



Sistemi Distribuiti

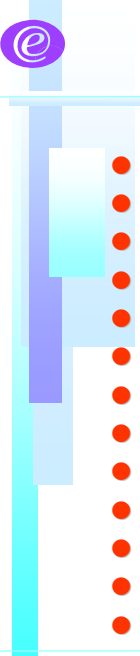
Corso di Laurea in Ingegneria

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Part 12:
Intro. to e-Commerce and Content Distribution

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Introduction to E-Commerce and Content Distribution

- Physical and digital good
- E-commerce technologies and problems
- Transaction and business Models
- Terminology and Value Chain
- Digital Rights Management
- Content Modeling and Packaging
- Licensing and content distribution
- Example of Microsoft Windows Media
- Example of Apple I-Tune
- Example of AXMEDIS solution
- Secure P2P content Distribution
- Distribution mediate via Kiosks
- Satellite broadcasting

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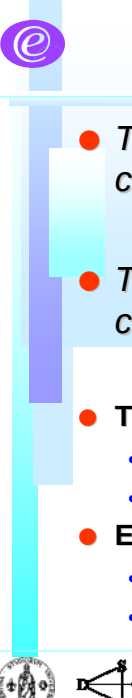


E-Commerce Introduction

- **Digital promotion and sale of traditional or *physical goods***
 - ♣ Off line delivering of goods
 - ♣ For example: AMAZON, eBay
- **Digital promotion and sale of *digital goods***
 - ♣ Off line delivering, for example:
 - ➔ For example: eBay, AMAZON
 - ♣ On-line delivering, for example:
 - ➔ i-Tune, Sky, Premium, La7, TISCALI, etc.



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Physical vs Digital Good

- *The usage of digital world/technology for the commerce of **physical** good*
is a subproblem of
- *The usage of digital world/technology for the commerce of **digital** good*
- **They share the:**
 - ♣ Marketing
 - ♣ Business model, transaction and payment
- **E-Commerce of digital good** has in addition problems of:
 - ♣ Digital distribution
 - ♣ IPR control/supervision, such as DRM or Copy Protection



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E-Commerce Services technologies

- **Architecture for distribution**
 - ♣ Streaming:
 - ♣ Downloading, progressive download, VOD, VOIP, ...
 - ♣ Broadcasting: DVB-T, DVB-S, DTT, DVB-H,
 - ♣ Providing services
 - ♣ Paying portals:.....
- **Content production and protection**
 - ♣ Content Processing: adaptation, production, etc.
 - ♣ GRID for content processing: licenses, content, search, production on demand
- **Other Technologies**
 - ♣ Security aspects: certification, authentication, etc.
 - ♣ IPR: Intellectually Property Right
 - ♣ DRM: Digital Rights Management
 - ♣ CP: Copy Protection
 - ♣ Fault Tolerance



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Content Modeling and Processing

- Production and production process definition
 - ♣ Workflow Management
 - ♣ Cooperative work
- Content gathering and ingestion
- Database management systems, CMS,
 - ♣ query support, distributed queries, etc.
- Content description for
 - ♣ Search, classification, retrieval
- **Content modelling for**
 - ♣ Production, integration, distribution, IPR, DRM
- **Content protection for enforcing respect of**
 - ♣ IPR, DRM
- **Automatic programme production**
 - ♣ EPG, GuidePlus, ShowView, etc.



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E-Commerce Services Problems

- **Business Model**
 - ♣ How/when to give goods, how/when to give money
- **Transaction Models**
 - ♣ Security: certification, smartcards, etc.
 - ♣ Mission Critical Applications
- **Payment solutions:**
 - ♣ Accounting, banking, micropayments, etc.
 - ♣ Prepaid, Credit Card, BOLLETTE, etc.
- **Scalability:**
 - ♣ from few to millions of transactions/users
- **Availability:**
 - ♣ Discovery on internet
 - ♣ Accessibility of the service, broadcast/cellular coverage
- **Privacy of the customers**
 - ♣ User anonymity during transactions
- **Intellectually property protection and management:**
 - ♣ IPR, DRM, copy protection
- **Multichannel distribution**
- **Interoperability of content on devices**



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Classification of Transaction Models

- **B2B: Business to Business**
 - ♣ Among digital good producer, publishers, integrator, resellers, etc.
 - ♣ They add values and thus ...
- **B2C: Business to Consumer**
 - ♣ From distributors to consumers
- **C2C: Consumer to Consumer**
 - ♣ File sharing
 - ♣ Good sharing
- **B2B2C**
 - ♣ Integrated B2B to B2C



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Examples of Business Model



	On Line delivering	Off Line delivering
On Line Payment	Digital good	Any good
Off Line Payment	Digital good	Any good

	On Line usage	Off Line usage
Digital good	Yes	Yes
Physical good	No sense	Yes




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A Transaction



- What is a transaction?
 - ♣ In the business world, is an action that change the state of an enterprise
 - ♣ In the computer world, is a collection of actions with properties of
 - ➔ Atomicity,
 - ➔ Consistency,
 - ➔ Isolation,
 - ➔ Durability
 - ♣ The so called ACID




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Transaction: ACID properties



- **Atomicity:**
 - ♣ do all-or-nothing
- **Consistency:**
 - ♣ transaction must leave the system in a correct state or it must abort
- **Isolation:**
 - ♣ Transaction behavior is not effected by other transactions that execute concurrently
- **Durability:**
 - ♣ transaction's effects are permanent after it commits. They survive system failures



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Major Requirements

- **Distributors:**
 - ♣ Make money on digital/physical good distribution
- **Final user:**
 - ♣ Acquisition of physical good, cheaper, faster, etc.
 - ♣ Acquisition of digital good
 - ➔ Immediate
 - ➔ At least, with the same features and usage of the physical good:
 - Copy, lend, share, etc.
 - ♣ More features in the digital than those usually in the physical world:
 - ➔ For example: buy one and use more: home, car, i-pod, PDA, phone, CD, etc.



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Requirements of E-Commerce Applications

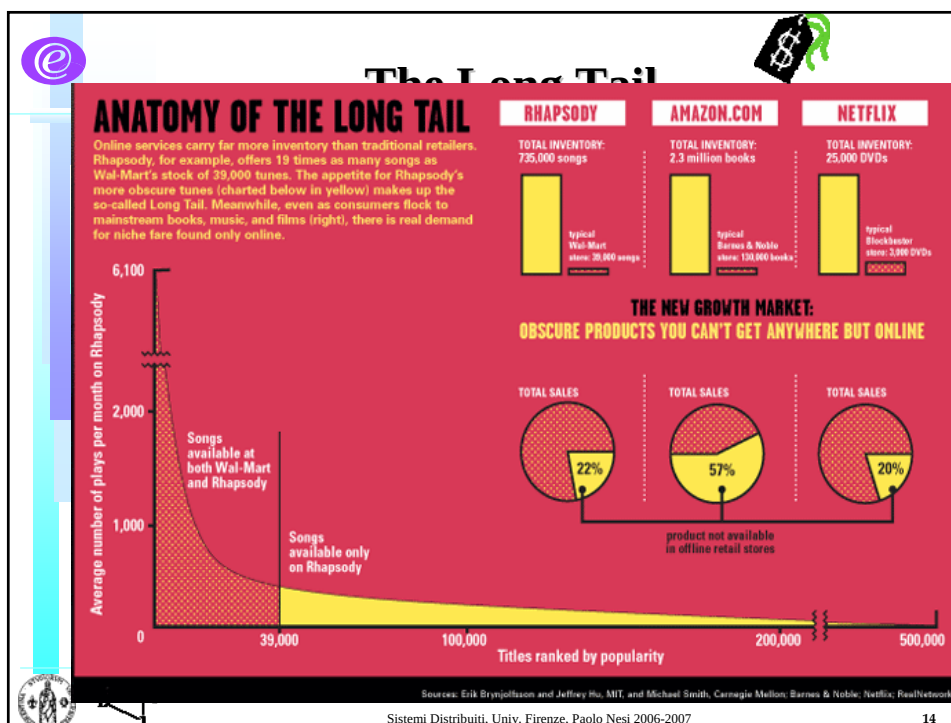


- High number of clients/users per applications (millions or more)
 - ♣ the server is on Internet, accessible to every user in the world
 - ♣ The users are connected via broadcast, cellular phones, etc.
- Client has to be suitable for using the digital content if any.
- Integration with legacy applications and heterogeneous databases
 - ♣ probably the enterprise already has legacy applications or DBMS (for internal purpose or because it is already a Commerce Enterprise: catalog/client information, etc.)
 - ♣ with the evolution of the infrastructure, other software may be added to the server (Data Warehouse, OLAP, Data Mining)




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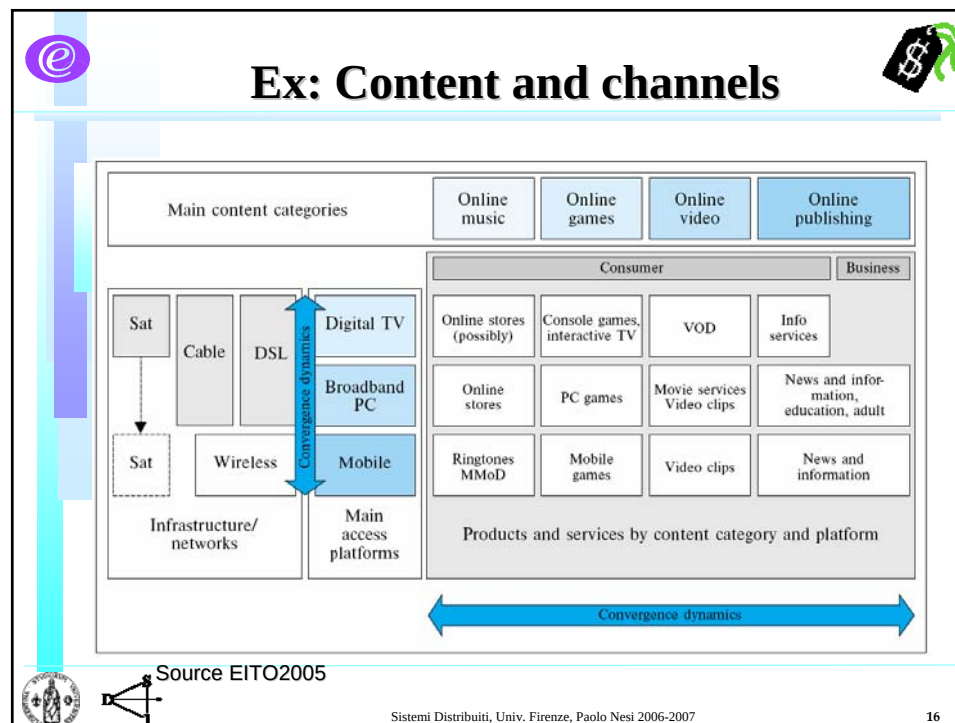
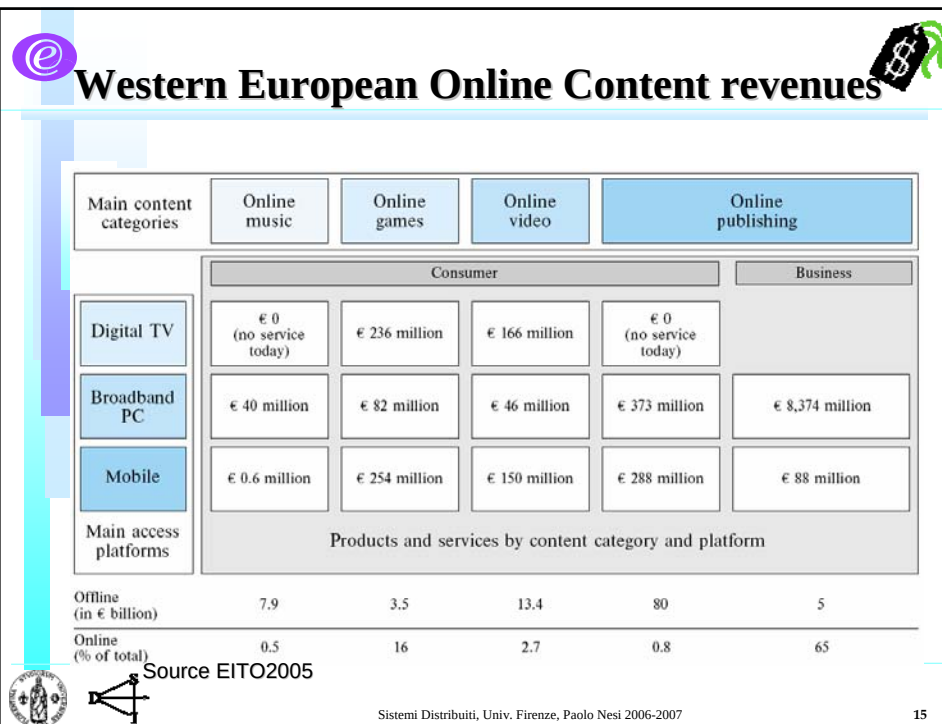
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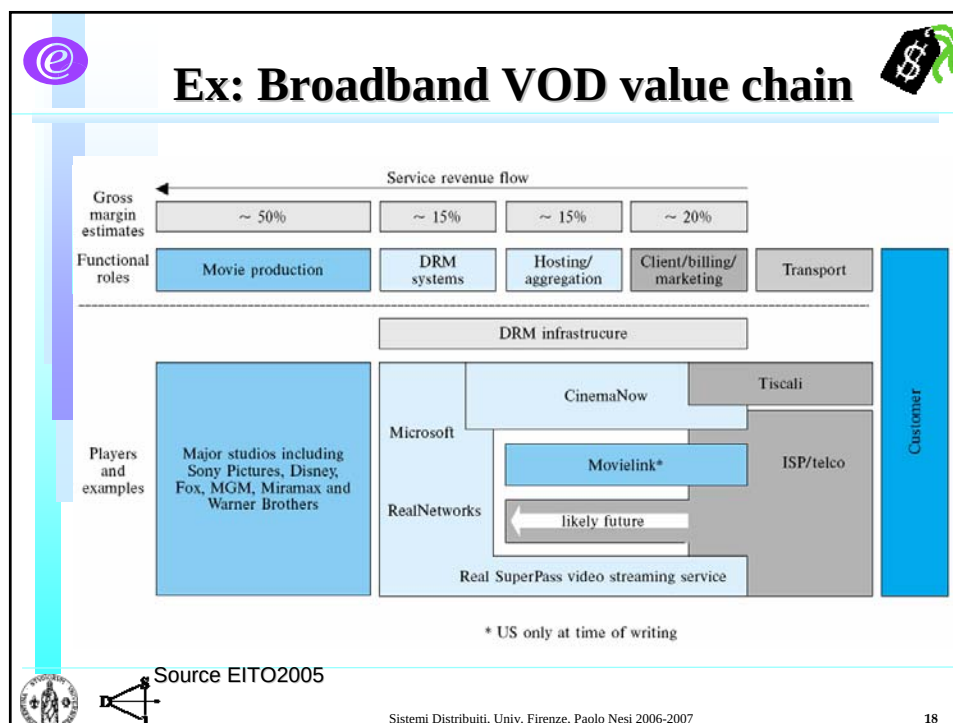
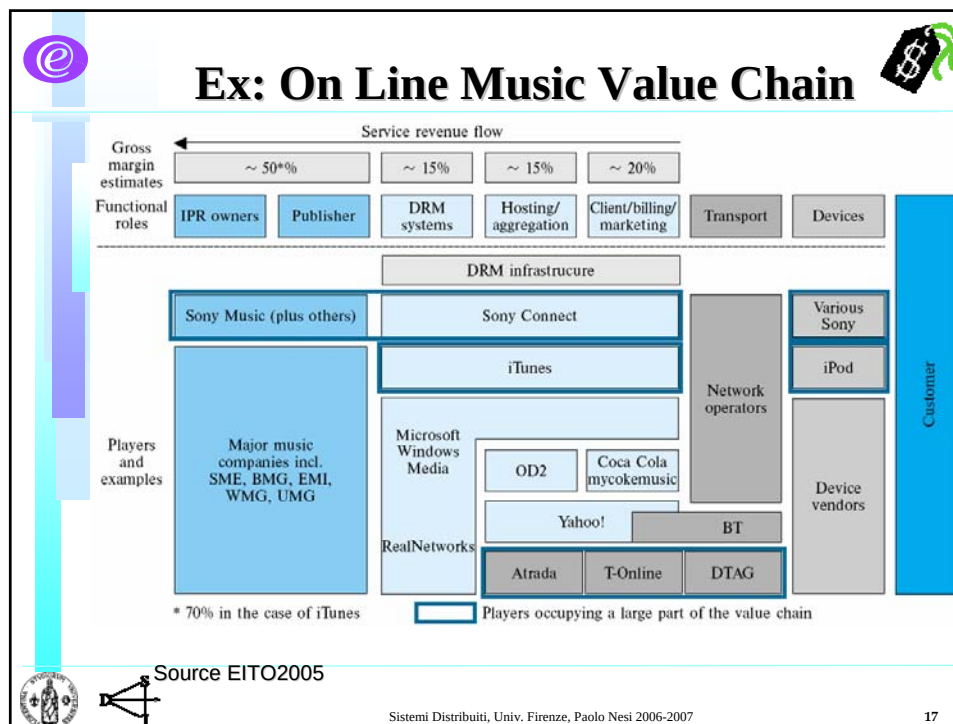


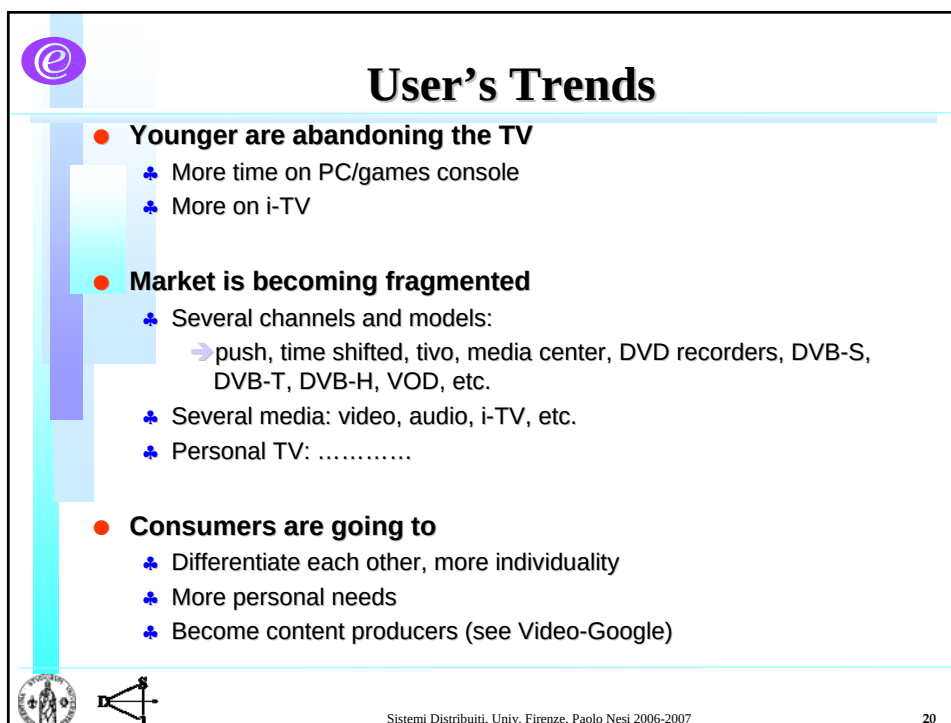
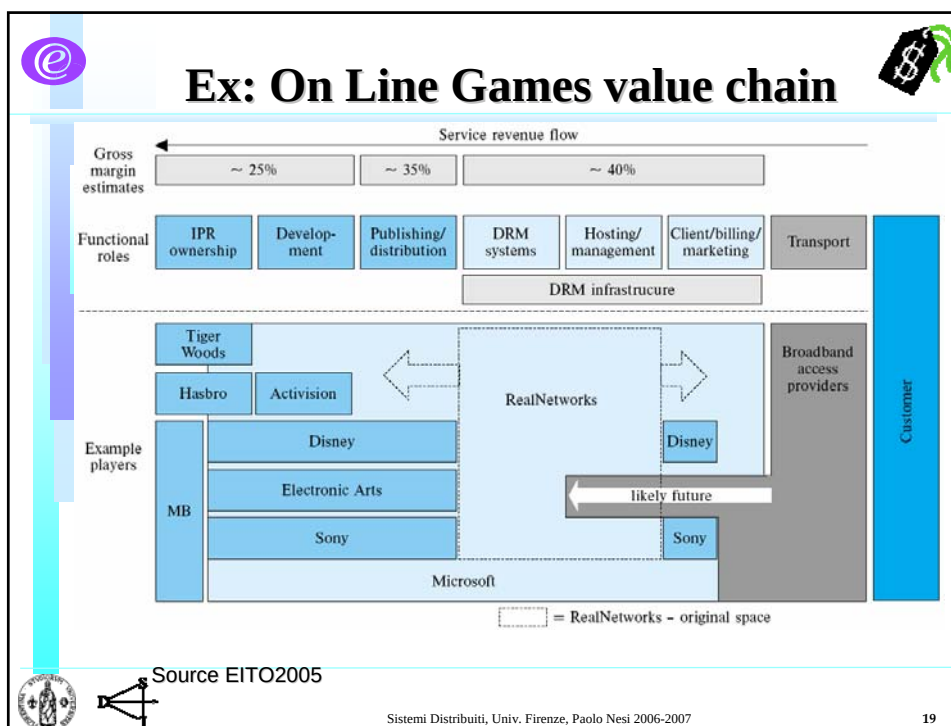


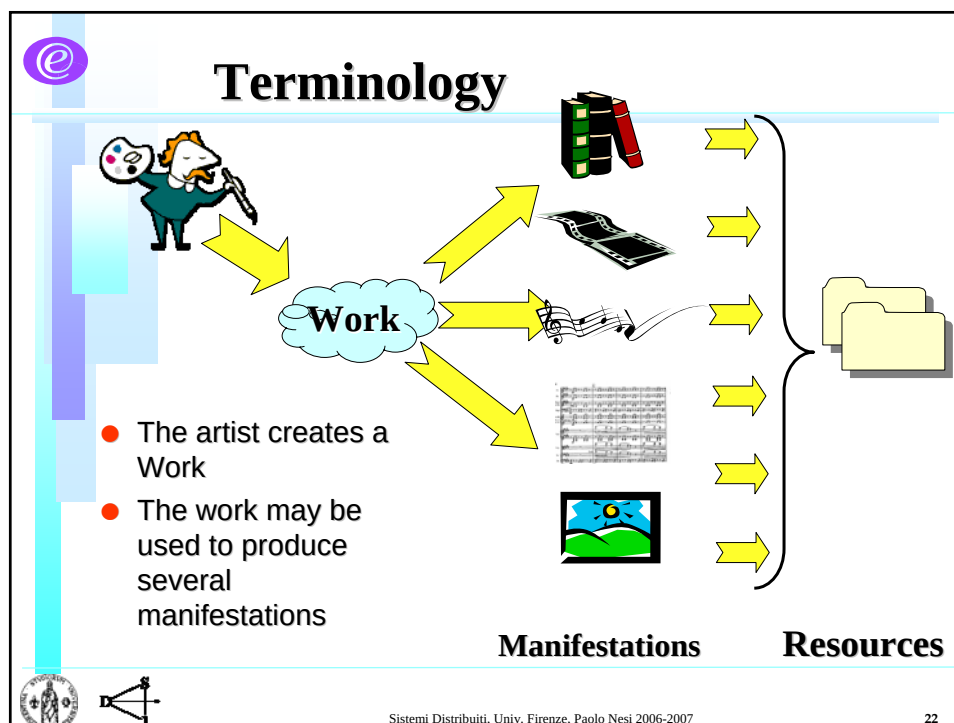
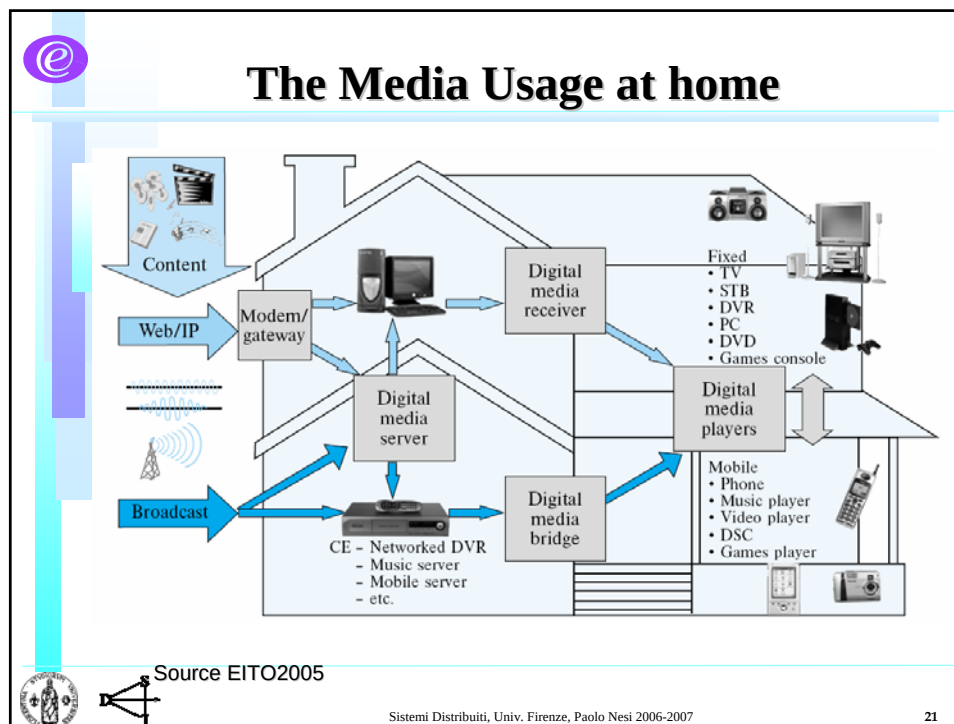
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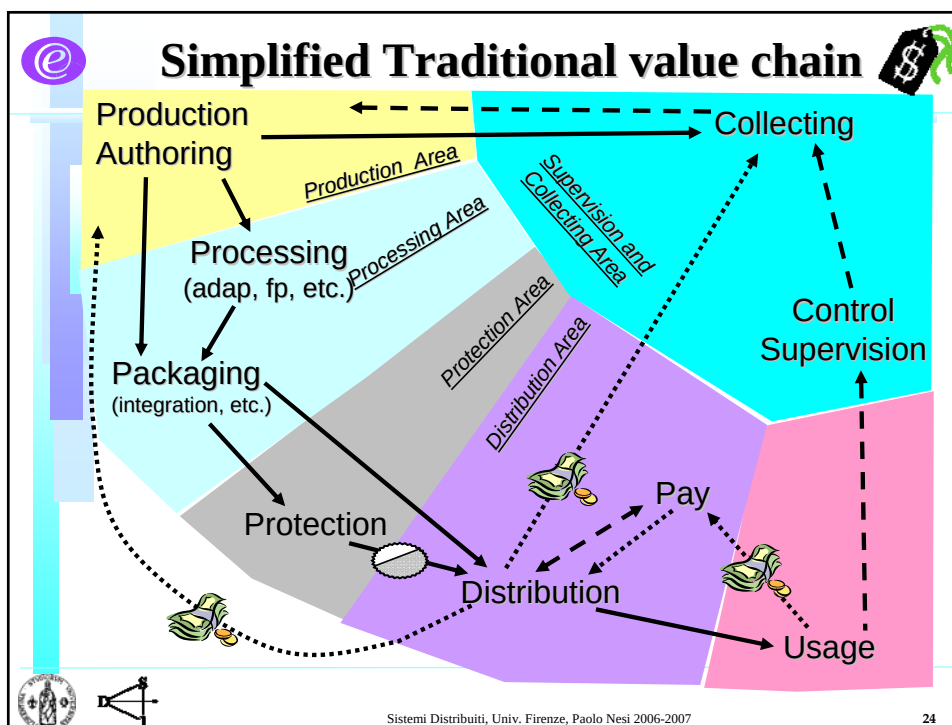


 **Some Actors of the value chain, “definitions”**

- **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

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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




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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 covers:
 - ♣ security and encryption
 - ♣ prevent non authorized copying
- 2nd generation of DRM covers:
 - ♣ description, identification, trading, protection,
 - ♣ monitoring, and tracking of all forms of rights usages over contents, including management of rights holders relationships



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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 (in some case can be relaxed)
 - ♣ Authentic. of users and/or tools/terminal/devices
 - ♣ Control of users
- *It has to be supported by a set of additional technical solutions*

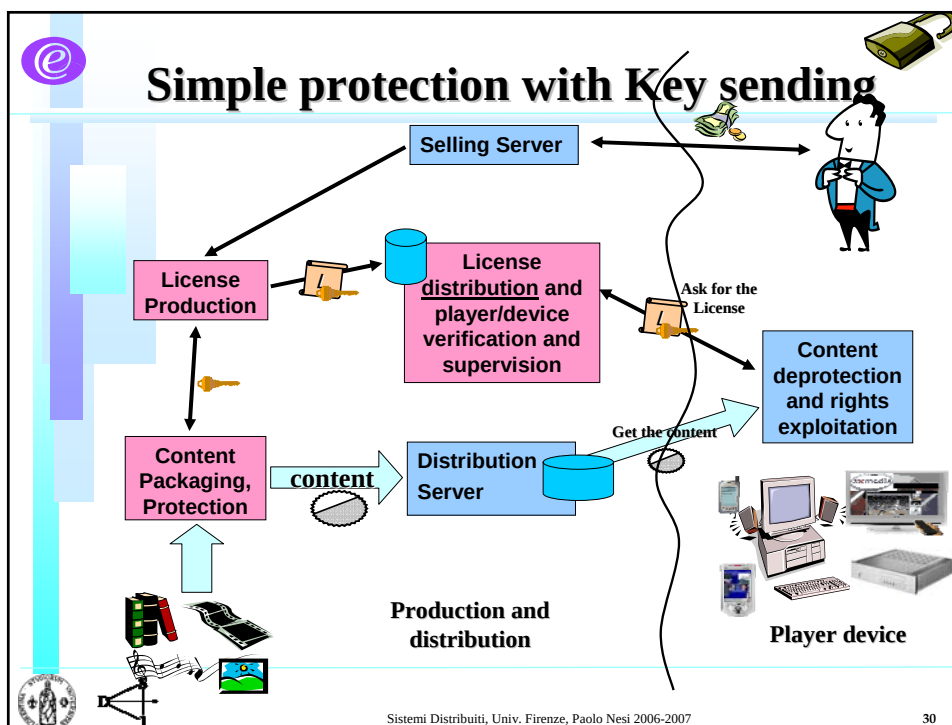


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Motivations for Digital Rights Management

- 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, SGAE, SAGEMA, etc.

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What Should be the DRM



- 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



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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,
 - ♣ Black list of devices



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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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Content Elements

- **Content Packaging to contain the following information**
 - ♣ Metadata.....
 - ♣ Digital Resources.....
 - ♣ Protection Information.....
 - ♣ License.....
- **The Package should allow to be**
 - ♣ Protected
 - ♣ Streamed (so called real-time) and/or downloaded,
 - ♣ Shared on P2P, etc..
 - ♣ Ported on physical supports,
 - ♣ Adapted, etc..
 - ♣ Coded in binary and/or XML, etc.
 - ♣ etc.



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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:**
 - ♣ What has to be done to access at a given information/resource
 - ♣ Tools used, their parameters, etc.
- **Licence:**
 - ♣ Which rights are provided, who is the recipient, conditions, etc.

Prot-Info Model → 

License Model → 




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License formal language



- **Windows Media DRM**
- **MPEG-21:**
 - ♣ REL: Rights Expression Language
 - Derived from XrML
 - ♣ RDD: Rights Data Dictionary
- **XrML 2.0: eXtensible rights Markup Language**
 - ♣ <http://www.xrml.org/>
 - ♣ General purpose
 - ♣ ContentGuard, Nov. 2001, Microsoft
 - ♣ Derived from DPRL
 - ♣ Usato come base per MPEG-21
- **OMA ODRL: Open Digital Rights Management**
 - ♣ Expression language for mobiles
 - ♣ In some way simpler than MPEG-21 REL
 - ♣ ..






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MPEG-21 — REL, Rights Expression Language

- A machine-readable language, XML
- To declare rights and permissions
- Uses terms defined in the Rights Data Dictionary RDD
- REL consists of licenses and grants that give specific permissions to Users to perform certain actions on certain resources, given that certain conditions are met
 - ♣ **Grants can also allow Users to delegate authority to others**
- User's system device has to
 - ♣ parse and validate the RE
 - ♣ check permissions before any further action is done
- DID parser is responsible for discovering and identifying where to gather licenses
- REL licenses are wrapped in Digital Items when the object is governed

ISO/IEC JTC1/SC28 WG11
MPEG
MOVING PICTURE EXPERTS GROUP

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REL data model

```

graph TD
    right[right] -- issued to --> principal[principal]
    right -- associated with --> resource[resource]
    right -- subject to --> condition[condition]
    
```

- 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

ISO/IEC JTC1/SC28 WG11
MPEG
MOVING PICTURE EXPERTS GROUP

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ISO/IEC JTC1/SC29 WG11
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REL – Principal and Rights



- **Principal:** Party to whom a grant conveys usage rights.
 - ♣ authentication mechanism by which the principal can prove its identity.
 - ♣ a principal that must present multiple credentials, all of them must be simultaneously valid, to be authenticated.
- **Right:**
 - ♣ Action or activity that a principal may perform using a resource under some condition.
- **Resource:**
 - ♣ Object to which the principal can be granted a right.
- **Condition:**
 - ♣ Terms under which rights can be exercised.
- MPEG REL provides a right element to encapsulate information about rights and provides a set of commonly used, specific rights, notably rights relating to other rights, such as issue, revoke and obtain. Extensions to MPEG REL could define rights appropriate to using specific types of resource. For instance, the MPEG REL content extension defines rights appropriate to using digital works (e.g., play and print)




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An example of statement

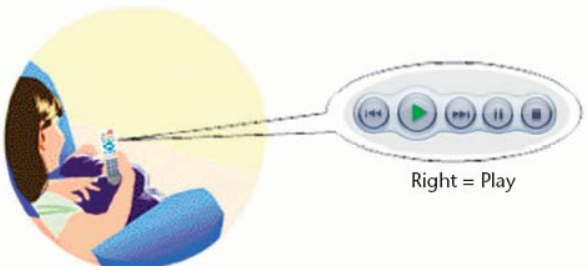




Condition = November 2003



Resource = Ocean Wilds



Right = Play

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




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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
 - ♣ SeekApproval
 - ♣ Territory
 - ♣ TrackQuery
 - ♣ TrackReport
 - ♣ TransferControl
 - ♣ ValidityIntervalFloating
 - ♣ ValidityIntervalStartsNow
 - ♣ ValidityTimeMetered
 - ♣ ValidityTimePeriodic

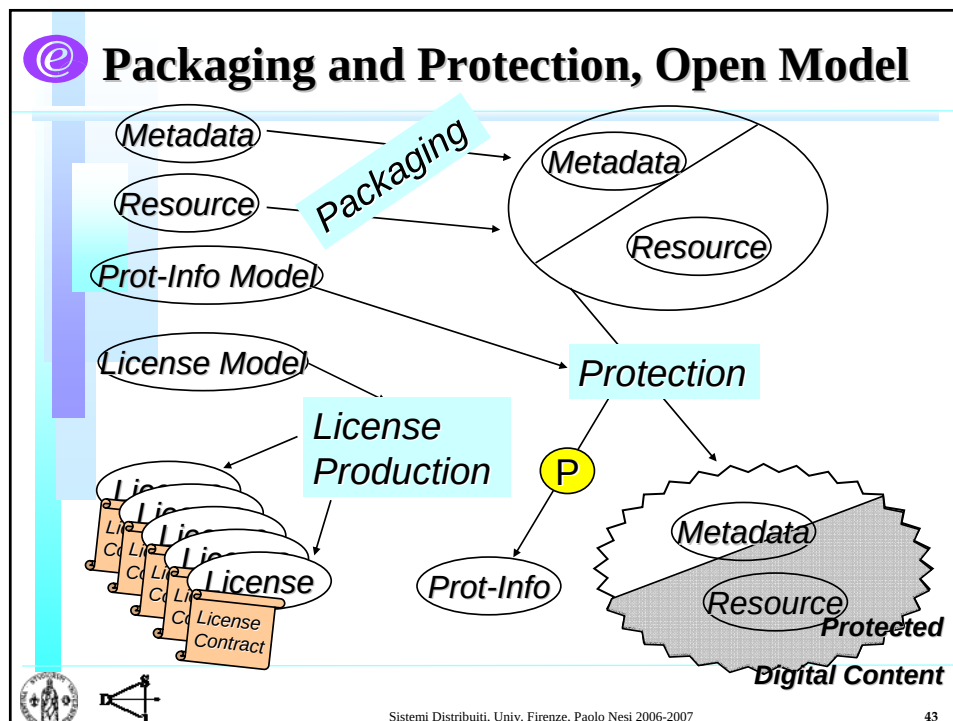
- **Examples of Rights**
 - ♣ Adapt
 - ♣ Delete
 - ♣ Diminish
 - ♣ Embed
 - ♣ Enhance
 - ♣ Enlarge
 - ♣ Execute
 - ♣ Install
 - ♣ Modify
 - ♣ Move
 - ♣ Play
 - ♣ Print
 - ♣ Reduce
 - ♣ Uninstall

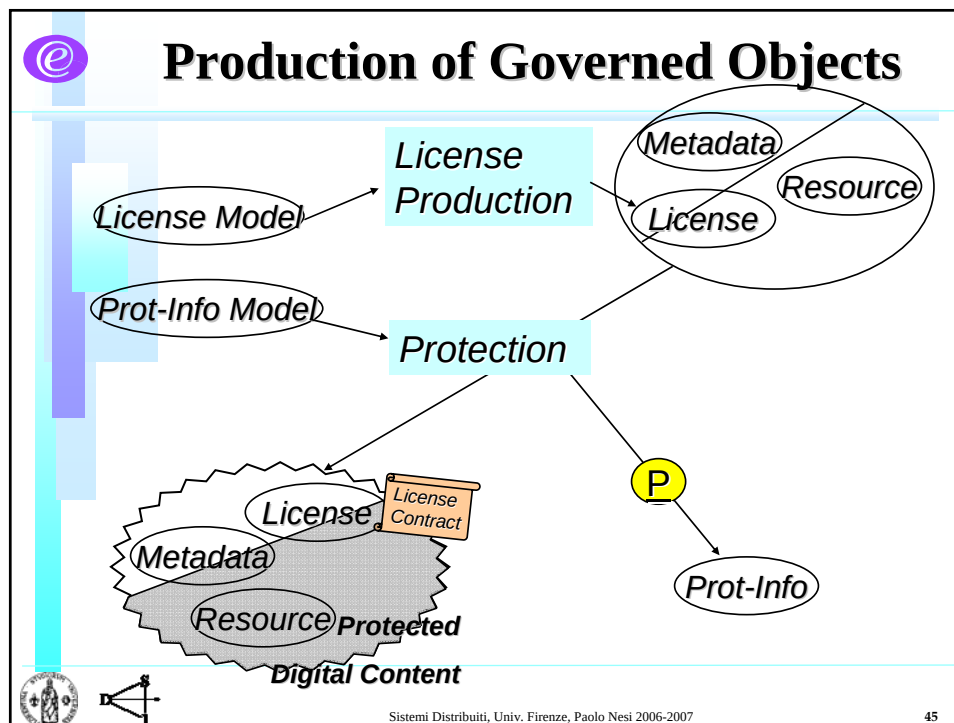
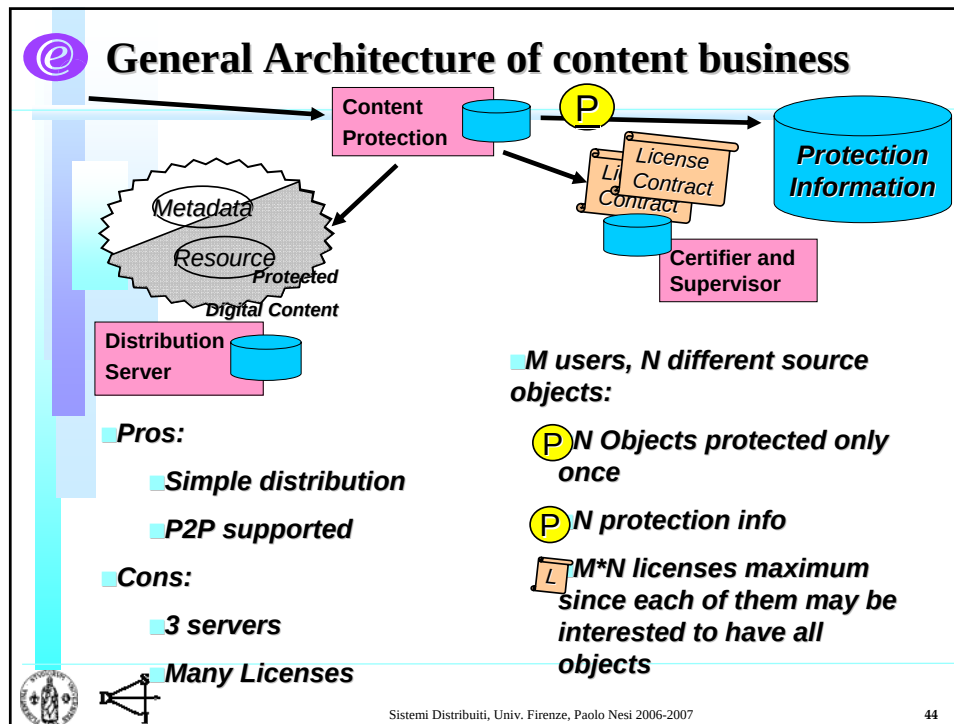


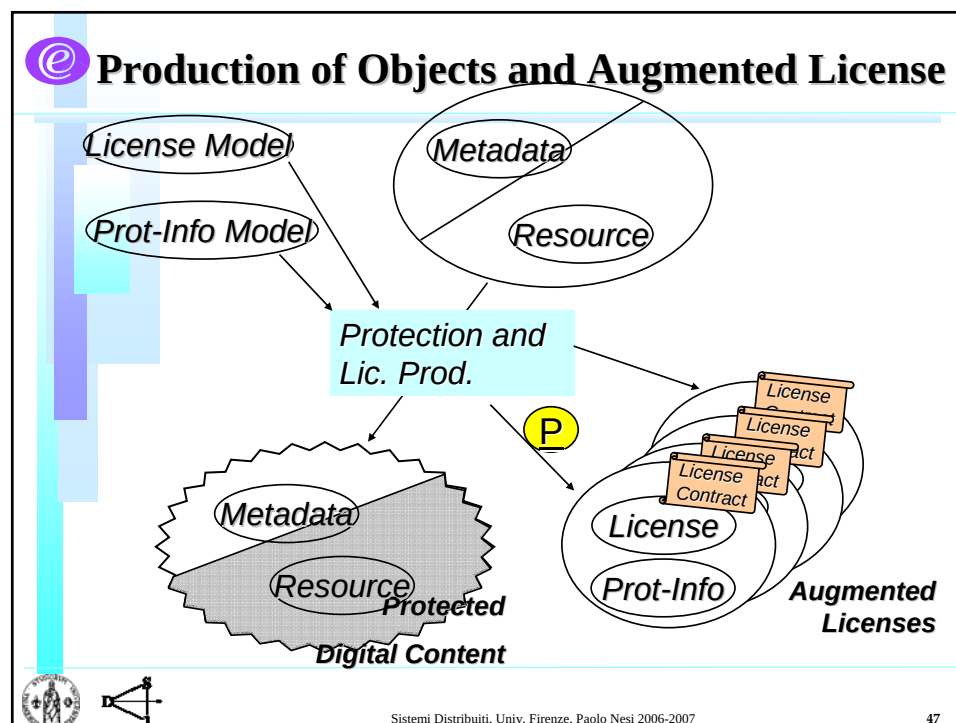
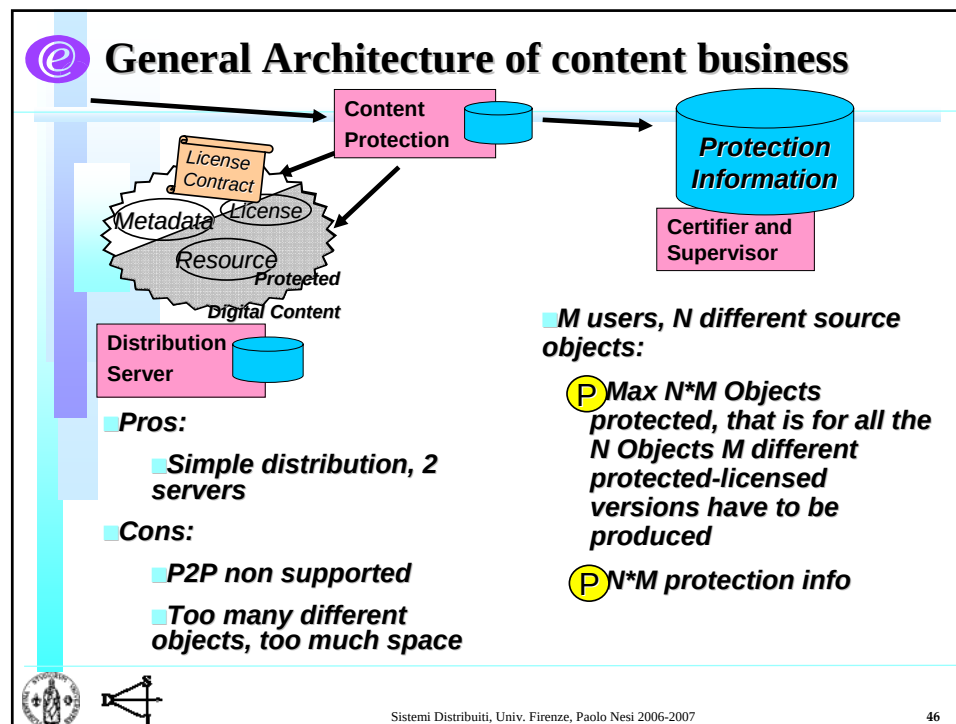


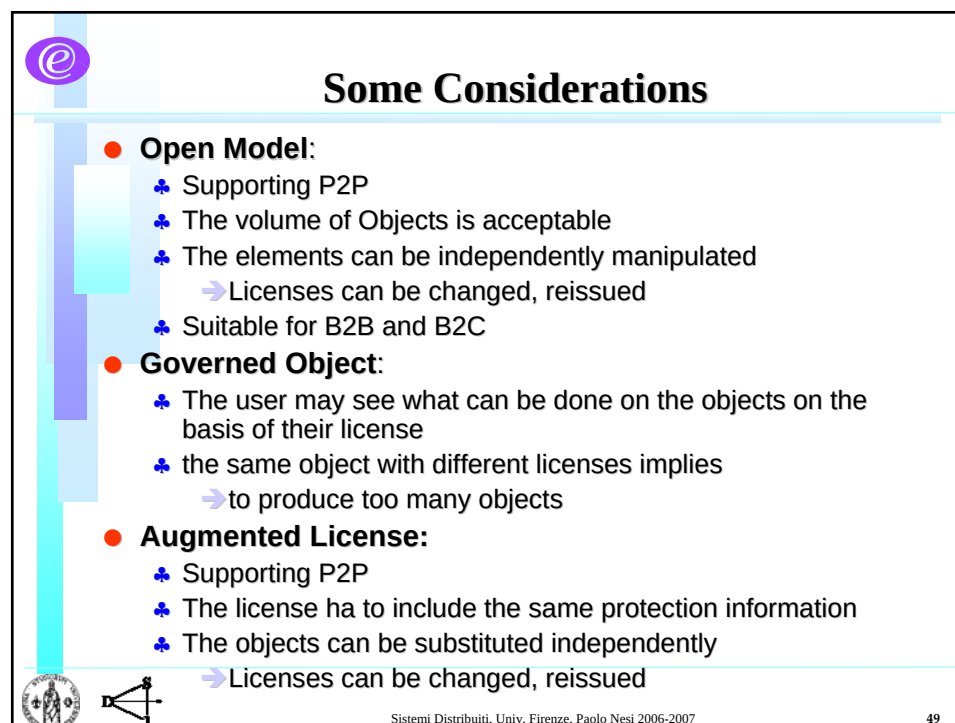
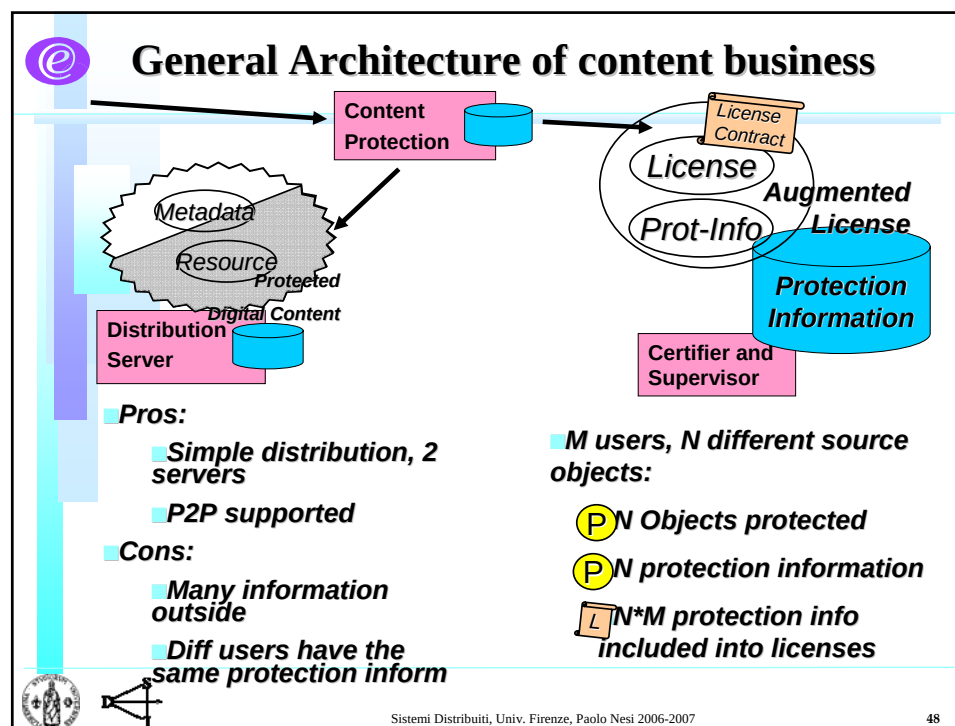

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Managing License Chain

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"

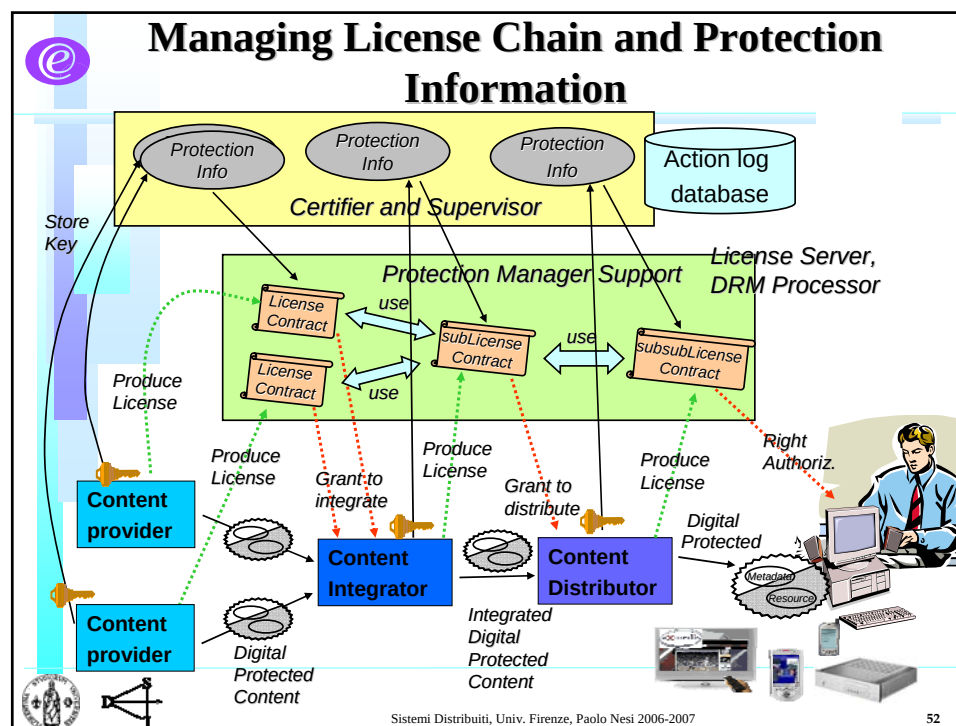
- To solve the SubSubLicense for Carl all the connected Licenses are needed
- Licenses have to be accessible on Processing Engine

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Managing License Chain

- A license server is needed to solve the SubSubLicense all the connected licenses
- All licenses have to be accessible by the License server
 - This may involve massive processing

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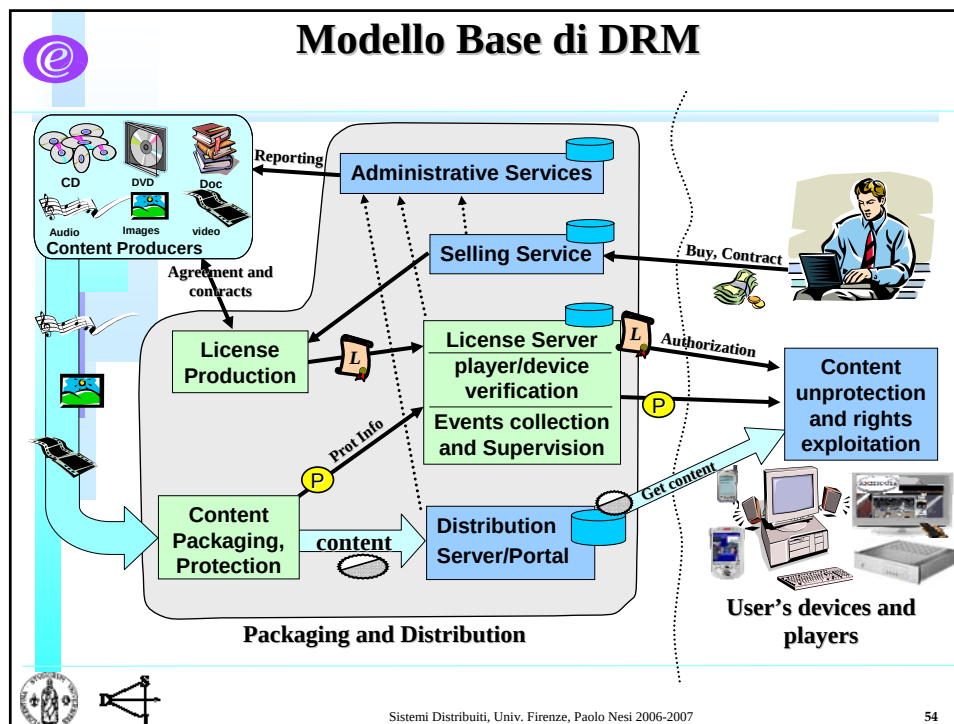


Open Model vs Augmented License

- 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

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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 eat
 - ♣ 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.**

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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.




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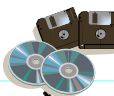


Convergence, the Interoperable Content









Internet Distributor

Internet Distributor

Mobile Distributor

Broadcasters, DVB-H

Media Distributor

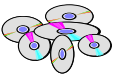
Broadcasters, DVB-T

Broadcasters, DVB-S

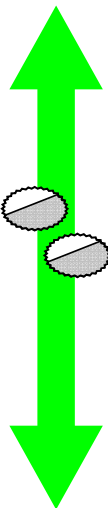
Kiosks distribution












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Present Needs for Accessing New Markets

- 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

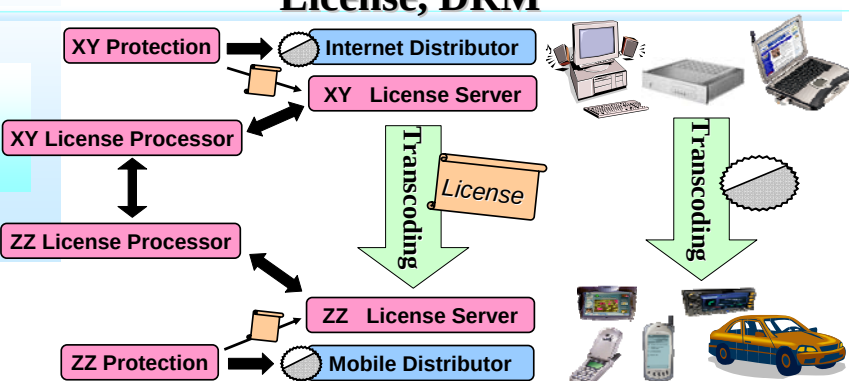



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Es: Convergence, the Interoperable License, DRM



- 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




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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.




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Content Distributors web sites

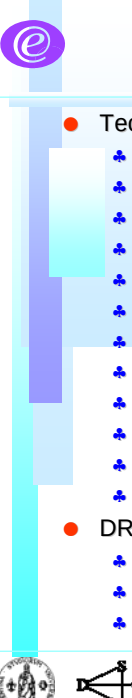


- **Apple i-Tune**
 - ♣ Audio, video distribution
 - ♣ Proprietary DRM
- **TISCALI, 12 portali**
 - ♣ Audio tracks of OD2 and videos (MIKADO)
 - ♣ Windows Media DRM
- **SKY (OpenSky), EUTELSAT**
 - ♣ Video, MPEG4, Smart CARD
- **DTT: MHP (MPEG-2 + Java)**
 - ♣ Mediaset, La-7, RAI,
 - ♣ Smart Card: IRDETO, NAGRAVISION
- **BuyMusic.com**
 - ♣ SDMI, Windows Media DRM
- **Real Networks**
- **ROXIO, Napster**
 - ♣ Windows Media DRM
- **Warner Music UK is using the Share!**
 - ♣ Windows Media DRM
- **Musicmatch.com**
 - ♣ 360.000 tracks, Windows Media DRM




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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
 - ♣ AXMEDIS
 - ♣ WEDELMUSIC
- DRM
 - ♣ ODRL, OMA, Open Mobile Association
 - ♣ XrML, Content Guard, related to MPEG-21
 - ♣ MPEG-21



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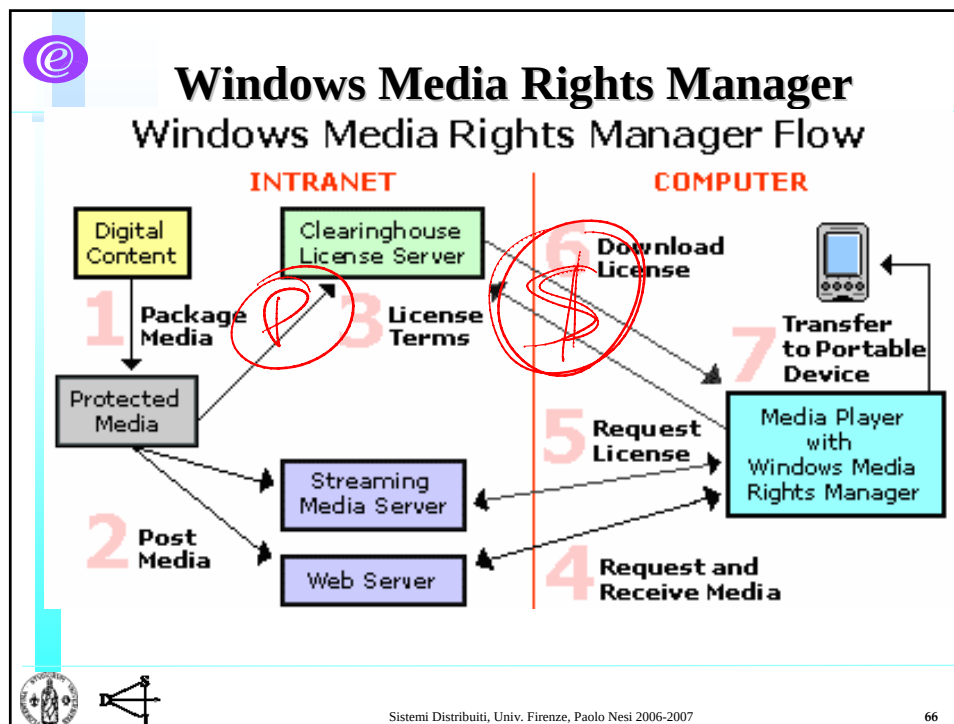


Windows Media

- Composto da:
 - ♣ Player (client)
 - ♣ Encoder/packager (content production)
 - ➔ Uso di codecs vari, MPEG, etc.
 - ♣ Server (distribution Server)
 - ♣ DRM model
 - ♣ Streaming and Download
- Realizzazione di soluzioni varie da 2-tier a n-tier



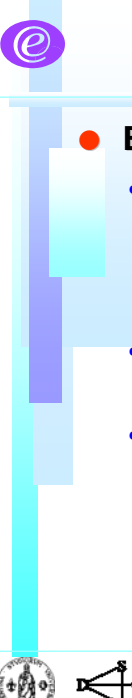
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Windows Media Rights Manager

- **Packaging**
 - ♣ Windows Media Rights Manager packages the digital media file.
 - ♣ The packaged media file has been encrypted and locked with a "key." This key is stored in an encrypted license, which is distributed separately.
 - ♣ Other information is added to the media file, such as the URL where the license can be acquired.
 - ♣ This packaged digital media file is saved in Windows Media Audio format (with a .wma file name extension) or Windows Media Video format (with a .wmv file name extension).

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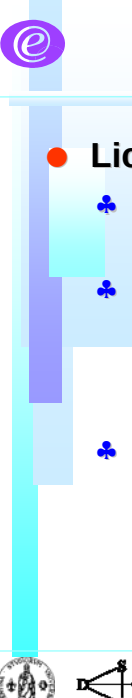
Windows Media Rights Manager

- **Establishing a License Server**
 - ♣ The content provider chooses a license clearing house that stores the specific rights or rules of the license and implements the Windows Media Rights Manager license services.
 - ♣ The role of the clearing house is to authenticate the consumer's request for a license.
 - ♣ Digital media files and licenses are distributed and stored separately, making it easier to manage the entire system.



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Windows Media Rights Manager

- **License Acquisition**
 - ♣ To play a packaged digital media file, the consumer must first acquire a license key to unlock the file.
 - ♣ The process of acquiring a license begins automatically when the consumer attempts to acquire the protected content, acquires a predelivered license, or plays the file for the first time.
 - ♣ Windows Media Rights Manager either sends the consumer to a registration page where information is requested or payment is required, or "silently" retrieves a license from a clearing house.



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Windows Media Rights Manager



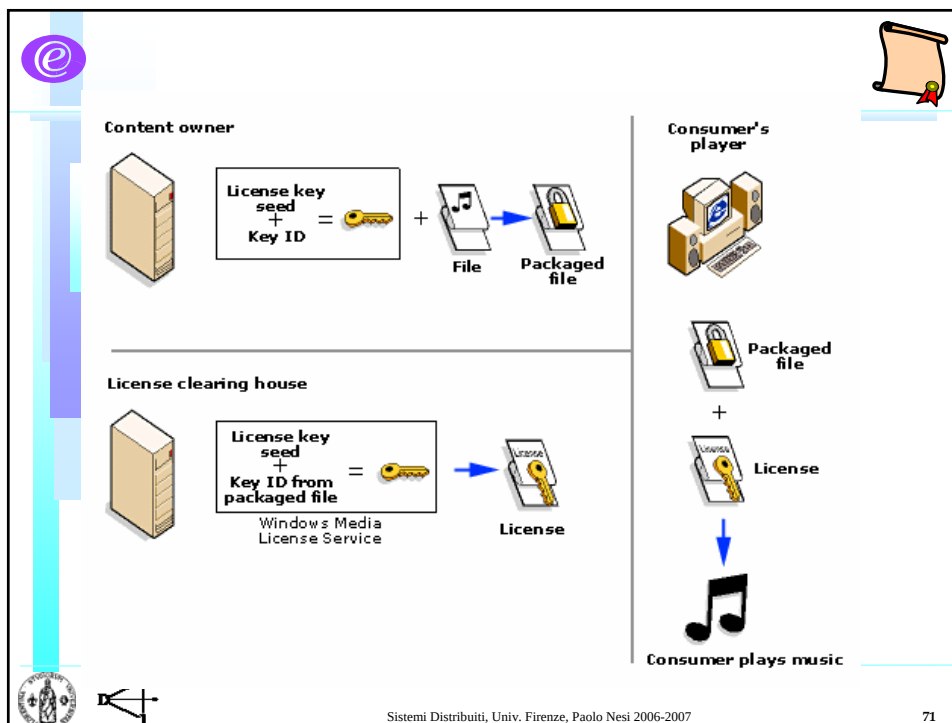
● **Playing the Media File**

- ♣ To play the digital media file, the consumer needs a media player that supports Windows Media Rights Manager.
- ♣ The consumer can then play the digital media file according to the rules or rights that are included in the license.
- ♣ Licenses can have different rights, such as start times and dates, duration, and counted operations. For instance, default rights may allow the consumer to play the digital media file on a specific computer and copy the file to a portable device.
- ♣ Licenses, however, are not transferable. If a consumer sends a packaged digital media file to a friend, this friend must acquire his or her own license to play the file.
- ♣ This PC-by-PC licensing scheme ensures that the packaged digital media file can only be played by the computer that has been granted the license key for that file.




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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.




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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
--	--




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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.



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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





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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



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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*



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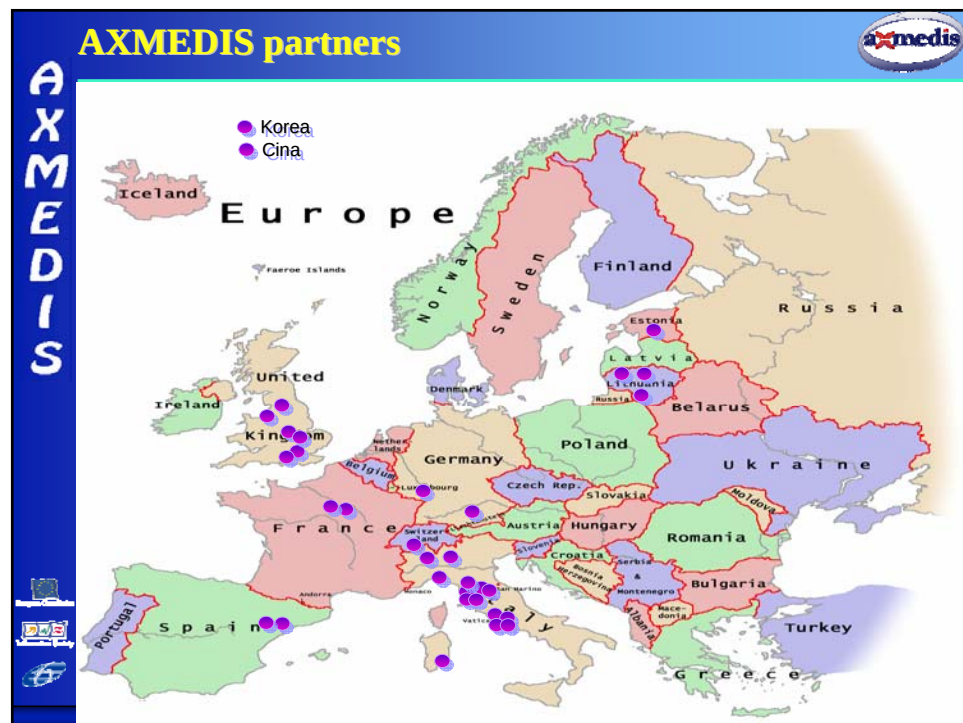
Automating Production of Cross Media Content
for Multi-channel Distribution

www.axmedis.org IST-2-511299

Automating Production of Cross Media Content for Multichannel Distribution

www.AXMEDIS.org

www.AXMEDIS.org, 2007 79



AXMEDIS



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





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AXMEDIS



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

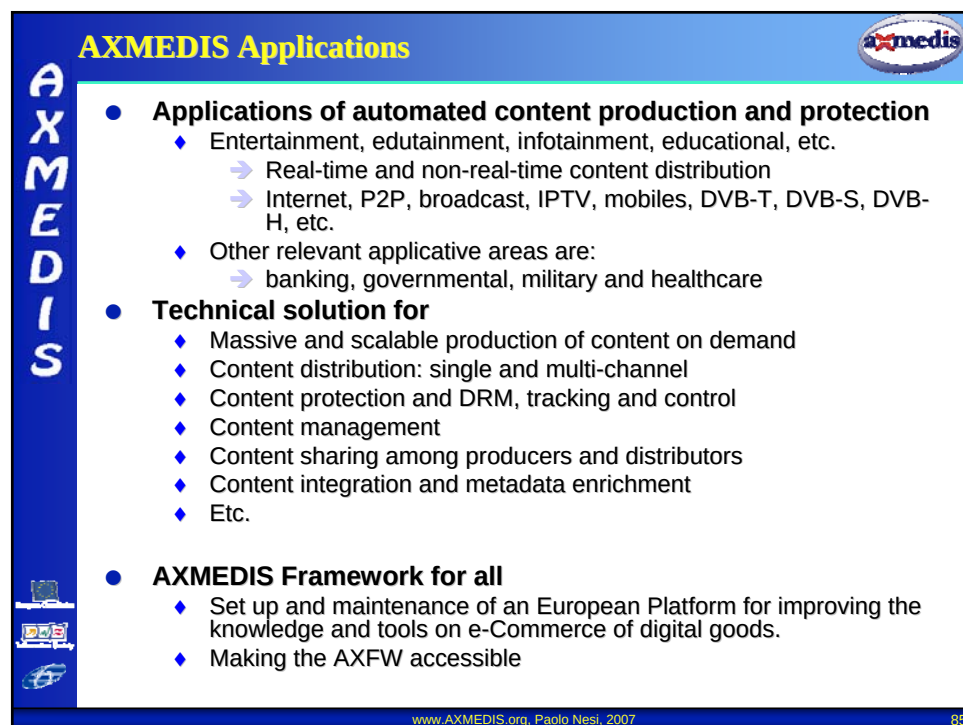
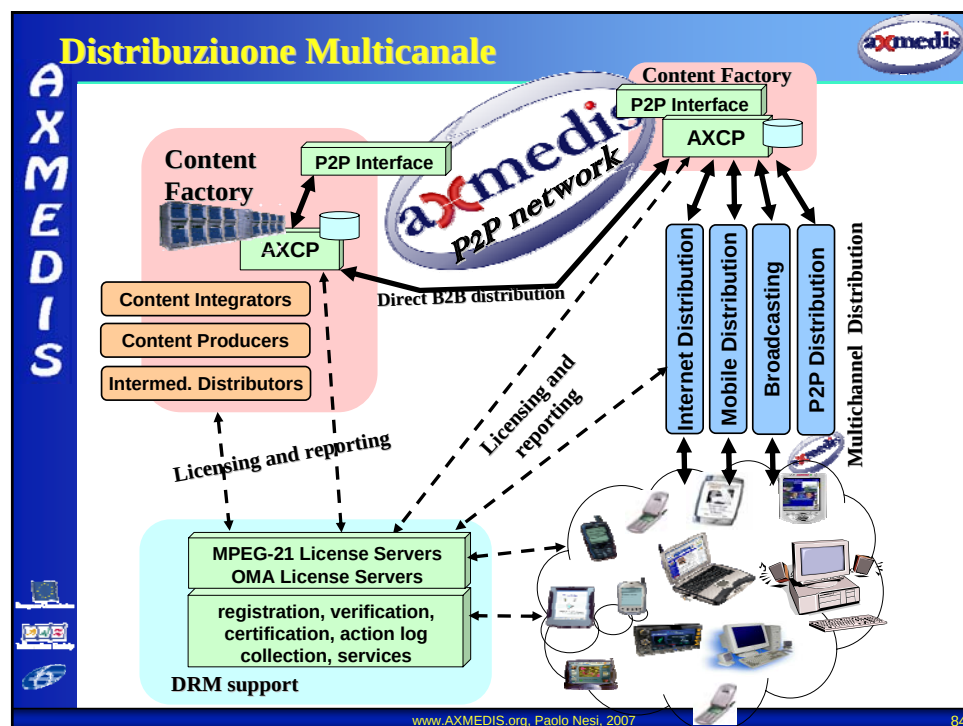
Create a unified European platform for content packaging, protection and distribution in terms of DRM and interoperability (convergence)

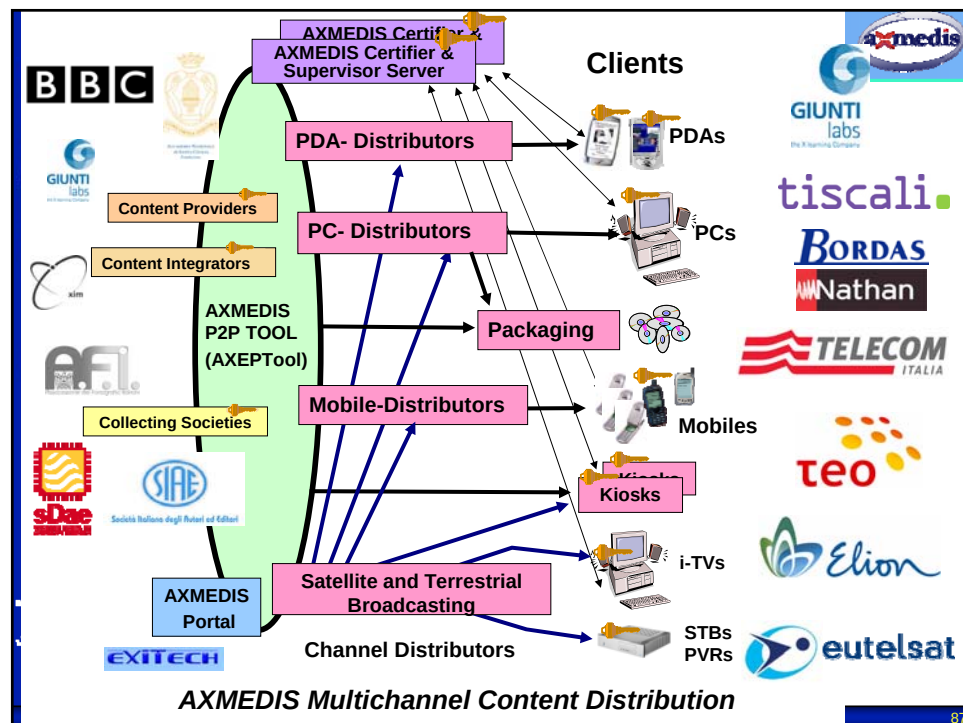
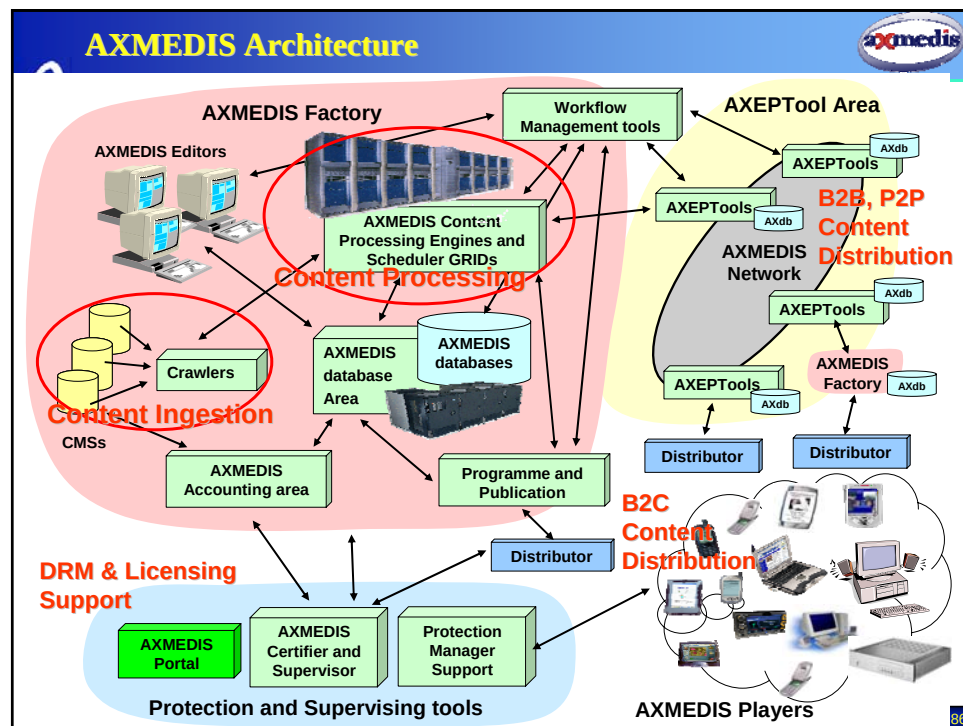


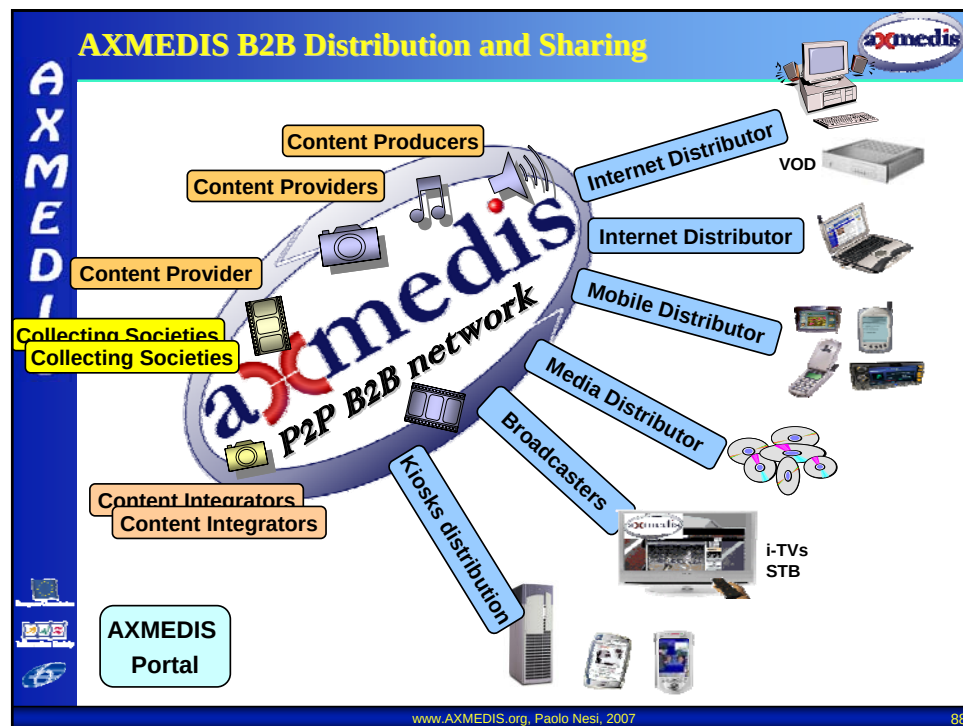


www.AXMEDIS.org, Paolo Nesi, 2007

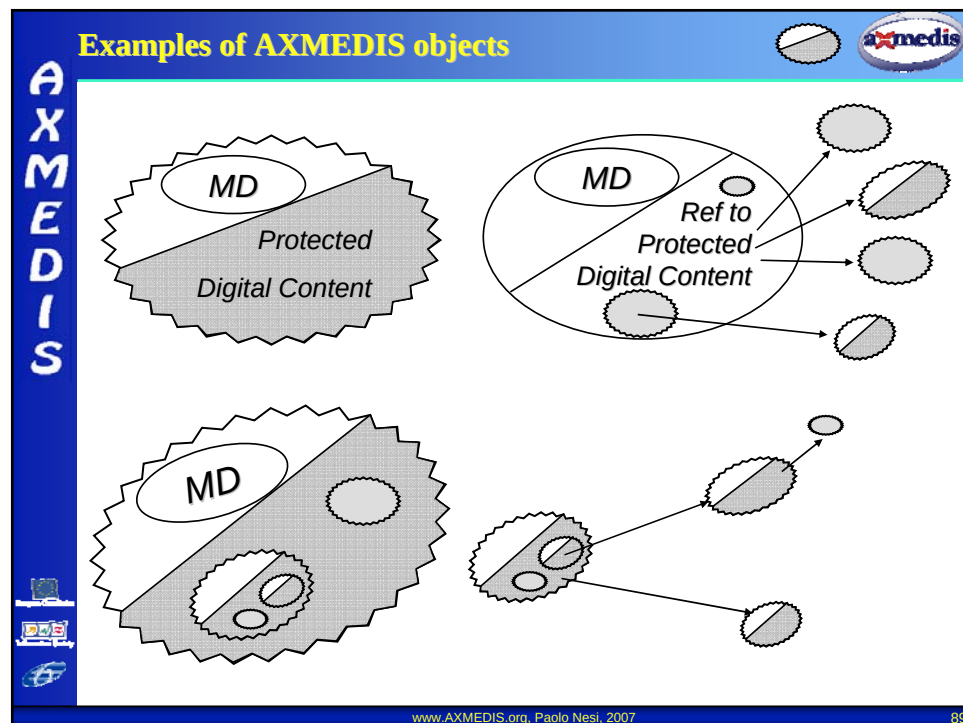
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AXMEDIS

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



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AXMEDIS

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



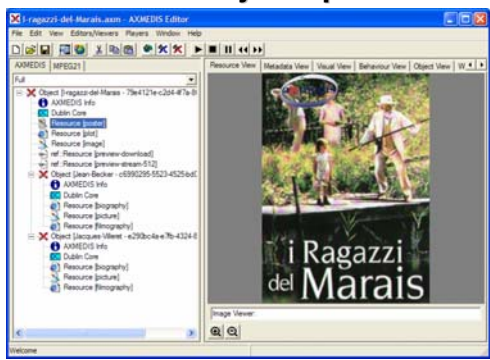
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AXMEDIS Editor

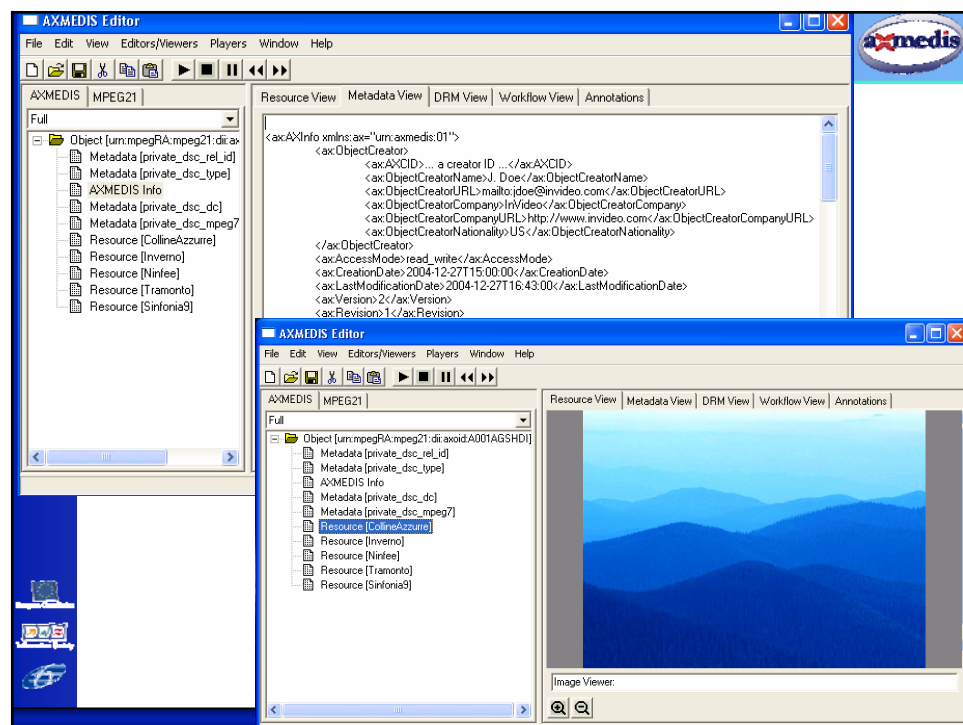
AXMEDIS

- **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
 - ◆ Workflow
 - ◆ Annotation
 - ◆ ...



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The top screenshot shows the 'Resource View' tab with a tree of metadata and resources for an MPEG21 object. The bottom screenshot shows the 'Metadata View' tab displaying XML metadata for the same object, including creator information, access mode, and creation date.

AXMEDIS Client Tools

AXMEDIS

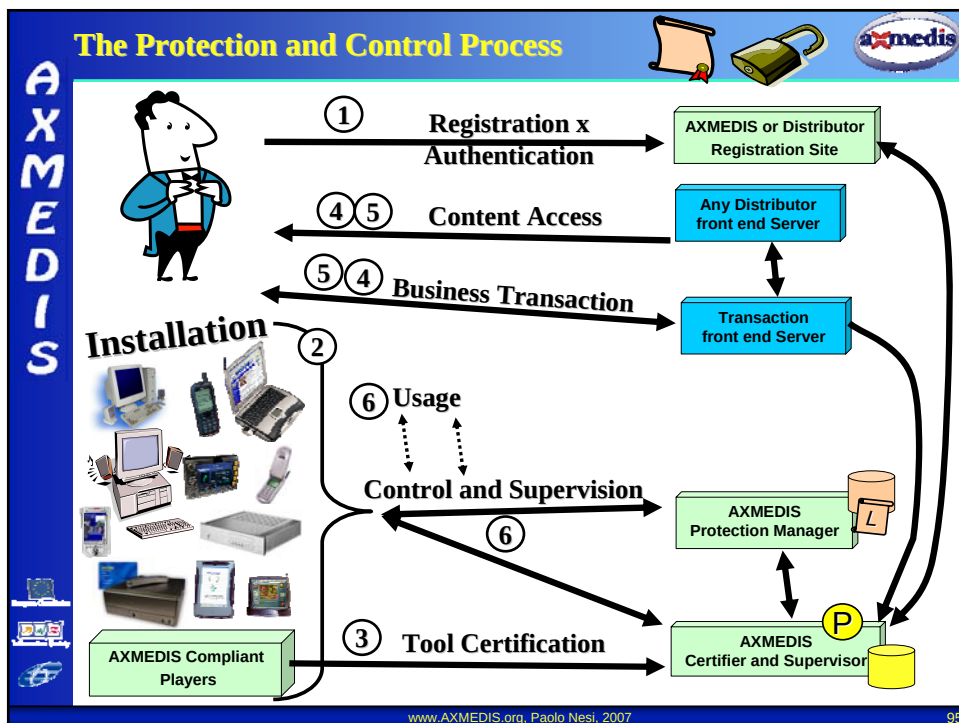
- **AXMEDIS clients tools**
 - ◆ Based on AXOM module plus a set of players
 - ➔ Audio player
 - ➔ Video player
 - ➔ Document viewer
 - ➔ Image viewer
 - ➔ Etc.
 - ◆ Different devices:
 - ➔ PC player, PDA player, etc.
 - ◆ AXMEDIS Plug ins:
 - ➔ Active X for integration with IE, Authorware, Tool Book,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





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AXMEDIS



Capabilities

- Content Ingestion and Gathering
- Content Retrieval
- Content Storage
- Content Processing
- Content Composition
- Content Formatting
- Content Protection
- Content Licensing
- Content Publication and Distribution



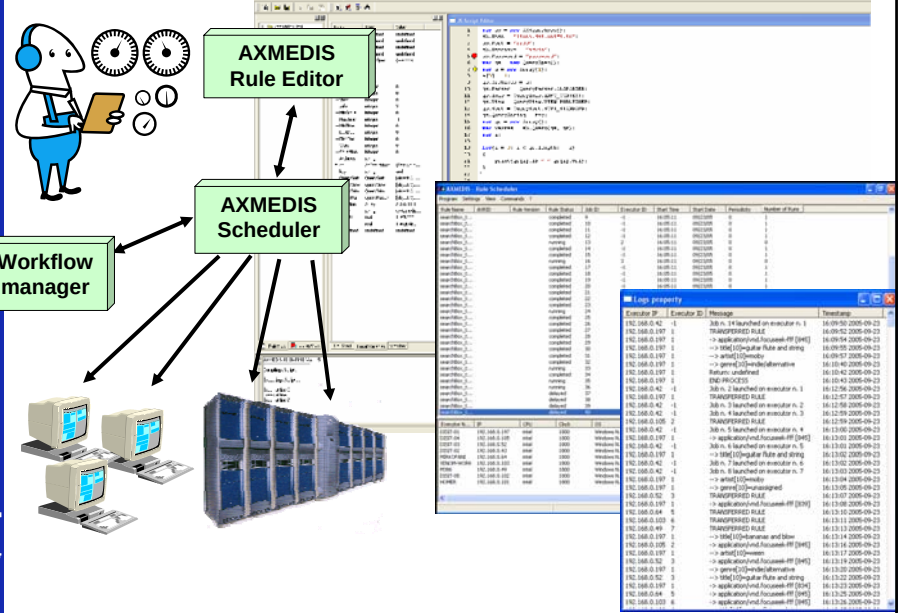

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AXMEDIS



AXMEDIS Content Processing GRID






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AXMEDIS



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



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AXMEDIS



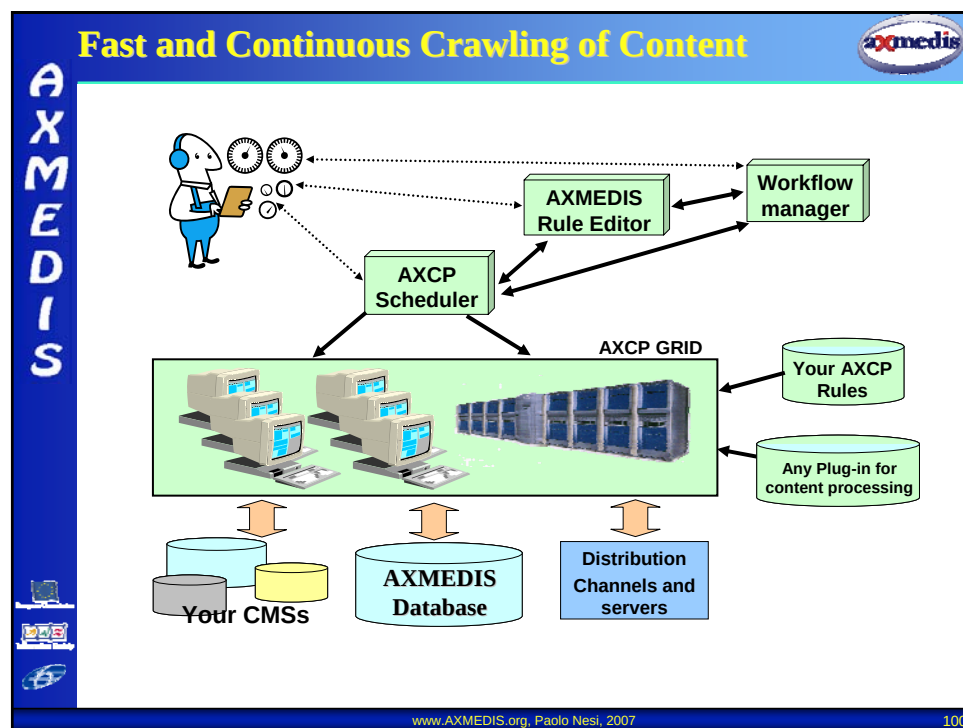
AXCP processing capabilities

- **Any type of resource in any format**
 - ◆ Also MPEG-21, IMS, SCORM, OMA/ODRL, 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
- **Accessing: ODBC, WEBDAV, HTTP, FTP, FileSystem, etc.**
- **Open to any other module with plug-in technology:**
 - ◆ Burning
 - ◆ Etc.

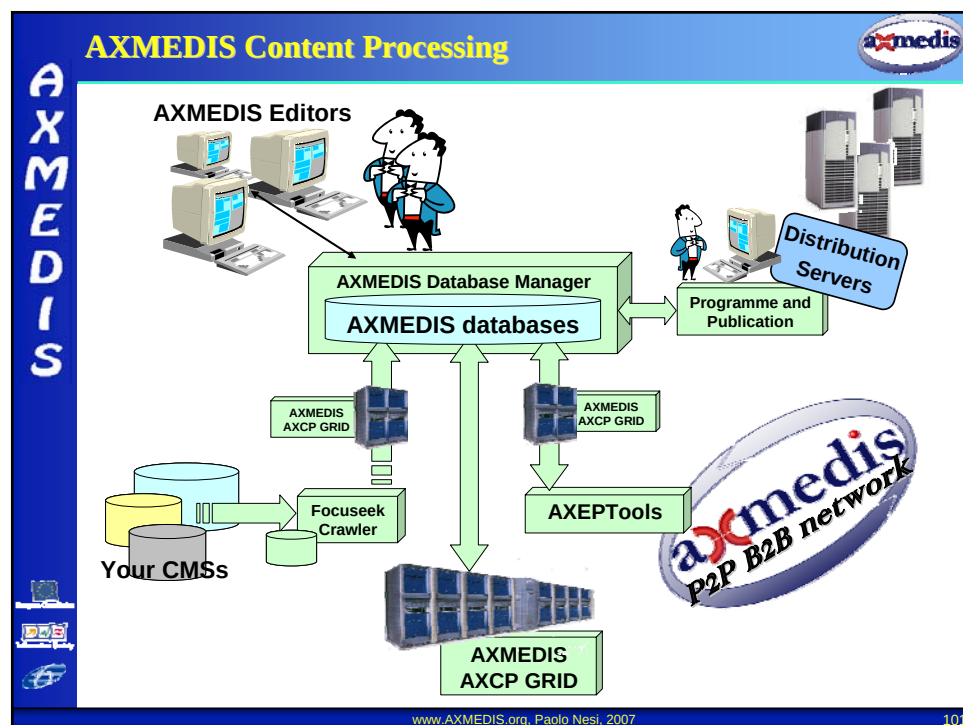


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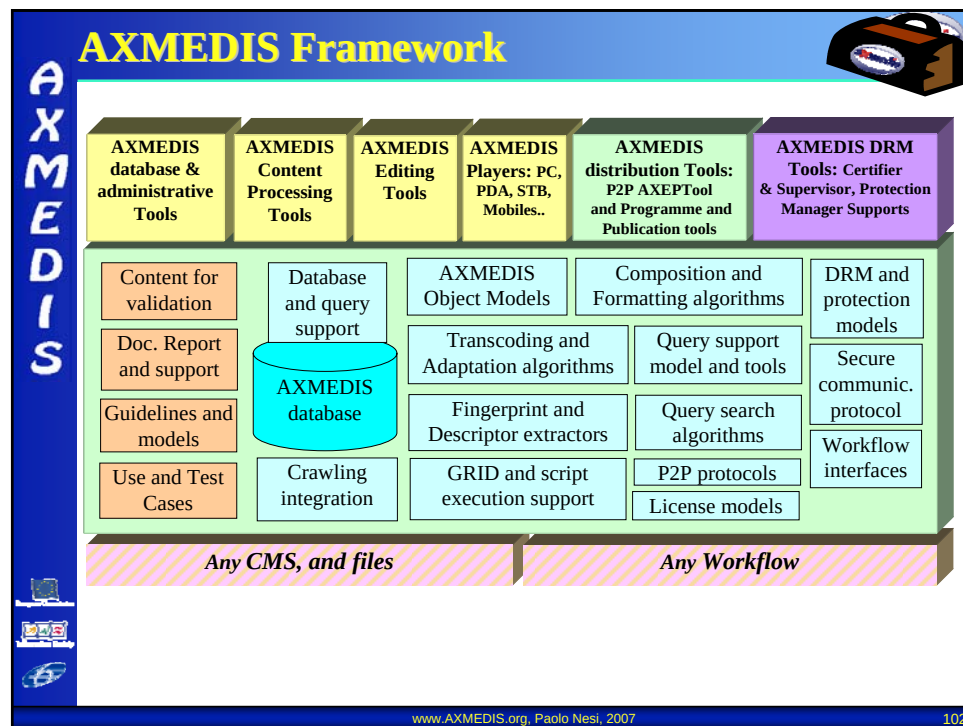
99



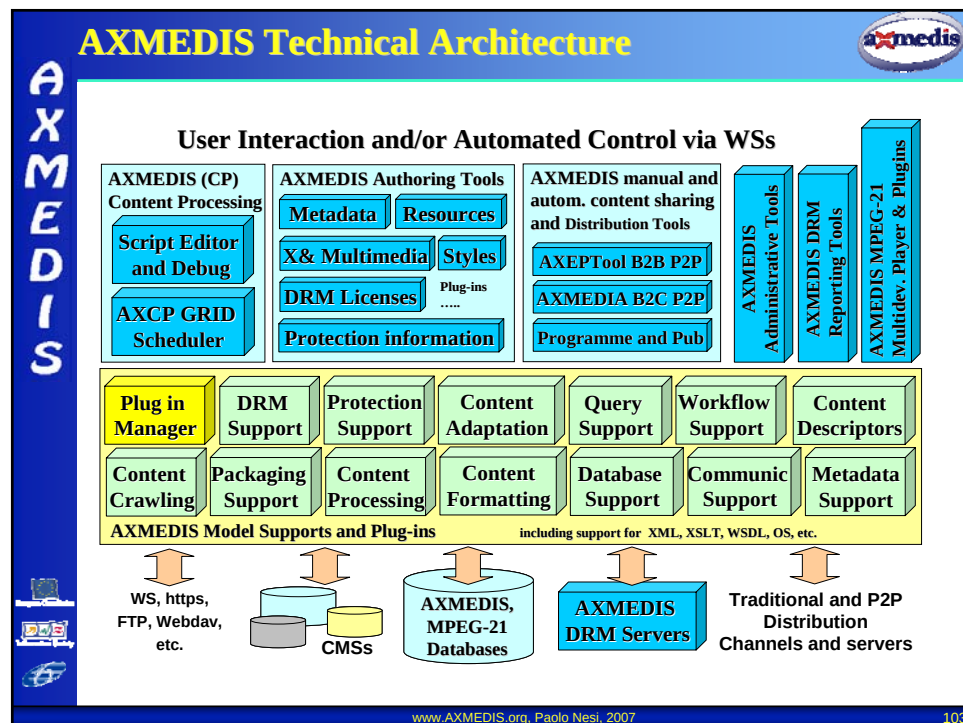
100



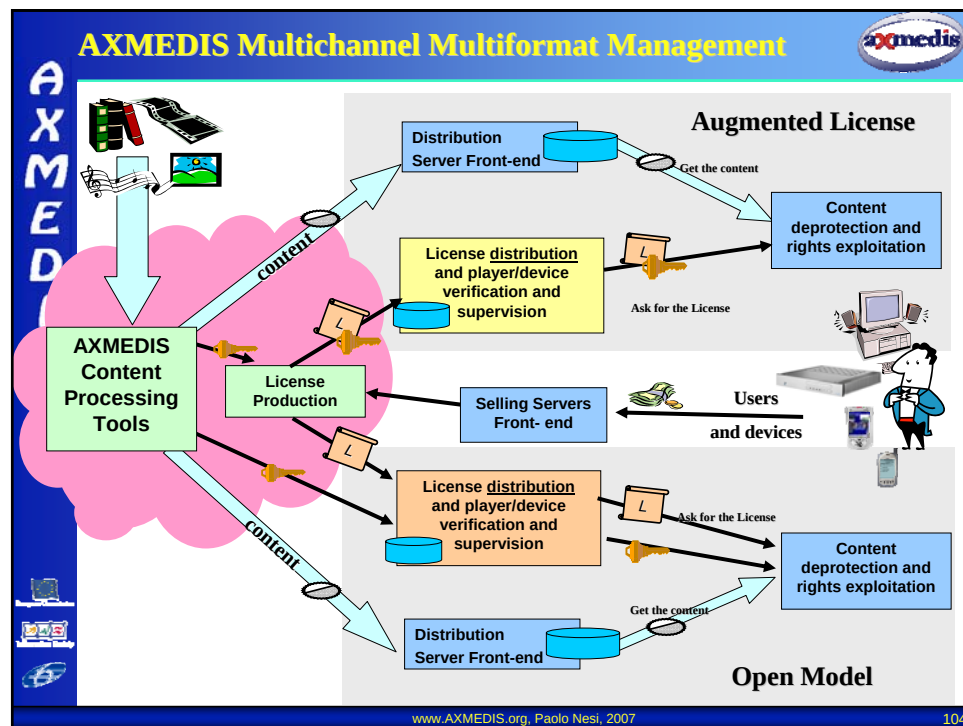
101



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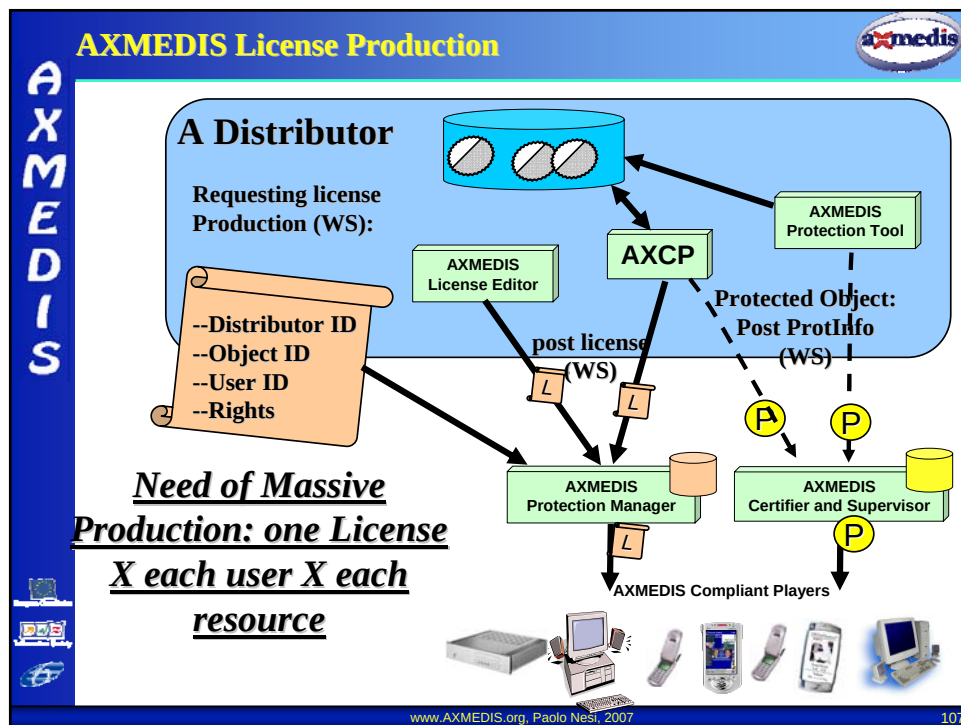
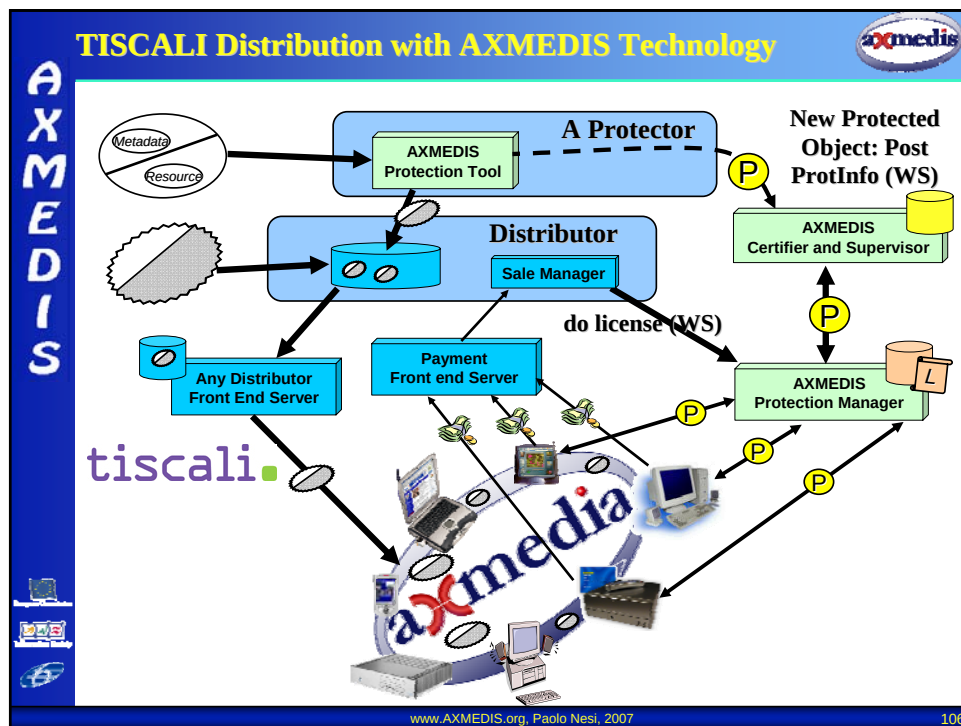


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AXMEDIS	Windows Media	vs	AXMEDIS
	• Limited number of BMs • ProtMod limited to Key • Content and license • Signed Content Header • Single channel • Proprietary License ♦ Limited dictionary ♦ Limited number of rights • Authentication of Player (device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

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AXMEDIS

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

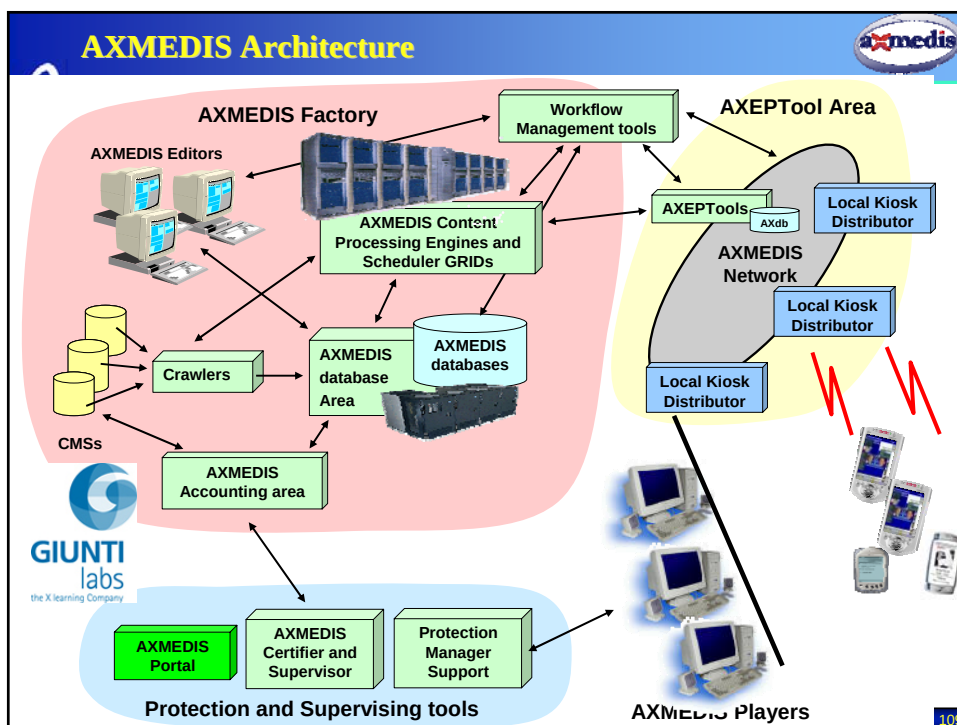






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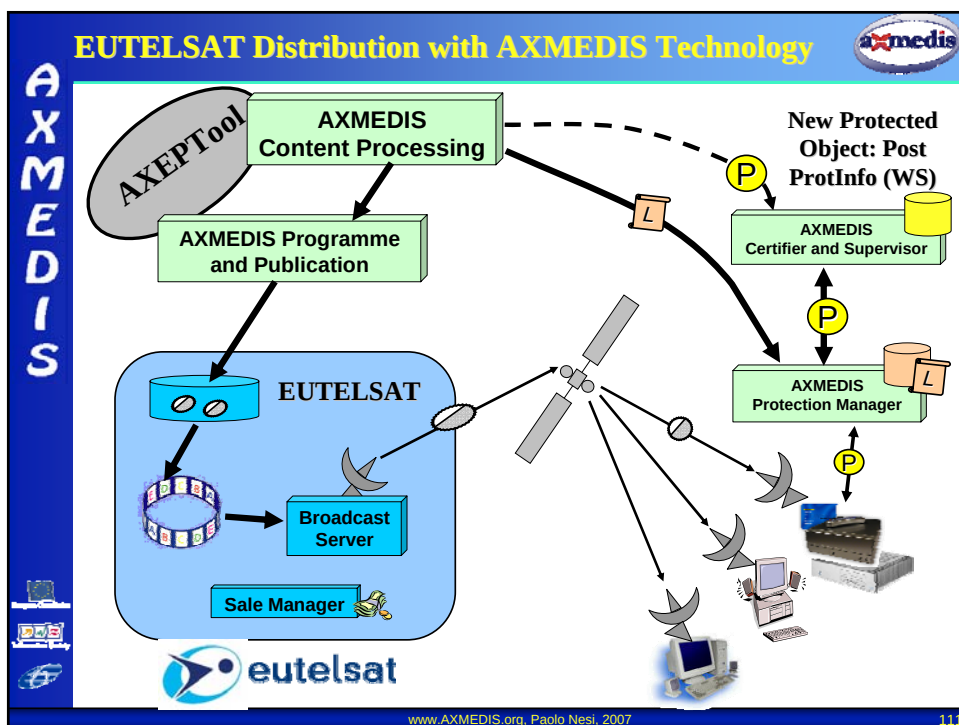
AXMEDIS

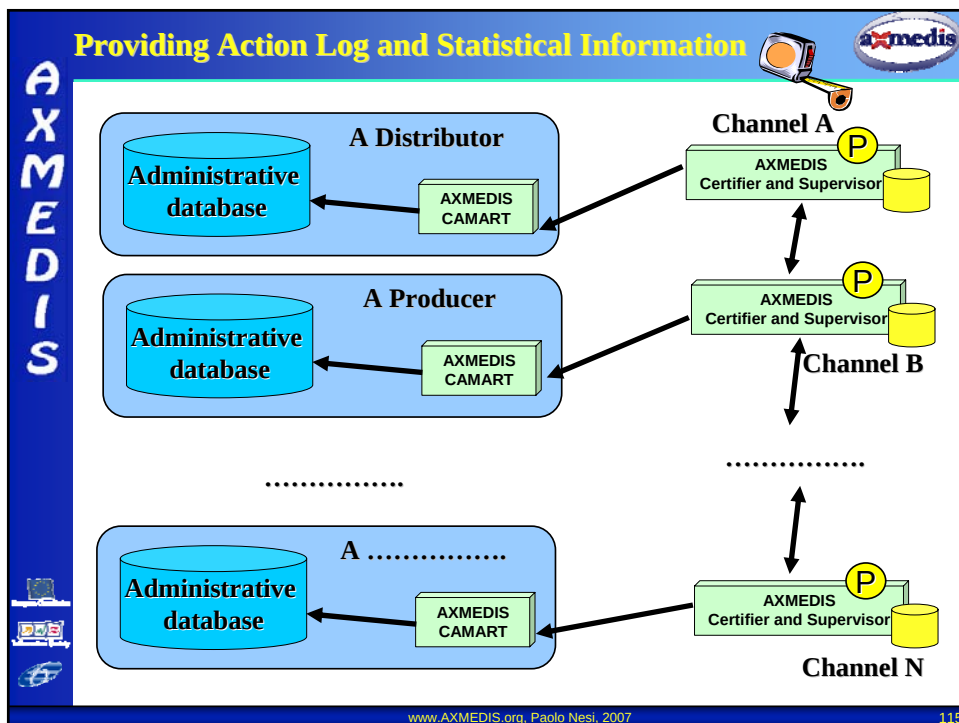
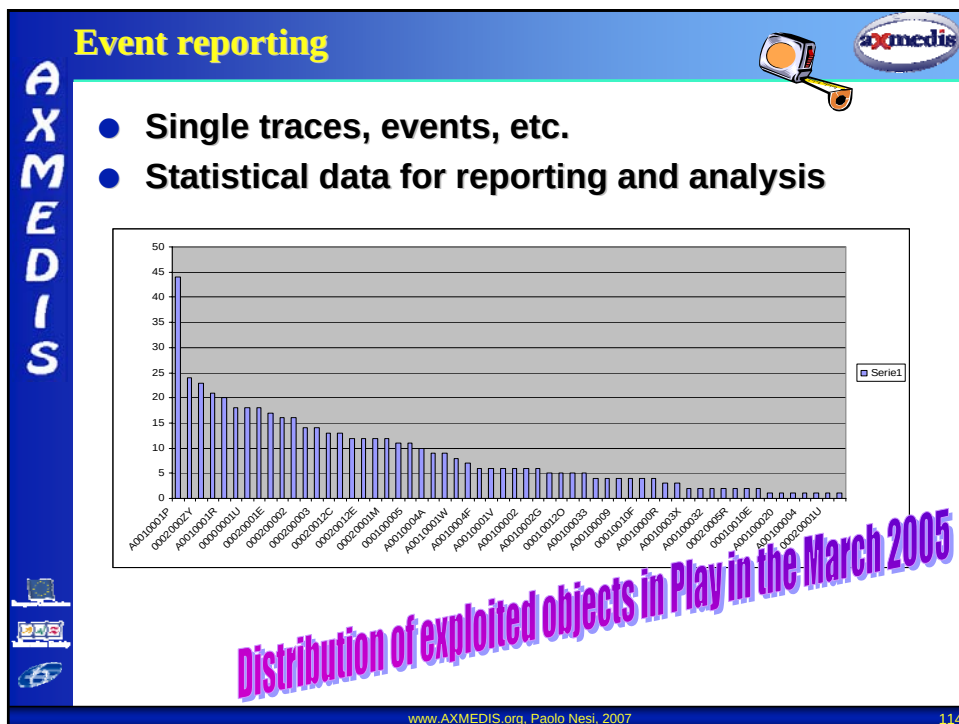
EUTELSAT Distribution with AXMEDIS technology

- **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

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Black Lists Management

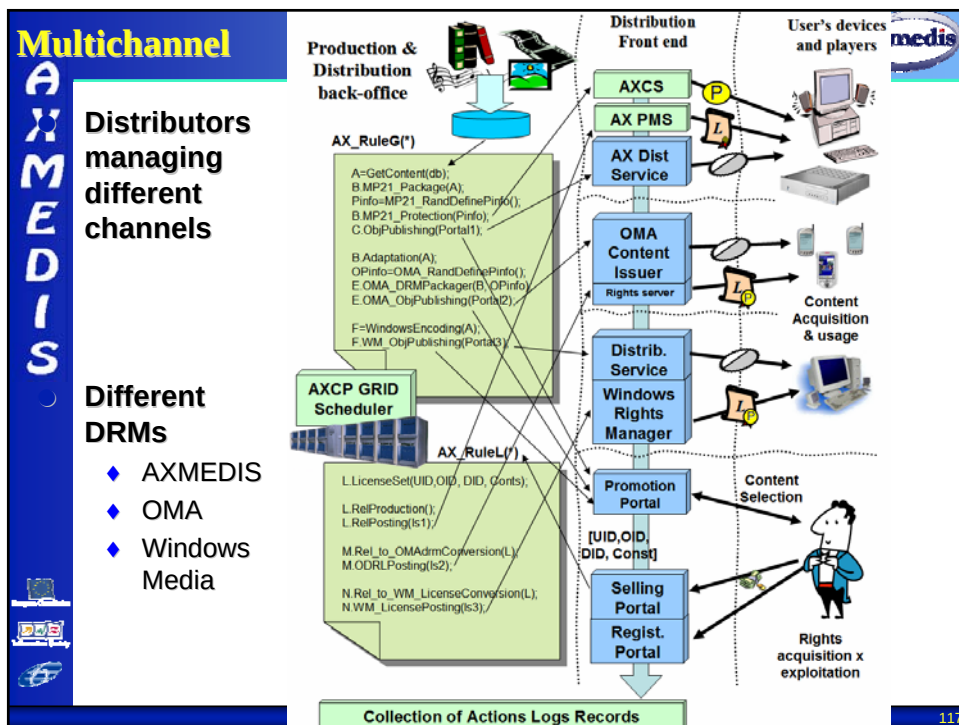
AXMEDIS

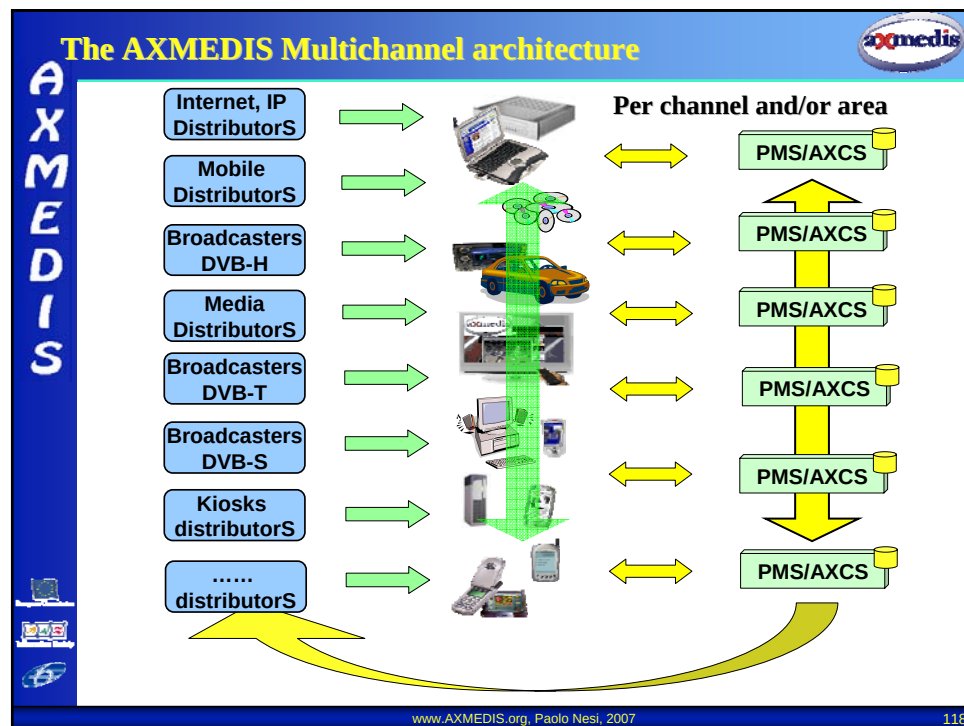


- **AXMEDIS Certifier and Supervisor may manage black lists of:**
 - ◆ Users
 - ◆ Licenses
 - ◆ Objects
 - ◆ Devices
 - ◆ Distributors
 - ◆ Etc.
- **The distinction from Users and Devices is strongly needed to preserve the distinction from the several channels**
- **This allows to define precise and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

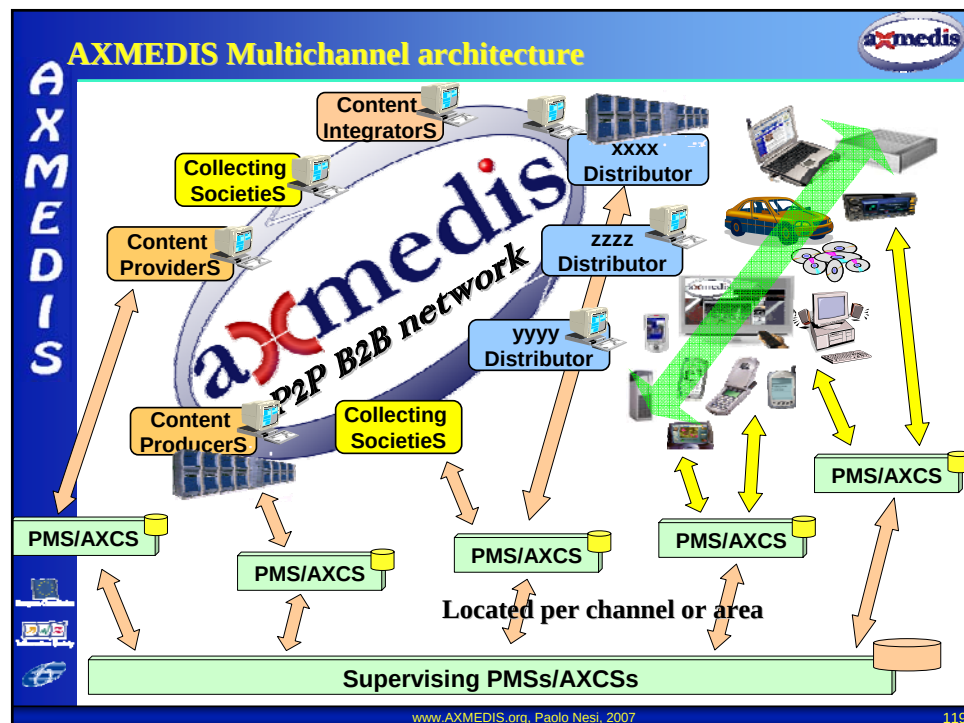
www.AXMEDIS.org, Paolo Nesi, 2007

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AXMEDIS

Summary of AXMEDIS Challenges

AXMEDIS

- **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

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AXMEDIS

As the AXMEDIS Framework can be exploited

AXMEDIS

AXMEDIS
Based solution

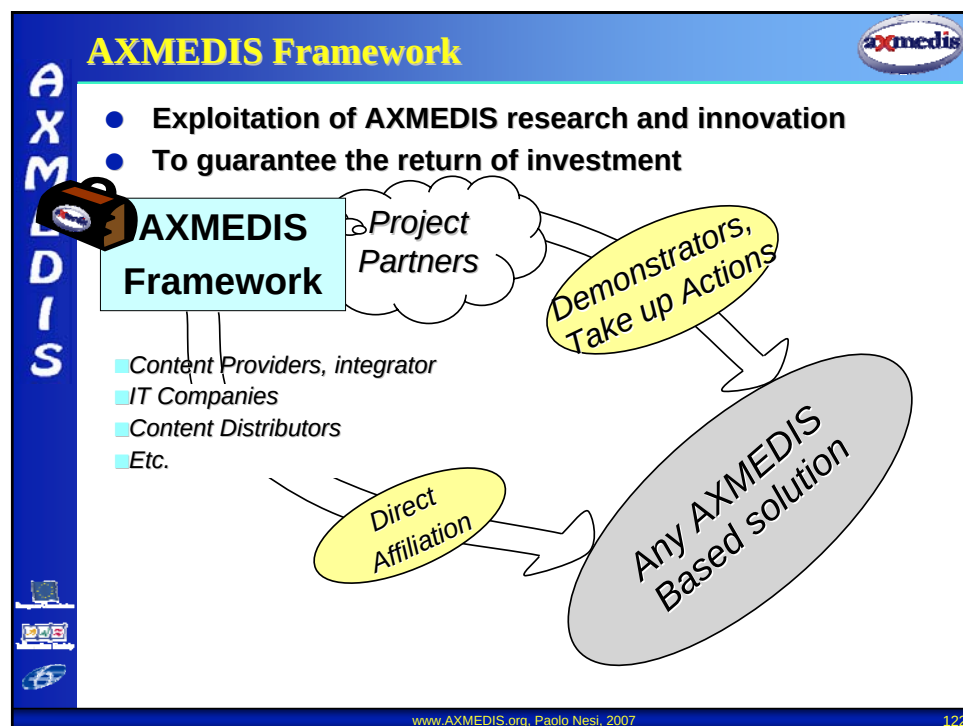
AXMEDIS

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

AXMEDIS

www.AXMEDIS.org, Paolo Nesi, 2007

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References

- AXMEDIS: www.axmedis.org
- 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>

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Organisations

Organisation	URL
AES	www.aes.org
SDMI	www.sdmi.org
MPEG (Motion Picture Expert Group)	www.mpeg.org
OMA (Open Mobile Alliance)	www.openmobilealliance.org
OASIS (Organisation for advancement in Structured Information Standards)	www.oasis-open.org
CRF (Content Reference Forum)	www.crforum.org
OeB (Open eBook Forum)	www.openebook.org
SMPTTE (Society of Motion Picture and Television Engineers)	www.smpte.org
WS-I (Web Services Interoperability Organisation)	www.ws-i.org
ISMA (Internet Streaming Media Alliance)	www.isma.tv
TV-Anytime Forum	www.tv-anytime.org
RIAA (Recording Industry Association of America)	www.riaa.com
WIPO (World Intellectual Property Organization)	www.wipo.int
CC (Creative Commons)	http://creativecommons.org/



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Major Technology Providers

Technology Provider	URL
Adobe	www.adobe.com
Apple	www.apple.com
AXMEDIS	WWW.axmedis.org
Beep Science	www.beepscience.com
ContentGuard	www.contentguard.com
Digital World Services (Bertelsmann)	www.dwsco.com
DMDsecure	www.dmdsecure.com
IBM	www.ibm.com
Intertrust	www.intertrust.com
LiquidAudio	www.liquidaudio.com
Lockstream	www.lockstream.com
Macrovision	www.macrovision.com
Microsoft	www.microsoft.com
NDS	www.nds.com
Panasonic Europe	www.panasonic-europe.com
Philips	www.philips.com
RealNetworks	www.realnetworks.com
Roxio	www.roxio.com
WEDELMUSIC	www.wedelmusic.org
Yacast	www.yacast.com



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Some DISIT Projects

- **Multimedia Content Modeling and distribution:**
 - ♣ MOODS, cooperative work on Music notation
 - ♣ WEDELMUSIC platform (chair), IST Fp5
 - WEDELMUSIC conference series
 - WEDELAUTHORING (chairs)
 - ♣ MUSICNETWORK Environment (chair), IST Fp5
 - Workshops, emerging European associations
 - ♣ IMUTUS, music tuition, distance learning, IST Fp5
 - ♣ MPEG-SMR integration (co-chair)
 - ♣ MPEG M3W, Multimedia Middleware
 - ♣ AXMEDIS, Automating cont. prod. and protection
 - ♣ IMAESTRO, music education, cooperative, gesture, etc.
 - ♣ Other minor projects: archives, mobile distribution, etc.












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