



Automating Production of Cross Media Content for Multi-channel Distribution

www.AXMEDIS.org

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AXMEDIS Framework for all, update

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Abstract: this document presents a complete overview of the AXMEDIS Framework and tools. The document is particularly suitable for who is interested in understanding the purpose of the AXMEDIS architecture and framework to see and how it can be used to cope with your problems and to offer solution for the area of content production, protection and distribution.

Keyword List: content production, content protection, cross media authoring, Digital Rights Management, MPEG-21, DRM, IPMP, GRID, AXMEDIS, REL, fingerprint, descriptor, content distribution, OMA, ODRL, plug-in, protection tools, database, crawling, ingestion, gathering, players, SMIL, XML, workflow.

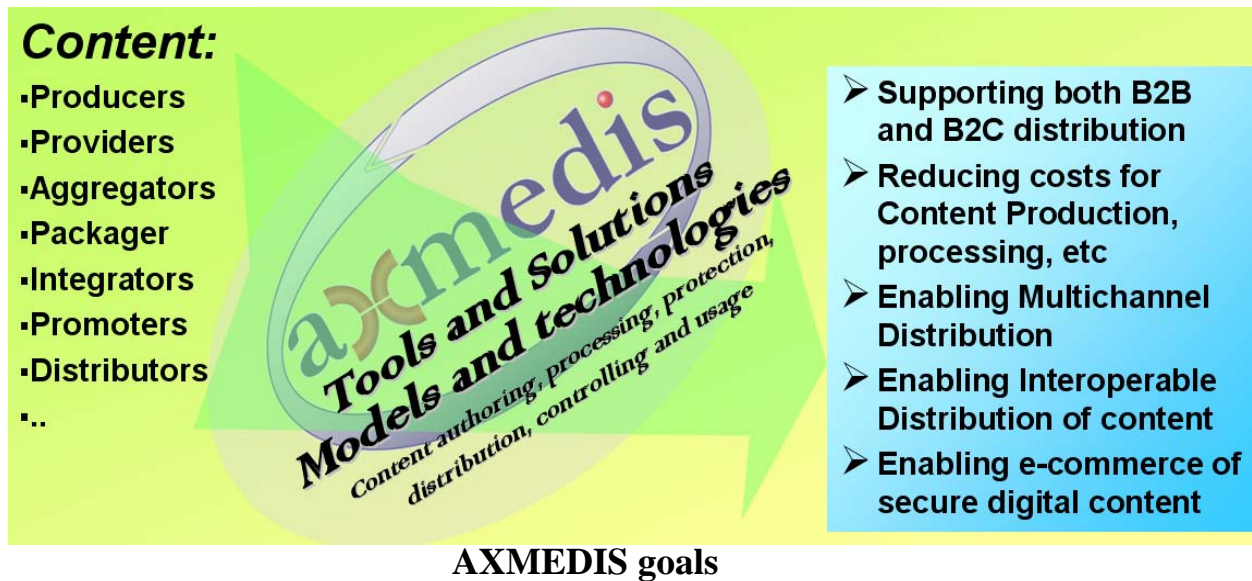
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1 Introduction

AXMEDIS is a consortium and a solution based on the AXMEDIS project partially funded by the European Commission in IST FP6 and including about 35 partners and affiliated partners such as University of Florence, TISCALI, AFI, SEJER, ILABS, EUTELSAT, HP, Telecom Italia, Telecom Lithuania, Telecom Estonia, EPFL, FHGIGD, ACIT, Technical University of Catalonia, University of Leeds, STRATEGICA, EXITECH, XIM, University of Reading, KTU, MBI, PKU, SDAE, SIAE, ANSC, ETRI, HEXAGLOBE, GESFOR, ALBENIZ, PENTEX, RIGEL, etc. AXMEDIS has produced innovative research results exploited in new tools and solutions that have been used for developing real trial and demonstrators for automated content production, protection and distribution.



The AXMEDIS Framework is an open solution which builds on new technologies and tools to:

- reduce costs and increase efficiency for content production, protection (multiple and interoperable DRMs), management and multichannel distribution. It offers effective automation for
 - integrating your Content Management Systems (CMSs), with the distribution systems by automating the communication and maintenance of content and information between the two systems;
 - content gathering and ingestion processes from local and remote CMSs as well as file systems;
 - composition, supporting parallel processing, GRID technology, and optimisation techniques for content ingestion, production, protection and formatting;
 - managing the workflow processes at content-factory level and between different content-factories;
 - the overall process allowing content production on demand.
- support the whole value chain, including composition, packaging, integration, aggregation, synchronisation, formatting, adaptation, transcoding, indexing. Additional features include the integration of both protected and non-protected components within an object, definition of relationships with other resources, metadata integration and remapping/transcoding, protection, license production and verification;
- allow the convergence of the media and interoperability of content to enable multi-channel distributions. The framework supports content distribution:
 - on different channels such as satellite data broadcast, Internet, cellular/mobile network, wireless and traditional media supports such as CDs, DVDs;

- via different communication technologies, particularly with Peer-to-Peer (P2P) for both B2B (Business-to-Business) and B2C (Business-to-Consumer) levels;
- to different devices such as PC, PDA, interactive TV (i-TV), set-top box (STB), etc.;
- with different transaction models on the same channels and content, and with flexibility.
- adopt new methods and tools for innovative, flexible and interoperable Digital Rights Management (DRM) in order to facilitate smooth transition from paper contracts to digital licenses. For examples:
 - the exploitation of MPEG-21 REL (Rights Expression Language) with specific extensions and enhancements;
 - the support of different business and transactions models and their integration;
 - the integration/interoperation of different DRM models such as MPEG-21 REL and ODRL OMA (Open Mobile Alliance).
- harmonise B2B and B2C areas for DRM, bringing the DRM model in the B2B area, supporting production and protection models in the whole value chain;
- increase content accessibility with a P2P platform at B2B level, which can integrate content management systems and workflows.

AXMEDIS implements the AXMEDIS Framework for all, especially small and large industries sharing a common interest in the exploitation of new technologies and solutions. The AXMEDIS Framework can be used to setup and build a large range of applications and services in the area of content production, protection and distribution, examples are also reported in this document. With the flexibility of AXMEDIS framework and dynamic plug-in technology, you can customize your applications and processes according to your needs. Moreover, accessing to the AXMEDIS Framework also means the full access to all the source code or client and server applications.

The AXMEDIS digital content and content components is an **open format** capable of integrating any kind of cross media format (video, images, animations, games, learning objects, multimedia, audiovisual, document, audio, etc.) in any digital format, any kind of metadata including identification, classification, categorization, indexing, descriptors, annotation, relationships and play activities and protection aspects.

The AXMEDIS format permits the combination of content components and their secure distribution in respect of the copyright laws, supporting a large variety of DRM rules and models according to concepts of interoperability among DRMs (mainly, but not only, based on MPEG-21, with both binary and XML low level formats and OMA). AXMEDIS is open to any DRM models and solutions.

Within the AXMEDIS content any type of cross media content can be included from simple multimedia files to games or software components, for leisure and entertainment, infotainment, and also for managing protected governmental content, healthcare information, business or value information, etc. (<http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Cross+Media+Content%3A+Examples>)

- AXOM: http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=333

This document describes the **AXMEDIS open architecture and framework**:

- All the AXMEDIS specification is public and its specific use is royalty free. Any company or third party can use the document to create an AXMEDIS compatible solution.
- All AXMEDIS client tools are accessible and are free of charge.
 - Tools to be installed:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2885
 - Tools examples:
<http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Tools+at+Work>
 - Videos and tutorials:
<http://www.axmedis.org/tiki/tiki-index.php?page=Early+Demonstrations+and+Videos>
- All the source code of AXMEDIS Framework is accessible if you get affiliated with AXMEDIS such as SIAE, ALBENIZ, RIGEL, PENTEX, HEXAGLOBE, FOCUSSEEK, GESFOR, etc. The affiliation fee is low and affordable for all. If you are an institution the Affiliation is FREE of charge if you collaborate to improve the framework in somehow, and you will become an AXMEDIS sustainer and developers;

- The affiliation to AXMEDIS can also be obtained by contributing work or results to the community which improve and extend the AXMEDIS Framework, becoming an AXMEDIS sustainer and developers;.
- The AXMEDIS plug-in technology is public. The source code for creating new plug-ins is public without need to be affiliated.
 - Affiliation agreement <http://www.axmedis.org/affiliation.php>
 - http://www.axmedis.org/documenti/view_documenti.php?doc_id=1751
- In AXMEDIS the focus is on interoperability and openness of content model, including multi-channel distribution.
- In AXMEDIS the focus is on interoperability of DRM model, including multi-channel distribution.

More technical information on AXMEDIS architecture and framework and about how to access at the AXMEDIS framework getting affiliated to AXMEDIS are available on <http://www.axmedis.org> .

2 Business to Business areas

To facilitate the collaboration amongst actors in the business area, AXMEDIS is providing a wide set of tools and especially the AXEPTool, a P2P tool for B2B distribution of content and tools. The tools support DRM and the reporting of content usage. Information related to the exploitation of rights along the value chain including the final user is gathered and reported back to the concerned actors. These utilities are very useful to provide the evidence of the exploited rights in a transparent manner to collecting societies or other business partners.

You can join the P2P B2B network of AXMEDIS installing the AXEPTool from:

http://www.axmedis.org/documenti/view_documenti.php?doc_id=2960 On the P2P B2B network of AXMEDIS you can download example, video of tutorials, demonstrator, etc. You can publish on the P2P B2B network AXMEDIS and non AXMEDIS objects. ALL THE AXMEDIS partners are on the network and will see your work immediately, please start collaborating with us.

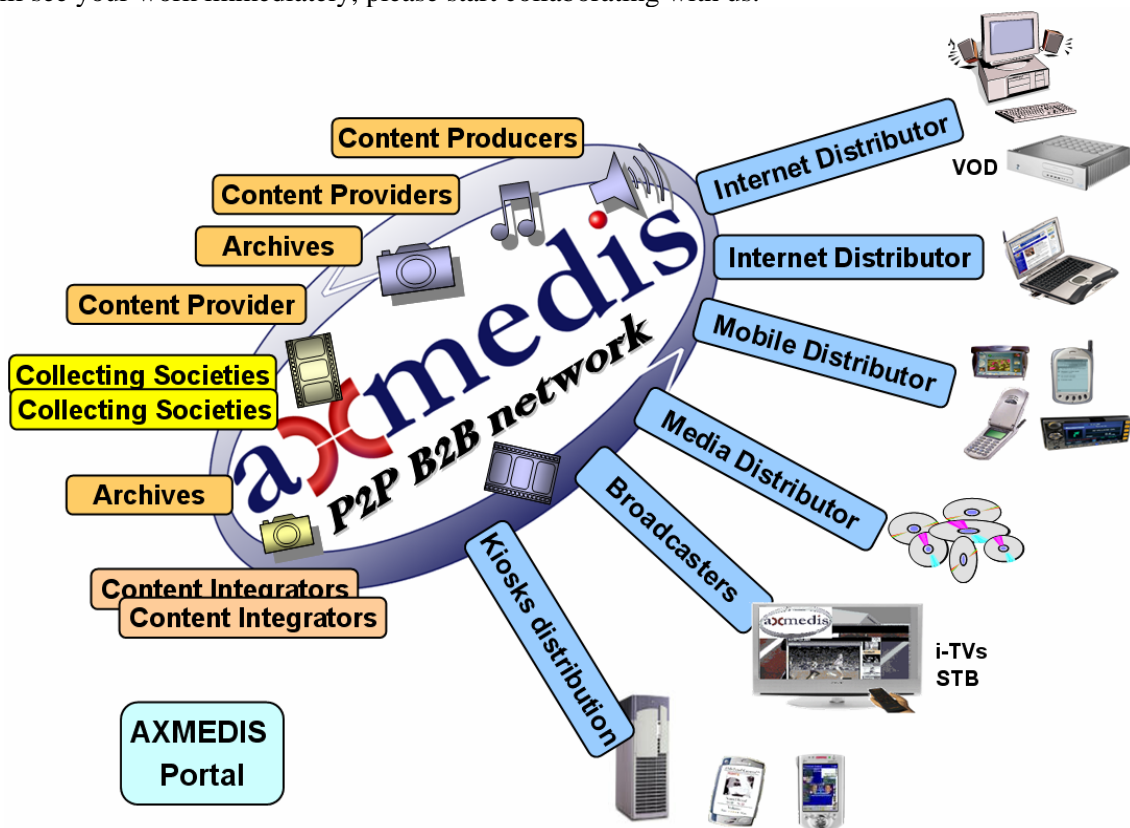


Fig.2 -- AXMEDIS Business to Business area with some distributors

The distribution side may present one or more single distribution paths for each type of content. In AXMEDIS, the content distributors can continue their preferred mechanisms for reaching the final users. The possible Channel Distributors have a large variety of capabilities, they are both of pull and push, and may include off-line and on-line connection from the client to the distributor.

3 AXMEDIS General Architecture

The diagram in figure 3 illustrates all the major areas of the AXMEDIS architecture. Each major component is described in relation to the flow of the content from its acquisition to distribution.

The major areas are the:

- **AXMEDIS Factory** for automatically: collecting content from legacy CMSs, producing the content, programming and scheduling the production process, processing metadata, composing and formatting content, collecting content information from content usage, producing licenses to harmonize the production with workflow applications in the factory and among geographically distributed factories, etc. The AXMEDIS Factory is scalable in the sense that it can satisfy the needs of small and large content producers, integrators, and distributors. The factory is supported by tools for automating the production process and to perform manual editing.
 - General download page: http://www.axmedis.org/documenti/documenti.php?area_id=1
 - Editors: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Editors>
 - AXMEDIS Tools to be installed: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2885
 - Tools examples: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Tools+at+Work>
 - Videos and tutorials: <http://www.axmedis.org/tiki/tiki-index.php?page=Early+Demonstrations+and+Videos>
- **AXMEDIS Distribution Area** for automating the content publication and acquisition in the business area allowing the interconnection of AXMEDIS Factories by means of the AXEPTool which is a secure and legal P2P tool. Among connected AXMEDIS Factories, it is also possible to make distributed queries to search for content, and to automatically publish and acquire/update content from/to the business partners, etc. The tools in this area also allow scheduling content distribution and publication towards external web services for example those of front end distribution servers.
 - AXEPTool: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2960
 - Programme and publication: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Programme+and+Publication>
 - Example of AXMEDIS based distribution: http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=351
- **AXMEDIS Player** for content playing and execution on several different platforms, to build specific and customized content players, for distributing and sharing content among final users by means of secure P2P tools such as AXMEDIA P2P tool.
 - Tools to be installed: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2885
 - Players: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Player>
 - AXMEDIA P2P tool: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3068
 - http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=348
- **AXMEDIS Protection and Supervising tools** for registering users, certificating users, authenticating devices and tools, monitoring all the activities on the AXMEDIS content on AXMEDIS players and tools, processing licenses, managing black lists, and collecting and reporting the information about content usage and rights exploitation, etc.
 - Editors: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Editors>

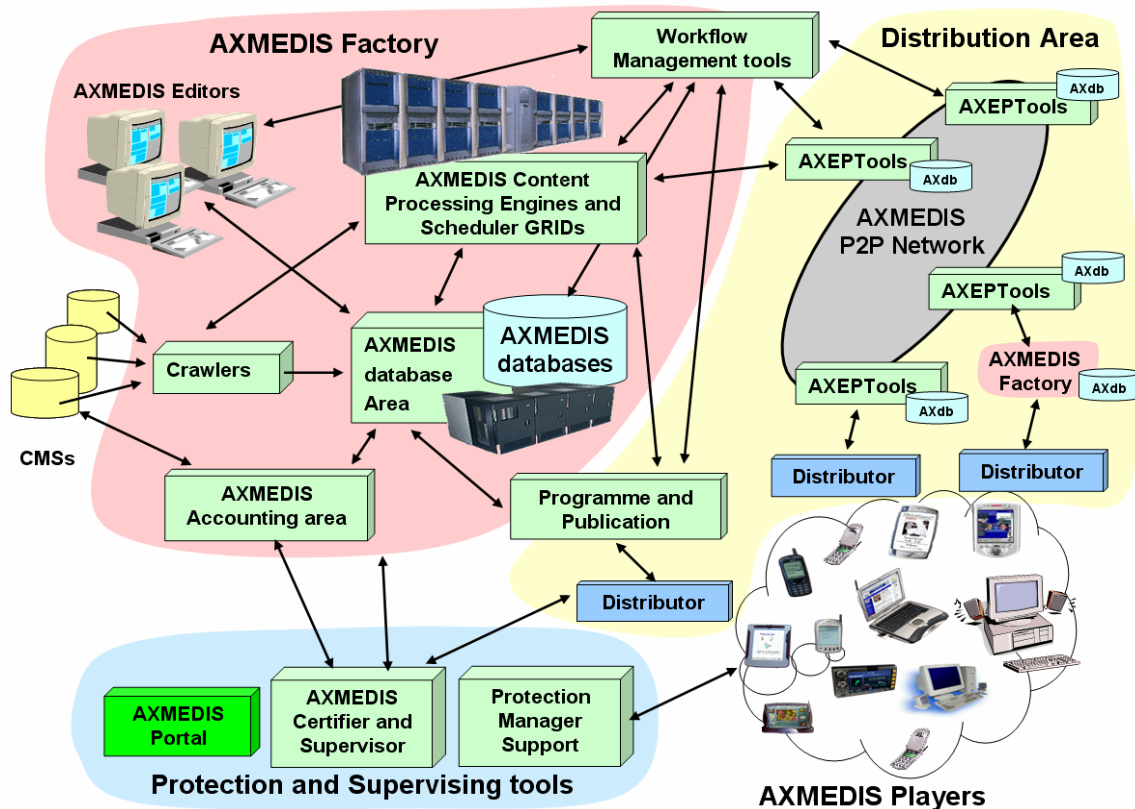


Fig.3 – AXMEDIS Architecture

4 AXMEDIS Factory

A content factory can be built on the basis of AXMEDIS tools in a scalable and flexible manner. For example, tuning is possible for GRID size, type of database, number of authoring tools, number and types of tools/algorithms and libraries for processing content, licenses, integration support based on Workflow or not. An AXMEDIS content factory can be customized to satisfy the needs of small and large content producers, integrators, and distributors.

The **AXMEDIS Database Area** includes the AXMEDIS/MPEG-21 database model, supporting the storage and access to content via a large set of metadata for each AXMEDIS object grouped in what is called AXInfo. The AXMEDIS database model can be customized to your needs. The database also includes produced licenses for the objects, histories of performed actions on content, potentially available rights for each digital resource, models of contracts, etc. The AXInfo includes Dublin core plus descriptors and many other metadata for managing protection, lifecycle, etc. Any descriptors and metadata can be added in a flexible manner. Thus, different AXMEDIS factories may be based on different AXInfo and metadata, while automatic adapters can be defined and activated. The database area is based on a scalable database, a powerful AXMEDIS Database manager, and an effective **AXMEDIS Query Support** endowed with an easy to use user interface. 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/published via the P2P network of AXEPTools in the AXMEDIS B2B Network.

- AXDB: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Database+accounting+and+reporting+tools>
- COPOP: <http://www.axmedis.org/tiki/tiki-index.php?page=COPOP+Client+and+Server+and+Distribution+Portal>
- Database: http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=341

The **AXMEDIS Content Processing Area** (AXCP Area) is based on a GRID solution for automating all the activities to be performed for the production, and processing of content. The major tools are the **AXCP**

GRID Node (Engine) and AXCP Scheduler, which are respectively the single node (computer) of the GRID and the organizer of processes on the GRID Nodes. They implement a scalable solution to process from smaller collections to huge amount of content per period of days, minutes. The processing algorithms can be specified in terms of script code (in Spider Monkey) allowing the manipulation of complex AXMEDIS data types and simple digital resources and content in general, and for the direct access to the AXMEDIS database and processing queries with the help of the AXMEDIS Query Support. The solution allows the writing of any kind of content processing algorithms, to activate them automatically on some query result, and these can be put in execution as independent processes on a scalable GRID for massive production and processing of digital resources in respect of the DRM.

- AXCP: <http://www.axmedis.org/tiki/tiki-index.php?page=Content+Processing>
- AXCP http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=335
- Adaptation: http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=338
- Fingerprint: http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=339

The available data types, operators and accessible algorithms allow manipulation of any digital resource in a large number of formats. Algorithms can be defined for massive content composition (packaging, combination, etc.) and content layout formatting (synchronization, image and screen layout, from image sequence to video, etc.), content adaptation (change in resolution, subsampling, change in format, etc.), transcoding, coding, decoding, fingerprint extraction, estimation of descriptors, license adaptation and transcoding, license production and verification, etc.

The users of the **AXMEDIS Content Processing Area (AXCP)** can create Java Script rules for any kind of processing procedures and algorithms.

- AXCP: <http://www.axmedis.org/tiki/tiki-index.php?page=Content+Processing>
- Rules: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Content+Processing+Scripts>

To manipulate/produce:

- Any digital resource:
 - such as images (more than 150 different formats), audio (more than 50 formats), video (more than 50 formats), documents (TXT, PS, HTML, PDF, RTF, DOC, etc.), multimedia (more than 20 formats including MPEG-4, HTML, LOM, etc.);
 - for their transcoding, adaptation, feature and descriptor extraction, recognition, certification, etc.;
 - with functionalities of many well known and powerful processing libraries such as: FFMPEG lib, LibSNDFile, TreTagger, DocFrac, GhostScript, XPDF, HTMLDOC, ImageMagik, MP4Box, Xerces, XALAN, CCPP, etc. (if you are interested in adding more libraries please contact AXMEDIS);
- Packages and their composition and formatting
 - AXMEDIS objects with AXInfo Metadata and indexing,
 - MPEG-21 Objects,
 - including digital resources, metadata (e.g., Dublin Core, etc.),
 - protection information, etc.
- Protected objects and resources, managing protection information:
 - by using MPEG-21 IPMP model, and format
 - by using algorithms for encryption/decryption, scramble, compression, key production, different sizes for keys, etc.
- Licenses on the basis of the business models chosen:
 - By stating grants, conditions, etc.,
 - by verifying license consistency with respect to the potentially available rights, with the license in production, etc.,
 - by using formalism of MPEG-21 REL, and with OMA ODRL – MPEG-21 REL transcoding
- Automatic content and information access
 - database accesses (ODBC, etc.) with direct facilities;
 - database access by means of crawling facilities to access to a larger set of possible database models. They may contain digital content, resources, files, metadata, administrative and

licensing information, etc., and can be physically located in several different computer systems and based on several different database models: ODBC, MySQL, ORACLE, MS-SQL, Tamino Lobster XML, etc., or files systems. The access to this information is performed by means of Focuseek Crawler;

- file system and operating system access;
- http and ftp accesses;
- AXMEDIS database access with query support, actualization of selections, active queries, etc.
- Device capabilities format and processing facilities, to take into account for adaptation and/or processing;
- User Profile format and processing facilities, to take into account for adaptation and/or processing;
- WSDL facilities for the activation of WEB services dynamically on the basis of their definition;
- XML facilities for the application of styles and general processing;
- SMIL facilities for the application of templates and styles and processing;
- etc.

The algorithms and procedures used in the AXCP Area can be expanded by using the AXMEDIS Plug In technology that allows customizing and easily expanding the processing capabilities of the AXMEDIS GRID. Algorithms for the extraction of fingerprint, descriptors, adaptation, content processing, DRM adaptation, metadata adaptation, are built as pluggable algorithms. ***Any other library, model and format and related algorithms for their manipulation can be plugged in the AXCP in a very easy manner.***

The AXMEDIS **Workflow Management tools** include a set of micro tools and interfaces which are pervasively connected to all the AXMEDIS tools and plug-ins to allow interfacing the whole content 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.

- AXWF: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Workflow+and+Workflow+manager>
- http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=350

The **AXMEDIS Editor** is the authoring tool for manually producing AXMEDIS objects when needed and for supporting the designer to create the scripts for the AXCP that could be considered macros of the AXMEDIS Editor. http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=337

The editor is based on the AXMEDIS Object Model (AXOM) and on MPEG-21 model and format. http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=333

The editor includes modules and tools to manipulate and create MPEG-21 and AXMEDIS objects and related information and digital resources such as:

- resource hierarchy viewer and editor;
- visual and behavioral viewer and editor to show/manipulate visual and temporal aspects of related digital resources according to SMIL;
- metadata editor and viewer, to manipulate and view general XML metadata and specific AXInfo metadata;
- DRM viewer and editor to create and verify the DRM licenses;
 - [From paper Contracts to Licenses](#)
 - [AXMEDIS License Definition and Usage](#)
 - [AXMEDIS License Translation and DRM interoperability](#)
- Protection Information viewer and editor to specify, apply and browse protection aspects on the basis of the MPEG-21 IPMP format with extension of AXMEDIS;
- Plug-ins to use algorithms for content processing as those mentioned and used in the AXCP Area mentioned above;
- Plug-ins to allow the integration of AXMEDIS Editor within other editing and viewing applications such as: Video Editors, Image Editors, etc.;
- an interface to connect the AXMEDIS Editor with other external powerful editor tools;
- an interface with workflow (OpenFlow and BizTalk);

- Internal viewers and players for digital resources such as document, images, video, MPEG-4, and audio resources, etc., for more than 250 different file formats.

The **AXMEDIS Accounting Area** includes a set of tools which allow content producers, distributors or collecting societies to collect administrative information and report about their content in order to gather information about the list of rights that have been exploited on their AXMEDIS objects by the final users and by the business users. This information is collected into the AXMEDIS database for further analysis. The acquisition of accounting information is performed by collecting it from the AXMEDIS Certifier and Supervisor, AXCS. The local database and the AXCS provide support to make queries to obtain statistics data on content usage in the area, in the channel, for a type of content, for a period, etc. A specific tool allows extracting data from the AXMEDIS Database to migrate them towards the administrative side of the CMS, such as high level administrative information to prepare the bill at the content users, distributors, etc., to interface with customer relationships services.

- Action logs: http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=347

5 AXMEDIS Distribution Area and Players

The AXMEDIS tools for the distribution area allow automating the content publication and acquisition in the business area establishing also interconnection among different AXMEDIS Factories by means of the so called AXEPTools (AXMEDIS P2P Tool for B2B distribution) which is a secure and legal P2P tool. The tools in this area also allow scheduling content distribution and publication towards external web services for example those of front end distribution servers.

Each **AXEPTool** includes an instance of the AXMEDIS Database that allows distinguishing content in the AXMEDIS Factory and content published to be distributed and shared with other business partners. It also allows searching for content among business partners connected on the AXMEDIS Network. Typically the network allows sharing content among producers, integrators, distributors, publishers, archives, etc. Among the interconnected AXEPTools it is possible to make distributed queries to search for content, and to automatically publish and acquire/update content from/to the business partners, etc. The Potentially Available Rights and the contact information are the instruments to start the negotiation of content acquisition. This mechanism makes the B2B content distribution faster, simpler and more secure. Each transaction and trial is monitored by the AXEPTool and by the AXCS. During queries, the content and the technical metadata are certified thus avoiding trivial problems of many P2P architectures.

- AXEPTool: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2960
- Snapshots <http://www.axmedis.org/tiki/tiki-index.php?page=AXEPTool>
- [AXMEDIS P2P Tools: AXEPTool and AXMEDIA tool](#)

The **AXMEDIS Programme and Publication (P&P) tools** include a set of tools for users to define AXMEDIS publication programmes to distribute content from the interconnecting AXMEDIS Databases to various user specified distribution channels. It utilizes the AXMEDIS Framework including the AXCP area for content adaptation, the AXMEDIS database and the AXMEDIS Query support. The P&P tools allow users to schedule distribution times, manage requests to use content production (AXCP) rules for content adaptation and specify configured distribution channels. AXCP rules requested using the AXP&P requests production/adaptation of content based on distribution profiles, production time costs and the delivering time of the content to be distributed. The P&P tools provide a front end and server in terms of Web services to deliver content ready for distribution.

- http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=349
- <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Programme+and+Publication>

The **Distributors** represent any kind of content distribution services (see Fig.3): Internet, satellite and terrestrial broadcast, mobile, towards: PC, STB, I-TV, mobiles, PDAs, etc.

Distributors may be also interested in having in their plant some components of the AXMEDIS factory such as an instance of the AXMEDIS Database to make queries, license editor to produce licenses, AXCP for content adaptation and/or to protect content in massive manner, for content production on demand, etc. In order cases, they can delegate these actions to other parties or to external web services. Some examples about

the usage of AXMEDIS tools to set up solutions for content distribution are reported in the following. In some cases, the Distributors may be interested in establishing a connection with the AXMEDIS Certifier and Supervisor for obtaining reports about the rights exploitation or for getting statistical information.

- [Examples of AXMEDIS Framework and tool Exploitation](#)
- [Distribution on Internet the TISCALI demonstrator](#)
- [Distribution on PDAs and mobiles the ILABS demonstrator](#)
- [Distribution via Satellite data broadcast the EUTELSAT Demonstrator](#)
- [Content Sharing among Archives the ANSC case](#)
- and many others

Some Distributors may be interested in exploiting AXMEDIS technology to set up a legal P2P service for content distribution. This solution can be realized by using the so called **AXMEDIA** tools. It is a P2P tool for distributing and sharing AXMEDIS content among end users, the distributor may insert AXMEDIS content in the network of peers and this may freely navigate among them but with the supervision and control of AXMEDIS protection and monitoring models.

The **AXMEDIS players** are based on the AXMEDIS object model and manager called AXOM (AXMEDIS Object Manager). They are capable of reading and playing/executing AXMEDIS objects according to the business models chosen and the license associated with the user/device. AXMEDIS player are available mainly for PC (as independent tools, as plug in for Internet Explorer and Mozilla browsers) and PDA with Pocket PC 2003. The AXOM module can be integrated in any other content processing tool in order to manipulate AXMEDIS and/or MPEG-21 objects.

- Tools to be installed: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2885
- Players: <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Player>
- http://www.axmedis.org/tiki/tiki-index.php?page_ref_id=348

AXMEDIS framework provides tool kits and libraries to create a large number of different players on different platforms, leaving free the customization of the user interface, skin, and much more; mainly MS-Windows, MAC and Linux, for PC, PDA and may be for mobiles and Set Top Boxes.

6 AXMEDIS Protection and Supervising Tools

AXMEDIS Protection and Supervision Tools provide support for registering and certifying users, providing unique IDs for the AXMEDIS objects, authenticating of devices and tools, processing licenses, managing black lists, continuous monitoring of the user activities on the AXMEDIS content on AXMEDIS players and tools on the basis of licenses, and collecting and reporting the information about content usage and rights exploitation, etc. The tools of this area are described in the following.

The **AXMEDIS Certifier and Supervisor, AXCS**, is the responsible of user registration, for device and tools authentication and certification, and for the registration and tracking of the activities performed on AXMEDIS objects on any AXMEDIS compliant tool. The AXCS provides protection information and share with the AXMEDIS Protection Manager Supports (PMS) the responsibility of managing the protection for distribution channels and domains. The AXCS also manages black lists of users, devices and tools to restrict their activities when irregularities are detected.

- [AXMEDIS Certification and Supervision Control about the rights usage](#)

The **AXMEDIS User Registration portal** is a service that can be used by content Distributors to make the registration of AXMEDIS final users (if they do not prefer to automatically register all their users). In any case, the User has to make a registration on AXMEDIS to obtain a certificate that could allow him/her to install tools and to cope with the related AXMEDIS licenses. Some Distributors may prefer to use a direct Web Service to automatically register their users in for AXMEDIS. Both solutions can be used.

The **AXMEDIS Object Registration service** to produce and assign a unique object ID to AXMEDIS objects. In the process, the most important metadata may be provided as well by allowing establishing relationship from standard and/or proprietary identification codes with those used in AXMEDIS. It is a

service accessible by all tools capable of creating new AXMEDIS objects for any AXMEDIS Factory (such as: AXMEDIS Editor, AXCP GRID Node) and it is a WEB service directly connected to the AXMEDIS Certifier and Supervisor.

The **AXMEDIS Protection Manager Support, PMS**, collects the licenses and has the duty of processing chains of licenses on the basis of the requests received from AXMEDIS players, and all other AXMEDIS tools that include an AXOM to manipulate objects. The PMS allows the management of licenses and the sharing of these along other PMSs by means of a network of AXCSs. Each PMS can be associated with one or more different distribution channels or can be geographically distributed, e.g., to cover a geographic area. The definition of licenses and the management of information into PMS and AXCS allow to set up of a large variety of different distribution and transactions models, from client server to P2P, from satellite data broadcast toward i-TV to content distribution to cellular phones. The PMS is also provided in versions that allow managing Domains (the so called PMS Domain) such as those that can be set up for managing licenses for a school, at home, or a company, etc. Each PMS Server allows receiving the posting of new licenses by means of a Web Service, which can be used for automating their production from the Distributor Front End Sales server. Alternatively, the **AXMEDIS DRM Editor** (license editor) can be used in order to associate licenses and potential available rights (PAR) to the AXMEDIS objects during their creation in the AXMEDIS Editor.

The **AXMEDIS Portal** includes services for all the AXMEDIS users including those that support AXMEDIS and contribute to the construction and improvement of the AXMEDIS framework. It provides a set of services including the database of AXMEDIS documentation, the deployment of the AXMEDIS framework, the management of the mailing lists, etc. It provides tools updates and information to AXMEDIS partners. On the AXMEDIS portal, you can get the list of AXMEDIS compliant tools, devices, registered companies, test cases, documentation, libraries, etc. In addition, you can find references to the AXMEDIS services that allow the authentication, certification and continuous monitoring and control of any AXMEDIS tools.

- <http://www.axmedis.org>

7 AXMEDIS Framework

The AXMEDIS Framework is the set of information and tools that is at the basis of the above mentioned applications and solutions. Figure 4 shows a coarse view of the AXMEDIS Framework structure. It contains all the necessary tools to set up a large set of services and solutions in the area of content production, protection and distribution. The AXMEDIS Framework is an infrastructure on which several other models for content modeling, protection, production, DRM and distribution can be built in a very simple manner reusing the components and functionalities provided.

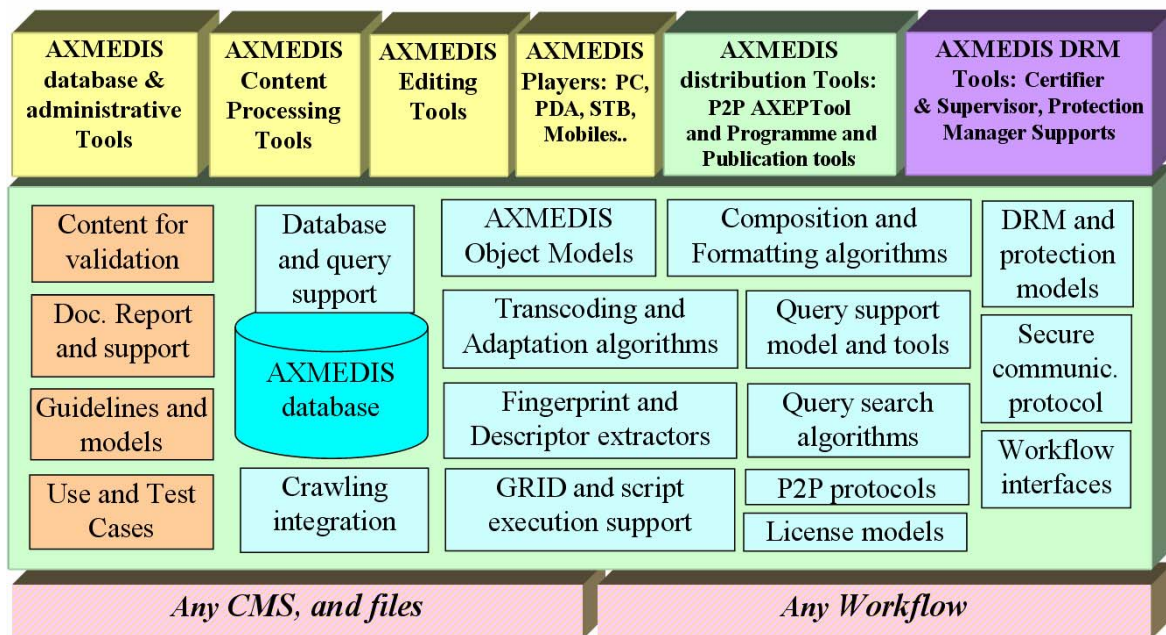


Fig.4 -- AXMEDIS Framework structure, a simplified view

The general infrastructure gives a common ground on which other content based applications and tools can be built by small and large industries deciding to adopt the AXMEDIS framework for their business and by research institutions. In addition to the modules and tools described before, the most relevant parts of the **AXMEDIS Framework** are:

- requirements for many innovative solutions and their revisions,
- test cases and uses cases and their revisions,
- content for validations of tools and solutions, both single resources and metadata and demonstrative AXMEDIS objects. They range from collection of resources to full cross media content with templates and styles,
- general documentation of AXMEDIS tools and supports, including the:
 - whole specification of the AXMEDIS framework and the
 - detailed technical documentation of the source code,
 - user and installation manuals, technical references, etc.
- CVS/SVN tree with source codes of the several modules of the AXMEDIS framework, including libraries, applications and tools,
- examples of AXCP scripts modeling algorithms for content 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.,
- examples of content, from single content element, to collection, advertising integration, cross media, with SMIL HTML, etc.
- examples and models for licenses (MPEG-21 REL and OMA),
- example and models for protection information,

- examples of workflow usage and programming for controlling AXMEDIS Factories,
- examples of queries and selections for accessing to the database,
- tutorials about AXMEDIS framework exploitation and tool usage:
 - on general aspects and on state of the art of the sector,
 - on AXMEDIS framework, general aspects,
 - on automated and manual content production,
 - on automated and manual content protection and DRM (Digital Rights Management),
 - on AXMEDIS tools,
 - on multichannel distribution tools, etc.,
- guidelines for source code production for contributing to the AXMEDIS framework,
- guidelines on content production and distribution,
- guidelines for the production of AXMEDIS Plug-ins for AXCP GRID and AXMEDIS Editors,
- guidelines for the production of licenses on the basis of contracts,
- ready to use/install AXMEDIS tools such as: AXMEDIS Players, AXEPTool P2P, AXTraker, AXMEDIS Query Support, AXMEDIA P2P tool, AXMEDIS Editors, AXMEDIS Programme and Publication tools, AXMEDIS Content Processing Tools, AXCS (Certifier and Supervisor), AXMEDIS PMS.

A more detailed technical view of the AXMEDIS Framework is reported in the following figure.

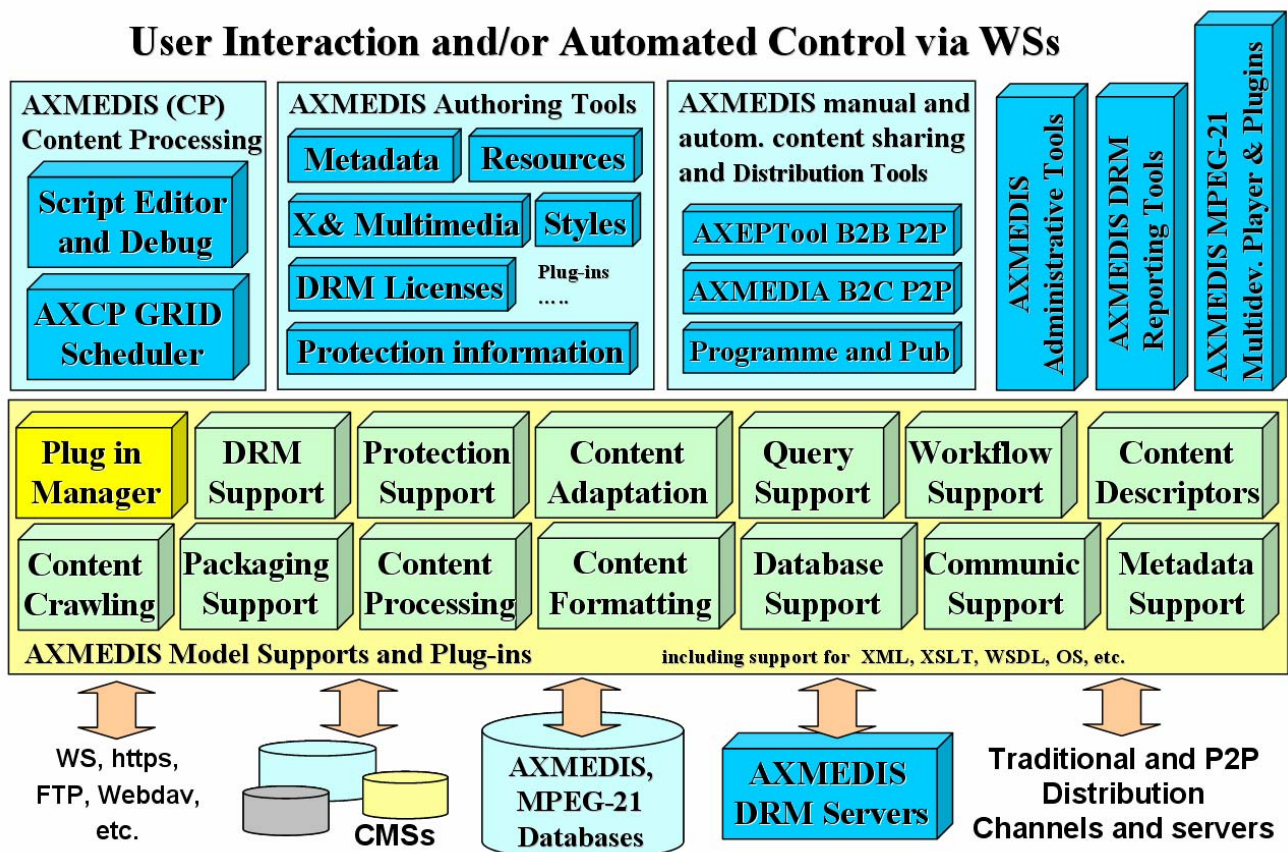


Fig.5 -- AXMEDIS Framework technical view

7.1 Accessing to the AXMEDIS Framework

The present status of the AXMEDIS Framework can be obtained from its coordinator or partners. Demonstrations of the AXMEDIS tools and of the whole AXMEDIS Framework are provided at AXMEDIS conferences and in other occasions listed on the AXMEDIS Portal. The AXMEDIS Framework can be accessed by all affiliated partners. The Affiliation to AXMEDIS is performed by subscribing an Affiliation

Agreement with an AXMEDIS Contractor. The Affiliation Agreement and the list of Contractors are accessible on the AXMEDIS portal.

- <http://www.axmedis.org/affiliation.php>
- Affiliation Agreement: http://www.axmedis.org/documenti/view_documenti.php?doc_id=1751

There are many **reasons to get affiliated to AXMEDIS**, which can be summarized as follows:

- Obtaining access to a royalty free and *open platform* that can be customized for your production, protection and distribution needs;
- *Reduction of costs* for content gathering, processing, production, protection and distribution;
- Adopting a standard model (MPEG-21, OMA) for content and licenses modeling and thus for inserting DRM in your business;
- Establishing contacts with other business partners interested in exploiting similar technology;
- Acquiring a greater control about content usage;
- Creating customized Cross media players for PC, PDA and mobiles, playing MPEG-21, MPEG-4, HTML, SMIL, etc., any format;
- Exploiting and trial of new business models;
- Joining the P2P B2B Network of AXMEDIS;
- Exploiting capabilities of secure legal P2P distribution;
- Setting up and creating a customized distribution channel interoperable with others;
- Setting up some new service (empowering your present solution) on the basis of AXMEDIS technology;
- Setting up a one-stop service for content protection and DRM set up;
- Allowing reporting to your business customers which rights are exploited on their content;
- Allowing the management of rights reporting for multimedia products;
- Allowing to use a solution that can be safer and more flexible with respect to state of the art;
- Saving money by using innovative technologies for content production and distribution, integrated environment;
- Accessing extremely innovative technology to give it a trial;
- Contributing to the AXMEDIS Framework gives you continuous access to the framework at reduced costs.

Research institutions and technology providers are interested in getting affiliated with AXMEDIS to:

- make visible and promote their algorithms and tools for content processing and modeling that can be somehow integrated into the AXFW. These tools may be provided as demonstrators with limited capabilities;
- exploit the AXMEDIS Framework to make business with it for the reasons reported in the above list;
- add new content models and new DRM models and make them interoperable with MPEG-21 and others already in place on AXMEDIS;
- test new algorithms and tools with respect to the state of the art solutions, in a very easy and cheap manner;
- access at low cost the AXMEDIS framework by means of which several different configurations and solutions may be built to cover the needs of the value chain actors and tested with low effort;
- access tools based on MPEG-21 standard;
- collaborate with very relevant and well known research institution and companies of the areas;
- etc.

The present **status of the AXMEDIS Framework** can be obtained from the AXMEDIS project coordinator. Demonstrations of the AXMEDIS tools and framework are provided at AXMEDIS conferences and in other occasions listed on the AXMEDIS Portal. The AXMEDIS Framework can be accessed by Affiliated Partners. The Affiliation to AXMEDIS may be performed by subscribing an Affiliation Agreement with an AXMEDIS Contractor.

The AXMEDIS 2007 conference will be held in Barcelona in November 2007. The Call for papers is open until 15 May 2007. <http://www.axmedis.org/axmedis2007/>

8 The Tutorial and Videos

The following is a list of available videos that are only a draft version of the demonstration videos that will be provided later in the project. They do not pretend to be professional neither to be an exhaustive representation of the project results. They are only internal video to document the activities that the consortium decided to share with public audience.

The videos are in DIVX, MPEG-I or WMV format and are playable with a large set of players. Also the torrent file can be downloaded. Please, use the [AXEPTool](#) to join the AXMEDIS P2P network.

AXMEDIS General Tutorial (Leeds, [AXMEDIS 2006](#)):

- Video on [part 1](#) - [torrent](#)
- Video on [part 2](#) - [torrent](#)
- Video on [part 3](#) - [torrent](#)
- Video on [part 4](#) - [torrent](#)
- Video on [part 5](#) - [torrent](#)
- Video on [part 6](#) - [torrent](#)

- **AXMEDIS Tutorial on Cross Media Content Production and Sharing ([Workshop in Rome](#), 11 April 2007. In Italian):**
 - Video on [part 1](#) - [torrent](#)
 - Video on [part 2](#) - [torrent](#)

- **AXMEDIS Presentation:**
 - [AXMEDIS General Architecture](#)
 - [Examples of AXMEDIS Framework and tool Exploitation](#)
 - Part 1 - video on [General Overview](#) - [torrent](#)
 - Part 2 - video on [The Creation of the Object](#) - [torrent](#)
 - Part 3 - video on [Content Processing, Database and Query Support](#) - [torrent](#)
 - Part 4 - video on [Licensing](#) - [torrent](#)
 - Part 5 - video on [Protection aspects and the PandP Editor](#) - [torrent](#)

- **AXMEDIS Content Distribution:**
 - Content Distribution via Satellite data broadcast, the EUTELSAT Case and demonstrator
 - Video on [Satellite data broadcast and push](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - Video on [Satellite data broadcast and push](#) (March 2006) - [torrent](#)
 - Internet Distribution of Content, the TISCALI MediaClub Case and demonstrator
 - Video on [the Distributor point of view](#) (March 2006) - [torrent](#)
 - Video on [the End User point of view](#) (March 2006) - [torrent](#)
 - Distribution towards Mobiles, the Giunti ILABS Case and demonstrator
 - Video on [the Distributor point of view](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - Video on [the End User point of view](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - Distribution of Content via Kiosks, the Giunti ILABS Case and demonstrator
 - Video on [Querying and Acquiring content from Kiosks for PDA](#) (July 2006) - [torrent](#)

- **[AXMEDIS Editors the authoring tools:](#)**
 - [AXMEDIS Factory](#)
 - video on [AXMEDIS Editor \(1\)](#) (Sept. 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - Creating an New Object
 - Creating Nested Object
 - Loading and Saving an object
 - video on [AXMEDIS Editor \(2\)](#) (Sept. 2006) - [torrent](#)

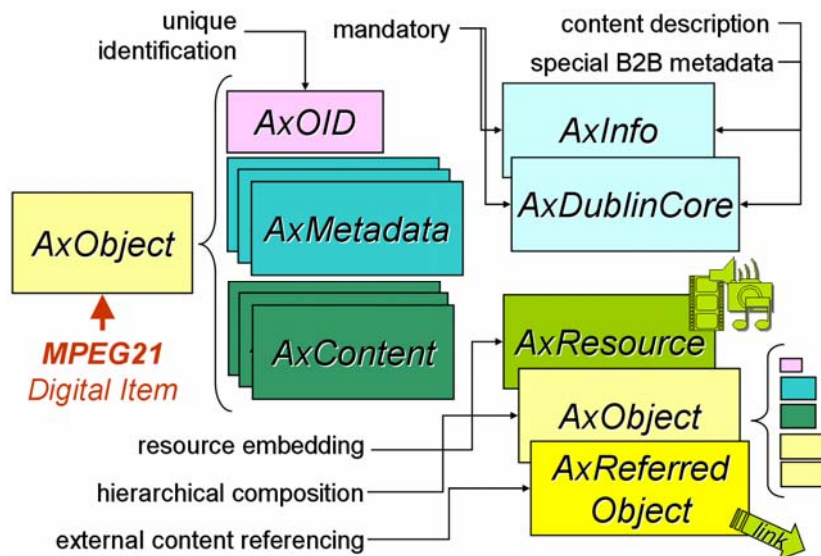
- [The same video available on YouTube](#)
 - Navigating in the object structure (AXMEDIS model)
 - Navigating in the object structure (MPEG-21 model)
 - video on [AXMEDIS Editor \(3\)](#) (Sept. 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - Video on [Metadata Editor and Viewer](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - Video on [Metadata Mapper Editor](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [Potentially Available Rights](#) (Sept. 2006) - [torrent](#)
 - Video on [SMIL Editor](#) (Sept. 2006)
 - Video on [SMIL Editor](#) (March 2005) - [torrent](#)
- **[AXMEDIS Players:](#)**
 - AXMEDIS Player for Windows
 - Integrated Video Player
 - Integrated Image Player
 - Integrated Video on [Document and HTML Player](#) - [torrent](#)
 - Integrated Audio Player
 - Integrated MPEG-4 [OSMO Player](#) (Sept. 2006) - [torrent](#)
 - AXMEDIS Player as Active X for Internet Explorer
 - AXMEDIS player as Plug in for Mozilla
 - video on [AXMEDIS PDA Player](#) - [torrent](#)
 - video on [AXMEDIS PDA Player](#) Old version
- **[AXMEDIS Protection Tools](#) Area:**
 - Video on [Contract analyser](#) (Sept. 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [License Conversion Assistant](#) (Sept. 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [DRM Editor and Viewer](#) (Sept. 2006) - [torrent](#)
 - Posting License on the PMS Server
 - Verification of a license against PMS server
 - video on [License GRANT Authorization](#) (Sept. 2006) - [torrent](#)
 - video on [DRM Editor and Viewer](#) (March 2006) - [torrent](#)
 - video on [License to Contract and Vice versa](#) (March 2006) - [torrent](#)
 - video on [Grant Authorization](#) (March 2006) - [torrent](#)
 - Protection Information Editor
- **[AXMEDIS Content Processing Tools](#) Area, AXCP Area:**
 - video on [AXMEDIS Rule Editor and debugger](#) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [AXMEDIS Rule Editor and debugger](#) (March 2006) - [torrent](#)
- **AXMEDIS Content Processing Algorithms and AXCP Plugins:**
 - Adaptation Algorithms
 - Video on Audio adaptation
 - Video on Ringtones adaptation
 - Video on Video adaptation
 - Video on Images adaptation
 - Video on [Document adaptation](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - Video on Metadata adaptation
 - Video on License adaptation
 - Fingerprint Algorithms

- video on [Audio fingerprint](#) (October 2006) - [torrent](#)
 - video on [Audio fingerprint](#) (March 2006)
 - video on [Video fingerprint](#) (October 2006) - [torrent](#)
 - video on [Video fingerprint](#) (March 2006) - [torrent](#)
 - video on [M2Any Audio fingerprint](#) (October 2006) - [torrent](#)
 - video on [Images fingerprint](#) - [torrent](#)
 - video on general data fingerprint
- Extractor of Descriptors Algorithms
 - video on [Document descriptors extractor](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [Audio descriptors plug-in](#) (Sept. 2006) - [torrent](#)
 - video on Video descriptors
 - video on Images descriptors
 - video on [Plagiarism detector plug-in](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
- **[AXMEDIS Database and query Support](#) Area:**
 - video on [AXMEDIS Database Administrative Interface](#) - [torrent](#)
 - video on [AXMEDIS Query Support](#) - [torrent](#)
 - Selection Editor
 - video on [General Overview](#) (Sept. 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [How to create a selection](#) (Sept. 2006) - [torrent](#)
 - [The same video available on YouTube](#)
- **AXMEDIS Publication Area:**
 - Video on [Programme and Publication Area](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [AXEPTool P2P B2B Tool](#) - [torrent](#)
 - AXMEDIS Tool, P2P for Consumers
 - [AXMEDIS Programme and Publication Tools](#)
 - video on [Programme and Publication](#) - [torrent](#)
- **AXMEDIS Reporting, Accounting:**
 - [Using the Action Logs about the exploitation of rights](#)
 - video on [CAMART and AII](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [AXMEDIS Accounting Information Integrator](#), Administrative collection of data - [torrent](#)
- **AXMEDIS Certifier and Supervisor:**
 - video on [Administrative User Interface](#) (July 2006) - [torrent](#)
 - [The same video available on YouTube](#)
 - video on [Administrative User Interface](#) (March 2006) - [torrent](#)
- **[AXMEDIS Workflow](#) Tools area:**
 - Open Flow Based Management
 - video on [Workflow integration - 1](#) (March 2006) - [torrent](#)
 - video on [Workflow integration - 2](#) (March 2006) - [torrent](#)
 - **AXMEDIS Workflow tutorial:**
 - video on [AXMEDIS Workflow tutorial - part 1/3](#) ~82MB (July2006) - [torrent](#)
 - video on [AXMEDIS Workflow tutorial - part 2/3](#) ~86MB (July2006) - [torrent](#)
 - video on [AXMEDIS Workflow tutorial - part 3/3](#) ~70MB (July2006) - [torrent](#)
 - slides of [AXMEDIS Workflow tutorial](#) (July2006)

9 AXMEDIS Framework Details

9.1 AXMEDIS Object Model

The state of the art of content production, distribution, modeling, composition, formatting, protection and management is grounded on the content formats. Presently, there exist a number of content formats that ranges from the simple files: documents, video, images, audio, multimedia, etc., to integrated content models and packages such MPEG-21, SCORM, MXF, AAF, and WEDELMUSIC. These models attempt to wrap any digital resource in a container to make them ready for delivering by using a large range of business and transaction models and few of them also supporting with some DRM (Digital Rights Management) model (only for MPEG-21 and WEDELMUSIC). More specifically, MPEG-21 is mainly focused on the standardization of the DRM aspects while WEDELMUSIC is mainly focused on Multimedia Music and provided limited DRM flexibility with an effective implementation of tools for digital item collection and distribution. MXF is focused on preparing content aggregation for the broadcasting; SCORM, is mainly focused on packaging collections of digital content/resources/files for educational purpose. There are also a number of formats that allow formalizing the presentation level such as: HTML, SMIL, SVG, LASER, MHP, etc. The integration of packaging, presentation and DRM aspects is fundamental to enable e commerce and control on digital content on the production and distribution life cycles phases.



AXMEDIS has an object model (cross media content model) based on MPEG-21. Any AXMEDIS object is MPEG-21 compliant. It formalizes how a cross media collection/group of digital resources and their metadata are organized to be presented, protected and delivered via downloading, streaming and other means, considering XML and Binary formats.

AXMEDIS formalizes:

- **Metadata that are also visible in protected and non protected objects and are certified**
 - ◆ Identification information, unique ID, distributor ID, any proprietary IDs, any ISxx IDs, ISAN, etc., and the so called AXMEDIS unique ID: AXOID;
 - ◆ Classification information also for indexing such as Dublin core, MPEG-7, plus any other format you may be interested to add, formalised in XML and not only;
 - ◆ Any descriptors for indexing digital resources, such as MPEG-7;
 - ◆ A set of references to value chain actors that have been involved in the creation and distribution of the object: owner, distributor, producers, editor, etc.;
 - ◆ Potentially Available Rights, PAR, that can be acquired from that object.
- **Digital Resources:**
 - ◆ Any digital information file: images, doc, txt, video, game, application, file, audio, etc.;

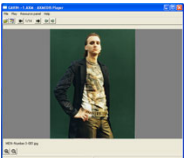




- ◆ Organised as a: hierarchy, list, cluster, nesting levels, or other. An object may contain other objects inside and thus several nesting levels can be created;
- ◆ Included in the object or simply referred with a link.

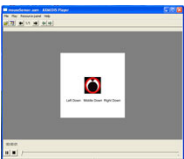
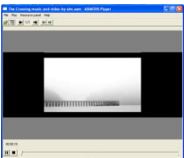

Once the object is packaged, and its ID registered it can be protected. In that process, Protection Information (Prot-Info) is produced to be used to exploit the rights related to the digital resources: play, print, view, etc. The Prot-Info is provided to the final user device tool if it has the “rights”. The “rights” are formalized with a license specifically created for that user, or device or group of them, according to eventual conditions such as territorial, temporal, number of times, etc.

9.2 The Cross Media content examples

The table below provides examples of the main media formats supported by the AXMEDIS Players. All of these examples have been created either manually using the AXMEDIS Editor, or via scripting and AXCP.

- <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Cross+Media+Content%3A+Examples>

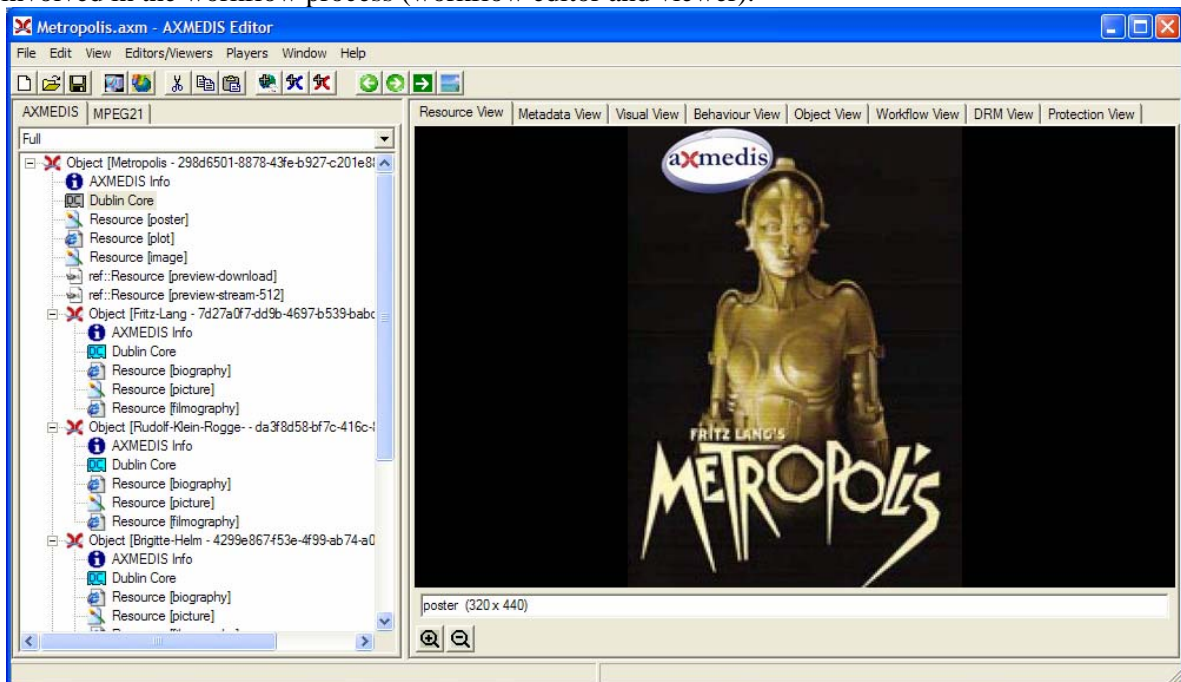
Example format	Object title	Description	Size	Filename
IMAGE GALLERY 	Gavin Fernandes Photographs	This object contains a collection of 14 JPEG images from London-based photographer Gavin Fernandes. Any kind of image format can be included into an AXMEDIS object	3.08Mb	gavin-fernandes-photography-set-3.axm
HTML, INTERACTIVE 	Mandolin	This object demonstrates multiple linked html pages with integral images, audio and video encapsulated in a single object.	2.60Mb	002.axm
DOCUMENT 	AXMEDIS Requirements document	This object contains a large PDF file demonstrating support for documents. Please note that viewing requires the Acrobat plug-in to be installed in Internet Explorer. An AXMEDIS object may contain collection of PDFs, documents, and may contain any combination of content formats (type) presented in these examples.	7.57Mb	AXMEDIS-Req-Use-Cases-Tests-2006.axm
FLASH, INTERACTIVE 	Moses game	This object contains a flash SWF game with two levels, including animation and sound	543Kb	moses-game-flash-html-xim.axm
SMIL, INTERACTIVE 	Accademia	This object uses SMIL to present a slideshow guide of selected paintings from the Academia Gallery in Florence. The SMIL can be based on multiple SMIL scenarios linked together to put in execution Audio and Video files and animations.	252Kb	accademia.axm
INTERACTIVE MPEG-	Mouse sensor	This object demonstrates MPEG4 interactive scripting, containing a single MPEG4 object	10Kb	mouseSensor.axm

4 		that reacts to mouse movement. Any kind of MPEG-4 content can be included and player by AXMEDIS players since they include the MPEG-4 OSMO with BIFS support, audio support, image support, etc.		
VIDEO 	The Crossing	This object contains a short video and music produced by XIM. The video is encoded in MPEG4 with AAC audio. Collection of documents and video and audio can be created as well.	5.76Mb	The-Crossing-music-and-video-by-xim.axm
AUDIO 	Silver Saddle	This object contains a single MP3 audio file of a piece of music contributed by AFI. Collection of audio files with eventual cover and documents and animation can be created as well.	1.67Mb	6770.silver_saddle.axm

9.3 AXMEDIS Editors, the authoring tools

AXMEDIS Editor is used for the manual production of AXMEDIS Objects, and allows creating and manipulating object features and their different aspects:

- **Structure and packaging**, to add, remove, move digital resources and metadata inside the AXMEDIS Object (hierarchy editor and viewer of the object), manipulation in terms of AXMEDIS elements and/or in terms of MPEG-21 standard;
- **Resource manipulation**, to use content processing plug-ins for generic and customizable resource manipulation (the same algorithms and tools used in the AXMEDIS Content Processing), so that it allow the test o AXMEDIS Content Processing algorithms;
- **Metadata editing and mapping**, allowing to edit/map the metadata (any XML format) related to digital resources and objects (metadata editor and viewer);
- **Visual and behavioral editing**, allowing to define content usage paradigm (presentation level) organization of resources to present/layouting the digital content contained inside the AXMEDIS Object (visual and behavioral editor and viewer), saving in SMIL, as templates, HTML, etc.;
- **Protection editing**, allowing to specify/test protection algorithms to be used for the AXMEDIS Object protection, and thus to define the Protection Information (Protection Editor and Viewer);
- **DRM editing**, allowing to produce and verify licenses for end users and/or distributors of the AXMEDIS Object as well as the Potentially Available Rights, PAR, that could be acquired on objects shared in the P2P Network (DRM editor and viewer);
- **Workflow**, allowing editing and viewing the status and the work to be done on the AXMEDIS Objects involved in the workflow process (workflow editor and viewer).



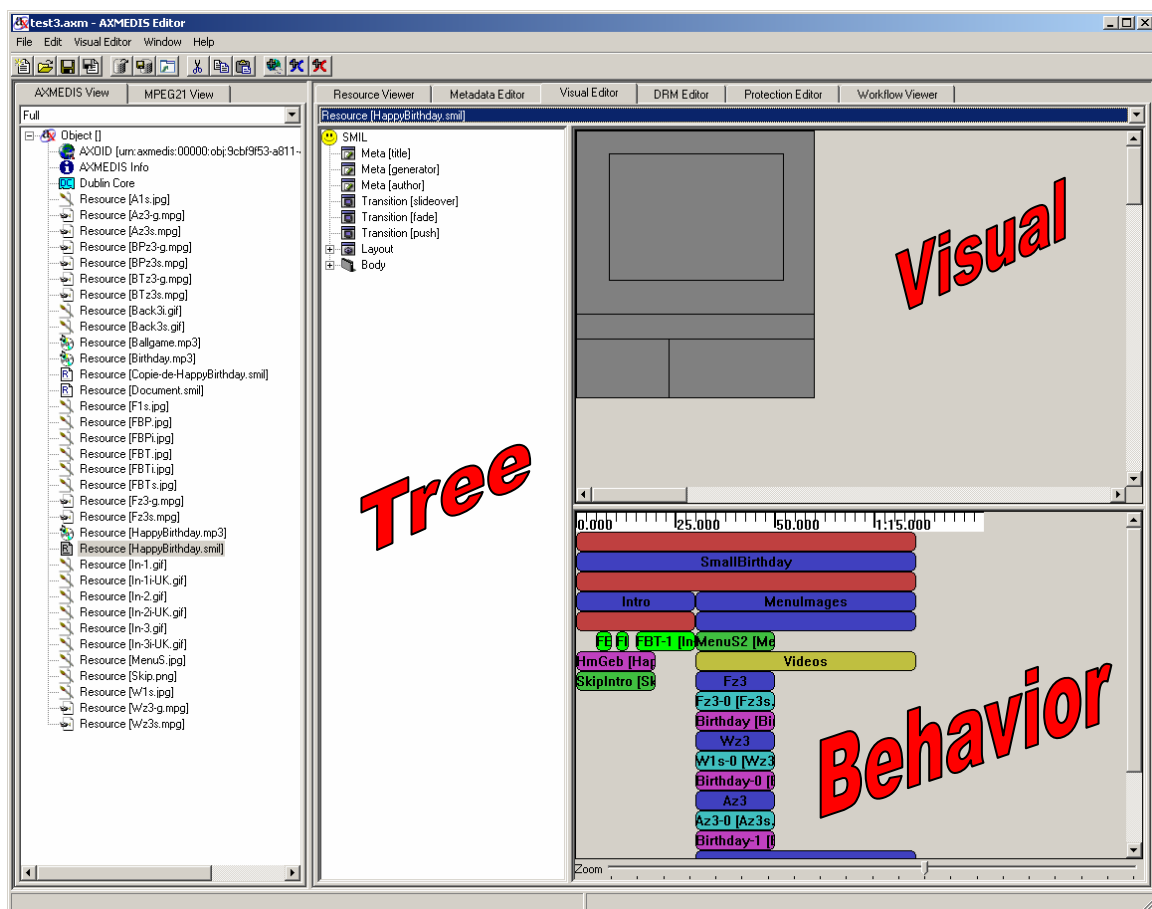
Moreover, **AXMEDIS Editor**:

- allows to perform queries towards databases to look for content to produce AXMEDIS Objects integrating other AXMEDIS objects coming from AXMEDIS Databases, and from the AXMEDIS P2P network or even from other connected factory/legacy CMSs (Content Management Systems) in many formats;
- allows download/upload AXMEDIS Objects from/to the AXMEDIS Databases and file systems;
- can be controlled by the AXMEDIS workflow (OpenFlow and BizTalk) system to integrate manual operations on AXMEDIS objects inside the production process formalized with the workflow system;
- can be used to inspect automatically generated objects for their validation;
- can finalize/revise the production of automatically produced objects;
- can be used to create and test internal behavioral aspects of the AXMEDIS content;
- can test rules/script to be used as templates for the AXMEDIS Content Processing environment.

9.4 AXMEDIS Visual and behavioral Editor

The AXMEDIS visual and behavioral editor allows editing the *presentation aspects of AXMEDIS objects* considering the resources coming from the AXMEDIS object itself by means of a simple and intuitive visual interface. The whole presentational behavior of an AXMEDIS object can be defined in terms of linked scenarios each of them can be formalized in a presentation file directly included into the AXMEDIS object. Each presentation scenarios can be produced by an external editor for SMIL or can be created by using the AXMEDIS visual and behavioral editor which is shown in the figure and is divided in three parts:

- **tree part** allows to edit the whole presentation structure (allowing defining the activities that have to be performed in parallel or sequential manner, thus allowing defining the synchronizations among digital resources);
- **visual part** allows to edit the regions used for resources displaying and the, graphically adjusting the visual dimensions and the relationships among the regions;
- **behavior part** allows to edit the timing structure and properties, graphically adjusting the timing position, and the durations.



The *presentation* information can be saved in

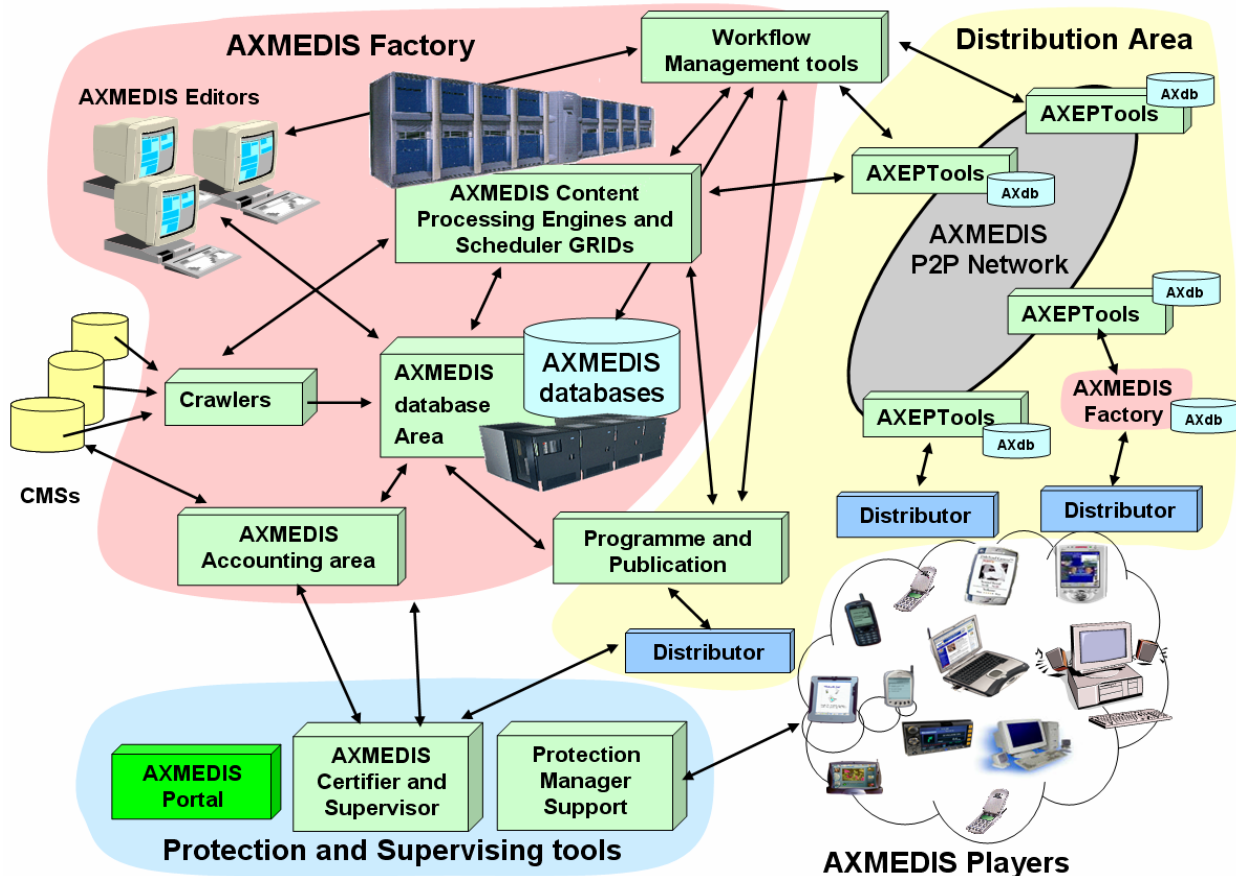
- SMIL files, related among them by means of navigation links and
- SMIL Templates to be used for the automatic formatting and may be in the future also in
- HTML, SVG and other formats such as LASER, etc.

The AXMEDIS *visual and behavioral* editor presents a set of facilities to:

- Load SMIL presentation produced by other tools;
- make simple the reuse of the same presentation layout in several connected scenarios;
- verify the consistency of the presentations information;
- define any details and parameters of the visual and behavior aspects;
- modify previous presentations.

9.5 AXMEDIS Content Production

The Content Production area of AXMEDIS is mainly focused on what it is called AXMEDIS Factory automating: (i) the packaging containing the digital resources, (ii) adapting and transcoding, (iii) protecting content and producing corresponding Prot-Info, (iv) publishing and distributing the produced packages/objects towards distribution channels (Internal, satellite, P2P, mobiles, etc.), (v) producing licenses for the users, (v) accessing to CMS, (vi) collecting information coming from DRM servers, etc.



Content Object Production

- Existing contents (e.g., resources and metadata located in databases, CMSs, file systems) are crawled and collected using automated processes and rules (e.g., Crawler, rule editing);
- Crawled contents or new contents can be inserted into the AXMEDIS Databases;
- Content can be automatically packaged in AXMEDIS model (e.g., in MPEG-21, OMA, ISO media);
- Content production and elements (metadata, resources, protection information and licenses) can be processed manually with authoring tools and editor or automatically produced with AXMEDIS Content Processing tools based on executable rules that can be hosted on single or massive GRID of computers;
- Authoring tools can be used to insert/revise metadata, define protection information, define DRM licenses models, to modify content or simply to view the objects;
- Various processing are offered (adaptation, transcoding, protection, etc.), either automatically or manually (using GUI editor);
- Components and digital resources can be glued together by means of SMIL, HTML, etc., presentation based templates and style that may be used to define the usage interface (format) of the whole object: karaoke, collection, menus, sliding presentation, buttons, live, animations, etc.;
- Results can be sorted in a database or on file systems or published in towards distributors or on the B2B P2P AXMEDIS network;
- They are now available on the AXMEDIS network, for further aggregation, distribution, etc., to be searched, modified, or shared;

- Queries and P2P allow retrieving and downloading content from other AXMEDIS Factories;
- Queries can be activated to automatically react to eventual changes in the sources, and thus to perform an automatic production and publishing updates;
- Queries can be performed on the basis of classification and identification metadata, but also on technical features, descriptors, licensing information (PAR), etc.;
- Once identified the objects or queries, they can be used as input parameters of processing rules for the GRID AXMEDIS Content Processing;
- All these activities can be governed by Workflow Management Tools for defining process production flow and information of the content factory and among different factories.

9.6 AXMEDIS Content Processing Capabilities

AXMEDIS framework and the AXMEDIS Content Processing (AXCP) GRID offers automated features and functionalities, supporting convenient scripting interface to enable automation and control with:

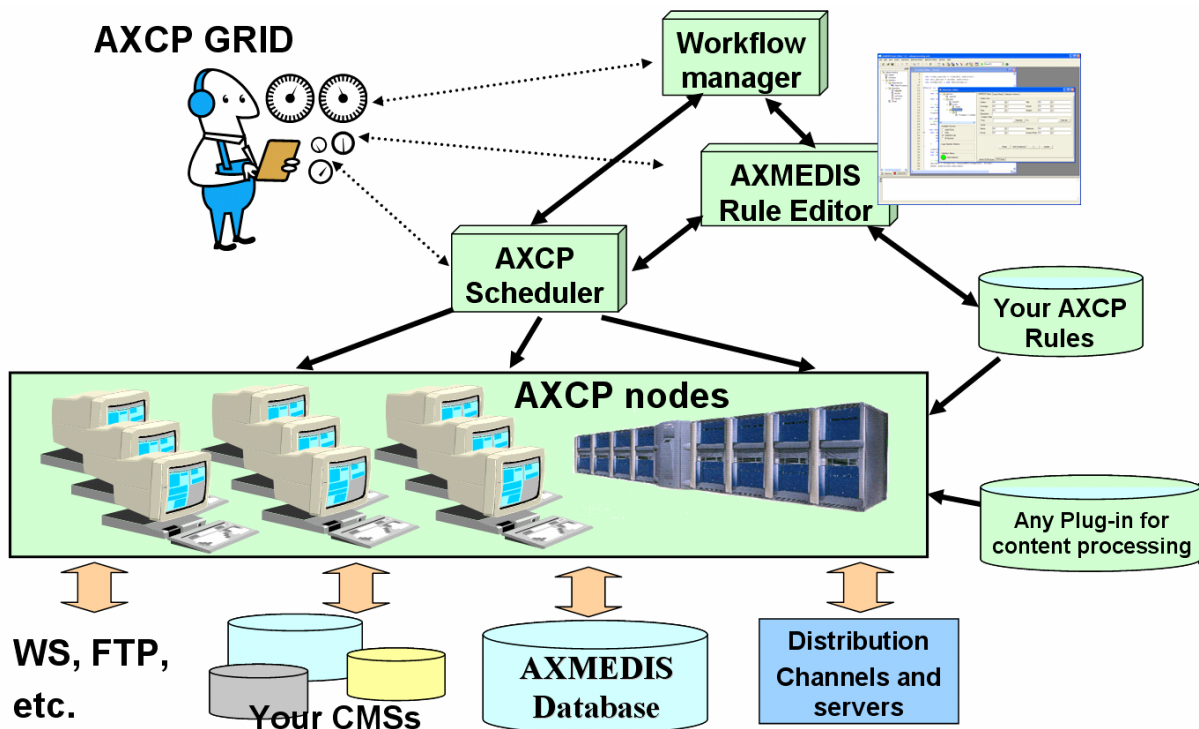
- **Content Ingestion and Gathering**
 - from Content Management Systems (CMS such as ORACLE, XML databases, Tamino, MySQL, MSSQL, HP DMP, ODBC, etc), file system, and protocols;
 - by processing resources and coupling them with metadata;
 - via Web Services, FTP, HTTP, WebDAV, SMB, Gopher, NNTP, and other models.
- **Content Storage and Retrieval** from/to
 - AXMEDIS database, MPEG-21 database;
 - other AXMEDIS content Factories by means of the AXMEDIS P2P tools (AXEPTTool).
- **Content Processing:**
 - digital resources adaptation, extraction of descriptors, transcoding, synchronization, metadata processing, estimation of fingerprint, watermarking, indexing, content summarization, etc.; for videos, images, documents, audio files, etc.;
 - metadata manipulation, mapping and adaptation: Dublin core, MPEG-7, etc.;
 - integration with OpenFlow and BizTalk Workflow Management systems.
- **Content Composition** for creation of content
 - components or objects by a combinations of raw assets such as text, images, audio, video, animation, metadata, descriptors, licenses, and other multimedia objects such as MPEG-4, HTML, SMIL, macromedia tool file, games, etc.;
 - as linear or hierarchical/nested combination of content components.
- **Content Packaging** such as
 - MPEG-21, with any digital resource inside, from other MPEG-21 to HTML, SMIL, groups of files and related resources;
 - OMA, Etc.
- **Content Presentation and Interactive models** such as:
 - SMIL, HTML, MPEG-4, etc.
- **Content Processing** such as
 - digital resources adaptation, extraction of descriptors, transcoding, synchronization, estimation of fingerprint, watermarking, indexing, content summarization, etc.;
 - metadata manipulation, mapping and adaptation;
 - resource descriptors recognition for monitoring distribution channels.
- **Content Formatting**
 - structuring and styling content elements by means of SMIL based templates and applying style-sheets to define the usage interface (format, layout) of the whole collection of content elements and the interested content usage paradigms. For example, karaoke, collection browsing, selection menus, slide presentation, background window with live video, animated text, graphics etc.;
 - optimizing and defining style parameters for layout. For example automated best fit of images for a screen, optimizing the amount of text in the page using Genetic Algorithms, best time fitting, etc.

- **Content Protection**
 - protecting digital resources and objects with their complex structure;
 - creating Protection Information parameters, such as keys, or other features;
 - applying Protection Information model to content objects, segmenting digital resources, slicing objects, applying encryption, scrambling, compression, and many other algorithms;
 - posting specific protection information of a given AXMEDIS object to the AXMEDIS Certifier and Supervisor server;
 - tracking exploited rights and reporting actions performed to the content owner, distributors, collecting societies, etc.
- **Content Licensing**
 - generating license from license model and additional information, storing licenses, and posting to license server automatically;
 - supporting transcoding/translating licenses (MPEG-21 REL, OMA ODLR);
 - invoking verification algorithms about licenses and available rights to simulate the usage from the user site;
 - generation of potential available rights.
- **Content Publication and Distribution**
 - supporting distribution towards multiple channels, for one or more: Internet, satellite, mobile, P2P distributions;
 - producing, monitoring and editing programmes and schedules;
 - controlling P2P network in download and publishing reducing the seeding time to zero;
 - connecting other AXMEDIS Factories of content integrators, producers, and distributors.

9.7 AXMEDIS Content Processing Tools

In order to exploit the features of **Section 9.6** to process/manipulate content, resources, licenses, XML, presentation, WS, SMIL, databases, protection information, etc., the AXMEDIS Content Processing Area is supported by a set of tools:

- **AXMEDIS Rule Editor:** to produce, debug, test and validate the executable AXCP Rules that can be:
 - written with a simple **AXCP language for content production** which is an extension of Java script;
 - tested, debugged and validated on the AXMEDIS Rule Editor;
 - activated for content processing on any AXCP GRID Node or on a single computer;
 - used for B2B or B2C purpose;
 - used/parameterized for producing content on demand or to be integrated in your content factory;
 - activated from your Workflow Manager engine via web service;
 - activated by changes in remote objects and queries in the local database and on the P2P network.
 - created as macros from AXMEDIS Editor and authoring tools;
 - created to specify the internal behavior of AXMEDIS Cross media content
- **AXCP GRID:** a set of general purpose, office, industrial or specialized computers to execute AXCP Rules governed by the AXCP Rule Scheduler;
- **AXCP GRID Node:** a single general purpose, office, industrial or specialized computer of the AXCP GRID;
- **AXCP Scheduler to manage AXCP rules of GRID nodes:**
 - Scheduling them according to the content production and processing needs in terms of time and resources. Allocating tasks on the basis of Deadline Monotonic solution and optimizing with taboo Search solution (in progress);
 - Activating them as sporadic and periodic tasks, controlled by other tools and/or web services;
 - Monitoring progress of production processes and their status, etc.



The processing capabilities and functionalities reported in the previous section and that can be exploited from AXCP Tools and Rules can be simply expanded by means of realizing and/or installing a set of additional plug-ins. The AXMEDIS Plug-in technology is open.

9.8 AXMEDIS Plug-in technology: content processing and protection tools

AXMEDIS framework is strongly flexible, scalable, customizable and open.

- scalable since the processing capabilities of the framework can be installed to exploit at the best a large range of different hardware platforms from single computer to a GRID of them.
- open since any it is accessible in source code and based on open standards. Many open and proprietary standards can be exploited at the same time in the platform. It also open since the affiliation is open to all.

The AXMEDIS framework is strongly **flexible and customizable** giving the possibility at any institutions and company using the AXMEDIS framework (both affiliated or not), to customize the AXMEDIS solutions with the addition of new features by means of creating plug ins, customizing tools, customizing players, contributing the AXMEDIS framework grow and directions.

The **AXMEDIS Plug-in technology is open since:**

- the specification of plug-in format is public, royalty free and not covered by any AXMEDIS patent;
- a plug-in tool kit to help you realizing AXMEDIS plug ins (including examples and source code for creating those plug in) is public and accessible to all;
- any user or third party company can create its own plug-in or include in a plug-in any open third party library including those open source. You do not need to be affiliated to create you own AXMEDIS Plug in and to use it in freely accessible AXMEDIS tools.

AXMEDIS Plug in technology is used for adding new functionalities for processing digital resources, metadata, licenses, ontologies, etc., in the:

- AXMEDIS Editors;
- AXMEDIS players: PC, PDA, STB, etc. ;
- AXMEDIS Content Processing nodes.

The AXMEDIS plug ins can be classified in two main types:

- Content Processing Plugins: used to make accessible into the AXMEDIS framework third party libraries and new functionalities for example for Adaptation, transcoding, processing, loading profiles, saving profiles, processing, optimization (Genetic Algorithms), integrating (via web services), manipulating XML, etc. A large part of the AXMEDIS Content Processing features are provided by means of AXMEDIS Plug-ins. This demonstrates their flexibility. This allows dynamically changing and reconfiguring the processing tools used in players and in the AXCP GRID nodes.
- Protection Tool plugins: used to add encryption and decryption algorithms such as DES, 3DES, AES, scrambling, pass generation, etc. A large part of the AXMEDIS Protection Tools are provided in forms of AXMEDIS plug ins. This allows dynamically changing and reconfiguring the protection tools used in the players.

9.9 The Scripts and their examples

<http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Content+Processing+Scripts>

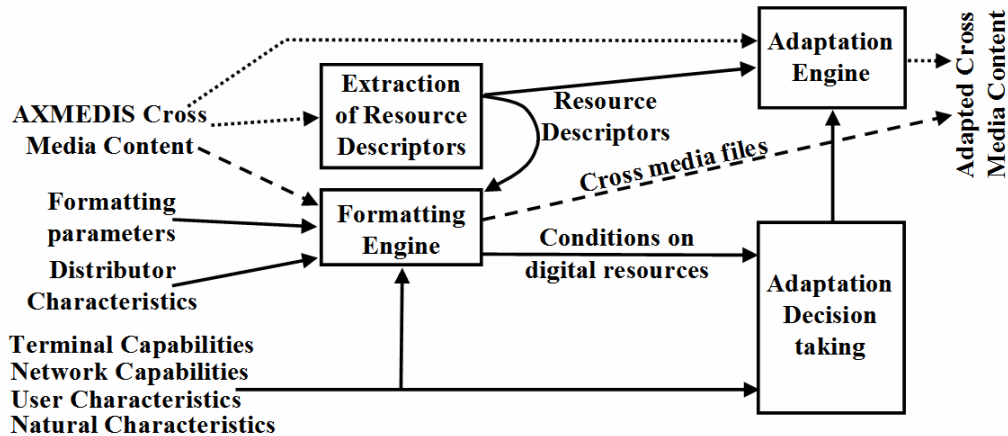
Rule File Name	Area	Description	Author
AXCPRule.xml	Crawling, metadata, CMS access, database	Example of interaction with Searchbox tool for crawling	DSI
create_object_from_dir-0-2.xml	Crawling, metadata, CMS access, database	The _main script is a tester for the dir2obj script and Dir2Obj function. It takes all subdirs in a directory and feeds them to Dir2Obj The function Dir2Obj adds all files in a directory with a certain mask to an AXMEDIS object. Optionally an indexfile match can be specified (e.g. "index.htm". If matched the file will be added as the first resource in the object Only htm* files are allowed for indexfile match. Dublin Core can be added. It will be taken from the file DC_file. This file must have been created from the AXMEDIS editor DC editor and viewer If an indexfile is searched and get_title is true title extraction will be tried on the indexfile and added as DCtitle to the object. A css file can be added as resource. In this case the contentID will be set to "css/style.css" by default. If the output_path doesn't exist it will be created The function returns true upon success and saves the object. false otherwise	ANSC
lobster-access.xml	Crawling, metadata, CMS access, database	Script for accessing to TAMINO Lobster ILABS Web Services, Accessing to metadata, accessing to content producing the AXMEDIS objects	DSI
ansc-utility-scripts-01.zip	Utility	Miscellaneous of JS scripts, to be cut and put in XML script for the AXCP editor	ANSC
dipita.xml	Document Manipulation, text processing	Conversion of pdf document in TXT format and retrieving of keywords exploiting frequency lists corpus only Related to the TEXT processing plug in of AXMEDIS	DIPITA
massiveaudio.xml	Production, audio processing	Rule for creating the AXMEDIS Object by composing and convert, transcode audio resources by providing a directory with digital resources	DSI
massivescaling.xml	Adaptation (Image Processing Plugin)	A selection is used to build a list of AXMEDIS objects matching the query on commedia type. For each of them the embedded image scaled and converted	DSI

massivescalinghorror.xml	Adaptation(Image Processing Plugin)	A selection is used to build a list of AXMEDIS objects matching the query on horror type. For each of them the embedded image is scaled	DSI
massivescaling_pdf.xml	Adaptation (Image Processing Plugin)	A selection is used to build a list of AXMEDIS objects matching the query on horror type. For each of them the embedded image is scaled and converted in PDF	DSI
Plagiarism_DIPITA.xml	Document Analysis processing	Rule for performing plagiarism analysis with text documents	DIPITA
PostingLicense.xml	License, creation of licenses, DRM	Rule for posting xml files of AXMEDIS licenses stored on disk	DSI
raw_multigeneration.xml	Production, image processing	It takes an image resource and generates multiple AXMEDIS object with different format and size of the source image	DSI
resizing_rule.xml	Production and Adaptation, image processing	The rule generates an AXMEDIS Object with an image and a text resource. The image is resized to the height x width size and the converted into JPEG ormat	DSI
ScriptLicensingOnDemand.xml	License, DRM licensing, massive	Rule for producing and posting licenses into the PMS Server	DSI
ScriptLicensingPush1.xml	License, licensing, DRM	Rule for producing and posting licenses into the PMS server using a PUSH approach	DSI
ScriptProduction.xml	Production, automated production, object production	Rule for producing in massive way AXMEDIS Objects by scanning a folder on file system containing digital items	DSI
ScriptSecondProduction.xml	Production, content production, license production and posting DRM	Composition of AXMEDIS Objects. A selection allows retrieving the list of AXOIDs. The AXMEDIS Objects of the list are used to generate a new composed object. Protect the object, produce PAR and Licenses are generated. All objects are uploaded on AXDB	DSI
searchbox-tiscali-medioclub.xml	Crawling, access to content, metadata	Crawling for accessing to TISCALI MediaClub catalogue. Production of AXMEDIS Objects	DSI
TextProcessing_DIPITA.xml	Production and Document Adaptation	Document Adaptation: 1.Transcoding to HTML; 2.Embedding the HTML resource in the object; 3.Transcoding to plain text; 4.Embedding the plain text resource in the object. Language Guessing: 5.Guessing resource language; 6.Adding language to Dublin Core metadata. Keyword Extraction: 7.Retrieving keywords; 8.Adding keywords to Dublin Core metadata; 9.saving object to file	DIPITA
OMA-management-JScript.zip	Production, OMA,	Production of content in OMA format,	DSI

	protection, distribution, licensing	production of licenses in OMA format, interaction with OMA tools for distribution	
Testing-JS-classes-licensing.zip	License, DRM, protection	Rule for testing JS Classes for licenses production and management: Grant, issuer, OMA licensing (a different model), PAR management, Rights, PMS access, interval, Fee, certification, territory, etc.	FHGIGD, UPC
mp3-split to objects with smil.zip	Production	This script tests the splitting of all mp3 files in a given directory (start_dir e.g. "c:\mp3s") which are added to an AXMEDIS object and a SMIL player is also added. For the sake of testing a basic HTML index of the files is created in the AXMEDIS object	ANSC
ResizeForAxDeviceProfile_andLic.xml	Production, processing	The rule read a device profile, extract data and adapt images according to profile	ILABS
rule theartists.zip	Production	Create AXMEDIS Objects with SMIL presentation	ILABS
smilautomaticproduction_upd.zip	Production	AXMEDIS Objects with SMIL presentation (artistic contents)	ILABS
split to dir.xml	Utility	Splits MP3 files and saves the split ones in a subdir (same name as input) in the output_dir input and root-output dirs must be different	ANSC
xim-sample-scripts.zip	Miscellaneous, production	Set of rules written by XIM to generate AXMEDIS Objects	XIM

9.10 AXMEDIS Automated Content Formatting

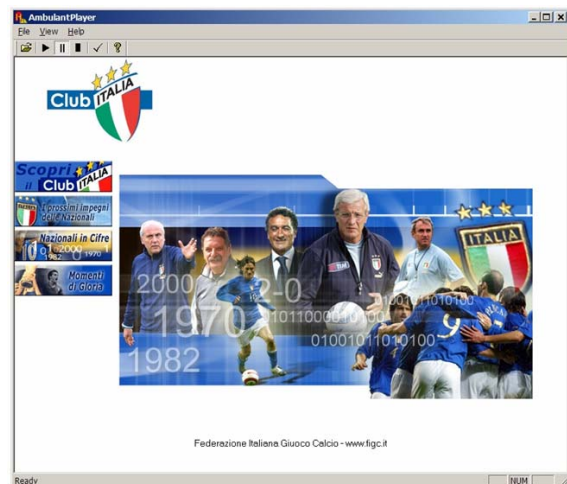
The AXMEDIS cross media content is organized as a set of SMIL and/or HTML files and/or with one or more MPEG-4. SMIL and HTML cross media content allow defining the layouting of the content scene rendering.



The adaptation of cross media content (e.g., the adaptation of an educational documentary about birds with several SMILs, video, audio, documents, HTML pages, etc.) takes into account (i) semantic-level adaptation with layouting aspects by means of the formatting engine and (ii) signal-level adaptation as single digital resource adaptation by means of the so-called adaptation engine supported by some extended Adaptation Decision Taking module.

The Formatting Engine has the duty of producing the adapted cross media content layout, reshaping the whole cross media content (e.g., elimination of some digital resource) if some functional aspects cannot be converted to device supported formats. For example, by converting video in images, animations in videos, passing from a SMIL template to a different layout by using style sheet, or from a HTML to SMIL, or from SMIL to MPEG-4, etc. This process is performed on the basis of:

- Terminal and Network capabilities, User and Natural Environment characteristics (see MPEG-21 DIA);
- Distributor Characteristics coming from the distribution channel features and/or intentions such as: device type (e.g., PC, PDA, mobile), output format (e.g., SMIL, HTML, MPEG-4), set of preferred templates/styles to be used for the cross media content layouting, etc. In a scenario of content sharing among devices. This set of information may be recovered from some extended terminal capabilities.
- Formatting Parameters: content layout -- e.g., formalized in SMIL and XSLT; criteria for the selection of the most suitable templates and style sheets, additional user preferences such as the minimum font size.
- Resource Descriptors which contain information largely automatically extracted from the resources using the descriptors extractors offered by the AXMEDIS framework and/or from the metadata provided for their semantic annotation.



xPC



xPDA

9.11 Content Adaptation facilities

AXMEDIS objects can be created to be distributed over heterogeneous networks and towards different kind of terminals, client tools/devices. Moreover, the people who will ultimately consume and interact with the content may have different behavior and preferences, and the best formats to provide them the best experience on their terminal could be different. Consequently, digital items may need to be adapted to fit any particular usage environment. This is the goal of AXMEDIS content adaptation tools which aim at achieving interoperable transparent access to (distributed) advanced multimedia content by shielding Users from network and terminal installation, management and implementation issues.

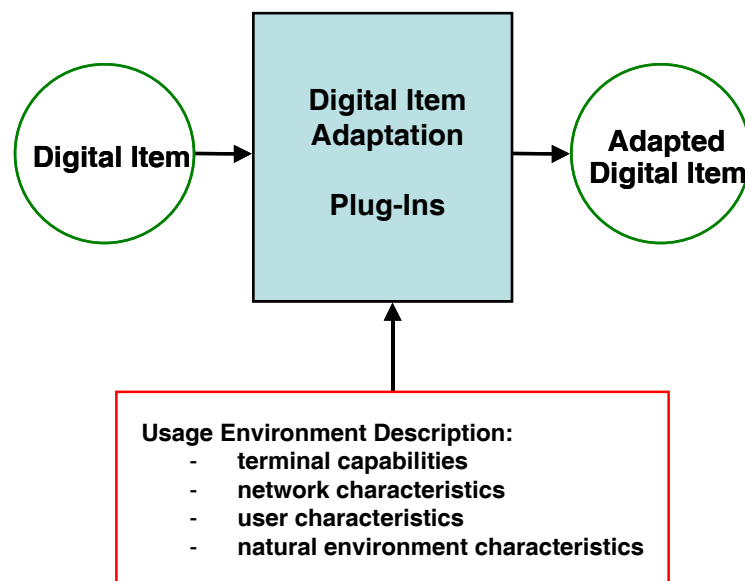
Adaptation may involve:

- transcoding of digital resources that means to change the format (for example, from TIF to GIF, from MPEG-4 to video, from a video to MPEG-4, from MPEG-4 video to a MPEG-2, from audio to symbolic music, from audio to MIDI, from audio in PCM to a ringtone format for mobiles, etc.), re-sampling, shrinking, stretching; In some cases, some features related to resolution, interactivity, are lost in the process in favor of having the content usable in another format. Typically the content is produced in a format that is transcoded scaling down its features and not the vice versa;
- manipulation of licenses, reduction of license scope, reduction of time or territorial information, transformation of format, translation of license (such as passing from ODRL to MPEG-21 REL), etc.;
- manipulation of metadata, metadata mapping, metadata reduction, translation of metadata, etc.

The **adaptation process** can be performed:

- during the content production (for digital resources, licenses and metadata) by exploiting functionalities accessible from the AXMEDIS Editors and/or for the AXMEDIS Content Processing tools
- directly on the player terminal/device (mainly for digital resources and metadata). In this case, ISO/IEC 21000 (MPEG-21) specified a set of normalized tools for the adaptation of digital content describing the usage environment of a digital item to command adaptation tools. Within the AXMEDIS players, MPEG-21 DIA usage environment descriptions are used to drive the adaptation tools considering:
 - Terminal capabilities (codec, formats, input-output, etc., supported by the terminal),
 - Network characteristics (for example, the minimum guaranteed bandwidth of a network),
 - User characteristics (presentation preferences, auditory or visual impairment etc.),
 - Natural environment characteristics (for example, the illumination characteristics that may affect the perceived display of visual information).

The conceptual architecture of the adaptation engine is shown below: a digital item is subject to adaptation thanks to dedicated plug-ins to produce the adapted digital item; the adaptation performed by the plug-ins is parameterized according to MPEG-21 DIA usage environment descriptions.

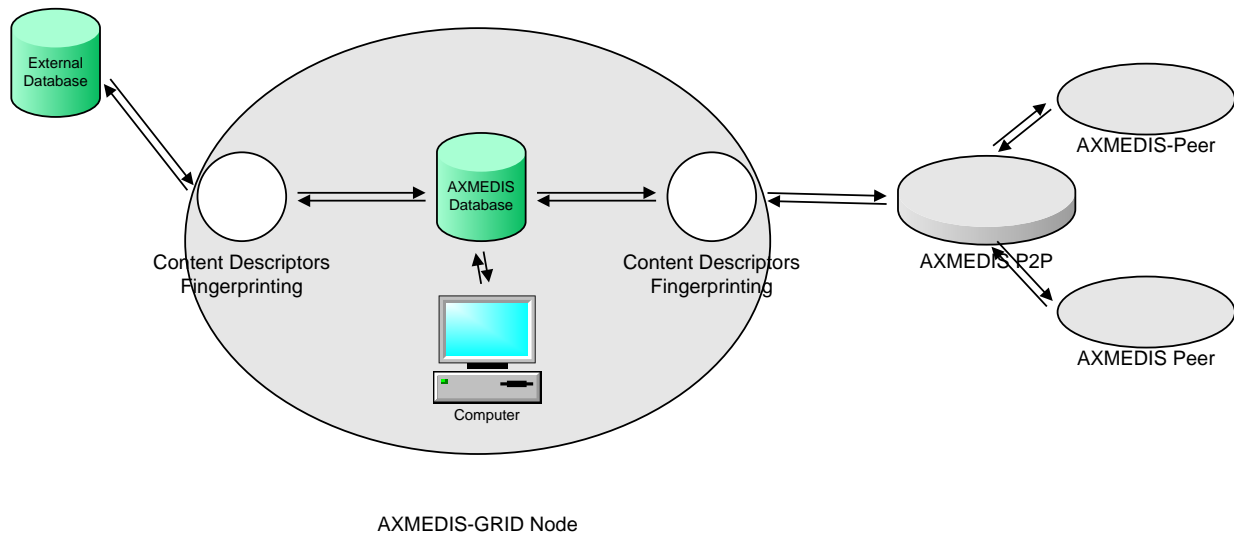


9.12 Content Fingerprint and Descriptors extraction

Among the several content processing algorithms that can be applied in AXMEDIS, a large set can be classified as extractors or estimators of Fingerprint and/or Descriptors of content.

Content fingerprints and descriptors can be used in the AXMEDIS framework for different purposes:

- Classification and recognition of content and/or digital resources;
- Identification of a single piece of content/resource and thus for content certification;
- Authentication/verification of content integrity.



They can be of classified as:

- **High-level descriptors** to describe content with a set of high-level features independent on the format and content resolution. They are typically high level features immediately related with concepts understandable by humans, such as: rhythm and tonality for music, subject for text, etc. They can be very easily used as Descriptors by humans to make queries in the data bases, and thus to retrieve similar content;
- **Digital fingerprints** (or **perceptual hash values**). They can be compared with human fingerprints and may be used to identify a specific content and are robust against data transformation;
- **Low-level descriptors** to describe digital information at lower level and sometime these descriptors are not independent on the format and resolution, such as: energy for music, spectra for images, dynamic, duration, etc. Similar content may share similar low-level descriptors. In some cases, they are used at the basis to estimate high-level descriptors. They can be used for recognition of content as well;
- **Low-level fingerprints** to estimate a value from a specific digital resource, in many cases estimated with algorithms that do not take into account the content type, such as: cryptographic hash value that can be estimated for any digital file. They can be used for content and digital resource verification of consistency and authentication.

In AXMEDIS, Content Fingerprints and Descriptors can be:

- manually selected and estimated via the AXMEDIS Editors;
- automatically estimated and stored in the object metadata or other places by means of an AXMEDIS Content Processing Rule script. For example: during the acquisition/crawling of content from CMS, during content composition and/or formatting, during any content processing also included in the production on demand;
- estimated to verify integrity of content when the content is opened by an AXMEDIS Editor, or by an AXMEDIS Player, or processed by a AXMEDIS P2P tool such as AXEPTool or AXMEDIA, etc., that is any time that an AXMEDIS object is loaded into the AXOM core component of AXMEDIS Framework.

9.13 AXMEDIS P2P Tools: AXEPTool and AXMEDIA tool

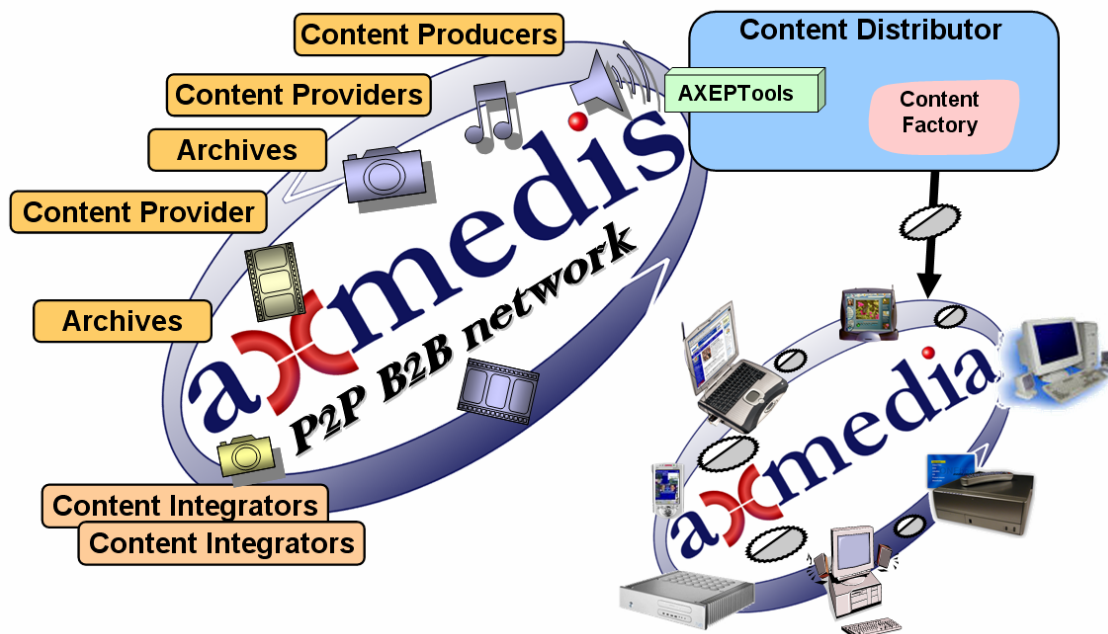
In AXMEDIS, the P2P technology is based on BitTorrent technology and it used for distributing and sharing AXMEDIS Content among:

- B2B partners such as content: producers, integrators, distributors, publishers, archives, etc.; realized with AXEPTool P2P B2B Tool that can be downloaded from: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3102
- final users of a content distributor, realized with AXMEDIA tool that can be downloaded from: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3103

Many P2P network can be realized for P2P distribution to final user. Each of them refer to an AXMEDIS Query Support Server and to an AXMEDIS BitTorrent Tracker.

The **general features of any AXMEDIS P2P tool** are:

- legal usage of P2P content distribution;
- guarantee of consistency between the exposed metadata and the downloaded content;
- verification and certification of content distribution and sharing;
- monitoring and controlling downloads and uploads in the P2P network for B2B and B2C.



From the point of view of B2B, the major features are:

- integration of P2P channel with the Content Factory;
- reduction of costs for content distribution, publication and sharing:
 - automating the application of queries on the P2P network with all the connected content factories and these queries also include: classification, identification, technical descriptors of content and licensing information;
 - automating the application of queries and the corresponding download of content;
 - automating the publication of content, so that reducing to zero the seeding time;
- monitoring the content downloads and usages of published content;
- reduction of costs for content promotion.

Distributors may exploit AXMEDIS technology to set up legal P2P services for content distribution towards and among their users, thus reducing their direct costs for distribution and infrastructure. This solution can be realized by using the **AXMEDIA** tools. It is a P2P tool for distributing and sharing AXMEDIS content among end users, the distributor may insert AXMEDIS content in the network of peers and that content may

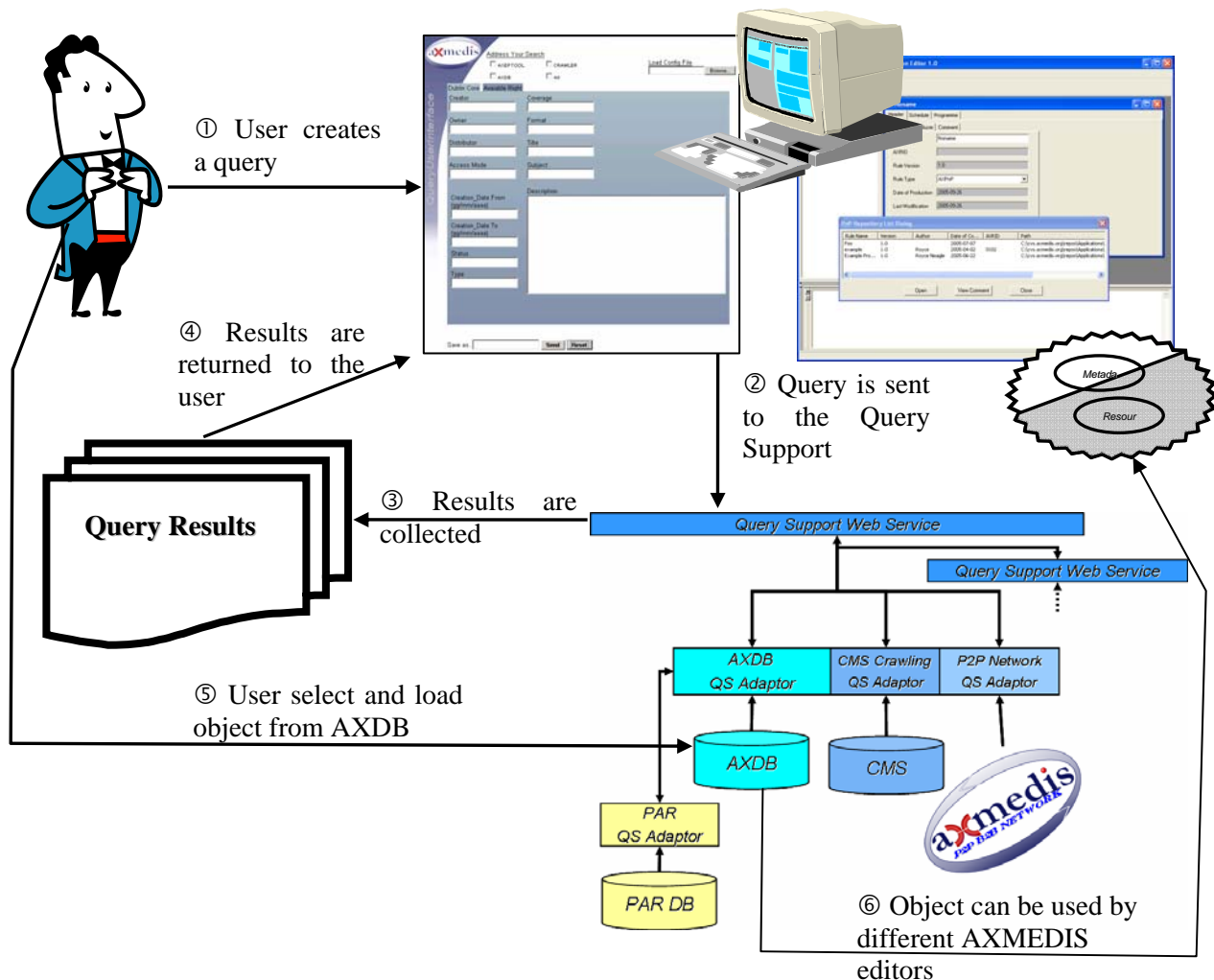
freely navigate among the peers with the supervision and control of AXMEDIS protection and monitoring model. Final users may share their content by using the same P2P network.

9.14 AXMEDIS Database and query Support

In any content factory and for many actors of the value chain, one of the most relevant problems is the storage and retrieval of digital content. In many cases, the problems is complicated by the fact that several different formats and information types have to be managed and maintained related, such as: digital resources, packages, styles, licenses, protection information, contracts, license models, etc.

The AXMEDIS database area with the query support is the answer to such a problem since it:

- is capable of storing object with an efficient and customizable indexing of metadata in order to help in a future object retrieving.
- permits to make integrated queries by the means of a query user interface that is able to return back results provided by the Query Support Web Service. Those queries can be applied on different sources and results are returned in an integrated manner:
 - local AXMEDIS database;
 - connected CMS via the crawler;
 - AXMEDIS P2P network and thus on all the other AXEPTools connected.



Among the returned results the user can easily decide to load one of more objects from the AXMEDIS database directly in the AXMEDIS editor he/she is using.

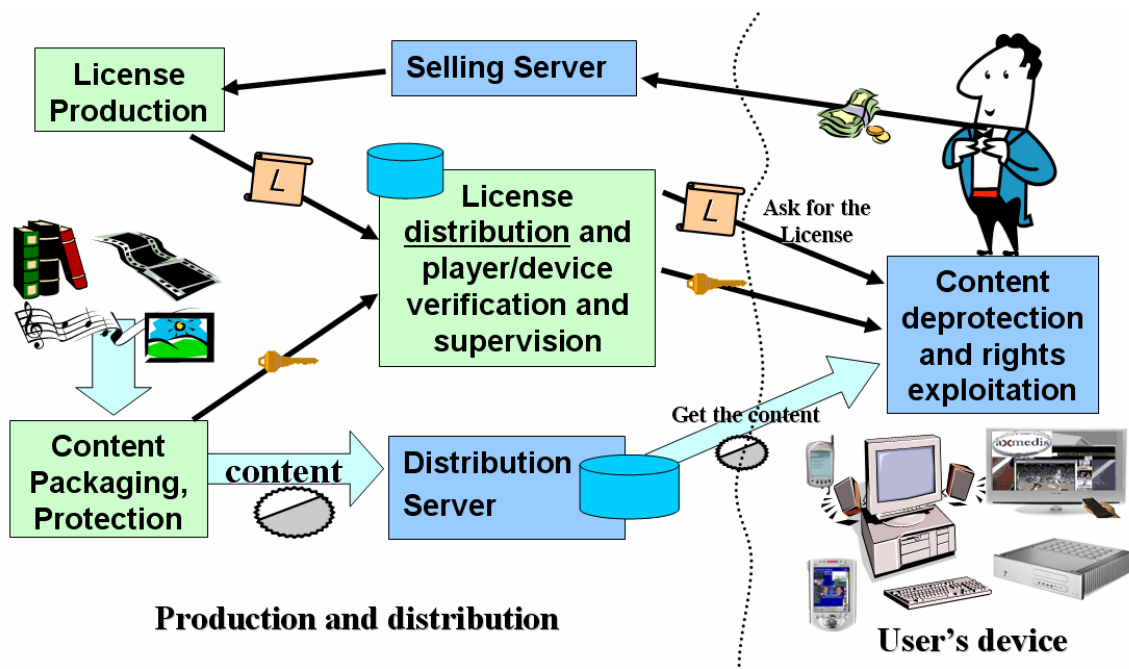
In short, the AXMEDIS database and query support is part of the core infrastructure of the user factory dedicated to the storage of AXMEDIS object with the capability of querying itself and other source such as legacy CMS and other factories by the means of the P2P network.

9.15 AXMEDIS License Definition and Usage

AXMEDIS allows managing protected and non protected content, and related mechanisms to protect and monitor the rights exploitation (that will be presented in the following sections). One of the major goals of AXMEDIS is the interoperability of content to permit its production once and a later distribution on many different channels. These two issues are mainly enforced by the capabilities of the AXMEDIS Content Processing tools and by the interoperable support for Digital Rights Management, DRM, and thus on its REL, Right Expression Language, that allows formalising digital licenses associated to AXMEDIS Objects.

In AXMEDIS, the REL is mainly based on MPEG-21 and related RDD (Rights Data Dictionary). MPEG-21 REL not only describes a rights expression language for the definition of licenses, offers and other kind of rights expressions, but it also describes an authorization algorithm for the enforcement of rights and it is used in AXMEDIS to formalize the Potentially Available Rights, PARs, which are the rights that potentially can be acquired for using a given object. They are a vehicle for promoting content.

AXMEDIS licenses are expressed in XML, on this regard a relational model and processing have been set up to process chain of licenses; such as those that can be created from the content owner giving rights to the distributor of producing licenses to the end-users. The AXMEDIS Protection Manager Support Server, PMS, allows processing licenses to provide authorizations for all activities related to rights; from the license production to the license verification against the content usage. The PMS is directly connected to the tools that manipulate AXMEDIS objects via an AXOM.



AXMEDIS provides modules and tools for exploiting DRM capabilities of:

- producing licenses (DRM Editors and/or in the AXCP tools);
- distribution licenses to the final users (PMS tools);
- authorizing the use of content depending on the licenses owned by users and distributors, resolving the chain of licenses, verifying the device integrity and supervising the rights exploitation (PMS Server and AXMEDIS Certifier and Supervisor Tools);
- protecting multimedia content (Protection editor and/or in the AXCP tools).

9.16 From Paper Contracts to Licenses

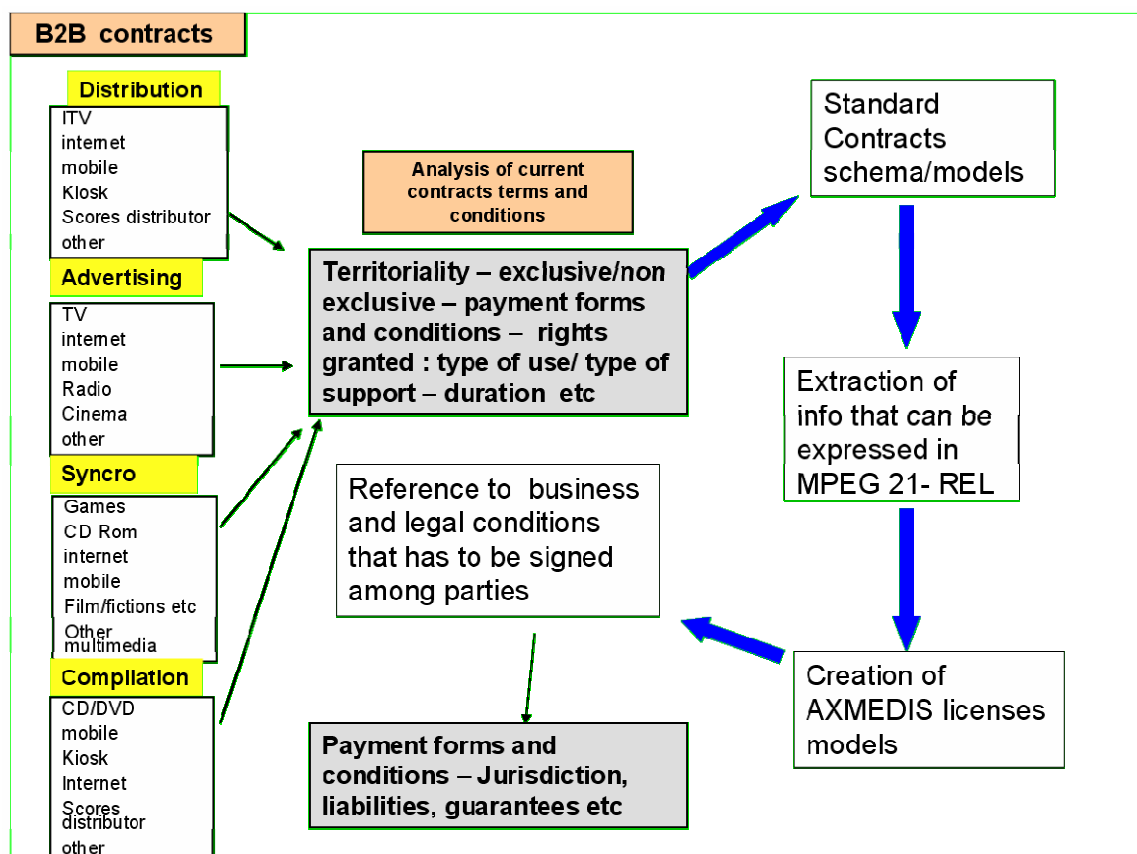
AXMEDIS is working on allowing the (semi-)automatic generation of licenses for the rights exploitation in all distribution channels and digital media format. This aspect implies that contracts rights and conditions that can be expressed in REL will be extracted from current contracts in order to implement the MPEG-21 and AXMEDIS license models.

Starting from the study and analysis of the contracts currently in use for the exploitation and distribution of content, this task aims to provide content users and providers with a tool facilitating them the generation of the license suitable to their needs. It will be possible to specify usage rights at both a B2B and B2C level, with B2B distribution rights inheriting the B2C rights for onward distribution. The license generator tools will therefore allow defining right usage and conditions for multi channels distribution, super distribution and multi-usage of the content. Once an AXMEDIS object has its license incorporated, the given inherent rights conditions will always follow the object by avoiding unauthorized use of it.

Contracts conditions and terms that cannot be “translated” in an MPEG-21-REL language are considered as well. AXMEDIS licenses will allow making a reference to the contracts’ parties and to the business and legal conditions that have to be signed. AXMEDIS partners are evaluating contracts in order to add other rights and conditions coming from contracts to AXMEDIS licenses.

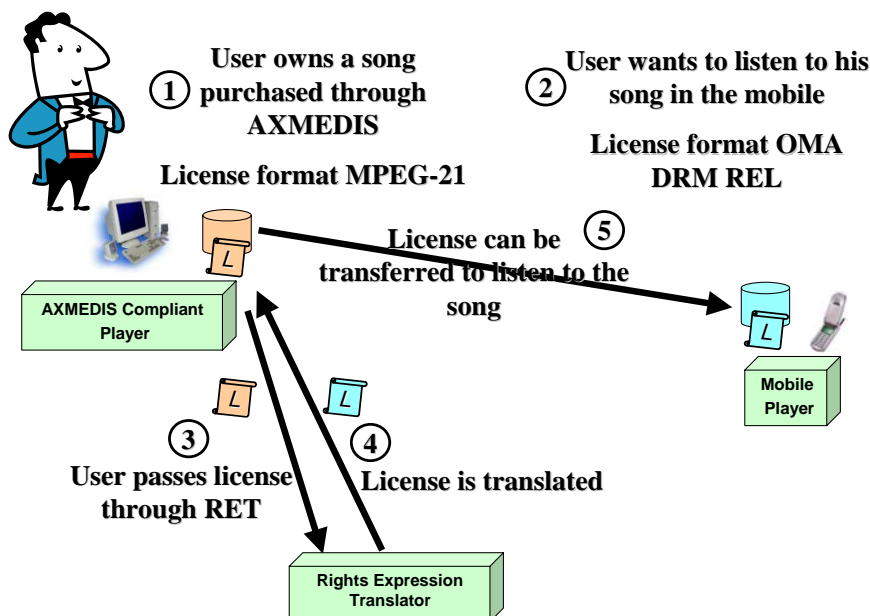
AXMEDIS license models will overcome main issues actually faced by content providers and users for the right clearance process and contracts negotiation such as the immediate identification of the right holders (through a simple query users receive available resources with relevant data) and the immediate verification of available rights (users receive the digital license associated to the requested resource). In addition the AXMEDIS reporting tools allow the content provider/owners to receive in real time the info on the rights usage and this info are also automatically delivered to relevant collecting societies.

The below figure shows the activity performed in order to obtain the above described scenario.



9.17 AXMEDIS License Translation and DRM interoperability

AXMEDIS supports MPEG-21 REL and also OMA ODRL (Open Mobile Alliance, Open Digital Rights Language) which is a largely diffused REL for the mobile environment. The native model of AXMEDIS in the PMS is the MPEG-21 REL.



AXMEDIS is an open solution, other Right Expression Languages, RELs, and models can be added. The support of several RELs gives the opportunity to link with other DRM systems and environments, which may use one or the other. The use of standardized mechanisms to provide DRM capabilities allows the connection with other proprietary solutions in an easiest way. Related to these activities, AXMEDIS is realizing tools for translating rights expressions from one language to other language (Rights Expression Translator). This allows providing the correct license for a specific environment, for instance, a license expressed in the language supported by the device.

9.18 AXMEDIS Protection Tools

In AXMEDIS, the content protection can be performed automatically (in the AXCP Rules) or manually (with AXMEDIS Editor, Protection Editor) on any kind of content, from simple digital resources to complex AXMEDIS objects that may contain nested and hierarchies of other content and/or resources and metadata.

The content protection consists of:

- changing the digital coding of content for example by using algorithms such as encryption, compression, scrambling, etc. Any other protection tool can be added by using AXMEDIS plug-in technology;
- applying the algorithms mentioned at the previous point with some parameters (such as keys) and additional information (such as the algorithm type, the size of segments, the order in which the algorithms are applied, etc.). These data are the Protection Information that are needed to unprotect the objects, and are delivered to the Players only when the needed authorization is provided on the basis of the license. AXMEDIS Protection Information is an extension of MPEG-21 IPMP model.

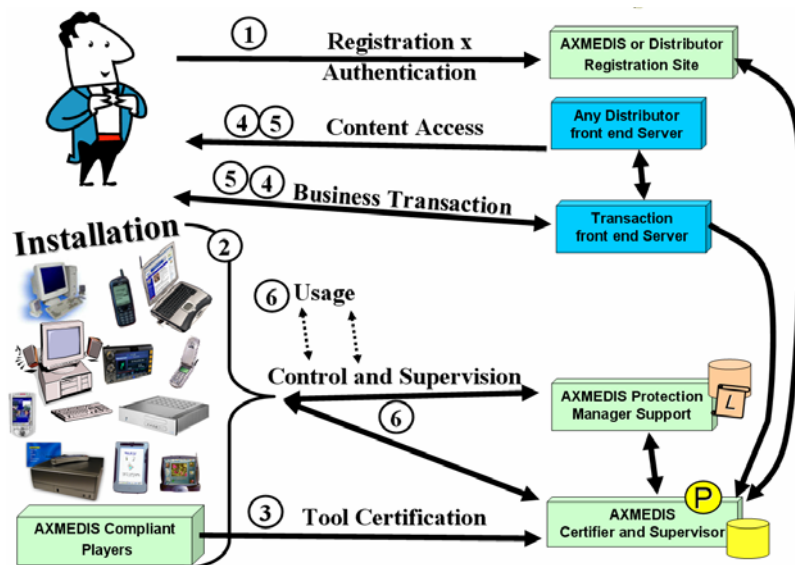
Thus the protection model of AXMEDIS is based on the combination of protection techniques together with the use of DRM technology. In this sense, the Protection Information and the License are provided to the AXMEDIS players following different paths and in different moments. This allows setting up and managing a large number of solutions for content distribution based on different transaction and business models.

9.19 AXMEDIS Certification and Supervision/Control about the rights usage

In AXMEDIS, the user credentials and tools have to be registered and certified before the effective their use. To this end the AXMEDIS Certifier and Supervisor (AXCS) allows registering:

- tools. Only AXMEDIS tools registered with an AXCS can be authorized to access and manipulate AXMEDIS contents. This activity has to be performed offline by the builders of all AXMEDIS compliant tools, such as: AXCP GRID Node, AXMEDIS Editor, AXMEDIS Player, AXEPTool;
- (1) business users and final users. It generates and assigns unique user identifiers and maintains user (not personal) data needed to determine users' role, status, credential to access the system.

Once both the user and tool have been registered, they can begin the certification process with an AXCS (3), which verifies the tool has not been compromised (during the first execution and before the tool installation (2)). With the Tools Certification a unique identifier is assigned, and certificate is delivered to the tools. The certificate contains data needed to establish protected communications when authorisations to perform actions over AXMEDIS objects are requested: in fact any action performed has to be authorised by a PMS and AXCS.



The AXCS is also responsible for:

- the generation and assignment of unique object identifiers;
- the registration of objects passing some metadata;
- keeping Protection Information related to objects eventually used in successive transactions;
- verifying consistency and integrity of any AXMEDIS tool capable of manipulating or playing objects;
- tracking every action performed on contents and storing a corresponding report called Action Log, this model is based on an extended version of MPEG-21 Event Reporting;
- providing information about list of Actions (exploited rights) performed on content to: producers, distributors, collecting societies, etc. This allows managing and producing accounting information related to the whole value chain activities;
- maintaining blacklists of blocked user, objects, devices, and tools, that contain those entities that cannot be any more used for some reasons.

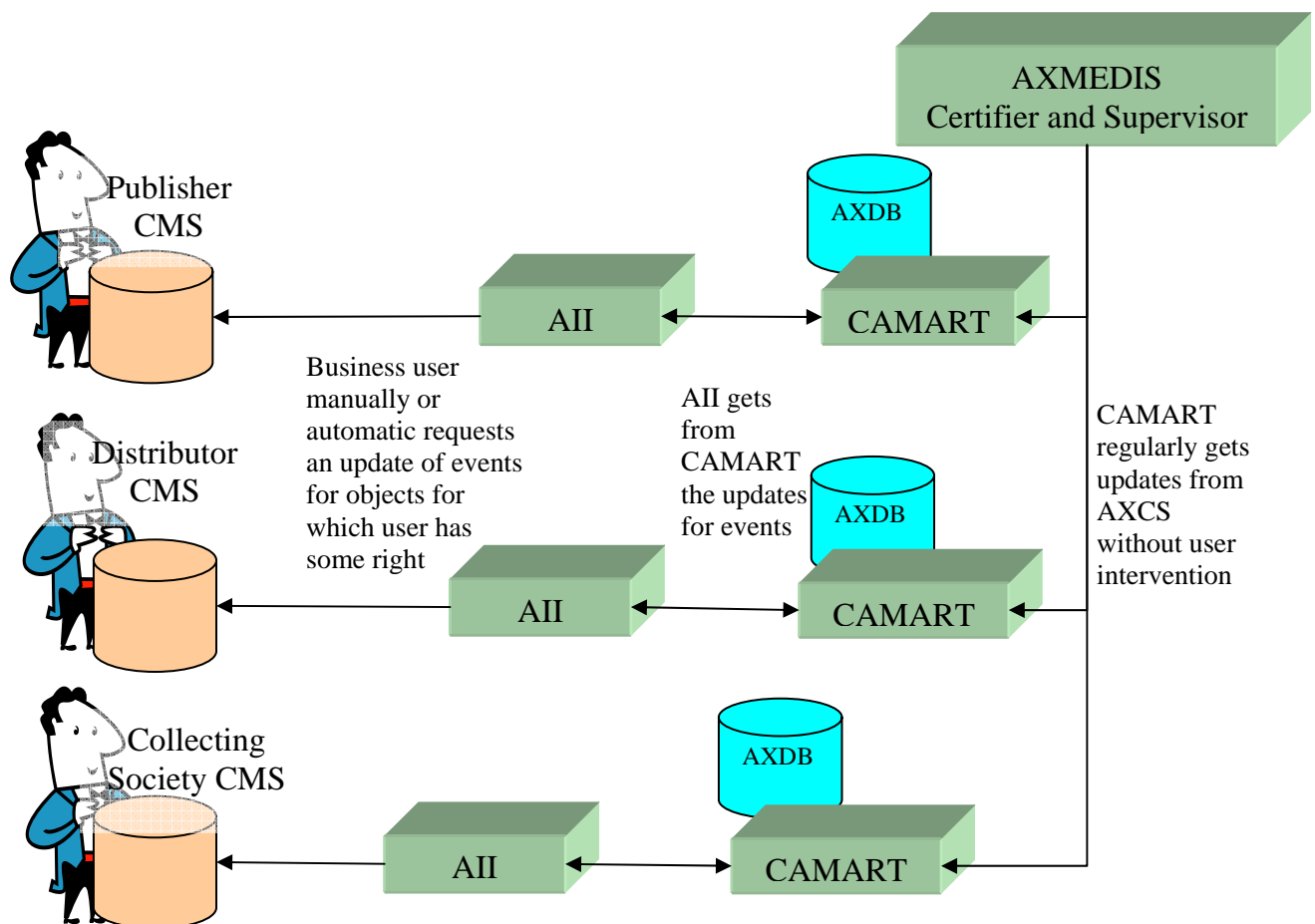
During the usage (6) the user may have acquired a license to allow playing a song. When the user is authorized, the AXMEDIS PMS contacts AXCS to inform of the authorized operation. Afterwards, all the database records regarding user actions can be checked and some analysis is performed. The verification may fail, for example, for the lack of integrity in the AXMEDIS player. This may provoke the blocking of the tool, and this action can be stored in the Action Log database of the AXCS for a further analysis.

9.20 Using the Action Logs about the exploitation of rights

The information regarding the exploitation of each right is collected in the AXCS and can be obtained from the authorized value chain actors. The access may be performed by the means of the Core Accounting Manager and Reporting Tools (CAMART) and by the Administrative Information Integrator (AII) tool.

The different business actors of the value chain are interested in getting different information and in feeding the administrative CMSs with the Actions Logs temporary stored in the AXCS. Since after a certain amount of time AXCS eliminates its older records, it is necessary to have a local AXDB to keep copy of all the logs. AXDB is automatically filled with Actions Logs by the CAMART tool.

On the other side, **AII tool** may read from CAMART the logs, and reformat them according the administrative CMS format required by the value chain actor. This process permits at the different actors of the value chain to have a precise report about the exploitation of their rights. It is a transparent solution for reporting rights exploitation and extremely useful for Collecting Societies.

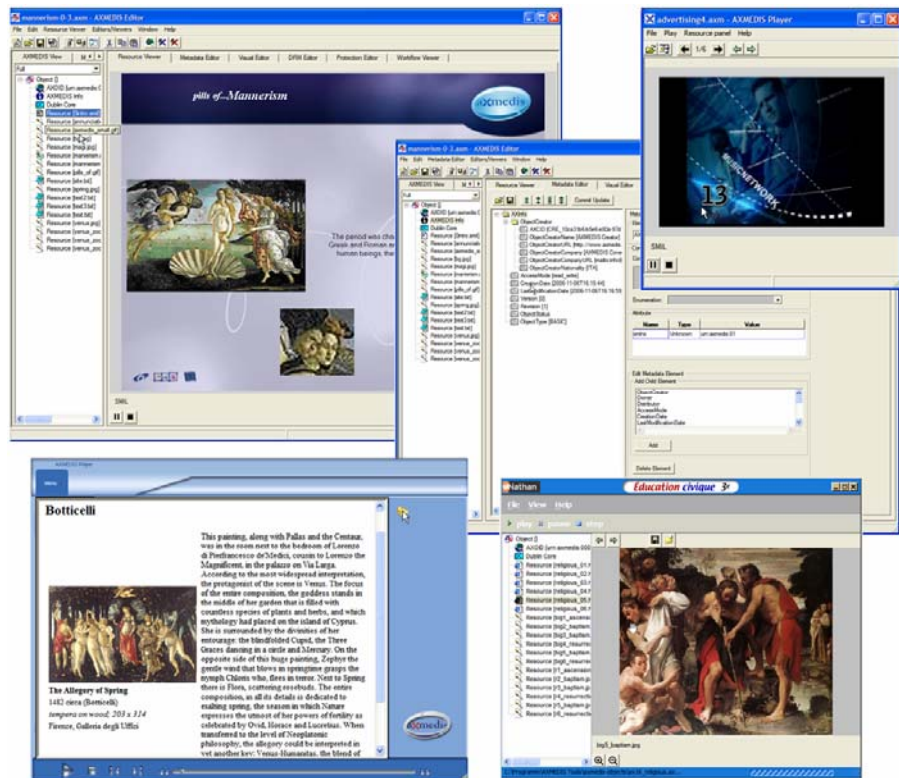


Independently of the ways and methodologies rights are granted to users (e.g. compulsory license, individual license) the Administrative Information Integrator tool provides data needed to check, verify and monitor the use of the AXMEDIS objects in conformity with the rights granted by the relevant license and with information necessary to identify right owners. When the access is performed by distributor they have also access to the information regarding the unique identification of the user that may allow them to match the exploited rights with the personal and accounting information of their customers.

9.21 AXMEDIS Players for multichannel

The AXMEDIS Players allow the end-users to play and interact with the AXMEDIS objects. The content acquisition can be performed for download, progressive download, and/or streaming. In some cases, the download is performed with other tools such as AXEPTool or AXMEDIS P2P tools or via a simple file transfer such as: FTP, operative system copy, FHTTP, etc., in other cases, the direct download, progressive download, stream is performed by the player itself in collaboration with a specific servers for distribution.

The **AXMEDIS** players are based on the so called AXMEDIS Object Manager, called AXOM. They are capable of reading and playing/executing AXMEDIS objects according to the business models chosen and the license associated with the user/device. Each new AXMEDIS player has to be registered by the builder, and each instance has to be certified by the final user to be used to access at protected content. The processes of user registration and AXMEDIS player certification are performed in a guided manner while completing the installation.



AXMEDIS players for:

- **Microsoft Windows Personal Computers** http://www.axmedis.org/documenti/view_documenti.php?doc_id=2885 for AXMEDIS objects containing HTML, SMIL and MPEG-4 and any kind of digital resources (video, audio, images, documents, etc.):
 - a complete **executable** independent tools;
 - an **Active X**: to be embedded in third-party applications to load, manage and display AXMEDIS objects, and also in HTML pages displayed inside Internet Explorer via Java Script;
 - a plug in for Mozilla browser to load, manage and display AXMEDIS objects, and also in HTML pages displayed inside browser via Java Script.
- **Apple MAC Personal Computers based on as** (in progress):
 - a complete **executable** independent tools;
 - a plug in for Mozilla Firefox browser to load, manage and display AXMEDIS objects, and also in HTML pages displayed inside Internet Explorer.
- **PDA based on Windows Mobile 5** For AXMEDIS objects containing HTML, SMIL and MPEG-4
 - http://www.axmedis.org/documenti/view_documenti.php?doc_id=3107
- **STB, Set Top Boxes**:
 - Linux based STB of MBI for AXMEDIS objects containing MPEG-2 and MPEG-4 content in downloading;
 - TEO (Telecom Lithuania) STB based on KreateL, for AXMEDIS objects containing MPEG-2 and MPEG-4 content in streaming and downloading (in progress).
- **Mobiles in pure Java** (in progress):
 - Streaming for AXMEDIS objects containing audio visual content.

9.22 AXMEDIS Player for PC based on Microsoft Windows

The AXMEDIS player for PC is capable of:

- Loading and playing protected and non protected AXMEDIS objects. The AXMEDIS objects may contain any kind of digital resources. Those that can be directly played the AXMEDIS PC player can be: images (almost any format), video in almost any format, document in PDF, PPT, XLS, PS, etc..(in some cases the play is performed by using specific Active X), audio files (almost any format), animations, etc. And Presentation files gluing the content file together such as: SMIL, HTML and MPEG-4. The player is capable to distinguish from links towards internal resources and those referring to external file via URI;
- Playing of timed resources (video and audio) with functionalities of STOP, PLAY, PAUSE, fast forward, fast backward, etc.
- Playing of visual resources with functionalities (for video and images) of ZOOM, resize, etc.
- Supporting full AXMEDIS DRM and protection, including reporting and Action Logs;
- Showing the AXMEDIS hierarchy and as well as the MPEG-21 hierarchy;
- Navigating into the AXMEDIS/MPEG-21 structure and presentation layers included. Presentation files gluing the content file together such as: SMIL, and HTML, and creating connected scenarios among the several resources/objects that can be included into an AXMEDIS object. They may in turn contain styles and java scripts;
- Showing full details of all Metadata and descriptors included;
- Supporting AXMEDIS plug in technology for new processing tools and AXMEDIS protection tools;
- Supporting inclusion of FLASH animations.



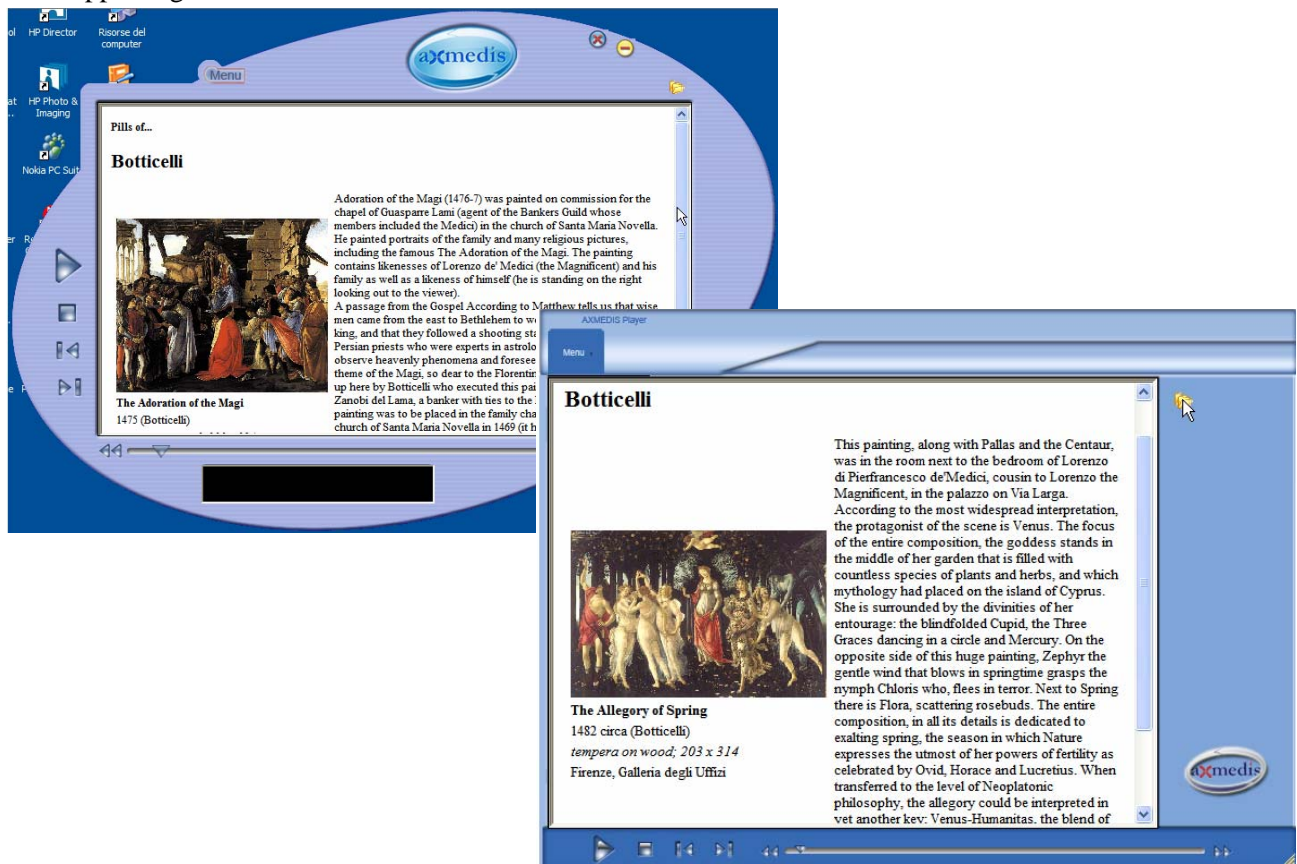
These AXMEDIS players can be downloaded as included into the:

- AXMEDIS tools package: http://www.axmedis.org/documenti/view_documento.php?doc_id=2885
- AXMEDIS player package: http://www.axmedis.org/documenti/view_documento.php?doc_id=2884.

9.23 AXMEDIS Player with custom Skin for PC based on Microsoft Windows

The AXMEDIS player with SKIN for PC is capable of:

- Support any custom made SKIN of any form from oval to classical media player look and feel see the example in the next image.
- Loading and playing protected and non protected AXMEDIS objects. The AXMEDIS objects may contain any kind of digital resources. Those that can be directly played the AXMEDIS PC player can be: images (almost any format), video in almost any format, document in PDF, PPT, XLS, PS, etc..(in some cases the play is performed by using specific Active X), audio files (almost any format), animations, etc. And Presentation files gluing the content file together such as: SMIL, HTML and MPEG-4. The player is capable to distinguish from links towards internal resources and those referring to external file via URI;
- Playing of timed resources (video and audio) with functionalities of STOP, PLAY, PAUSE, fast forward, fast backward, etc.
- Playing of visual resources with functionalities (for video and images) of ZOOM, resize, etc.
- Supporting full AXMEDIS DRM and protection, including reporting and Action Logs;
- Showing the AXMEDIS hierarchy and as well as the MPEG-21 hierarchy;
- Navigating into the AXMEDIS/MPEG-21 structure and presentation layers included. Presentation files gluing the content file together such as: SMIL, and HTML, and creating connected scenarios among the several resources/objects that can be included into an AXMEDIS object. They may in turn contain styles and java scripts;
- Showing full details of all Metadata and descriptors included;
- Supporting AXMEDIS plug in technology for new processing tools and AXMEDIS protection tools;
- Supporting inclusion of FLASH animations.



These AXMEDIS players can be downloaded as included into the:

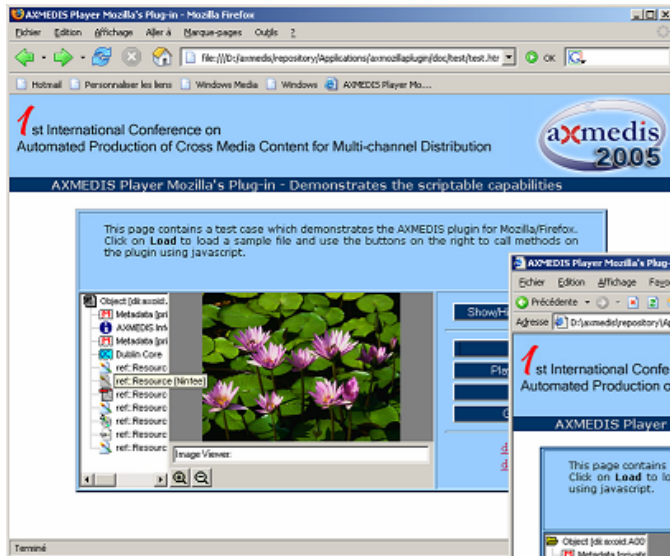
- AXMEDIS tools package: http://www.axmedis.org/documenti/view_documento.php?doc_id=2885
- AXMEDIS player package: http://www.axmedis.org/documenti/view_documento.php?doc_id=2884

9.24 AXMEDIS Player as Active X

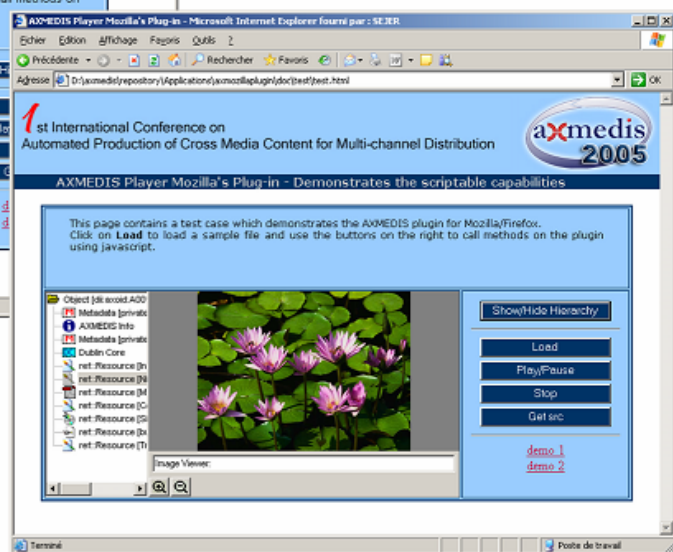
The AXMEDIS PC player realized as an Active X can be used to:

- create in short time a customized AXMEDIS player using .NET framework tools (see for example the generic AXMEDIS player produced by DSI and the player produced by Bordas and Nathan), and
- enforce the AXMEDIS player into HTML pages with JavaScript

These players have the same features of the above described AXMEDIS Player for PC based on Microsoft Windows.

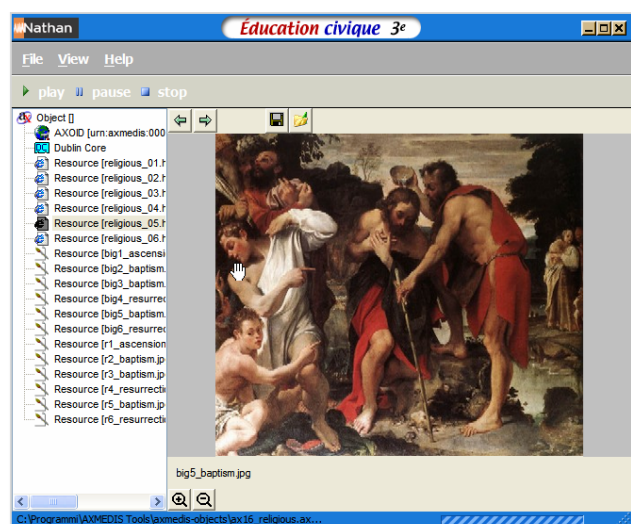
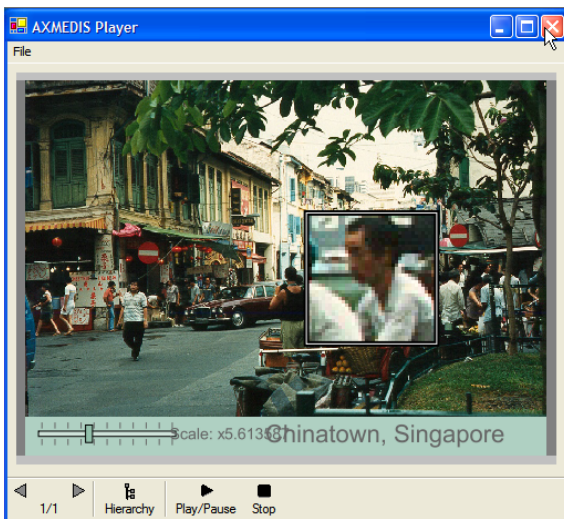


The same page can be displayed on Mozilla...



... and Internet Explorer

HTML page playing AXMEDIS object on both Internet Explorer and Mozilla Firefox



These AXMEDIS players can be downloaded as included into the:

- AXMEDIS tools package: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2885
- AXMEDIS player package: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2884

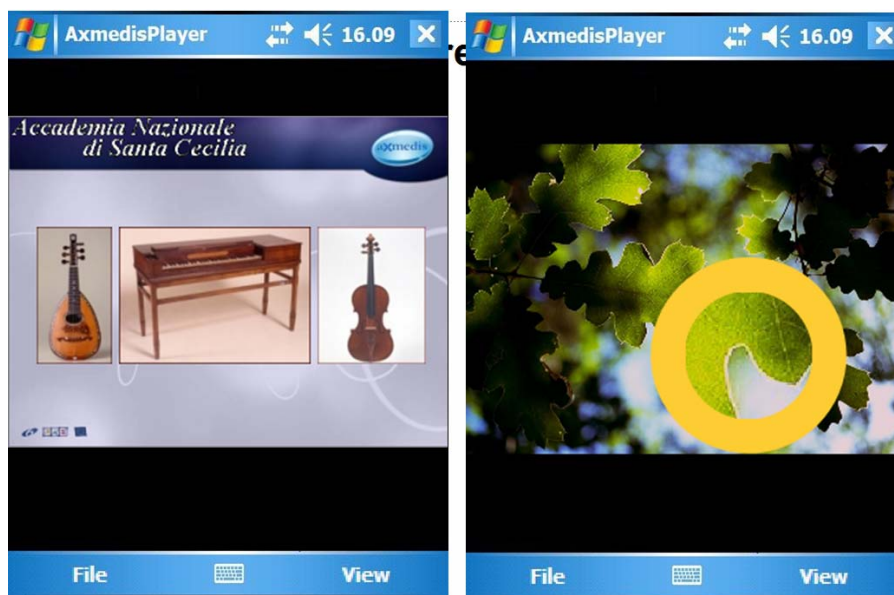
9.25 AXMEDIS PDA Player

The AXMEDIS player for PDA is capable of:

- Loading and playing protected and non protected AXMEDIS objects. The AXMEDIS objects may contain digital resources including those that can be played by:
 - SMIL player with audio, video and text;
 - HTML player with text, images, and audio;
 - MPEG-4 player with images, audio, video and interactivity in BIFS supported.

The player is capable to distinguish from links towards internal resources and those referring to external file via URI;

- Playing of timed resources (video and audio) with functionalities of STOP, PLAY, PAUSE, fast forward, fast backward, etc.
- Playing of visual resources with functionalities (for video and images) of ZOOM, resize, etc.
- Supporting full AXMEDIS DRM and protection, including reporting and Action Logs;
- Showing some Metadata.



Two examples in which the AXMEDIS PDA player is used to show AXMEDIS objects containing HTML/SMIL objects (on the left), and an MPEG-4 interactive content based on BIFS (on the right).

- AXMEDIS PDA player for Windows Mobiles 5: It is capable to play AXMEDIS objects based on SMIL, HTML, video, audio, MPEG-4 files, etc. AXMEDIS PDA player for AXMEDIS MPEG-21 content including resources with presentations layer based on MPEG-4, HTML and SMIL Unzip the file, copy the CAB file and execute it on the PDA
 - http://www.axmedis.org/documenti/view_documenti.php?doc_id=3107

9.26 AXMEDIS Mobile Player

The AXMEDIS player for Mobiles is going to be published soon and it based on Java and it is capable of:

- Receiving in streaming AXMEDIS objects
- Playing protected and non protected AXMEDIS objects. The AXMEDIS objects may contain digital resources including those that can be played by simple SMIL representing menus to start other play of audio, video and text. The player is capable to distinguish from links towards internal resources and those referring to external file via URI;
- Playing of timed resources (video and audio) with functionalities of STOP, PLAY, PAUSE, fast forward, fast backward, etc.
- Supporting full AXMEDIS DRM and protection, including reporting and Action Logs;
- Showing some Metadata.

9.27 AXMEDIS STB, Set Top Box, Decoders

The AXMEDIS STB (Set Top Box) consists in a device for receiving AXMEDIS content and playing the resources included on a TV set. Two kind of STB are going to be developed. The first one from MBI is almost completed and can be tested. These STB may include HD recording capabilities and/or can be simple devices/decoders for receiving in streaming or downloading the AXMEDIS content.

The AXMEDIS players for STB are of two types:

- Linux based on STB developed by MBI partner (creator of Open Sky decoders) and suitable for AXMEDIS objects containing MPEG-2 and MPEG-4 content received in downloading;
- based on Kreatel STB developed by TEO (Telecom Lithuania) partner, to play AXMEDIS objects containing MPEG-2 and MPEG-4 content in streaming and downloading (in progress).

The MBI AXMEDIS players for STB are capable of:

- Receiving in streaming/downloading AXMEDIS objects;
- Playing protected and non protected AXMEDIS objects.
- Playing of timed resources (video and audio) with functionalities of STOP, PLAY, PAUSE, fast forward, fast backward, etc.
- Supporting full AXMEDIS DRM and protection, including reporting and Action Logs;
- Showing some Metadata.



The STB of MBI has been built by integrating the AXOM module of the AXMEDIS framework in their Set Top Box. The AXOM module is accessible in source code from the AXMEDIS framework.

9.28 Content Posting Tool, for Final User content production/publication/DRM

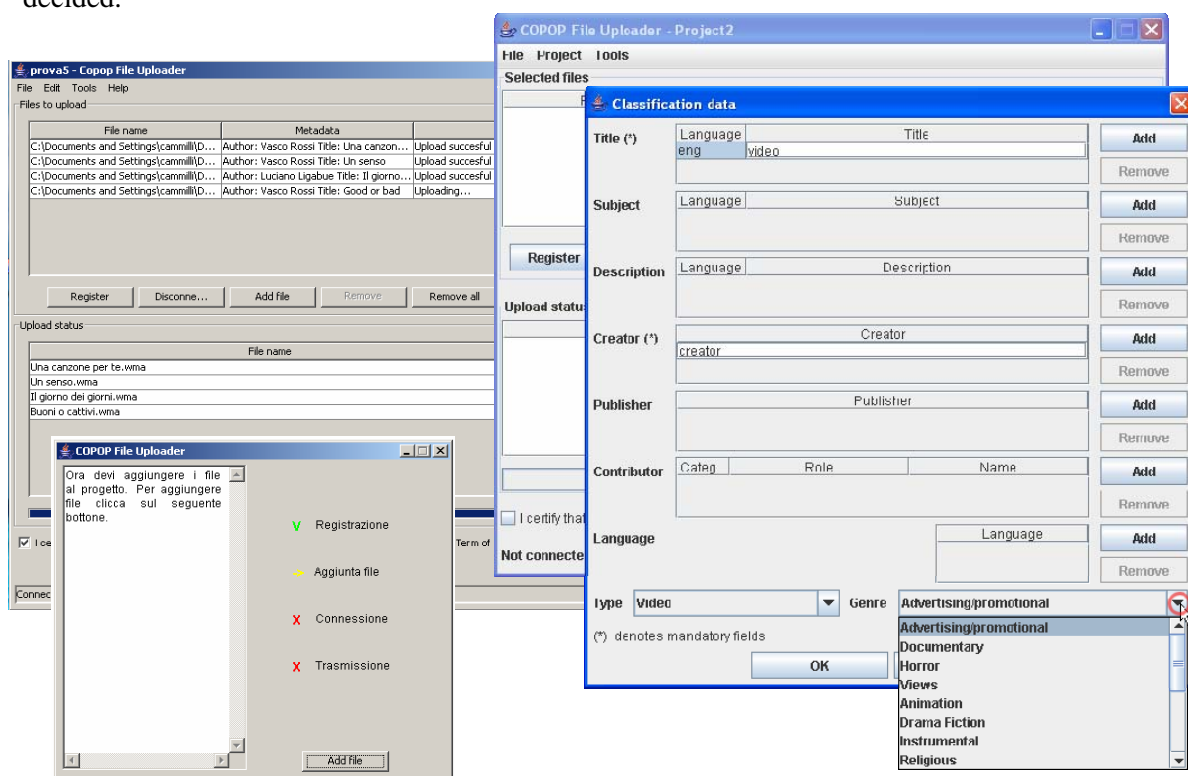
By using the AXMEDIS factory tools the content can be professionally produced, packaged and published by using AXMEDIS editor and AXMEDIS Content Processing Tools.

On the other hand, the Final Users are becoming every day more interested in becoming also publishers of content to see eventual possibilities of entering in a business and/to to share this kind of collective experience. Examples of this trend and strong interests are services set up by YouTube, Video Google, etc.

In order to provide support for the direct production of content from the Final Users a set of tools have been created with the support of SIAE (the major Collecting Society of Italy). The Final User in this content can be small authors, editors, and producers. In particular, an effective set of tools for Content Posting have been created. The simple one is given in the hands of the Final Users and it is called COPOP Client (Content Posting Portal). The COPOP Client establishes an SSL connection with the COPOP Server and it can be used for the upload of digital resources to an AXMEDIS content production factory. This allows to activate scripts for direct production, protection and publication of content on multichannel.

The Final User can:

- adopt the COPOP client tool and related service to reduce the costs of producing, protecting and publishing content on different channels;
- adopt the COPOP client tool to shortening time for publishing content on different channels;
- decide how many metadata include into the content posted;
- define its own DRM rules according to several business model offered, including prices, etc.;
- monitor on the COPOP server the status of the its published content according to the DRM model decided.



The COPOP service can be connected to any AXMEDIS distribution channel, automating the publication towards P2P, satellite data broadcast, mobiles, etc. etc., including processing and adaptation for the different channels and devices also supporting DRM and licensing. SIAE Trial presentation:

- http://www.axmedis.org/documenti/view_documenti.php?doc_id=2922
- http://www.axmedis.org/documenti/view_documenti.php?doc_id=2923

Please stay tuned on the AXMEDIS portal since this service will be activated soon for final users interested in contributing to AXMEDIS content distribution via P2P and other towards other AXMEDIS channels.

9.29 AXMEDIS Programme and Publication Tools

AXMEDIS Programme and Publication (P&P) Area is the connection in the AXMEDIS framework between the AXMEDIS Factory and the Distributors. This means that AXMEDIS digital multimedia objects can be delivered to AXMEDIS players using the P&P tools with the correct attributes such as format, size, etc. depending on the distribution channel profile.

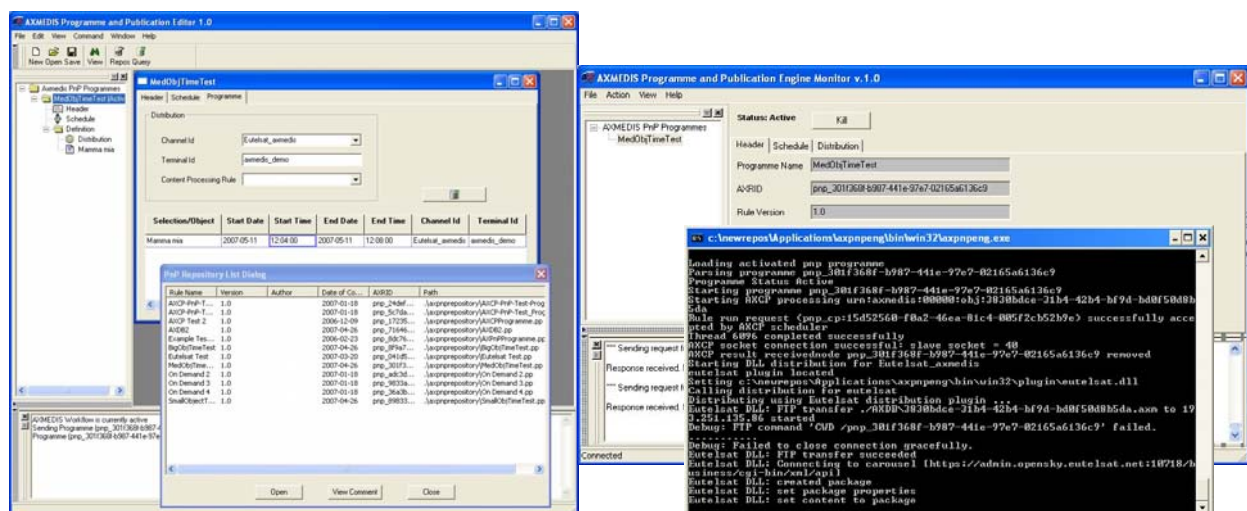
The P&P tools are supporting two concepts for the distribution of the AXMEDIS content containing digital multimedia objects (images, doc, txt, video, game, application, file, audio, etc) over various channels (satellite to kiosk, satellite to STB, mobile, PC etc.) to terminals of various specifications. The two concepts are:

- (i) Requesting content or objects On-demand where users can search on their device and the selected object is passed through the P&P Area for distribution, and
- (ii) Sending content or objects over specified distribution channels with distribution details such as scheduled delivery date and time, content production/adaptation (if any), etc. specified in a distribution programme (P&P Programme).

The P&P tools include the P&P Editor and the P&P Engine. The P&P Editor provides an interface for a user such as a programme manager to create a P&P Programme. This includes providing functionalities not only for creating, editing and saving programmes, but also where AXMEDIS Objects can be searched and selected to add into a P&P Programme. After selecting the Objects, the user can specify the distribution details including the scheduling information (e.g. start distribution date and time, end distribution date and time) and the distribution channel for each object to be distributed. The state of the art occurs once a P&P Programme has been activated (set for publishing) and delivered to the P&P Engine for distribution. The P&P Engine begins the automated process by checking whether the Object can be delivered as required for a specific channel or terminal. If not, the AXMEDIS Object selected for distribution is automatically adapted using the AXCP factory tool (see section 9.10 AXMEDIS Content Processing). The newly adapted object with the correct attributes for the distribution channel is then retrieved from the AXMEDIS database and delivered to the distribution server(s). In this way the received digital objects are correctly formatted which is a seamless process for the user.

For On-Demand requests of an object, the same process occurs with no time delay. The engine receives the distribution profile and client profile from the On-Demand tool and uses this information to transform digital objects (if required) and distribute as soon as the object is available.

In summary, the P&P Area allows the users (distributors, programme managers, etc) to distribute and/or receive AXMEDIS objects with no concerns on the details of the object such as size, compression, format, etc.



left) P&P Editor; right) P&P Engine and P&P Engine Monitor.

9.30 AXMEDIS Workflow

The AXMEDIS Workflow Management Systems (WfMS) satisfies the needs of multimedia content creators that would harmonize and coordinate all the activities performed in the Content factory including automatic content production and processing, manual content manipulation, movement of content files, publication, downloading, and database management, etc. It allows support the harmonization of these activities when they are performed on AXMEDIS factory geographically located.

For this purpose AXMEDIS Workflow provides integration and control of: AXMEDIS Editors, AXMEDIS Rule Editor, AXCP Scheduler, AXMEDIS Engine in the GRID Node, Program and Publications Engine, and AXMEDIS Query Support. The AXMEDIS Workflow is going to support all the actions that are typically to be performed for content locating, retrieving, authoring, formatting, rendering, packaging, bundling and distribution.

Through the WfMS User Interface users are able to log-in, interactively produce and set up their own workflow process instances by means of a graphical interface for programming and to see all the work items in which they are involved or committed and, by accessing one of these work items, are able to perform the actions required on multimedia objects e.g. launching the required tools for content authoring. Thus AXMEDIS Workflow helps to automate and thus reduce the cost of inter/intra-factory content production and its P2P, B2C and B2B distribution for all stakeholders.

For a streamlined integration with open and flexible interfaces to third party WfMSs, the AXMEDIS

WfMS provides uniform integration channels comprising dedicated Request and Response Gateways, Adaptors and Plug-ins for all AXMEDIS tools and Engines as illustrated below. This integration framework exploits Web Services and XML Technology to allow seamless interfacing to server side components with specified APIs regardless of their language, platform or location.

The present version of AXMEDIS WfMS is based on an open-source workflow (Openflow) running on the Microsoft Windows XP Operating System; however clients from various platforms including Linux, Mac/OS will be supported. The Web Services needed to interface with the WfMS can be easily developed and customized. For example, by using the open-source AXIS product with JAVA application server (Apache Tomcat, JBoss) or in Microsoft environment they can be developed using IIS web server and .Net Framework.

Activities

Activity	Kind	JoinSplit	Application name	Push Application	Start mode	Finish mode	Subflow process
<input type="checkbox"/> Begin	standard	and			Manual	Manual	
<input type="checkbox"/> End	standard	and			Manual	Manual	
<input type="checkbox"/> myactiv	standard	and		myapp	Automatic	Manual	

Transitions

Transition	Condition	From	To
<input type="checkbox"/> Begin_myactiv	python.instance.some_property=='value'	Begin	myactiv
<input type="checkbox"/> myactiv_End	python.instance.some_property=='value'	myactiv	End

10 Examples of AXMEDIS Framework and tool Exploitation

By using AXMEDIS tools and technology, the content Distributors may realize a large set of content distribution services: Internet, satellite and terrestrial broadcast, mobile, towards: PC, STB, i-TV, mobiles, PDAs, etc. In some cases, the distributors may be also interested in having/exploiting in their plants some components of the AXMEDIS factory such as an instance of the AXMEDIS Database to make queries, license editor to produce licenses, AXCP for content adaptation and/or to protect content in massive manner, for content production on demand, etc. In other cases, they can delegate these actions to other parties or to external web services.

Some examples about the usage of AXMEDIS tools to set up solutions for content distribution are reported in this section. In some of the examples provided, the Distributors may be interested in establishing a connection with the AXMEDIS Certifier and Supervisor, AXCS, for obtaining reports about the rights exploitation or for getting statistical information. In other cases, they may prefer to use their logs and this information is only accessed by other value chain actors for verifying the effective correctness and exploited rights. According to the exposed flexibility, the Distributors with AXMEDIS may decide to change configuration and business model at reasonable costs, and many different models can be supported by the same distribution channel or in more of them.

In the following subsections: some examples are provided related to the demonstrators that in part are already accessible while other will be set up and make accessible for final users from the September 2007 to arrive at their completion for the begin of the 2008:

- **Content Distribution via Internet toward PC (TISCALI case):**
 - Direct download from a portal, http links
 - P2P content sharing of content via AXMEDIA tool;
 - AXMEDIS players for PC and MAC
- **Content Distribution toward PDAs and mobiles from (ILABS cases):**
 - Local Distributor kiosks, local communication by means of WiFi;
 - GPRS or UMTS communication;
 - AXMEDIS players for PDA and Mobiles
- **Content Distribution via satellite data broadcast (DVB-S) toward (EUTELSAT Case):**
 - Local Distributors for B2B, for updating their archive (ILABS Case);
 - PC of final users (UNIVLEEDS Case);
 - AXMEDIS compliant Set Top Boxes of final users (MBI STB and Case).
 - Automatic production of Satellite distribution programme
- **Content sharing among archives (ANSC Case) managed by Local Distributors with P2P AXEPTool and from them to**
 - Other Archives connected with P2P AXEPTools
 - Final user connected with AXMEDIA tools
 - PC connected and located in the archive;
 - PDA connected to the Local Distributor via WiFi.
 - AXMEDIS PDA player with SMIL, HTML and MPEG-4
- **Content distribution to licensing domains via DVB-T and P2P integration of metadata and additional information (BBC case with SDAE support for domain):**
 - Domain managed by a PC to support the home content management, a sort of media center.
 - The PC is endowed of a DVB-T card and connection with Internet with some ADSL;
 - The AXMEDIS client creates added value content for the final user taking DVB-T recording and added value content from P2P at each recording of TV programme
 - License is produced automatically only for the domain usage.
 - The same content can be taken for general usage and limited to the domain from the P2P.
- **Content Distribution toward mobiles based on OMA (Telecom Italia Case)**
 - AXMEDIS Content processing used for producing OMA packages and licenses
 - AXMEDIS content can be distributed on other AXMEDIS channels as well
- **Video on Demand, VOD, distribution to STB (TEO, Telecom Lithuania Case)**

- Content produced on the AXMEDIS factory with AXCP
 - Content distributed via Streaming in MPEG-2 TS
 - Licenses produced on demand
 - AXMEDIS Player as STBs based on Kreatel with AXMEDIS tools inside
- **Video on Demand, VOD, distribution to PC** (ELION, Telecom Estonia Case)
 - Content produced on the AXMEDIS factory with AXCP
 - Content distributed via Internet: downloading and/or P2P
 - Licenses produced on demand
 - AXMEDIS Player for PC
- **Multichannel and multi/interoperable DRM distribution** (general case)
 - AXMEDIS content processing for managing the back office content production in MPEG-21/AXMEDIS format, OMA format and Windows Media
 - Players based on AXMEDIS PC players, OMA mobile players and PC players
- **Content Enrichment, automated production and distribution** (VARIAZIONI Case)
 - VARIAZIONI portal with several institutions
 - AXMEDIS content processing tools for producing enriched content at new iteration with DRM
 - Licensing new content for content enrichment
 - AXMEDIS players integrated into HTML pages
 - AXMEDIS players for PC and MAC

In all these cases, the major AXMEDIS tools, features and tools used are:

- **Automated production** of AXMEDIS objects:
 - AXCP tools, AXCP editor,
 - AXCP Scheduler
 - AXCP nodes
 - Set of AXCP plug ins for content processing
- **Production** of AXMEDIS objects and their protection:
 - AXMEDIS Editors
 - Metadata mapping and manipulation
 - Algorithm for extracting fingerprint, descriptors, etc.
 - P2P tools such as AXEPTool and AXMEDIA
 - Programme and publication tools
- **Production and posting of licenses, protection**
 - DRM editor, Protection Editor and AXCP tools
 - PMS for posting licenses, AXCS for posting protection information
- **Registration of users** and AXMEDIS players
 - AXCS and AXMEDIS Registration Portal
 - AXMEDIS Certification Authority
- **DRM and Control of rights** exploitation with
 - AXMEDIS PMS and AXCS
- **DRM Reporting** to value chain actors the Action Logs about the exploitation of rights
 - AXCS, CAMART, and AII
- **AXMEDIS Players:**
 - PC players
 - PDA players
 - STB players
 - Mobile Player

In the following subsections, some scenarios and success stories are provided as simplifications in order to make them direct accessible and understandable to all. For additional details please refer to the AXMEDIS Framework Specification that can be obtained from the portal and that also include the specification of the distribution scenarios and success stories presented in this document.

10.1 Core Accounting manager and Reporting Tool CAMART and Administrative Information Integrator

Main purposes of Core Accounting manager and Reporting Tool (CAMART) is strictly bound with database for logs (provided by AXCS) since it has to collect information regarding the B2B activities and B2C actions. AXCS will not store forever its logs and therefore it is necessary for CAMART to gather time by time such logs and store locally in the AXMEDIS database. Such information will be collected on scheduled time interval and CAMART will act as a client of the AXCS Reporting Web Service.

AXMEDIS system is scalable and therefore we have to deal with the fact that some installation can have AXDB, AXCS and other supporting tools on different machines, while others can be less distributed due to a lesser need for speed or storage capacity.

The core accounting manager is a sort of Client side of the bridge between the AXDB and the AXCS databases in order to allow AXCS to be independent by the database. The server side in the AXCS is the Web Service: AXMEDIS Reporting Web Service. The CAMART can be interpreted as a part of the AXMEDIS Database Interface, since is the part of the system that allows writing data related to Action-Logs into the AXMEDIS DB.



Administrative Information integrator is a critical part of the AXMEDIS system since it is the real bridge between the AXMEDIS world and the world of company's CMS and CRM for taking in account administrative and legal aspects (such reclaim for payment not done and so on). Main purposes of this component is to operate in a dual manner: used for polling information from AXMEDIS system when needed by distributor for example, or used for pushing information in the CMS as soon as they

are available for example in the case of collecting societies. The AII can also completely remotely managed by a Web Service that offers all the functionalities guaranteed by the web application.

The operating mode is determined by accounting people during the installation/configuration of the system when it will be established whose fields have to be exported from the DB to the CMS and the frequency of exporting. When a frequency is set, the Administrative Information Integrator will work in push mode, pushing information in the CMS import area, otherwise it operates in polling mode by starting the update in the CMS by a link to a web page.

The role of Core Accounting manager and Reporting Tool (CAMART) for Statistics is strictly bound with database for logs (provided by AXCS) since it has to gather information from AXMEDIS Certifier and Supervisor about Action Log and provide them to the user via web page or web service interface.

By using this demonstrator you can:

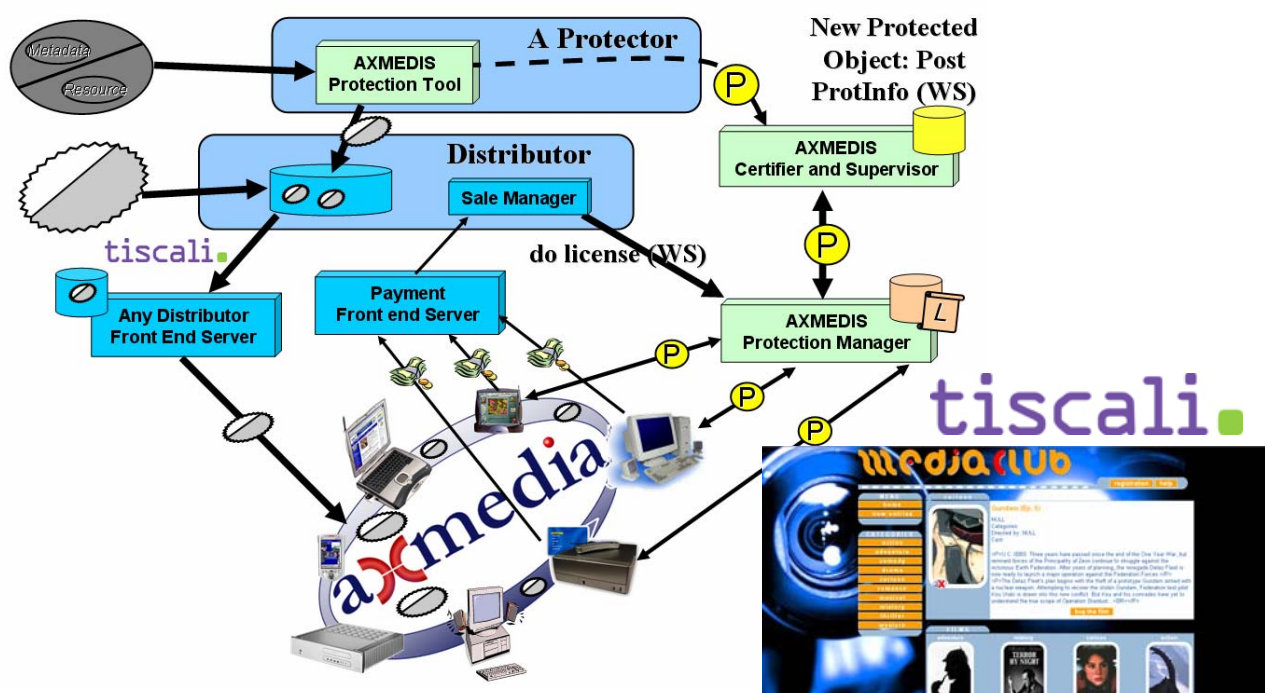
- Get logs coming from AXCS web service
- Organize such logs in the internal database of the factory
- Generate internal XML format in polling mode
- Generate the XML format provided by one of the partners according to the specification and publishing at a predefined time frequency the resulting XML in an ftp directory or file path
- Generate also in polling mode an XML format that is transformed according to the profiled XSLT.
- Generate top-bottom ten on demand for statistics.
- Use a web service for gathering statistics instead of the GUI only
- Use a Web service to remotely control AII completely in order to be able to automate log collection

10.2 Distribution on Internet, the TISCALI demonstrator

Distribution of AXMEDIS content via Internet from TISCALI portals. This demonstrator for the exploitation of AXMEDIS tools presents the following features:

http://www.axmedis.org/documenti/view_documenti.php?doc_id=2951

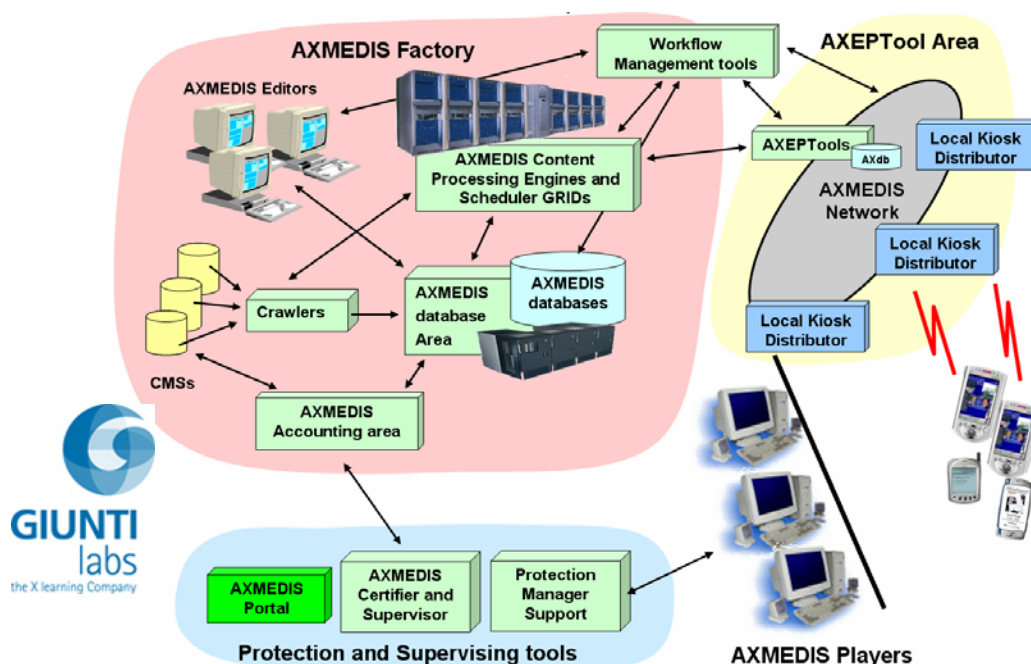
- B2C distribution and among final users via AXMEDIA tools
- AXMEDIS objects with Video and Audio Files and related metadata
- The AXMEDIS Objects are
 - Initially put in the P2P AXMEDIA by TISCALI;
 - shared among consumers with AXMEDIA Tool a P2P tool;
 - Visualized and played on AXMEDIS players free downloaded from their portal.
- Protection Information not in the object
 - Produced with the AXCP with an automatic massive processing of objects, with the protection tool
 - Automatically Posted in the AXCS by the Protection Tool
- License is produced on the fly when an AXMEDIS object is bought by clicking on the TISCALI payment front end server portal:
 - Many other business models, monthly rate, pay per play with payment on the accounting, etc.
- License allows
 - Content download and sharing on AXMEDIA peers, content copy
 - Content play
 - Content Adaptation
 - Content Migration on other channels including P2P
 - Content Migration on any other AXMEDIS terminal
 - Other rights according to the content type
- The users operates mainly on PC and have perform the registration of
 - themselves on an AXMEDIS user registration portal
 - any AXMEDIS player tool they would use, mainly on PC and Media Centers
- TISCALI, the distributor collects from the DRM servers (PMS and AXCS) the report with:
 - Details of all the exploited rights which can be used to monitor and/or to prepare the bill to the final users according to the business models adopted.



10.3 Distribution on PDAs and mobiles, the ILABS demonstrator

This demonstrator of AXMEDIS tools capabilities has been designed within a well defined and specific context (cultural heritage and edutainment) and presents the following features:

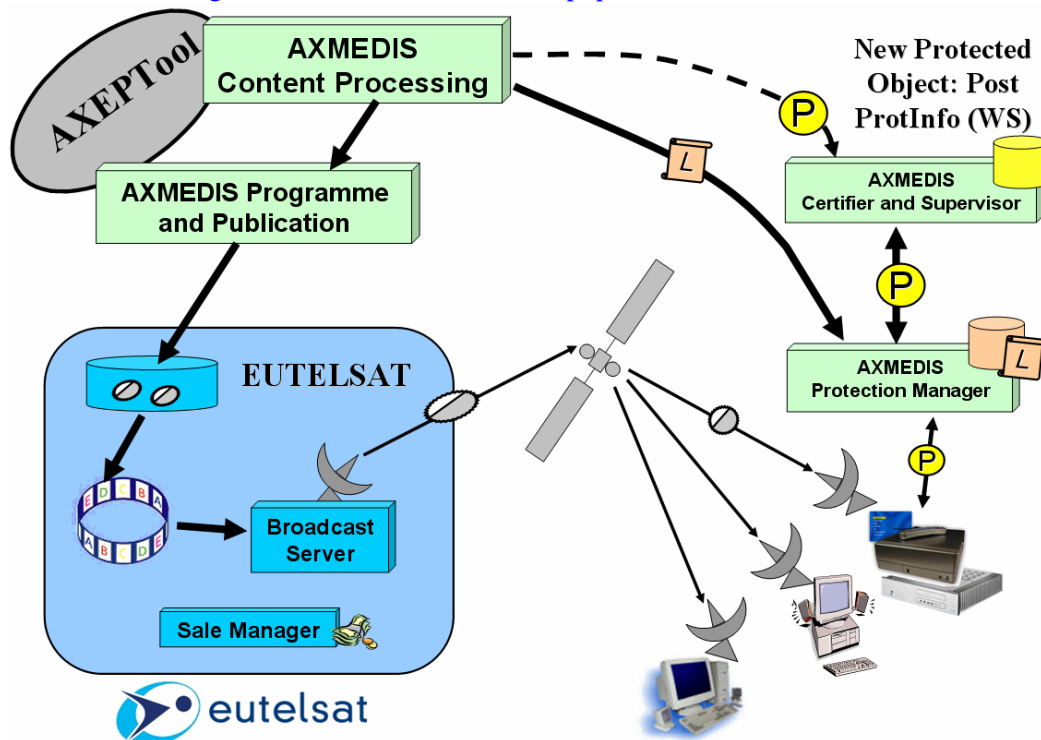
- A combination of B2B and B2C distribution, where:
 - B2B distribution is achieved on IP and satellite (in data broadcast mode) for ensuring proper Kiosk Distributors feeding
 - B2C distribution from Kiosk Distributor to visitors/customers connected to the local network (for example in an archive or library), and/or via WiFi towards mobile phones and PDAs.
 - B2C distribution from a Distributor toward mobile connected in GPRS or UMTS
- AXMEDIS objects specifically made via aggregation and adaptation of content and focused on
 - Educational and cultural content
 - Comprising Text, images, audio, animations, etc.
- Protection Information external to the object and produced either via AXCP thanks to an automatic massive processing of objects, or via the protection tool and automatically Posted in the AXCS by the Protection Tool
 - Other business models, monthly rate, pay per play with payment on the accounting, etc.
- License produced on the fly whenever an AXMEDIS object is bought. The license allows:
 - Content play, Content print
 - Content Adaptation needed for distribution (this is an internal process and such grant is not provided to the end user that can only use the object but not modify it)
 - Content Migration on any other AXMEDIS terminal (only in some cases, and in particular when no further processing is needed)
- The AXMEDIS Objects may be visualized and played on AXMEDIS players provided they are for free usage or that the related license is acquired, while they can be freely downloaded in all cases.
- The users have operate mainly on terminals and PDA and possibly also on some selected mobiles .They have to perform the registration both:
 - as users (on an AXMEDIS portal) and of
 - any AXMEDIS player / tool they would use
- ILABS, the distributor collects from the DRM servers (PMS and AXCS) the report with:
 - Details of all the exploited rights which can be used to monitor and/or to prepare the bill to the final users according to the business models adopted.
- distribution towards mobiles: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2945
- Distrbution to PDA via Kiosks: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2944



10.4 Distribution via Satellite data broadcast, the EUTELSAT Demonstrator

This AXMEDIS content distribution via Satellite data broadcast for the exploitation of AXMEDIS tools presents the following features:

- B2B and B2C distribution via satellite data broadcast for feeding one of the following devices:
 - Final User PC endowed of an AXMEDIS player
 - Local Distributor Server or Kiosk to redistribute the content towards AXMEDIS mobile players
 - AXMEDIS compliant Set Top Box, STB
 - AXMEDIS objects with
 - Any kind of content type subject, from educational to recreational
 - Mostly video and audio, but also images, documents
 - Limitations on the content type depend on the AXMEDIS player used.
 - Protection Information external to the object and produced with the AXCP with an automatic massive processing of objects, with the protection tool and automatically posted in the AXCS by the Protection Tool. Any other business models, monthly rate, pay per play with payment on the accounting, etc.
 - License produced on the fly whenever an AXMEDIS Object is bought. The license allows:
 - Content play
 - Content migration on any other AXMEDIS terminal (only in some cases)
 - Other rights according to the content type
 - The AXMEDIS Objects may be
 - Visualized and played on AXMEDIS players (free downloaded), or
 - on AXMEDIS compliant Set Top Box, STB
 - The users mainly operate on PC or on STB, and have to perform the registration of:
 - as users (on an AXMEDIS portal) and of
 - any AXMEDIS player / tool they would use.
 - the distributor collects from the DRM servers (PMS and AXCS) the report with:
 - Details of all the exploited rights which can be used to monitor and/or to prepare the bill to the final users according to the business models adopted.
 - Distribution via satellite data broadcast:
- http://www.axmedis.org/documenti/view_documenti.php?doc_id=2954



10.5 Content Sharing among Archives, the ANSC case

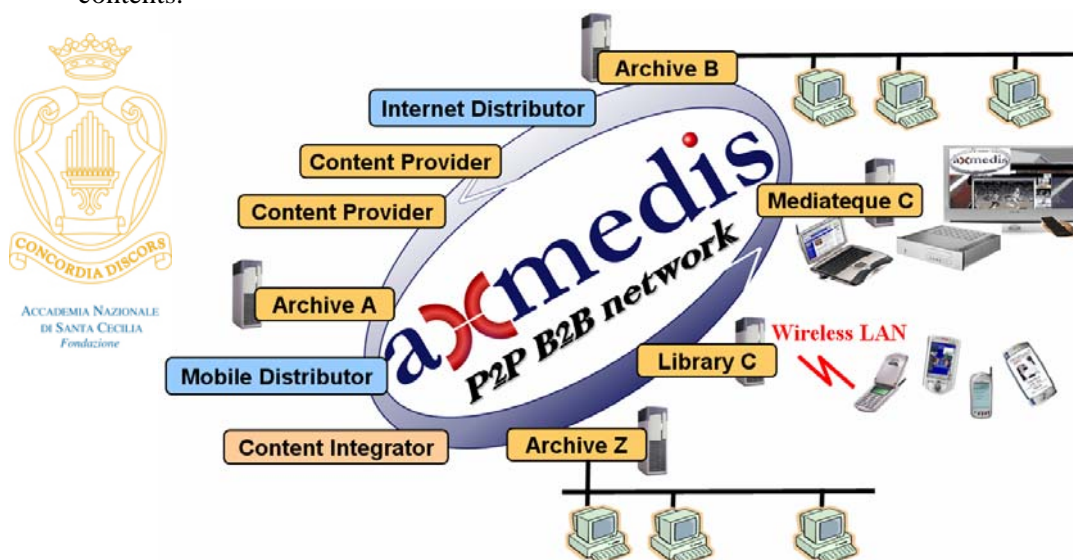
On the basis of the AXMEDIS framework, Libraries and Archives have the possibility to promote, manage and distribute their content on a global scale with less effort exploiting the automatism for content production and the facilities for P2P publication.

One of the key benefits offered by the AXMEDIS framework is the functionalities and capabilities to process and manage combinations of contents and create complex digital objects.

Depending on the ownership, each institution has the right to produce licenses for the use of the content (i.e., print, play, save, time limited use, etc., to control the access and proper usage). On the basis of the profile, each library or archive can issue licenses and establish relevant fees and/or to limit the usage of the content only in some specific locations, such as in other archives, or education institutions.

AXMEDIS permits the content production according to different editorial and presentation formats and their distribution by using multichannel. AXMEDIS provides a complete framework for the normal processes required in an archive, or in a Museum, regarding content management, control, processing, distribution, transaction (selling and buying), etc. With AXMEDIS, the objects are stored in a database within the institution (reachable through IP address), or in a Kiosk, and the process of digital contents transaction can be improved in several different contexts:

- in normal day-to-day operations;
- new possibility of complete/share content collections (virtually), with access to digital contents from other museums/archives and, at the same time, widen the accessibilities and availabilities of the contents.

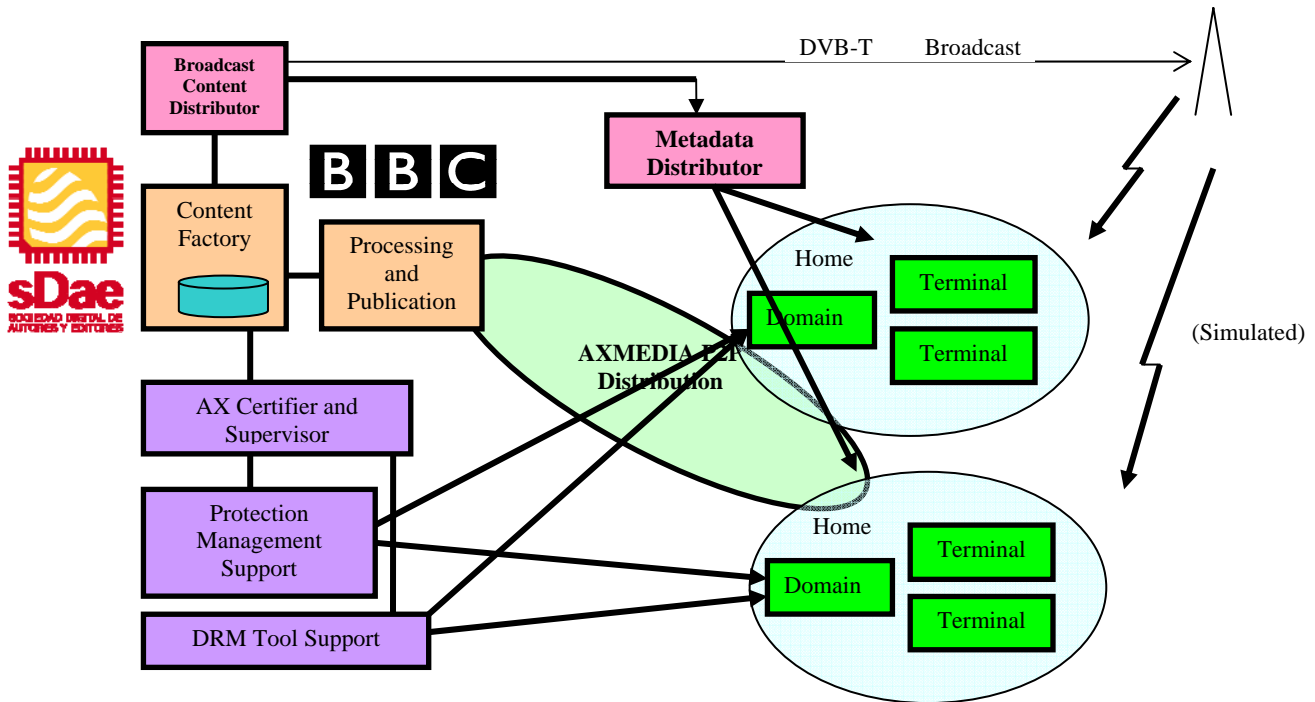


With AXMEDIS, the customer can go through the whole process online and receives the contents requested in real time. The library staff has only to check the results of the process and does not need to manually perform all the time-consuming individual sub-tasks.

There are many different ways in which AXMEDIS can promote and stimulate the library related market. For examples, on a B2C scenario, the library can make use of the AXMEDIS environment to support the sale of the contents from the library (self) for example digital reproduction, the merchandising of digital objects owned by the library to its own customer, a system of preview / requesting material service using, for instance, mobile phone provided to the customer in advance. In other terms, customer can preview the catalogue and the digital resources of the library some time before coming and buying them for PC use. In addition, the framework can also provide the sale of the contents from other libraries to their own customers. On a B2B scenario, the AXMEDIS environment can be used to support the sale of the contents from their own library to other libraries, or to support the sale of the contents from their own library to another business user.

10.6 Content distribution for TV recording, the BBC case

This is the so called AXMEDIS 4HOME demonstrator in which AXMEDIS framework is used to support the distribution of content over internet and broadcast channels to a rights-managed platform within the home. The 4HOME demonstrator uses the DRM support of AXMEDIS to enable the rightful use of content distributed over the Internet, or on content derived from Free to Air broadcast content in the home and supplemented with other services over the Internet.



Content is distributed from a central 4HOME AXMEDIS content factory. This is then adapted to form licensed, registered AXMEDIS objects for distribution over IP. Similar content is also made available over DVB-T transport, unprotected. Content is also distributed via P2P AXEPTool.

Content is protected and registered within the central content factory. Content packaged for the user into enhanced presentations on the user client are bound to the user's home domain or given an AXMEDIS license from the content factory and registration facility. Mother licenses are produced using the AXMEDIS Editor and associated with the AXMEDIS Object. The AXMEDIS Ontology is used to check that the creation of licenses is consistent with the corresponding user and AXMEDIS Object. The final licenses are produced on demand.

The 4HOME demonstrator uses the AXMEDIS home domain concept to license content to any device within a user home domain. Devices are registered in the AXMEDIS PMS Domain Home and AXCS.

Content is made available over IP in AXMEDIS format, selectable by the end user from an appropriate user interface. In addition, new AXMEDIS objects can be made on the home client from a combination of the Free to Air broadcast content and further enhancements delivered over the protected IP channel. The Free to Air content (DVB-T) can be selected for capture and enhancement through the AXMEDIS viewer.

The distribution of AXMEDIS content over the internet to the home users is achieved over the AXMEDIS AXMEDIA P2P tool for P2P distribution of protected content to the home. The AXMEDIS client can retrieve programme description metadata from a metadata server using a simple protocol and delivering metadata in the TV-Anytime format.

The Protected content and access to metadata is over the public internet using the AXMEDIS P2P tool and simple HTTP respectively. The broadcast demo is a pre-prepared MPEG2 transport stream with broadcast style programmes. Some of these, and others, are available for download over P2P as protected objects.

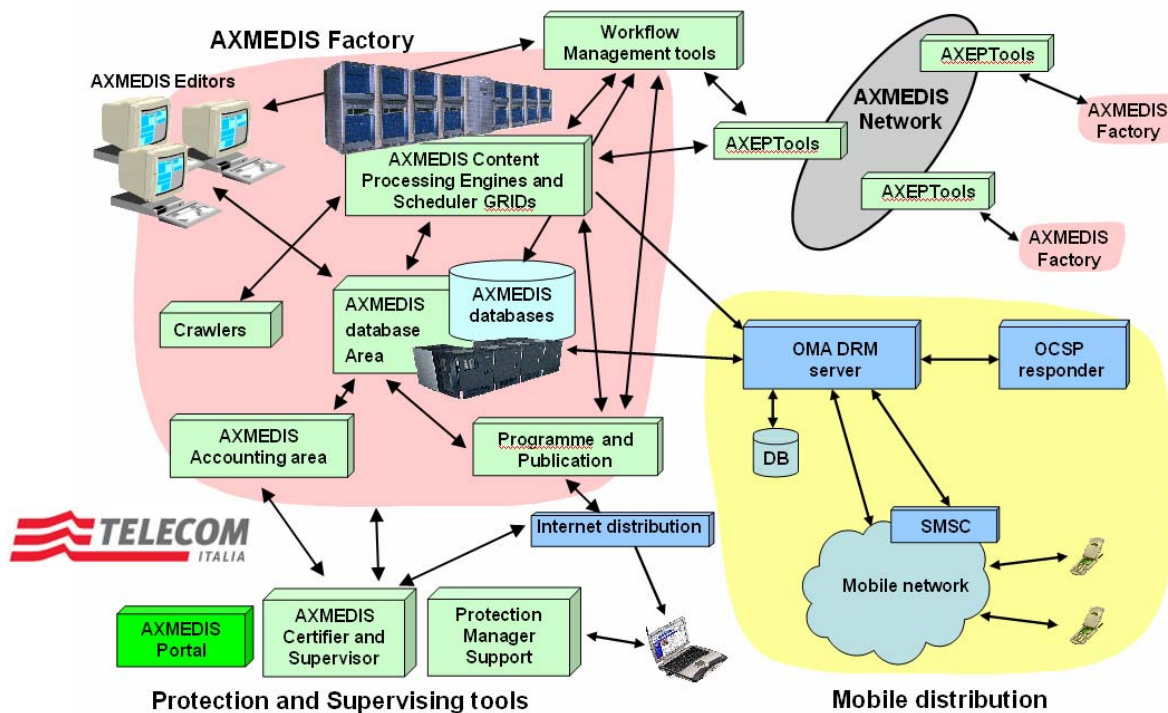
- o requirements and use cases of the 4HOME take up, demonstrators of BBC, TI, SDAE, including domains, AXMEDIS for broadcasting, and OMA integration and distribution

http://www.axmedis.org/documenti/view_documenti.php?doc_id=2976

10.7 Content distribution with OMA, AXMEDIS back office, the Telecom Italia case

This demonstrator of Telecom Italia (TI) shows how the AXMEDIS framework can be deployed to support the distribution of content over the mobile distribution channel exploiting OMA standard and interoperability with AXMEDIS. At the same time, it shows that the same content is made available in the native AXMEDIS format for download and use on PCs under the same conditions.

The demonstrator uses the rights management aspects of the AXMEDIS Framework on the server side and the OMA DRM v2 corresponding features on the client side. To enable this scenario, an OMA gateway is introduced in the AXMEDIS architecture, which translates AXMEDIS Objects and the corresponding licenses from the source format into an OMA compatible format.



Content is produced in an AXMEDIS factory. This is then adapted to form licensed, registered AXMEDIS objects for distribution over Internet and translated into OMA DRM v2 format for mobile distribution. Content adapted to mobile distribution is exported from the AXMEDIS Content Factory and imported into an OMA DRM server. The entity taking care of the protection of the adapted object is the OMA DRM server. At the same time, the original AXMEDIS Object remains under control of the AXMEDIS PMS.

The mobile demo utilizes an OMA DRM 2.0 Server provided by Telecom Italia (TI) as external technology which is adapted to operate as an OMA Gateway in order to be able to receive content from the AXMEDIS platform. The server is composed by an OMA DRM Rights Issuer which implements the ROAP protocol; an OCSP responder which checks and validates the certificates; a root Certification Authority issuing certificates for devices, Rights Issuer and OCSP responder (not shown in the picture).

The mobile demo uses as client devices Nokia N91 commercial terminals equipped with certificates issued by the above mentioned root Certification Authority. Details on the Nokia N91 features are available at <http://forum.nokia.com/devices/N91>

The distribution of AXMEDIS content over the internet to the home users is achieved using a PC client where the AXMEDIS AXMEDIA P2P tool is installed.

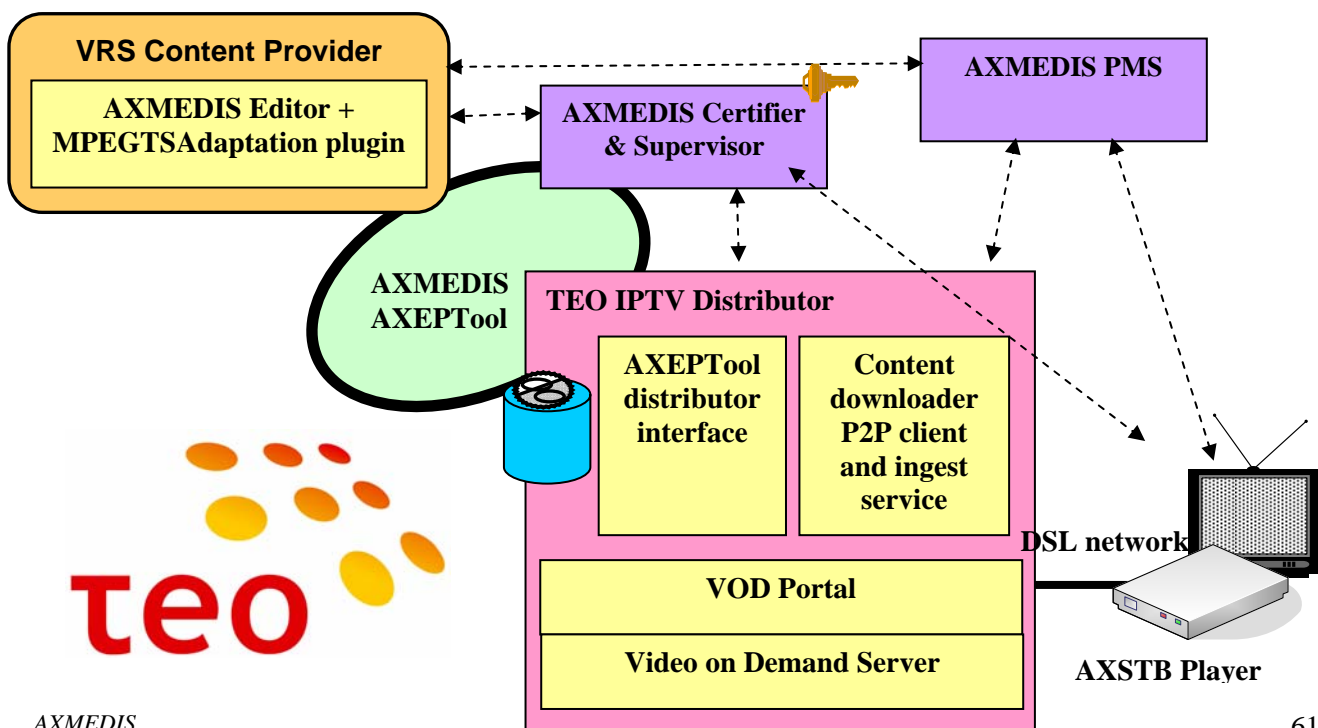
- requirements and use cases of the 4HOME take up, demonstrators of BBC, TI, SDAE, including domains, AXMEDIS for broadcasting, and OMA integration and distribution

http://www.axmedis.org/documenti/view_documenti.php?doc_id=2976

10.8 Content distribution for Video on STB, the TEO (Telecom Lithuania) case

The TEO (Telecom Lithuania) case for the exploitation of AXMEDIS tools presents the following features:

- B2C distribution of video on demand (VOD) via IP network by means of MPEG-2 Transport Stream (TS) feeding an AXMEDIS compliant Set Top Box (STB) for viewing video on TV;
- AXMEDIS objects with MPEG 2 video content, specially processed for MPEG TS video with accompanying information;
- Protection at signal protection level:
 - The transmitted video signal resource is encapsulated into MPEG-2 TS resource and scrambled using DVB-CSA algorithm. AXOM is used for de-protecting video signal.
- Protection at content license level:
 - At production (VRS Factory) level, using AXMEDIS Editor or AXCP grid, with newly developed AXCP MPEGTS Adaptation Plugin for scrambling MPEG-2 TS resource.
 - At Distributor (TEO) and end user level, upon trying to access protected AXMEDIS object, AXOM protection processor is executed to de-protect the object according to the issued license.
- License: mother licenses provided by content provider for distribution using its DRM editor or AXCP tools or directly posted on the PMS Web Services.
 - Final licenses are produced by TEO VOD access service using AXCP Executor after receiving confirmation of payment. The issued license is sent to PMS server.
- License allows:
 - Free of charge view of trailers and pay-per-view for AXMEDIS objects.
 - Play, stop, pause and skip video stream from VOD server.
 - Other rights according to content type and business model
- Registration of users and tools (AXSTB Player) as follows:
 - The end user is registered to TEO database upon subscription of IPTV service. TEO IPTV administrator checks AXMEDIS option in registration form and the user is registered to AXCS deployed at TEO site.
 - When user buys STB hardware it is registered to AXCS automatically upon first usage.
- the distributor collects from the DRM servers (PMS and AXCS) the report with:
 - Details of all the exploited rights which can be used to monitor and/or to prepare the bill to the final users according to the business models adopted.
- Specification AXMEDIS ELTEO for Video on demand, STB, IPTV solutions based on AXMEDIS technology: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3096

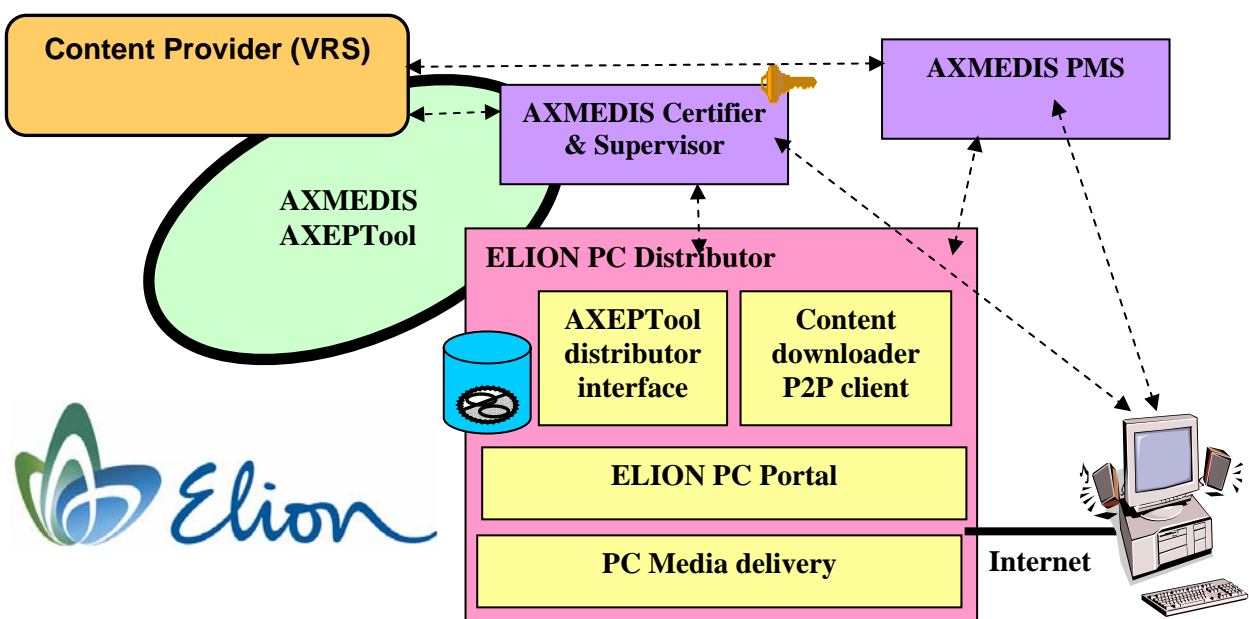


10.9 Content distribution for Video on demand, the ELION (Telecom Estonia) case

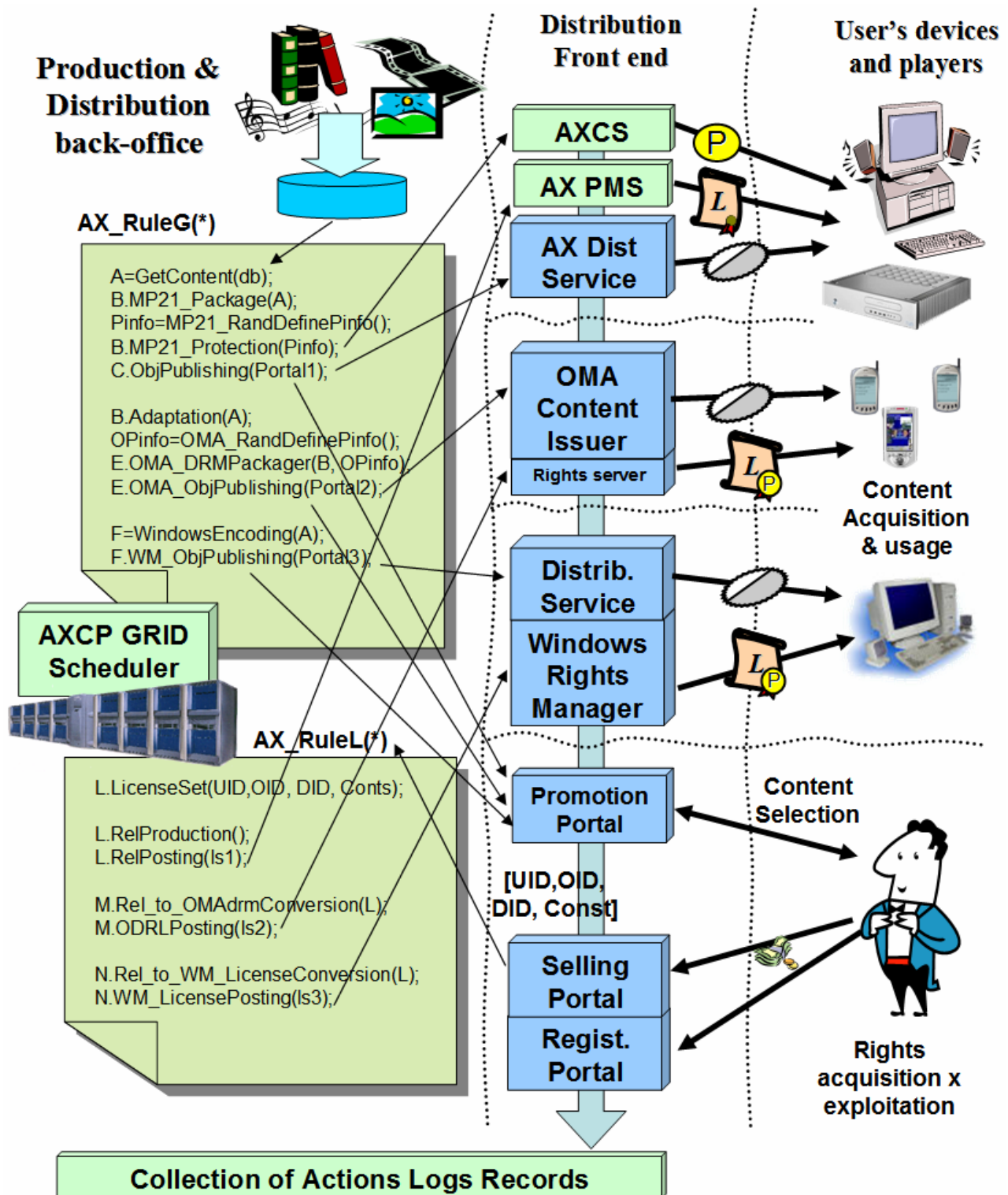
The ELION (Telecom Estonia) case is focused on the exploitation of AXMEDIS tools presents the following features:

- B2C video on demand, VOD, distribution on IP network by:
 - downloading video content into PC using http server
 - Streaming video content to end user PC from a streaming server
- AXMEDIS objects with
 - Any kind of content, all types mentioned in the other examples
 - Video, images, document, audio, animations, etc.
- Protection information not in the object:
 - produced with the AXCP with an automatic massive processing of objects
 - with the protection tool, automatically Posted in the AXCS by the Protection Tool
- License:
 - produced on the fly when an AXMEDIS object is bought by:
 - clicking on the payment web page or
 - calling the mobile phone number provided for toll payment.
- License allows
 - Free of charge view of trailers and pay per view for AXMEDIS objects.
 - Play, stop, pause and skip video stream from VOD server (ads inserted into clips cannot be skipped using seek operation; end user can skip forward only).
 - Other rights according to content type and business model
- The AXMEDIS Objects may be
 - Displayed/played on AXMEDIS PC player (free downloaded)
- The users operate a PC. The user has to perform the registration of
 - themselves as users (on an AXMEDIS portal)
 - any AXMEDIS player tool they would use
- the distributor collects from the DRM servers (PMS and AXCS) the report with:
 - Details of all the exploited rights which can be used to monitor and/or to prepare the bill to the final users according to the business models adopted.
- Specification IPTV solutions based on AXMEDIS technology:

http://www.axmedis.org/documenti/view_documenti.php?doc_id=3096



11 AXMEDIS Multichannel Support and DRM interoperability



12 VARIAZIONI project for the Enrichment of Cultural Content

VARIAZIONI is an e-ContentPlus project that is going to exploit the AXMEDIS framework for setting up an automated production of DRMed content and its distribution in AXMEDIS format by means of P2P and Client Server portal to be used on AXMEDIS players.



The content that to be enriched will be mainly based on:

- 700 hours of audiovisual; Master classes of famous magisters (Harmos), Concerts, Conferences, Special Events...;
- 1000 hours of audio, Concerts, Lessons, Rehearsals of concerts, Popular Songs...;
- 2000 historic documents, Programs of concerts, Letters, Scores, Images, Articles, Pedagogical, Material.

The process of enrichment will mainly produce a set of new versions of the above mentioned AXMEDIS objects. The AXMEDIS Content Processing platform will be used for creating new content on the basis of the user activities and republishing them automatically. Thus completely automating the content production on demand and licensing on demand.

The presentation level into the AXMEDIS objects will be mainly HTML and/or SMIL.

Involved partners are:

- Fundacion Albeniz (FIA)- Spain
 - Germinus XXI, Grupo Gesfor (Germinus)- Spain
 - Dipartimento di Sistemi e Informatica, Università degli Studi di Firenze (DSI) -Italy
 - Rigel Engineering SRL (Rigel)- Italy
 - Music Technology Group, Universitat Pompeu Fabra (UPF)- Spain
 - Exitech SRL – Italy
 - Lithuanian Academy of Music and Theatre (LMTA)- Lithuania
 - Koninklijk Conservatorium Brussel, Erasmushogeschool Brussel (EHB)- Belgium
 - Escola Superior de Música e Artes do Espectáculo do Porto (ESMAE)- Portugal
 - Sibelius Academy (SIBA)- Finland
 - Association Européenne des Conservatoires, Académies de Musique et Musikhochschulen (AEC) - Netherlands
- VARIAZIONI project portal: <http://www.variazioniproject.org/>



13 Conclusions

AXMEDIS framework has been produced by the AXMEDIS consortium that is actively performing research activities, developing new tools and products and trialing them within effective demonstrators.

The developed **AXMEDIS Framework is an open solution** exploiting a set of new technologies and tools, which can be used by third parties for their business to:

- reduce costs and increase efficiency for content production, protection, management and distribution. It offers effective automation for
 - integrating your Content Management Systems (CMSs), with the distribution systems by automating the communication and maintenance of content and information between the two systems;
 - content gathering and ingestion processes from local and remote CMSs as well as file systems;
 - composition, supporting parallel processing, GRID technology, and optimisation techniques for content ingestion, production, protection and formatting;
 - managing the workflow processes at content-factory level and between different content-factories;
 - the overall process allowing content production on demand.
- support the whole value chain, including composition, packaging, integration, aggregation, synchronisation, formatting, adaptation, transcoding, indexing. Additional features include the integration of both protected and non-protected components within an object, definition of relationships with other resources, metadata integration and remapping/transcoding, protection, license production and verification;
- allow the convergence of the media and interoperability of content to enable multi-channel distributions. The framework supports content distribution:
 - on different channels such as satellite data broadcast, Internet, cellular/mobile network, wireless and traditional media supports such as CDs, DVDs;
 - via different communication technologies, particularly with Peer-to-Peer (P2P) for both B2B (Business-to-Business) and B2C (Business-to-Consumer) levels;
 - to different devices such as PC, PDA, interactive TV (i-TV), set-top box (STB), etc.;
 - with different transaction models on the same channels and content, and with flexibility.
- adopt new methods and tools for innovative, flexible and interoperable Digital Rights Management (DRM) in order to facilitate smooth transition from paper contracts to digital licenses. For examples:
 - the exploitation of MPEG-21 REL (Rights Expression Language) with specific extensions and enhancements;
 - the support of different business and transactions models and their integration;
 - the integration/interoperation of different DRM models such as MPEG-21 REL and ODRL OMA (Open Mobile Alliance).
- harmonise B2B and B2C areas for DRM, bringing the DRM model in the B2B area, supporting production and protection models in the whole value chain;
- increase content accessibility with a P2P platform at B2B level, which can integrate content management systems and workflows.

The AXMEDIS Framework is accessible to all including industries, large or small, who share the interest to exploit new technologies and solutions for automated content production and multi-channel distribution. The AXMEDIS Framework can be used to setup and build a set of complete applications and services in the area of content production, protection and distribution. With the flexibility of AXMEDIS dynamic Plug-In technology, you can customise your applications and processes according to your needs.

AXMEDIS Framework is Open:

- AXMEDIS focuses on interoperability and openness of content model and interoperability of DRM models, including multi-channel distribution;

- AXMEDIS specification is public. Its specific use is royalty free;
- source code of the AXMEDIS Framework is accessible by the AXMEDIS Affiliation programme. The affiliation fee is low cost and affordable for all. Alternatively affiliation can also be offered in return for contributions to improve and/or extend the AXMEDIS Framework;
- AXMEDIS plug-in technology is public. The source code for creating new plug-in is public without the needs to be affiliated. Any tool can be made accessible into the AXMEDIS Content Processing GRID with this technology.

The AXMEDIS digital content and content components are **open format**, capable of integrating any kind of cross media format (video, images, animations, games, learning objects, multimedia, audiovisual, document, audio, etc.) in any digital format, any kind of metadata including identification, classification, categorization, indexing, descriptors, annotation, relationships and play activities and protection aspects.

AXMEDIS format allows the combination of content components and their secure distribution in respect of copyright laws, supporting a large variety of DRM rules and models according to concepts of interoperability among DRM models. AXMEDIS is open to any DRM model and solution.

Within AXMEDIS content, any type of cross media content can be included, from simple multimedia files to games or software components, for leisure and entertainment, infotainment, and also for managing protected governmental content, healthcare information, business of value information, etc.

More technical information and about how to make registration and affiliation to AXMEDIS can be recovered on www.axmedis.org

14 Acknowledgments

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15 References and links

15.1 AXMEDIS Tutorials

- General Tutorial and Overview (December 2006, Leeds, UK)
 - PPT: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2659
 - Video on [part 1](#) - [torrent](#)
 - Video on [part 2](#) - [torrent](#)
 - Video on [part 3](#) - [torrent](#)
 - Video on [part 4](#) - [torrent](#)
 - Video on [part 5](#) - [torrent](#)
 - Video on [part 6](#) - [torrent](#)
- Content Production Tutorial http://www.axmedis.org/documenti/view_documenti.php?doc_id=2667
- Content Distribution Tutorial http://www.axmedis.org/documenti/view_documenti.php?doc_id=2666
- Content Processing Tutorial http://www.axmedis.org/documenti/view_documenti.php?doc_id=2655
- Workflow Tutorial http://www.axmedis.org/documenti/view_documenti.php?doc_id=2652

15.2 AXMEDIS tools for free download

- General download page: http://www.axmedis.org/documenti/documenti.php?area_id=1
- AXMEDIS tools (AXTOOLS) which include http://www.axmedis.org/documenti/view_documenti.php?doc_id=2885
 - AXMEDIS players described in the next point;
 - AXMEDIS Editor;
 - AXMEDIS Content Processing GRID tools: AXCP Scheduler, AXCP Rule Editor, AXCP GRID node, etc.;
 - DRM editor: License Editor, examples of licenses;
 - AXMEDIS plug ins for video, audio, document, images, processing, etc.
 - Examples of AXMEDIS objects in several type; <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Cross+Media+Content%3A+Examples>
 - Examples of AXCP scripts for content processing of several kind; <http://www.axmedis.org/tiki/tiki-index.php?page=AXMEDIS+Content+Processing+Scripts>
 - etc.
- AXMEDIS players: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2884 including (all these players are included into the above mentioned package):
 - PC players,
 - PC player with Skin,
 - Bordas and Nathan Player for PC,
 - AXMEDIS Active X player for PC
 - Content Examples etc.
- AXEPTools: P2P client tool for establishing connection with the AXMEDIS P2P B2B network as Business User: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3102
- AXMEDIA: P2P client tool for establishing connection with the AXMEDIS P2P B2B network as final users: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3103
- AXMEDIS PDA player for Windows Mobiles 5: It is capable to play AXMEDIS objects based on SMIL, HTML, video, audio, MPEG-4 files, etc. AXMEDIS PDA player for AXMEDIS MPEG-21 content including resources with presentations layer based on MPEG-4, HTML and SMIL Unzip the file, copy the CAB file and execute it on the PDA
 - http://www.axmedis.org/documenti/view_documenti.php?doc_id=3107

15.3 AXMEDIS Framework Specification

- AXMEDIS Framework [General aspects, Editor and Model](#)
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1891
- AXMEDIS Command Manager http://www.axmedis.org/documenti/view_documenti.php?doc_id=2686
- AXMEDIS Object Manager and Protection Processor:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1972

- AXMEDIS Editor and Viewers: http://www.axmedis.org/documenti/view_documenti.php?doc_id=2213
- AXMEDIS External Editors, Viewers and Players:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2211
- AXMEDIS Content Processing Area:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1958
- AXMEDIS External Processing Algorithms:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2017
- AXMEDIS CMS Crawling capabilities:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1907
- AXMEDIS Database and query support:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1932
- AXMEDIS AXEPTool and AXMedia Tools:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2718
- AXMEDIS Programme and Publication Tools:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1885
- AXMEDIS Workflow Tools:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1883
- AXMEDIS Certifier and Supervisor and networks of AXCS
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1952
- AXMEDIS Protection Support
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1882
- AXMEDIS Accounting and Reporting :
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1887
- Definitions Terms tables links http://www.axmedis.org/documenti/view_documenti.php?doc_id=1388

AXMEDIS reports on basic enabling technologies

- Content Model and Managing, MPEG-21, authoring, etc.
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2324
- Content indexing and querying:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2436
- Content processing, Composition and Formatting
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2374
- Content sharing and Production on P2P:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2454
- Content Protection and Supervision
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2371
- Content Distribution via Internet
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2451
- Content Distribution via Mobile
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2442
- Content Distribution via Satellite data broadcast
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2313
- Usability issues
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2339
- AXMEDIS vs DMP MPEG21 Analysis
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1063
- AXMEDIS Framework Infrastructure, guidelines and some tools
http://www.axmedis.org/documenti/view_documenti.php?doc_id=1391
- AXMEDIS Framework Validation and integration
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2445

Basic knowledge reports

- User requirements http://www.axmedis.org/documenti/view_documenti.php?doc_id=1712
- Use Cases http://www.axmedis.org/documenti/view_documenti.php?doc_id=1824
- Test Case http://www.axmedis.org/documenti/view_documenti.php?doc_id=2023

Content Modeling and Test Cases

- [Content Aspect Specification](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1389) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1389
- [Content Aspect Specification Appendix](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1670) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1670
- [Content for Test Cases and Validation](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1393) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1393
- [Content Selection Guidelines](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1390) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1390
- [Multilingual Guidelines and Technical Solutions](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1427) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1427
- [AXMEDIS Editorial Format Guidelines and basic examples](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1394) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1394

15.4 AXMEDIS Framework Demonstrators, Cases, Trials, for distribution etc.

- requirements and use cases of AXMEDIS ELTEO of the content distribution for DVB-T to STB of Telecom Lithuania, and content distribution of Telecom Estonia
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2978
- requirements and use cases of the 4HOME take up, demonstrators of BBC, TI, SDAE, including domains, AXMEDIS for broadcasting, and OMA integration and distribution
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2976
- Specification final version of Take up AXMEDIS ELTEO for Video on demand, STB, IPTV solutions based on AXMEDIS technology:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=3096
- Integrated CMS integration aspects:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2853
- Integrated prototype: automated content production and formatting:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2939
- Integrated Distribution on demand via Internet
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2951
- Integrated distribution via satellite data broadcast:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2954
- Integrated distribution towards mobiles:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2945
- Integrated Distribution towards PDA via Kiosks:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2944
- Content Posting Portal, Content Posting for Final User publication, SIAE Trial presentation:
 - http://www.axmedis.org/documenti/view_documenti.php?doc_id=2922
 - http://www.axmedis.org/documenti/view_documenti.php?doc_id=2923
- VARIAZIONI project portal: <http://www.variazioniproject.org/>

15.5 Brochures and press cutting (a part)

- AXMEDIS Project Brochure
http://www.axmedis.org/documenti/view_documenti.php?doc_id=2712
- [Annual Public Report \(2006\)](http://www.axmedis.org/documenti/view_documenti.php?doc_id=2471) http://www.axmedis.org/documenti/view_documenti.php?doc_id=2471
- [Annual Public Report \(2005\)](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1439) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1439
- [AXMEDIS Project Synopsis](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1668) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1668
- [Digital Media in Italy presentation](http://www.axmedis.org/documenti/view_documenti.php?doc_id=1669) http://www.axmedis.org/documenti/view_documenti.php?doc_id=1669

15.6 Other references

- ISO/IEC, ISO/IEC FDIS 21000-5 - Rights Expression Language. ISO/IEC JTC1/SC 29/WG 11/N5839. July 2003.
- ISO/IEC, ISO/IEC FDIS 21000-6 - Rights Data Dictionary. ISO/IEC JTC 1/SC 29/WG 11/N5842. July 2003.
- Iannella, R.: Open Digital Right Language (ODRL) Version 1.1. <http://odrl.net/1.1/ODRL-1.1.pdf> . August 2002.

- Open Mobile Alliance (OMA), <http://www.openmobilealliance.com/>
- OMA DRM Rights Expression Language version 2 (OMA DRM REL v.2), <http://www.openmobilealliance.com/>
- ISO/IEC, Study of ISO/IEC FCD 21000-4 IPMP Components. ISO/IEC JTC 1/SC 29/WG 11/N7426. July 2005.