Automating Production of Cross Media Content for Multi-channel Distribution
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DE12.1.2.1
AXMEDIS-4HOME Identification of Technological components Required for Apparatus and Ontology Analysis

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Abstract: this part includes the Use cases and general requirements analysis of components, formats, databases and protocol related to the AXMEDIS-4HOME demonstrator Framework area WP12.1 including the requirement on the AXMEDIS tools selected and the descriptions of Use Case and requirements for the IP Entity ontology.
Keyword List: 4HOME, Domains, Distribution, Ontology, Licences, Tool Download, OMA, Mobile

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Table of Content

1 Executive Summary and Report Scope (BBC, All)

This document is the first deliverable of the AXMEDIS 4HOME take up action, WP12.1. It captures the Use Cases to be demonstrated and resulting requirements on and identification of the AXMEDIS components needed to show the Use Cases in action. It is intended to form the input to the second deliverable 12.1.3 that will specify the architectural arrangement of the demonstrator showing the position and configuration of all the technologies to be used and giving a technical description of the demonstration
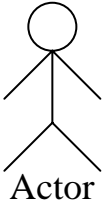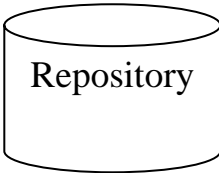
This document also captures the Use Case and Requirements of the Ontology work to be undertaken by the 4HOME consortium and gives the Use Cases of such and Ontology in a way that can be demonstrated as part of the AXMEDIS-4HOME deliverable
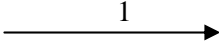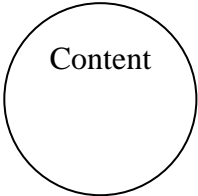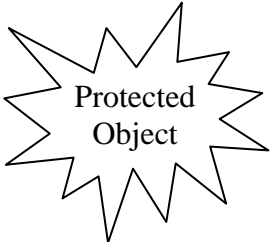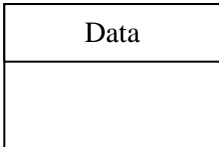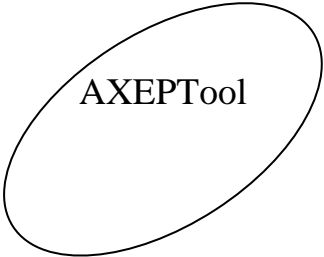
2 Structure of Use Case

2.1 Structure of Use Cases

UCId	Unique identifier of the use case
Use case	Name of the use case
Description	Plain description of the use case activation, execution and termination
Actors	People, tools or entities involved in the use case, e.g. who (or what) activates the use case
Assumptions	Conditions which must be satisfied before use case activation
Steps	Step by step description of the use case activation, execution and termination
Post-conditions	Conditions which must be satisfied after use case termination
Variations	Use case variations which could be relevant by the end-user point of view and that are similar to the main use case for developers
Asynchronous actions	Important actors' actions which change standard use case step flow, e.g. during a background search an actor could stop it by clicking on the stop button. For each asynchronous actions, relevant post-conditions should be reported
Design suggestions	Useful hints or implications about the thought project structure regarding the use case
Issues	Possible issues, notes or annotations related to the use case implementation

2.2 Use Case and Scenario diagram: shapes and semantics

Shape	Name	Semantic
Actor	Actor	The shape represents one of the Actor declared in the related use case or scenario
Tool	Tool	The shape represents the tool whose name (defined in the specifications document) is contained within the shape, e.g. an engine or the AXMEDIS Editor, etc…
Support	Support/library	The shape represents the support whose name (defined in the specifications document) is contained within the shape, e.g. AXDBM, etc…
Repository	Repository	The shape represents a data repository whose name (defined in the specifications document) is contained within the shape, e.g. the local AXDB or the "Repository of Publication Rules/Selections" in "Programme and Publication Area"

1 ——→	Interaction	The shape represents an interaction between two modules, e.g. a call to an available function in another module, a data flow between tools, etc… The number above the arrow should correspond to a step of the related use case or scenario. If one step implies more than one interaction among actors, tools and supports than the label could be the number of the step plus a letter, e.g. 1a, 1b, etc… Notice that interaction arrow can not be bidirectional, i.e. if an interaction between two modules implies a double exchange of data you will draw two one-way interactions. In use cases and scenarios description, you should explain what kind of interaction a step implies, i.e. a data or content transmission, function call, use, etc…
Content	Unprotected AXMEDIS Object or Content	The shape represents a raw content (mp3, wav, etc…) or an unprotected AXMEDIS object. The shape could contains the "name" of content with respect to the related use case
Protected Object	Protected AXMEDIS Object or content	The shape represents a protected AXMEDIS object. The shape could contains the "name" of content with respect to the related use case
Data	Data	The shape represents data, other than content and protected/unprotected AXMEDIS object, used in the use case, e.g. selection, rule, etc…
AXEPTool	AXEPTool Distributed Database	The shape represents the AXEPTool in its meaning of distributed database as it is used in all other documents of AXMEDIS

3 General Use Cases and Scenarios(All)

The AXMEDIS 4HOME Workpackage aims to demonstrate the distribution of AXMEDIS content from a standard AXMEDIS content factory arrangement to the home domain environment over peer to peer and broadcast transport, and also to the mobile platform through an OMA gateway. The following Use Cases are designed to describe such an arrangement and show how such an arrangement can be used by the appropriate value chain actors.

The AXMEDIS 4HOME Workpackage is also concerned with the wider representation and use of the IP Entities implicit within licensing terms. This section includes Use Cases to explain the utility of representing these entities explicitly in the form of an AXMEDIS Ontology and API as an aid to authoring and validating licenses.

3.1 Use Case: General Broadcast and Internet Distribution Scenario to Home Consumer Environment (BBC/PKU/ETRI)

UCId	4HOME_1
Use case	Distribution to the Home over broadcast and internet.
Description	Service Provider makes content available over broadcast and again over internet distribution after broadcast.
	The AXMEDIS client can form an AXMEDIS object from the Free to Air (FTA) broadcast programme and enhance this. The resultant enhanced object will be bound to the domain.
	All internet distributed objects are entirely protected by AXMEDIS from source.

	The provision of the FTA content enhancements provides opportunity to secure the 'added value' content more fully, or at least provide some other license, since there could be a link to the enhancement and the back office AXCS, and PMS. The free enhancement service is only available to 'trusted clients', eg AXMEDIS. The original broadcast contains, or can be mapped to, a URI reference for access to an instance of the same object made available over P2P as a protected AXMEDIS object. In this way a user can 'share' programmes by producing a promotional object (clear text). Any user that receives a promo object can request the full object through the P2P download service, if available. Local FTA broadcast content will use AXMEDIS protection to avoid unauthorised redistribution.
Actors	Service Provider: making content available from AXMEDIS factory. Home User: Acquiring content from broadcast or internet, can be based on intelligent appliance or user selection driven by programme metadata. Home user client: Receiving AXMEDIS objects over IP or forming them from the Free to Air Broadcast, augmenting these broadcast objects and binding them to the user domain.
Assumptions	Users have established an AXMEDIS player on home media system that can be fed from broadcast transport, internet connection or local store.

Steps	Step by step description of the use case activation, execution and termination
	1. Service provider prepares content for distribution as well as for superdistribution if that feature is desired:
	    a. Authors metadata for EPG/library interface
	    b. Assigns appropriate license terms for IP distribution
	    c. Authors License in AXMEDIS representation for IP
	    d. Authors Signalling in Broadcast format for broadcasting. In the event of superdistribution the inclusion of URI of the superdistributed instance may be required.
	    e. Broadcasts content in schedule over MPEG2.
	    f. Allows complementary offer to be downloaded over IP as protected AXMEDIS object.
	2. Home User Selects content from either an EPG or Web Page
	3. Home Client acquires selected content and, if from Free to Air braodcast formulates an AXMEDIS object that includes an enriched presentation applying domain protection or adopting alternative licence from the enhancements delivered over P2P
	4. Home User browses home library through the AXMEDIS interface using programme metadata associated with AXMEDIS object and presses to play any content, independent of delivery.
	5. Home user is presented with a compelling FTA experience with opening titles, targeted promotions and supplementary information presented through the AXMEDIS player. It may incorporate up to date links.
	6. Home User who wishes to share the content can send off the URI link, maybe as an AXMEDIS object to a friend who then accesses the equivalent object though the P2P protected AXMEDIS Framework.

Post-conditions	Objects in home store are in standard form that can be processed by AXFW tools.
Variations	Internet streaming could also be included here if supported by AXFW.(Out of scope)
Asynchronous actions	Home user can select content from an EPG or schedule any time before broadcast or when available from a web interface.
Design suggestions	The emphasis here is on the consistency of the user experience and the ability of the AXFW to provide the user with these acquisition options from a single

	interface that allows simple intuitive playing, assuming simple rights are granted. Exercising rights modalities is left to further Use Case
Issues	- Use of rights expressions over broadcast: - Emerging Broadcast signals (TVA_RMPI, DVB_FTA) and consistent interpretation with standard REL over IP. Only a small set of FTA rights are required to indicate the Free to Air status.. - There may be a role for the downloadable DRM tool to show AXMEDIS FW accommodating invoking a good experience from the FTA policy - Internet steaming: Out of scope (unless available through AXFW) - Use of programme description metadata: Broadcast programmes are described through TVA-Metadata.

Themes:
a. Delivery over 2 transports
b. Consistent end user experience (although rights may change dependent on delivery)
c. Consistent use of metadata for relationship with broadcast material (TV-Anytime).

The object of this aspect of the 4HOME demonstrator is to show how the AXMEDIS framework can be used to support the aspirations of the broadcast industry as expressed through the recent broadcast centric standardization groups as well as support complementary distribution of content over the internet, and offer a consistent 'look and feel' to the user experience, independent of the mode of delivery.

Note that although some content control mechanisms are required, the content itself may or may not be encrypted during transmission over broadcast transport, though it typically will be over the IP network.
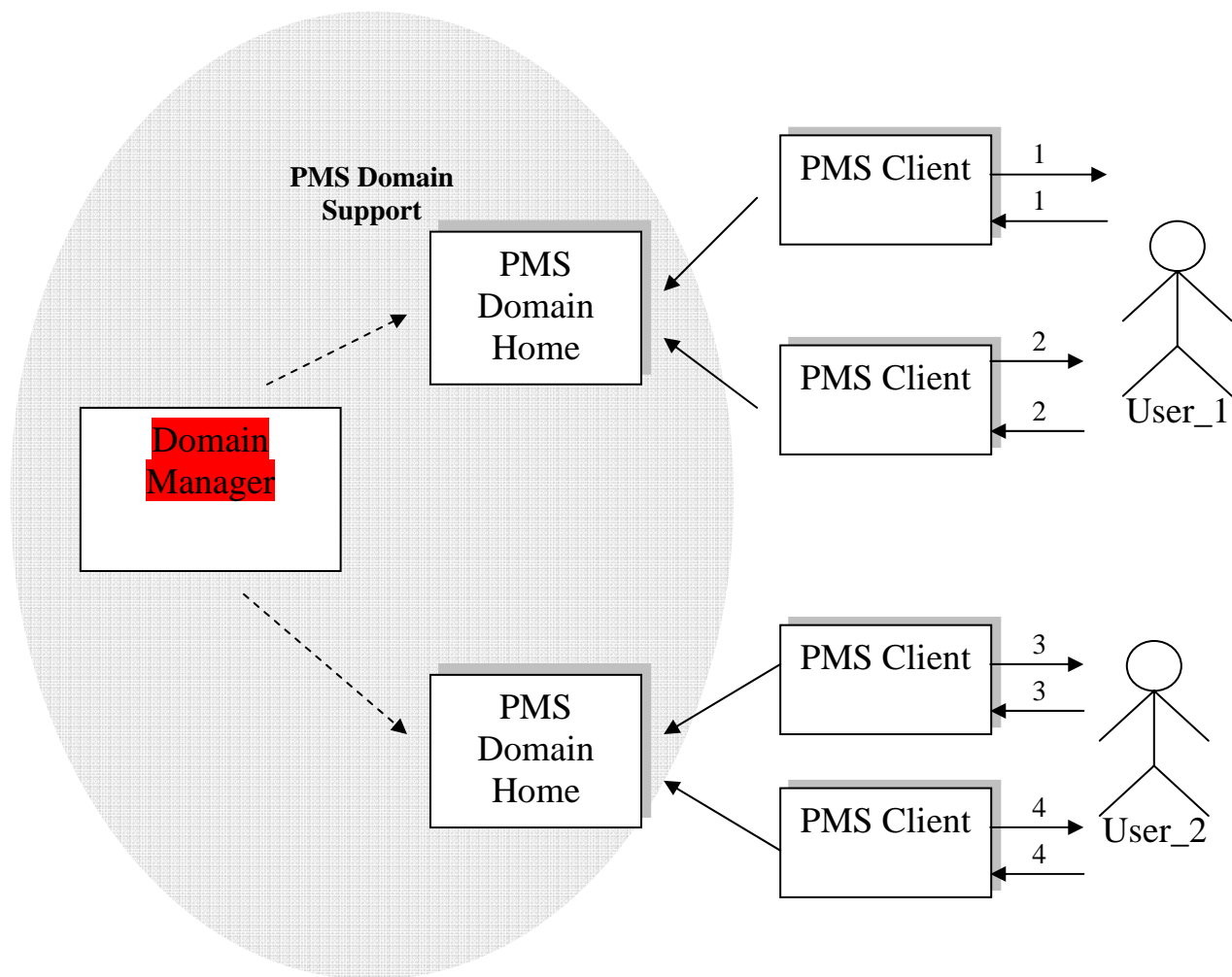
In today's environment, standards for copy control over broadcast have followed a different track to that of internet standards. This Use Case attempts to reconcile both approaches, at least from the perspective of the end user, using the AXMEDIS Framework.

A service provider wishes to make content available to the public, initially over broadcast using a traditional broadcast schedule (MPEG transport) and then over an IP distribution network (AXEPTOOL/AXMEDIA) to allow audience not connected over broadcast to 'catch up'. In this way the service broadcaster can continue to serve an audience becoming ever more accessible through the internet.

The broadcaster would like the broadcasts selected by the viewer to be easily consumed according to the broadcaster policy and implemented by the AXMEDIS Framework, e.g, stored and made available to the viewer. Similarly the content downloaded by the audience over the internet should be subject to usage conditions, including time of deletion, for a period after the file download. Note that these two sets of usage conditions granted to the viewer may not necessarily be the same over both transports.

Content that is downloaded, or permitted to be stored from broadcast must contain a consistent set of programme descriptors that can be presented to the viewer in a typical home content selection scenario, such as those standardised in the TV-Anytime metadata standard, to present a compelling home media library to the home viewer, including any conditions that apply. These descriptors are also displayed on any download menu from a remote website and can be made available when offering selection of content over a peer to peer network.

3.1.1 Use Case: Establishing a Home Domain Environment (BBC,PKU,ETRI)

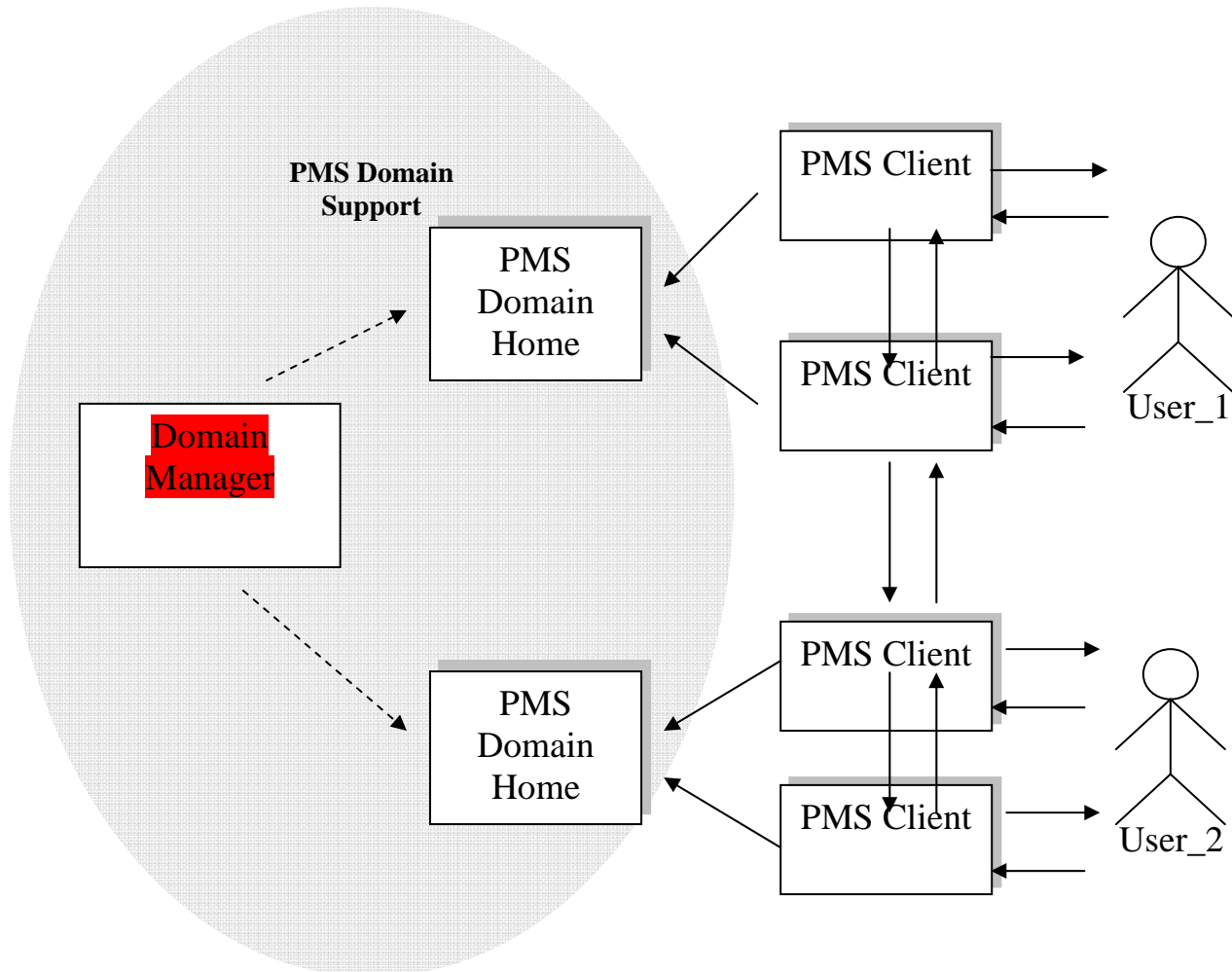| UCId	4HOME_2
Use case	Setting up the home domain environment
Description	Starting with a newly acquired application or device, a user wishes to establish a home domain between her home devices for transferring content between devices in the home or at least connected within her domain
Actors	Home_user_1, Domain_1 (2 devices) Home_user_2, Domain_2 (2 devices) Domain Manager stand-alone application Domain Manager module (PMS Domain Home) Domain Registration Manager module (PMS Domain Home)
Assumptions	Home users have compliant AXMEDIS clients on their devices and access to appropriate Protection Manager Support (PMS) Servers within the AXMEDIS Certifier and Supervisor (AXCS) Framework. They may have downloaded AXMEDIS players as skinned players from a service provider.
Steps	1. User_1 actives AXMEDIS Domain registration service home manager device 2. User chooses to add device to an existing domain, or create a new one 3. User_1 adds second device to this domain 4. User_2 actives AXMEDIS Domain registration service home manager

	device
	5. User_2 chooses to create a new domain
	6. User_2 adds device to this domain
Post-conditions	Clients within the same domain can transfer domain bound content between them, but not to non-domain clients.
Variations	Domain management could be static, one step set up, or dynamic state
Asynchronous actions	Depends upon the detail of the AXMEDIS registration and joining progress as already designed. At this level we assume the user friendly action menu is provided that may ask for some authentication or such like
Design suggestions	The emphasis here should be on simple user actions concealing the more detailed and robust actions that protect the content rights holder
Issues	- How can content be transferred between different domains with common characteristics like geographical territory or common service provider? Is it better to define one large multi user domain to achieve this instead? - This can be achieved through the kind of license issued. If the license is issued for a specific domain, then the content will be only available to it. To make the content available for another domain, it will need a different license. The current domain architecture uses User authentication for domain authorization but does provide any support device authentication.

Theme: Allowing content to be consumed in a user friendly, rights managed manner.

Using AXMEDIS technology, the home viewer would like to purchase or download an AXMEDIS player with AXMEDIS Home Domain technology and establish their environment of 2 or 3 interconnected user terminals. This may mean registering their devices with some device identification service such that they can be given the means to transfer secure assets between themselves subject to the rules expressed within the AXMEDIS objects, including the likely condition that content cannot be redistributed out of the domain.

Domains might also be common to service providers with multi users, rather than single users, multiple service providers, to enable all users with a domain subscription to securely share content between themselves as licensed by the domain owner.

3.1.2 Use Case: Content Usage in the Home Environment (BBC,PKU,ETRI)

UCId	4HOME_3
Use case	Use of content within the home based on Domains
Description	A home user obtains content from a service provider and is able to consume this in a number of ways and over a time window specified within the accompanying content terms and conditions. She may be able to share the content between her home devices or with other people depending on the power of the domain model and the license obtained. Licenses may be extended or reviewed and may be acquired with the content or separately.
Actors	Service (Content and License) provider: Providing content and licenses from P2P or Broadcast fed from the Content Factory and managed by the PMS Tools and AXCS in conjunction with the AXMEDIS Domain (Factory and Home modules) End User: With local 'same domain' devices and access to other AXMEDIS devices not belonging to the user domain or necessarily any domain.
Assumptions	The end user has set up membership with Domains appropriate to exercise the

	rights that can be granted from the broadcast/P2P case. This would be a local private domain and maybe some wider domains if possible.

Steps	The user chooses to consume content by pressing play/store/export as per license.
	
	 Note: such control can only be asserted over fully protected AXMEDIS objects.
	
	 Controlled User requested actions include:
	
	 1. Play (Export to trusted renderer)
	
	 2. Record a live braodcast programme locally for playback.
	
	 3. Keep content in perpetuity in violation of consumption window
	
	 4. Make a limited number of controlled copies/ simultaneously playback content on a number of rendering devices.
	
	 5. Renew access to the expired content.
	
	 6. Export to removable media.
	
	 7. Delete, (license and file)
	
	 8. Limited sharing within jurisdiction:
	
	     a. The service provider would like to enable movement of the enabled content objects between homes within a defined geographical area based on a political jurisdiction. Player authentication based on geographic authentication.
	
	     Note: The demonstrator should at least include message to user vis á vis territory
	
	     b. The service provider would like to restrict the movement of files to allow movement only within the home network.
	
	 9. Extend or renew rights using call-back server for new license acquisition (as supported by REL)

Post-conditions	Content actions as represented to user and consistent with license must be enacted, whilst other actions not granted are prohibited by the system with an explanation and possible remedial suggestions (eg, action grant can be obtained by further user action)
Variations	A number of variations on license grants can be demonstrated that have found appeal in related standards forum. Note that these actions will be consistent if verified by the rights ontology tool.
Asynchronous actions	The user may wish to register a domain after receiving content in order to fully benefit from the grants as in earlier User Case 4HOME _2
Design suggestions	Again, the representation of the status of the content as expressed in the license is key to making the system usable and acceptable as much as the flexibility of the business models enabled.
Issues	Direct use of REL over broadcast is not likely to be acceptable to the broadcast

	industry. If necessary the language for defining rights for this environment should be defined and some translation module implemented, like the one already available from MPEG-21 REL to OMA DRM REL. This can be accomplished with simple signalling just to avoid re-distribution of the incoming FTA by the platform. Once the FTA content is made into an enhanced AXMEDIS object, it can have a normal AXMEDIS licence.

The service provider would like to enable a consistent end user experience by making content accessible to the end user through the AXMEDIS player and using the AXMEDIS domain control technology to restrict secondary distribution, even though the content can be acquired through two distinct mechanisms: Internet delivery and broadcast delivery. Where possible, especially at the consumer device, the AXMEDIS technologies are the common enabling framework and result in the AXMEDIS AXOM being present in the receiver device.

Although internet distribution has the potential to convey a large variety of business models through rich rights expression languages expressed in XML, the broadcast community has traditionally used smaller sets of rights expression based on copy control or a limited set of business modalities, for instance those expressed in the TV-Anytime RMPI-MB standard as specified in ETSI TS 102 822-5. Alternative broadcast rights signaling is also being considered as expressed in the DVB-CPT Blue Book [DVB CPCM Usage State Information (USI) DVB Doc A094] and the US SMPTE exCCI standard currently work in progress.

The service provider would like to enable the following consumption modes, compatible with new and emerging standards for signaling over a broadcast network e.g., DVB USI or TV-Anytime RMPI-MB, consistently with REL when conveyed over IP. Note that due to the regulatory environment, it may be that content distributed over broadcast and then IP may not necessarily be subject to the same usage conditions.

The demonstrator should show the following license conditions being interpreted and implemented using the AXMEDIS player through the deployment of AXMEDIS domain, license servers and downloadable DRM tools to the AXMEDIS home client. For the case of FTA broadcast, the mapping will be light so as to enforce simple Export and redistribution conditions only. In contrast, the internet licence for protected or enhanced modes will permit more commercial usage modes.

1. Play/not play (Export to trusted renderer only, ie switch on export controls with CCI))

2. Broadcast/streaming : retain on receiver PDR, to be viewed anytime on any receiver within a home network or user domain.

3. Permit/disable a limited number of controlled copies (or simultaneous accesses)

4. Renew access to the 'deleted' file after content expiry

5. Export to removable media. –or export to trusted media only with CCI

6. Delete, (license and file)

7. Limited sharing within jurisdiction:

    a. The service provider would like to enable movement of the enabled content objects between homes within a defined geographical area based on a political jurisdiction. Player authentication based on geographical authentication.

      b.   The service provider would like to restrict the movement of files to allow movement only within the home network.

8.   Permit superdistribution, using call-back server for licence acquisition

3.2 Diverse Service Provider policies (ETRI)

Currently, each broadcaster has used his own protection mechanism for the broadcasting service, and there has been no interoperable protection mechanism up to now. Therefore, if an End User wants to take a new channel service from other broadcaster, he has to change his STB or Smart card. This makes End Users very cumbersome and economically inefficient.

Now, more advanced protection mechanism is needed as the broadcasting service is digitalized. Existing CAS can not ensure the security of broadcasting content from the arising broadcasting business model. For example it can not protect broadcasting content from recording and redistribution. Various protection tools will be developed and used to protect broadcasting content to satisfy their new business model and the copyrighter of the broadcasting content. However, if the broadcasters develop new protection mechanism without considering interoperability, new business model will be restricted and End Users will be unhappy.
In this document, we propose several Use Case scenarios for the broadcasting service. These scenarios are focused on how to support interoperability between the broadcasters and STB. They also deal with how to support the interoperability between STB and other multimedia devices.

3.2.1 Register Protection Tool
Every Protection Tool should be registered before being used. Registering Protection Tool results in Protection Tool ID and packaged Protection Tool which will be downloaded to the client.
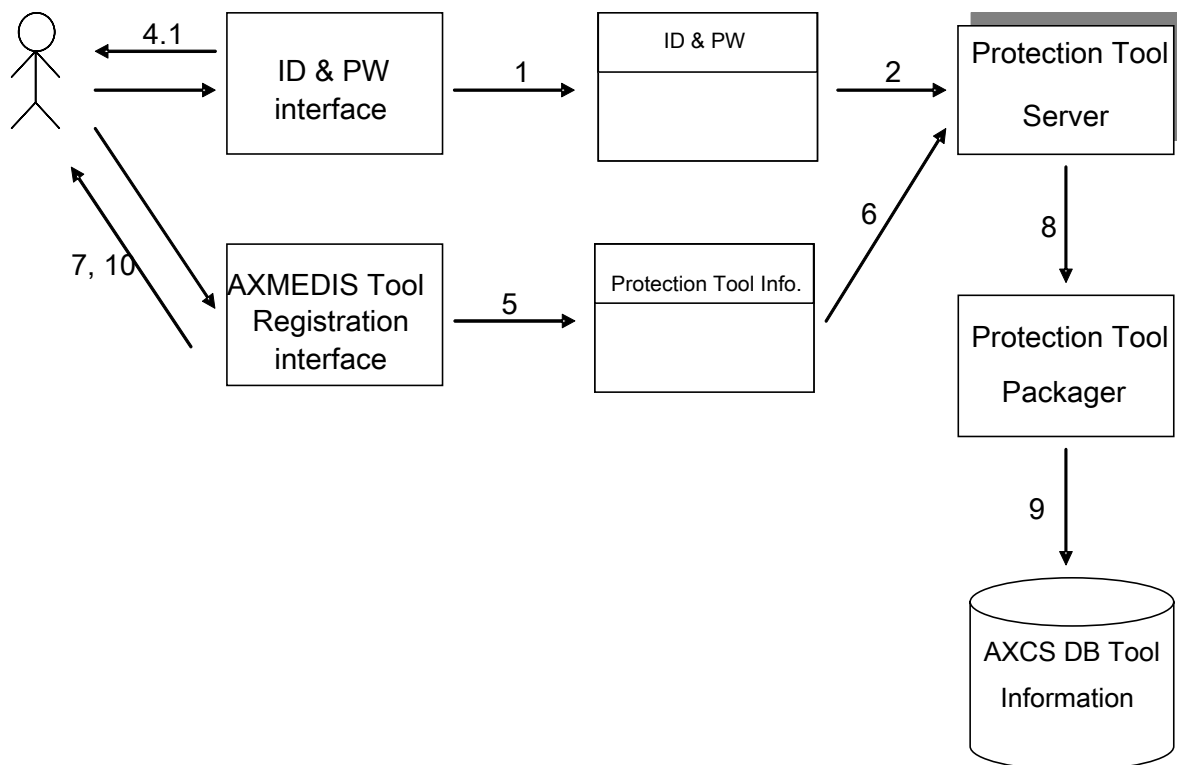
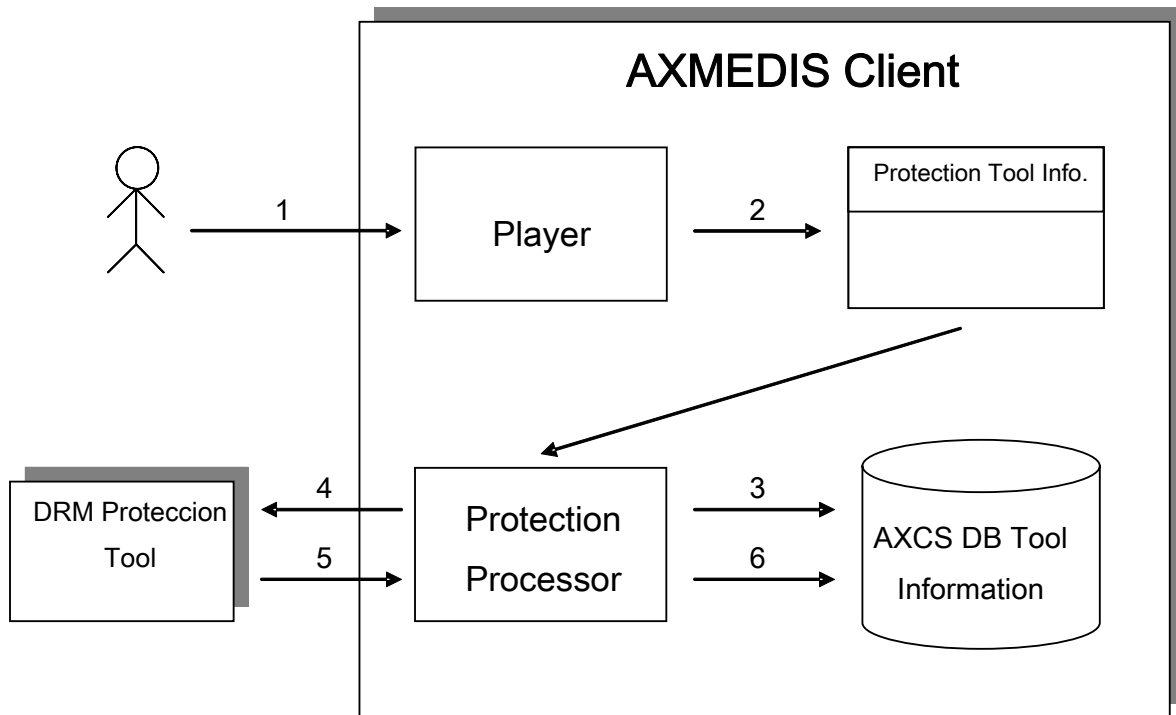| UCId	4HOME_4
Use case	Register Protection Tool
Description	An actor wants to register and upload Protection Tool
Actors	Protection Tool developer
Assumptions	An Actor is registered to the Protection Tool Server.

	An Actor has binary Protection Tool.

Steps	1 The Actor connects to the Protection Tool Server
	2 The browser shows the page for log-in. The Actor logs in by user ID and PW.
	3 If log-in is successful
	   3.1 Go to the step 5
	4 Else
	   4.1 Shows a dialog to inform the Actor about wrong ID or PW.
	5 The browser shows the page for registration of Protection Tool
	6 The Actor fills in the Protection Tool information such as tool name, developer, date of development, functional information. The Actor clicks on the "Upload Protection Tool" button. The browser shows a dialog to present the files in local folder. The Actor selects Protection Tool file. The Actor clicks on the "Next Step" button.
	7 The browser shows the summary information (the input from the Actor and Protection Tool ID which is issued by the server). The Actor clicks on the "Confirm" button.
	8 The Protection Tool Server packages Protection Tool and issues a Protection Tool ID.
	9 The Protection Tool Server stores the new Protection Tool in the storage
	10 The browser shows a dialog to inform the Actor about success of Protection Tool registration.

Post-conditions	The Protection Tool Server packages uploaded Protection Tool and stores it in the DB for the future downloading.
Variations	More than one binary Protection Tool for various client platforms can be included in one packaged Protection Tool (Tool Pack)
Asynchronous actions	User's client can download Protection Tool when necessary if Protection Tool is missing.
Design suggestions	None.
Issues	None.

Note: Proposed protocol for Protection Tool downloading between device and Protection Tool Server needed and welcomed. Also, Tool registration and authentication is needed. Protection Tool format is already defined by AXMEDIS (XML related to a DLL) for more information see: AXMEDIS spec "protection processor".

3.2.2 Download Protection Tool

When a missing Protection Tool event occurs, the Protection Processor in the client tries to connect remote server (Protection Tool Server) and download required Protection Tool. Note that all Protection Tools should be registered before being downloaded and used in the client.

Note: In AXMEDIS the Protection Processor is bound to the rendering application (statically).

UCId	4HOME_5
Use case	Download Protection Tool
Description	The client downloads a proper Protection Tool when it does not exist in the client
Actors	AXMEDIS Client User
Assumptions	An Protection Tool has been registered to the Protection Tool Server. The AXMEDIS Client has network capability A required Protection Tool does not exist in the AXMEDIS Client
Steps	1 The Actor tries to play an AXMEDIS object 2 The Player extracts protection information from the AXMEDIS object and sends it to the Protection Processor 3 The Protection Processor tries to locate a required Protection Tool but cannot finds that there is no such Protection Tool in the Protection Tool storage 4 The Protection Processor connects to the Protection Tool Server 5 The Protection Tool Server searches the queried Protection Tool and sends it to the AXMEDIS Client 6 The Protection Processor stores the Protection Tool in the appropriate Protection Tool storage
Post-conditions	The Protection Processor registers the new Protection Tool in the AXMEDIS Client for future use
Variations	In case there is no Protection Tool that matches the queried one, the Protection Tool Server sends "No matched Protection Tool" message to the AXMEDIS Client.
Asynchronous actions	None
Design suggestions	None.
Issues	Protocol between the Protection Tool Server and the user client should be defined in order to downloading Protection Tool.

3.2.3 Play AXMEDIS object protected by the Protection Tool

Consumer wants to use (play, store, move, etc.) content without any restriction of DRM type. In order to achieve this, the Device should satisfy the requirements of interoperable DRM. Least set of core functionality in the Device will support interoperable platform for various Protection Tools. This scenario will show that the customer in his Device can use the contents those are packaged by different DRM vendors.
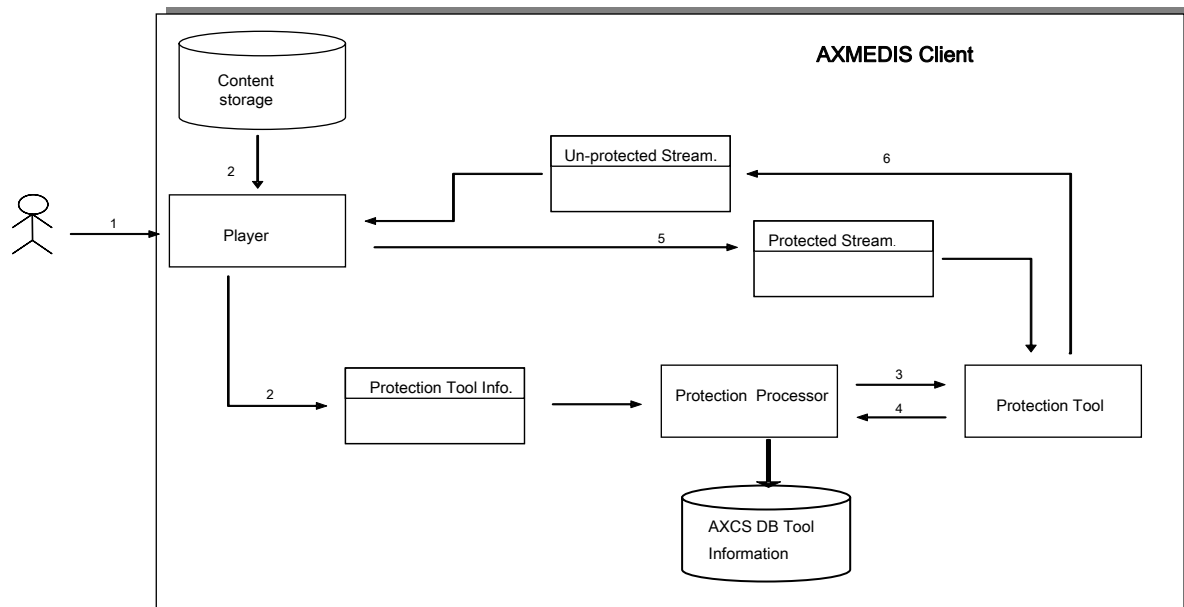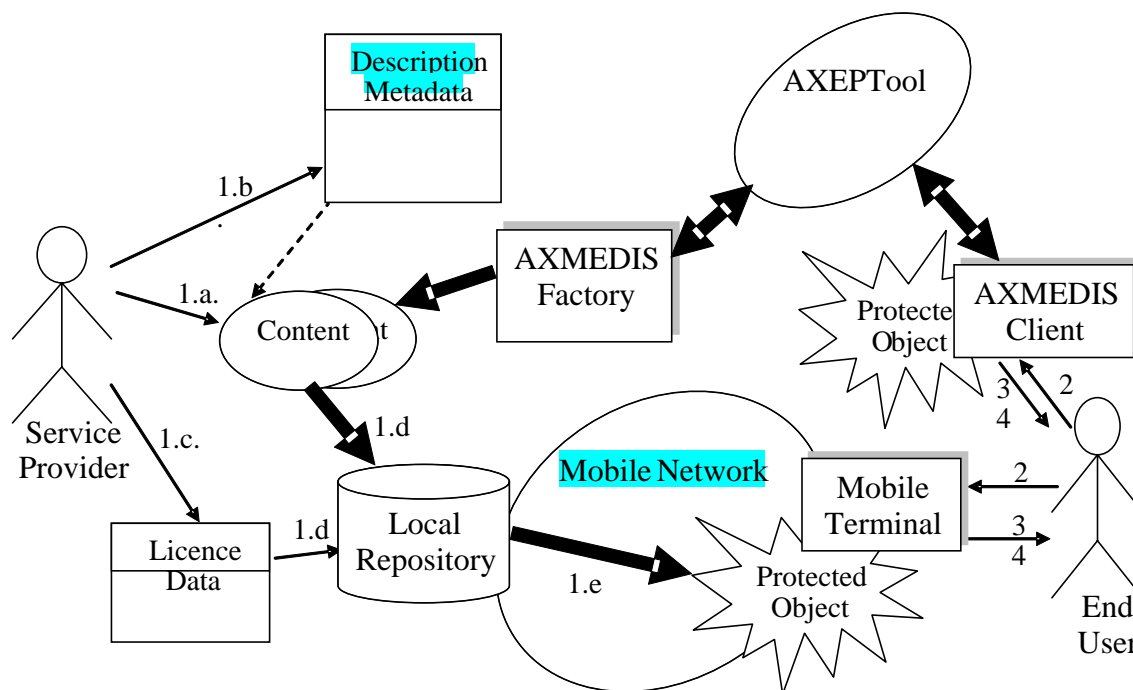

Note: Need to analyse interface between Protection Processor and Protection Tools to see if it is sufficient for the use case.

UCId	4HOME_6
Use case	Play DRM Protected content using Protection Tool
Description	An actor wants to play AXMEDIS object without restriction of the type of Protection Tool
Actors	Consumer
Assumptions	The Protection Tool has been registered. The Protection Tool has been downloaded on the Device. The protected AXMEDIS object has been downloaded on the Device. The licenses and the Protection Tool information related to the User and the AXMEDIS Object are cacheable.
Steps	1 An actor tries to consume a protected and governed AXMEDIS Object. 2 The Player extracts protection information from the AXMEDIS Object and sends it to the Protection Processor. 3 The Protection Processor locates, instantiates, and connects the Protection Tool to a proper Control Point in the media decoding pipeline. The Protection Processor initializes the Protection Tool according to the initialization data which is included in the Protection Tool information. 4 The Protection Processor and Protection Tool interacts using common interface messages. 5 The Protection Tool notifies tool events to the Protection Processor 6 Once Protection Tool is connected to the Control Point, Protected media stream is passed to Protection Tool. 7 Protection Tool processes DRM function (ex. Decryption) on the media stream and sends it back to the Player.

Post-conditions	After decoding content, the Protection Tool will be disconnected from the Control Point. Once the Protection Tool is downloaded in the Device, it will be stored in the Device for future use.
Variations	If there is a missing Protection Tool in the Device, the Protection Processor connects to the remote server to download the missing Protection Tool.
Asynchronous actions	None
Design suggestions	None
Issues	None

3.3 Use Case: Integrated Access to Premium Content (TI)

UCId	4HOME_7
Use case	Integrated Access to Premium Content
Description	The service provider distributes premium content over fixed and mobile networks. The end user can buy a single license from either a PC or a mobile. The same license entitles the user to download and view the content (in different formats) from its mobile, its PC or both.
Actors	Service Provider: making content available on fixed and mobile networks. Home User: acquiring content from either a mobile terminal or a PC connected to the Internet.
Assumptions	It is assumed here that the AXMEDIS Content Factory already contains objects provided by some Content Owners in the form of AXMEDIS Objects. The AXMEDIS Objects are protected and include a license, which establishes whether the content can be further distributed by a Service Provider to his customers (end users), and under which conditions. The license also specifies if the content may

	be adapted and exported to OMA DRM. End users are equipped with an AXMEDIS player on a PC that can be fed from an Internet connection. End users also have a 3G mobile terminal which can connect at high speed to the mobile network, enabled to receive and manage OMA DRM v2 content.

Steps	Step by step description of the use case activation, execution and termination
	
	1. The Service Provider (SP) adapts content for distribution on fixed and mobile networks.
	    a. Still pictures, digital music, or digital video, stored in the AXMEDIS Framework as AXMEDIS Objects, will be processed and converted into OMA supported formats.
	    b. SP complements metadata for user interface (e.g. Web or Wap page)
	    c. SP converts the license terms in OMA DRM v2.0 representation for the specific case of the mobile channel
	    d. SP publishes the content in the supported distribution channels (fixed and mobile networks).
	    e. The content may be downloaded at any time in the end user's terminal.
	2. The end user buys the content (actually, the license to use the content) from a Web (or WAP) page, either directly or as the result of a subscription service ("all you can eat").
	3. The end user can play the content on both the mobile terminal or the AXMEDIS player on the PC.

Post-conditions	none.
Variations	Variation to this scenario include: - different kind of licenses (e.g. unlimited, subscription based, with expiration date, with possibility to download and burn protected content on portable recordable media - DVD, HD-DVD, BD, SD - in the PC environment, etc.) - different scope of licenses (single terminal vs. domains) - automatic adaptation of content quality (video resolution, audio fidelity, etc.) to the intended delivery channel (content for mobile terminals may be of lower quality in order to achieve a higher compression)
Asynchronous actions	None
Design suggestions	Automatic translation of licenses between the AXMEDIS REL format and the OMA DRM REL v2 needs to be performed in order to achieve a fully automated content management chain. Alternatively, the AXMEDIS license generation tool could be upgraded in order to be able to generate both the AXMEDIS license and the OMA DRM v2 license.
Issues	• Automatic conversion of licenses may be inaccurate due to implementation issues or differences in the design of the AXMEDIS and OMA REL • OMA DRM v2 licenses are designed to address only the distribution of protected content to the end user. • There is no event reporting in OMA DRM v2.0; this functionality, called "usage metering" in OMA, has been added in OMA DRM v2.1 which is not yet published. • Automatic adaptation of content quality may be difficult to achieve, due to the large number of different formats of audiovisual material currently existing. However AXMEDIS provides several tools to support adaptation (see AXMEDIS workflow layer).

Description

The service provider would like to improve the end users experience by allowing them to access and use their own licensed premium content (music, videos) from both the fixed and the mobile network, irrespective of where did they buy the content, and how. However there are a number of limitations that must be overcome in order to do so: limited bandwidth on the mobile network, different content formats, different authentication systems, and different content protection mechanisms are the main ones.

- The bandwidth limitation is not anymore a major obstacle, now that 3G networks are widely available in Europe. However, it is clear that a full length movie cannot (yet) be downloaded on a mobile phone. Small videoclips (less than 6 MB) can be delivered via MMS, other content can be downloaded from a Wap or Web site.

- Content formats supported by mobile terminals are a limited subset of those supported by the PC. Such formats are typically specified by 3GPP on a case-by-case basis.

- The authentication on the Internet is normally based on a username/password pair, while mobile devices have a number of ways to identify themselves (IMEI, SIM card, device certificate, etc.). Which method is used is determined by the application design.

- Content protection on mobile terminals is typically based on OMA DRM. Currently OMA DRM v1 is the most deployed content protection mechanism on cellular phones. We expect the new OMA DRM v2 technology to replace the previous version in high end phones this year. These phones are equipped with a multimedia player that allows the phone to play music and videos.

In order to setup an environment where the end user can buy licenses and use content irrespective of the specific delivery channel, we need to make some assumptions on the devices that will be used by the end user to purchase, download and play the content. We assume that as far as regards the mobile network, these devices will be 3G phones equipped with OMA DRM v2.0 content protection mechanism. This assumption is based on the current marketplace situation where support of OMA DRM v2.0 is announced by almost all the major mobile phone manufacturers. On the other delivery channel (the Internet), we have a PC equipped with the AXMEDIS player.

While the AXMEDIS player can directly use the AXMEDIS licenses to play AXMEDIS content, the OMA-compliant phone needs that both licenses and content are translated into OMA DRM REL v2.0 and OMA DCF v2.0 format. This translation should occur automatically in some place in the network, before delivering the content and the associated license to the end user mobile device. It has to be evaluated from an architectural standpoint whether this translation can be better achieved in the AXMEDIS Content Factory or in an OMA gateway positioned at the border of the AXMEDIS architecture. The first solution is more integrated in the AXMEDIS architecture, but taints it with external formats which may be not desirable. The second solution is less integrated and more object-oriented, since the adaptation occurs only where it is needed. Of course the license and content translation must be as much transparent as possible. However it must be noted that the rights expressions allowed by the OMA REL are far simpler than those possible in the AXMEDIS system, therefore only a limited subset of the latter will be fully supported on the mobile devices. Another difference is that while PC can support full resolution videos and hi-fidelity audio, this is rarely possible on mobile devices. A reduction in content quality is normally accepted in mobile devices, because it is compensated by the added value of the mobility of the device.

The final outcome of this scenario is that end users are able to use the same content on both fixed and mobile devices. For example, let's assume that the user is interested in subscribing a news service. He can buy the subscription either from the mobile phone (where he's charged on his phone bill) or from the Internet (where he pays by credit card). Once his has subscribed the service, he can get the videos containing the news either from a Web site on the Internet (where he uses the AXMEDIS player to do so) or from an MMS received on

the mobile phone (where he uses an OMA/3GPP player). The fact that the content and the license formats are actually different must be as much transparent as possible to the end user.

3.4   Ontology related use cases (sDae)

The ontology Use Cases presented intend to illustrate how the proposed ontology work will support the following generic scenarios:

- Cataloguing content in terms of Intellectual Property (IP) status from a wide array of value chains of diverse nature and scope.
- Contract creation evaluation
- DRM License creation and editing
- User action authorization

The objectives are to show how the proposed ontology along with appropriate API and where required corresponding user interfaces can simplify the above processes and make them available to a wider array of users. This is achieved through the following:

1. Classification of content in terms of the IP represented by the content and the agents responsible for creating that content using standard terms and relators.
2. Mapping the terms used in contracts to equivalent terms in the ontology
3. Mapping the ontology IP and role classification and relators to the appropriate REL license fields.
4. Analysing relations between terms in the ontology.

To achieve this, the following AXMEDIS modules are required:

Modules developed in other WPs:
- PMS Server,
- PMS Client,
- Protection Processor,
- DRM Editor and Viewer,
- Contract analyser,
- other AXMEDIS Tools.

Modules to be developed in this WP:
- File(s) storing the Creation Model Ontology (CMO),
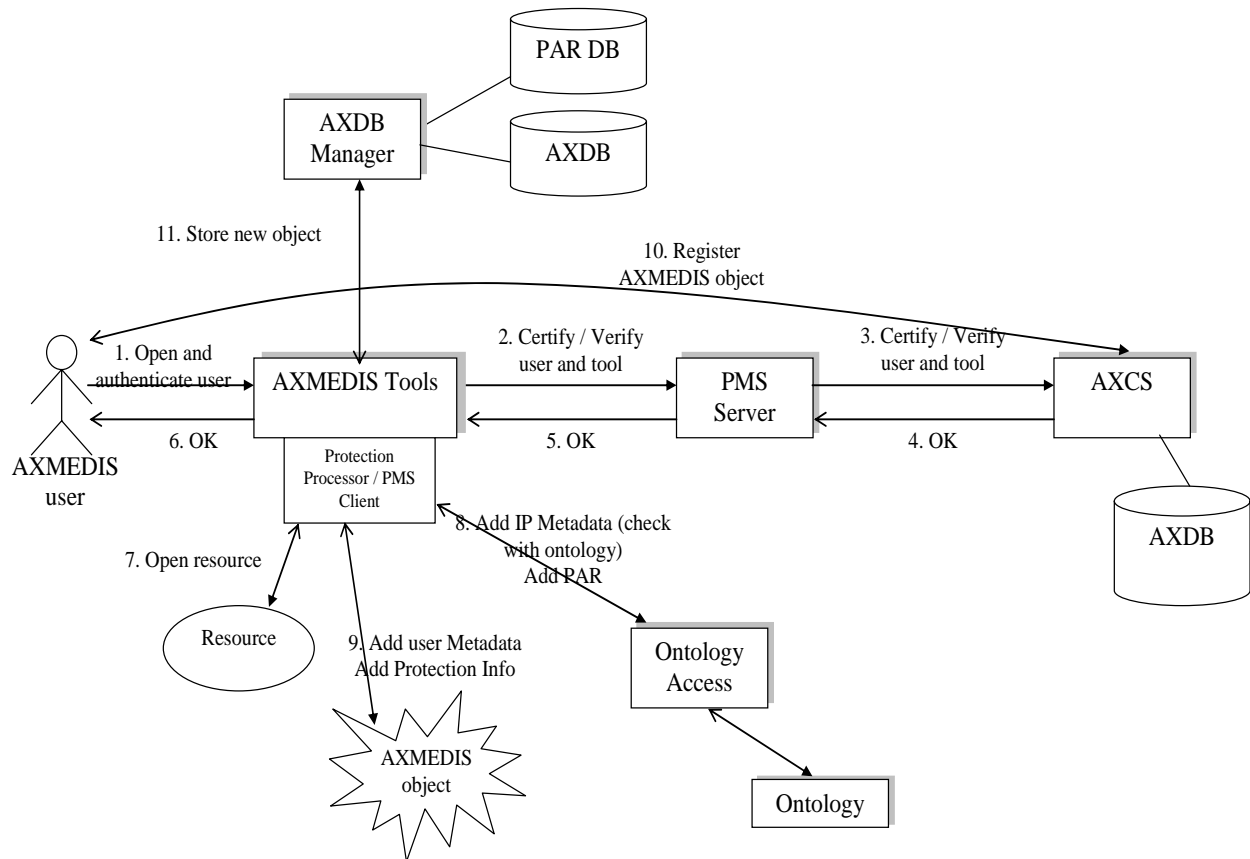- Ontology API (Application Programming Interface).

3.5   Ontology scenarios

This section describes the scenarios related to ontology use cases.

3.5.1   Creation model scenario

The scenario in which an AXMEDIS object is created making use of the creation model ontology can be represented by the following diagram:

Note: Plug-in is directly to AXMEDIS Tool (Editor, AXCP GRID node) Ontology API accessed through Web Service with prior Ontology Server authentication. Web service access applies to all use cases below

1. User opens the AXMEDIS Tool and authenticates himself in the system
2. 3. The tool and the user are certified or verified in the AXMEDIS system
4. 5. 6. The response from the system is OK
7. The user opens a resource with the AXMEDIS Tools
8. The user associates IP Metadata and PAR in order to convert the resource into an AXMEDIS object. The Ontology is checked in order to decide if the metadata and rights are correct or not according to it.
9. The user associates User Metadata and Protection Info, to complete the structure of the AXMEDIS object.
10. The user registers the object in the AXMEDIS CS database
11. The user stores the object and the PAR in the AXMEDIS database and the PAR database, through the AXDB manager

### 3.5.2 Creation of Licenses from Contract scenario

The creation of licenses from contract making use of the creation model ontology can be represented by the following scenario:
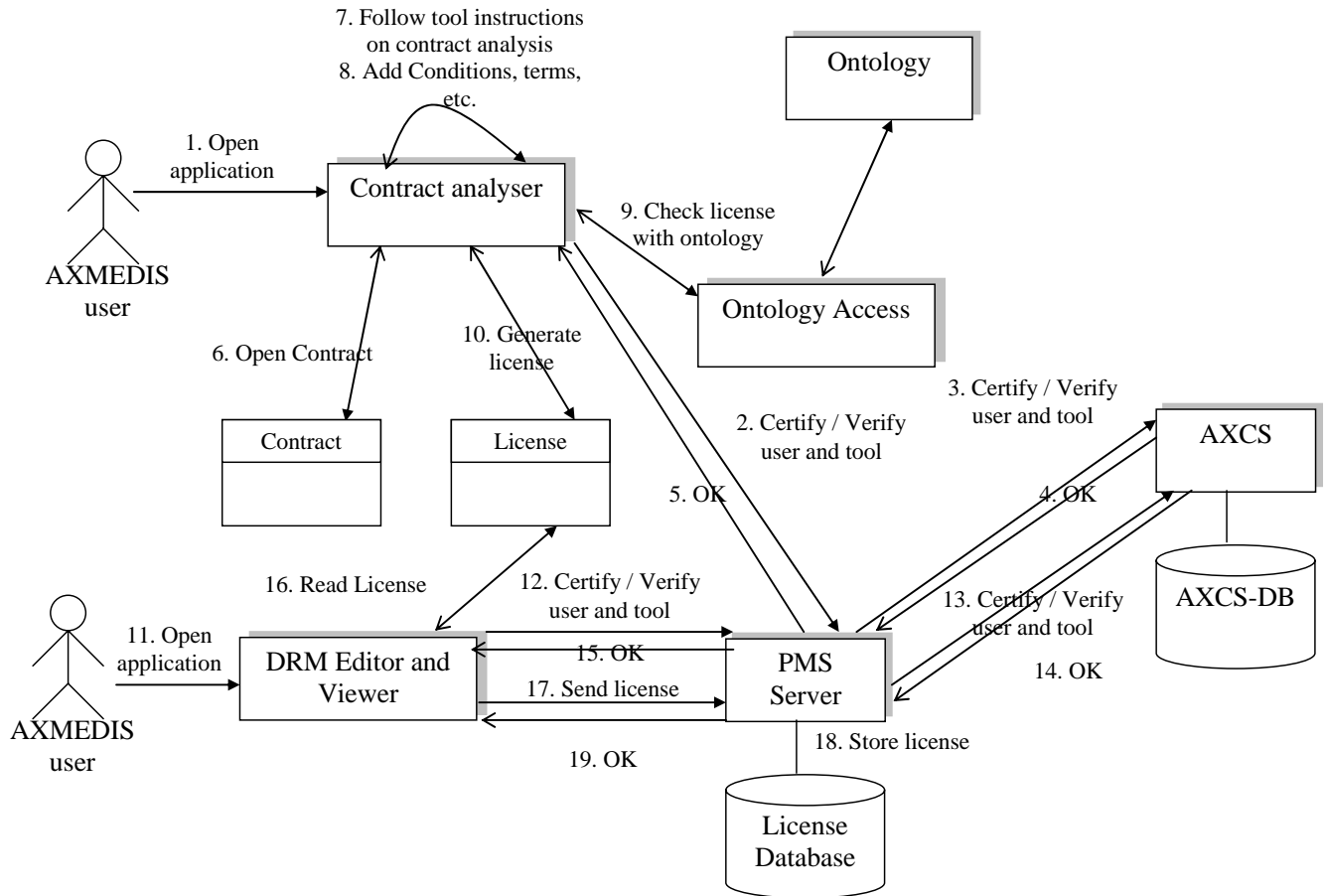
1. User opens the contract analyser
2. 3. 4. 5. The user and the tool are certified or verified
6. The user loads a contract text file
7. The contract is analysed and the information inside it is presented to the user
8. The user can add more conditions or terms to the ones detected by the contract analyser
9. The license is generated after the contract is analysed and the user has added the corresponding information.
10. After license generation, the ontology is checked in order to verify that the generation of the license is correct according to it.
11. 12. 13. 14. 15. The user and the tool are verified or certified.
16. 17. 18. 19. The user can open the license in the DRM Editor and viewer in order to send it to the PMS Server and store it in the license database. The corresponding checks on the user, tool and license chain are done.

3.5.3 Creation of Licenses with DRM Editor Scenario

The creation of licenses with DRM Editor making use of the creation model ontology can be represented by the following scenario:
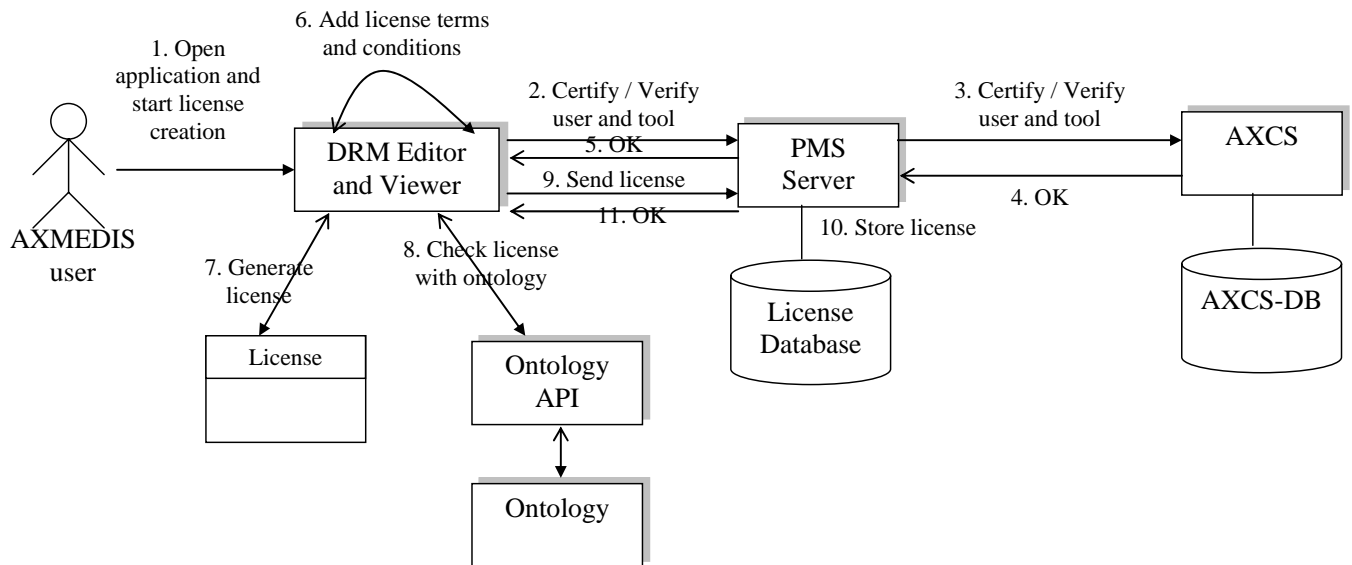
1. User opens the DRM Editor
2. 3. 4. 5. The user and the tool are certified or verified
6. The user edits the license, adding principal, conditions, etc.
7. Generate the license
8. Check that the generated license is correct according to the ontology
9. 10. 11. Store the license in the PMS Server. The license is checked against the license chain.

3.6 Use Case Creation model

UCId	4HOME_9
Use case	Creation Model
Description	This Use Case describes how the Creation Model Ontology can be used to capture and classify Content from spontaneous value chains of a varied array of users for the purpose of feeding the AXMEDIS Content Factory for subsequent licensing, production and distribution.
Actors	User classifying resource for Rights management, ontology, ontology API, generator of AXMEDIS Object, ….
Assumptions	An AXMEDIS Tool, interfaces to the Creation Model Ontology (CMO)
Steps	1. User starts AXMEDIS Tool 2. AXMEDIS Tool identifies/authenticates User as an AXMEDIS User 3. User chooses a resource file 4. User chooses one or more roles from the ontology to represent his relationship to the chosen resource 5. AXMEDIS Tool creates pre-AXMEDIS factory object (maybe AXMEDIS object directly) 6. User classifies what the resource file represents according to the Intellectual Property types (IP Entities) available in the ontology (Work Manifestation, Adaptation, Instance, etc.) 7. User adds IP Entity metadata 8. User adds User metadata 9. User generates Potential Available Rights for the Object. After the storage of the AXMEDIS object, he can also generate Licenses for this object 10. User associates protection information to the object 11. Pre-AXMEDIS object or AXMEDIS object is sent to the AXMEDIS Factory

Post-conditions	In the case that the object is a pre-AXMEDIS a process is required for converting the object and PAR to a full fledged AXMEDIS object.
Variations	None
Asynchronous actions	None
Design suggestions	None
Issues	None

3.7 Use Case Creation of Licenses from Contract

UCId	4HOME_10
Use case	Creation of licenses from contract
Description	This use case describes how the Ontology will be used in the contract creation tool, allowing the checking of rights inside the existing contract and the relationship between them
Actors	User creating the license from contract, ontology, contract analyser, PMS Server, DRM Editor and Viewer
Assumptions	A contract with several parties, terms and conditions exist

Steps	1. The user loads the contract inside the contract analyser. The contract should be a text file (without formatting)
	2. The user follows the instructions given by the contract analyser for defining the parties, terms, rights and conditions extracted from the loaded contract
	3. The user can create more conditions, rights and parties, apart from the ones detected by the contract analyser tool
	4. The user generates the license according to the contract analysed.
	    4.1. The ontology is used here to control that the rights, the user role and other terms present in the contract are correct according to the terms and relationships defined in the ontology
	5. The license generated is stored in an XML file in the local disk of the user
	6. After the generation of the license, the user can perform the following actions:
	    6.1. Check that the generated license represents the original contract (or at least the one the user wanted)
	    6.2. Send this license to the PMS Server using the DRM Editor and Viewer or the automatic mechanisms for sending licenses

Post-conditions	A license with one or more grants is generated from the contract analyser tool
Variations	The tool cannot extract information from the contract, so no license can be generated from the tool. Not all the terms, conditions and parties are extracted by the tool, so the generated license is not complete, although it is valid.
Asynchronous actions	None
Design suggestions	None
Issues	None

3.8 Use Case Creation of Licenses with DRM Editor

UCId	4HOME_11
Use case	Creation of licenses with DRM Editor
Description	This use case describes how the Ontology will be used in the DRM Editor tool
Actors	User creating the license, ontology, PMS Server, DRM Editor and Viewer
Assumptions	None

Steps	1. The user opens the DRM Editor application
	2. The user can start a license from scratch or load a license model to add fields
	3. The user adds the principal (licensee)
	4. The user adds the right or rights
	5. The user adds conditions to the different rights
	6. The user generates the license
	   6.1. The ontology is used here to control that the rights expressed in the license and the user role are correct according to the terms and relationships defined in the ontology
	7. The user can perform the following actions:
	   7.1. Store the license in XML format in the local disk and send the license to PMS Server later
	   7.2. Send this license to the PMS Server

Post-conditions	A license with one or more grants is generated
Variations	The license is not valid and cannot be stored in the PMS Server
Asynchronous actions	None
Design suggestions	None
Issues	None

4 Requirements of the Demonstrator Architecture

4.1 Distribution over Internet and Mobile networks (TI)

Content preparation shall support:

1. Unique identifier (AxOID) to the AXMEDIS Object
2. Embedding audio, video, still images objects
3. Inserting metadata elements into AXMEDIS Objects
4. IPMP of Object elements (Note: AXMEDIS supports metadata (signature) and resource protection)
5. Object licensing (Note: to license it must be identifiable, identification is the AxOID)
6. Automatic adaptation to formats suitable for distribution to mobile devices (i.e. smart phones like the Nokia N91). In particular, the following formats may be used:
    a. Video: 3GPP H.263, MPEG-4
    b. Audio: MP3, AAC, AAC HE
    c. Protected file format: OMA DCF v.2 (based on ISO Base Media File Format)

(AXMEDIS Content Processing (AXCP) can be extended to include all needed formats)

Content publication shall support:

7. Re-distribution of AXMEDIS Objects from a single AXMEDIS Factory to other Factories through P2P (AXEPTool)

8. Programme and Publication Engine Content Factories publishing and distributing protected content over multiple channels (Note: The required channel requires specific plug-ins)

9. User visibility of published distributor catalogues

10. User licensing of content published in distributor catalogue

Content purchase shall support

11. End user accounts maintained on the distributor web sites (Note: AXMEDIS only supports user identification and authentication)

12. Registration of end user devices on the distributor web site (Note: AXMEDIS only supports user identification and authentication)

13. End user authentication via multiple devices

14. End user multiple devices (PC + Mobile Device) (Note : AXMEDIS can only support users through non AXMEDIS devices through back office)

15. End users content access through the web or WAP sites (Note: Distributor responsibility WAP (OMA))

16. Content purchase notification and URI via SMS (Note: OMA)

17. Content purchase notification and URI via electronic mail (Note: Distributor responsibility)

18. Content access via DRM agent

19. Single licensing of protected content for multiple delivery channels (Note: implemented as a double licensing under equivalent terms on the PC and the mobile device)

20. Simultaneous copies on different user devices (PC + Mobile Device)

21. Licenses with only upper limit counter constraints per device not absolute values. (Note: AXMEDIS players can enforce absolute count)

22. MPEG 21 content format

23. OMA DCF V2 content format

24. On Mobile OMA DRM Agent ROAP protocol and Rights Issuer.

25. On the PC, the AXMEDIS player, PMS, AXOM,

Content usage shall support

26. One time content licensing

27. Simple license expiry notification

28. Simple license update and renewal (Note: AXMEDIS license revoke)

29. License free access to content metadata information

30. Temporary off line content use (Note: If license supports it and if initial authorization has taken place)

31. Quality of audiovisual signal unaffected by the protection mechanism. (Note: Content producer can freely select protection mechanism)

4.2   Distribution to non Mobile (BBC, ETRI, PKU)) as Task 12.1.2.3.

Content Preparation shall support

32. Content and licenses for broadcast and IP delivery (Note: Broadcast license out of AXMEDIS scope)

33. License verification via AXMEDIS Ontology

34. Remote content uploading to the AXMEDIS Content Factory

35. Access to Content, licenses and metadata for Broadcast stream (Note: This will not be a real time process as broadcast stream is pre prepared without a dynamic encoder bank/CMS etc)

36. Generation of license and key for IP delivery by the PMS (not for broadcast)

Broadcast integration with the PMS, AXMEDIS Factory, AXCS shall support

36. ID for Linking content and license for the broadcast stream (Note: AXOID serves this function)

37. DVB Event_ID to identify content for recording (Note: see 37 above)

38. User actions based on CRID selection and mapping (Note. Specific to TVA navigation)

39. Generation of the AXMEDIS object in the PDR (Note: Not protected or domain protected)

40. Association of AXMEDIS object and license metadata for presentation on the home device (Note: License can be derived from FTA signals or be default for FTA broadcasts)

41. Use of flags and other data from the Broadcast Head end for the AXOM structure to be constituted in the home client (Note: Client must observe flags. Application can perform this logic)

42. Broadcast stream information carriage over MPEG TS and chosen TS mechanism e.g. DMCC Stream, Private Stream, Private Section or Private Descriptor (Note: AXMEDIS client must know how to gather the metadata from the stream. This may be 'looked up' using DVB EventID and other data from DVB-SI EIT)

43. Assembly of transport stream by Broadcast Head End for streaming over Wire through DVBT card (unencrypted, no CAS will be used)

IP Delivery shall support

44. IP initial source server populated with objects derived from the Content Factory

45. IP initial source server content list access through web based user interface

46. Video on demand proposition on web service

47. AXMEDIS objects for P2P IP content access (Note: Responsibility of web service to connect content download and license production)

Home client shall support

48. At least minimal programme description metadata in the AXMEDIS object

49. Remote access to supplementary metadata to minimal programme description (Note: URI/CRID can be embedded in the AXMEDIS Object)

50. Broadcast and Web Server programme description metadata access for broadcast content selection (Titles etc from web service or from input broadcast card, either DVB EIT or TV-Anytime Metadata.

51. Unidirectional environment for Broadcast client in the home - possible exception for domain set up (Note: Clearly for clear text)

52. Simultaneous AXMEDIS object assembly on home client device and broadcast streaming for live content selection (Note: protection is domain specific)

53. Home viewing of content and usage conditions by user

54. REL license representation for typical FTA Broadcast stream

56. PMS client adding key to reconstituted AXMEDIS object in device from the broadcast, + domain key (Note: To achieve at least Domain binding of AXMEDIS object formed from FTA content)

55. Public service Broadcast Policy to client from broadcast (Note: Need to specify dynamic or static)

56. Client upholding Export restrictions from Domain

57. Client recognition of the FTA broadcast stream

58. Simple FTA broadcast license or signalling.

59. Client determining whether plug-in required for DRM policy is in effect

4.3   Domain technology arrangement (BBC/PKU)) as Task 12.1.2.4.

Domain shall support

60. GUI for Domain status of content and devices

61. Device binding to domain

62. Content binding to devices in a domain

63. Geographical Territory and broadcast footprint recognition (Note: Supported in REL)

64. Transfer of Content not bound to a Domain between Domains and devices

4.4   DRM Tool Management technology arrangement (ETRI)) as Task 12.1.2.5.

IPMP Tool Registration shall support

65. Authentication of User
66. GUI for user interaction
67. Issuing unique ID for IPMP Tool
68. Asking AXMEDIS Authority to sign IPMP Tool
69. Packaging IPMP Tool including binary, metadata and signature
70. Protocol for downloading IPMP Tool to Client
71. GUI for listing registered IPMP Tools
72. GUI for downloading IPMP Tool by User

IPMP Tool Manager shall support

73. Messaging protocol protection processor and IPMP Tool

4.5   Ontology Related User Requirements (sDae)

AXMEDIS Ontology shall support:

74. Describe user or agent value chain Roles

75. Describe Intellectual Property objects herein called IP Entities

76. Represent what actions can be performed on or with IP Entities.

77. Represent what actions given agents can perform on or with IP Entities.

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78. Represent relationships between IP Entities.

79. Represent the relationships between roles and actions. (e.g. an end-user is expected to play a digital representation of an IP Entity but not commercialize it).

80. Represent the transfer of rights.

81. Represent all the relevant rights

82. Represent all actions that require prior consent of the author.

83. Represent which IP Entities are required by a given Actions and which (in any) IP Entities are produced by a given Action

84. Roles and actions described by the CISAC (International Confederation of Societies of Authors and Composers and the Interested Parties Information database.

85. AXMEDIS partner businesses.

86. Represent rights commonly used in written contracts.

87. Use of the terms defined in the REL (Rights Expression Language).

88. Represent the IP Entities as described by standard identification schemes such as the ISO Standards for Musical Work Code (ISWC) or the International Standard Recording Code (ISRC).

89. Roles identified by the International Standard Party Information Code ISPI ISO Standard.

Demonstrator shall support

90. Two or more internet based clients at each partner location with each configured as a home domain.

91. AXMEDIS client displaying
    Content on the home device
    Content available from a broadcast schedule
    Content available from an internet portal

92. AXMEDIS client capturing/downloading content from the broadcast stream and represent this to the viewer, along with usage limitations.

93. User actions that cause a change in the rights conditions, e.g. obtain a license to export to another client not in the same client domain for a commercial fee.

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