**Technical Note
n.5101
May 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 interactive multimedia and cross media content. For example, content which can:

o include several kinds of media inside (audio, video, games, documents, etc.), reproducing in a single digital object the interactivity and the entertainment capabilities that you can see now on DVDs and much more;

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, 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 personal information of the user, the profiles;

o be acquired by using preferred business models: renting, pay per play, subscription, advertising, etc.;

o be stored in media centers to be redistributed to other devices;

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 model is designed to support all types of cross-media interactive contents with DRM support or without, from simple multimedia files to complex collections for a large range of applications, from business to business to personal and/or global scale **production, protection and distribution** of:

o cross media content for cultural heritage valorization;

o content for DVB, VOD, POD, IPTV, WEBTV, etc., with interactive parts;

o content for PC, PDA, P2P, Kiosks and mobiles with interactive parts;

o intelligent content having the possibility of defining the internal business model and actions on the content itself, dynamic modeling of content behavior;

o interchange content format as wrapped MXF for safer audio/visual sharing;

o leisure and entertainment content: video, TV, games, etc.;

o educational and infotainment content: lessons, coursewares;

o governmental and/or military information and content;

o healthcare content such as clinical information;

o news as packages, newsML, for exchange, protection and delivering;

o content with advertising (customized and/or real time personalized advertising inside the package or linked to outside);

o business content such as contracts and data;

o personalized content inside the package or linked to outside;

o personally produced content from final users and customers;

o multichannel experience and distribution: different content on different channels at the same time for multichannel experience of the user.

The above mentioned innovations and many others can be accessible thanks to AXMEDIS solutions for cross media content modeling, DRM, controlled P2P, and content processing, with the support of automated
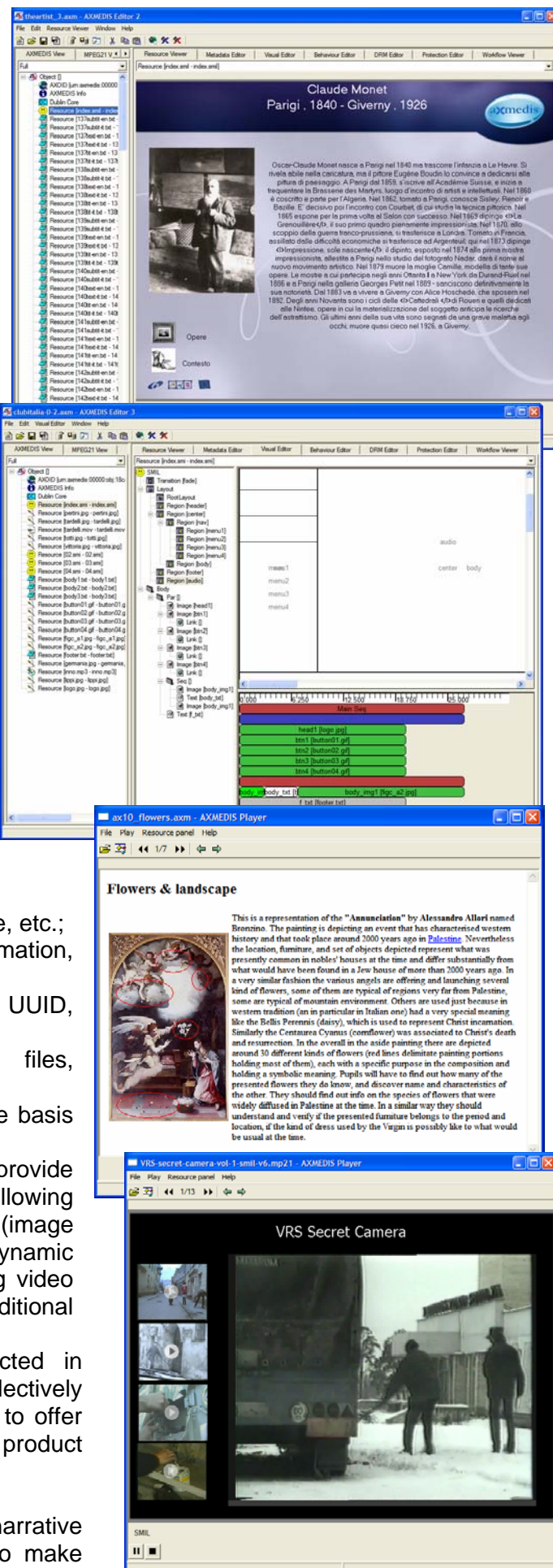
production and DRM tools and players as described in the following and in other AXMEDIS Technical Notes http://www.axmedis.org/documenti/documenti.php

AXMEDIS Content Model and Package

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 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.

The AXMEDIS content model enables to distribute, for download or streaming (RTSP and/or MPEG-2 TS), AXMEDIS content packages (also called AXMEDIS Objects) containing:

o simple files:
 o audio, video, images, documents, animations, games, etc.;
 o any combinations of cross media with presentation formalized in HTML, SMIL, MPEG-4, XML, FLASH, MXF, etc.;
 o hypermedia with internal and external links;
 o menus, collections, lists, interactive elements on animations, etc.
o reference to external files and/or other AXMEDIS objects as URIs and links;
o content with a large variety of information associated to single resources and/or content collections.
 o any metadata, classification information, Dublin Core, etc.;
 o any descriptors such as fingerprint, technical information, MPEG-7, XML, etc.;
 o any single and/or multiple identifications: AXOID, UUID, ISBN, ISMN, ISRC, ISAN, etc.
o collections as lists or hierarchically organized files, collections/packages, AXMEDIS objects (nesting levels)
 o on which users may navigate, make queries on the basis of metadata of single components or files;
 o with HTML and/or SMIL as presentation layers to provide interactivity to users and presentation of other files allowing the setup of: menus, lists, text, list of icons (image previews), audio play and image presentation, dynamic advertising integration, chaining of videos, merging video and special content, packaging audio visual with additional content, etc.;
 o with files and internal nested packages protected in different manners with different algorithms, or selectively non-protected. This allows to create previews and to offer non protected content elements to show users the product and stimulate them to acquire licenses;
o annotations to AXMEDIS/MPEG-21 content elements;
o AXmethods, to add dynamic JavaScript adding narrative capabilities, actions and semantics, and in general to make

more intelligent and interactive the content package behavior. This enables final users to perform activities of: (i) content enrichment (addition of comments and data to content), (ii) content transformations (for example the migration of the same object to another device with some adaptation), (iii) content queries inside the content collection, (iv) integration of recording with additional content coming from P2P, Web, etc. All these features are operated on the basis of user rights obtained from a purchased license.
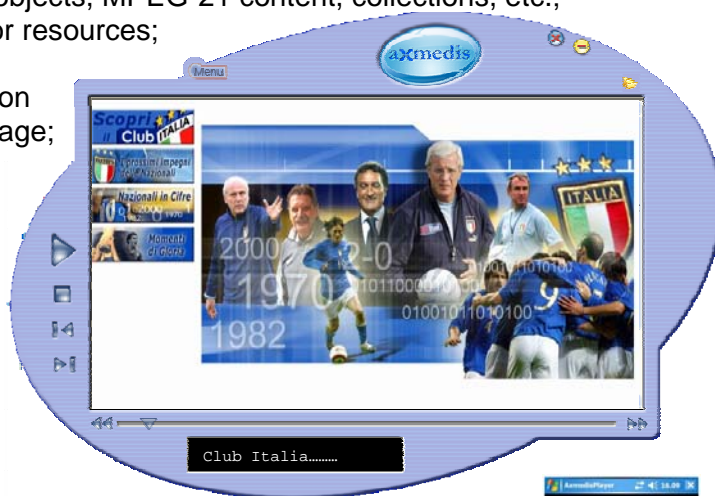
AXMEDIS permits the combination of innovative content models with protection and DRM aspects to respect copyright laws. AXMEDIS supports a large variety of DRM models and rules according to concepts of interoperability among DRM models (e.g., MPEG-21 and OMA).

AXMEDIS model support both binary and XML file formats, as ".mp21" and ".axm" extensions, respectively.

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 to actions and other events;
o DRM editor (MPEG-21 REL) to create licenses;
o Protection editor to protect the content;
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 capable of rendering AXMEDIS objects, and are available on different operating systems

and of different kinds:

o PC Windows players, capable of executing SMIL, HTML, MPEG-4, video, audio, documents, images, etc., and JavaScript.
o Available AXMEDIS PC players are:
    o stand alone PC player;
    o Skin based PC player;
    o Active X, for usage into HTML pages and simple VB and/or .NET applications and PC players;
    o .Net player based on Active X;
    o Mozilla plugin;
    o SEJER player;
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;
o PC Apple MAC player, supporting: SMIL, MPEG-4, video, audio, documents, images, etc.

All the 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.

Customization of AXMEDIS Players

Most of 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). 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 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

The AXMEDIS Automated Content Production tool, AXCP, and related AXMEDIS database, are an open, integrated, distributed, and scalable solution for Content Management; capable of automating content production, management and protection for multichannel distribution and many other purposes.
AXCP solution is based on GRID technology and allows automated management of: content, metadata and licensing information, etc., with the operations of ingestion, crawling, database management, indexing, processing, adaptation, transcoding, encoding, decoding, descriptor extractor, recognition, filtering, production, archiving, storing, packaging, preview, extracting fingerprint, licensing, DRM, profiling, protection,

encryption, accounting, enrichment, network management, etc. AXCP tools can be integrated and controlled by your applications and/or workflow management systems.
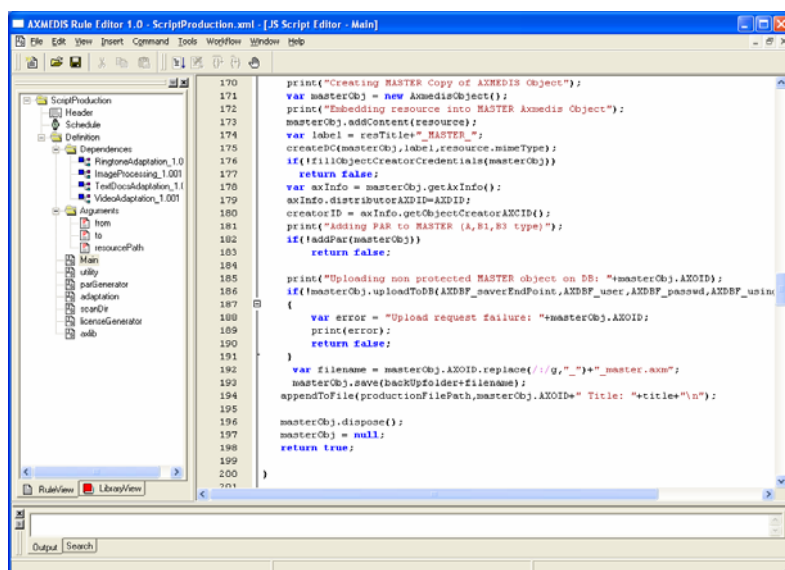
AXMEDIS allows reducing costs and increasing efficiency of your content management. AXMEDIS supports the whole value chain and makes real and simple the convergence of media, the media transcoding, and the interoperability of content enabling multi-channel production and distribution (e.g., mobile, satellite, kiosk, iTV, web, P2P, interactivity, etc). AXMEDIS also provides a flexible and interoperable DRM, for both B2B and B2C across traditional and P2P distribution platforms.

The AXCP can be used for simplifying the back office for production and portals by automating:

o content production for single as well as for multiple distribution channels and multiple DRM models in a fast manner and low costs;
o content and/or license production on demand, VOD;
o content filtering and repurposing in real time;
o video, audio and text fingerprint, and fingerprint recognition in real time;
o control of P2P networks, content sharing and distribution, in real time;
o content processing, adaptation, transcoding, etc., in real time;
o collecting content and metadata, metadata integration, processing and enrichment;
o layout of content: SMIL and HTML automated production and optimization.

In brief, the AXCP facility 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 executing AXCP 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).

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.
o

Technical Information

AXMEDIS players are available for the above mentioned platforms. The AXMEDIS server 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. 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.
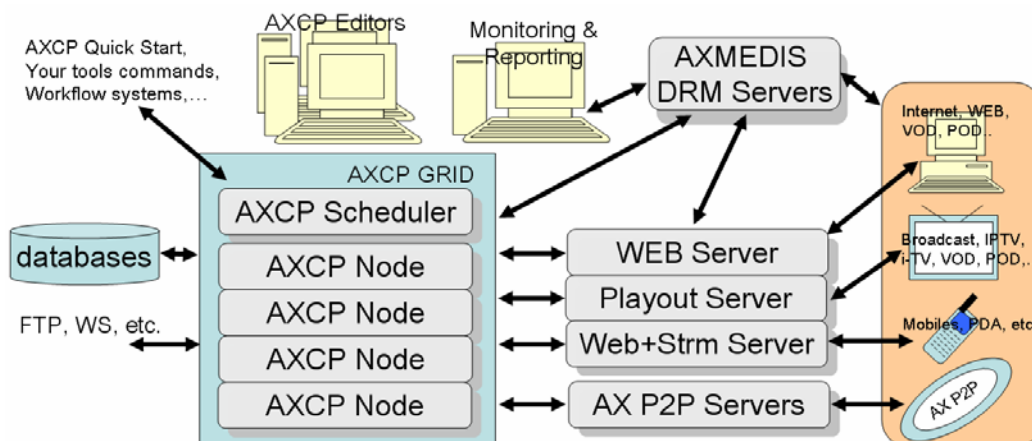
AXMEDIS Adoption and Affiliation Programs

AXMEDIS has been adopted and currently trialed by several industrial partners, who have expressed their appreciation (see http://www.axmedis.org/ibc2007/). 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 38 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 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 tool 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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