Intelligent Multimedia Mind Maps to Support Media Pre-Production

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***Abstract*—To date, there are almost no tools that support the elaboration and research of project ideas in media pre-production. The typical tools that are being used are merely a browser and a simple text editor. Therefore, it is our goal to improve this pre-production process by structuring the multimedia and accompanying annotations found by the creator, by providing functionality that makes it easier to find appropriate multimedia in a more efficient way, and by providing the possibility to work together. To achieve these goals, intelligent multimedia mind maps are introduced. These mind maps offer the possibility to structure your multimedia information and accompanying annotations by creating relations between the multimedia. By automatic connecting to external sources, the user can rapidly search different information sources without visiting them one by one. Furthermore, the content that is added to the mind map is analyzed and enriched; these enrichments are then used to give the user extra recommendations based on the content of the current mind map. Subsequently, an architecture for these needs has been designed and implemented as an architectural concept. Finally, this architectural concept is evaluated positively by several people that are active in the media production industry.**

Keywords - media pre-production; mind maps; information search; semantic web.

I. INTRODUCTION

In professional media pre-production [1], there is little support to elaborate on an idea. Usually, one only uses a browser and a text editor as tools, i.e., one to search for information and one to gather the information [2], but most of the idea is in their brain and not on virtual and/or collaborative "paper".

The main problem with the current research method is that there is almost no logical structure, as most of the structure is in the brain of the creators. In a co-production, this problem becomes even bigger, because the idea is spread over multiple brains. A result of the lack of structure is that it is hard to reuse information in future productions, because existing documents –if they still exist at all– are hard to comprehend, since it is a linear list of non-related pieces of information, and thus, it is hard to find the necessary information, certainly for people that did not perform the research in the first place. Another problem is the fact that information is widely spread, and thus, creators have to use several search engines within different distributed information bases.

We counter these problems by introducing the notion of *intelligent multimedia mind maps* [3]. First of all, this multimedia mind map structures the found multimedia. This structure, as such, has little short-term impact, but has a big long-term influence, since it is easier to reuse older work as re-finding sources is self-evident by reusing the accompanying annotations. Secondly, the information from the multimedia mind map can be used to suggest new relevant information; hence from now on our implemented automatic recommendations makes us talk about "intelligent" multimedia mind maps.

Section 2 describes the concept of mind mapping, whereas Section 3 explains why current search services will be reused. Furthermore, Section 4 elaborates on the Architectural Concept, and afterwards, Section 5 evaluates our solution. Finally, Section 6 draws conclusions and looks at future extensions.

II. MIND MAPPING

A mind map [4] is a tree structure where you start with a main topic, preferably the center of your mind map. Subsequently, you associate subtopics with the main topic; thereafter you do the same with the subtopics. To have a view on what's available we searched for existing mind map software. There are plenty, but most of them only support text. However, there are two that have more functionality. Mind42 [5] furthermore supports images and collaboration, but lacks support for videos and connection with external sources. On the other hand, Visual Understanding Environment (VUE) [6] supports images and limited connection with not-modifiable external sources, but lacks support for videos, and collaboration. Our envisioned intelligent multimedia mind maps do fully support text, images, audio & video, external links via Linked Open Data (LOD), and collaborative user management.

III. SEARCH SERVICE

There are many multimedia sources and most of them have a search service, which is optimized for their own needs. Both local and generic services are apparent, i.e., an example of such a local service is MediaLoep [7], which provides a service to search the VRT [8] video archive. The most well known generic multimedia search engine is Google's YouTube [9]. Therefore, it is not our goal to provide our own search service but to integrate existing services by using and incorporating their Application Programming Interfaces (API).

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IV. ARCHITECTURAL CONCEPT

Before creating an architectural concept, a generically extensible architecture was designed according to the generic requirements, resulting from the analysis of the problems in current methods of topic research in media pre-production, and conforming the Attribute-Driven Design (ADD) [10] principles. This resulted in a 3-tiered layer architecture, as shown in Figure 1. The top-layer communicates with the client and forwards commands to the second layer, i.e., the model layer, which –among other things– comprises the state of the mind map and uses the services from the bottom layer, the service layer. There are three main services in the bottom layer, i.e., storage, enrichment, and recommendation. The storage service is a module that is used to communicate with a database. In this case, a graph database was chosen, because of better performance on traversing related data, and greater flexibility [11].

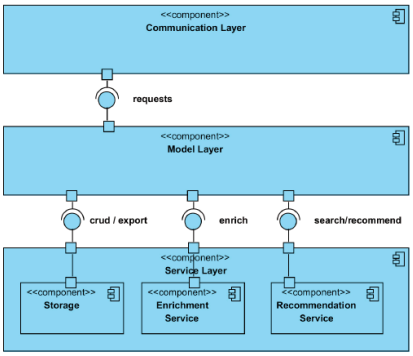

Figure 1. Generic Architecture of the Architectural Concept.

The enrichment service is decomposed according to a composite pattern [12]. This way it is easy to add and remove enrichers, which are modules that analyze the content and return important features. For the architectural concept Named Entity Recognition (NER) was performed using Apache Stanbol [13], which was chosen over DBpediaSpotlight [14] as such, because the first includes the DBpediaSpotlight service and gives more possibilities with modifiability in mind, e.g., you can incorporate your own thesaurus and/or ontology. Mind you, in the current architectural concept there is only a text enricher, but this can easily be extended to enrichers for other multimedia formats.

The recommendation service is similar to the enrichment service and is also decomposed into a composite pattern. This makes it easy to always add extra modules that connect with external sources with their accompanying search functionality. To be able to show this functionality in the architectural concept three modules, i.e., a connection with Flickr [15], Wikipedia [16] & its LOD counterpart DBPedia [17], and YouTube, were implemented. These three initial sources were chosen because they offer three different multimedia formats and they have a publicly available and well-documented API. In Figure 2, you can see an overview of the resulting architectural concept application.

V. EVALUATION

Firstly, our predefined goals –especially the goal to improve the structuring and reuse of the content– were confirmed by the people of both Limecraft [18] and Taglicht Media [19]. They both have the need for more structure in their research, because it is hard to find content again, certainly when they share their research with others.

Structuring content according to a mind map structure is a beginning, but there was need for more functionality, including named relationships and cross-linking. The integration of external LOD sources was a great addition, because the creator can simply add a piece of content to the mind map, but the current implementation has it flaws. The user always has to add the complete piece of content, but is usually only interested in a quote or a small piece of the content. Another remark is that it should not only be possible to search external sources, but also the content that's in some other mind maps. This would be useful in very large mind maps, certainly when you don't know how the content was structured in the first place.

Also the recommendation functionality is a nice feature to have, but there are some limitations as well. It cannot replace the human brain and therefore, it is only suited to define high-level concepts, which is useful to rapidly divide research work. It cannot, at least for now, give the user a full background of his developing topic.

VI. CONCLUSION AND FUTURE WORK

The provided solution for the predefined goals show potential, certainly the structural functionality as this is a big problem right now. Because reuse of research data saves a lot of time, it has a big impact on the value chain of future productions. However, before our tool can be used in professional media production, there's a need to improve the application taking the feedback of the previous section into account, i.e., the incorporation of media fragments and the search between implemented intelligent mind maps.

Next to the improvements to the current application there's also the possibility to add some extra functionality. The mind map could be more intelligent by adding the possibility that when you add a piece of content you get suggestions how this piece of content is related to the content in the current mind map. For example, when you have two nodes as pictured in Figure 2, one about "Caesar" and one about "Pompey", and you add a node about "Julia" you get the suggestion to add it to the node about "Caesar" with relation 'daughter' and/or to the node about "Pompey" with the relation 'wife'.

Other extensions are to provide export functionality for the multimedia mind maps to support interoperability or to add the functionality to create a scenario. Merging the two applications –scenario creation and multimedia mind map– in one application makes it easy to switch between creating the scenario and expanding the mind map, which is useful because these processes happen in an iterative and parallel way anyway [20]. Another advantage would be to drag and drop parts of the mind map, e.g., quotes, into the scenario.

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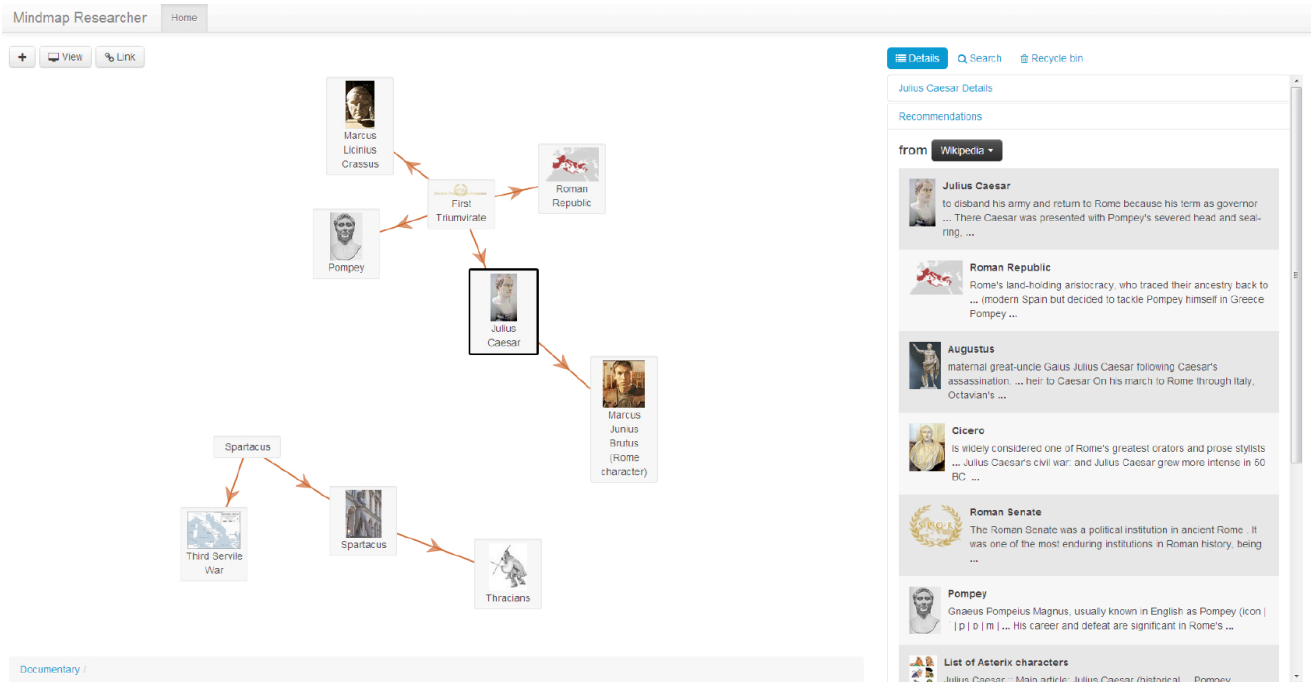

Figure 2. Architectural Concept Multimedia Mind Map Application.