New services for the public in a technology-related approach: the AXMEDIS solution inside libraries

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Abstract. The library sector is not exploiting the new possibilities from the Information Technologies for their public services and management. Possible technology-enhanced solutions to contain sale price challenge could be found by automating, accelerating and restructuring content managing and delivering processes, and providing solutions for content protection. The AXMEDIS project (Automating Production of Cross Media Content for Multi-channel Distribution) is supported by the European Commission to create an innovative technology framework for the automatic production, protection and distribution of digital cross-media contents over a range different media channels including PC (on the internet), PDA, kiosk, mobile phones and i-TV (interactive-TV). This paper presents a brief introduction to the AXMEDIS IST FP6 EC project and discusses the new functionalities and capabilities highlighting the applications and exploitations in the library context. For further details on the AXMEDIS project, see the project website at www.axmedis.org.

1 Introduction

In the evolving scenario of the digital content market, multimedia libraries are demanding for better pricing and better value-for-money for the products and services. Vital key issues for the setting up and management of a viable and sustainable business venture in the digital cross media content include the containment of sale prices and increased accessibilities to the contents in order to provide a better exploitation of the library's heritage. Possible solutions to these challenges can be found by automating, accelerating and restructuring the management and delivering and distribution processes, together with the application of content protection solutions. These approaches can enhance the management and delivery processes by offering faster and cheaper services, while at the same time providing new capabilities to support a safer and protected distribution and sharing of digital content.

2 AXMEDIS Overview

The AXMEDIS is an IST Integrated Project of the FP6, and thus is funded by the European Commission to create and explore innovative technological framework for automatic production and distribution of cross-media contents over a number of different distribution channels (e.g., networked PC, PDA, kiosk, mobile phone, i-TV, etc) with DRM (Digital Rights Management). In the context of the libraries market, AXMEDIS aims to offer a framework in which all industries and research centers may enforce their technologies integrating them with innovative AXMEDIS solutions and tools to:

- manage and distribute and share digital content, such as audio-visual materials (video/film), images, documents, games, and others, in a protected and verified manner, over many different distribution channels including Internet, mobiles devices, PDA, PC, i-TV, satellite and others;
- increase the visibility and accessibility of content with the realisation of tools for content sharing among content owners. This allows the content to reach distant markets with access to larger markets;
- offer additional and relevant sales channels that can simplify content distribution at a reasonable cost for end-users;
- increase both the safety and reliability with the protection models to ensure verifiable and protected delivery the objects to content producers and distributors;
- provide new international business opportunities to all the related SMEs in the areas of cross media content production, aggregation and distribution;
- allow end-users to gain access to the contents at a reduced costs.

This will be realised by exploiting the AXMEDIS infrastructure which will open paths for new services for industrial content exploitation and for both public and corporate clients (archives, schools, libraries, etc).

The AXMEDIS consortium consists of leading European digital content producers, integrators, aggregators, and distributors, together with information technology companies and research groups [1]. The consortium has important resources and complementary skills which will have an effective impact upon the industry. It will also demonstrate the value of the project outcomes and the reliability and effectiveness of the project results to a wide range of potential users, including:

- Archives, institutions, schools and content producers;
- Associations of content producers;
- Publishers and digital content providers;
- Content integration and design, audio and video;
- Networks, broadcaster and their technology providers for i-TV, PC, etc.; Mobile distributor for GSM cells or UMTS, etc.;
- Content distributor operators and technicians towards PC on internet;

All these actors may affiliate to AXMEDIS to access at its the results, specifications and software tools. More details of AXMEDIS are presented at the annual AXMEDIS International Conference (see http://www.axmedis.org/axmedis2005).

3 Technology-Enhanced New Services

With the innovations of the AXMEDIS framework, European Libraries will have the possibility to promote, share/exchange, manage and distribute their content on a global scale with less effort [1]. There are many different ways in which AXMEDIS can promote and stimulate the library related market. For examples, on a B2C (Business-to-Customer) scenario, the library can make use of the AXMEDIS environment to support the sale of the contents from the library (self) to their own customer. In addition, the framework can also provide the sale of the contents from other library to their own customer. On a B2B (Business-to-Business) scenario, the AXMEDIS environment can be used to support the sale of the contents from their own library to another library, and to support the sale of the contents from their own library to another business user.

With AXMEDIS, the new possibility will stimulate better value-for-money digital content due to effective and automated processing, production and delivery of the content using latest network technology to enable optimum interconnection and transactions between B2B and B2C, with DRM. The AXMEDIS Framework manages any kind of digital objects. An object here is a digital container for some digital content according to MPEG-21 and AXMEDIS extension [2], [3], [4], [5]. Depending on the ownership, each library has the right to produce licenses which are modelled as profiles for the use of the content (i.e., print, play, save, time limited use, etc., to control the access and proper usage). On the base of the profile, each library can issue licenses and establish relevant fees. AXMEDIS is a complete framework for the normal processes required in the Library domain including, management, control, processing, distribution, transaction (selling and buying), etc. [1].

With AXMEDIS, the customer can go through the whole process online and receives the contents requested in real time. The library staff has only to check the results of the process and does not need to manually perform all the time-consuming individual sub-tasks as described earlier. All the content-owner(s) of the digital resources within the requested object receive their revenues in accordant to the licence provided and contract with the libraries which produced the objects. The content distributor can receive a percentage of the income (as agreed) if the content is acquired through a distributor. All these activities are managed in a transparent manner and accessible independently from the different partners of the value chain. Thus each value chain partner may access to the AXMEDIS certifier and supervisor to enquire and receive information on the consumption of objects according to its rights.

4 AXMEDIS General Architecture

In Fig. 1, the AXMEDIS architecture is reported. The following description reports some comments for each major component. A more detailed description can be recovered in [7]. The main components are:

CMSs – Legacy Content Management Systems and archives can be connected to AXMEDIS content factory. They may be ODBC, XML, ORCALE, MSSQL, etc., or

files systems. The access to this information is performed by means of Crawling Area tool to automatically gathering the content;

AXMEDIS Database – database model, supporting the storage and access to AXMEDIS content (MPEG-21, any digital resource, etc., [3], [5]) via large set of metadata for each object called AXInfo, plus Dublin core. Any other metadata format can be managed by the meta-metadata editors and tools. Different descriptors and metadata can be added. Different AXMEDIS installations may be based on different databases, metadata. Adapters can be activated. The database is based on a scalable and interoperable database layer and an effective Query Support. The User may perform queries to search for objects and content located in the CMSs, in the local AXMEDIS database and in the virtual database comprised of the AXMEDIS content accessible via the P2P network of AXEPTools in the AXMEDIS Network. This allows the creation of network of libraries that exchange digital objects and metadata;

AXMEDIS GRID for Content Processing is based of tools and algorithms for the automatic content production/processing [8]. It implements a scalable solution to process from small collections to huge amount of content per day. It is very important for the initial feed of the archive and for the integration of different archives to uniform formats and models. The processing algorithms may be specified in terms of script (SpiderMonkey Javascript) allowing the manipulation of complex AXMEDIS data types and simple digital resources in massive and automated manner. Algorithms can be defined for massive content packaging, combination, layout formatting, synchronization, content adaptation, change in resolution and format, transcoding, coding, decoding, estimation of descriptors, license production, protection, etc.;

AXMEDIS Editors is a set authoring tools for AXMEDIS objects. It is based on the AXMEDIS Object Model, called AXOM and based on MPEG-21 [6], and all the modules and tools to manipulate and create AXMEDIS objects and related information and digital resources such as: (i) a resource hierarchy viewer and editor, (ii) a visual and behavioral viewer and editor to show/manipulate visual and time aspects of related digital resources, (iii) a DRM viewer and editor, (iv) a protection information tools, (v) a set of plug-ins to use algorithms for content processing, (vi) a set of plug-ins to allow the integration of AXMEDIS Editor within other editing and viewing applications, (vii) an interface with workflow (OpenFlow and BizTalk), (viii) a set of internal viewers and players for digital resources such as document, images, video, and audio resources, etc., for more than 200 different file formats; presently a first version of the AXMEDIS authoring tools is available.

Workflow Management includes a set of tools and interfaces which are pervasively connected to all the above mentioned tools and plug-ins to allow interfacing the whole AXMEDIS factory to Workflow tools such as Open Flow and Biztalk. The control is performed to define AXMEDIS factory workflow policies and to manage inter-factory workflows policies;

Accounting includes a set of tools to allow content producers, distributors or collecting societies to collect administrative information and report about their content in order to gathering information about what has been performed on their AXMEDIS objects;

AXMEDIS network allows the content sharing and distribution among different connected AXMEDIS factories of producers, integrators, distributors, publishers, etc.; The Connection is performed by means of the AXEPTool;

AXEPTool allows the interchange of content and to establish trading mechanism and business among different AXMEDIS installations with the support of a P2P tools for content sharing and publication. AXMEDIS content published on AXEPTool is automatically and immediately accessible to all AXMEDIS compliant partners.
AXMEDIS Players are mainly capable of reading and playing/executing AXMEDIS objects according to the DRM models chosen. AXMEDIS framework will provides tool kits and libraries to create a large number of different players on different platforms, leaving the customization of the user interface, skin, and much more; mainly MS-Windows, MAC and Linux, for PC, PDA and may be for mobiles.
AXMEDIS players are obtained as plug-in to allow objects visualization and playing in other tools such as Internet Explorer, Mozilla Browser, etc.;

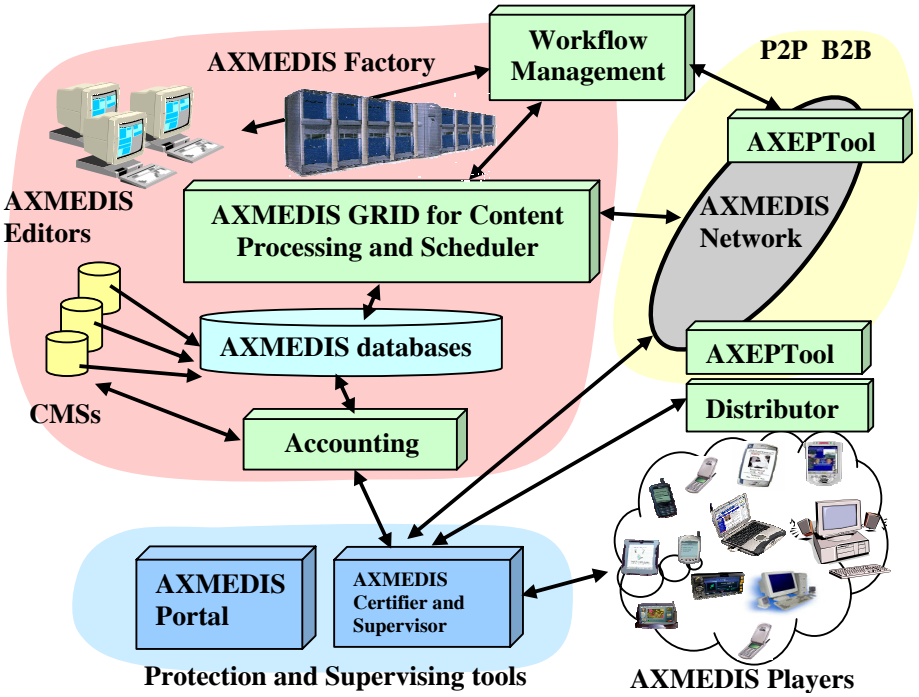

Fig.1 -- AXMEDIS General Architecture (AXMEDIS copyrights)

Distribution tools. Any third party distribution tool can be used to distribute content on their distribution channels. AXMEDIS tools and models support the distribution on different distribution channels: satellite data broadcast, Internet, cellular networks, wireless from kiosks, etc., to reach devices such as: i-TV STB, PC, PDA, mobiles, etc.;
AXMEDIS Certifier and Supervisor, the responsible of user registration and authentication, of software certification, and of the registration and tracking of the activities performed on AXMEDIS objects on any AXMEDIS compliant tool.

AXMEDIS Portal includes information and services for AXMEDIS participants and users of the AXMEDIS framework: deployment of the AXMEDIS framework, provide updated tools and information to AMXEDIS affiliated companies.

5 AXMEDIS Framework

In Fig. 2, the structure of the AXMEDIS Framework is reported [7]. It contains all the necessary tools to manage the content workflow from the content production to the distribution over different channels.

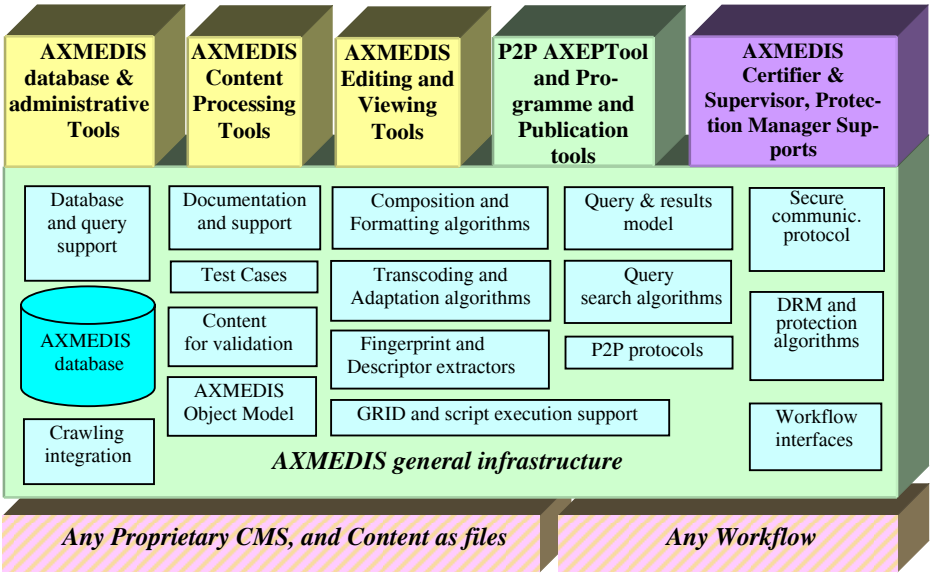

Fig.2 -- AXMEDIS Framework (AXMEDIS copyrights)

The general infrastructure gives a common ground on the base of which other AXMEDIS-compliant applications can be built [7]. The most relevant parts of the AXMEDIS Framework which will be accessible are:

Archive Set up and customization to your needs

- **AXMEDIS Framework:** test cases, uses cases, requirements, content for validations, general documentation of AXMEDIS tools and supports, source code, guidelines for source code production, guidelines on content production and distribution, tutorials on content protection, tutorial on AXMEDIS tools, etc.;
- **Integration with proprietary CMSs** by means of Crawler and Accounting Manager tools to bring back the administrative information;
- **AXMEDIS Content Processing tools:** SpiderMonkey engine for executing

Javascript code accessing to all the above mentioned supports and data types;

- **Algorithms** for compositions and formatting, for transcoding and adaptation, for extraction of fingerprint and descriptors, content processing, license manipulation and verification, license adaptation, etc., for many different formats of digital resources and for any categories of them: audio, video, document, multimedia, images, animations, text, metadata, etc.

Content production and organization

- **AXMEDIS Authoring tools and Players** to the production of content and for the realization of customized players on the basis of specific needs and the above support tools;
- **AXMEDIS Object Model** for content representation which allows that the information about the content can be exchanged between the different tools for the manipulation/fruition, AXMEDIS is a flexible specialization of MPEG-21 format, very suitable for libraries;
- **Database model and tools** to access at the AXMEDIS data base and to make queries and search algorithms. The access is performed by beans of WEB service, for easy integration with other archives;

Content Distribution

- **AXMEDIS distribution model:** it support any kind of business and transaction model, and allow you producing content for multichannel platforms.
- **Protection tools:** DRM/Protection solutions, DRM engines, guidelines for licensing and contract definition, protection tools, monitoring tools, secure communication protocol
- **P2P protocols** for creating GRIDs and P2P tools such as the AXMEDIS Content Processing Engine and Scheduler, the AXEPTools, and the AXMEDIA peers;

6 Conclusions

AXMEDIS solution is going to encourage not only the creation of new digital archives (based on international standards of cataloguing and descriptions (metadata)) but also stimulate the exploitation process for a wider range of digital media over many different distribution channels. AXMEDIS can introduce a new vision for the digitalisation process, encouraging the creation of digital archives for heritage preservation, as well as providing wider and better access to the important contents of the libraries such as books (in electronic form) and all other types of audio-visual materials. We hope that AXMEDIS can also encourage the creation of networks of libraries with the framework where it will be possible to buy and sell (free or otherwise) digital contents between all partners, significantly increase the points of entrance to the contents of the library, on a Business-to-Business model.
It is easy and beneficial for all to gain access to the AXMEDIS technologies. Over the course of the project, some didactic events will be organised to provide better understanding of the AXMEDIS technologies with further information about the potentialities of AXMEDIS. Business delegates can attend these events in order to

participate in the project and bring AXMEDIS technologies to their company. Special training sessions and courses will be held for managers, content managers, content producers and integrators, and digital content distributors. Workshops and courses will be organised in several venues in Europe. To provide better understanding of the new solutions, AXMEDIS is providing a forum for discussion with technologists and experts who are ready to assist with any AXMEDIS related queries. Further information, events and calls are available online at the project website, www.axmedis.org Furthermore, the AXMEDIS consortium will grant the sum of 1 Million Euro by means an European competitive call to companies and research institutes interested in developing real solutions by exploiting AXMEDIS technologies.

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