall SAM platform and provides a dedicated user interface widget for interacting with these social media. The user interface widget displays social media content and allows users to post messages through their personal social media accounts (provided the user allows SAM to post on their behalf). The integration of external social media also allows content providers to associate their content with specific social media channels or terms (e.g. for hashtags), so that social media channels relevant to content showing on the first screen can automatically be shown on the end user second screen device. Content providers will also be able to restrict integration of social media into second screen experiences in situations where the content provider policy does not allow an "open" integration of social media sources alongside their editorial content (e.g. in order to protect users from exposure to profanity).

The SAM dynamic community component acts as a "micro social network" integrated into the overall SAM experience. The main purpose of SAM dynamic communities is to connect end users of the SAM platform with other system users, thus allowing them to socialise around media content.

The social media functionalities of the SAM dynamic community component are simple. The messaging format is derived from the Twitter messaging format; special hashtags can be used to reference content presented through the SAM platform. Users of SAM dynamic community component post messages to one or more of their active communities; messages sent to a community are relayed to all members of a community that are online. Messages are displayed in a timeline similar to the one used for displaying Twitter content in a timeline.

Since the demonstration scenarios for SAM have been developed to showcase on-demand access to media content, SAM dynamic community content has been designed so that it can be synchronised to the timeline of a media event in addition to the real-world time on messaging. Effectively, users will be able to see dynamic community content at the point in time in a video content timeline during which it has been posted by the respective user.

The creation of dynamic communities and the invitation of users to become member of a particular dynamic community are key features of the dynamic community component. SAM will create and manage dynamic communities of three types:

- Static communities are created for each first screen content experience that is provided to end users (and that has not disabled social media interactions). These communities remain static, and all users who view a first screen content experience get invited to view it.
- Dynamic sub-communities are created and managed based on users' social media interactions and the analysis results created from their interactions, and later on also including the second screen content types they interact with. Sub-communities are created as sub-communities of static communities as described above. The goal is to identify specific clusters of users that have distinct sets of preferences concerning what happens in the first screen content or which second screen content to interact with.
- Dynamic cross-communities are created and managed based on user preferences as expressed by metadata statistics of the content they consume. The profiles derived from these data are then used to identify users with similar profiles, which are then invited to join the identified communities.

We apply graph-based clustering techniques in order to identify suitable clusters of users for the two types of dynamic communities that are to be created. Separate graphs are created for each sub-community clustering task and for the cross-community creation task. Users are defined as the nodes of the created graphs; edges represent the connections between users and the connection strength between all users. Very low-scoring connections are removed from the graph in a first step, then standard graph clustering techniques are applied. We are currently investigating several different well-known divisive graph clustering techniques that do not consider connection strengths between nodes as well as ones that do in order to compare their performance in this task (see [4] for details on graph community detection techniques).

Further information on SAM dynamic communities can be found in [5].

## VI. Social Media Analytics

For business users of the SAM platform, the system provides Business Intelligence functionalities in order to evaluate the usage of the content provided through the SAM platform. These Business Intelligence functionalities are provided through a commercial Microsoft product. The SAM project integrates the data retrieved from user interactions into a custom data warehousing structure created for the SAM project.

The Business Intelligence component extends on these standard functionalities by also including social media analytics into the analytics functionalities. To this end, the Business Intelligence system can execute the same functionalities that are also available for dynamic communities in order to extract the following types of information from social media content:

- Named entity recognition of the SAM assets that are referred to in social media messages
- Global sentiment analysis of the sentiment of users towards the content they interact with
- Specific sentiment analysis of the sentiment of users towards recognised named entities

Further details on sentiment analysis techniques applied to social media content can be found in [6].

For Business Intelligence functionalities, the analysis results will be aggregated at the level of assets (as opposed to users for dynamic community creation). The aggregated data are available to use for Business Intelligence functionalities such as drill-down queries and for report generation.

## VII. Conclusion

At the time of writing, the SAM project and platform are in the second year of development and working on the delivery of a second prototype version of the SAM platform that integrates functioning versions of the system components characterised in this article. The project has an overall duration of 37 months and will be completed at the end of 2016 with the completion of a live evaluation of the third SAM system prototype with a large user population of around 100 end users from a teenager demographic that may be expected to be particularly proficient with and used to interacting with social media and second screen devices.

Upon completion of the project, SAM will be at the level of a complete prototype system that integrates synchronised multi-screen video content augmentation and integrates social media channels both as providers of triggers for recommendations and as a dynamically updated social community platform. It is expected that SAM will enter a commercialisation development phase after completion of the project.

Further information on the SAM project is available at http://www.socialisingaroundmedia.com/. More detailed information on the research and development efforts in the project are available in the SAM Wiki available at http://wiki.socialisingaroundmedia.com/. The project also provides regular updates on events and project progress on Twitter under @samproject.

## Acknowledgments

This work has been partially funded by the European Commission under the Seventh (FP7 - 2007-2013) Framework Programme for Research and Technological Development through the SAM (FP7-611312) project.

## References

[1] A. Badii et. Al., “SAM: Dynamic and social content delivery for second screen interaction.”, Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video, Brussels, Belgium, 2015, pp. 119-124.

[2] HbbTV Association, “HbbTV 2.0 Specification (2015-05-01)”, https://www.hbbtv.org/pages/about_hbbtv/HbbTV_specification_2_0.pdf, 2015.

[3] M. Haesel, “OpenSocial: an enable for social applications on the web”, Communications of the ACM, vol. 54, no. 1, 2011, pp. 139-144.

[4] S. Fortunato. “Community detection in graphs”, Physics Reports, vol. 486, no. 1, 2009, pp. 131-160.

[5] A Badii and M. Tiemann, “Creating dynamic TV viewer communities to increase user engagement”, Proceedings of eChallenges 2015, Vilnius, Lithuania, November 2015 (in press).

[6] J. Fernandez, Y. Gutierrez, J. Gomez and P. Martinez-Barco, “GPLSI: supervised sentiment analysis in Twitter using Skipgrams”, Proceedings of the 8th International Workshop on Semantic Evaluation (SemEval 2014), Dublin, Ireland, 2014.

[7] J. Fernandez, Y. Gutierrez, J. Gomez and P. Martinez-Barco, “Social rankings: visual sentiment analysis in social networks”, Proceedings of SEPLN 2015, Alicante, Spain, 2015 (in press).