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  - contribute to the improvement of AXMEDIS documents and specification by sending the contribution to P. Nesi at nesi@dsi.unifi.it.
  - attend AXMEDIS public meetings, for further information see www.axmedis.org or contact P. Nesi at nesi@dsi.unifi.it.
Preface

Currently, the digital-content market is growing very fast and it needs solutions of production, protection and distribution of massive content collections for accessing new markets and defining/trial new business solutions.

Major limitations:
- Convergence of the media, interoperability of content
- DRM applications and introduction in several distribution channel
- Massive processing of content processing and distribution
- Etc.

These are a real challenge for many industries that are discovering the complexity of managing large digital content factories and distribution chains.

Content producers, providers, aggregators and distributors constantly need to adopt innovative means.
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**AXMEDIS Model**

- An AXMEDIS Object is a container of:
  - Metadata (Dublin Core, AXMEDIS specific metadata, any XML metadata)
  - Any Digital Resources (audio, video, images, documents)
  - An (optional) SMIL file for the presentation of digital resources
  - Other AXMEDIS Objects (embedded or referenced)
- An AXMEDIS Object is a MPEG21 Digital Item with a specific structure
- Kinds of AXMEDIS Objects
  - A Basic AXMEDIS Object is an AXMEDIS object with resources and the related metadata
  - A Composite AXMEDIS Object contains/references other Basic/Composite AXMEDIS Objects
- Only AXMEDIS Objects have metadata
- Only AXMEDIS Objects can be protected but metadata are always accessible

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**AXMEDIS Object structure**

- **AxObject**
  - **AxOID**: unique identification
  - **AxMetadata**: mandatory content description special B2B metadata
  - **AxContent**: resource embedding hierarchical composition external content referencing
  - **AxResource**
  - **AxReferred Object**

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**AXMEDIS Object: an example**

- **Music Album Object**
  - **AxOID**
  - **AxInfo**
  - **AxDublinCore**
  - **AxMetadata**
  - **AxContent**
  - **AxResource**
  - **AxReferred Object**

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**Metada – Dublin Core**

- Dublin Core Metadata are a standard set of metadata usable for multimedia cataloging
- 15 basic elements
  - title, creator, contributor, description, coverage, format, date, identifier, language, publisher, rights, source, subject, type, relation
- Other elements and derived elements
  - abstract, audience, available, conformsTo, dateAccepted, ...

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**AXMEDIS Object Manager**

- The AxInfo contains B2B and AXMEDIS specific metadata
  - ObjectCreators (ID, Name, Company, Nationality, etc.)
  - Owner (ID, Company etc.)
  - Distributor (ID, Name, Company, etc.)
  - Object version & revision
  - IsPromoOf (AXOIDs)
  - History of object production
  - Workflow information
  - Fingerprint algorithms used
  - Internal Potential Available Rights (the rights owned)
  - Potential Available Rights (the rights on sell)
  - Metadata certification and status

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**AXMEDIS Object Manager**

- Execution of commands
  - add, delete, ...
  - change resource
  - edit metadata
  - save, upload on DB

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**Backstage Video**

- Metadata will be always accessible for indexing and querying

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  - Adaptation
  - Fingerprint
  - Descriptors
  - Workflow
- Content Protection Tools
  - Legal Aspects
  - Protection Processor
  - DRM Tools
- Comments, Acknowledgements & Contact Information

AXMEDIS Architecture

AXMEDIS Editor inside the AXMEDIS Factory

AXMEDIS ActiveX

AXMEDIS Editor

AXMEDIS Player Mozilla's plugin
The same page can be displayed on Mozilla...

... and Internet Explorer

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Demos:
- Demonstration
  - AXMEDIS Editors
  - Metadata editor
  - DRM editor
  - Plug in for processing content
  - Access to the database
  - Creation of composed objects
  - AXMEDIS Players as Active X and plugins

Fast and Continuous Crawling of Content
- Your CMSs
- AXMEDIS Rule Editor
- Workflow manager
- Focus seek Crawler
- AXMEDIS Content Production
- Rule Engine
- AXMEDIS Database

Crawling the TISCALI Xaura2 CMS
- Xaura2 is a Java XML/XSL based CMS platform for Internet content distribution
- All content metadata are stored in the file system as XML files, only a few of them, mainly for search, indexing and status purposes, are stored in the Database.
- The MediaClub is an instance of Xaura2 containing a movie archive:
  - 89 movies
  - 189 people (directors and actors)
**Purpose of this tutorial**

- **Content Model and Production Overview**
  - AXMEDIS Model
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**AXMEDIS Editor / Authoring / Renderer / Players**

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**AXMEDIS Content Processing**

- AXCP Rules include metadata for heading information (Header) and firing (Schedule)
- AXCP Rules contain algorithms for composition, formatting, adaptation, transcoding, extraction of fingerprint and descriptors, protection, license manipulation, potential available rights manipulation, resource manipulation, load and save from databases and file system, content migration etc. (Definition)
- Algorithms are written by using JavaScript programming language
- JS was extended with data types derived from AXMEDIS Framework, MPEG21, and general resource definition such as: images, documents, video, licenses, etc.
- to use different functionalities for content processing by means the AXMEDIS Plugin technology (adaptation, fingerprint, etc...)

**AXMEDIS Content Processing Area: AXCP Rule Engine**

- It is an IDE tool for:
  - Creating and editing AXCP Rules
  - Defining parameters and required AXMEDIS Plugins
  - Editing, checking and debugging JS code
  - Activating AXCP Rules into the AXCP Rule Engine

**AXMEDIS Content Processing Area: AXCP Rule Engine (GRID)**

- AXCP Rule Scheduler performs:
  - rule installation, firing
  - executors discovering, monitoring, engaging, remote control (GRID)
  - rules transfer, logs generation
  - rule installation, firing

**AXMEDIS Content Processing Area: AXCP Rule Engine (GRID)**

- AXCP Remote Executors is an executor of AXCP rules in the Factory LAN and consists of a JavaScript script engine to run the JScript code associated with rules.
Adaptation of audio content

- **Functionalities:**
  - Support a variety of file formats and codecs (mp3, wav, aiff, wma,...)
  - Supports down-sampling and channel-mixing
  - Allows selecting precisely a piece of a file
  - Support for MPEG-21 Digital Item Adaptation descriptors:
    - adapt to a particular user’s presentation or rendering preferences
    - adapt to a particular user’s auditory deficiency
    - adapt to output capabilities of the terminal

Usage of Fingerprint

- Then Content Owners, may
  - monitor distribution channels
  - published content collection
  - Etc.

To detect the passage of their content by
- estimating in real time the fingerprint
- searching into the database

Adaptation of multimedia content

- **Functionalities:**
  - Allows creating generic multimedia files (3GP, MP4, ISMA compliant)
  - Adaptation of aggregated simple media files (MPEG-4 audio and video, JPEG images, AVI files, SRT subtitles...)
  - Media tracks may be added, removed and delayed
  - Extraction of single track from multimedia files
  - File splitting by size or time
  - Concatenation of multimedia files
  - Conversion between different multimedia scene formats (MP4, BT, XMT, SWF, X3D, SMIL...)

Excursus – Biometrics
Extraction of descriptors from audiovisual data

- General Purpose
  - Content Identification
  - Content Verification

- Purpose within AXMEDIS
  - Primary: ensuring a "clean" AXMEDIS environment
  - Secondary: content identification, e.g. for monitoring of the distribution channels

- In AXMEDIS
  - Developments for audio content, images, video content
  - Plug-In interface for the integration of existing algorithms

- MPEG-7 "Multimedia Content Description Interface"
  - Description of audiovisual content in multimedia environments
  - Provides standardized core technologies

- Applications
  - Indexing
  - Retrieval
  - Recommendation
  - Intelligent browsing
  - Classification
  - Automatic summarization

Extraction of descriptors from audio content

- Functionalities
  - Each file characterized by a numerical model describing its content according to different dimensions of music perception:
    - Currently: timbre
  - Models can be used to compute similarity between files
  - Application:
    - Music classification
    - Music recommendation
    - Playlist generation
    - Clustering of music collections

- Future functionalities
  - Rhythm and melody/harmony models to describe audio content more faithfully
  - Segmentation based on semantic regions to allow for easy browsing of audio files and automatic thumbnailing

Extraction of descriptors from audiovisual data

- Low Level Descriptors
  - Describe audiovisual data on a low semantic level
  - Example:
    - Spectrum shape of an audio signal
    - Dominant colour of a picture

- High Level Descriptors
  - Descriptors with a higher semantic hierarchy
  - Example:
    - Music genre of a song
    - Keywords of a text

Lexical processing

- PoS tagging of plain text files (English only)
- Extraction of a definable number of single word keywords (TF.IDF)
- Integration with collocation keywords

Semantic processing

- Word Sense Disambiguation of the extracted keywords
- WordNet synset association to each keyword
- Identification of main semantic domain
Extraction of descriptors from audio content

- **Functionality**
  - Each file characterized by a numerical model describing its content according to different dimensions of music perception:
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**Axmedis Workflow Integration**

For AXMEDIS, the workflow will form a backbone for the automation of various production and distribution activities by inter-acting with various AXMEDIS tools.

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Rights clearance process – state of the art

1. I have to identify the rights holders

Potential Rights holders
- Music Producer - master owner
- Music Publisher
- Recording label
- Companies with rights to license
- Distributors (licensed in various markets)

2. I have to negotiate clearances for the intended usage with each right holder of each work

I have to send them all information needed (description of the new work, usage, territories, terms etc)

Right holders may change some conditions (only certain territories) ... may not grant permission for certain usage (can’t edit the work)

or worst, they may deny permission on my preferred choices... or propose too high costs...
Problems to be solved

- Rights negotiation process is arduous and frustrating...
- The multimedia producer has spent a lot of time
- The multimedia producer has spent a lot of money
- The multimedia producer has not get permission for all chosen works
- The multimedia producer can’t afford all proposed costs
- The multimedia producer has to reshape the original project or, worst, renounce to do it ...

Rights clearance process – state of the art

- In the best case dozen of separate written contracts have to be issued.
- Right holders are inclined to apply lump sum schemes (once for all payment) also because it is impossible for them to control if licenses’ conditions are respected...

Problems to be solved

- Rights holders cannot control if their contracts are respected
- Multimedia producers cannot control if their contracts are respected
- Users may not control consumers behaviors...
- Users reports sent to collecting societies are often not homogenous
- Collecting societies data are often not exhaustive
- Collection and distribution of rights revenues may be frustrated

Rights collection process – state of the art

- Rights holders identification: easy and in real time
- He can easily search any digital content – several criteria
- He directly receives available resources with relevant data
- Multimedia producer registered in AXMEDIS
- Multimedia producer will try to get advances and flat fee payment also because he cannot control if contracts’ conditions are respected...

AXMEDIS SOLUTIONS
**AXMEDIS SOLUTIONS**

**2. Rights clearance process: easy and in real time**

- Multimedia producer registered in AXMEDIS
- To get rights he must obtain the licences
- He immediately receives digital licenses and protection info associated to each AXMEDIS content
- Licences include rights available, conditions, eventual prices and protection info include all details on what has to be done in access to the resources

**AXMEDIS SOLUTIONS**

**3. With AXMEDIS each content is protected, each action is controlled**

- AXMEDIS protects each content (i.e. encryption, fingerprint, watermark, etc.)
- AXMEDIS allows access at content only to who has been authorized and certified
- AXMEDIS allows to do only what is define in the licenses
- AXMEDIS verifies, supervises and controls if licenses conditions are respected
- AXMEDIS prevents any unauthorized use of content

**AXMEDIS SOLUTIONS**

**Thanks to AXMEDIS ...**

- Multimedia producer registered in AXMEDIS
- Does NOT have to spend time and efforts to search for digital content
- Does NOT have to spend time and efforts and to identify right holders
- Does NOT have to spend time and efforts to know what rights are available
- Does NOT have to spend time and efforts to negotiate agreements
- Does NOT have to spend time and efforts to issue contracts
- Does NOT have to spend time and efforts to create a new audiovisual object

**AXMEDIS SOLUTIONS**

**AXMEDIS automatically reports to rights holders info on their rights usage**

- Multimedia producer
- Number of time rights have been exploited, where, when etc
- Rights holders of the music incorporated in the object
- AXMEDIS reporting tool

**AXMEDIS SOLUTIONS**

**AXMEDIS automatically reports to collecting societies info on rights usage**

- Music Collecting societies
- Number of time rights have been exploited, where, when etc
- AXMEDIS reporting tool
With AXMEDIS each right usage is automatically reported to actors involved in the value chain.

With AXMEDIS each right holder can control the use of their rights (original right holders, new right holders, distributors, users etc)

With AXMEDIS consumers behavior can be controlled

With AXMEDIS collecting societies can get all data needed to monitor users and to collect and distribute revenues in an efficient and transparent manner.

In addition AXMEDIS incorporated objects can be separately exploited.

A registered user watches the documentary. He wants to get rights for using a song heard in the documentary but he does not know the song title.

He makes the query to get metadata and rights available on that object.

That song can be extracted for reuse following the associated license and he can directly get the license.

That song can’t be extracted but he got data to directly make the query of that song.

AXMEDIS increments the access to content and offers several new business opportunities.

Managing License Chain

Alice says, “Bob has the right to issue a license to anyone to print the book.”

Bob says, “Carol has the right to print the book.”

To solve the SubSubLicense all the connected Licenses are needed

They have to be accessible on Processing Engine.

This may involve massive processing.

No risk of piracy
More creativity
More business
More revenues
The Protection and Control Process

1. Registration & Authentication
2. Content Access
3. Business Transaction
4. Usage
5. Control and Supervision
6. Tool Certification

Installation

A Distributor

Requesting license

Production, one for each

Tool Certification

Control and Supervision

Protection Processor

- Core module to ensure trustiness of the AXMEDIS content manipulator
  - HW/SW Fingerprint estimation
  - Content (Un)Protection

Protection Processor

- Rendering, modifying, ...
- any Content Manipulator

AxObjectManager

Protection Processor: Step by step example

1. do verification
2. request authorization
3. load Prot. Tool (identified by ID)
4. unprotect

AXMEDIS License Production

A Distributor

Needs Massive Production, one for each user for each content

 AXMEDIS License Editor

AXMEDIS Protection Manager

Prot. Content

AXMEDIS Compliant Players

AXMEDIS The Protection and Control Process

A Distributor

New Protected Object: Post Portfolio (WS)

AXMEDIS Protection Tool

AXMEDIS License Editor

AXMEDIS Protection Manager

AXMEDIS Compliant Players

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**Successful Content Consumption**

1. **Play a song**
2. **Is user authorised?**
3. **Yes! Play the song!**
4. **User & tool ok, check licenses**
5. **Log authorisation**

If user is not authorised:
6. **Request license**
7. **Purchase license**
8. **License OK**

**Rights Expression Translator**

1. **User owns a song purchased through AXMEDIS**
2. **License format MPEG-21**
3. **License can be transferred to listen to the song**
4. **User wants to listen to his song in the mobile**
5. **License format OMA DRM REL**
6. **License is translated**
7. **Rights Expression Translator**
DE8.4.1 AXMEDIS Editorial Format Guidelines and AXMEDIS Editorial Format Guidelines
DE8.3.1 Multilingual guidelines and technical solutions
DE8.2.1 Content Selection Guidelines
DE8.1.1 Content for Test Cases and Validation
DE2.2.1 Test Cases and Content Description
DE2.1.1 User Requirements and use reports on content
DE4.8.1 Content Distribution via satellite data
DE4.7.1 Content Distribution toward mobiles
DE4.6.1 Content Distribution via Internet
DE4.4.1 Content sharing and production on P2P
DE4.3.1 Content Composition and formatting
DE4.2.1 Content indexing, monitoring and querying
DE4.1.1 Content Modelling and managing
DE5.2.1 AXMEDIS Framework Validation and AXMEDIS Framework Infrastructure
DE5.1.1 AXMEDIS Framework Infrastructure
Early Reports on Basic Technologies
DE4.1.1 Content Modelling and managing
DE4.2.1 Content indexing, monitoring and querying
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DE4.8.1 Content Distribution via satellite data broadcast, the push optimisation and the on demand problem
DE4.9.1 The Usability issues for the AXMEDIS production tools

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Comments, Acknowledgements & Contact Information

Hope you have enjoyed this Tutorial

- For additional information please refer to AXMEDIS contact person or access to the AXMEDIS web portal and/or CD for further documentations and reports from which this Tutorial has been produced.
- Updated reports are being produced annually.
- By affiliating with AXMEDIS and participating the AXMEDIS events and activities, you will be kept up to date with the latest progress and development.

Additional AXMEDIS courses include:

- AXMEDIS Detailed Overview, 6 hours, full day course
- AXMEDIS Content Production area, demonstration and training
- AXMEDIS Content Distribution area, demonstration and training
- They are available online at the AXMEDIS web portal

Contact Information

- If you like to know more about the AXMEDIS framework and other AXMEDIS technologies and functionalities please do not hesitate to contact the project coordinator:
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