Distribuzione Multicanale di Contenuti Cross Mediali e Multimediali

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Convergence, the Interoperable Content

- Internet Distributor
- P2P Distribution
- Mobile Distributor
- Broadcasters, DVB-H
- Media Distributor
- Broadcasters, DVB-T
- Broadcasters, DVB-S
- Kiosks distribution
Cross-Media Content

- Cross-Media content is substantially
  - a model where digital resources are glued with some XML based document (e.g., HTML, SMIL, SVG, SCORM, MXF, LASER, …).
  - the latter establishes hyperlinks among them to navigate among them.

- a generalization of the concepts of:
  - hypertext
  - e-book, e-literature
  - e-newspaper
  - e-guide
  - electronic school book
  - …

Typically created by composition
Why Cross-Media?

- Cross-media is used in the areas of:
  - educational, edutainment, entertainment, infotainment
  - ... (omitted)
- Cross-media allows making business delivered in:
  - DVD/CD ROM,
  - HTTP protocol
- A large number of applications and it is growing
- UPT TO Now, they cannot be:
  - Delivered in a single package, shared, streamed
  - Protected
  - Reused as components
- NEEDS shared among AXMEDIS consortium and other partners of other projects such as IMAESTRO, VARIAZIONI, etc.,
  - a unified package/format to enable their business
  - about 55 partners with similar requirements

AXMEDIS Editor: an example
AXMEDIS: is a R&D Integrated project of the EC

- Perform research on enabling technologies to allow
  - reduction of distribution and aggregation costs for content production, protection and management
  - using and exploiting new models, methods and tools for content production, protection and distribution

- Create a unified platform for content production and distribution:
  - Supporting interoperability among different
    - content formats, cross media and simple resources
    - distribution channels (TV, PDA, mobile, kiosks, broadcasting,..)
    - DRMs (digital rights management) models (e.g., MPEG-21, OMA, Windows DRM, etc.)
  - Supporting massive processing for content production and distribution (on demand), license processing, protection, tracking and DRM, exploitation of legacy CMSs
  - Integration and Harmonization of DRM in B2B and B2C areas
    - Enforcing flexibility in business and transaction models
    - Modeling secure/legal P2P sharing for B2B and B2C
    - Expanding and exploiting MPEG-21 standard

Distribuzione Multicanale
AXMEDIS Applications

- Applications of automated content production and protection
  - Entertainment, edutainment, infotainment, educational, etc.
    - Real-time and non-real-time content distribution
    - Internet, P2P, broadcast, IPTV, mobiles, DVB-T, DVB-S, DVB-H, etc.
  - Other relevant applicative areas are:
    - banking, governmental, military and healthcare

- Technical solution for
  - Massive and scalable production of content on demand
  - Content distribution: single and multi-channel
  - Content protection and DRM, tracking and control
  - Content management
  - Content sharing among producers and distributors
  - Content integration and metadata enrichment
  - Etc.

- AXMEDIS Framework for all
  - Set up and maintenance of an European Platform for improving the knowledge and tools on e-Commerce of digital goods.
  - Making the AXFW accessible

AXMEDIS Architecture
Content

- Cross Media Content
- DRM
- Content Production on Demand, POD
- Content Adaptation
- Content Processing, AXCP GRID architecture
- DRM Interoperability for multichannel
- AXMEDIS framework

AXMEDIS Cross Media Content Model

- Model supporting B2B-B2C content production and transactions,
  - for protected and non protected objects
- Based on MPEG21 Digital Items
- Overcoming limitations in content modeling and DRM of Windows Media, I-Tune, Adobe, Google, etc.:
  - Any kind of metadata and Any kind of IDs, multiple IDs
  - Cross media: any kind of digital resource
    - images, documents, video, audio, games, MPEG-4, etc.;
    - Presentation: HTML, SMIL, SVG, LASER, etc.
  - Content components: composition and reuse;
  - DRM interoperability: MPEG-21 and OMA, etc.
  - DRM Chain of licenses: B2B and B2C integration;
  - Integration of semantics and behavior into the content.
- Supporting legal/secure P2P for B2B and B2C/C2C
- DRM, Digital Rights Management
  - Modeling licenses for the B2B-B2C areas
  - Algorithms and tools for processing licenses, chains and relationships
AXMEDIS Object Model

- UUID
- Metadata
- Content
- Resource
- Object
- Referred Object

**MPEG21 Digital Item**

- unique identification
- mandatory
- content description
- special B2B metadata
- Info and PAR
- DublinCore
- resource embedding
- hierarchical composition
- external content referencing

Packaging and Protection, Open Model

- Packaging
- Metadata
- Resource
- Prot-Info Model
- License Mode
- License Production
- Protection
- Protected Digital Content

www.axmedis.org
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MPEG-21 REL data model

- REL grant consists of
  - principal to whom grant is issued
  - rights the grant specifies
  - resource to which right in grant applies
  - condition to be met before grant can be exercised
Rosy can Play 3 times the Ocean Wilds in November 2003.
Managing License Chain

- **Alice states**: “Bob has the right to issue a license to anyone to print the book in Italy”
- **Bob states**: “Carl has the right to print the book in Italy”

To solve the SubSubLicense for Carl all the connected Licenses are needed
- Licenses have to be accessible on Processing Engine

Managing License Chain and Protection Information
The Protection and Control Process

1. Registration for Authentication
2. Installation
3. Tool Certification
4. Business Transaction
5. Content Access
6. Usage

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Cross media Content Adaption

Examples of Cross media Adaption
Convergenza della formattazione con GA

![Graph showing convergence of formatting with GA](image)
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The Content Processing

- Automating massive processing, applications
  - For the on-demand problem:
    - Adaptation, transcoding, processing, ...
    - Advertisement insertion
    - Managing profiling (user device, network, etc.), etc.
  - Multi-channel distribution:
    - multiple interoperable DRMs, license chain processing/reasoning
  - Content recognition for monitoring
    - broadcast and networks,
    - P2P, Web sites, etc.

- Automating back office content production/protection and distribution
  - Open, secure and scalable architecture for content processing, GRID
  - Language for content processing and GRID
  - Uses plugins for content adaptation/transcoding for multi-channel production, fingerprinting, processing profiles, etc.
  - Algorithms for automated formatting of content: SMIL, style, Genetic Algorithms
**AXMEDIS Content Processing GRID**

- **AXCP GRID**
- **Workflow manager**
- **AXMEDIS Rule Editor**
- **Your CMSs**
- **AXCP Scheduler**
- **AXCP nodes**
- **WS, FTP, etc.**
- **Your CMSs**
- **AXMEDIS Database**
- **Distribution Channels and servers**
- **Any Plug-in for content processing**

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**AXCP processing capabilities**

- **Access**
  - Content and metadata Ingestion and Gathering
  - Access to databases and communication channels
  - WEB Service, Op. System access, etc.
- **Profiling**
  - Profile management: device/terminal, user, environment and network
  - Decision taking and processing
- **Protection**
  - MPEG-21 IPMP, OMA, etc.
- **Licensing**
  - Production and processing, verification, querying, etc.
  - MPEG-21 REL, OMA ODRL, etc.
- **Content production/Processing**
  - Metadata, integration, augmentation and extraction
  - Content Processing: adaptation, transcoding, filtering, analysis, recognition, etc.
  - Content Composition and Formatting (SMIL, XSLT)
  - Packaging: MPEG-21, OMA, MPEG-4
- **Supporting security**
  - Using protected content and DRM support, content processing is performed in secure manner even on the GRID nodes according to the DRM rules/licenses
AXMEDIS slides, http://www.axmedis.org

Paolo Nesi, Facolta' di Ingegneria, Universita' di Modena, 8 Giugno 2007

AXCP Rule Editor

AXCP Rule Engine: Rule Scheduler

- The Rule Scheduler manages the rules and available remote executors.
- Each Rule Remote Executor has a corresponding counterpart image on the Rule Scheduler side to represent its capabilities and status.
- Knowing the availability and capabilities of a Remote Executor is mandatory to verify the suitability of the computer that will execute the rule.
Formally, an AXCP Rule signature is:

$$ R = f (S_1, S_2, ..., S_n, P_1, ..., P_m) $$

Where:

- $S_i$ is a Selection (sequence of queries), to be sent to the AXMEDIS Database to retrieve digital object (content) IDs, such parameter is exploded in terms of list of objects IDs during the execution of the rule.

- $P_i$ is a parameter (basic type as integer, string, XML string, Boolean, etc.), it could represent, for example, the scale factor or the MIME type of the output format, the number of object collections to be created, name of the author, etc.

- $f$ is the identifier of a rule (e.g., the Rule ID);

- $R$ is the consumptive result of the rule application. It could be a status, a new AXMEDIS object, or a metadata manipulation result, the license of an AXMEDIS object, a message to be returned to the AXMEDIS Content Processing Area, etc.
AXCP Rule Engine: Rule Executor

- It is a computational unit in the distributed environment that executes the rule.
- **Rule Executor Manager** is the command interface to the SpiderMonkey Javascript engine.
- **Script Executor** hosts an instance of SpiderMonkey Javascript Engine (called JS Engine).
- **Launcher and Initializer** prepare the JS Environment and create the context for the script.

**GRID Node Executor Profile**
- Identity of the executor (computer name, IP address, location, etc…)
- Computational capabilities: (CPU, RAM, Clock, Disk Space, network costs for the communication with the database, etc…)
- Provided Functionalities:
  - AXMEDIS Plug-In installed (For each plug in the name and version are provided).
  - External tools Plug-In installed (For each plug in the name and version are provided).

AXCP Rule XML description

- General metadata regarding: rule name, AXRID (rule identifier), rule version, rule type, software name, version of software, date of production, time of production, author, affiliation, URL, comment, last modification and terminal ID. (Header), etc…
- Temporal metadata describing conditions for firing the rule, expiration time, periodicity and the rule status (“active” or “inactive” and (Schedule)
- List of arguments (parameters and selections), list of dependences (required AXMEDIS plug-ins) and the rule body (the JavaScript code to run). (Definition)
Planning and Exploiting Node capabilities

- GRID node has a profile describing its capabilities: time profile, memory, HD, communication, tools and plug ins, etc.

Script per l’adattamento di Cross Media

- // acquisition of profiles, content to be adapted
- Directives=GetUpdatedProfileInformation(UserID, Terminal, Network, Distributor, Natural);
- A=GetCrossMediaContent(database, ObjectID);
- ResourceDescriptors=ExtractingResourceDescriptors(A);
- // production and publication for MPEG-21/AXMEDIS distribution channel
- FormattingParameters=MPEG21_Channel;
- FA=CMC_Adaptation(A, FormattingParameters, ResourceDescriptors, Directives);
- OB=MPEG21_Package(FA); // packaging the cross media content into MPEG-21/AXMEDIS format
- AXOID=OB.RegisteringSetAXOID(AXCS);
- If (OB is not protected) {
  - Pinfo=MP21_RandDefinePinfo(); // define protection information
  - OB.MP21_Protection(Pinfo); // protection
}
- OB.ObjPublishing(Portal1); // publishing on MPEG-21 distribution channel

- // production and publication for OMA channel
- FormattingParameters=Mobile_OMA_Channel;
- FB=CMC_Adaptation(A, FormattingParameters, ResourceDescriptors, Directives);
- OMAPinfo=OMA_RandDefinePinfo(); // define protection information
- OC=OMA_Package(FB); // packaging the cross media content
- OC.ObjPublishing(Portal2); // publishing on OMA distribution channel
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Multichannel

Distributors managing different channels

Different DRMs

- AXMEDIS
- OMA
- Windows Media
The AXMEDIS Multichannel architecture

Per channel and/or area

- Internet, IP DistributorS
- Mobile DistributorS
- Broadcasters DVB-H
- Media DistributorS
- Broadcasters DVB-T
- Broadcasters DVB-S
- Kiosks distributorS
- ...... distributorS

PMS/AXCS

Internet, IP DistributorS

DistributorS

Mobile DistributorS

Media DistributorS

Broadcasters DVB-T

Broadcasters DVB-S

Kiosks distributorS

...... distributorS

PMS/AXCS

PMS/AXCS

PMS/AXCS

PMS/AXCS

PMS/AXCS

PMS/AXCS

PMS/AXCS

PMS/AXCS

P2P Network among DRM Servers

Req Collected Action Logs

Req User info

Post User info

Reg. OBJ info

Req OBJ Grant

User movement

Req User info

Replicas

Replicas

Replicas

Replicas

Replicas

Replicas

Replicas
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- AXMEDIS framework and demonstrators

AXMEDIS Technical Architecture

User Interaction and/or Automated Control via WSs

AXMEDIS (CP) Content Processing
- Script Editor and Debug
- AXCP GRID Scheduler

AXMEDIS Authoring Tools
- Metadata
- Resources
- X & Multimedia
- Styles
- DRM Licenses
- Protection information

AXMEDIS manual and automation, content sharing and Distribution Tools
- AXPETool B2B P2P
- AXMEDIA B2C P2P
- Programme and Pubs

AXMEDIS Model Supports and Plug-ins
- AXMEDIS, MPEG-21 Databases
- AXMEDIS, DRM Servers
- AXMEDIS Authoring Tools
- Metadata Resources

AXMEDIS, XML, XSLT, WSDL, OS, etc.

Plug-in Manager
- DRM Support
- Protection Support
- Content Processing
- Content Formatting
- Database Support
- Workflow Support
- Content Descriptors
- Communication Support
- Metadata Support

WS, https, FTP, Webdav, etc.

AXMEDIS, MPEG-21 Databases

AXMEDIS, DRM Servers

Traditional and P2P Distribution Channels and servers

AXMEDIS manual and automation, content sharing and Distribution Tools

AXMEDIS Authoring Tools
- Metadata Resources

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AXMEDIS, XML, XSLT, WSDL, OS, etc.
AXMEDIS Applications/Demonstrators

- P2P distribution with AXMEDIS
  - B2B content distribution
  - C2C content distribution and sharing
  - Sharing content among archives and mediateques

- Distribution towards:
  - PC players:
    - via Internet+P2P: TISCALI Media Club, DSI
    - via Satellite data broadcast: EUTELSAT, ILABS, DSI
  - PDA via Kiosks: ILABS + ANSC Kiosks, TISCALI, DSI
  - STBs:
    - DVB-T, VOD: TEO, VRS (telecom Lithuania)
    - STB/PVRs via Satellite data broadcast: EUTELSAT, MBI
  - Mobiles:
    - MPEG-21 distribution to mobiles: ILABS, TISCALI, DSI
    - OMA based distribution to mobiles: Telecom Italia, BBC, DSI
  - IPTV players: Telecom Estonia, TEO, VRS
  - DVB-T + home domains/media center: BBC, SDAE, ETRI, UPC

- Content Enrichment and sharing via P2P:
  - VARIAZIONI (other 10 partners): GERMINUS, RIGEL, ALBENIZ, UPC, etc. (www.variazioni.org)

- Content Posting Portal for Authors and Editors
  - Trial: SIAE, DSI, UPC, EXITECH

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