The Design of "Intelligence" for the Management of Personal Multimedia Content

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Abstract— **aceMedia has taken the challenge of organising personal content by creating tools to automatically generate metadata descriptors and search content intuitively. In this paper we review part of the approach taken by aceMedia to create semantic metadata (ontologies) and use of this to enable more appropriate search and matching and managing of content. However, there is further benefit the end user can gain from this semantic metadata and this is from adding intelligence in the software. The benefits and how intelligence can be added is described with a particular focus on assisting the user in the creation of privacy preference rules when sharing content: the creation of self-governing inferencing.**

Index Terms— **semantic metadata, ontologies, intelligent software, inferencing, self-governance. Topic "Integration of multimedia processing and Semantic Web technologies (SS3)"**

I. INTRODUCTION

THE vision of the aceMedia project is to provide the tools to assist in advanced content management. This is to deal with the classic information overload, as users have not just access to content in many forms but also many tools and devices to create all types of content themselves. Management of content becomes increasingly difficult such as finding the right content, creating collections, annotating content etc.

aceMedia is researching methods to assist in information and content management via knowledge technologies and developments in the semantic web. The aceMedia approach involves creating and using metadata to enable intelligent applications such as advanced search and retrieval, personalisation, self-organisation of content, and autonomous content actions such as self-determined privacy. The use of metadata does not come without some key challenges itself. Many terms used within the metadata may refer to an implicit informal semantics and do not necessarily provide essential properties or relationships between terms to assist in any automated approach to be applied. However, the move towards the development of ontologies that model domains, preferences, policies and profiles provide an approach to assist in automating the matching and filtering of content searches.

II. ONTOLOGIES, METADATA AND SEMANTICS

Knowledge-assisted applications can enhance a user experience because, for example, the user decides what they want to access and can then set up an automatic feature that the user controls. This is based on the same features that are available to the application developer, because it is about the same domain model; the only difference is in the access perspective. The application developer can make available to the user the same application configuration features that are available to the application itself because of the formal representation of the model. A granularity of control is made possible because the formal model explicitly states what is available. Further re-use is gained as the user profiles, models, and data can be easily shared across many applications

III. ACEMEDIA PROJECT

aceMedia uses the metadata and ontologies to provide context to assist in content management on behalf of the user. The metadata and ontologies are used to:

1. Enable the user to search for content: the user can enter natural language sentences that are parsed to provide a structured query for the knowledge base.
2. Enable personalisation methods to create and manage personal metadata to be applied to the search and retrieval of appropriate content, in particular ranking content, which is based on using machine learning techniques to weight preferences and content.
3. Enable visual methods, which use intelligent multimedia algorithms, through the low level descriptors, to assist the user in matching similar visual properties of particular content with other content.

As well as the above functionality to assist the user in content management, aceMedia has researched into the requirement and application of the intelligent layer, as part of the Autonomous Content Entity (ACE). An ACE is a concept which captures the content, metadata and the intelligence layer as a type of intelligent media object. There are two specific drivers that require the intelligence layer:

1. Digital Content is very nomadic; in that context it is better to have content management attached to the content such that the user can always optimally deal with the content, wherever it resides
2. Digital content can easily flow to other places where

the owner of the content does not have control over this content; by carrying the rules of management with the content then the owner's rights and privacy preferences are enabled.

The Intelligence Layer is defined as code executing in an aceMedia system that provides "intelligence" to autonomously support content management. This for example means how to present itself, maintain and enhance the metadata, handle privacy, self-adapt and self-organize etc. The intelligence layer can be transported together with the content and metadata as one object and the execution of the intelligence layer is done in a secure environment.

There are two specific applications which make use of the intelligence layer: personal content ownership rights to support personal preferences about privacy of content through self-governance and self-organising content to assist in the automation of content collections dependent on the devices and environments. The self-governance context is built on assisting the user with a means to declare their access preferences to their content. This in terms of concepts is close to digital access rights, so access preferences available to the user are captured in terms of digital rights access attributes.

A. aceMedia framework

The aceMedia system facilitates digital multimedia content management through its software framework that enables the execution of application modules and ACEs. The aceMedia framework [1] enables ACEs to run, and reuse base content analysis functionality, shared by all running ACEs. The framework further enables users to control and restrain the behaviour of ACEs. An application interface allows users to interact with individual ACEs and manage ACE collections.

B. Intelligence layer: Requirements and Design

The intelligence layer provides a framework where code (rules, methods and inferencing techniques) can exploit the semantic structure of the explicit knowledge about the content (multimedia content plus metadata descriptors, users, devices and domains).

The original concept of the ACE was about creating a mechanism that would assist in the users in managing their content and enable designers and developers methods to support this managing of content while creating flexibility for: a) tailoring solutions to the trends (ease of configuration) and b) extensibility for future unknown development.

C. Design of the self-governance

In the user studies done by the aceMedia project there were indications that the users had concerns and wanted to have some control over their content and have certain checks about how their personal content is shared and used [4]. The autonomous nature of content requires that the user's intent is carried with the content and this is captured and generated as self-governing rules. The rules are generated dynamically because it is impossible to define before hand all the possible rules that user would consider when applying to their content plus this gives the possibility to be extended to new contexts that have not yet been considered. This approach to self-governing inferencing system is further enabled because of the structured semantic metadata used as grounding knowledge within the overall aceMedia system. The concept of the intelligence layer means that the rules can be executed when the content is being accessed, used or modified in some way.

We capture the user's privacy preference in a way that does not demand constant attention from the user but does capture the intended behaviour from the user by using a policy model [2] to convert the user's preferences into a rights context. This rights context plus a priority system converts this into rules that is carried with the context. There are default policies and priority settings but these can be changed by the user and a particular context.

Some degree of self-governance of a computational system is required if there is a need to support privacy preference-based access to content when content leaves the control of the owner. Here we express a degree of self-governance and the self-governance of a system is required to be grounded in some knowledge and facts about itself. Although theoretically computational self-governance could be infinite, for example, if the architecture incorporates a reflective tower principle [3] e.g. of self-governing of the self-governing rules etc. but this only indicates to the designer the flexibility potential of such an architecture to deal with dynamics of a system itself.

IV. CONCLUSION

We are now in the first stages of including into the aceMedia framework computational intelligence. The use of semantic metadata has provided some of the key cues for enabling context-aware computations that provide computational intelligence functionality. It has provided the semantic structure and grounding knowledge that is required when performing intelligent behaviours.

The use of autonomy was drawn from the autonomic computing of defining a notion of "self". This is supported by the aceMedia system: 1) the aceMedia framework enables a concept of "code" within an ACE itself, 2) the semantic metadata provide some context that can benefit and be benefited by some form of computational intelligence, and 3) the inclusion of the self-governing inference rules.

In providing the self-governing inference rules we have added to the semantic metadata and have incorporated more context cues through the use of policies that capture a user's privacy preferences. The semantic metadata has meant we can define an inferencing system to build both the appropriate privacy preference context and rules that can be attached to the content creating an intelligence layer as part of the content.

REFERENCES

[1] A. Matellanes, A. May, P. Villegas, F. Snijder, A. Kobzhev, E. O. Dijk, "An architecture for multimedia content management", EWIMT 2005.
[2] http://www.cs.umbc.edu/~lkagal1/rei
[3] Smith B, "Reflection and Semantics in Lisp" ACM, pages 23-35, 1983.
[4] P. Charlton, J. Teh, A Self-governance Approach to Supporting Privacy Preference-based Content Sharing, International Transactions on Systems Science and Applications, Special issue 2006.