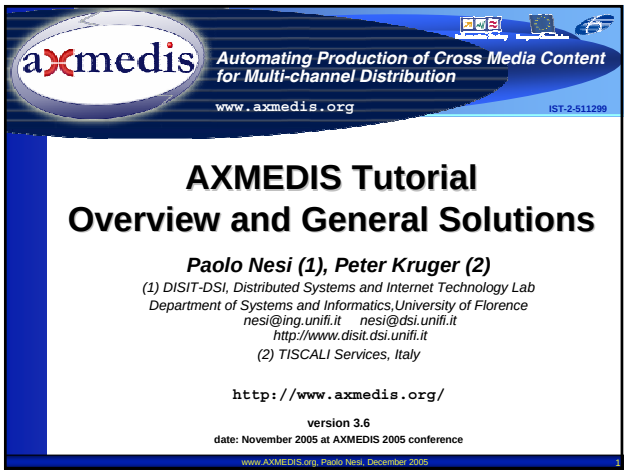
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Automating Production of Cross Media Content for Multi-channel Distribution
www.axmedis.org
IST-2-511299
AXMEDIS Tutorial
Overview and General Solutions
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version 3.6
date: November 2005 at AXMEDIS 2005 conference
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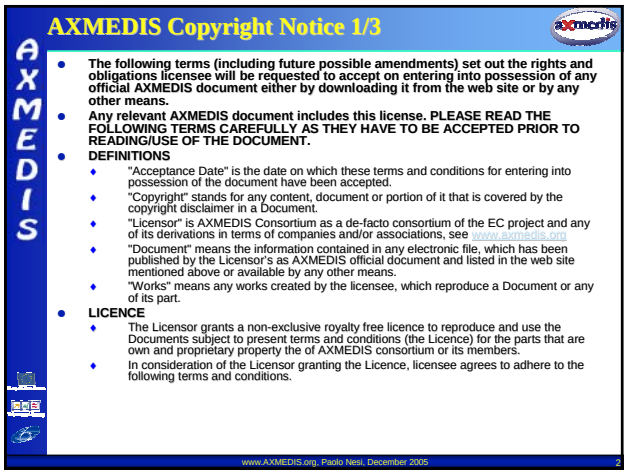
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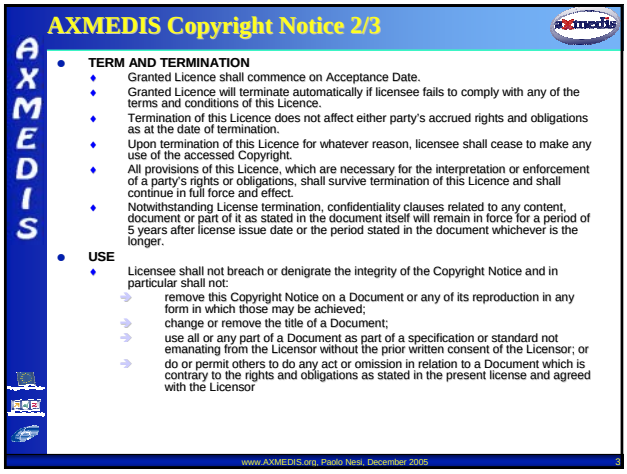
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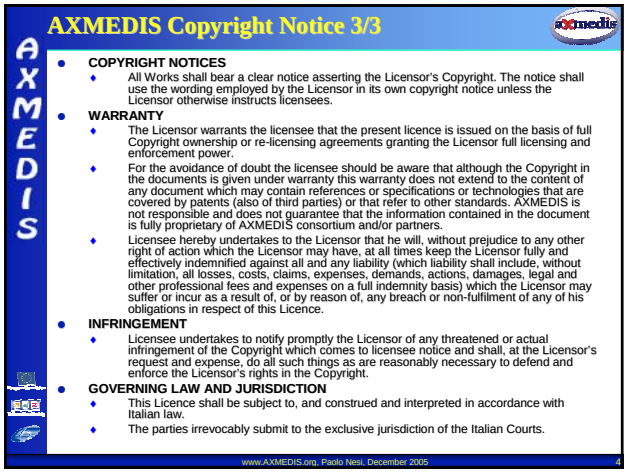
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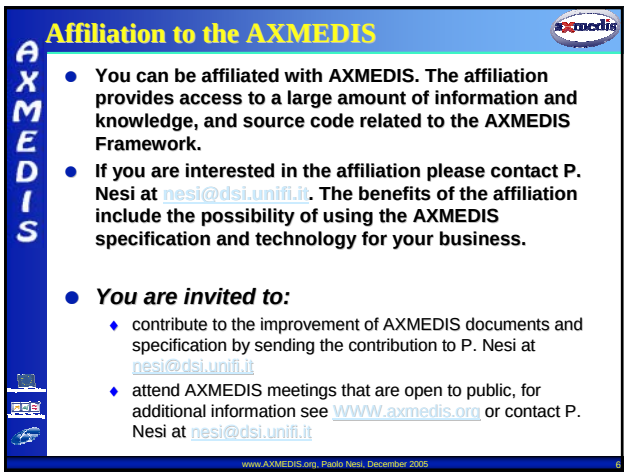
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- What is AXMEDIS
- Market Analysis and Opportunities
- General State of the Art
- Needs and Limitations
- AXMEDIS Content Packaging
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- AXMEDIS Content Production and Processing
- Examples of AXMEDIS Applications
- Conclusions and references

Preface

- ***Currently, market of digital-content is growing very fast and it needs solutions for accessing new markets and defining/trial new business solutions***
- ***Major needs:***
  - *Convergence of the media, interoperability of content*
  - *Flexibility in the business and transaction models*
  - *DRM applications and introduction in several distribution channels*
  - *Harmonization of B2B and B2C areas for DRM*
  - *Massive processing in content production and distribution, and in license processing and event tracking*
  - *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 need to adopt innovative means to cope with the above needs**

Purpose of this Tutorial

- **This training course is the first of a series and provide you an overview of the AXMEDIS technologies, solutions and architecture.**
- **It gives you answers to the following question**
  - What is AXMEDIS ?
  - Which is the State of the Art of the sector ?
  - Which are the innovations/advantages of AXMEDIS ?
  - What can I do with AXMEDIS ?
  - Why I should use AXMEDIS ?
  - Which are the major tools of AXMEDIS ?
  - How can I use AXMEDIS for my business ?
  - Which implications I have in using AXMEDIS ?
  - Who can help me in knowing more ?
  - Any other whish ?
  - …

- **If you are not satisfied please ask to the tutor to have more !!**

Schema of the Tutorial and Purpose

- **Duration: 3.5-4 hours**
- **Which could be the Attendees of this Tutorial:**
  - **who** is interested to get a general overview of AXMEDIS aim, technology, solutions and tools
  - **Business Managers** interested in assessing if AXMEDIS is suitable for their business or not, if it is an advantage or not, etc.
  - **Technical Managers** interested to have a first overview
    - impact of AXMEDIS technology in their solutions
    - technical innovation of AXMEDIS with respect to the state of the art
  - **Research Managers** interested to get on overview of the whole architecture and assessing the advantages for Using AXMEDIS framework for:
    - testing and developing new solutions, new algorithms, etc., reducing costs of infrastructure creation
    - Promoting and disseminating their new solutions on a large audience

WHAT is AXMEDIS

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What is AXMEDIS ?

- **A project of the European Commission, proposed by a set of companies to solve a set of problems in the area of e-commerce of digital content**
  - approved by the EC for reaching a fixed set of objectives
  - partially funded by the EC and partially from the Companies involved
- **The major aim is**
  - *to create the AXMEDIS Platform on the basis of new technologies and*
  - *to make accessible this platform for SME, research centers, and any other partner interested in*
- **The affiliation is possible, and allow you to access at the knowledge and tools/source code produced**
- **Started the 1st September 2004**
- **Value of about 14 Meuro**
- **About 120 people are working on AXMEDIS every day**

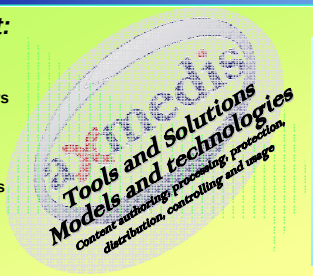
Main general Objectives

- **reducing distribution and aggregation costs for content production and management by**
  - applying innovative techniques to content production, processing (GRID), representation (format) and workflow;
  - Produce and distribute cross media content in protected manner, integrating B2B and B2C sides, the IPR respect
  - Allowing the content distribution and collaborative production at B2B level, via P2P in the respect of IPR
- **Increase accessibility to the European audio visual content for its exploitation for entertainment, valorisation, etc.**
- **Create a unified European platform for content distribution in terms of DRM and interoperability**

AXMEDIS purpose

Content:

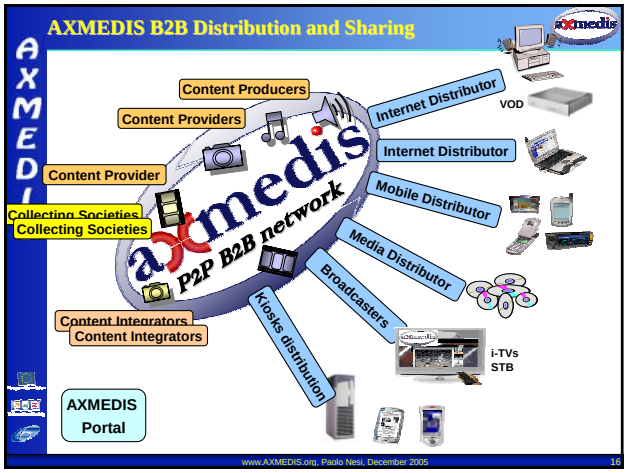
- Producers
- Providers
- Aggregators
- Packager
- Integrators
- Promoters
- Distributors
- ..



- Supporting both B2B and B2C distribution
- Reducing costs for Content Production, processing, etc
- Enabling Multichannel Distribution
- Enabling Interoperable Distribution of content
- Enabling e-commerce of secure digital content

Create a unified European platform for content packaging, protection and distribution in terms of DRM and interoperability (convergence)

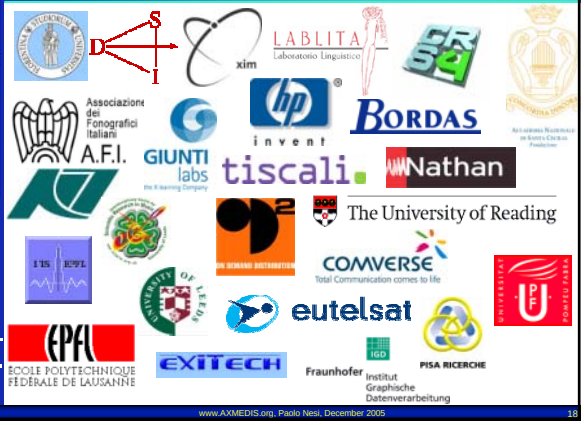
AXMEDIS B2B Distribution and Sharing



Main general Objectives

- **developing and providing new methods and tools for innovative and flexible Digital Rights Management (DRM), including the**
  - Allowing file sharing on P2P with the respect of IPR
  - exploitation of MPEG-21 and overcoming its limitations,
  - support different business and transaction models.
  - Supporting MPEG-21 and ODRL of OMA
- **Integrating present CMSs and solution with AXMEDIS framework and tools**

AXMEDIS Consortium



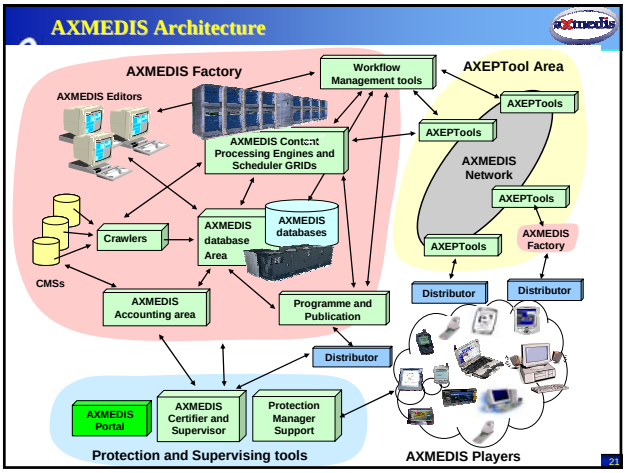
Business Opportunities 1/2

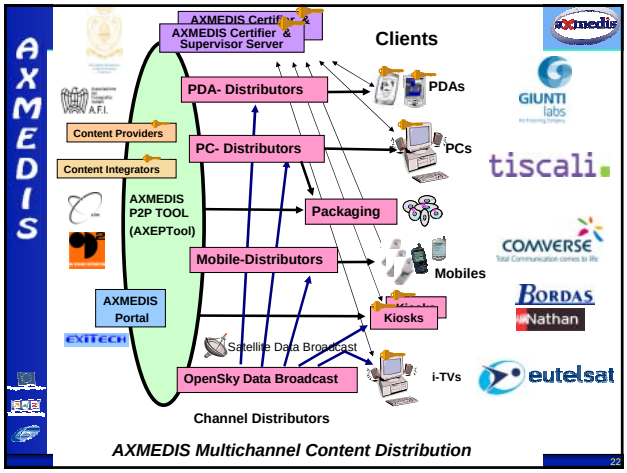
- **For ALL Business Actors and for Content Provider/Producers**
  - exploit a multi-channel distribution, convergence of media
  - Greater control of content usage in all the channels B2B2C
  - possibility of creating new business model
  - lower costs of production, B2B distribution, promotion via P2P B2B
  - lower costs for content gathering, transcoding platform, production of content on demand with AXCP
  - greater level of security
- **For Content Distributors/Mediators to**
  - defining several different business models adapting the distribution channel to the users needs and would
  - distribute content with AXMEDIS tools on P2P to Consumers but based on DRM
  - exploit P2P technology to access at content via the AXEPTool P2P B2B

Business Opportunities 2/2

- **For Content Integrators and Multimedia Publishers to**
  - simple and direct access at content coming from many content providers, integrators, etc., in easy manner,
  - integrate cross media content and automatically managing rights for complex multimedia products
  - have the possibility of defining several different business models adapting the distribution channel to the users needs and would
- **For Final user to**
  - get access to the same content on several platforms and locations, to have content at low price, etc.
  - have content at lower price, etc.
  - share content with AXMEDIS tools on P2P but based on DRM
- **For Collecting Societies to**
  - have access at direct reports about the Content exploitation
- **For IT companies to**
  - Save time and money in accessing at innovative technologies for content production and distribution, integrated environment

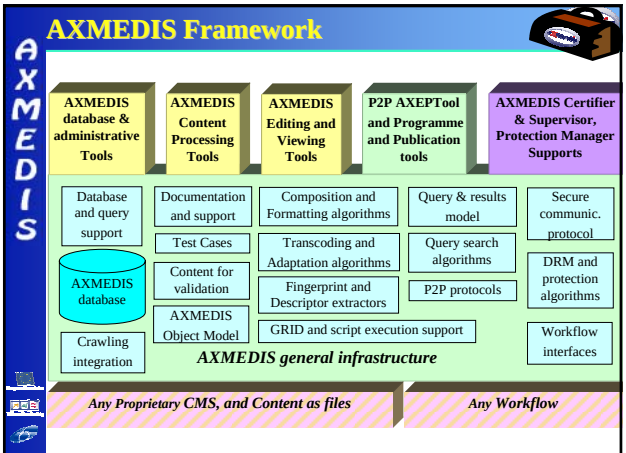
AXMEDIS Architecture





AXMEDIS Multichannel Content Distribution

AXMEDIS Framework

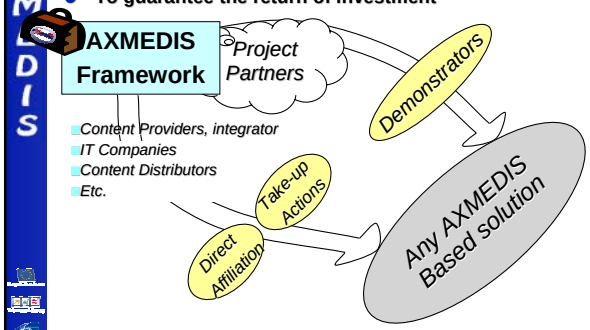


AXMEDIS features

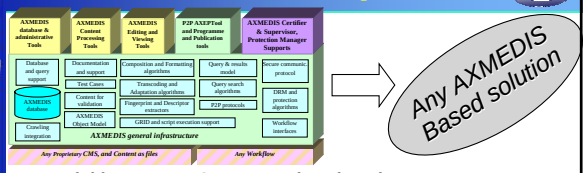
- **Technical solutions related to the above mentioned technical objectives:**
  - Integration with legacy
  - Interoperability of content and DRM, multichannel, etc.
  - Reduction of production costs
  - DRM improvement, tracking of events
  - Innovative technologies in Fingerprinting, modelling, P2P, DRM, authoring, production, etc.
- **AXMEDIS framework for all**
  - European platform for common exploitation of results

AXMEDIS Framework

- **Exploitation of AXMEDIS research and innovation**
- **To guarantee the return of investment**



As the AXMEDIS Framework can be exploited



- **Exploiting AXMEDIS Framework and Tools**
  - Content Processing (AXMEDIS CP GRID)
    - Reducing production costs and time
    - Accelerating: composition, formatting, protection, feature extraction, distributions, publishing, etc.
  - Set up and management of single/multichannel Content Distribution with DRM
  - Customising AXMEDIS Players (PC, PDA, etc.) for creating YOUR Players
  - Customising AXMEDIS P2P tools for B2B
- **Exploiting AXMEDIS Infrastructure**
  - Accessing to advanced State of the Art and standards solutions
  - Sharing Content in a B2B Environment (AXEPTool)

Contact Information

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Market, trend and opportunities

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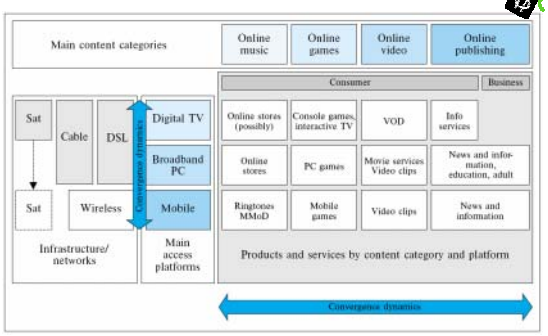
Key facts

- IP infrastructure is reshaping the media entertainment and media business market
- Western Europe broadband entertainment content will rise from less than 1 Bil. € in 2005 to over 5 Bil. € in 2009 (IDC)
- By 2009 over 50% value in video distribution. The rest being made of music and gaming distribution (IDC)
- Two new distribution paradigms adding to existing digital distribution:
  - **IPTV – operator centric DTV model**
  - **Home and personal Network Entertainment – open PC centric model (with DMAs, mobiles etc.)**

Content and channels



Source EITO2005

Western European Online Content revenues

Main content categories	Online music	Online games	Online video	Online publishing	
	Consumer				Business
Digital TV	€ 0 (no service today)	€ 236 million	€ 166 million	€ 0 (no service today)	
Broadband PC	€ 40 million	€ 82 million	€ 46 million	€ 373 million	€ 8,374 million
Mobile	€ 0.6 million	€ 254 million	€ 150 million	€ 288 million	€ 88 million
Main access platforms	Products and services by content category and platform				
Offline (in € billion)	7.9	3.5	13.4	80	5
Online (% of total)	0.5	16	2.7	0.8	65

Source EITO2005

User's Trends

- **Younger are abandoning the TV**
  - More time on PC/games console
  - More money on i-TV
- **Market is becoming fragmented**
  - Several channels and models:
    - push, time shifted, tivo, media center, DVD recorders, DVB-S, DVB-T, DVB-H, VOD, etc.
  - Several media: video, audio, i-TV, etc.
  - Personal TV: ……
- **Consumers are going to**
  - Differentiate each other, more individuality
  - More personal needs

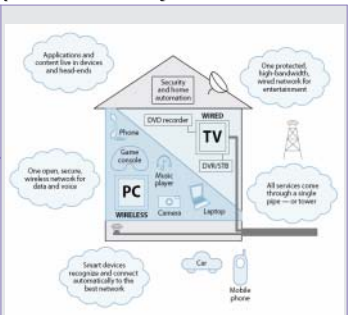
Hardware devices will be key to the customer relationship

- **The Apple I-tunes/I-pod success story**

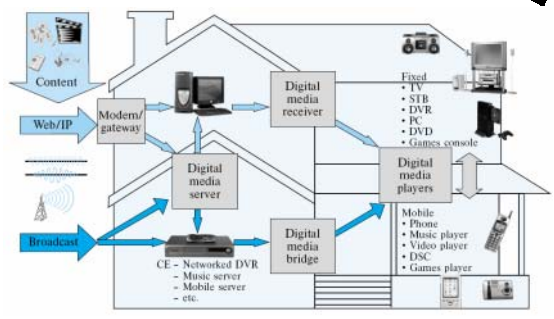
If content is King, then the device is King Kong:
- During the 2000-2003 timeframe the music industry has lost ca. 15% value each year
- By combining by coupling a service (I-Tunes) to the device (I-pod) Apple has managed to kick start the music on line distribution business
- 300 million tracks sold (up 200% over 6 months)
- Apple's profits are not in the tracks, but in the devices
- Users perceive value in the device rather than in the files
- It's the fetishistic shift from the plastic support to the device (PDAs, mobiles, music players)

But which device is the living room equivalent of the I-pod?
- focused on ease of use adds value to content

All players involved:
- Content owners
- Large retailers
- Telcos
- Broadcasters
- Hardware manufacturers
- Software giants
- Consumer Electronics



The Media Usage at home



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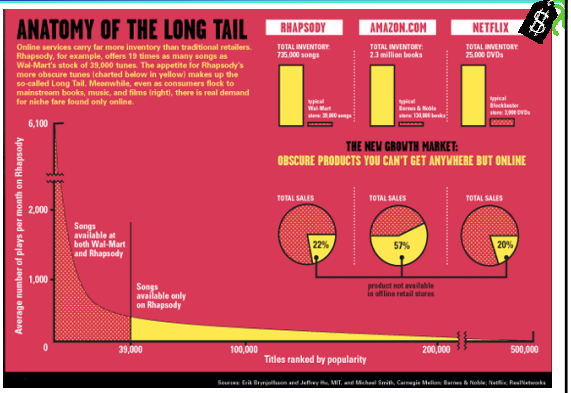
The long tail

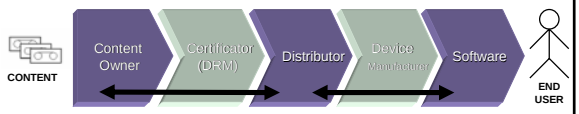


Trends

- **The tail is growing**
  - The ration 20%/80% is moving to a 40%/60%
- **Making more visible to buyers**
  - Smart metadata would help in suggesting content and thus on going on the tail:
    - *"who you like AAAA also take BBBB!"*
    - *"if you like AAAA, you will love also BBBB!"*
  - Characterization and comparison with the rest of the head, the 20% of the famous pieces
- **B2B Needs**
  - Lower costs of production (packaging, protection, management, etc.)
  - Lower costs of distribution
  - Automating contract management, licensing, accounting, reporting, etc.

The new value chain

Distributors (Telcos, ISPs and portals) have a weak position in the long run and must secure their business by developing/integrating certification (DRM) and building the user experience



Certification is key to monetize content

The **device** is key to own the user

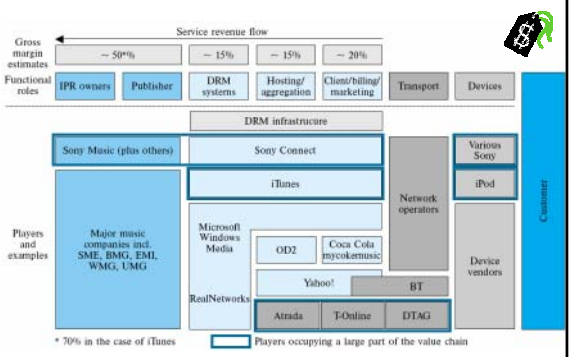
Digital Rights Management (DRM) is the technology key to the on line distribution business

- DRM services can be operated regardless of how content is distributed
- DRM is the technology that translates rights management into a content service

Personal Encryption:
- DRM is an encryption technology that provides state of the art protection
- Content protected by a DRM encryption can be unlocked only by a key that is specific to each device
- If a key is copied onto another devices it is useless
- Content protected by a DRM encryption can be safely distributed on any device (even on P2P networks). Unlocking the content will always require an individual key

Personal licensing:
- Each key implements a specific licensing rule
- DRM keys can be seen as the consume license
- Keys can be personalized so to enable the most flexible business models as:
  - Rental: 24 hours, 48 hours, 10 days etc.
  - Sell through with an option to burn one DVD
  - Sell through with an option to multiple copies on other devices

Emerging On Line Music Value Chain



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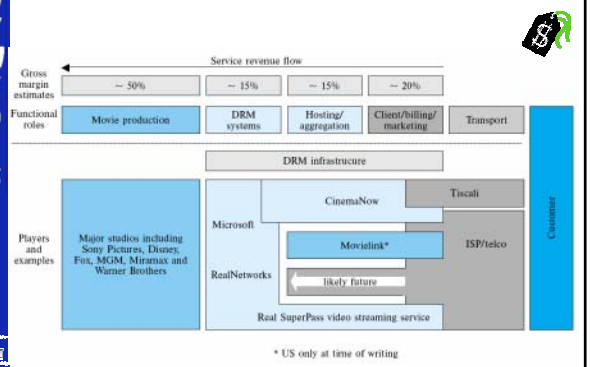
Emerging Broadband VOD value chain



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General State of the Art

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  - Rights Management
  - Content Elements and Distribution
  - Third Party Distribution Examples
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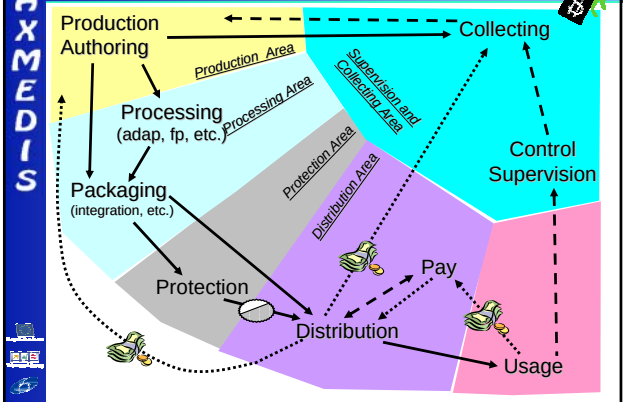
- Conclusions and references

Simplified Traditional value chain (2)



Traditional value chain Issues

- **The protection is performed before distribution**
  - By the distributor or
  - By a specialized third party
- **The B2B areas are (production, integration, etc.):**
  - Considered trusted
  - Based on paper contracts
  - Contracts are produced on the basis of a limited and not standard terminology, so that they are not easy interpreted and transported on other media, or channels, etc.
- **No control about what is done on the content on the B2C:**
  - The author and producers cannot verify, they may ask
  - The integrators cannot verify, they may ask at the seconds,
  - Etc.
- **The distributor:**
  - controls the selling of content
  - Does not control/verify the exploitation of each single rights

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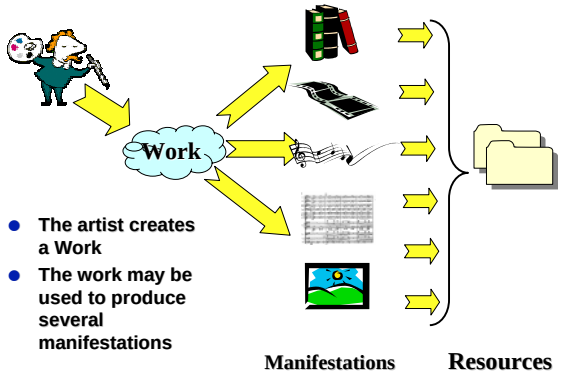
Rights Management

- **DRM: Digital Rights Management, general terms many times abused**
- **Management of Digital Rights**
  - Limited to the management of rights of digital content ?
- **Digital Management of Rights**
  - More correct and reasonable
  - Management of both rights for original *works* and related *manifestations*, digital *resources*, etc.
  - in many solutions DRM is not intended in this way

Terminology



- **The artist creates a Work**
- **The work may be used to produce several manifestations**

Some Actors of the value chain, "definitions"

- **Right/Content Owners, B2B, artists, etc.**
  - who has the rights on the initial work, non digital
- **Content Producers, B2B, Publishers**
  - Who is producing the manifestations of the work, define its rights, may produce the digital resources or not, etc.
- **Content Integrators, aggregators, B2B**
  - Who is Integration/aggregation: resources + metadata ++ , added value, etc., may be add other rights, etc.
- **Content Distributors, B2B, B2C**
  - Who is distributing digital content
- **Final Users, C2C (P2P)**
  - Who is using (or should use) the digital content on behalf of the rights obtained
- **Users, in general**
  - All the above actors that use in some way content on the basis of the rights obtained

Digital Rights Management

- **DRM: Digital Rights Management is**
  - A set of technologies and solution to cope with Digital Management of Rights
- **1st generation of DRM cover:**
  - security and encryption
  - prevent non authorized copying
- **2nd generation of DRM cover:**
  - description, identification, trading, protection,
  - monitoring, and tracking of all forms of rights usages over contents, including management of rights holders relationships

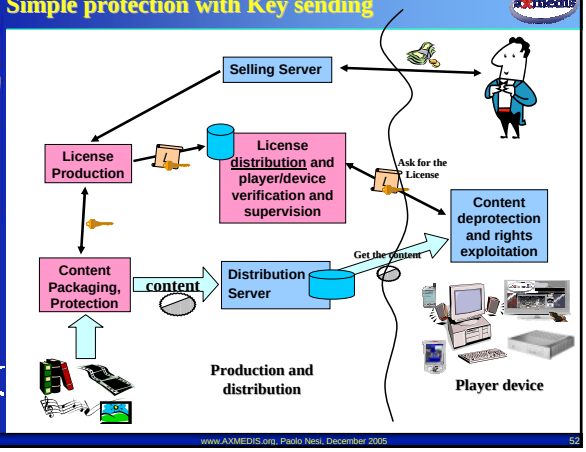
Aim of …… Digital Rights Management

- **To allow accessing at the digital content functionalities in a controlled manner**
  - To who has been **authenticated/certified**
  - To do what (are the rights) is defined in a **license**
  - **Verifying/Control/Supervise** if the above conditions and others are respected
  - By using technologies to **protect content** (e.g., encryption, fingerprint, watermark, etc.)
- **Cons:**
  - Registration of users
  - Authentic. of users and/or tools/terminal/devices
  - Control of users
- ***It has to be supported by a set of additional technical solutions***

Motivations for Digital Rights Management

- **Prevent the rights exploitation to who has not acquired the rights**
- **Verifying/Control if the allowed rights are respected:**
  - In the whole value chain or at least at the end users
- **This role is traditionally partially covered by Collecting Societies (clearing house) that**
  - Guarantee/protect the interests of the content/rights owners.
  - One or more Collecting Soc. for each Country
  - Some agreements among the majors Collecting Societies in Europe: SIAE, SDAE, SAGEMA, etc.

Simple protection with Key sending



How is DRM Secure?

- **Encryption**
  - DRM may use strong encryption (# bits) never been cracked
- **Digital signatures**
  - content header is digitally signed to prevent tampering
  - License is digitally signed, etc.
- **Separation of licenses from content**
  - Licenses should be kept separate from content,
  - content can be widely and securely distributed, P2P allowed
- **Revocation of licenses or objects**
  - of license, of authorization, etc.
  - various ways to prevent players from exploiting content
- **Authentication and certification of users and devices**
  - To prevent compromised player or non trusting users to receive or distribute other content, ….

Single Channel Distribution value chain Issues

- **The protection is performed before distribution**
- **The B2B areas are (production, integration, etc.):**
  - Considered trusted, based on paper contracts
  - The authors and producers cannot verify
  - The integrators cannot verify
- **The single channel distributor:**
  - Establishes the business models for the channel:
    - pay per play, subscription, ……etc….
    - Produce licenses for each person/device, etc.
  - sale the content and produce the Bill
  - has a limited control on the exploitation of rights
  - Etc.

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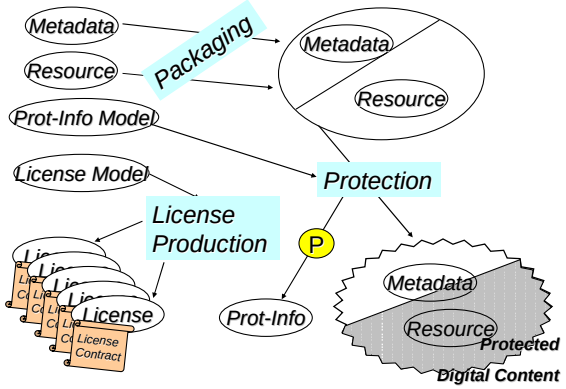
AXMEDIS Content Elements

- **Content Packaging**
- **To contain the following information**
  - Metadata……
  - Digital Resources……
  - Protection Information…..
  - License……..
- **Suitable for**
  - Streaming (so called real-time) and/or downloading
  - Sharing on P2P, etc..
  - portable on physical supports, etc.
- **In specific formats**
  - binary and/or XML, etc.

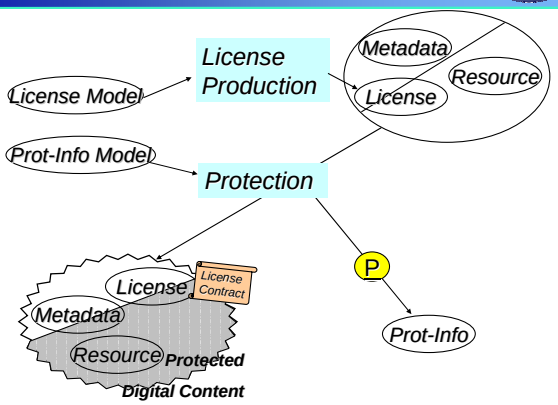
AXMEDIS Content Elements

- **Metadata** (Metadata)
  - Identification information, unique ID, distributor ID, etc.
  - Classification information also for indexing: Dublin core, etc.
  - Descriptors, MPEG-7, for indexing, etc.
  - References to Owner, to distributor, etc.
  - Etc.
- **Digital Resources:** (Resource)
  - Any digital information: images, doc, txt, video, game, application, file, audio, etc.
  - Hierarchy of digital resources
- **Protection Information:** (Prot-Info Model → P)
  - What has to be done to access at a given information/resource
  - Tools used, their parameters, etc.
- **License:** (License Model → License Contract)
  - Which rights are provided, who is the recipient, conditions, etc.

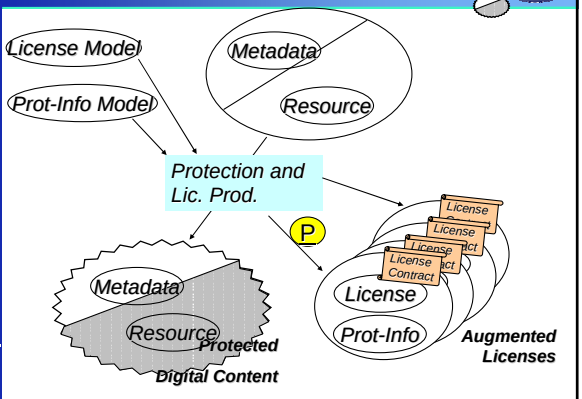
Packaging and Protection, Open Model



Production of Governed Objects



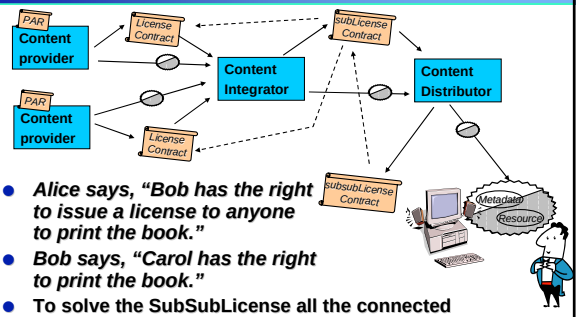
Production of Objects and Augmented License



Some Considerations

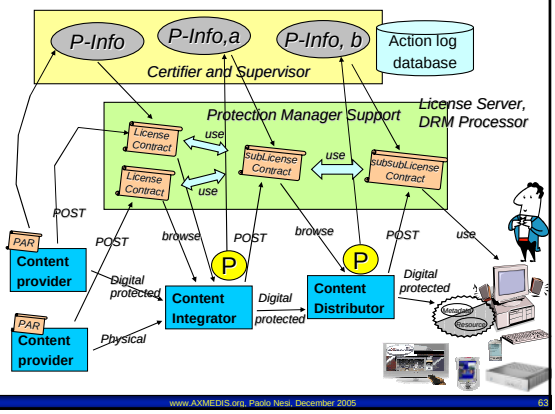
- **Open Model:**
  - Supporting P2P
  - The volume of Objects is acceptable
  - The elements can be independently manipulated
    - Licenses can be changed, reissued
  - Suitable for B2B and B2C
- **Governed Object:**
  - The user may see what can be done on the objects on the basis of their license
  - the same object with different licenses implies
    - to produce too many objects
- **Augmented License:**
  - Supporting P2P
  - The license ha to include the same protection information
  - The objects can be substituted independently
    - Licenses can be changed, reissued

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**

Managing License Chain in AXMEDIS



Open Model vs Augmented License

- **Pros of Open Model vs the Augmented License**
  - If the protected objects are used for producing several different more complex objects:
    - They are reused in the B2B area for different productions
    - Since the Protection Information is stored only once and not in every license, this implies to
      - have a more precise control of the black list, and
      - avoid duplications
  - Better for hierarchical nested protected and non prot objects
  - Thus the Open model is better for the B2B
- **Pros of Augmented License vs the Open Model**
  - Simpler management for the servers
  - Higher number of licenses
  - Suitable for simpler objects, non nesting protected objects
  - May be better for B2C

AXMEDIS Considerations

- **In AXMEDIS it is possible to adopt different models for packaging and/or protecting objects**
  - Open Model
  - Governed Objects
  - Augmented License

- **AXMEDIS provides tools for**
  - Packaging Object, protecting objects, etc.
    - AXMEDIS Editor, and AXMEDIS Content Processing
  - Creating Licenses:
    - DRM Editor in the AXMEDIS Editor
    - WEB Service for remote production of licenses
  - Managing/Processing Licenses:
    - Protection Manager Support, PMS, Server
  - Controlling and Supervising User Actions:
    - AXMEDIS Certifier and Supervisor, AXCS
- **Any other question/issue ?**

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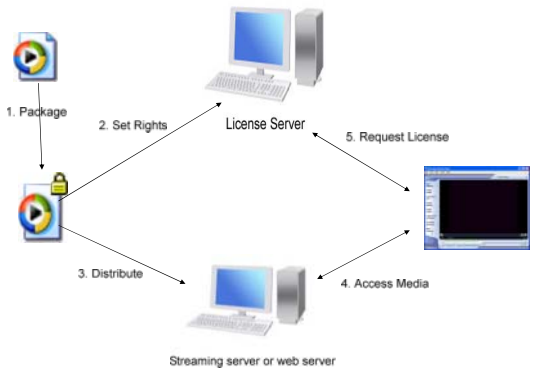
Technologies and standards

- **Technologies for content protection**
  - Microsoft Windows Media, DRM
  - Apple I-Tune
  - Media Commerce Suite of Real Network
  - EMMS of IBM
  - Liquid Audio
  - DMD secure
  - Sealed Media
  - Intertrust
  - DMOD
  - Adobe, mainly limited to documents
- **DRM**
  - ODRL, OMA, Open Mobile Association
  - XrML, Content Guard, related to MPEG-21
  - MPEG-21

Major Related Organisations

- **Standardisation Bodies for elements**
  - MPEG-2, MPEG (Motion Picture Expert Group)
  - OMA (Open Mobile Alliance)
  - MI3P (ID and licensing aspects)
  - OASIS (Organisation for advancement in Structured Information Standards)
  - TV-AnyTime (DVB….)
- **Associations/organization:**
  - OeB (Open eBook Forum)
  - CRF (Content Reference Forum)
  - WIPO (World Intellectual Property Organization)
  - RIAA (Recording Industry Association of America)
  - WS-I (Web Services Interoperability Organisation)
  - ISMA (Internet Streaming Media Alliance)
  - CC (Creative Commons)
- **Projects on Architecture and Value chain solutions**
  - AXMEDIS Project, research and development project
  - DMP (Digital Media Project), standardisation project
  - Etc.

Process Overview



Windows Media DRM?

- **Pay per view**
  - Play count
- **Rental**
  - Expiration after first use
    Useful for different time zones
  - Expiration on store
    Useful for different time zones
  - Begin & expiration dates
- **Subscription**
  - Begin & expiration dates
- **Controlled distribution of media assets**
  - Can include any of the above

- Allow Backup Restore
- Allow Burn To CD
- Allow Play On PC
- Allow Transfer To Non SDMI
- Allow Transfer To SDMI
- Begin Date
- Burn To CD Count
- Delete On Clock Roll back
- Disable On Clock Rollback
- Exclude Application
- Expiration After First Use
- Expiration Date
- Expiration On Store
- Minimum App Security
- Minimum Client SDK Security
- Play Count
- PM App Security
- PM Expiration Date
- PM Rights
- Transfer Count

Microsoft Windows Media Rights Manager License

- **license contains the**
  - key to unlock the Windows Media file.
  - rights, or rules, that govern the use of the digital media file.
  - (model based on Augmented License)
- **content owner sets rights to determine which actions are allowed from minimal control over playback to more restrictive licenses.**
- **licenses can support different business rules, including:**
  - How many times can a file be played.
  - Which devices a file can be played or transferred on. For example, rights can specify if consumers can transfer the file to portable devices that are compliant with the Secure Digital Music Initiative (SDMI).
  - When the user can start playing the file and what is the expiration date.
  - If the file can be transferred to a CD recorder (burner).
  - If the user can back up and restore the license.
  - What security level is required on the client to play the Windows Media file.
  - And many others.

Microsoft License delivering

- **Licenses can be delivered in different ways and at different times, depending on the business model**
  - Can be delivered before or after the content
  - Both possible if downloading
  - Only the first is reasonable in the case of streaming
- **Licenses can be delivered with or without the consumer being aware of the process using silent or non-silent license delivery.**

i-Tunes of Apple, iTMS, I-Tunes Music Store

- **AAC 128 Kbit, comparable with 160Kbit MP3**
- **70 Millions of Files in the first year of work**
- **> 500.000 traces**
- **Very easy**
- **No subscription costs**
- **Pay per download (0.99$ per file, 9.99$ per collection)**
- **Tools: download, player, burning, play lists, etc.**
- **DRM proprietary, "FairPlay", cracked in April 2004**
- **Continue to work even if cracked**

I-Tune and DRM limits

- **Transfer of a trace to at most**
  - 7 CDs, burning
  - 3 authorized computers
- **Authorized transfer on a non limited number of i-POD**
  - Market and money on iPods
- **Content is bought forever**
- **Authorized transfer on any computer but they can be played only on those that are authorized**

Concept of Super Distribution

- **What is intended as superdistribution ??**
  - A distribution in which the users collaborate to the distribution, such as in the P2P environments
  - A solution in which the content is separate from the license:
    - Open Model
    - Augmented License
  - *A Solution in which the Certifier and Supervisors and/or the devices are capable of detecting violations thus activating some recovering activity*

AXMEDIS Considerations

- **In AXMEDIS it is possible to select different models and/or configure/reconfigure your distribution channel according to your needs and business**
- **At macro level, AXMEDIS supports your:**
  - Content Distribution
    - Multichannel
    - reducing your costs for setting up
    - B2B distribution with P2P and DRM
  - Content protection and DRM
    - Many many new rights with respect to other models
    - Interoperable MPEG-21 ←→ OMA licenses
  - Content production
    - GRID processing for production and distribution, for transcoding and on-demand, etc.
    - Integration with Workflow
  - Content supervision and control
  - ….
- **Any other question/issue ?**

Needs and Limitations

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The effective User Needs and AXMEDIS Motivations

- **The market is moving**
  - From few content of high value to many of lower value, the log tail is become fatter and more relevant
  - From few actors to many
  - From high costs of production to more sustainable lower costs
  - From high prices to more sustainable lower prices
  - From ringtones to audio tracks and from them to video
  - From single channel to multichannel, the convergence
  - From proprietary to standard, interoperable solutions
  - From illegal to legal to P2P
  - From DRM for B2C to DRM for B2B2C, etc.
  - …..
  - The digital content is not only entertainment but also: e-learning, e-culture, e-banking, e-government, e-health, e-personal content, etc.

The effective User Needs and AXMEDIS Motivations

- **New markets and business solutions**
  - Convergence of distribution on different channels
  - Reduction of production, protection and distribution costs
  - Increment of control
    - insertion of DRM in the B2B areas
    - Harmonization of B2B and B2C
  - Content management in the home
    - the domain management
    - Interoperability of content in the home, interoperability of the devices, the Home Media Server
    - Multimedia Middleware among devices
    - Integration with domotic applications and tools
  - Content production/protection on demand
  - Content on demand, content in Push, personal content, etc.…

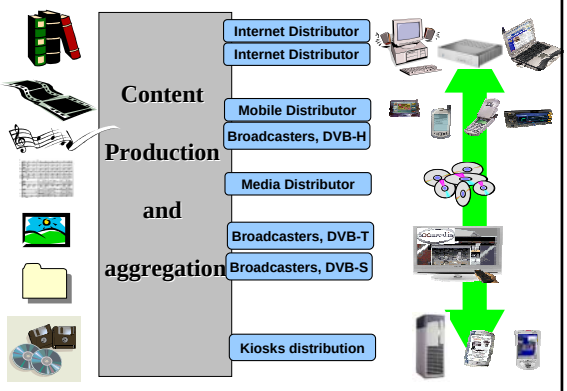
Business Rules, a way to formalize allowed rights

- **Exploitation Models (contracts from the consumers to the provider are aligned to the exploitation model):**
  - Subscription to a collection or service
  - All you can heat
  - Pay per renting
  - Pay per use, pay per play, pay per print, etc.
  - Pay per stream, download, etc…
  - Pay per minute all you can heat
  - Burning the CD
  - Copy the object
  - Moving the object
  - Passing the object to a different device
  - Pay per building a collection
  - Preview without paying
  - Try and buy
- **Etc.**

Business Rules, a way to formalize allowed rights

- **It may be based on limiting**
  - Number of times you can do an action, and usage
  - in a temporal window for the exploitation of any rights
    - renting
  - in a space
    - regional area or
    - domain (set of computers, etc.)
  - The usage according to the user profile:
    - impaired,
    - student,
    - Archival
    - etc.

Content distribution, the multichannel needs



Interoperable Content

- **diversification of channel management has to be performed**
  - When and where ?
- **More channels may be obtained with**
  - A smarter production
    - More formats, more production lines and/or
    - Scalable formats (not for all media) or unified formats and/or
    - Adaptation tools, etc.
  - DRM uniform, standard or interoperable ?
- **No one of these paths is 100% systematically used, but some of them could be viable ?**
  - Emerging standard/formats for scalability
  - The production and process is a problem, huge amount of data to be processed per day, week and month, etc., flexibility is needed
  - Many DRM models for license, they are not interoperable at the 100%, standards are not consolidated.

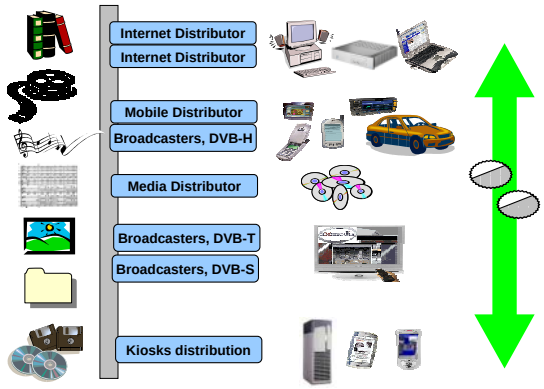
Limitations of Present DRM solutions

- DRM is typically added only in the Integration or distribution phases
  - DRM is seen mainly for B2C
    - Added by distributors
    - Owners demand to producers
    - Producers demand to integrators or distributors
    - Some Distributors demand to carriers
  - DRM is tuned for a specific distribution channel
    - Windows Media DRM for PC/internet, etc.
    - OMA DRM for Mobile
    - Etc.
  - No convergence
    - no interoperability of content
    - No possibility of assigning a License to a Domain
    - Partially solved producing content in several formats for several channels and terminals, very complex and expensive
  - Large Limitations for the final users
  - Limitations for the business and markets

The Convergence, the Multichannel Problems

- Different formats to be produced
  - Different terminal support different formats
    - PC: may formats
    - Mobiles: MPEG-4, or specific formats
    - DTT: MHP
    - DVB-S: MPEG-4
    - Etc..
  - Different content type: video, audio, multimedia, etc.
- Different business and transaction models
  - Pay per play, subscription, etc..
  - Different methods for payments
- Different methods of delivering
  - Streaming, downloading, push, etc.
- Different DRM methods and models
- Large number of final user devices, need of profiling for users and devices with channel

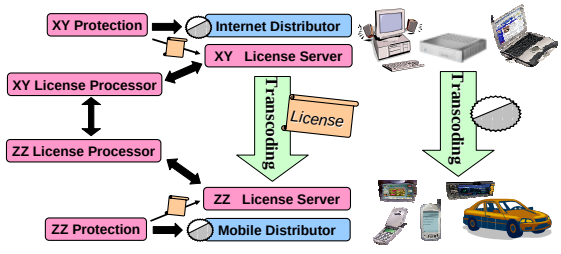
Convergence, the Interoperable Content



Present Needs for Accessing New Markets

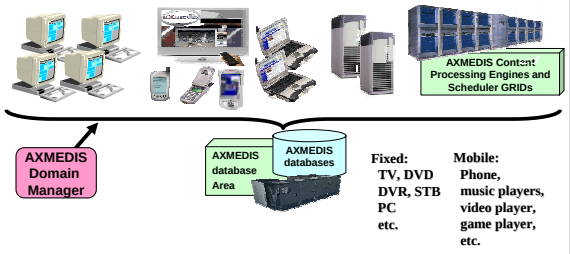
- Reduction of costs to access at the Fatter "Tail"
- Needs of Interoperable Content that may **Migrate** from
  - one terminal/device to another
  - one user to another
  - one channel to another
  - Licenses assigned to users, devices or domains
  - etc.
- Transcoding/**Adaptation** problems
  - Content is packaged
  - Content is protected, adaptation of protected content is needed
  - Content contains several types of information: digital resources, metadata, glue, etc.
  - On the servers and/or on the client terminals
- DRM Architecture has to support Migration and Adaptation
  - see in the following

EX: Convergence, the Interoperable License, DRM



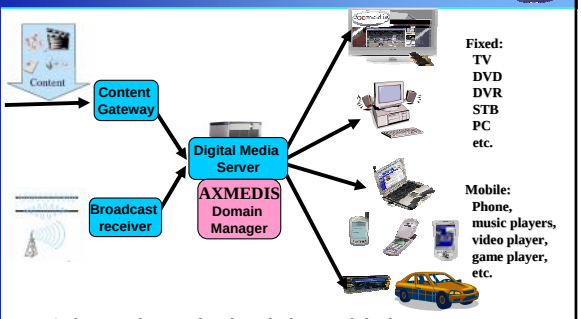
- When interoperable content in terms of format passes from two devices supporting different DRM models and licenses
- License needs to be transcribed and rights semantics preserved
- License chain processing need to be interoperable

Factory: Multichannel with Domain Manager



- Only one License for the whole set of devices/terminals, tools, of the company, and thus for any AXMEDIS Tool, etc.
- Only one Transaction for all the company
- Transparent management of licenses
- Etc.

Home: Multichannel with Domain Manager



- Only one License for the whole set of devices
- Only one Transaction for all the family
- Transparent management of licenses
- Etc.

Real Time Content Processing

- Reducing production and distribution costs
  - High costs of content processing
- Flexible Content Distribution
  - Automating content packaging
  - Automating production of licenses
  - Automating content formatting
- Content production on demand
  - Device capabilities
  - User Profile and preferences
  - Request of the User
  - Transcoding/adaptation needed
- Real Time
  - Massive processing

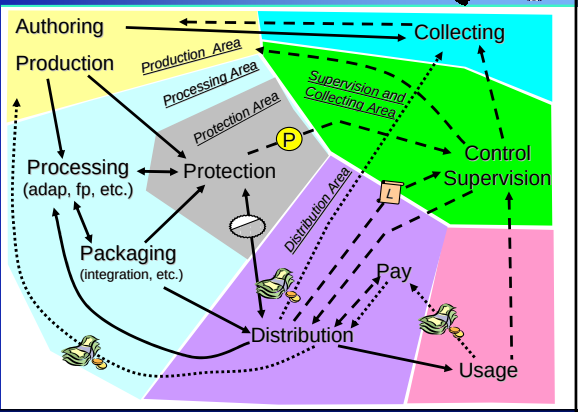
B2B Rights Management

- Advantages of B2B DRM
  - Automation of contract-based deals
  - Assessing the Usage in the B2B
  - Reducing costs of B2B promotion
  - Allowing integration and composition of protected content
  - Allowing content production on demand, no contracts signatures, immediate DRM processing
  - Try and buy, try and use for business
  - Free try for Business users
  - Increasing the control, decreasing the risk
- P2P distribution
  - sharing of content
  - lower costs to access content
  - Lower costs to promote/distribute content
  - Increment of accessible content

Windows Media viz AXMEDIS

Windows Media	AXMEDIS
Limited number of BMs	Larger number of BMs
ProtMod limited to Key	Any Protection Model
Content and license	Content and license
Signed Content Header	Signed Content AXINFO
Single channel	Multichannel
Proprietary License ◆ Limited dictionary ◆ Limited number of rights	MPEG-21 REL license ◆ Expandable dictionary ◆ Any type of rights
Authentication of Player (device plus user)	Authentication of device, user, etc.
Revocation per Player	Revocation per device, user, etc,
Revocation per license	Revocation per license
Only digital resources that can be included into Widows Media	Any digital format, of any type
Non B2B DRM	Allowed B2B DRM

AXMEDIS and the value chain



Summary of Needs: the AXMEDIS Challenges

- Unified Platform for all
  - AXMEDIS Framework
  - Accessible Source code and Knowledge
  - Complement and make new technologies accessible for the industry, reducing the gap to enter in the market
- Standardization
  - Exploitation and expand standard models such as MPEG-21, etc.
- Convergence of content distribution and usage
- Real Time content Processing
- Increasing security: rights usage and control on
- Automating the B2B area, DRM and distribution
  - Harmonizing B2B and B2C area for DRM
- Integrating the effort of many skilled actors

Summary of Needs: the AXMEDIS Challenges

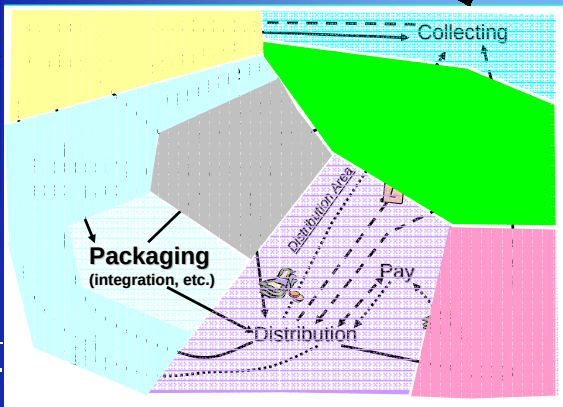
- **Convergence of content distribution and usage**
  - Interoperable Content and Devices
  - Interoperable DRM, Licenses
  - Multichannel solution
- **Real Time content Processing**
  - Reducing production and distribution costs
  - Flexible Content Distribution
  - Content production, protection, distribution on demand
  - Adaptation and transcoding
  - Accelerating B2B processing
- **Increasing security: rights usage and control on**
  - Increasing security and interoperability
  - Increasing control of rights exploitation
  - Allowing the set up of a large number of business models
- **Automating the B2B area, DRM and distribution**
  - Expanding DRM to B2B
  - Reducing costs of B2B distribution
- **Any other question/issue ??**

AXMEDIS Content Packaging

Table of Content

- Preface
- What is AXMEDIS
- Market Analysis and Opportunities
- General State of the Art
- Needs and Limitations
- AXMEDIS Content Packaging
- AXMEDIS Content Protection and Tracking
- AXMEDIS Content Production and Processing
- Examples of AXMEDIS Applications
- Conclusions and references

AXMEDIS Packaging



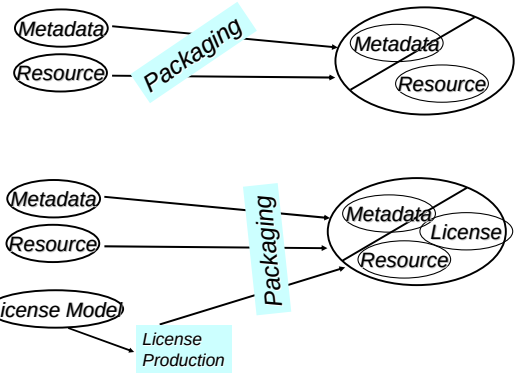
AXMEDIS Package

- **Streaming and/or downloading**
- **binary and/or XML, etc.**
- **Single files, and/or Multimedia hierarchies of files such as those related to**
  - HTML, LOM, WEDELMUSIC, MPEG-4, etc.
- **containing the following information**
  - Metadata (the so called AXMEDIS Information, AXINFO)
  - Digital Resources
  - Protection Information
  - License

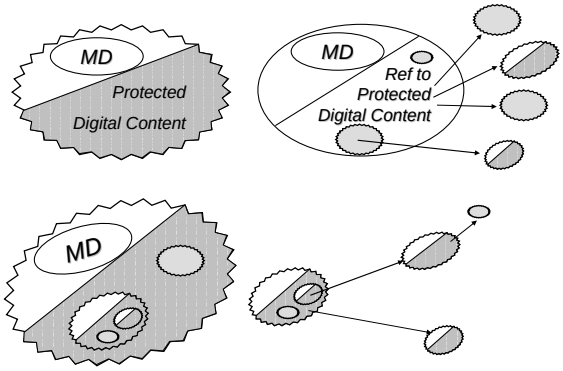
AXMEDIS Object Elements

- **Metadata (the so called AXMEDIS Information, AXINFO)**
  - Identification information, unique ID (AXOID), distributor ID, UUID, ISRC, etc.
  - Classification information also for indexing: Dublin core, etc.
  - Descriptors: for indexing, MPEG-7, technical and conceptual, etc.
  - References to Owner, to distributor, etc.
  - Fingerprint
  - Historical and versioning aspects
  - Producer ID and Information, etc.
  - Author Information, etc.
  - Etc.
- **Digital Resources:**
  - Any digital information: images, doc, txt, video, game, application, file, audio, etc.
- **Protection Information:**
  - What has to be done to access at a given information/resource
  - Tools used, their parameters, etc.
- **License:**
  - Which rights are provided, who is the recipient, conditions, etc.

Packaging AXMEDIS Objects



Examples of AXMEDIS objects



AXMEDIS Object

- **Any digital resource**
  - Any hierarchy can be incorporate and modeled
  - Nested information
- **Addition of formalized Metadata**
  - AXMEDIS Information, AXInfo
- **Extension for AXMEDIS objects**
  - <file name>.axm
- **MPEG-21 based**
  - DID: Digital Item Declaration
  - DII: Digital item Identification
  - XML, binarization

AXMEDIS Objects

- **AxObject**
  - an MPEG21 DIDL Item (or IPMPDIDL)
    - Recursive Structure
- **AxInfo**
  - B2B relevant metadata
    - Creator, Owner, Distributor,…
    - Workflow info, lifecycle details and history of commands
    - Potentially Available Rights (PAR): which describes rights can be acquired by a customer (B2B)
    - Fingerprint algorithms info, metadata certification
- **Public and Private object metadata**
  - issue
    - Public must be always at disposal for indexing, querying, etc.
    - Private metadata are assets to be protected with the content
    - Some of the metadata are replicated in both locations
  - thus
    - Once resolved with “index” Item
    - Now addressed in new IPMPDIDL:ContentInfo
    - Metadata are reported in clear for protected content

Coffe Break

AXMEDIS

Content Protection and Tracking

Table of Content

- Preface
- What is AXMEDIS
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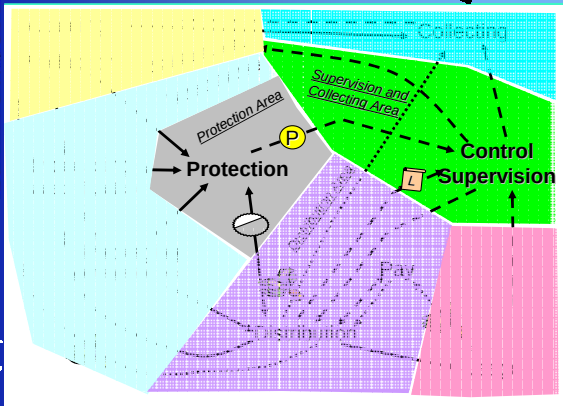
- AXMEDIS Content Packaging
- AXMEDIS Content Protection and Tracking
  - Authentication and certification
  - License Definition and Production
  - Protection Information & low level technologies
  - Tracking: Supervision and Control
- AXMEDIS Content Production and Processing
- Examples of AXMEDIS Applications
- Conclusions and references

AXMEDIS Protection and Tracking

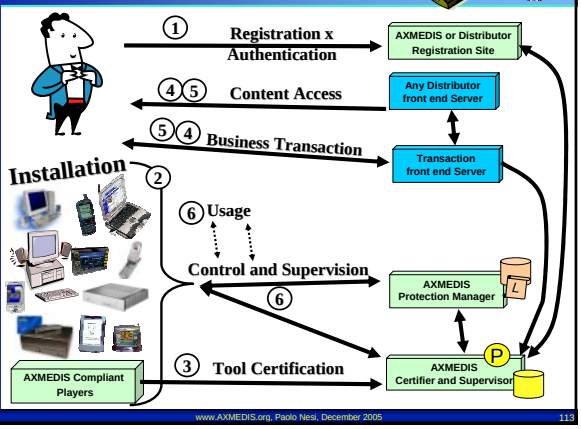


AXMEDIS Digital Rights Management

- **To allow accessing at the digital content functionalities in a controlled manner**
  - To who has been **authenticated/certified**
  - To do what (are the rights) is defined in a **license**
  - By using technologies to **protect content** (e.g., encryption, fingerprint, watermark, etc.)
  - **Verifying/Control/Supervise** if the above conditions and others are respected

Authentication and Certification

The Protection and Control Process



Authentication and Certification

- **Authentication is the process:**
  - To register the User/Device/Terminal/Tool, independently or as unified elements
  - to assign a unique ID to an User/Device/Terminal/Tool, independently each other or as a unified element
  - typically concluded with the emission of a **Certificate**
- **Certificate:**
  - typically Hidden in the computer/device hosting the terminal
  - Contains:
    - the Unique ID
    - One or more Passwords for establishing protected communications and thus to proof the authenticity of the User/Device/Terminal/Tool during transactions

Certification and verification

- **Certification and Verification is the process:**
  - In which an authenticated User/Device/Terminal/Tool is confirmed/verified to be still trusting, not corrupted or violated
  - For which eventual attempts/trials of violation are detected
- **Performed by:**
  - Verification about the consistency
  - Verification of the certificate
  - Verification about the eventual corruptions
  - Verification of Tool, Device, Terminal, Tool violation or not
  - Etc.
- **When one is not certified and tries to play a protected content, it is required to become certified and thus to upgrade its security**

License Definition and Production

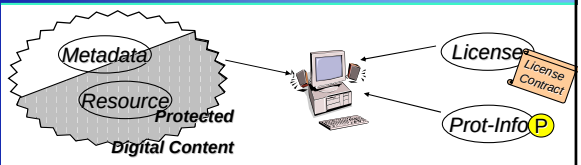
License Definition and Processing 1/2

- **License:**
  - A digital version of the contract
  - The contract/license is signed by clicking
  - Is supported by a way to demonstrate its authenticity
  - Associated with who has signed the contract thus he/it has to be authenticated and may be certified/verified at each action
  - can be stored in the digital object or not
    - If not, may in the terminal or remotely located
  - may refer to other licenses, creating a chain of licenses for the evaluation of each given grant associated to a right

License Definition and Processing 2/2

- **License:**
  - Is formalized in some language
    - Refer to some dictionary for terms that define the semantics of the expressions of the language
  - contains the list of acquired rights
  - may refer to other licenses, creating a chain of licenses for the evaluation of each given grant associated to a right
  - May be produced only by who has the rights to do it
  - May define/provide the price for each grant/action performed
  - May be revoked
  - May allow to define dynamic policies of control
  - Etc.

Managing License and Protection Information

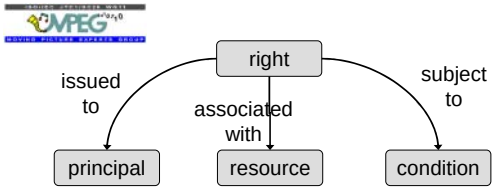


- **Once obtained the content a license is needed to know what you can do on it, which Right you have acquired**
- **On the License you may get a reference to**
  - the Protection Information to Unprotect the specific object segment and/or digital resources
- **During all these phases the AXMEDIS Certifier and Supervisor verify integrity and certificate**
- **License and Protection Information are typically located in external and remotely located Servers but may be cached on the terminal device if allowed by the license issuer**

AXMEDIS License formal language

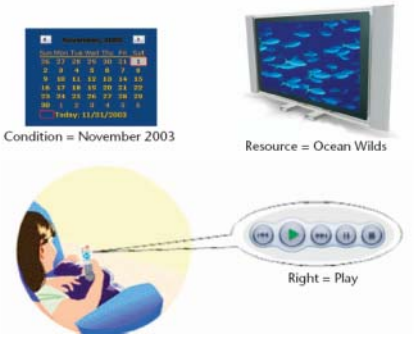
- **AXMEDIS License**
  - Derived from MPEG-21REL
  - Support for RDD: Rights Data Dictionary
- **MPEG-21 RELRights Expression Language**
  - Derived from XrML
- **XrML 2.0: eXtensible rights Markup Language**
  - At the basis of the MPEG-21 REL
  - ContentGuard, Nov. 2001, Microsoft
  - At the basis of the Windows Media
  - Derived from DPRL
- **OMA ODRL: Open Digital Rights Management**
  - Expression language for mobiles
  - Simpler than MPEG REL
  - Under certain restriction is compatible with AXMEDIS license
  - ..

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

An example of statement



- Rosy can Play 3 times the Ocean Wilds in November 2003.

Possible values for terms

- Principal
  - AllPrincipals and KeyHolder
- Rights
  - Issue, Obtain, PossesProperty and Revoke
- Resources
  - DigitalResource, Revocable and ServiceReference
- Conditions
  - AllConditions, ExerciseMechanism, ExistsRight, Fullfiler, PrerequisiteRight, RevocationFreshness, ValidityInterval
  - CallForCondition
  - ExerciseLimit
  - FeeFlat
  - FeeMetered
  - FeePerInterval
  - FeePerUse
  - FeePerUsePrePay
  - SeekAproval
  - Territory
  - TrackQuery
  - TrackReport
  - TransferControl
  - ValidityIntervalFloating
  - ValidityIntervalStartsNow
  - ValidityTimeMetered
  - ValidityTimePeriodic

- **Examples of Rights**
  - Adapt
  - Delete
  - Diminish
  - Embed
  - Enhance
  - Enlarge
  - Execute
  - Install
  - Modify
  - Move/Migrate
  - Play
  - Print
  - Reduce
  - Uninstall
  - Burn
  - .....

OMA DRM – Stakeholders

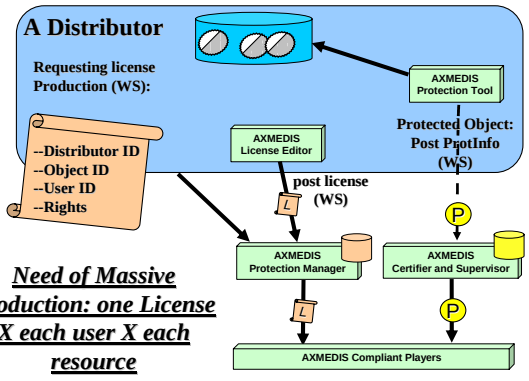
- **OMA DRM is developed by the entire mobile value chain for the mobile industry**
  - Content Providers
  - Information Technology Companies
  - Mobile Operators
  - Wireless Vendors
- **About 50 Companies participating in monthly meetings and weekly conference calls**
- **Consolidated from DRM standardization at 3GPP, WAPForum etc.**
- **Liasons created with industry organizations such as MPEG, RIAA, 3GPP, etc.**

ODRL vz MPEG-21 (Jaime Delgado, FUPF, AXMEDIS)

- **Differences**
  - Different syntax and elements.
  - ODRL is simpler. MPEG-21 REL has many options.
  - MPEG-21 REL works with an independent rights data dictionary.

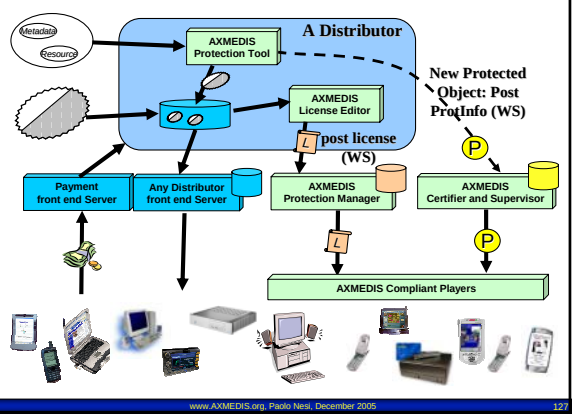
ENTITY	ODRL	MPEG-21 REL
Subject	Party	Principal
Object	Asset	Resource
Right (action)	Permission (Right)	Right
Condition (terms)	Constraint (Right)	Condition

AXMEDIS License Production

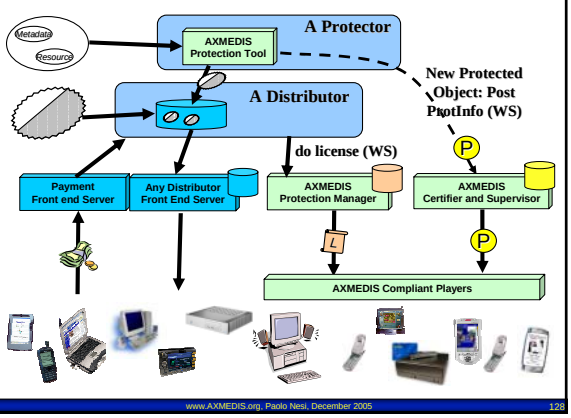


Need of Massive Production: one License X each user X each resource

AXMEDIS The Protection and Control Process



AXMEDIS The Protection and Control Process



AXMEDIS Consideration

- **AXMEDIS License:**
  - Formalized in MPEG-21 REL
  - Can be interoperable with OMA ODRL licenses
  - Can be produced
    - **Manually** with AXMEDIS DRM Editor
    - **Remotely** by using a WEB service
    - **Massively** by using AXMEDIS content processing tools
  - Is processed in the chain of licenses
    - by the AXMEDIS Protection Manager Support as License Server/DRM Processor
  - Can be included into AXMEDIS objects or can be provided independently
  - Can be cached or not on the client terminal
  - Etc.
- **Any other question/issue ??**

AXMEDIS

Protection Information and low level Technologies

Protection information Model

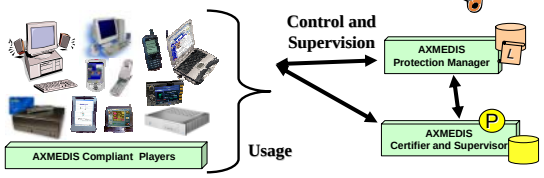
- **Protection information for each Single Protected Object**
  - How an object is protected
  - How each digital resource is protected
    - Which algorithms are used for encryption, scrambling, compressing, etc.
    - How they are applied: sequence, segment, etc.
    - Which parameters have been used, associated key, etc.
  - Protection behavior in download and streaming
  - References to other IPMP models and information
    - for example into an MPEG-21 object MPEG-4 IPMPX are included
  - Etc.
- **MPEG-21: Intellectual Property Management and Protection, IPMP**

Protection, Low Level Technologies

- **Encryption**
  - A digital resource transformation based on some algorithm and a key. The inverse operation is typically computationally expensive to be performed without knowing the needed key even if one know the algorithm
- **Scrambling**
  - A digital resource transformation based on some simple algorithms: line, byte, segments, exchanges, etc. The inverse operation is typically simply if one know the algorithm to scramble.
- **Digital Signature**
  - The estimation of a unique code presenting a digital resource, license or certificate. It can be re-estimated to verify the consistency of the original resource, license or certificate.
- **Fingerprint**
  - Estimating a code (may be unique) from the digital resource data, it may be strong enough to remain valid even after adaptation
- **Watermark**
  - Hiding into the digital resource some information, transforming the original digital resource, it is permanently associated with

Supervision and Control about the rights usage

AXMEDIS Control and Supervision



- Performed by the: AXCS and AXPMS
- Continuously verify and certify the trusting level of the Tool/Device/Terminal and of the User
- Collect Action Logs (event logs) related to rights exploitation and thus to License usage
- Allow the implementation of black lists for Users and Tools/Devices/Terminals

Continuous Control and Supervision

- Continuously verify and certify the trusting level of the Tool/Device/Terminal and of the User
  - Verification of certificates
  - Verification of terminal consistency and trusting level
  - Detecting infringement and violations
  - Recovering of critical situations
  - Taking decision on the movement of User, Tools, etc. into the black list to revoked authorizations

List of Events/Actions on rights Exploitation

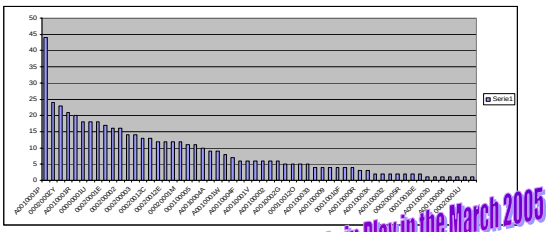
- Collecting Events and Actions
  - Further reporting
  - Further verification of consistency
  - provide the evidence about the exploitation of rights to: content owners, producers, collecting societies, distributors, etc.
  - provide the billing information to the final user
  - provide the statistical information
- Counting the usage, exploitation of rights
  - how many times a music piece has been played, how many print out have been produced, etc.
  - Dynamic definition of price for example…
- MPEG-21 Event Reporting
  - Specifies how to express ER-Request and Event Report and how they are represented as digital item

Reporting, accounting manager and tool, examples

- Reporting to Distributor
  - Each exploited right with references to the User-ID for each distributed object (objects that contains its Dist-ID)
- Reporting to the Integrator/creator
  - Who create new object from other objects of from scratch
  - The number of exploited rights for each object that contains the Creator-ID and the Dist-ID for each of them
- Reporting for the Collecting societies, CS
  - Who is monitoring the exploited rights for third parties, for other creators
  - The number of exploited rights for each Creator-ID associated with the CS, for each object that contains the Creator-ID and the Dist-ID for each of them, in a certain Geographic Region or State

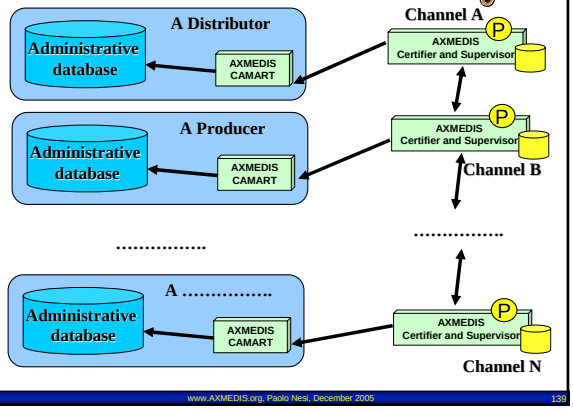
Event reporting

- Single traces, events, etc.
- Statistical data for reporting and analysis



Distribution of exploited objects in Play in the March 2005

Providing Action Log and Statistical Information



Black Lists Management

- **AXMEDIS Certifier and Supervisor may manage black lists of:**
  - Users
  - Licenses
  - Objects
  - Devices
  - Distributors
  - Etc.
- **The distinction from Users and Devices is strongly needed to preserve the distinction from the several channels**
- **This allows to define precise and fine policies for managing critical conditions that may occur.**

AXMEDIS Considerations

- **AXMEDIS:**
  - Controls user terminals
  - Collects Actions Logs
  - Manages black lists
  - Allows the definition of policies for putting user, device, license, objects, etc. into the black lists
  - If requested, Provides the evidence of the exploited rights
  - Allows the control on multichannel distribution
  - Provides statistical data on the rights exploitation
  - Allows to bring back easily the Action Log on your Administration
  - Etc.
- **Any other question/issue ??**

Content Production and Processing

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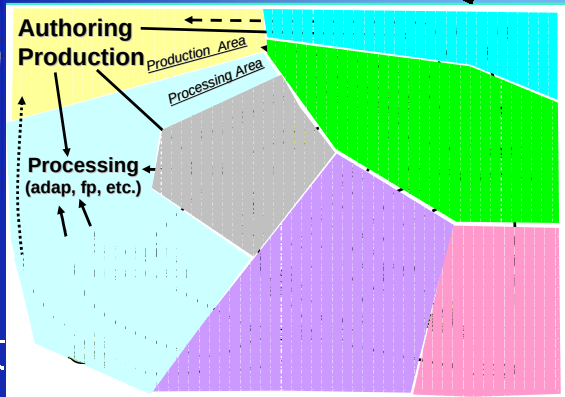
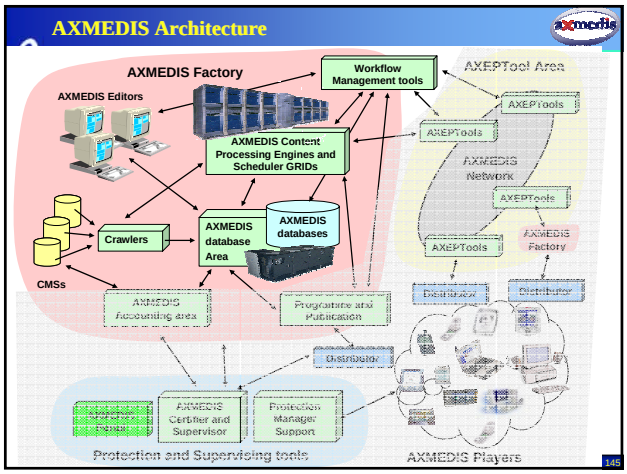
AXMEDIS Production and Processing




AXMEDIS Architecture
AXMEDIS Factory
AXMEDIS Editors
Workflow Management tools
AXEPTool Area
AXEPTools
AXMEDIS Content Processing Engines and Scheduler GRIDs
AXMEDIS Network
Crawlers
AXMEDIS database Area
AXMEDIS databases
CMSs
AXMEDIS Accounting area
Programme and Publication
Distributor
Certifier and Supervisor
Protection Manager Support
Protection and Supervising tools
AXMEDIS Players
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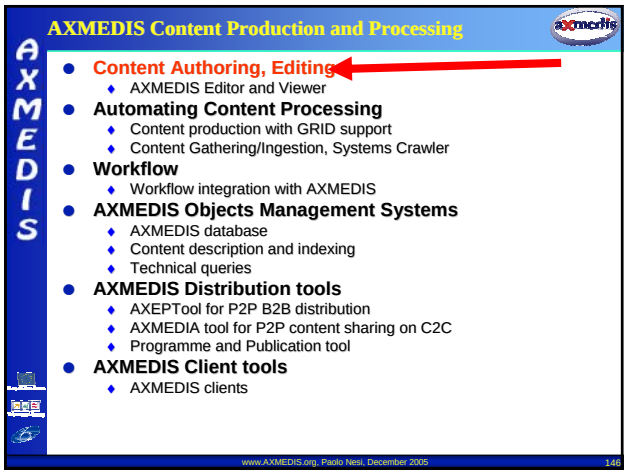
AXMEDIS Content Production and Processing
Content Authoring, Editing
AXMEDIS Editor and Viewer
Automating Content Processing
Content production with GRID support
Content Gathering/Ingestion, Systems Crawler
Workflow
Workflow integration with AXMEDIS
AXMEDIS Objects Management Systems
AXMEDIS database
Content description and indexing
Technical queries
AXMEDIS Distribution tools
AXEPTool for P2P B2B distribution
AXMEDIA tool for P2P content sharing on C2C
Programme and Publication tool
AXMEDIS Client tools
AXMEDIS clients
www.AXMEDIS.org, Paolo Nesi, December 2005
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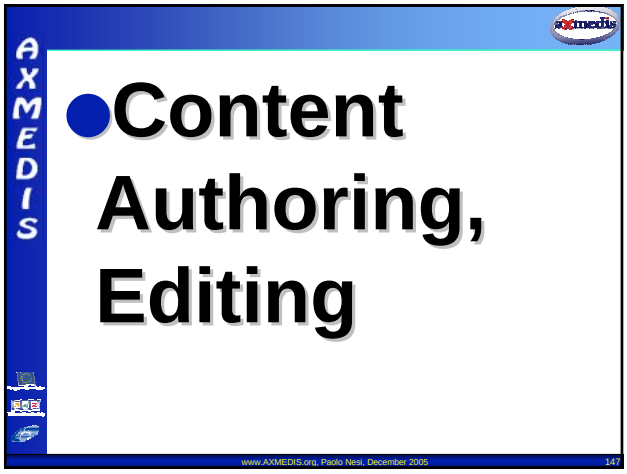
Content Authoring, Editing
www.AXMEDIS.org, Paolo Nesi, December 2005
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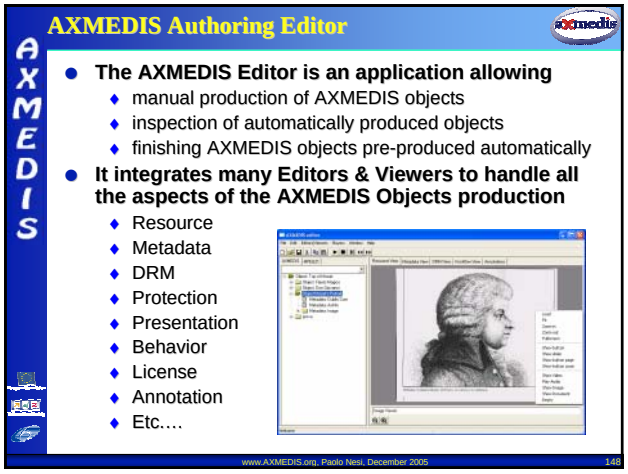
AXMEDIS Authoring Editor
The AXMEDIS Editor is an application allowing
manual production of AXMEDIS objects
inspection of automatically produced objects
finishing AXMEDIS objects pre-produced automatically
It integrates many Editors & Viewers to handle all the aspects of the AXMEDIS Objects production
Resource
Metadata
DRM
Protection
Presentation
Behavior
License
Annotation
Etc.…
www.AXMEDIS.org, Paolo Nesi, December 2005
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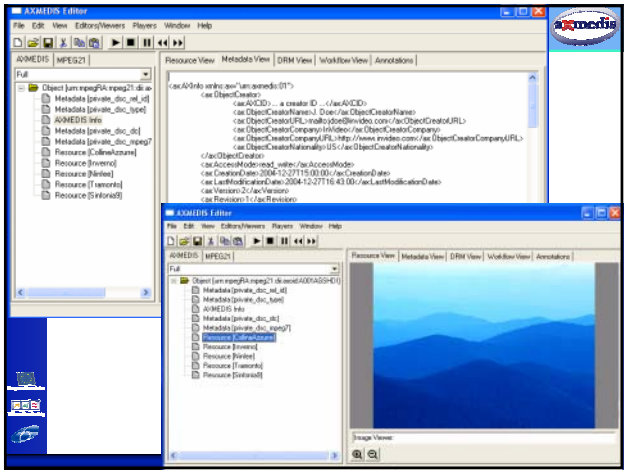
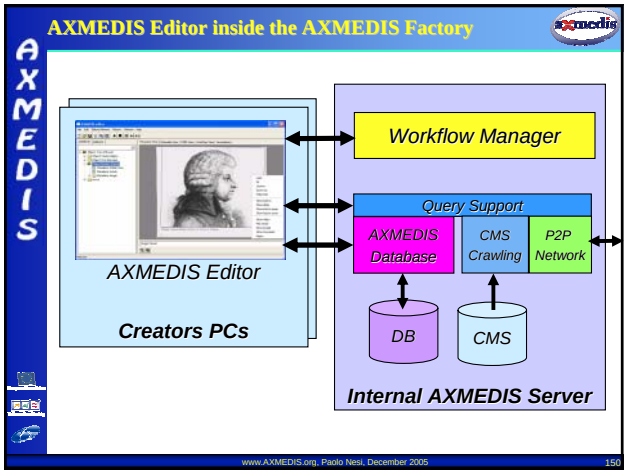
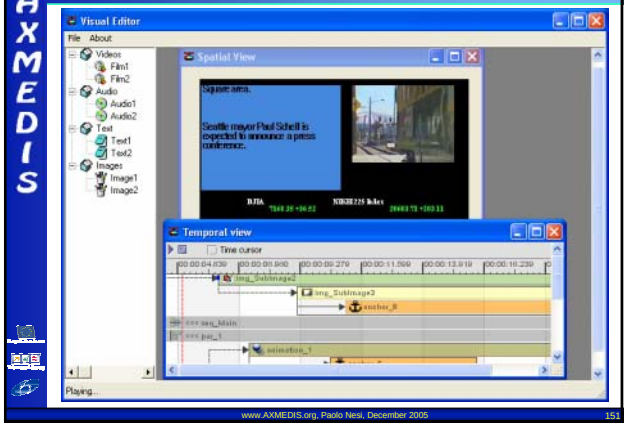

AXMEDIS Editor


AXMEDIS Editor inside the AXMEDIS Factory
Workflow Manager
Query Support
AXMEDIS Database
CMS Crawling
P2P Network
DB
CMS
AXMEDIS Editor
Creators PCs
Internal AXMEDIS Server
www.AXMEDIS.org, Paolo Nesi, December 2005
150

Visual and Behavioral Editor/Viewer



Automating Content Processing

AXMEDIS Content Production and Processing

- **Content Authoring, Editing**
  - AXMEDIS Editor and Viewer
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  - Content production with GRID support
  - Content Gathering/Ingestion, Crawler
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  - AXMEDIA tool for P2P content sharing on C2C
  - Programme and Publication tool
- **AXMEDIS Client tools**
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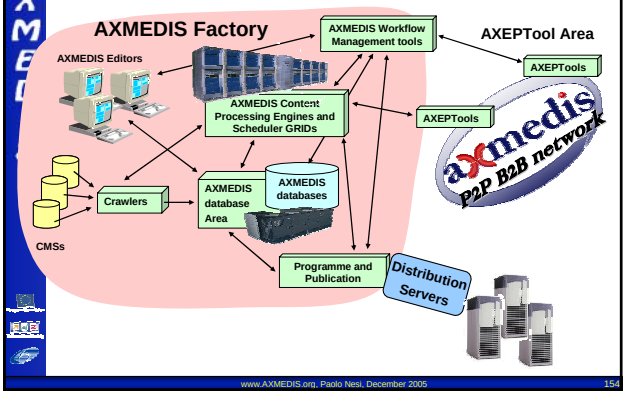
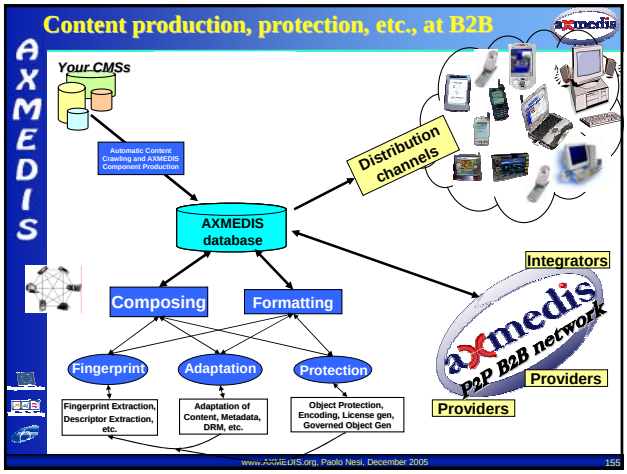
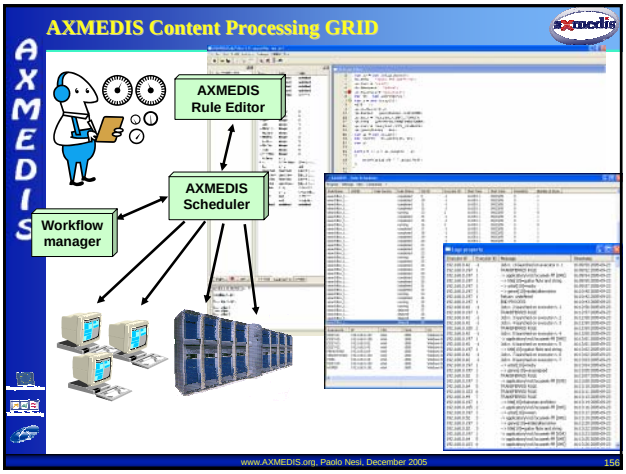
AXMEDIS Content Processing



Content production, protection, etc., at B2B



AXMEDIS Content Processing GRID



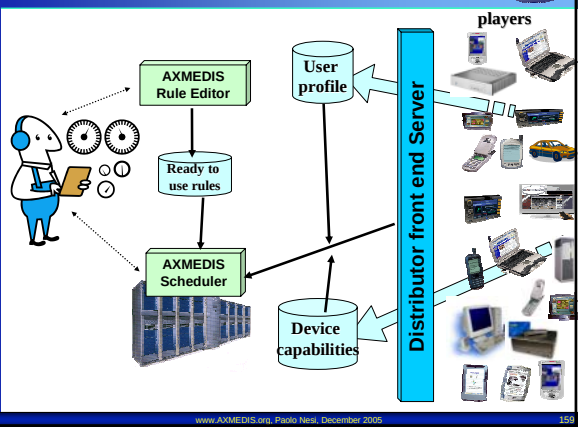
AXMEDIS Content Processing capabilities

- **Scripts will be produced by Example (recording commands) on the AXMEDIS Authoring Tools**
- **In AXCP Scripts you can manipulate, produce, adapt and process:**
  - AXMEDIS/MPEG-21 Objects and features
  - Digital resources in any format
  - Descriptors, fingerprint, etc.
  - Metadata, metadata mapping
  - Licenses and PAR
  - Protection Information
  - Device Capabilities
  - User Profile and preferences
  - Etc.
- **And you can automate:**
  - Load and Save of AXMEDIS objects
    - From/by the AXEPTool, P2P B2B tools
    - From/by the AXMEDIS database
    - From/by other legacy CMS via Crawler and other means
    - From/by the file system and Local Area Network
  - Publication of results on distribution channels

AXCP processing capabilities

- **Any type of resource in any format**
  - Also MPEG21, IMS, SCORM, etc.
- **Processing functionalities:**
  - Production of new objects: composition, etc.
  - Formatting: SMIL, XSLT, etc.
  - Synchronization of media, etc.
  - Adaptation, transcoding, ……
  - Reasoning on device capabilities and user preferences
  - Production of licenses
  - Verification of Licenses against them and PAR
  - Extraction of descriptors and fingerprints
- **Open to any other module with plug-in technology:**
  - Burning
  - Etc.

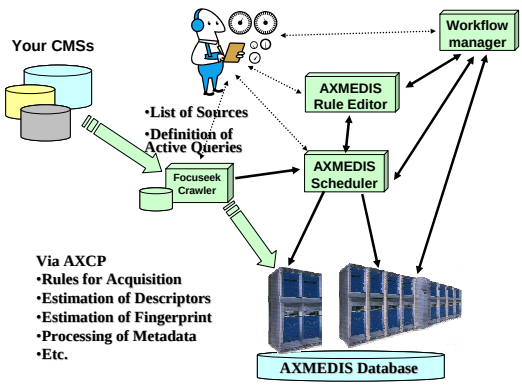
AXCP as Transcoding/Adapt. Platform



AXMEDIS Considerations

- **AXMEDIS Content Processing allows you to automate any kind of content processing:**
  - Massive or small scale processing
  - Locally performed or Workflow controlled
  - On any kind of Digital Resource not only AXMEDIS objects
- **AXCP Applications for massive processing as**
  - Production/packaging platform for producers and integrators
    - Digital files, metadata, etc.
  - Protection of objects, and protection information processing
  - Transcoding/adaptation platform for distributors
  - License Production, or as License Sever/processor
  - etc.
- **Any other question/issue ??**

Fast and Continuous Crawling of Content



Content Gathering from Content Management Systems

- **Access to several different resources:**
  - File Systems: Win, Linux, MAC, etc.
  - ODBC, JDBC, etc.
  - Native DB: DB2, Oracle, MS-SQL, MySQL, etc.
  - Protocols: IMAP, POP, Z39.50, etc.
  - XML databases
- **Integrated with AXMEDIS Content Processing Capabilities:**
  - Processing of any digital resources and metadata
  - GRID executing and computing, high performance

WORKFLOW Integration

AXMEDIS Content Production and Processing

- **Content Authoring, Editing**
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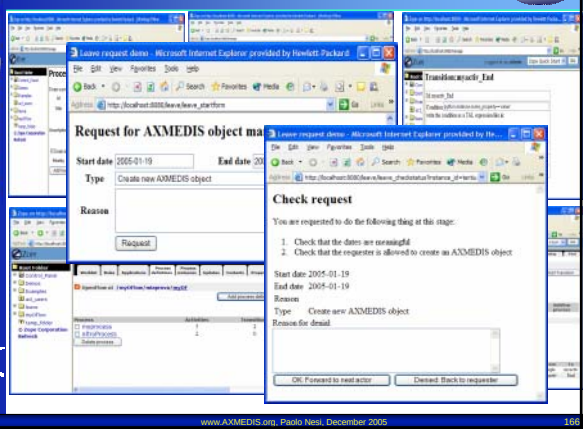
- **AXMEDIS Client tools**
  - AXMEDIS clients

What is Workflow?

- **Definition of activities/tasks/production-processes:**
  - What they are,
  - how they are structured, step by step,
  - how they are tracked, controlled,
  - who or what has to performs them,
  - what is the relative order of actions, they are synchronized ?
  - Which is the information/control flow
  - when they are carried out automatically and/or manually either by human actor and/or tools in the defined order produces the desired output,
  - Etc.
- **AXWF provides an interface & glossary to**
  - define the workflow and enables some users to act and monitor the progress of all the activities
  - a centralised mechanism for controlling the productions of a factory.

What is Workflow?



AXMEDIS Workflow

- **Based on**
  - OpenFlow, Biz Talk in a second step
  - Web service as integration
- **Control and monitoring of**
  - AXMEDIS Authoring/Editing tools
  - AXMEDIS Scheduler of the AXCP
  - AXMEDIS database
  - AXMEDIS AXEPTools
  - AXMEDIS Programme and Publication
  - Etc.
- **Full control and monitoring of all the Content Factory activities**

AXMEDIS Objects Management Systems

AXMEDIS Content Production and Processing

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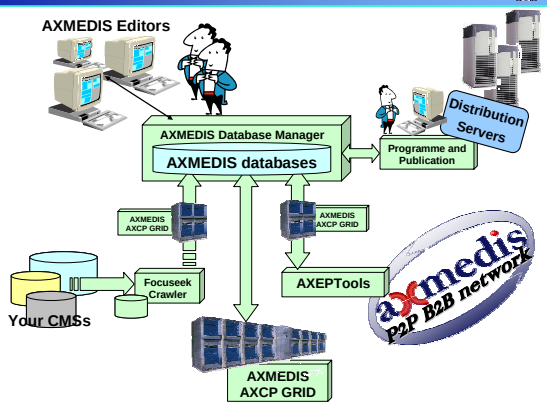
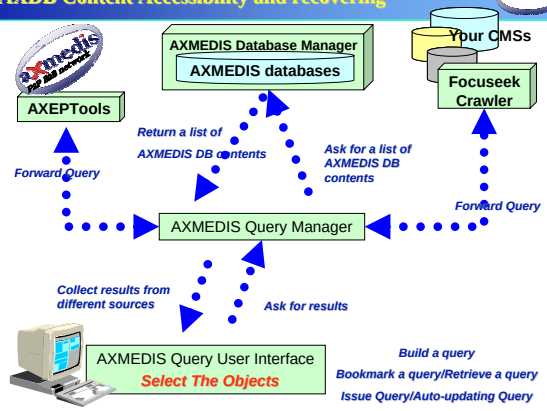
AXMEDIS Content Processing



AXDB Content management systems, CMS

- **Scalable to manipulate a large number of:**
  - Objects, components, protected objects
  - Licenses, protection information
  - Digital resources
  - Etc.
- **Making queries on the basis of**
  - Descriptions, formal descriptors
  - Technical information
  - License information
  - Classification metadata
  - Indexing on the basis of selected information
- **Direct access via IDs**
  - Fast Retrieval
  - Typically objects on File Systems
  - Modelling of XML information

AXDB Content Accessibility and recovering



AXMEDIS Database Information

- **Management and Query on Several Information**
  - **AXMEDIS Objects**
    - Protected and non protected AXMEDIS objects
  - **Licensing information**
    - License models
    - Specific instances of Licenses related to objects
    - Specific Instances of Licenses related to signed contracts
    - PAR: Potential Available Rights
  - **Protection information**
    - Protection information models
    - Specific instances of Protection Information of the Objects
  - **Action Logs coming from the AXCS**
  - **User information**
  - Etc.
- **AXMEDIS Objects:**
  - MPEG-21
  - From metadata to digital resources
  - From complex composed digital objects to simple resources
  - From licenses to games, etc.
  - From MS-WORD files to MPEG4, HTML, LOM, etc.

AXMEDIS Considerations

- **AXMEDIS integrates:**
  - A Crawling solution to fast gathering of Content and other information located in your CMSs
  - A Database Manager capable of Collecting and managing AXMEDIS content
  - Query Support to make technical business queries on: local AXDB, AXEPTool, and on yours CMSs
  - Queries on the AXEPTools are applied to all the P2P AXMEDIS network virtual database
- **AXMEDIS Automated Content processing Integrates:**
  - Access to the AXMEDIS database
  - Publication of Content on the P2P AXEPTool
  - Publication of Content towards the Distributors Servers
  - Loading and processing content coming from the legacy and/or current CMSs via the integrated Crawler Focuseek
  - Saving results of the Content Processing back to you CMSs
- **Any other question/issue ??**

AXMEDIS Distribution tools

AXMEDIS Content Production and Processing

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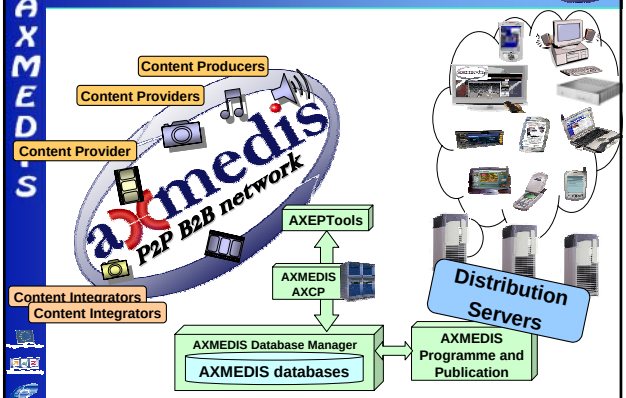
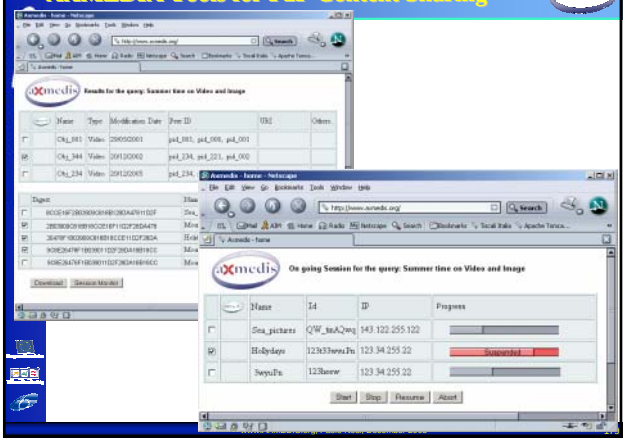
AXMEDIS Publication Capabilities



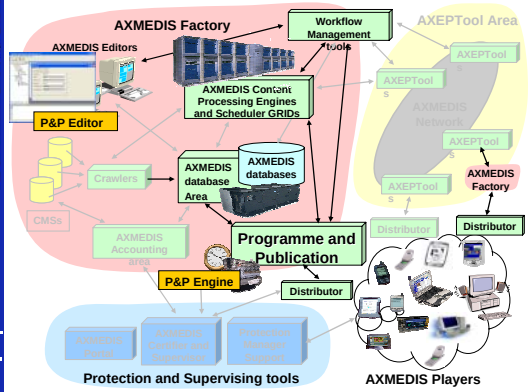
AXMEDIS P2P Tools

- **AXMEDIS P2P tools for content sharing respecting IPR**
  - Content Distribution and P2P file sharing
  - DRM support, supervision and control
  - Certified metadata, etc.
- **AXEPTool**
  - Only for B2B
  - Technical queries and information:
    - Features, descriptors, duration, formats, license information, distribution model, etc.
  - Automated loading and publication
  - Control and certification of metadata
- **AXMEDIA tool:**
  - Only for C2C and B2C
  - Simple queries on simple user focussed metadata
  - Simple management of files on the file system
  - Control and certification of metadata

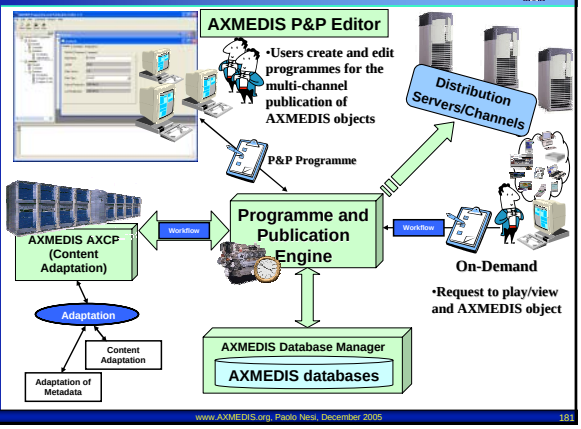
AXMEDIA Tools for P2P Content Sharing



AXMEDIS Programme and Publication



AXMEDIS Programme and Publication



AXMEDIS Client tools

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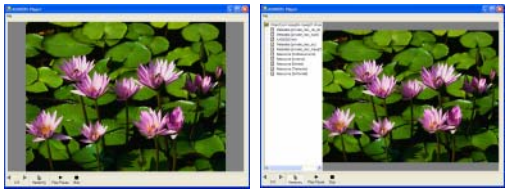
AXMEDIS Client Tools

- **AXMEDIS clients tools**
  - Based on AXOM module plus a set of players
    - Audio player
    - Video player
    - Document viewer
    - Image viewer
    - Etc.
  - Different devices:
    - PC player, PDA player, etc.
  - AXMEDIS Plug ins:
    - Active X for integration with IE, Authorware, Tool Book, etc.
    - For Mozilla
  - Possible integration of AXMEDIS AXOM in any player

AXMEDIS ActiveX

- **The AXMEDIS ActiveX allows**
  - the fruition of AXMEDIS Objects within other Windows applications and web pages
- **It allows to:**
  - Show the resources inside the object (unprotected)
  - Control the execution of resources (play/pause/stop)
  - Hide/show the AXMEDIS Hierarchy



- **It has been used to produce a prototype of the PC Player**

AXMEDIS Player Mozilla's plugin

Examples of AXMEDIS Applications

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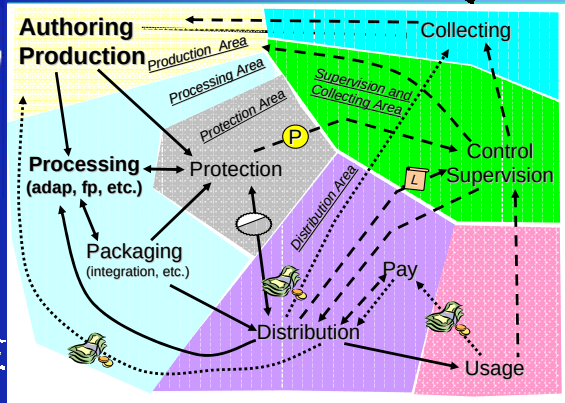
- Conclusions and references

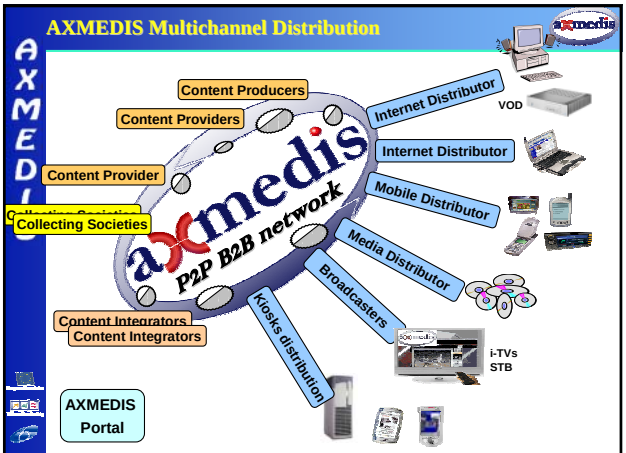
Examples of AXMEDIS Applications

- Distribution on Internet, the TISCALI demonstrator
- Distribution via Kiosks, the ILABS demonstrator
- Distribution via Satellite data broadcast, the EUTELSAT Demonstrator
- General AXMEDIS Multichannel Architecture

AXMEDIS Distribution



AXMEDIS Multichannel Distribution

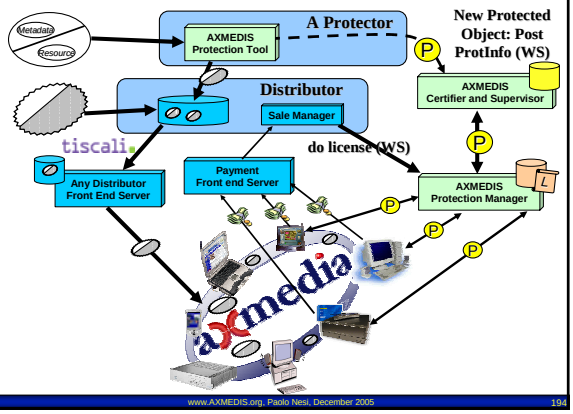


Distribution on Internet, the TISCALI demonstrator

TISCALI Distribution with AXMEDIS Technology

- **B2C distribution**
- **AXMEDIS objects with**
  - Video and Audio Files
- **Licenses and Protection Information not in the object**
- **The AXMEDIS Objects may be**
  - shared among consumers with AXMEDIA Tool a P2P tool
  - Visualized and played on AXMEDIS players free downloaded
- **The users have to perform the registration of**
  - themselves on an AXMEDIS portal
  - any AXMEDIS player tool they would use
  - Mainly on PC and Media Centres
- **License allows**
  - Content sharing on AXMEDIA
  - Content play
  - Content Adaptation…
  - Content Migration on other P2P channels…
  - Content Migration on any other AXMEDIS terminal

TISCALI Distribution with AXMEDIS Technology

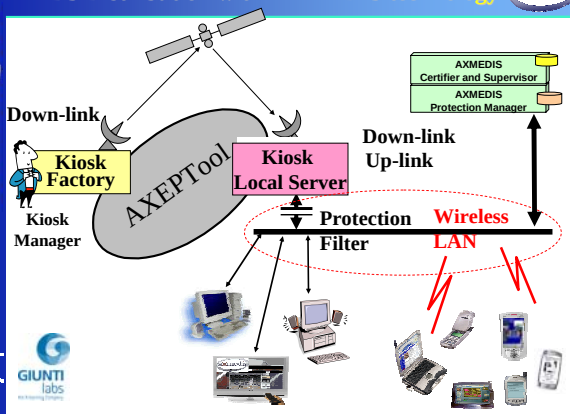


Distribution via Kiosks, the ILABS demonstrator

ILABS Distribution with AXMEDIS technology

- **B2B and B2C distribution**
- **AXMEDIS objects with**
  - Educational and cultural content,…
  - Video, images, document, audio, animations, etc.
- **Licenses and Protection Information not in the object**
- **The AXMEDIS Objects may be**
  - Visualized and played on AXMEDIS players free downloaded
- **The users have to perform the registration of**
  - themselves on an AXMEDIS portal
  - any AXMEDIS player tool they would use
  - Mainly on PDA and mobiles
- **License allows**
  - Content play
  - Content Adaptation…
  - Content Migration on any other AXMEDIS terminal, in some cases

ILABS Distribution with AXMEDIS technology



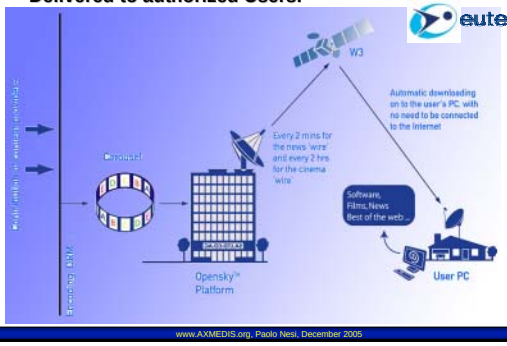
Distribution via Satellite data broadcast, the EUTELSAT Demonstrator

EUTELSAT Distribution with AXMEDIS technology

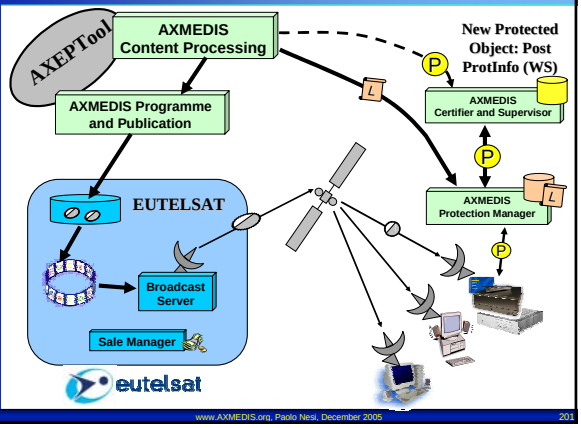
- B2B and B2C distribution
- AXMEDIS objects with
  - Any kind of content,…
  - Video, images, document, audio, animations, etc.
- Licenses and Protection Information not in the object
- The AXMEDIS Objects may be
  - Visualized and played on AXMEDIS players free downloaded
- The users have to perform the registration of
  - themselves on an AXMEDIS portal
  - any AXMEDIS player tool they would use
  - Mainly on PC for TV and/or i-TV
- License allows
  - Content play
  - Content Adaptation…
  - Content Migration on any other AXMEDIS terminal, in some cases

EUTELSAT Distribution via Satellite Data Broadcast

- Satellite data broadcast in PUSH
- The Produced Content is Packaged, Scheduled and Delivered to authorized Users.



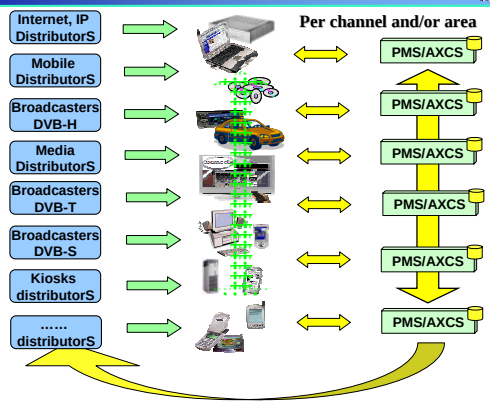
EUTELSAT Distribution with AXMEDIS Technology



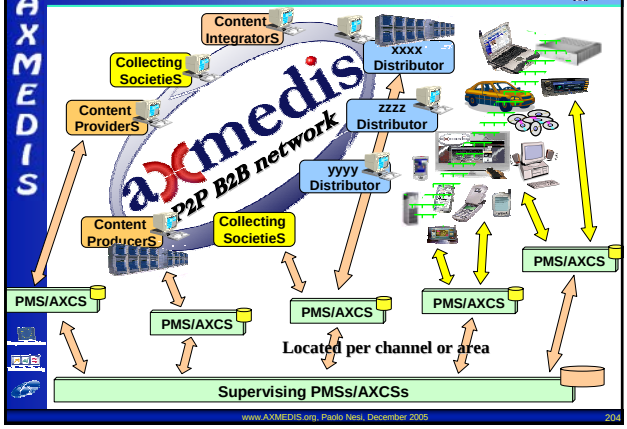
AXMEDIS

Multichannel Architecture

The AXMEDIS Multichannel architecture



AXMEDIS Multichannel architecture



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Publicly Accessible General AXMEDIS documents

- DE2.1.1 (two parts, and b) User Requirements and use cases
  - A) user requirements
  - B) Use Cases
- DE2.2.1 -- Test cases and content description

- Reports on Content
- DE3.1.3 -- AXMEDIS Content Aspects Specification
- DE8.1.1 -- Content for Test Cases and Validation
- DE8.2.1 -- Content Selection Guidelines
- DE8.3.1 -- Multilingual guidelines and technical solutions
- DE8.4.1 -- AXMEDIS Editorial Format Guidelines and basic examples

Publicly Accessible AXMEDIS Framework documents

- DE3.1.3 -- Framework and tools Specification, 10 parts
  - A) AXMEDIS General aspect and Model
  - B) AXMEDIS Viewers and Players
  - C) AXMEDIS content processing area, GRID
  - D) AXMEDIS Fingerprint and Descriptors
  - E) AXMEDIS Database and Content gathering
  - F) AXMEDIS AXEPTools P2P
  - G) AXMEDIS Workflow
  - H) AXMEDIS Protection and accounting
  - I) AXMEDIS Draft Distribution and Portal
  - J) AXMEDIS Definitions and Terminology

- DE5.1.1 -- AXMEDIS Framework Infrastructure
- DE5.2.1 -- AXMEDIS Framework Validation and Integration

Publicly Accessible AXMEDIS Framework documents

- *Early reports on Basic Technologies*
- *DE4.1.1 - Content Modelling and managing*
- *DE4.2.1 - Content indexing, monitoring and querying*
- *DE4.3.1 - Content Composition and formatting*
- *DE4.4.1 - Content sharing and production on P2P*
- *DE4.5.1 - Content Protection and Supervision*
- *DE4.6.1 - Content Distribution via Internet*
- *DE4.7.1 - Content Distribution toward mobiles*
- *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*

References

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- CRF: Content Reference Forum: http://www.crforum.org/
- DMP: Digital Media Project, www.chiariglione.org
- EITO 2005: European Information Technology Observation 2005: http://www.eito.com/index-eito.html
- ODRL: http://odrl.net/
- OMA: www.openmobilealliance.org
- MI3P, Music Industry Integrated Identifier Project, http://www.mi3p-standard.org/
- MPEG, MPEG-21: www.chiariglione.org
- MUSICNETWORK: www.interactivemusicnetwork.org
- WEDELMUSIC: www.wedelmusic.org
- Microsoft Windows Media: http://www.microsoft.com/windows/windowsmedia/default.aspx

Comments, Acknowledgements & Contact Information

Other AXMEDIS courses

- **We 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 produced annually
  - By affiliating with AXMEDIS and participating at the AXMEDIS events and activities you will be kept up to date with the latest progresses 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.*

Affiliation to the AXMEDIS

- **You can be affiliated with AXMEDIS. The affiliation provides access to a large amount of information and knowledge, and source code related to the AXMEDIS Framework.**
- **If you are interested in the affiliation please contact P. Nesi at nesi@dsi.unifi.it. The benefits of the affiliation include the possibility of using the AXMEDIS specification and technology for your business.**
- ***You are invited to:***
  - contribute to the improvement of AXMEDIS documents and specification by sending the contribution to P. Nesi at nesi@dsi.unifi.it
  - attend AXMEDIS meetings that are open to public, for additional information see WWW.axmedis.org or contact P. Nesi at nesi@dsi.unifi.it

Thanks to all AXMEDIS partners

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:***
- ***Prof. Paolo Nesi, Ph.D.***

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