



Technical Note
n.4501
July 2008

Multichannel DRM for your content:

Multi-channel production and distribution: broadcasting, IP/Internet, WEB sites, P2P, mobile, PDA, IPTV, interactive TV and channels, etc.

Multi-channel experience for your customers

Exploit Video on Demand (VOD), and production on demand solutions

Control of P2P content sharing and distribution, involving your customers in distribution (super-distribution)

Involve your customers and final users in content production and social networking

Integrate interoperable DRM into your business (MPEG-21, OMA, etc.)

Exploit different business models and/or transactions on the same distribution channels: pay per play, monthly rate, preview, renting, advertising, etc.

Exploit interactivity with cross media models

Adopt advertising (customized and/or real time personalized advertising)

Provide content with unprotected preview and the rest protected

AXMEDIS Multichannel Digital Rights Management

The market of digital content is rapidly changing. Users are requesting richer content and more services from content distributors. Presently, business and final users are becoming more and more interested in using interactive cross media content. For example, content with several kinds of media inside (audio, video, games, images, documents, etc.) which provide interactivity such as selecting content elements, navigating and playing with the information inside. Users are strongly interested in:

- o obtaining innovative forms of content from several different interoperable distribution channels based on Internet, wireless mobile, satellite, terrestrial networks, and other means;
- o paying for content only after previewing it;
- o acquiring content using their preferred business model for different content on the same channel: renting, pay per play, subscription, etc.;
- o exploiting the acquired interoperable content on different devices/tools: PC, Mobiles, TV, etc.;
- o collecting content from in-house or on portable media centers;
- o sharing content with others at homes and/or on the street;
- o creating new content for sharing with other friends.

New models of content usage, based on new forms of content exploiting fully digital content distribution, are opening paths for a larger set of new applications and markets far beyond the limitations of the physical media. Combinations of digital content formats and digital distribution channels are creating new applications including: IPTV, DVB-T, DVB-S, DVB-H, VOD, POD, WEBTV, etc. An evolving set of business models and solutions have been proposed on the market for the acceptance of users. These recent distribution models have been enabled by a set of new technologies grounded on content formats, high speed connections and digital transmission, content processing and adaptation capabilities, content protection models and solutions, hardware capabilities, and finally new solutions for Digital Rights Management, DRM.

Many of these innovations can be now exploited thanks to AXMEDIS solutions for DRM, controlled P2P, cross media content modeling, and automated content processing, with the support of production and DRM tools, and players.

AXMEDIS DRM Overview

AXMEDIS solutions reduce costs and increase efficiency for content management. AXMEDIS supports the whole value chain and provides tools to simplify the convergence of media, the media transcoding, and the interoperability of content enabling multi-channel distribution. AXMEDIS provides a flexible and interoperable DRM, for both B2B and B2C across traditional and P2P distribution platforms.

AXMEDIS Multichannel DRM is an open interoperable solution for protecting and managing rights for a wide range of content, from single files to complex cross-media and multimedia, distributed on different channels towards different type of players and devices. AXMEDIS can be used to setup and manage DRM solutions for:

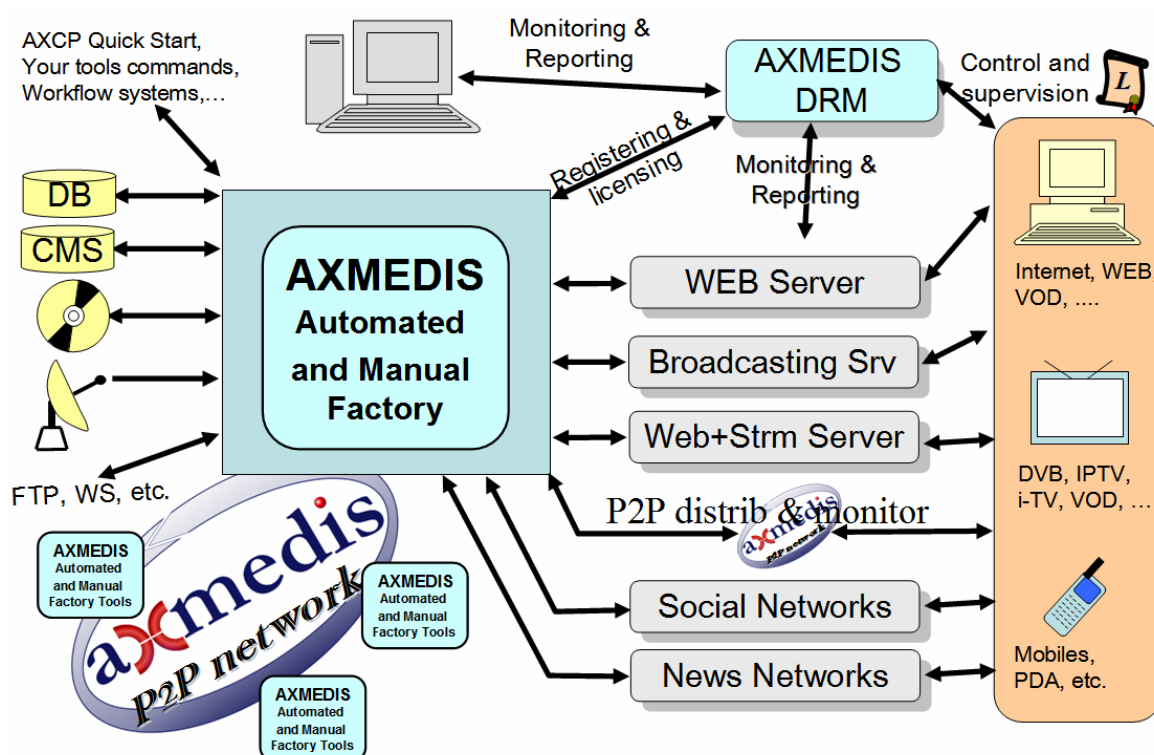
- o Internet, client server and P2P distribution;
- o broadcasting, satellite and terrestrial distribution;
- o production and video on demand distribution;
- o mobile and PDA distribution;
- o interactive TV and educational content distribution;
- o PC, STB/PVR, HDR, PDA, Mobiles, etc.;
- o physical media: CD, DVD, USB, etc.;
- o business to business (B2B) distribution;
- o integrated business to business to consumers (B2B2C) distribution models.

AXMEDIS Adoption and Affiliation Programs

AXMEDIS has been adopted and currently trialed by several industrial partners, who have expressed their appreciation (see <http://www.axmedis.org/ibc2008.html>). AXMEDIS is open and allows to access source code, reports, technical support, training days, tutorial material, technical notes and documentation, by means of the affiliation program. AXMEDIS consists of over 40 partners (such as: TISCALI, EUTELSAT, Telecom Italia, TEO, ELION, HP, BBC, Giunti Labs, AFI, ACIT, EXITECH, XIM, SIAE, SDAE, etc.).

AXMEDIS DRM Architecture and Solution

AXMEDIS DRM architecture has been designed to be easily integrated into any distribution channel, allowing maintaining the your front end distribution solution and customer relationship management tools. In the following figure, the grey parts are your servers and orange are your customers/markets; cyan and light blue parts are those that can be provided by AXMEDIS or in which AXMEDIS parts can make the difference with enhancing tools.



AXMEDIS DRM exploits and extends the MPEG-21 standard allowing to:

- **protect any content formats and types:**
 - video, audio, images, documents, games, etc.;
 - cross media and multimedia content: HTML, SMIL, MPEG-4, etc.;
 - collections and combinations of the above mentioned content formats;
- **control the exploitation of rights** of the above content formats:
 - formalization of rights and conditions with formal content licenses. The license is a digital version of a contract that contains the list of rights (with related conditions) that can be exploited on that content by a given user. In AXMEDIS, licenses are formalized in MPEG-21 REL Standard;
- **collect and report information about consumption** of rights for
 - accounting, billing and/or statistical analysis;

AXMEDIS DRM solution provides:

- **Automated and Manual Factory: AXCP GRID tools for content post production, packaging and protection** (they range from simple manual tools to automated tools based on GRID technology, AXMEDIS Content Processing, AXCP solution), and are capable to make automatic: registration of users, content adaptation, transcoding, fingerprinting, management, repurposing, licensing, delivering, etc., see a summary in the following technical note

http://www.axmedis.org/documenti/view_documento.php?doc_id=3624



- **DRM servers** for (i) controlling the exploitation of rights of protected content, (ii) collecting information about the exploitation of rights; for example counting the times a given content object has been played, by a given user, on given device, etc. (iii) optionally interacting with an intellectual property ontology to facilitate the production and verification of licenses.
- **AXMEDIS players for protected and non protected cross media content** on PC (MS Windows), PDA (Windows Mobile 5 and 6), STB/PVR (Linux and Kreatel based), and AXMEDIS Java based Mobile. AXMEDIS players can be customized in several different manners and can be hosted in WEB pages (AXMEDIS player in the form of Active X).
http://www.axmedis.org/documenti/view_documenti.php?doc_id=3845
- **DRM tools** for
 - manual and automated production of licenses
 - accelerating the transformation of contracts to licenses directly from the contract text, and vice versa for legal validation of licenses.
 - producing licenses, via licensing wizard produced as AXMEDIS object, see the LicenseMaker AXMEDIS object.

To make a tour in the AXMEDIS DRM we suggest to read and and try the AXMEDIS DRM for dummies:

http://www.axmedis.org/documenti/view_documenti.php?doc_id=3993

Front end content distribution servers, commerce servers, customer relationship servers can produce licenses for your final customers. These licenses are required to be produced posted onto the AXMEDIS DRM Servers via a Web Service call. In alternative, the same servers can use the AXCP GRID to perform the same activity, particularly when there are a high number of licenses produced. For example, in the case of a business model based on subscription; each new subscription produces a set of licenses to enable the new user to access all the content distributed.

As illustrated in the above figure, it is possible to exploit the P2P technology for content distribution by using AXMEDIS P2P Network solution which is fully integrated with the AXCP GRID and AXMEDIS DRM. See technical note on P2P http://www.axmedis.org/documenti/view_documenti.php?doc_id=3612

AXMEDIS Content and Players

AXMEDIS content may range from simple files with single resources such as video, audio, images, documents, animations, games, etc., to cross media and multimedia content with presentation layer based on: HTML, SMIL, FLASH, MPEG-4, etc. Combinations of the above mentioned content formats for interaction can be used, protected and managed in terms of detailed rights. AXMEDIS content model extends the MPEG-21 standard and allows creating different solutions for your distribution channels. The model enables you to distribute, for download or streaming, AXMEDIS content packages (also called AXMEDIS Objects) may contain:

- **elements** which are essences:
 - simple files audio, video, images, documents, animations, games, etc.;
 - any combinations of cross media with presentation in HTML, SMIL, MPEG-4, XML, FLASH, etc., hypermedia with internal and external links;
- **reference** to external files and/or other AXMEDIS objects as URIs and links;
 - menus, collections, lists, interactive elements on animations, etc.
- **metadata and descriptors** associated with single resources and/or collections:
 - metadata, classification information, Dublin Core, etc.;
 - descriptors such as fingerprint, technical information, MPEG-7, XML, etc.;
 - single and/or multiple identifications: AXOID, UUID, ISBN, ISMN, ISRC, ISAN, etc.
 - business descriptors such as the AXInfo, PAR, etc.;
- **collections** as lists, hierarchy of files, nesting levels, menus, etc., on which users may
 - navigate, make queries on the basis of metadata of single components or files;
 - receive auto play, automated presentation, dynamic advertising, chained videos, special content, packaging audio visual with additional content, etc.;
 - access to content with different presentation algorithms, protected and/or selectively non-protected, with or without previews, and many other models.
 - perform annotations to content elements;
- **narrative capabilities:** actions and semantics to make intelligent and interactive the content package behavior, allowing the final users to perform not only interaction but



- o enrichment (addition of comments and data to content);
- o transformations (for example the migration of the same object to another device with some adaptation);
- o queries inside the content collection;
- o recording with additional content coming from P2P, Web, etc.
- o licensing with specific content wizard.

All these features are operated on the basis of user rights.

For the production of AXMEDIS content it is possible to use AXMEDIS Editor tools for MPEG-21 and AXMEDIS authoring, DRM, licensing, protection, packaging, workflow, playing, etc. AXMEDIS authoring is available on MS Windows. AXMEDIS players run on MS Windows, Windows Mobile 5, Java mobiles, and are available for PC, STB/PVR/HDR, Media Centers, PDA, and mobiles. Their GUI and functionalities can be customized (examples of customizations are available). The production of AXMEDIS content can be also automated by using AXCP tools, see the above mentioned technical note.



AXMEDIS DRM Servers Main Capabilities

AXMEDIS DRM allows the exploitation of rights on a given content to any user that has been registered and certified, as long as there is a license that assigns the right for that content to the user. AXMEDIS enforces the DRM by means of protection technologies, certification models and protocols, and authentication models and protocols. For the physical protection, any kind of encryption algorithms can be used as an alternative to those provided by default: AES, DES, 3-DES, Blowfish, Cipher, CAST. Other AXMEDIS Protection Tools can be developed as plug-ins and thus can be even easily updated in final user players.

Technically, the AXMEDIS DRM Servers support the following functionalities:

- o licensing of final users and business users including distributors, large range of rights controlled;
- o collection and processing of licenses to provide authorizations to players. Licenses are expressed in MPEG-21 REL standard;
- o detection of attacks performed at AXMEDIS DRM and tools by final users; verification and supervision of the activity performed at players;
- o collection of action logs reporting the rights exploited by final users on players. This extends the MPEG-21 ER standard and can be used for reporting and statistical purposes;
- o registration of users via web service or on a portal;
- o certification and authentication of final users, players and devices;
- o counting the number of times a given right is exploited and revoking the grant when the number is greater than that imposed by the license;
- o revoke licenses assigned to a user, which disables the exploitation of rights on a given object; manage black lists of licenses;
- o revoke users' authorizations; manage black lists of users;
- o revoke players' and devices' authorizations; manage black lists of players/devices;
- o management of domains for subscription and managing collectivities.

AXMEDIS DRM Advanced Capabilities

AXMEDIS DRM provides a number of Advanced Capabilities that can be used to widen the market by creating specific business models and solutions:

- o Rights expressions translation: conversion of MPEG-21 REL to OMA DRM licenses, and vice versa;
- o Production and management of chains of licenses
 - o Final level licenses are verified in AXMEDIS DRM Servers against the parent license(s) to verify that

the rights are fulfilled along the whole value chain.

- o Example: to create a license which enables Distributors to make licenses for final users. This allows content producers, collecting societies, authors and publishers to control the distribution process and to obtain the report on content consumption directly from AXMEDIS DRM servers;
- o Example: to create a license which enables final users to make/change the content and produce other licenses. This allows distributors and/or the other actors in the value chain to monitor and control the exploitation of rights via AXMEDIS DRM servers;
- o Production and management of domain licenses to
 - o assign rights/licenses to a group of users and devices, simplifying the license processing;
 - o allow creating and managing a collection of content (at home, in the disco, in the pizzeria, etc.) that can be played on a set of devices;
- o Production of specific reports to all actors in the value chain according to the visibility that they can have on private information of users, such as Action Logs registered at AXMEDIS DRM servers;
- o Classification of user roles and AXMEDIS objects;
- o Integrating ontology to support the correct production of licenses from contracts.

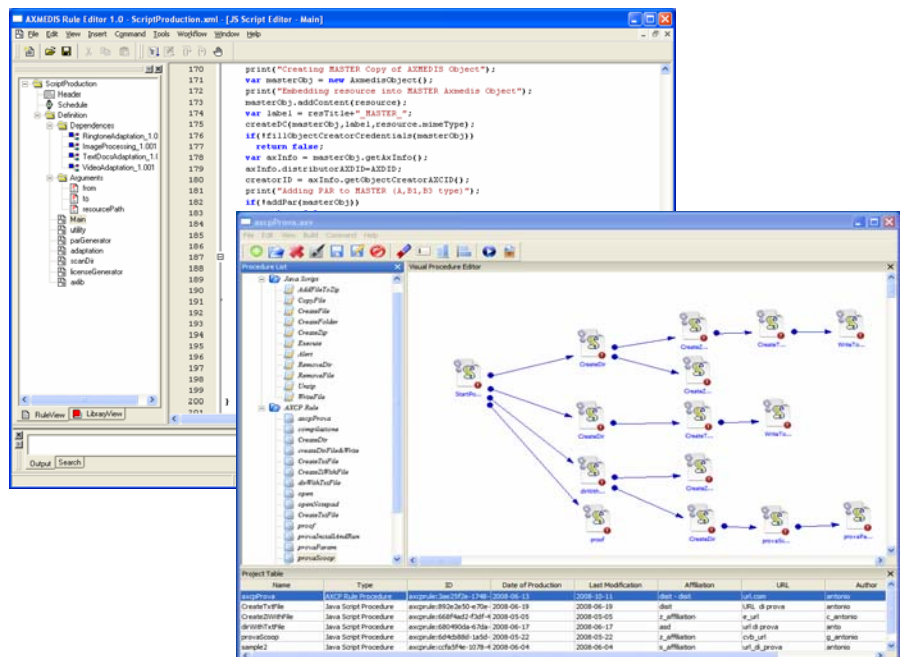
AXMEDIS can be used to create trading market places on digital content for B2B, B2C and C2C applications. Those are areas in which users (business or consumers) may access protected content to see which rights can be bought for a given object or collection. This operation can be performed by making queries via an AXMEDIS database or P2P network; e.g. looking for content to be compounded, distributed and/or played in January 2009 in Germany. These possibilities enable potential customers to search and select content in a free accessible market and maybe to negotiate the price later. This feature is grounded on the information that may be included in an AXMEDIS object regarding the producers of the object itself and on the possibility of nesting protected objects. AXMEDIS objects may contain among its metadata the AXMEDIS Information PAR. The AXMEDIS PAR is the list of Potentially Available Rights that object creators may be capable to provide for an object. It is substantially a formalization of what users (business or consumers) could do with that object after acquiring one or more specific licenses.

AXCP Main Capabilities to Automate the DRM Processes

AXCP GRID allows (i) automated management of content, metadata, licensing information, and so on; and (ii) operations of ingestion, database management, indexing, processing, adaptation, transcoding, encoding, decoding, description extraction, recognition, filtering, archiving, packaging, preview, extracting fingerprint, licensing, DRM, profiling, protection, and much more. Additionally, the AXCP tools can be integrated into and controlled by your applications and/or workflow management systems.

In brief, the AXCP solution is based on AXCP Rules formalized in JavaScript and XML to define jobs, processes and their characteristics (deadlines, needs, etc.). An AXCP solution can be expanded and/or customized for your needs by:

- o creating and customizing AXCP Rules to be executed;
- o entering in execution Rules according to different policies such as: periodic, sporadic or on demand from third parties, external tools, web services, etc.;
- o customizing, realizing and installing additional AXMEDIS plug-ins to add new formats, encoders, decoders, adapters, converters, etc. The AXMEDIS Plug-in technology is open, well documented and supported by a development tool kit.
- o executing operating system processes, passing them parameters/files and getting eventual errors (if any).





The AXCP tools are based on a Service Oriented Architecture (SOA). Fully documented APIs are available for all the JavaScript functionalities and Web Services for accessing and controlling tools and distributing produced content towards your front-end distribution servers. For additional details see the last technical note on AXCP: http://www.axmedis.org/documenti/view_documento.php?doc_id=3624

Technical Information

AXMEDIS DRM servers are based in MS Windows XP. Among the servers AXMEDIS can provide: registration portal and service, certification authority (all AXMEDIS tools and users are certified by using standard X.509 certificates), AXMEDIS Certifier and Supervisor and the AXMEDIS Protection Manager Support. Specific customizations have to be negotiated on the basis of your needs. Training, integration and service level agreement are also available.

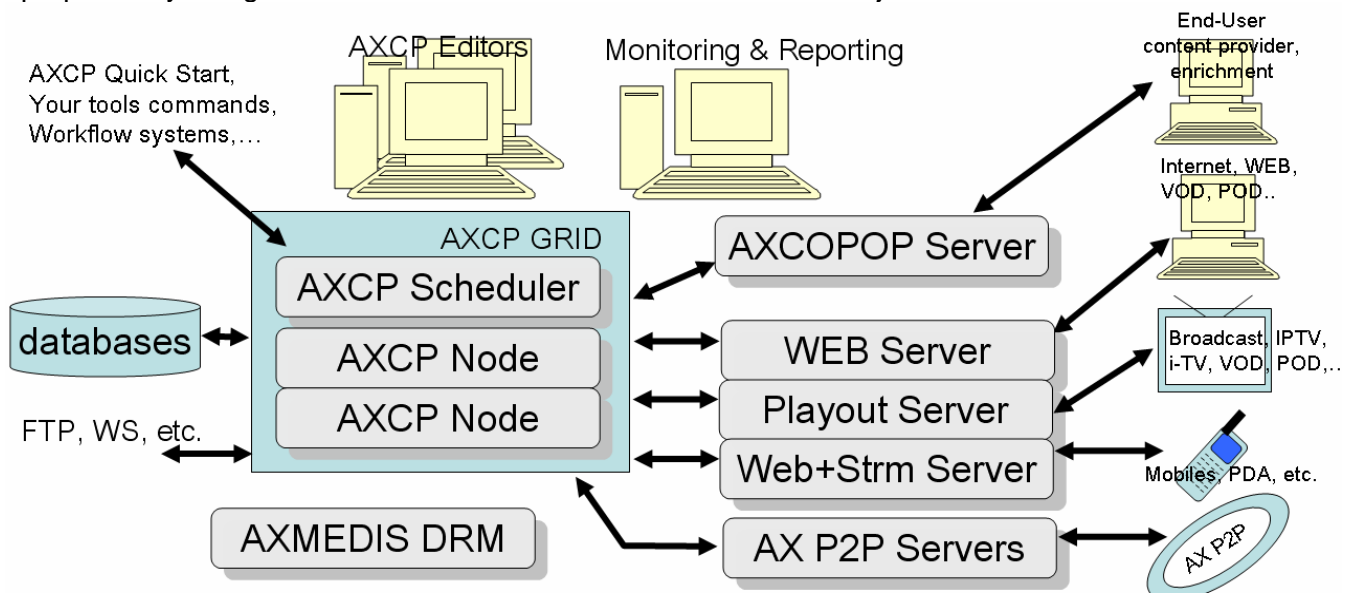
AXMEDIS DRM Integrated Solutions

The AXMEDIS DRM solution is independent, while it has been designed to be used with:

- **AXMEDIS P2P Controlled Network**, for content distribution via P2P. It utilizes B2B and B2C BitTorrent Technology with query support and cataloguing servers, for protected or non protected content. It has capabilities of automating content publication/distribution, controlling P2P network, and extracting statistical data and reports. AXMEDIS P2P network has P2P clients for PC and Mobiles http://www.axmedis.org/documenti/view_documento.php?doc_id=3612
- **AXMEDIS COPOP**, content posting solution, to involve your final users, to collect their content and redistribute it for social networking and content enrichment, and/or to integrate it into your content business solutions, protect and distribute the content with DRM.
- **AXMEDIS Cross Media Finder: an integrated portal for demonstrating AXMEDIS content and distribution:** <http://variazioni.axmedis.org:8080/CrossMediaFinder/>

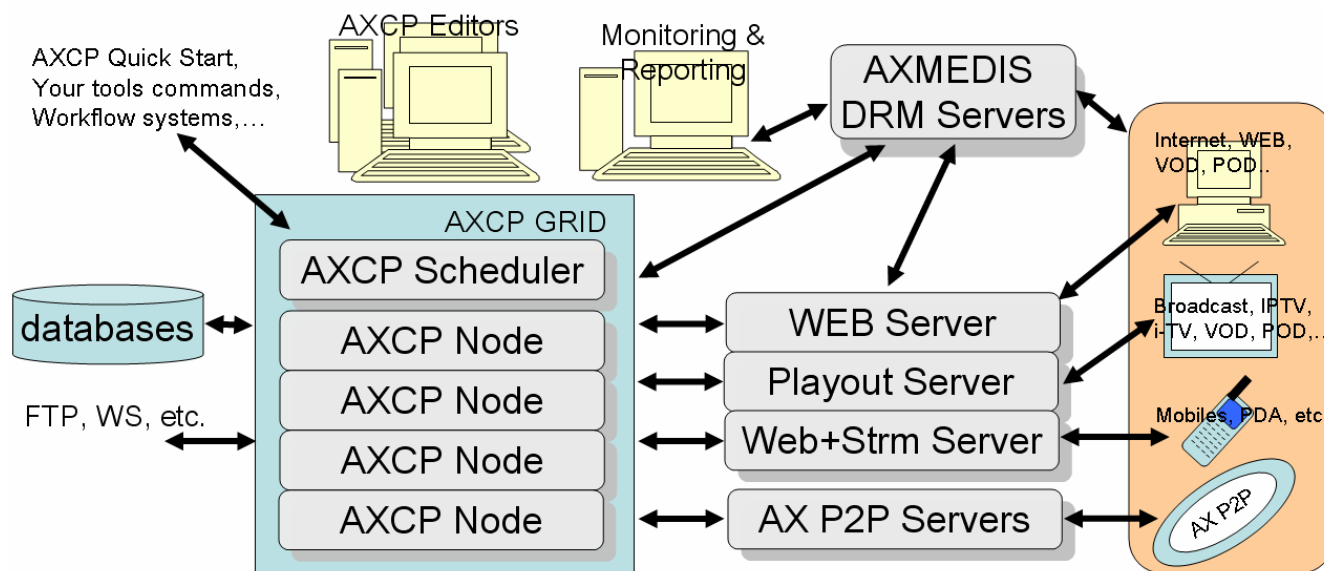
It is possible to read a document that goes in deep into the AXMEDIS DRM architecture showing how you can integrate the AXMEDIS DRM into a content distribution channel: http://www.axmedis.org/documenti/view_documento.php?doc_id=3891

The example reported in the following figure describes a solution in which AXMEDIS COPOP is used to collect content provided by final users. The content is processed, adapted, protected on the AXCP GRID, and finally distributed via traditional multichannel distribution with the AXMEDIS DRM support as well as via the AXMEDIS P2P controlled network for PC and Mobiles. In the figure, the details regarding the DRM have been omitted since they are identical to what has been presented before. The final user providing the user generated content may define the licensing model. This procedure can be performed for demonstrative and test purposes by using the LicenseMaker wizard. It is an AXMEDIS object to create licenses.



The following example presents an AXCP solution for automating production, protection and distribution of

content with DRM. This solution allows the reduction of costs for content post-production and management for DRMed distribution. In this case, the DRM technology can be MPEG-21 or OMA which is used to distribute content according to several different business models (pay per play, monthly rate, etc.), different rights (play, print, etc.), with different conditions (times of play, duration, etc.). The AXCP allows (i) producing content on demand on the basis of final user profiles (device, network, etc.); (ii) producing licenses on demand for pay per play and new subscriptions; and (iii) managing black lists of terminals and/or users.



AXMEDIS tools (AXMEDIS P2P, AXCP, AXMEDIS DRM, AXCOPOP, AXP2P, etc.) have been designed on the basis of a large set of requirements collected by AXMEDIS Consortium partners. AXMEDIS tools are based on modular components which can be reused to set up a large range of different configurations. They are open to be customized to cover your needs and business ideas.

References

AXMEDIS portal <http://www.axmedis.org> on which you can find:

- AXMEDIS tools:
 - production tools : editor and automated production
 - players for several platforms
- AXMEDIS objects and examples
 - audio, video, images, collection, education, cross media, training objects, documents, etc.
 - Interactive and smart objects
- AXMEDIS P2P network for demonstration
- AXMEDIS Cross Media Finder Portal for demonstration
- AXMEDIS Technical Notes
 - AXCP, Automated production tools, AXMEDIS Model, AXMEDIS P2P,
 - AXMEDIS DRM, AXMEDIS DRM how to integrate and use
 - AXMEDIS DRM for dummies http://www.axmedis.org/documenti/view_documento.php?doc_id=3993
 - VOD for PC, STB
- AXMEDIS show cases:
 - examples and technical documentation about AXMEDIS distribution cases for : VOD, IPTV, mobile, PDA, STB, etc.
 - download and streaming
 - etc.
- AXMEDIS tutorials:
 - videos, slides, and documents
 - example of AXCP rules

Contact: Paolo Nesi
 DSI DISIT AXMEDIS
 Vis S. Marta 3
 50139 Firenze, Italy
 Tel: +39-055-4796523
 Fax: +39-055-4796469/363
axmedisinfo@axmedis.org
nesi@dsi.unifi.it