The Importance of Linked Media to the Future Web

LiME 2013 keynote talk – a proposal for the Linked Media research agenda

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ABSTRACT

If the future Web will be able to fully leverage the scale and quality of online media, a Web scale layer of structured, interlinked media annotations is needed, which we will call Linked Media, inspired by the Linked Data movement for making structured, interlinked descriptions of resources better available online. Mobile and tablet devices, as well as connected TVs, introduce novel application domains that will benefit from broad understanding and acceptance of Linked Media standards. In the keynote, I will provide an overview of current practices and specification efforts in the domain of video and Web content integration, drawing from the LinkedTV[1] and MediaMixer[2] projects. From this, I will present a vision for a Linked Media layer on the future Web will can empower new media-centric applications in a world of ubiquitous online multimedia.

Categories and Subject Descriptors

E.2. [**Data Storage representations**]: Linked representations

H.5.1 [**Multimedia information systems]**

H.5.4 [**Hypertext/hypermedia**]

Keywords

Web multimedia, online media, media metadata, media semantics, media descriptions, Linked Media, hypermedia, hypervideo, interactive video.

1.   INTRODUCTION

Multimedia content online is increasing rapidly in scale and ubiquity, such that the Web today is less the hypertext medium of old and more a rich media experience with interactivity and audio-visual content being a first class citizen (as reflected in HTML5).

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[1] http://www.linkedtv.eu, @linkedtv

[2] http://www.mediamixer.eu, @project_mmixer

Also media contents which were previously separated from the Web, such as television, are rapidly converging on a wide range of connected devices. In my view, future media and Web contents will become indistinguishable, regardless of the device being used or the source of the audio-visual material. This is not the case today, where neither media content over the Web is integrated well with related Web content, nor Web convergence with other media networks such as TV integrated well with the underlying media content. The reason for this is fundamentally technological, as there are not the shared data schemas or identifiers across the different media sources to allow the implementation of applications richly and seamlessly integrating media and other Web content to the benefit, ultimately, of the consumer. In line with other developments on the Web to support structured publication of data and services on the Web (Linked Data, Linked Services) I propose to follow the same principles to publish metadata about media resources which can then be interlinked on the Web (Linked Media). This future layer of *Linked Media* on the Web can lead to new media-centric applications in a world of ubiquituous online multimedia.

2.   A LINKED MEDIA RESEARCH AGENDA

Media metadata has been the subject of much research, with many different schemas and supporting (controlled) vocabularies developed for the description of media resources for different communities. The heterogeneity of media descriptions in closed systems was transferred to the open Web, where – in the fewer cases where media descriptions were embedded with media resources on Web pages – different schemas and vocabularies made Web-wide search and retrieval a too challenging task. The same situation arose with Web APIs, which could return data about media resources in their online repositories (e.g. Flickr, YouTube, Soundcloud), each using different properties and property value spaces for the media metadata.

Since the Web is not just a Web of documents, but those documents are about *things*, and those things need to be represented in the metadata in a manner that allows for a shared understanding of what is being referred to, it becomes important to find a shared representation of *concepts* on the Web. **Linked**

Data[3] is the proposed answer to this, using the same principles as that of the Web itself: identify things by an URI, resolve those URIs to metadata information about those things, and link between those URIs so that machines can browse concepts like humans browse Web pages.

Non-textual media such as audio-visual streams are not well integrated into the Linked Data Cloud. A core problem here is that there is not a Web-wide shared approach to annotating Web media such that the media metadata could consequently be linked into the growing layer of Linked Data on the Web. Initial approaches to allow for images and video to be part of Linked Data has focused on natural language processing and clustering techniques across the free text tags attached to media on Web 2.0 sites like Flickr[4] and YouTube. A desirable development would be attaching Linked Data concepts directly into video, such as done in Annomation[5]. As such, I identify core research issues around media on the Web today which are vital to be taken into account if Web media is to be fully integrated into the Web of linked content in the future:

1. *Web media needs to be annotated in terms of its online parts*, both along spatial and temporal dimensions, since it is too imprecise to say that an atomic media item is about a concept X where that concept may only relate to a (small) part of the media. For a long time, we have lacked a standard means to refer to spatial or temporal segments of media on the Web, however a proposal is now at W3C Working Draft status for Media Fragments URIs[6]

2. *Web media needs to be annotated with terms which represent a shared understanding of a domain* or identification of a thing. When these terms are provided in a machine-understandable manner, we can say they are drawn from an ontology. Providing ontologies and means to describe things using an ontology has been the domain of the Semantic Web community for many years, and Linked Data draws on the principles of Semantic Web in using the RDF format as the data model for Linked Data and sharing the use of URIs to identify things. Hence Linked Data can tie into richer, ontological descriptions of domains where appropriate.

3. *Web media needs to be annotated using a media ontology which supports the above two issues*. There is no agreed annotation schema for media on the Web, with the best known example MPEG-7 proving both to be too complex and not formally structured enough to be usable in this context. The W3C has proposed a Media Ontology, which seeks to capture common properties of different media annotation schemas and provide as a result a means to map between them[7]. However, we add an additional requirement for that ontology, which is that of capturing the type of the link between the media fragment and the represented thing. The Media Ontology provides a `ma:keyword` property

which takes an URI as a value, without providing any further guidelines. However, for machine-driven decision making about the concepts represented in media segments, we consider it important to be able to capture in the annotation the aspect *how* the concept is represented in the segment. For example, if it is visible in the segment, or audibly referenced, or implicitly addressed by the content. Current media annotations barely consider this aspect.

The importance of Linked Media lies less in what it itself is, but what can be done once it is there. Linked Media could improve Web-based media retrieval based on conceptual representation, allow machines to choose and rank media resources on the Web by relevance (to something), and organize and present sets of media resources in a meaningful way based not just on the subject concepts but how those concepts relate to one another in Linked Data. This brings us to the fourth core issue around media on the Web, which is necessary to ensure that distributed annotations of Web media can be *effectively and meaningfully linked together* to form the foreseen layer of Linked Media on the Web:

4. *The expressed representation of different concepts by different media fragments in different ways shall be the basis to interlink media across the Web.*

The below figure illustrates this core goal of Linked Media: to determine links between different media contents based on the existing relationships between the concepts they represent in some way (determined by following conceptual paths between resources in Linked Data).
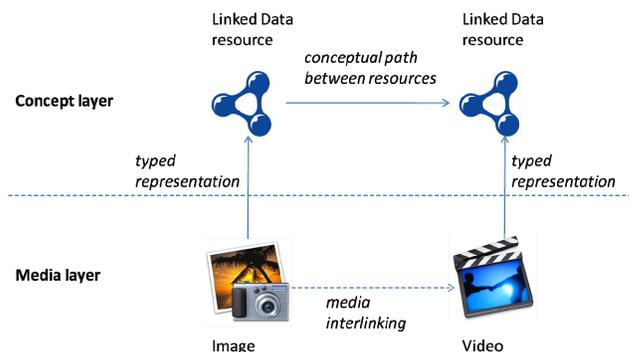
In the keynote, I will show how the MediaMixer and LinkedTV projects[8] are already addressing the first three points I outlined in this research agenda. I believe in the projects we are only beginning to scratch the surface of what is possible in order to address the fourth point, which would complete the remaining part of this vision, which is to be able to interlink the currently disparate media descriptions across the Web, and provide a layer of interlinked media to a new breed of media-centric applications.

This LiME workshop is an opportunity to build a core consensus on Linked Media, and seek to address the research challenges which will rely on expert collaborations in online media description creation, publication, and processing, as well as need the support of media owning stakeholders.

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[3] http://linkeddata.org

[4] http://www4.wiwiss.fu-berlin.de/flickrwrappr/

[5] http://annomation.open.ac.uk/annomation

[6] http://www.w3.org/2008/WebVideo/Fragments/WD-media-fragments-spec/

[7] http://www.w3.org/TR/mediaont-10/