**Technical Note
n.5101
July 2008**

**Model, format, tools
and players for:**

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 Model and Format main features and rationales

The market of digital content is rapidly changing. Users are becoming more interested in using more interactive and intelligent content, that example can:
o   include/describe/package several kinds of media (audio, video, games, documents, etc.), reproducing in a single digital object the interactivity and much more powerful entertainment capabilities than DVDs;
o   provide enhanced interactivity such as navigating and selecting content elements to be played, making queries into the content elements, reacting to user commands and changes, providing annotations, etc.;
o   be exchanged and distributed among different devices/tools: PC, mobiles, smart-phones, STB/PVR, HDR, PDA, game station, etc.;
o   be obtained from several different interoperable distribution channels based on Internet, P2P, wireless mobile, satellite and/or terrestrial networks, etc.;
o   change content behavior according to the context and/or to the user profiles, context, device capabilities, etc.;
o   protect and manage the IPR, that means that the content format has to support some DRM model and that this support a set of business models, for example: renting, pay per play, subscription, advertising, etc.;
o   be stored in media centers to be redistributed to other devices;
o   present some autonomy of control, asking to the user to provide information and data;
o   provide autonomous capabilities for example to create an electronic guide, to issues content usage licenses, ask at the user to provide content, etc.;
o   be personally produced at home and/or shared in the network.

These new forms of content and content usages can be fully exploited for digital content distribution, and are opening paths for a larger set of new applications and markets beyond the limitations of the physical media. With AXMEDIS the combinations of digital content formats and digital distribution channels are creating new applications including: user content, shared content, IPTV, DVB, VOD, POD, WEBTV, etc., for PC, PDA, mobiles and STB/PVR. Recent distribution models have been enabled by a set of new technologies grounded on content formats, content processing and adaptation capabilities, content protection models and solutions, hardware capabilities, and new solutions for Digital Rights Management, DRM.

AXMEDIS Content Model Applications

AXMEDIS content format supports from simple files to complex collections of multimedia for a large range of applications, from business to business to personal and/or global scale production, protection and distribution, with and without DRM. AXMEDIS format and solution can be used:
o   for describing and/or packing and may be protected any kind of digital content, with standard, custom and extended metadata;
o   for cultural heritage valorization and distribution, educational and infotainment content: lessons, coursewares;
o   for content distribution: VOD, IPTV, WEBTV, etc.;
o   for modeling content for PC, PDA, P2P, Kiosks and mobiles with interactive parts;
o   as intelligent content having the possibility of defining the internal business model and actions on the content itself, dynamic modeling of content behavior;
o   as interchange content format, wrapping any kind of files, including SMIL, HTML, FLASH, MXF, etc., for safer audio/visual sharing;
o   for sharing content among B2B actors of the value chain, in protected and non protected versions;
o   for leisure and entertainment content: video, TV, games, etc.;
o   for distributing and protecting governmental, military, clinical information;
o   for packaging, protecting and distributing newsML;
o   for creating audio guides for PDA and mobiles

o for producing content with advertising (customized and/or real time personalized advertising inside the package or linked to outside);
o for producing and delivering personalized content inside the package or linked to outside;
o for managing personally produced content from final users and customers;
o to provide multichannel experience and distribution: different content on different channels at the same time for multichannel experience of the user.

The above mentioned scenarios and many others can be realized thanks to AXMEDIS technology and tools of: AXMEDIS content format, DRM, controlled P2P, and Content Processing, see AXMEDIS Technical Notes http://www.axmedis.org/documenti/documenti.php

AXMEDIS Content Model and Package

AXMEDIS content model can be used as a descriptor and/or package for the content for distribution of more complex elements such as NewsML, MXF, SCORM, collections, menus, etc. The AXMEDIS package can be protected and the resources managed by AXMEDIS DRM model. It may contain also links to other AXMEDIS objects and direct URL. AXMEDIS may range from simple files with single resources such as video, audio, images, documents, animations, games, etc., to cross media and multimedia content including: HTML, SMIL, MPEG-4, FLASH, etc., as presentation layer. Combinations of the above mentioned content formats 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 any distribution channels for download or streaming.

AXMEDIS Objects may contain:
o **elements** which are essences:
  o simple files audio, video, images, documents, animations, games, etc.;
  o any combinations of cross media with and without presentation: HTML, SMIL, MPEG-4, XML, FLASH, MXF, NewsML, SCORM, ZIP, etc.;
  o hypermedia with internal and external links;
  o AXMEDIS Objects as well;
o **reference** to external files and/or other AXMEDIS objects as URIs and links;
  o menus, collections, lists, interactive elements on animations, etc.
o **metadata and descriptors** associated with single resources and/or collections:
  o metadata, classification information, Dublin Core, etc.;
  o descriptors such as fingerprint, technical information, MPEG-7, XML, etc.;
  o single and/or multiple identifications: AXOID, UUID, ISBN, ISMN, ISRC, ISAN, etc.
  o business descriptors such as the AXInfo, PAR, etc.;
  o annotations to AXMEDIS/MPEG-21 content elements;
o **collections** as lists, hierarchy of files, nesting levels, menus, etc., on which users may
  o navigate, make queries on the basis of metadata of single components or files;
  o receive auto play, automated presentation, dynamic advertising, chained videos, special content, packaging audio visual with additional content, etc.;
  o access to content with different presentation algorithms, protected and/or selectively non-protected, with or without previews, and many other models.
  o perform annotations to content elements;
o **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);
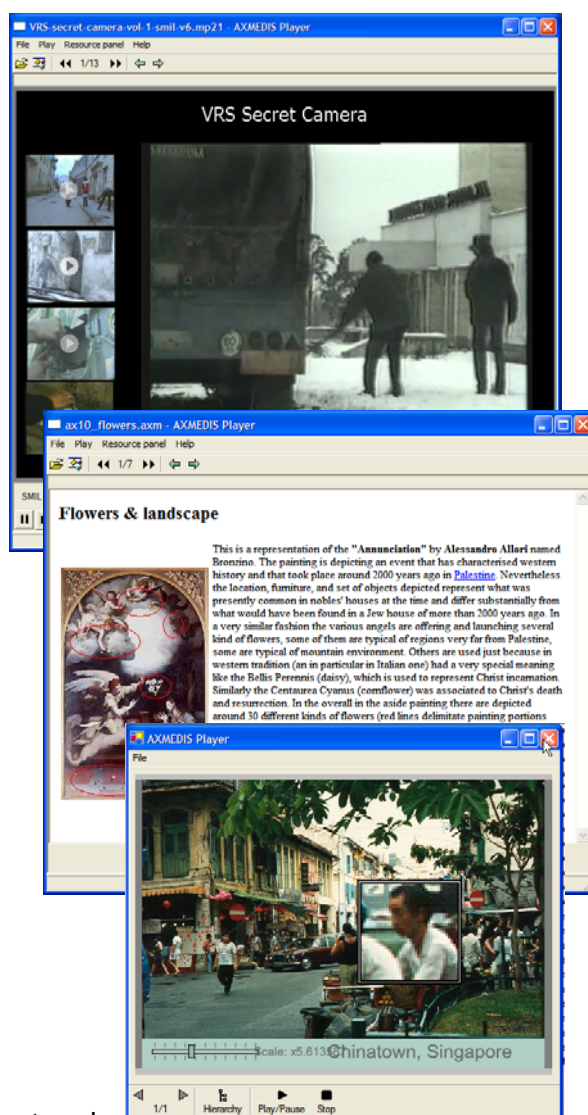
- o transformations (for example the migration of the same object to another device with some adaptation);
- o queries inside the content collection;
- o recording with additional content coming from P2P, Web, etc.
- o licensing with specific content wizard;
- o Forms to get inputs from the users;

AXMEDIS model supports both binary and XML file formats, as ".mp21", ".m21" and ".axm" extensions, respectively, download and progressive download.

AXMEDIS Editor, how to create AXMEDIS cross media content!

The AXMEDIS Editor can be used for the manual production, authoring, editing and/or inspection of AXMEDIS MPEG-21 cross media content/objects.
It can be used for

- o creation of simple and/or complex (nested) AXMEDIS objects, MPEG-21 content, collections, etc.;
- o creation of objects with links/URI to other objects and/or resources;
- o authoring of multiple Metadata and IDs;
- o integration/inclusion of digital resources and presentation information and content into the AXMEDIS object package;
- o application of content processing and/or protection algorithms (via AXMEDIS plug in);
- o registration and certification of content for DRM;
- o protection of content for DRM;
- o search, query, load and save on databases, etc. The integration with the AXMEDIS database is performed via Web Services and the AXDB module;
- o integration with OpenFlow workflow to receive commands from the workflow management system, and integrate the tools in any production process.

The AXMEDIS Editor presents:

- o Hierarchy editor to navigate the object structure, to add resources with drag and drop: images, video, documents, audio, SMIL, HTML, MPEG-4, etc., to edit their details and parameters, etc.;
- o Metadata editor and Mapper, to manipulate metadata and create XSLT mappings for them;
- o Visual editor for defining SMIL presentation details and links. Any other SMIL or HTML Editor can be used and files can be dropped into the package. HTML files can be included with their own CSS, and JavaScript, etc.;
- o Behavioral editor to create Axmethods in JavaScript defining the content business intelligence and semantics, associated with actions and other events;
- o DRM editor (MPEG-21 REL) to create licenses; Also performed with simple wizard for creating licenses and tools for licensing content for distributors;
- o Protection editor to protect the content with several different algorithms;
- o Workflow editor to set up workflow parameters, etc.

The production of AXMEDIS content can be automated by using AXCP tools as described in the Technical Note:
http://www.axmedis.org/documenti/view_documenti.php?doc_id=3624
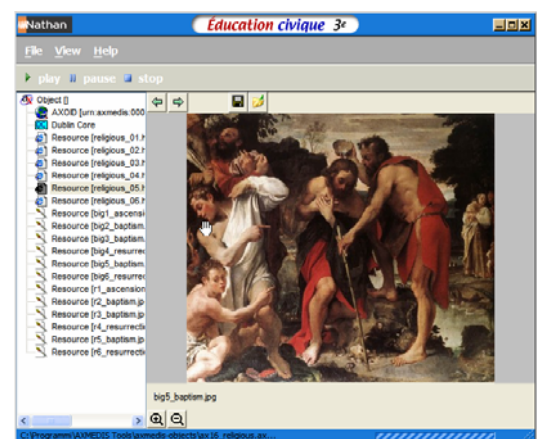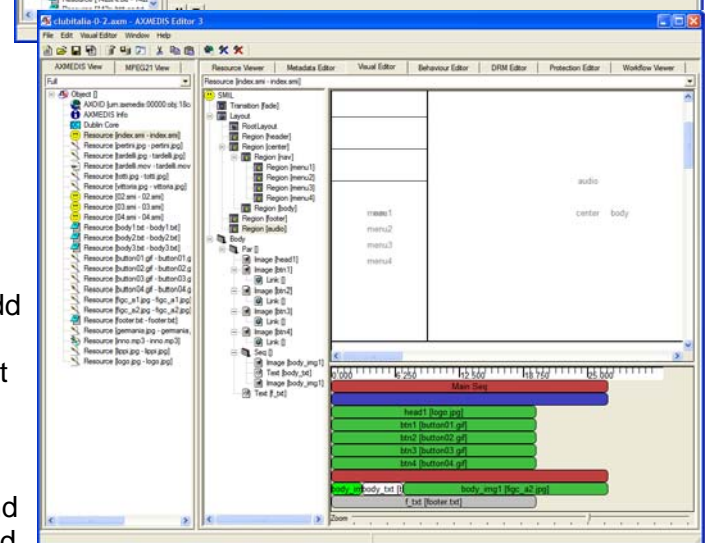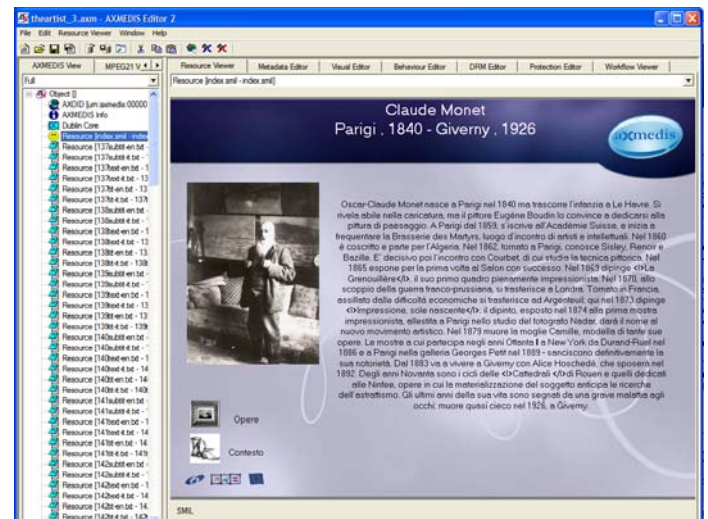
AXMEDIS Players

AXMEDIS players are interoperable, that means that are capable of rendering the same AXMEDIS objects on different players and operating systems:

o PC Windows players, capable of executing SMIL, HTML, MPEG-4, video, audio, documents, images, etc., and JavaScript. PC player may provide different skin; Most of the AXMEDIS players can be customized in terms of GUI and functionalities. AXMEDIS Skin based player can be easily customized by a designer changing the graphical look and feel.

o Active X for IE player to integrate the player into WEB pages and other applications, for example .NET based; See the CrossMedia Finder of AXMEDIS as example.

o PDA Windows Mobile 5 and 6 player, supporting: SMIL, HTML, MPEG-4, video, audio, documents, images, etc.;

o STB/PVR player based on (i) Linux, supporting audio visual, SMIL and HTML and on (ii) Kreatel STB;

o Pure java player for mobiles, supporting: SMIL, images and audio visual;

All the above AXMEDIS players have DRM capabilities. In order to access protected AXMEDIS objects, players have to be certified by a registered AXMEDIS user. AXMEDIS players are capable of reading AXMEDIS objects from files and streaming, navigating the resources, showing metadata, presenting the internal hierarchy, etc.

AXMEDIS Players Customization

The AXMEDIS players can be customized in terms of GUI and functionalities (examples of customizations are shown in this technical note figures, other can be downloaded from the portal). The customization can be focused on tuning the performance on some specific formats (audio, video, document, images, etc.) or on reducing the number of them. The standard AXMEDIS player for PC includes player capabilities for more than 400 formats.

A module/library called AXOM (AXMEDIS Object Model) can be integrated into your tool or STB decoder to transform it into an AXMEDIS DRM enabled player/decoder. AXMEDIS Skin based player can be easily customized by your designer, adding your logos and style, and changing the graphical look and feel of the player. Customizations or further extensions can be also realized by you or by AXMEDIS according to your needs.

AXMEDIS players coverage

Device for player	Models	CAS	DRM	Accounting, rep.	Player	Down, Stream, PDown.	Automated back office
PC	VOD, PPV, Counting, Periodic, subscription, ….	Yes	Yes	Yes	Yes	D,(S),PD	Yes
STB/PVR		Yes	Yes	Yes	AXOM	D,(S),PD	Yes
PDA		Yes	Yes	Yes	Yes	D	Yes
Mobile		Yes	Yes	Yes	Yes	D, PD	Yes
IPTV/STB		Yes	Yes	Yes	AXOM	any	Yes
webTV		Yes	Yes	Yes	Yes	D, PD	Yes
Social network		Yes	Yes	Yes	Yes	D, PD	Yes
UGC		Yes	Yes	Yes	Yes	--	Yes
P2P		Yes	Yes	Yes	Yes	D, PD	Yes

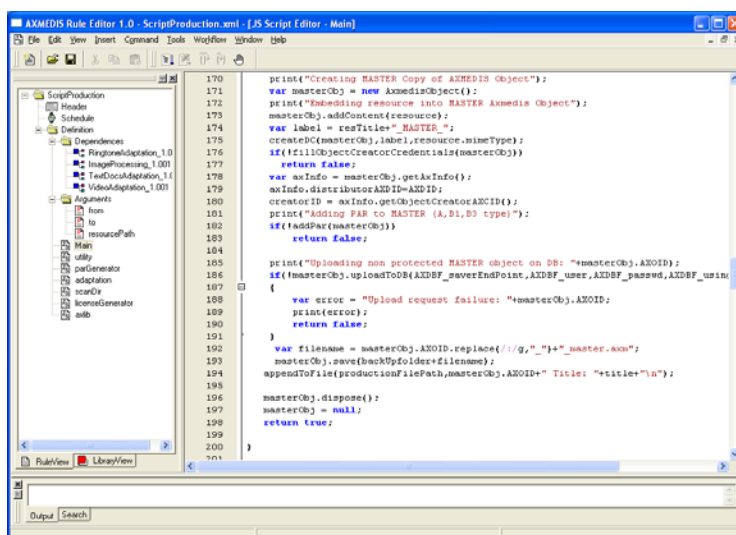## AXMEDIS Intelligent Content for advanced interactivity

AXMEDIS object model has also introduced a set of new capabilities and features that allow to provide at the final users content that interact in deeper manner with the user and may change the content's behavior and aspect on the basis on the user activities. For example, content that allows migrating its parts to another computer/device, content that may permit to make a query among its internal data, content that may stimulate the user to create other content, for example its collection of video and images, and so on. This kind of content may have potentially all features of the AXCP platform and much more interactivity with respect to any other content model: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3624. AXMEDIS PC players have full support for the production of intelligent content and annotations.

AXMEDIS CMS and Automated Content Production Tools

AXMEDIS tools and solution allows the automation of the content management process, and the content production, distribution, and publication, The automated, AXCP, and manual authoring solutions are based on a Service Oriented Architecture, SOA, and GRID to exploit legacy CMSs and archives, scheduling and automating the content production processes in the content factory and among geographically distributed factories, and workflows, etc. The user can easily formalize custom processes in AXMEDIS Javascript language and/or visual tools (the AXMEDIS javascript is compliant with javascript language).

AXMEDIS reduces the costs of content management, supports the whole value chain and makes real the convergence of media, and the interoperability of content enabling multi-channel distribution (e.g., mobile, satellite, kiosk, iTV, web, P2P, interactivity, etc), and provides a flexible and interoperable DRM, for both B2B and B2C across traditional and P2P distribution platforms. The following figure depicts an integrated AXCP solution for automated content processing and multichannel distribution.

AXCP solution is based on a scalable technology to satisfy the needs of small and large content producers, integrators, and distributors. The AXCP offers automated features and functionalities, supporting convenient integrated development tools to automate integrated activities of:

- content Ingestion and gathering, database management, crawling, indexing, archiving;
- content storage and retrieval, active querying;
- content processing, repurposing, adaptation, transmoding, transcoding for text, docs, images, audio, video, multimedia, XML, SMIL, HTML, styles, MXF, newsML, MPEG-4, MPEG-21, etc.;
- metadata repurposing, adaptation, transcoding, integration, enrichment, validation;
- content descriptors, extraction and comparison, fingerprint, MPEG-7, MPEG-21, etc.;
- content composition, formatting, layout, styling;
- communication with databases, FTP, HTTP, P2P and distribution servers via several protocols;
- content packaging: MPEG-21, MXF, OMA, newsML, ZIP, etc.;
- content protection via several algorithms;
- content DRM with MPEG-21 and OMA, with tracking and reporting rights exploitation;
- content licensing, licensing the production of licenses;
- content publication and distribution toward multiple channels;
- workflow management integration with BizTalk and OpenFlow;
- user management: registration, licensing, profiling, advertising.

AXCP Rule processes can be formalized by composing visual blocks (as in the above figure) that may represent elementary elements as well as processes with their deadlines and activation models. The AXCP solution is open and can be expanded and/or customized by:

o creating AXCP Rules as visual processes and composing them;
o creating and customizing javascript AXCP Rules and blocks to be executed on AXCP Nodes and reused;
o activating Rules according to different policies such as: periodic, sporadic or on demand from third parties, external tools, web services, etc.; Also the AXCP rules may active other rules, etc.
o customizing, realizing and installing additional AXMEDIS plug-ins to add new formats, encoders, decoders, adapters and converters, etc. The AXMEDIS Plug-in technology is open, well documented and supported by a development tool kit;
o organizing AXCP GRID Nodes in a hierarchical manner. An AXCP Node may control one or more AXCP Schedulers which in turn may control other AXCP Nodes, etc.;
o executing operating system processes, passing them parameters/files and getting eventual errors.

For additional details on the AXCP solutions and tools, please see the technical note on AXCP: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3624

AXMEDIS Multichannel DRM support

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 DRM can be used to setup and manage DRM solutions for AXMEDIS content model using AXMEDIS players or other tools with AXMEDIS technology.

All the AXMEDIS players have DRM capabilities. AXMEDIS DRM solution can cover:

o Internet distribution: 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 self production, distribution and sharing;
o integrated business to business to consumers (B2B2C) distribution models.

Technical Information

AXMEDIS players are available for the above mentioned platforms. 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. AXMEDIS servers are based in MS Windows XP and/or Linux. Specific customizations have to be negotiated on the basis of your needs. Training, integration and service level agreements are also available.

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/). AXMEDIS is open and allows you to access source code of all libraries and tools, 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, BBC, EUTELSAT, Telecom Italia, TEO, ELION, HP, Giunti Labs, AFI, ACIT, EXITECH, XIM, SIAE, SDAE, etc.). AXMEDIS allows you to exploit innovative results with new tools and solutions for content market.

AXMEDIS Content Distribution and other Integrated Solutions

The AXMEDIS Object Model is a solution for modeling distributing content. It has also been designed to be used in conjunction with:

- **AXMEDIS AXCP** to automate your content production, protection and distribution as stated above and in more details into the technical note:
  http://www.axmedis.org/documenti/view_documenti.php?doc_id=3624
- **AXMEDIS DRM** which adopts MPEG-21 DRM, including servers and licensing tools and allowing DRM, detection of attacks, black list management, collection of actions logs containing traces about the rights exploitation, tools for administrative management, etc.
  http://www.axmedis.org/documenti/view_documenti.php?doc_id=3616
- **AXMEDIS P2P Controlled Network**, for content distribution via P2P. It utilizes BitTorrent Technology with query support and cataloguing servers, for protected or non protected content. It has capabilities of automating content publication, controlling P2P network, and extracting statistical data and reports. The AXMEDIS P2P solution allows to control the network by means of control nodes that can be geographically distributed: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3612
- **AXMEDIS Cross Media Finder:** an integrated portal for demonstrating AXMEDIS content and distribution: http://variazioni.axmedis.org:8080/CrossMediaFinder/
- **AXMEDIS COPOP**, to involve your final users, to collect their content and metadata, to automatically transcoding, packing and redistributing user content for social networking and content enrichment.
  http://www.axmedis.org/com/index.php?option=com_content&task=view&id=79&Itemid=50

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.
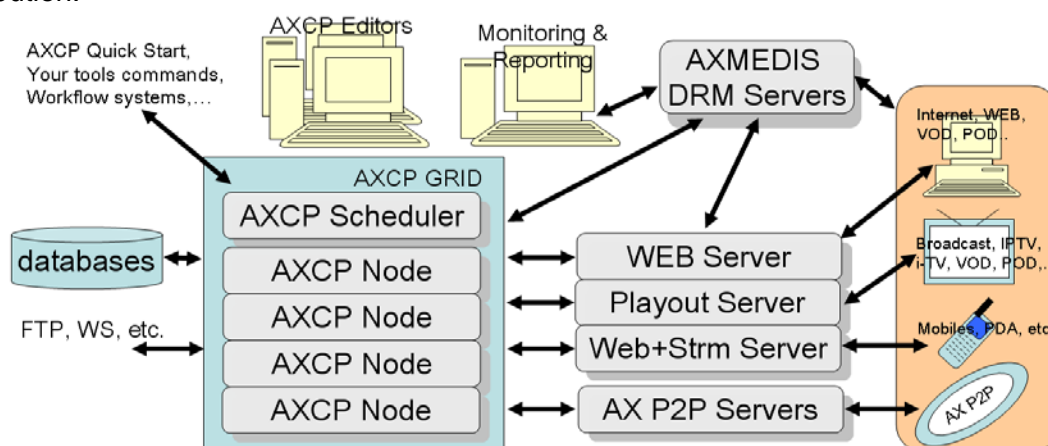
In this case, the DRM technology can be MPEG-21 or OMA which is used to distribute content according to several different business models (pay per play, monthly rate, etc.), different rights (play, print, etc.), with different conditions (times of play, duration, etc.).

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, AXMEDIS COPOP, etc.) have been designed to satisfy a large set of requirements collected by AXMEDIS Consortium partners and user group AXMEDIS tools are based on modular components which can be reused to set up a large range of different configurations/solutions. They are open to be customized to cover your needs and business ideas. For any issue, please contact AXMEDIS reference person.

AXMEDIS Tools for your download

In the following, the links to download the most important AXMEDIS player are reported. It is also possible from the AXMEDIS portal to download additional AXMEDIS tools and content:

o Available PC players are:
  o AXMEDIS stand alone PC player;
    http://www.axmedis.org/documenti/view_documenti.php?doc_id=3767
  o AXMEDIS Skin based PC player;
    http://www.axmedis.org/documenti/view_documenti.php?doc_id=3716
  o AXMEDIS Active X, for usage into HTML pages and simple VB and/or .NET applications and PC players. .NET Player; http://www.axmedis.org/documenti/view_documenti.php?doc_id=3717
o PDA Windows Mobile 5 and 6 player, supporting: SMIL, HTML, MPEG-4, video, audio, documents, images, etc.; http://www.axmedis.org/documenti/view_documenti.php?doc_id=3842
o Mobile http://www.axmedis.org/com/index.php?option=com_content&task=view&id=172&Itemid=91
o Many other production tools of AXMEDIS from:
  http://www.axmedis.org/com/index.php?option=com_content&task=view&id=83&Itemid=55

AXMEDIS Technical Notes

On the AXMEDIS portal you can find a set of other technical notes on:

o How to integrate the AXMEDIS DRM into a e-Commerce portal for digital content
  http://www.axmedis.org/documenti/view_documenti.php?doc_id=3736
o The show case of TEO (Telecom Lithuania) in adopting AXMEDIS DRM into their VOD service to STB based on Kreatel http://www.axmedis.org/documenti/view_documenti.php?doc_id=3738
o The show case of ELION (Telecom Estonia) in adopting AXMEDIS DRM for content distribution service towards PC http://www.axmedis.org/documenti/view_documenti.php?doc_id=3745
o The show case of EUTELSAT in adopting AXMEDIS for satellite data broadcast of AXMEDIS content towards PC and STB http://www.axmedis.org/documenti/view_documenti.php?doc_id=3820
o The show case of TISCALI in adopting AXMEDIS Model, P2P and DRM for content distribution service towards PC.
o The show case of ILABS in adopting AXMEDIS solution for the automated production of content and distribution towards PDA and java enabled mobiles
o The show case of BBC in adopting the AXMEDIS tools for distributing content that is created on the user side by recoding free on air DVB-T and integrating additional content and information coming from internet and AXMEDIS P2P.
o The show case of TI, Telecom Italia, about the usage of AXMEDIS as back office management and interoperable platform among AXMEDIS MPEG-21 DRM and OMA
o The show case of SIAE for content collection from the users.
o The show case of VARIAZIONI about the usage of AXMEDIS DRM for content enrichment and distribution, mainly video, images and audio
o Etc.

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