



## **Automating Production of Cross Media Content for Multi-channel Distribution**

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# DE3.1.3 AXMEDIS Content Aspects Specification and Specification of Training and Demonstration

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**Abstract:**

This Document can be dichotomised into two main sections. Section one aims to describe how content aspect should be planned and developed, their constraints and related issues which needs to be taken into account, such as metadata, formats, layouts, templates and other processes involved. Section two describes the guidelines and specifications on the activities of training and demonstration for the AXMEDIS project, including public training activities such as workshops for users, decision makers and managers. This section of the report constitutes a starting point for actual work to be performed in WP7 including training on DRM rules definition, training for production of Content using the automatic tools, publication of Training materials and others. These guidelines specify work plan for the several training and demonstration activities, including model of documentations, scheduling, and others. Initial version of demonstrator will be available within the first 18 months. This Deliverable consists of two documents. This is the main document, with an accompanying document which contains all the Appendixes.

**Keyword List:**

Content, Aspect, Specification, Metadata, Formats, Layouts, Templates, Processes, Guideline, Training, Demonstrator, Demonstration, Specification

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## 1 Executive Summary and Report Scope (ILABS, UNIVLEEDS)

This Document is dichotomised into two sections. Section one describes specifications related to the Content aspects and Section two presents Specification of Training and Demonstration. The first section discusses the activities and specification related to the Content aspects for the whole project with particular focus for the first 18 months. It utilises information from the work performed in WP2 on user requirements, and from the preliminary work performed by project partners and summarised in the proposal and technical annex. The specification will take into account the general structure of the AXMEDIS framework and of the demonstrators planned in WP9.

**WP3.1.3 -- Specification of AXMEDIS Training and Demonstration** – managed by UNIVLEEDS – mainly used for preparing WP7, producing: guidelines for producing training courses, considering target people, skill and tutorial purpose; detailed schedule for the training activities, production of tutorial documents, distribution of the documentation via AXMEDIS portal and at the workshops; The training will be mainly dedicated to forming technical people for producing content by using the new tools. In this case, the training will be very simple since the usability of the tools will be very high. The training, in the first 18 months, will be dedicated to train user group experts and volunteers in using the tools for their validation and analysis. The demonstration activities will be mainly performed in the second part of the project after the 18 months. The activity of demonstration performed in this first part of the project consists of demonstrating the early results of the AXMEDIS framework WP7.1. In this WP, the guidelines for presenting the demonstrators will be stated.

**WP3.1.4 -- Specification of Content Production for test cases and validation.** This is managed by ILABS on the specification of content for test cases for research activities and for production of content (mainly used by WP8). It is designed to produce: guidelines for content identification considering the different types of production processes, integration needs and technical formats, Digital Rights Management rules and distribution channels. The guidelines will be used by WP8; Detailed schedule for collecting and producing content for test cases for research activities of WP4; Detailed schedule for collecting and producing content for validation via demonstrators of WP9 and in the framework of WP5.

The second part of the report presents the specifications and guidelines for AXMEDIS training and demonstration activities. It specifies work plan for the several training and demonstration activities, including models of documentation, scheduling, and others. This report is mainly used for the preparation of WP7. It discusses:

- the production of guidelines for producing training courses;
- the consideration of target people, what kind of skill to build;
- the purpose of the tutorials;
- the plan and schedule for the training activities;
- the production of the tutorial documentation;
- the distribution of the documentation via the AXMEDIS portal and at the workshops;

The training will be mainly focused to allow technical people to produce content using the new tools created by the project. These trainings should be straight forward since it is expected that the usability of the new tools developed by the project is very high. In the first 18 months, the training is designed to train User Group Experts and relevant volunteers to use the tools for their validation and analysis.

Demonstration activities will be mainly performed in the second part of the project, i.e. after the 18 months. The activity of demonstration performed in this first part of the project consists of demonstrating the early results of the AXMEDIS framework WP7.1. In this WP, the guidelines for presenting the demonstrators will be stated.

This Deliverable consists of two documents. This is the main document, with an accompanying document which contains all the Appendixes.

## 1.1 Responsibilities

Main responsibility of the first part of the document is managed by ILABS, who with the contribution of XIM will collect and combine contributions coming from all partners mentioned either at chapter or section level. Main responsibility of the second part of the document on Training issues is managed by UNIVLEEDS with contribution from all partners, particularly from all Demonstrators who will be working on the design and develop the training materials.

## 2 An introduction to content aspect design (ILABS, XIM, SEJER, ...)

It is a well-known fact that communication is a complex process and requires a combination of fascination, psychology and content to be really successful. Definitely content aspect plays a crucial role in this, as the same content can be totally ineffective if presented in the wrong way.

In the context of educational contents, while it is not strictly communications, the approaches that the contents are designed/created is crucial to its success in helping the people involved (teacher and the student), and therefore to the commercial success. The following sections discuss a set of issues and recommendations that would support the content authors in developing, and/or combining objects, effectively. The following sections also present a set of indication related to constraints to be taken into account during the production phase even if they do belong to the distribution issues, but can deeply impact in the effectiveness of the achieved result.

### 2.1 Effective & Efficient Content Design (ILABS, XIM, SEJER, AFI, ANSC, OD2, DIPITA ...)

Communication can be effective and attractive but it also has to be efficient especially since cost related issues are concerned. In today's world, it is not possible to afford a communication process without taking into the account of proper budgeting requirements. Production and distribution costs will have a major impact on the process and therefore each step has to be carefully planned. Achieving the balance between effectiveness and efficiency is, or can be, very complex. Creativity and innovation have a high value and often are the main assets of the authors who are able to combine them and turn them into a real communication tool.

Although it may seem obvious, a message to be received has to be clear. If this is a need in oral communication it is a must in multimedia communication. Due to production and distribution cost, a message has to be designed to be easy to understand, to be really effective, but all this has to be achieved in an efficient way. No TV channel can afford to broadcast something that is not sustainable in the long term. The same applies to books, magazines, CD, video, audio...

Consumers today are accustomed to multi-million Euro mass media productions, and as a result have increasingly high expectations of the quality and professionalism of content, irrespective of how narrow or specialised the target audience may in fact be. In parallel, consumers are also accustomed to paying little or nothing for such mass media, therefore as AXMEDIS aims to achieve, the production costs must become minimal for future content to be viable. Thirdly, content must grab and hold the attention of such consumers, who are bombarded with high-budget advertising and choices of channel.

Messages therefore must be delivered in increasingly compelling and innovative ways. Research has shown that people receive a message more effectively if it is delivered in multiple forms (visual, audio, text, interactive...)

*"A point no educational psychologist would dispute is that students learn more when information is presented in a variety of modes than when only a single mode is used. The point is supported by a research study carried out several decades ago, which concluded that students retain 10 percent of what they read, 26 percent of what they hear, 30 percent of what they see, 50 percent of what they see and hear, 70 percent of what they say, and 90 percent of what they say as they do something" [6]*

The effectiveness of communicating a message can be substantially increased by multimedia if the content is designed with this in mind, although this must be traded-off against the available budget and other design

goals and constraints, especially the capabilities of the distribution channel and client/playback device.

Good contents can often be hidden (at least partially) by a graphic layout, interface, etc.. but not at the same level. A clear example can be found in a CD Rom on Verdi operas (for obvious reason we cannot mention the publisher). Here contents are well structured, clear, easy to access, but there are also heavy and very scientific bits. This second huge and important set of contents appears less appropriate because the interface is not aligned with it. To be more specific in the criticism we can state that the interface has done conceived probably by graphic designers with not knowledge of music, musical symbols and their meaning. In this case is apparent a lack in comprehension of target audience for the specific content. For a musicologist it is apparent that musical signs have to be dealt with in a meaningful way, while for a non musicologist this aspect may be far less clear. Just to give an example, if the product is aimed to experts it cannot use the “a capo sign” or a Basso Clef to go to biography section or as a button to go to glossary, is senseless...Musically speaking, in terms of multimedia, interface and musical contents (especially if the product is dedicated to a large public) has to be aligned and they do not give contradictory messages. It is more or less the same challenging problem with contents: people who do graphic layouts has to know something about music.

In terms of audio content, the clearest form of communication to the consumer is to follow the conventions laid down by the traditional “album” or “single” formats. Although digital content need not follow such conventions, the vast majority of audio content is still recorded to fit the CD or vinyl album format. The collection of 8-12 songs totalling 45 minutes running time with a single cover artwork and sleeve notes is the format which recorded music has followed since Columbia Records developed the 12 inch 33rpm two sided vinyl disc in the late 1940s. Consumers expect to see collections of recordings in this format, with an image resembling the ‘record sleeve’ to represent the collection.

Having said this, the 45 minute album format should not be restrictive. In the future, the digital format gives artists the freedom to experiment with the release of anything from single short tracks to epics lasting several hours. The only constraint is the interest of the consumer. The digital format can be used to share ideas, rough recordings or demos produced long before final artwork is completed. Thus there can be no real hard and fast rules for constraints of the format. Given the huge amount of back catalogue which exists within the traditional constraints of “album” and “single”, it seems that these will continue to be important formats for the communication of music selections to consumers.

#### **Content selection for a production / market trend**

Nowadays, the music production process is mostly driven by the media. The role of radio networks, for example, is crucial in the artistic selection of music creations. Video clips, advertisements, and prominence in magazines, in radio and in television (not only in the Music TV networks) are all nearly essential to understand the market trends and therefore to orient the producers choices.

The increasing use of the new media, and the move to digital delivery is changing the conditions in which producers work. New aesthetic paradigms and technological development are strongly affecting both the user's demand for music and the production of music - by hopefully enriching the business opportunities. This is an important issue since new technologies are being utilised in an increasing speed, it has made digital media (e.g. music and others) much easier to copy and pass around illegally. Traditional way of producing music is being dramatically affected as it has to face the new challenge in the new digital era.

New media and distribution channels capable to generate different music business models could allow tremendous exploitations of sound recording. That's why what will be more important, is not only, where music will be sold, **but how music will be used**. The sound recording process might therefore follow also these objectives. In view of an exponential use of sound recording in multimedia market, in most case as primary part of a new compounded content (i.e. interactive games), the selection of an artistic work for recording and therefore for entering the digital market will be also driven by the new exploitation plan of that audio content. With regards to phonographic producers, we are already seeing a pronounced shift of their income from the primary sources of selling records to secondary sources of collection of rights such as those ensuing from the public exploitation of their recordings through public performance (discotheque, clubs etc), broadcast, new media and so on (neighbouring rights).

The consumption of music will continue to be a social phenomena, but certainly the social organisation of

consumption is changing in particular ways. The trend is moving towards "mass customisation" where consumers are dealt with as unique individuals with unique needs. This trend of the consumer taking more and more control into his or her own hands again underlines that music producers will mainly make his business from facilitating and expanding exploitations opportunities of the recorded music acting more likely a music publisher. This can be seen in the many new "customise your own CD"

**Some important aspect of communication in music :**

- Content emotional message
  - Level of emotional appeals based on personal feeling and on the creative aspects: artists, music style, lyrics message, song easy to “memorize” etc
- Content and audience decisions
  - Message content is a central component of communications. Communicates a number of important pieces of information to consumers
- Communication effects
  - Verify different levels of consumer response: awareness, acceptance, preference, buying intention, trial, or purchase
- Source factors
  - Source credibility
  - Source attractiveness
  - Power of the Source congruity
  - Match of source with audience – e.g. gender, age

Once a listener knows of some music - typically after hearing it on a major radio network , or reading about a new release of an artist they already like - they can usually purchase it. Still the primary means of music discovery is listening to the radio. Television, listening to friends' music and hearing music at dance clubs, cinemas and theatres are also important. Video clips, advertisements, and prominence in magazines and radio are all nearly essential for spreading communication on new music content.

Educational content is not part of the entertainment industry. It is designed to teach something, to ease the learning process, to transmit knowledge, or to be a support for a teacher in his course etc. This has a strong impact on the way such kind of content is designed. The market of educational content is divided in different part, each one with its specificities that have strong impact on the way the content is designed and conceived. Moreover, educational content is very country specific. For example, e-learning is a very different market than schoolbooks, especially in France, where there is a very strong distinction between "instructional" products (mainly schoolbooks) and "extra scholar" products (educational products to work at home, edutainment etc.). Last, but not least, educational content is targeted at specific ages and precisely designed for this age. Every year between 0 to 18 could quite be considered as a specific market inside the whole educational content market.

**Communication aspects:**

The design of any educational product has basically the same rules than the advertisement industry or any visual communication industry: choice of a set of colours representing the brand, the product, and susceptible to seduce the targeted audience; choice of a set of fonts following the same rules etc. That is: choose the main components of what will become the visual identify of the product. As it is for e.g. the press business, this is important to attract the eye on the product, to make the user feel comfortable when manipulating the book etc.

However these are not the most important part of what makes a schoolbook a commercial success. What's make a schoolbook a commercial success is its pedagogical value. Once a strong pedagogical value has been recognized to a schoolbook, this book is promised to a commercial success for many years

It is obviously not possible to define rules to produce content with a good pedagogical value. In fact, there seems to be no rule at all: the way the content is chosen, organised, presented is the work of a team of authors and editors, and can not be constrained or predicable, because their choices are the core of the school book. In terms of design and marketing, usual techniques apply, taking into account the known specificities of the audience, the main one being the fact that the teacher chooses the schoolbook for its students. Thus selling 30 books needs to seduce only one person.

**Effective communication with pre-existing materials**

Ensuring effective communication when starting from existing content requires the following factors:

- ❑ ***a clear objective for the new content*** – in order to differentiate it from the existing content. A promotional website advertising a movie must make clear both its purpose and its relationship to the film (e.g. "official site")
- ❑ ***use elements from the original content in a relevant way*** – adding value to the new content yet maintains the integrity of the original. In the case of a game or animation to promote a movie, characters, logos, designs and sounds from the original film can be carefully used to identify the new content closely with the original, but these elements must make sense to the user in their own right, either as navigational elements with a function, or as part of the design template for the new content's presentation.
- ❑ ***allow for new users unfamiliar with the existing content*** – it should not be necessary to have seen a film in order to understand the images and navigation of a movie website. Design elements, even if taken from the film, must make sense in the new content in their own right.

To further support the need for designing content in accordance to the target public, is worth taking into account as an example ANSC website: contents are very light, generic and impersonal at the surface (lets say so when referring to the home page) and become much detailed and specialized once going deeper into the site. This allows a sort of audience automatic selection. The choice to read increasingly complex content is a surfer choice and implies full awareness of the related implications. Following this rational, AXMEDIS objects could also reflect this organization of contents, especially regarding learning and edutainment activity. We could suppose to have at least 3 levels (generic user, student, professional/scholars) inside the same AXMEDIS objects (this means to have 3 different kind of presentation of the same content) which can be addressed to different public.

## **2.2 Readability ease (ILABS, XIM, SEJER, AFI, ANSC, OD2, DIPITA...)**

If a basic object to be usable has to be easy to “read” this is not enough. In this context “read” means the most generalized version of the fruition. We give for granted that is clear the distinction between see and watch, listen and hear... this is all but marginal in the development of content. There are subtleties to be taken into account in the production of objects especially multimedia ones. Usually each publisher has a sort of look and feel that is constantly expressed in own products and this has to be taken into account when combining objects. The combination of objects exploiting different styles may result in poor “readability”.

In musical field this aspect is crucial. It is matter of many essays how cultural contents about music have to be communicated. Of course it is a matter of language but also of readability ease. Multimedia concerning music for example can use 2 sensorial channels at the same time (reading a text or a graphic example while hearing music). Therefore it would be much profitable if layers of sensorial channels are considered in an AXMEDIS object and if it could be possible to set a different (or aligned) timing for opening parts so that they could be a really effective multimedia objects.

Clarity of audio is important for a scenario where consumers are listening as the main point of focus, however it can be sacrificed when consumed for the purpose of selection (i.e. Try before you buy, sample clips, etc.) it may also be necessary to sacrifice audio quality for the sake of file size on certain target platforms. For example, a mobile phone which is capable of playing audio, but does not have sufficient on board memory for the storage of audiophile quality recordings.

A mass customisation market means that you can't just take components and mix and match them to suit the preferences of individual customers unless you've designed a product architecture that will allow that. That is where the critical enabling role of modularity comes in: mass customisation requires creating content design architectures that allow plug-and-play, mix-and-match compatibility of components to configure product variations to meet specific customers' preferences.

These preferences are substantially changing the design process. Sound recording development is not only about realizing a “creative” product but is also about creating a product “architecture” which is not just a technical issue. Creating appropriate design to support new kinds of production strategies is now central to business strategies. Easy readability is the need to create product and design that are capable of providing the flexibility to customise content for users and to upgrade them when better components come along.

Another extremely relevant aspects to be taken into account is the navigation structure and hierarchies inside

the object. For example in many multimedia objects there are at least two different sets of possible navigation paths that allow the user to exploit the content. Usually there is a linear or sequential path and a hyper-textual one. In many cases there is also an additional navigation level (based on links) that allows to access to drilldowns or complementary info depending on user choice. The content related to drilldowns is often inaccessible with the ordinary navigation path but can be reached (according to user will) via cross-links.

Other relevant aspects are related to colour combinations conveying the developer brand image (colour, fonts, logos...) and the style of the communication related to the content. This latter point is often highly related to the target audience. The same content will be presented in a very different style and format if the audience is belonging to a K12 audience or to a professional one. Most of the formatting of digital content is usually achieved following a well-defined set of steps, each aimed at determining the constraints and needs, nominally:

- Target audience identification (children 3-6, K12, adult...)
- Kind of communication need required (advertisement, company communication, leisure, edutainment, formal education, informal education, personal competencies training, professional training, re-training...)
- Kind of delivery media (books, magazines, newspapers, computer, TV, radio, PDA, CD, DVD, class, blended...)
- Kind of fruition (individual, group, class, blended...)

The leading idea behind is that at each step of the previous chain of steps a refinement is applied so that the original idea is transformed into the final product. Most commercial products (unless they are simple/raw assets) are complex and built out of complex items. This does not necessarily imply that every digital asset has to be a complex one, yet at least multimedia ones tend to be. On the other side simple assets (text, images, videos and audios) are often used as starting point for the development of products that are not necessarily digital ones. Yet sometimes, at industrial level some production steps are still handled in analogue especially when the digital equivalent is still too poor (for example a photo-colour image A3 size based on a 16 ASA film has a grain resolution that is far higher than the one achievable with a digital camera).

As previously mentioned, there are some rules that can be followed to ensure readability of a content, most of them coming directly from the paper world, the other specifically for screen reading, or printing etc. Beside, there are some basic rules in ergonomics that should be followed to ensure a good usability of the final product. However, all these rules are only a basis and currently there is no known way to build automatically a readable content. There is always manual adjustment to perform, first to make the content readable, and even more to enforce the pedagogical logic of the resource. This, of course, has to be balanced with the necessity to reduce costs.

### **Design guidelines and style guides**

Many organisations possess 'brand guidelines' which can dictate exactly how the organisation's logo and associated design elements for corporate identity must appear, whether in print, on signage, in letters, on video or online. Not all guidelines take account of all possible media channels however, and among those that do, the guidelines often fail to anticipate possible applications of new media especially (such as online customer portals with interactivity where the customer can modify the content, for example). Irrespective of the coverage of an organisation's guidelines, the principles and approach of the identity must be preserved across all channels to provide a consistent message and image to customers, employees and other stakeholders.

Design guidelines extend this concept into specific product lines and brands, often inheriting the guidelines of the content owner as the starting point for the guidelines. Therefore a hierarchy can exist for design and styling, which must also maintain ease of readability at each level.

An example would be a 'microsite' website designed for a specific product launch such as a new car, which needs to convey the design/mood/styling of the car but also comply with the branding of the automotive company.

### **Tone of voice**

Part of the guidelines for a brand can include guidance on the 'tone of voice' to be used in written communications. Examples of this might be a formal, traditional tone of voice for an old, famous European

bank, while a modern internet travel company may require an informal, friendly tone of voice. While sounding subjective, this directive can help a customer to sense a strong consistency whenever they read text content from this organisation, regardless of where they are, who wrote the text, or the medium they are reading.

### **Co-branding**

Another area requiring clear design is where multiple brands (and even brand guideline hierarchies) may be applied to a single multimedia object. In this instance, the designer must apply subjective design skills to create a product which closely satisfies sometimes conflicting guidelines while at the same time maintaining ease of readability.

An example would be a DVD released by a UK DVD distributor on behalf of a European film distributor based on a Hollywood movie. The film's own branding would need to be the most prominent in the DVD menu system and packaging, but references must also be made to the styling and branding of both the film distributor and the DVD distributor without confusing the end customer.

### **Readability implications for information architecture**

An important feature of multimedia design is the co-development of actual software functionality along with the media elements. This can take the form of simple scripting or include complex modular, extensible code with remote services over the Internet. The requirement for ease of use and understandability are imperative here, as the functional elements of content should be designed with the same ergonomic principles that are applied to user interface development.

## **2.3 Understand ability ease (XIM, ILABS, AFI, ANSC, OD2, DIPITA...)**

To be effective a “message” needs more than to be perceived, it needs to be understood. In other words it is not enough to ensure that the object is easy to be read, looked at, heard... It is necessary to be easy to understand it, so that the user can recall it, and to look at it as something acquired.

In order to make a message on a music content effective the content must be designed so to offer users sorted, relevant information, enabling users to provide feedback, and to be easily adapted to the user's needs.

One vital aspect of understandability of web-based content is the need for simplicity, minimising word counts and numbers of pages and ensuring that the key message is at the top of the page to avoid requiring users to scroll before reading it. Although this issue is emphasised with web-content where users have millions of choices of content just a few clicks away, the same principle of 'KISS' (Keep It Simple Stupid) is well established in traditional media design.

It is also possible with multimedia to increase the understandability of content, which may already be clear and readable, by applying interactivity and learning techniques to develop the content from being a passive communication into an active communication. This is a very challenging activity. Especially in musical field there is a crucial point which the content producer has to take into account: the user's knowledge of music and musical grammar and syntax. Music is not metalinguistic. This means that in every product you have to decide in advance (more than in other cases) at which point (of knowledge of user) you are aiming unless you want to rewrite the treatise of harmony or solfège inside every single multimedia object. This is a special aspect of communicating music content beyond simple hearing. We are thinking to this kind of communication very carefully since years and we'd like to try some solutions available with AXMEDIS multimedia platform (for example, downloading some musical rules as helper while using a multimedia object).

In the overall we can say that for achieving compound objects of some relevance is necessary to take into account the psychology of the end user as a crucial aspect for the success or failure. If a message is unclear or conveys a distorted message rather than the intended one (simply because the wrong aspect or language or format have been used) all incurred cost will have been a waist and represent a direct damage for the company promoting/selling the content itself. This is even more relevant when content will be produced automatically by aggregation and formatting. If possible we need to define the rules (or at least a possible representation of them) that represent and embed this kind of logic so to ensure also the possibility to derive complex, structured objects via rule based composition and formatting.

## 2.4 Accessibility (ILABS, XIM, SEJER, AFI, ANSC, OD2, DIPITA...)

On a side, in the context of traditional publishing or media production, the digital world makes it easier to produce content that is accessible both in the wider sense and to different kind of people with disabilities. On the other side it is often said that people with disabilities do not represent a significant market to justify any effort of providing really accessible content; yet according to Eurostat, in year 2000, people with some degree of impairment were accounting over 40 million in the EU (well over 10% of the whole population of the time).

It has to be taken into account that, with a more general use of structured content, the constantly increasing volume of metadata associated to digital resources, and the growth in sophistication of production processes, it has become easier to produce really accessible digital resources. On some markets, it is considered as a requirement to provide accessible resource rather than “traditional” ones. This is the case in the Nederland where is mandatory to have a Braille version deposited for every newly published book. In addition, experience shows that resources that are conceived taking into account accessibility prove to have a far better quality also in their “standard” version. A truly accessible design can often enhance usability for all users. When taking into account websites this makes them also easier to be managed by automated access such as by search engines.

A key to accessibility is to allow people access content in their preferred way. This can benefit both generic users as well as those with disabilities. Some user may prefer icons and others may prefer text; even fully able people may like to adjust text sizes depending on their viewing circumstances. On the other side search engines, just like blind people, generally cannot make much use of graphics. Different contents require different degrees of concern as far as accessibility is concerned; for example: a content providing information specifically related to blindness would need to be fully accessible to blind people while content about (or a site selling) spectacles, probably, would have far less reasons to be fully accessible to totally blind users.

As far as educational content, like school books, is concerned, it is necessary to take into account that content is for now mainly text and images, therefore the first concern is to make it fully accessible also to visual impaired users. The work to do this is still at an early stage, but some basic rules do emerge and are integrated in the construction and design process.

### **Basic rules to make content accessible**

What follows is a very basic set of rules for making content more accessible to an end-user:

- **Text**
  - avoid structuring using frames or tables,
  - always provide titles, subtitles and summaries,
  - provide optional audio dubbing or description.
  - use XHTML instead of HTML to make the structure usable to translation tools (text to speech etc.)
- **Images**
  - avoid positioning using frames or tables,
  - always provide a title, a description and a caption,
  - provide an alternative text description,
  - provide optional audio dubbing or description.
- **Audio**
  - always provide titles, description and summaries,
  - provide optional subtitling or textual description in synchronous.
- **Video**
  - avoid structuring using frames or tables,
  - always provide titles, description and summaries,
  - provide optional subtitling,
  - use XHTML instead of HTML to make the structure usable to translation tools (text to speech etc.)

### 3 Content classification & formats (ILABS, XIM, SEJER, IRC)

This section provides information on the basic kind of objects that will be available for aggregation or direct fruition. The focus is on basic assets and represents a sort of quick reference for the selection process as to be able to quickly recall specific object characteristics and needs / constraints to usage. It is necessary to recall to that content should be available either for B2B or B2C usage, but the same content will have to be selected and manipulated in a different manner according to its final usage destination.

For a comprehensive table of content formats, please refer to the content classification in AXMEDIS document DE3.1.1 Guidelines and Specification of research enabling technologies.

#### 3.1 Text

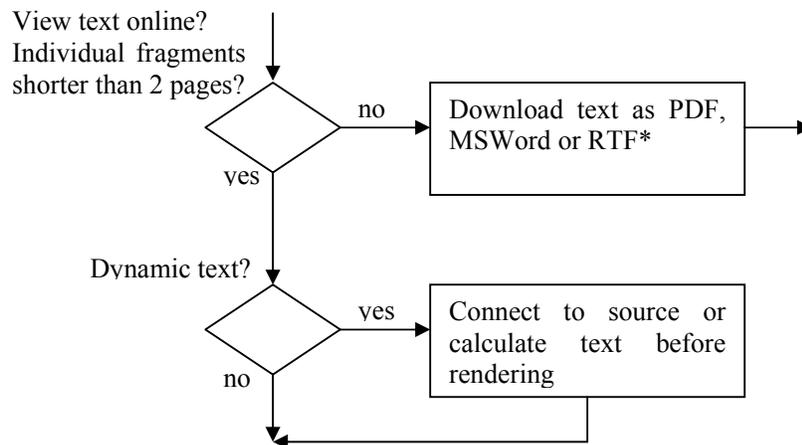
In the present section are reported basic information, constraints, suggestions and guidelines to produce high quality text content.

##### *Web-based text*

For web-based text, content can be either viewed online or downloaded as a printable document. The criteria whether to download or display online varies from producer to producer, but a de-facto standard is emerging that longer, more complex text is generally made available as a PDF and/or Word document, while shorter text should be only web-viewable, using HTML or within a media object such as Flash, QuickTime, RealMedia or WindowsMedia. Online text should be short and clear, maximum 2 pages to minimize scrolling and to allow for visually impaired users to scale font size up, etc. There are exceptions to this rule depending on the nature of the content, for example a one-page brochure might be made available as a printable PDF while a long reference document used by software developers might be published as HTML as well as PDF but broken into easy-to-browse, well indexed chapters and subsections.

Also key to online text is the concept of static (fixed) text and dynamic text, which may be generated as the result of a calculation or streamed from an information service (e.g. in RSS format). In the case of dynamic text, some form of metatags are required in order to define the location and formatting of the text to be generated within the text object. With dynamic text pages, individual text objects within a page may need to be associated with images and other page layout elements, including multiple text boxes to allow for additional text to spill into another box gracefully.

These steps are illustrated in the informal flowchart below.



\* see table below for possible formats.

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Format	Description	Usage	Constraints
PDF	Short for Portable Document Format, a file format developed by Adobe Systems. PDF captures formatting information from a variety of desktop publishing applications, making it possible to send formatted documents and have them appear on the recipient's monitor or printer as they were intended. To view a file in PDF format, you need Adobe Reader, a free application distributed by Adobe Systems.	Ideal for online documents that need to be printed in a predictable layout and formatting by the end-user, for example instruction manuals, brochures etc.	Requires plug-in, although this plug-in is now almost universally installed. Limited interactivity compared with mark-up languages. Version compatibility issues exist where content is encoded using a recent level of writer software.
DOC	Standard textual format of document produced with several word processors (actually the extension .doc is typical of MS-Word or MS-WordPad)	Editable documents, ideal for providing a template format, or for providing educational or corporate content that can be collaboratively enhanced (like this deliverable!)	Proprietary format, with limited cross-platform support; version compatibility issues can also arise, including complexities of embedded objects authored in other applications.
TXT	Standard textual format of document produced with several word processors (actually the extension .txt is typical of MS-Textpad)	Ubiquitous, almost universal human and machine readable format.	No formatting capability beyond line breaks and tabs, plain text content only.
RTF	Rich Text Format. A standard formalized by Microsoft Corporation for specifying formatting of documents. RTF files are actually ASCII files with special commands to indicate formatting information, such as fonts and margins. Other document formatting languages include the Hypertext Mark-up Language (HTML), which is used to define documents on the World Wide Web, and the Standard Generalized Mark-up Language (SGML), which is a more robust version of HTML.	Editable documents with greater cross-platform and cross-application support than DOC.	Relies upon common fonts installed, and can lose/change formatting rules from machine/word processor to machine.
HTML	Short for HyperText Mark-up Language, the authoring language used to create documents on the World Wide Web. HTML is similar to SGML, although it is not a strict subset.  HTML defines the structure and layout of a Web document by using a variety of tags and attributes. The correct structure for an HTML document starts with <HTML><HEAD>(enter here what document is about)<BODY> and ends with </BODY></HTML>. All the information you'd like to include in your Web page fits in between the <BODY> and </BODY> tags.  There are hundreds of other tags used to format and layout the information in a Web page. Tags are also used to specify hypertext links. These allow Web developers to direct users to other Web pages with only a click of the mouse on either an image or word(s).	Ideal for online pages, with full browser support. Ideal for interrelated content with inline hyperlinks. Integrated meta tags for indexing and searching.	Difficult to ensure consistent printing across platforms and browsers. Online viewing not suited to long linear documents.

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SGML	<p>Short for Standard Generalized Mark-up Language, a system for organizing and tagging elements of a document. SGML was developed and standardized by the International Organization for Standards (ISO) in 1986. SGML itself does not specify any particular formatting; rather, it specifies the rules for tagging elements. These tags can then be interpreted to format elements in different ways.</p> <p>SGML is used widely to manage large documents that are subject to frequent revisions and need to be printed in different formats. Because it is a large and complex system, it is not yet widely used on personal computers. However, the growth of Internet, and especially the World Wide Web, is creating renewed interest in SGML because the World Wide Web uses HTML, which is one way of defining and interpreting tags according to SGML rules.</p>	<p>Longstanding standard with close relationship to both HTML and XML. Used primarily for specialized applications.</p>	<p>Poor browser support, low rate of adoption.</p>
XML	<p>Short for Extensible Mark-up Language, a specification developed by the W3C. XML is a pared-down version of SGML, designed especially for Web documents. It allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.</p>	<p>Well structured tag hierarchy makes XML ideal as a machine readable content format, making it popular as the framework for creating parameter documents as well as cross-application, cross-platform content formats used for content management systems</p>	<p>Less common as a human-readable content format; XHTML (below) tends to be used for displaying content.</p>
XHTML	<p>Short for Extensible Hypertext Mark-up Language, a hybrid between HTML and XML specifically designed for Net device displays.</p> <p>XHTML is a Mark-up language written in XML; therefore, it is an XML application.</p> <p>XHTML uses three XML namespaces (used to qualify element and attributes names by associating them with namespaces identified by URI references. Namespaces prevent identically custom-named tags that may be used in different XML documents from being read the same way), which correspond to three HTML 4.0 DTDs: Strict, Transitional, and Frameset.</p> <p>XHTML Mark-up must conform to the Mark-up standards defined in a HTML DTD.</p> <p>When applied to Net devices, XHTML must go through a modularization process. This enables XHTML pages to be read by many different platforms.</p> <p>A device designer, using standard building blocks, will specify which elements are supported. Content creators will then target these building blocks--or modules.</p> <p>Because these modules conform to certain standards, XHTML's extensibility ensures that layout and presentation stay true-to-form over any platform.</p>	<p>Provides a practical mechanism to improve the rigour and hence reliability of HTML based documents.</p> <p>Improves cross-browser and cross-platform compatibility of mark-up based content.</p>	

<p>ASCII</p>	<p>American Standard Code for Information Interchange, ASCII, is a code for representing English characters as numbers, with each letter assigned a number from 0 to 127. Most computers use ASCII codes to represent text, which makes it possible to transfer data from one computer to another.</p> <p>Text files stored in ASCII format are sometimes called ASCII files. Text editors and word processors are usually capable of storing data in ASCII format, although ASCII format is not always the default storage format. Most data files, particularly if they contain numeric data, are not stored in ASCII format. Executable programs are never stored in ASCII format.</p> <p>The standard ASCII character set uses just 7 bits for each character. There are several larger character sets that use 8 bits, which gives them 128 additional characters. The extra characters are used to represent non-English characters, graphics symbols, and mathematical symbols. Several companies and organizations have proposed extensions for these 128 characters. The DOS operating system uses a superset of ASCII called extended ASCII or high ASCII. A more universal standard is the ISO Latin 1 set of characters, which is used by many operating systems, as well as Web browsers. Another set of codes that is used on large IBM computers is EBCDIC.</p>		<p>The lowest common denominator of text file formats is ASCII. There are two forms of ASCII: standard and extended. Extended ASCII is a non-standard format containing codes for 256 characters. The first (lower), 128 characters are the standard ASCII character codes. The second (upper), 128 character codes are machine dependent defined by each hardware vendor for their own platform. Transferring plain text files between different systems can present problems e.g. End of line representation on Macintosh, Unix and Dos differ.</p>
<p>UNICODE</p>	<p>A standard for representing characters as integers. Unlike ASCII, which uses 7 bits for each character, Unicode uses 16 bits, which means that it can represent more than 65,000 unique characters. This is a bit of overkill for English and Western-European languages, but it is necessary for some other languages, such as Greek, Chinese and Japanese. Many analysts believe that as the software industry becomes increasingly global, Unicode will eventually supplant ASCII as the standard character coding format.</p>	<p>Provides a framework for multi-language character set support, essential to the future of the Internet as growth in Far East users outpaces Western users.</p>	

### 3.2 Images

In the present section are reported basic information, constraints, suggestions and guidelines to produce high quality image based content. In this section particular attention will be placed on the issue of possible rendering / distribution formats, bandwidth usage and similar issues that will deeply affect the choice of the author during content production/selection so to ensure the highest possible quality of achievable results.

As a starting point it is worth comparing some basic features of some of the most used image formats for web based content, nominally JPG (JPEG), GIF (Graphic Interchange Format) and BMP (Windows bitmap) files.

- BMP images are able to present all colours details but related file size is very large comparatively and thus require a high bandwidth.
- JPG images are compressed images and are of moderate size. They are able to preserve most of the colour detail and are sufficient to be comparable to BMP images.
- The file size of GIF images is very small compared to other file formats and is best suited to narrow band environments. However the GIF images are not able to preserve all of the colour information

Samples



JPG Format



GIF Format



BMP Format

Once stated this is worth examining other formats and their usage in content production process. In more details is worth noting that while constructing a web-based resource is common to use:

- PNG for images that are part of the GUI of the content (navigation, buttons, etc.). The comprehension algorithm is chosen to reduce the size of the image at the best (colour palette size etc.) Usually, only web colours are used for such images; since it's the only way to get them have the same aspect on different platforms. Therefore the number of colour used on a same product is quite small and the highest compression rate allowed with PNG can be used.
- JPG for content images. Care should be taken of not using the progressive compression algorithm of JPG, which produce files that are not recognized by some viewers (Flash player not to name it).

Source images are usually provided uncompressed or compressed with a lossless algorithm. As just stated, for online projects, JPG is used for photographic images or images with soft graduation of colour or brightness, while GIF for solid coloured images with high contrast such as logos, coloured bars, etc, and Flash (SWF) images for vector-based shapes where either some scaling, animation or scripting (such as navigation) is required. It is also common to make use of the ability to colour HTML elements such as table cells and <DIV> layers extensively for solid colours in order to simplify repurposing and editing designs, as only HTML editing is then required. All online images are rendered to an output resolution of 72DPI.

Examples of images and formats selected are shown in the table below. More detailed description of these formats is provided in the table on the following pages.

JPG	GIF	SWF
		
Photo image, soft graduation between colours and intensity.	Solid colours, no graduation needed	Vector image, scaleable. Compact (this image is just 800 bytes).

In order to generate these formats, we work with very high resolution Photoshop or tiff format source bitmaps and Adobe Illustrator vector source files, only cropping and compressing to the target format once the design, layout and image size are defined. It is vital for end product quality not to work with already compressed images, unless uncompressed versions are not available (for example, in the case of images pre-compressed by a digital camera).

For projects also requiring printed output, the high resolution bitmap (.PSD/.TIF) or native vector formats (mainly .AI from Illustrator, or .EPS postscript) are also used to render 200-300dpi output.

For video and DVD production work, 72DPI resolution is used, with PAL standard (720x576) and widescreen (1024x576) image sizes used. Limitations on supported formats for DVD mean that JPG compression is used for still images even where GIF would have been more suitable (e.g. high contrast / solid shapes).

Format	Description	Usage	Constraints
JPEG	Short for Joint Photographic Experts Group, the original name of the committee that wrote the standard. JPG is one of the image file formats supported on the Web. JPG is a lossy compression technique that is designed to compress colour and greyscale continuous-tone images. Although it can reduce files sizes to about 5% of their normal size, some detail is lost in the compression. The information that is discarded in the compression is information that the human eye cannot detect. JPG images support 16 million colours and are best suited for photographs and complex graphics. The user typically has to compromise on either the quality of the image or the size of the file.	<p>Ideal for photographic and soft contrast images, to be viewed on screen especially where small file sizes are beneficial (web, interactive TV, mobile phone. Etc).</p> <p>Usually in archive / library environments is adopted the following rule of thumb:</p> <ul style="list-style-type: none"> <li>• 300 dpi for intranet</li> <li>• 72 dpi for Web</li> </ul>	JPG does not work well on line drawings, lettering or simple graphics because there is not a lot of the image that can be thrown out in the lossy process, so the image loses clarity and sharpness. Artefacts of compression look especially poor in printed form, so high-compression rate JPEG files are not recommended where printed output is required.

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GIF	Short for Graphics Interchange Format, another of the graphics formats supported by the Web. Unlike JPG, the GIF format is a lossless compression technique and it supports only 256 colours. The compression algorithm used in the GIF format is owned by Unisys, and companies that use the algorithm are supposed to license the use from Unisys (Unisys announced in 1995 that it would require people to pay licensing fees in order to use GIF. This does not mean that anyone who creates or uses a GIF image has to pay for it. Authors writing programs that output GIF images are subject to licensing fees.)	GIF is better than JPG for images with only a few distinct colours, such as line drawings, black and white images and small text that is only a few pixels high. With an animation editor, GIF images can be put together for animated images. GIF also supports transparency, where the background colour can be set to transparent in order to let the colour on the underlying page to show through.	GIF is less efficient than JPEG at compressing images with larger numbers of colours or brightness levels.
PNG	Short for Portable Network Graphics, the third graphics standard supported by the Web (though not supported by all browsers). PNG was developed as a patent-free answer to the GIF format but is also an improvement on the GIF technique. An image in a lossless PNG file can be 5%-25% more compressed than a GIF file of the same image. PNG builds on the idea of transparency in GIF images and allows the control of the degree of transparency, known as opacity. Saving, restoring and re-saving a PNG image will not degrade its quality. PNG does not support animation like GIF does.  <a href="http://www.ietf.org/rfc/rfc2083.txt?number=2083">http://www.ietf.org/rfc/rfc2083.txt?number=2083</a>	Suitable for similar applications to GIF files.	Some browser support limitations
TIF	Acronym for tagged image file format, one of the most widely supported file formats for storing bit-mapped images on personal computers (both PCs and Macintosh computers). Other popular formats are BMP and PCX.  TIFF graphics can be any resolution, and they can be black and white, grey-scaled, or colour. Files in TIFF format often end with a .tif extension. TIF files allow for additional channels beyond RGB, sometimes called alpha channels, to support transparency.	Important as a file exchange medium in production workflow.  Usually in archive / library environments is adopted the following rule of thumb: <ul style="list-style-type: none"> <li>• 600 dpi for conservative images (up to A4) off line</li> <li>• 400 dpi for conservative images (over A4) off line</li> </ul>	Not optimized for compressed online viewing. More suited to content production, (especially image scanning, digital photography and editing applications) than to content distribution.  Please take into account the difference between PCs and MAC when saving the TIFF files
TGA	A photorealistic graphics file format designed for systems with a Truevision display adapter. Targa format developed by Truevision; usually 15 or 24 bit full colour images, compressed or uncompressed; maximum colours = 16.7 millions.  The real name for this format is just plain "TGA" or "Truevision File Format", but a lot of people call it "Targa", after the Truevision video card that first used it. There's a lot of this name confusion in image file formats. It supports 1 to 32 bit images and professional features like an alpha (mask) channel, gamma settings and a built-in thumbnail image.  TARGA image file format; this commonly has a .tga or .TGA ending.  FrontPage can import TGA files.	Image scanning and editing.	More widely supported by Windows applications than by other platforms due in part to its graphics card roots.
BMP	The standard bit-mapped graphics format used in the Windows environment. By convention, graphics files in the BMP format end with a .BMP extension. BMP files store graphics in a format called device-independent bitmap (DIB).	Ideal for uncompressed image file exchange, especially between Windows applications.	More widely supported by Windows applications than by other platforms.

DIB	Short for device-independent bitmap, the bit-mapped graphics format used by Windows. Graphics stored in DIB format generally end with a .bmp extension. It's called device-independent because colours are represented in a format independent of the final output device. When a DIB image is output (to a monitor or printer), the device driver translates the DIB colours into actual colours that the output device can display.	Ideal for uncompressed image file exchange, especially between Windows applications.	More widely supported by Windows applications than by other platforms.
PCX	Originally developed by ZSOFT for its PC Paintbrush program, PCX is a graphics file format for graphics programs running on PCs. It is supported by most optical scanners, fax programs, and desktop publishing systems. Files in the PCX format end with a ".pcx" (pronounced dot -p-c-x) extension. Two other common bit map formats are BMP and TIFF.	Ideal for uncompressed image file exchange, especially between Windows applications.	More widely supported by Windows applications than by other platforms.
AI	Adobe Illustrator format. Used for vector graphics.	Used for exchange of vector format graphics.	Primarily Mac-based format, with growing Windows platform support.
SWF	Macromedia Flash format. Although primarily used for animation and interaction, SWF files can be used for highly optimised still images based on vectors. They also have the advantage of being resizable (scaleable) without degrading image quality.	Ideal for highly compressed vector graphics, especially where scaling of images to suit display sizes may be required.	Requires Flash plug-in support in browser or on device, although Flash is gaining wide adoption, including mobile phones, set top boxes and even in-car entertainment systems.
SVG	Scaleable Vector Graphics. An open format developed by Adobe, but not frequently deployed on the web.	Similar benefits to SWF	Low level of adoption.
EPS	Encapsulated Postscript. Designed as a portable image file format that can include text layout, fonts, images, vector graphics, etc. Well supported as an import/export format by graphics and image editing tools.	Cross-platform/cross-application exchange format.	Somewhat redundant with the growth of PDF, although still offers greater editability.  Please take into account the difference between EPS preview for PCs and MAC
PSD	Photoshop format. Proprietary image editing file format native to the cross-platform image editing tool of the same name. Widely used across the graphics industry for print, web and television design, so has become an important image exchange format between designers.	Cross-platform/cross-application exchange format for bitmap editing.	Proprietary format.

### 3.3 Audio

In the present section are reported basic information, constraints, suggestions and guidelines to produce high quality audio based content. In this section particular attention will be placed on the issue of possible rendering / distribution formats, bandwidth usage and similar issues that will deeply affect the choice of the author during content production/selection so to ensure the highest possible quality of achievable results.

When taking into account the usual production process of audio content at origin is easy to realise that normally are used CDA formats for direct input from the audio CD. Typically, for a track of 5 minutes the file size is roughly about 50 Mb. This provides a high quality sound with all the sound effects (e.g. Dolby, 5.1 surround sound) preserved in it. This file format is not suitable for narrow band applications while instead it is convenient to use RM (real media) formats for listening to online streamed audio. On the other side this format is not able to preserve the sound effects but the file sizes are roughly 8-9 times smaller than CDA format. moreover a proprietary player (real media player) is needed to play such files. The other typically used format is MP3 which can provide good sound quality comparable to audio CDs with file sizes up to 10 times less. This file format is best suited for online music applications as it uses less bandwidth but provides near-CD quality sounds. Occasionally WMA files are used.

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To be able to ensure playability on any platform, without requiring much additional software installation from the user, Falshplayer is often used to play audio. The input audio format for flash is MP3. it is often possible to note that MP3 is used at different bit rate (depending on the original bit rate) but good practices suggest never to use VBR encoding.

As source files, is either used AIF or WAV format for uncompressed PCM audio. Ideally sampled at 44.1Khz to avoid the need to resample (and hence degrade audio quality). Otherwise, a higher sample rate is preferred (usually 96KHz or increasingly, 192KHz). Source word lengths are either 24bit or 16bit linear. Just as with images, it is essential to start with the best possible quality source audio in order to maximise compression amounts and retain a good quality output format. Recordings need to be low noise, without distortion or glitches, as any such imperfections tend to be emphasised in lossy compression algorithms.

If the source audio is of poor quality, is often common to apply audio noise gates, some modest EQ and limiting/compression to an audio file before applying lossy compression such as MP3, as this can help to improve clarity.

Target output audio is usually compressed to MP3 for our online projects, in stereo, usually to 128KBPS for music or less for narrative or sound effects (some games sound effects can be compressed as low as 16KBPS in MP3 format and still sound acceptable, helping to reduce overall download time and enhance game performance on low-speed clients).

While most work requires stereo or mono audio, some DVD work involves surround format, for which is required to exploit Dolby Digital 5.1, which is an efficient format with readily available compression software. When editing source material for this format, is necessary to work with either 6xmono or 3xstereo PCM audio files in AIF or WAV format.

Although MP3 is still the most commonly used lossy compressed audio format online, there are evidences of benefits of adoption of the AAC/MP4 format and the WindowsMedia9 WMA format when specified for some well designed client project. Real Audio is another popular online format, which is tangentially more regularly offered as an option alongside WMA and MP3 online to maximise the ability for users to hear content.

In some context (like the one represented by ANSC) archive digitization is being performed using WAVE file with different sampling rate depending on the original media for conservative storage: 16 bit 44Khz if the recording is taken from DAT or CD. 24 or 48 bit 96Khz if the recording is taken from original analogue tape. While for intranet use is planned the adoption of MP3 streaming at 128 Kbps. This should give enough quality to the listener (both of our oral traditional music archive and classical concerts).

OD2 and parent company Loudeye encode and store lossless WAV files either ripped from CD or supplied directly from the label masters. For PC download 128Kbps / 192Kbps WMA v9 fixed bit rate is used. For streaming, 128Kbps / 64KBps / 32Kbps WMA v9 have been used, depending on the bandwidth available to the consumer. Formats are currently being developed for over the air mobile delivery. For discovery (30 second clips) 32Kbps has always been adequate.

Note that the actual bit rate used for each purpose is often subject to contractual agreement with record labels.

All these are examples of successful initiative representing also a best practical case.

<b>Format</b>	<b>Description</b>	<b>Usage</b>	<b>Constraints</b>
WAV	The format for storing sound in files developed jointly by Microsoft and IBM. Support for WAV files was built into Windows 95 making it the de facto standard for sound on PCs. WAV sound files end with a .wav extension and can be played by nearly all Windows applications that support sound.	Exchange format for media production	Large file sizes. Windows-centric.

MP3	<p>The name of the file extension and also the name of the type of file for MPEG, audio layer 3. Layer 3 is one of three coding schemes (layer 1, layer 2 and layer 3) for the compression of audio signals. Layer 3 uses perceptual audio coding and psychoacoustic compression to remove all superfluous information (more specifically, the redundant and irrelevant parts of a sound signal. The stuff the human ear doesn't hear anyway). It also adds a MDCT (Modified Discrete Cosine Transform) that implements a filter bank, increasing the frequency resolution 18 times higher than that of layer 2.</p> <p>The result in real terms is layer 3 shrinks the original sound data from a CD (with a bit rate of 1411.2 kilobits per one second of stereo music) by a factor of 12 (down to 112-128kbps) without sacrificing sound quality. Because MP3 files are small, they can easily be transferred across the Internet.</p>	Popular consumer download format. Efficient lossy compression algorithm, although less effective than newer algorithms. Widespread support.	
AIF	<p>Short for Audio Interchange File Format, a common format for storing and transmitting sampled sound. The format was developed by Apple Computer and is the standard audio format for Macintosh computers. It is also used by Silicon Graphics Incorporated (SGI).</p> <p>AIFF files generally end with a .AIF or .IEF extension.</p> <p>The AIFF format does not support data compression so AIFF files tend to be large. However, there is another format called AIFF-Compressed (AIFF-C or AIFC) that supports compression ratios as high as 6:1.</p>	Exchange format for media production	Large file sizes. Mac-centric.
PCM	<p>Short for pulse code modulation, a sampling technique for digitizing analogue signals, especially audio signals. PCM samples the signal thousands of times a second; each sample is represented by 8, 16 or 24 bits. There are two standards for coding the sample level. The Mu-Law standard is used in North America and Japan while the A-Law standard is use in most other countries.</p> <p>PCM is used with T-1 and T-3 carrier systems. These carrier systems combine the PCM signals from many lines and transmit them over a single cable or other medium.</p> <p>PCM is also the modulation technique used for CD audio and WAV and AIF files. It is popular as a format because it does not compress the signal, so the only distortion arises from the digitizing process (A-D and D-A conversion). Any loss of quality is a function of the sample rate and word length, therefore the greater these two parameters are, the more information about the analogue signal is captured.</p>		
RealAudio	<p>RealAudio provides high audio quality at a broad range of the bit rate spectrum, with its ability to scale from 12 - 800 Kbps.</p> <p>For low to mid bit rate files (&lt; 128 Kbps), RealAudio deploys advanced audio compression techniques dividing original data from the audio spectrum into distinct frequency bands, bands which are imperceptible by the human ear are discarded, resulting in a decreased file size with virtually no degradation.</p> <p>At higher bit rates (&gt; 128 Kbps - typically suited for download or high bandwidth networks), RealAudio incorporates the MPEG-4 AAC codec.</p> <p>RealAudio Multichannel enables more than two discrete channels, including the commonly configured 5 or 6 channel (5.1 channel audio)</p> <p>Delivers full surround sound experience: left, right, left-surround, right-surround, front-center, and low frequency sub-woofer</p>	Popular consumer download format.	Proprietary format, requires proprietary player.

### 3.4 Video

In the present section are reported basic information, constraints, suggestions and guidelines to produce high quality video based content. In this section particular attention will be placed on the issue of possible rendering / distribution formats, bandwidth usage and similar issues that will deeply affect the choice of the author during content production/selection so to ensure the highest possible quality of achievable results.

Some of the most used video file formats are AVI, MPEG, MOV, RM and DAT. Normally the DVDs are able to preserve all the details for the video and the audio and provide high quality images and sounds for watching and listening respectively. However the file sizes of DVD movies are very large and hence require a very high bandwidth for online delivery. Moreover AVI file formats are able to give a good quality video and audio for a moderate file size and can be used for online delivery compared to other file formats. MPG (MPEG) videos can be of varying quality based on the degree of compression applied to them. MOV video files are comparatively small in size but the quality of the video is not good. It requires the proprietary Quick

Time player for playing, which is available for free download. RM files formats are the proprietary Real Media files which are normally available for online streaming videos. They require the proprietary Real Player for playing. The DAT file formats are those found in traditional video CDs. They are of moderate size and are able to provide good quality videos. However sound effects may not be encoded with this format.

As for audio, is often common to use Flash to play video inside content, for the same reasons mentioned before: portability and ease of installation. The encoding format is Flash for Video (FLV) file format. FLV files contain encoded audio and video data that is highly optimized (through the use of Sorenson's Spark codec) for delivery through the Flash Player. Edited video content is encoded into the FLV format as it is imported into the Flash authoring environment (or encoded into FLV format from third party applications via the Flash Video Exporter plug-in). Once imported into the Flash authoring environment, FLV files can be converted to movie clips and can benefit from all of the programmatic manipulations ActionScript has to offer, or exported back out as standalone FLV files that can be invoked and streamed by the Flash player.

Before starting a video-based project, is necessary to agree the target audience and communication goals with the commissioning client. This can radically affect the choice of development format, target medium/download formats to support, and of course budget. Defining the target audience helps to determine whether the output needs to be optimised for high-speed LAN (in the case of a corporate intranet, for example), broadband, dial-up, windows-centric or cross-platform etc.

In many cases filming is carried out in miniDV format, which is transferred onto hard disk via Firewire for editing in native DV format. When this is the case it is also other adopted a QuickTime's DV codec for processing, content is not re-compressed more than necessary, and any titling or effects are simply rendered to DV format to be added to the original. In the case of movie trailers, work is usually commissioned to specialised companies that will then print a 35mm film version that can be digitised at maximum quality.

Once a production has been edited for online content, is common to prepare and optimise the file by careful final editing including adjustment of compression parameters. Usually a number of compression tests iterations are required before achieving desired balance in quality and dimension for target video files (the actual files to be deployed). Actions such as cropping an unwanted moving background or noise around the edges from a video sequence, or increasing contrast can reduce the target file size by 20% without losing any quality in the content. In the case of film-originated content, a further step is required to remove "pull-down" artefacts, which occur because the film original frame rate was 24 fps whereas the digital video is 25 fps for PAL. Ideally, the final target video for the web should also be at 24 fps.

Once the files are ready and parameter optimised, is usual to compress the final file(s) down to a set of target formats to allow maximum browser/player compatibility for the target audience. These formats are typically devised for a large audience:

- Large QuickTime file (progressive download) 10-50Mb
- Small QuickTime file (progressive download) 1-5Mb
- Real Media stream
- Large Windows Media file (progressive download) 10-50Mb
- Small Windows Media file (progressive download) 1-5Mb

This compression operation is carried out using Discreet Media Cleaner Pro which can work in batch mode to generate a series of target files from a single source.

Compression and preparation for other channels (like Digital TV, DVD, CD-ROM...) follow similar stages, in each case starting with the best available source content and optimising the compression according to the channel's constraints and capabilities.

As well as the technical process, there are other important factors affecting quality and acceptance of the project by involved people: clients/content commissioners, people in charge of budget and expected quality level, consumer (who typically has high expectations based on mass media experience with multi-million dollar websites, games and movies). Film company clients expect very high quality web compression for movie trailers, and therefore the whole process result must be approved before a site can go live.

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Format	Description	Usage	Constraints
AVI	<p>Short for Audio Video Interleave, the file format for Microsoft's Video for Windows standard.</p> <p>A format developed by Microsoft Corporation for storing video and audio information. Files in this format have a .AVI extension. AVI files are limited to 320 x 240 resolution, and 30 frames per second, neither of which is adequate for full-screen, full-motion video. However, Video for Windows does not require any special hardware, making it the lowest common denominator for multimedia applications. Many multimedia producers use this format because it allows them to sell their products to the largest base of users.</p> <p>Video for Windows supports several data compression techniques, including RLE, Indeo, and Cinepak. A competing software-only video format is QuickTime.</p>	<p>Low-end video players, supported by older PCs.</p>	<p>Limited quality, size and performance. Windows-centric.</p>
MPEG	<p>Short for Moving Picture Experts Group, and pronounced m-peg, a working group of ISO. The term also refers to the family of digital video compression standards and file formats developed by the group. MPEG generally produces better-quality video than competing formats, such as Video for Windows, Indeo and QuickTime. MPEG files can be decoded by special hardware or by software.</p> <p>MPEG achieves high compression rate by storing only the changes from one frame to another, instead of each entire frame. The video information is then encoded using a technique called DCT. MPEG uses a type of lossy compression, since some data is removed. But the diminishment of data is generally imperceptible to the human eye.</p> <p>There are three major MPEG standards: MPEG-1, MPEG-2 and MPEG-4.</p> <p>The most common implementations of the MPEG-1 standard provide a video resolution of 352-by-240 at 30 frames per second (fps). This produces video quality slightly below the quality of conventional VCR videos.</p> <p>MPEG-2 offers resolutions of 720x480 and 1280x720 at 60 fps, with full CD-quality audio. This is sufficient for all the major TV standards, including NTSC, and even HDTV. MPEG-2 is used by DVD-ROMs. MPEG-2 can compress a 2 hour video into a few gigabytes. While decompressing an MPEG-2 data stream requires only modest computing power, encoding video in MPEG-2 format requires significantly more processing power.</p> <p>MPEG-4 is a graphics and video compression algorithm standard that is based on MPEG-1 and MPEG-2 and Apple QuickTime technology. Wavelet-based MPEG-4 files are smaller than JPEG or QuickTime files, so they are designed to transmit video and images over a narrower bandwidth and can mix video with text, graphics and 2-D and 3-D animation layers. MPEG-4 was standardized in October 1998 in the ISO/IEC document 14496.</p>	<p>MPEG-2 required for current DVD and digital TV (satellite, cable and terrestrial) production. MPEG-4 slowly superseding MPEG-2 in these applications, but held back by the high cost of TV head-end hardware, high volume of set top boxes that would require replacement and consumer resistance.</p>	

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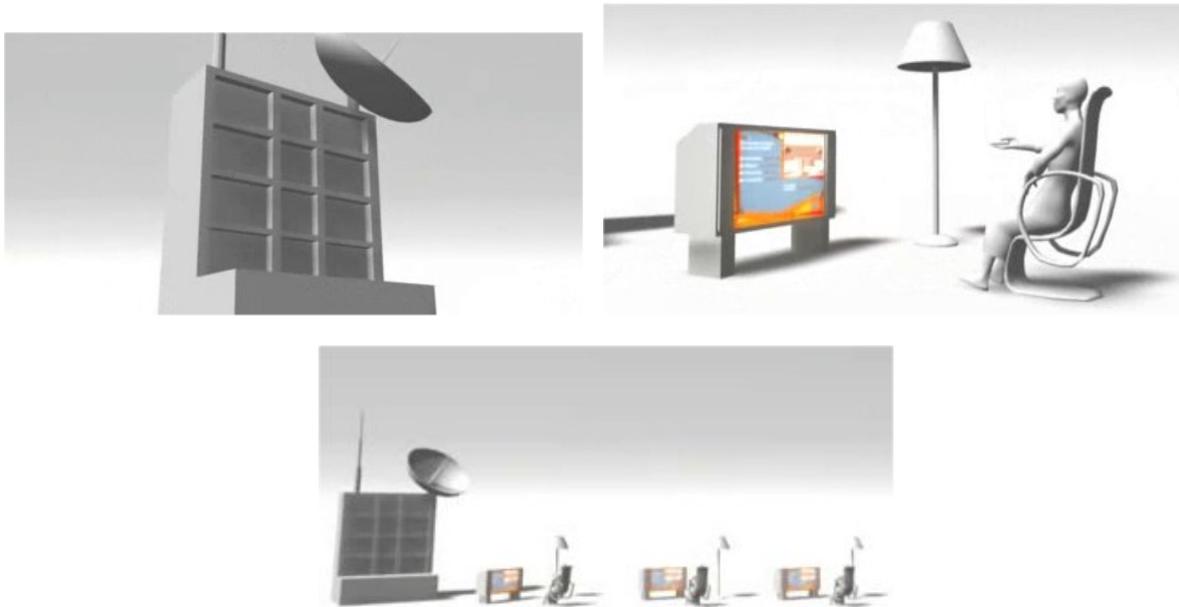
RealVideo	<p>Used for download or streaming, RealVideo delivers from dialup to HDTV. Provides compression and reduces bandwidth costs while enabling high-quality, rich media experiences. According to producer with the latest version (10) is possible to achieve the following bit rate reduction at same image quality:</p> <ul style="list-style-type: none"> <li>30% than RealVideo 9</li> <li>80% than MPEG-2</li> <li>75% than HDTV</li> <li>45% than MPEG-4 (ASP)</li> <li>30% than WMV 9</li> <li>15% than H.264</li> </ul> <p>Visual quality has been improved by reducing distracting visual distortions (artefacts) while all previous encoding modes are supported (Constant Bitrate, Variable Bitrate, and Quality-Based Encoding). The new version employs rigorous analysis to decompose &amp; compress video content exploiting sophisticated image segmentation and motion analysis highly accurate mode decisions to improve bit efficiency and improved pixel prediction. HDTV quality video at &lt;5 Mbps Supports all HD formats and resolutions including 720p and 1080i In terms of interlaced support RealVideo 10 bitstream can carry 60 fields / second interlaced content</p> <p><a href="http://docs.real.com/docs/rn/rv10/RV10_Tech_Overview.pdf">http://docs.real.com/docs/rn/rv10/RV10_Tech_Overview.pdf</a></p>		
QuickTime	<p>A video and animation system developed by Apple Computer. QuickTime is built into the Macintosh operating system and is used by most Mac applications that include video or animation. PCs can also run files in QuickTime format, but they require a special QuickTime driver. QuickTime supports most encoding formats, including Cinepak, JPEG, and MPEG. QuickTime is competing with a number of other standards, including AVI and ActiveMovie.</p> <p>In February 1998, the ISO standards body gave QuickTime a boost by deciding to use it as the basis for the new MPEG-4 standard.</p>		
Active Movie	<p>A multimedia streaming technology developed by Microsoft. ActiveMovie is already built into the Internet Explorer browser will be part of future versions of the Windows operating system. Supporting most multimedia formats, including MPEG, ActiveMovie enables users to view multimedia content distributed over the Internet, an intranet, or CD-ROM.</p> <p>ActiveMovie's main competition is the QuickTime standard developed by Apple Computer</p>		
DVI	<p>Short for Digital Video Interactive, a now-defunct technology developed by General Electric that enables a computer to store and display moving video images like those on television. The most difficult aspect of displaying TV-like images on a computer is overcoming the fact that each frame requires an immense amount of storage. A single frame can require up to 2MB (megabytes) of storage. Televisions display 30 frames per second, which can quickly exhaust a computer's mass storage resources. It is also difficult to transfer so much data to a display screen at a rate of 30 frames per second.</p> <p>DVI overcomes these problems by using specialized processors to compress and decompress the data. DVI is a hardware -only codec (compression/decompression) technology. A competing hardware codec, which has become much more popular, is MPEG. Intel has developed a software version of the DVI algorithms, which it markets under the name Indeo.</p>		
Indeo	<p>A codec (compression/decompression technology) for computer video developed by Intel Corporation. Although it is a software -only codec, Indeo is based on the DVI, which is a hardware -only codec. Competing video standards include Cinepak and MPEG.</p>		
Cinepak	<p>A popular codec (compression/decompression technology) for computer video developed by SuperMac Inc.</p>		
FLV	<p>Flash for Video (FLV) file format. FLV files contain encoded audio and video data that is highly optimized (through the use of Sorenson's Spark codec) for delivery through the Flash Player.</p>	<p>Ideal for combining live action footage into interactive SWF applications</p>	<p>Limited to same platforms and browsers as SWF</p>

### 3.5 Animations

In the present section are reported basic information, constraints, suggestions and guidelines to produce high quality animations based content. In this section particular attention will be placed on the issue of possible rendering / distribution formats, bandwidth usage and similar issues that will deeply affect the choice of the author during content production/selection so to ensure the highest possible quality of achievable results.

The most diffused industry standard format for animations is Flash, even though for professional usage are very often used software tools like MAYA, 3D Studio Max, etc. These tools have a large foot-print, and the resultant animation files produced are also large. However such animations are of high quality and can also be in 3D virtual space.

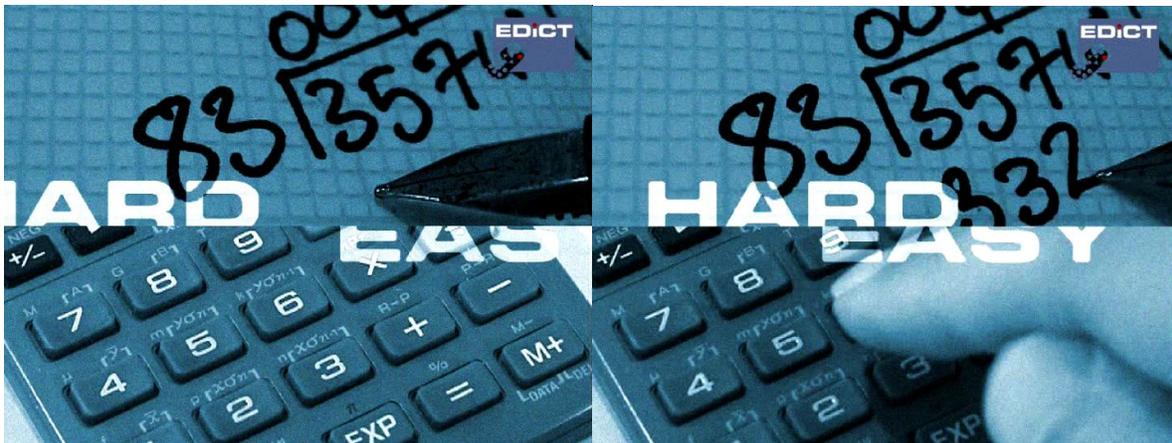
In other cases, for generating animations, is possible to use a combination of Toonz, Flash, Adobe After Effects and Maya for authoring, while creating SWF and QuickTime outputs depending on the content. Toonz is used for traditional cell-style animation, Maya for 3d rendering and Flash for 2d web-based animation. Hereafter are reported some samples:



Animation sequence created using MAYA. Published as an interactive SWF movie and as DVD (MPEG2 video)



Animation created using Flash and published as swf. Requires web access to interact with MySQL database for interactive questionnaire and scoring process.





Animation using layered video elements (filmed in DV), animated and composite using Adobe After Effects in QuickTime and rendered to MPEG-2 for DVD.

Format	Description	Usage	Constraints
Flash	<p>A bandwidth friendly and browser independent vector-graphic animation technology. As long as different browsers are equipped with the necessary plug-ins, Flash animations will look the same.</p> <p>With Flash, users can draw their own animations or import other vector-based or bitmap images, video, and audio files.</p> <p>Flash has includes comprehensive support for JavaScript scripting internally, which enables advanced front-end client software to be developed within a single SWF file.</p> <p>Flash was known as FutureSplash until 1997, when Macromedia Inc. bought the company that developed it.</p>		Requires proprietary plug-in or player.
QuickTime	<p>A video and animation system developed by Apple Computer. QuickTime is built into the Macintosh operating system and is used by most Mac applications that include video or animation. PCs can also run files in QuickTime format, but they require a special QuickTime driver. QuickTime supports most encoding formats, including Cinepak, JPEG, and MPEG.</p> <p>QuickTime is competing with a number of other standards, including AVI and ActiveMovie.</p> <p>In February 1998, the ISO standards body gave QuickTime a boost by deciding to use it as the basis for the new MPEG-4 standard.</p>		Requires proprietary plug-in or player on non-Mac platforms.

Active Movie	A multimedia streaming technology developed by Microsoft. ActiveMovie is already built into the Internet Explorer browser will be part of future versions of the Windows operating system. Supporting most multimedia formats, including MPEG, ActiveMovie enables users to view multimedia content distributed over the Internet, an intranet, or CD-ROM. ActiveMovie's main competition is the QuickTime standard developed by Apple Computer		Requires proprietary plug-in or player on non-Windows platforms.
GIF	Although often overlooked, the GIF file format can be used to perform efficient animations based on a sequence of repeating frames.	This is most commonly used for banner advertising on websites, but can be applied to other media channels also, such as interactive TV, as the GIF format can be memory efficient.	Best suited to small number of frames (e.g. less than 16) in a repeating loop. No temporal compression so file sizes multiply for each additional frame.

### 3.6 Multimedia

In the present section are presented the most relevant combination of basic content that are expected to be relevant in the AXMEDIS context. With the presented combination is possible to achieve also very complex objects as each multimedia object can be combined with an other multimedia / simple object to generate a new object.

The first point to take into account in this section is that we are dealing with multimedia to be used onto a set of different devices into a multiplatform environment comprising PDA and smart phones. This was not possible only a very little time ago. Such evolution is dramatically changing the market in terms of customer expectations and production processes. If once it was not even imaginable to develop or just even deliver multimedia content for a mobile phone, this is nowadays a reality (games, ring tones, images, backdrops, applications...). Yet at present some of the major limiting factors for the fruition of multimedia contents on devices like PDA, smart phones and mobiles are the following:

- ❑ Battery duration in relation to screen size, resolution, definition, illumination and number of supported colours
- ❑ Screen size, resolution, definition, illumination and number of supported colours
- ❑ Screen orientation (usually portrait on such devices and landscape in all others)
- ❑ Available memory storage
- ❑ Available computational capabilities of the device (particularly relevant when dealing with SW only based rendering methods)
- ❑ Easiness of usage of the device and its GUI

All those factors should be addressed as may be the one preventing a real burst in the usage of such devices. For example most software used for replacing accelerated graphic boards are demanding in terms of computational efforts, therefore it may be necessary to develop new techniques to handle this aspect. It may be desirable also to devise new methods of content production to deal with those aspects.

Another important aspect that we consider as crucial for multimedia content management and production is accessibility. As a matter of facts accessibility refers not only to impairment managing; it is also a matter of making content and all relevant data available at all levels and in this sense is strictly related to metadata.

For example for an image the essential data are not only the title and the caption but also the classification keywords and all info related to the shot (speed, shutter, focal...). In the editorial and content production environment the classification info are crucial as they are used to retrieve, use, store and process content. Similar considerations apply also to DRM info, as they are essential to enable real and profitable exploitation of digital content, therefore accessibility considerations should be applied to metadata management including DRM.

Apparently an easy solution for these constraints could be sought in aspect adaptation. For basic contents this could be achieved with some algorithms (cropping, downscaling, rotation...) while for more complex objects may require an offline editorial process to derive a specific version of the content. Therefore even if

technically adaptation is possible it has to be carefully taken into account the economical and DRM aspect of such adaptation. At present are already in place services of video streaming (mainly related to sport, news and reality-shows) but video streaming of a movie or other kind of content may be limited by the inherent copyrights acquiring cost. Yet streaming is a simpler case as the end user is accessing content on a pay per use base while a different issue is the kind of content that can be downloaded and stored on the end user device.

At present for example in the audio industry the most relevant market is the one related to the ring-tones derived by songs or soundtracks, yet this is a very different issue if compared to the fruition of high quality music. In particular for the multimedia and audio-visual content has to be taken into account also the aspect of adaptation permission from the IPR owner, this latter aspect combines with the cost that may be required for the adaptation and the technical feasibility (at least in terms of quality preservation).

Another relevant aspect to be taken into account during multimedia content development is related to style (like image, font, colour combinations, logos ...) conveying the developer brand image and the desired communication through the delivered content. As a matter of facts this latter point is often highly related to the target audience. The same content will be presented in a very different stile and format if the audience is belonging to a K12 audience or to a professional one. Moreover most of digital content formatting is usually achieved following a well-defined set of steps, each aimed at dealing with constraints and needs of the target audience, nominally:

- ❑ Target audience identification (children 3-6, K12, adult...)
- ❑ Kind of communication need required (advertisement, company communication, leisure, edutainment, formal education, informal education, personal competencies training, professional training, re-training...)
- ❑ Kind of delivery media (books, magazines, newspapers, computer, TV, radio, PDA, CD, DVD, class, blended...)
- ❑ Kind of fruition (individual, group, class, blended...)

The key idea behind is that at each step of the previous chain of steps a refinement is applied so that the original idea is transformed into the final product. Most commercial products (unless they are simple/raw assets) are complex and built out of complex items. This does not necessarily imply that every digital asset has to be a complex one, yet at lest multimedia ones tend to be.

On the other side simple assets (text, images, videos and audios) are often used as starting point for the development of products that are not necessarily digital ones. Yet sometimes, at industrial level some production steps are still handled in analogue especially when the digital equivalent is still too poor (for example a photo-colour image A3 size based on a 16 ASA film has a grain resolution that is far higher that the one achievable with a digital camera).

In the following example (based on info kindly provided by OD2) is apparent how basic content is managed to achieve a result that, even while being functionally the same, has a specific look and feel related to target audience and committing parties. In more detail we will see now how a catalogue of music hits is presented for various environments:

### MSN Music (UK)

### MyCokeMusic (UK)

<http://sib1.od2.com/common/config.asp?shop=16&associd=2>

<http://sib1.od2.com/common/config.asp?shop=50&associd=4>

From this example is quite clear that the same content is presented in a different order style according to end user preferences. This kind of information (the look and feel requested by the end user for content presentation) is extremely relevant and represents part of the business domain knowledge of the distributor. In certain environment such knowledge can even represent a relevant asset as it can represent a complete advantage in respect to other actors operating on the same market. It is quite evident that a specific content has the same relevance for both target communities while other are differently arranged (dimension and location on the page have a communication impact that is exploited to point out the content that is more relevant for the interested community) so to satisfy the overall communication criteria for which (in the western world) most relevant info are presented in the left side from top to bottom. Distributor brands are well placed in evidence and functions of customer relevance are grouped on the right side of the page.

A similar approach is reported in the following Italian samples with the same overall criteria for page layout (in publishing and functional terms) respected as in the previous case. What is apparent at first glance is that in this case there is no superposition of interests between the two different communities addressed as the most relevant asset presented differ substantially.

Tiscali Music Club (ITA)	MTV (ITA)
 <p>The screenshot shows the Tiscali Music Club website. It features a navigation bar with 'Home', 'Mio Account', 'Miei Download', 'Compro Musica', and 'Aiuto'. The main content area is divided into several sections: 'Speciale Soulwax', 'TOP TEN 2004', 'Il primo album solista', 'Gwen Stefani', 'Di nuovo insieme', 'Destiny's Child', 'La nuova hit', 'Gemelli Diversi', and 'sonic generi'. Each section displays album covers and song titles. A 'sonicselector' widget is also present, offering options to 'Sample 30"', 'Stream', or 'Download' music. The footer includes copyright information for 2004 and links to terms of service and privacy.</p>	 <p>The screenshot shows the MTV website's music section. It features a navigation bar with 'CERCA', 'Seleziona', 'VAI', 'LOGIN MTVCLUB', 'NEWS', 'MUSIC', 'TV', 'MTVCLUB', 'XTRA', 'MUSIC STORE', and 'MOBILE'. The main content area is divided into several sections: 'Prova il NUOVO sonicselector!', 'Il meglio di Britney', 'Eccellente on-line', 'album top', 'Il nuovo singolo', 'top 10 download', and 'generi'. Each section displays album covers and song titles. A 'sonicselector' widget is also present, offering options to 'Sample 30"', 'Stream', or 'Download' music. The footer includes copyright information for 2004 and links to terms of service and privacy.</p>
<p><a href="http://sib1.od2.com/common/config.asp?shop=11&amp;associd=2">http://sib1.od2.com/common/config.asp?shop=11&amp;associd=2</a></p>	<p><a href="http://sib1.od2.com/common/config.asp?shop=35&amp;associd=2">http://sib1.od2.com/common/config.asp?shop=35&amp;associd=2</a></p>

Most of the achieved result is based on proper management of metadata attached to original sources and assets that have been processed to fill in the pages. Also pages structure and functioning are described via metadata. Therefore, as already pointed out previously, we can state that in content production the most challenging part is metadata management. The user (professional or not) will be highly relying on metadata to identify, select and operate on digital assets.

This is already the habit in most editorial environments and tools, where metadata are used during the search phase, the classification and archival phase and even during the processing phase (especially as far as annotations are concerned), but it is necessary to take into account that usually professional search and classification tools place emphasis on a keyword-based approach.

This has a high impact as it is reflected both in the standards processing routine and in the professionals' habits, therefore compositional tools rules based should be able to manage metadata as one of the most relevant sources of information about an object, its "content", "history" and "processing". In the most efficient tools and work environments metadata also bear relevant info about rights and other relevant aspects related to the value chain.

In the following subsections we will briefly point out samples of possible structures for content delivery of basic compound objects. The possible set of combinations is reported hereafter in terms of table and possible relations:

<b>Media</b>	<i>Text</i>	<i>Image</i>	<i>Audio</i>	<i>Video</i>	<i>Animation</i>
<i>Text</i>		x	x	x	x
<i>Image</i>	x		x	x	x
<i>Audio</i>	x	x		x	x
<i>Video</i>	x	x	x		x
<i>Animation</i>	x	x	x	x	

A combination is defined as:

$$\{ \text{couples of media} \mid \{ (\text{couples of media combinations}) \} \}$$

The formal description used could also be adopted, in essence, to describe every other set of compound objects as this formalism allows generalising in a simple way what would otherwise require a quite long and repetitive description of all possible instances of media combination. Therefore in the rest of the document only the most common samples will be dealt with in detail as all others may be derived as combination as described through the adopted formalism.

The first thing to note prior to enter into a detailed description is the difference presently in place in terms of content rendering among a PC based client and a PDA one (especially for web-based content). In essence, when taking into account web-based content, the most relevant market share is represented by MS-Windows based operating system (both on PC and PDA); therefore we have to deal with MS-Internet Explorer. This has a direct consequence “*.css*” style sheets are not supported on PDAs; therefore a content designed with this kind of rendering management will not work properly. In case of simple distribution of content prepared by others, this aspect has to be taken into account under two aspects, nominally: rendering result and adaptation rights.

Having clearly pointed out this as an example of the device dependent constraints to be taken into account in the content production process for multiplatform delivery we can now pass to examine the various basic sets of compound objects. Given the fact that usually text is used in almost every content (under one form or the other) we will refer to it as the basic content (text can comprise music notation or any other form of description like formal logic [12], [14], time notation [13]...) what just stated applies also to non web based content as it could be the case of TV / CD / DVD / iTV based content.

### 3.6.1 Text + (Image | Audio | Video | Animation)

This is definitely the simplest form of compound object. Basically almost every web based page falls under this description, even if the page can host multiple instances of the basic set. Moreover this kind of object can be generalised according to the following definition:

$$\{ \text{text} \wedge \{ (\text{image} \mid \text{audio} \mid \text{video} \mid \text{animation}) \} \}$$

### 3.6.2 Text + Image + (Audio | Video | Animation)

The level of complexity of this compound object is just a little above the one of the previous one. Most of the structure may be static (text and image) but the dynamic part of it may have several different way to be managed. For example audio may be launched automatically as soon as the overall object is loaded or only after direct user intervention. Audio can be simply the “reading of proposed text” or a background audio or a complementary one (like a narration) that will be used by the end-user as the primary guide to content (it can represent instruction for content usage...). Using the previously adopted formalism the generalised form of this object can be described as:

$$\{ \text{text} \wedge (\text{image} \mid \text{audio} \mid \text{video} \mid \text{animation}) \wedge \{ (\text{image} \mid \text{audio} \mid \text{video} \mid \text{animation}) \} \}$$

What follows are just a couple of examples of web based content where components are highlighted. In more detail the first example is the one for which full content description (packaging, page format, style sheet ...) are provided as reference in this document. The other is directly taken from the development environment

and represents a different kind of content where single components are more evident than in this case where the image refers to a spreadsheet table and therefore resembles more a text than a real image. It is worth noting that there are also image based portion of the content that are only functional to usage (like the navigation bar at the bottom right of this page).

**Introduction to Spreadsheets**  
Changing Data in a Spreadsheet

	A	B	C	D	E
1	<b>EXAM RESULTS</b>				
2					
3		<b>JANUARY</b>	<b>FEBRUARY</b>	<b>MARCH</b>	
4	CLAIT	32	45	55	
5	CLAIT PLUS	44	29	21	
6	ECDL	25	36	43	
7					
8					

**HOW WOULD I MAKE TEXT IN A SPREADSHEET LOOK DIFFERENT?**  
You can change the look of text in a spreadsheet by:

- Using bold
- Using underline
- Using italics
- Changing the font (shape and size of the letters)
- Centring the text within the cell
- Aligning the text to the right of the cell

This is called formatting a cell

**NAVIGATION AREA**

A sample web-based content page compliant to this kind of format

eXact Package - EMUSE-040510 - [Discus04 [KL\_En\_Pagetext\_image4.html] - Layout Editor]

**Learning Objects:**

- Discus01 [KL\_En\_Pagetext\_image1.Mal]
- Discus02 [KL\_En\_Pagetext\_image2.Mal]
- Discus03 [KL\_En\_Pagetext\_image3.Mal]
- Discus04 [KL\_En\_Pagetext\_image4.Mal]
- Discus05 [KL\_En\_Pagetext\_image5.Mal]
- Discus06 [KL\_En\_Pagetext\_image6.Mal]
- Discus07 [KL\_En\_Pagetext\_image7.Mal]
- Discus08 [KL\_En\_Pagetext\_image8.Mal]
- Discus09 [KL\_En\_Pagetext\_image9.Mal]
- Javelin01 [KL\_En\_Pagetext\_image10.Mal]

**Manifest (E-MUSE-040510)**

- 1. Discus01
- 2. Discus02
- 3. Discus03
- 4. Discus04
- 5. Discus05
- 6. Discus06
- 7. Discus07
- 8. Discus08
- 9. Discus09
- 10. Javelin01
- 11. Javelin02
- 12. Javelin03
- 13. Javelin04

**The discus-thrower**

The natural movements of the discus-thrower have not changed significantly since antiquity. As a matter of fact, their technique was very similar to the present day technique of free style throw. The athlete, in order to make a good throw, should hold the discus high with one hand and support it with the other. Then, he brought it downwards and to the front or sideways and to the front. This movement utilised the muscles of the shoulders, the chest and the sides of his upper body. Discus-throwing demanded rhythm, precision and strength. Contrary to the mythological references, there was no information regarding accidents during the games, since the spectators sat on embankments. Famous discus-throwers were Phaylus from the city of Croton, who is said to have thrown his discus at 20,10 meters, and one

A sample web-based content page compliant to this kind of format

### 3.6.3 Text + Image + Audio + (Video | Animation)

The level of complexity of this compound object is still limited, yet there is already a good degree of complexity to be handled. Only part of the structure will be static (text + image) while, once again, the dynamic part of it may have several different way to be managed. Just like in the previous example audio may be launched automatically as soon as the overall object is loaded or only after direct user intervention, but the video, or animation, can embed audio too, therefore it will be necessary to take into account content intelligibility. Using the previously adopted formalism the generalised form of this object can be described as:

$$\{ \text{text} \wedge (\text{image} | \text{audio} | \text{video} | \text{animation}) \wedge \\ (\text{image} | \text{audio} | \text{video} | \text{animation}) \wedge \\ \{ (\text{image} | \text{audio} | \text{video} | \text{animation}) \} \}$$

### 3.6.4 Multimedia and Music Notation

The purpose of this section is to present two straightforward application scenarios that introduce Music Notation technology integrated with existing MPEG-4 and possibly MPEG-7 technology. These two application scenarios are useful first to exemplify to the MPEG and Music Notation communities two simple cases where Music Notation and other multimedia object types are integrated resulting in mutual added value; secondly, these scenarios can be useful to better understand and consequently refine the definition of the requirements in order to possibly approach a call for technology as a next step.

The first section of this document introduces a scenario related with interactive multimedia content distribution for an “enhanced karaoke” application; the second section introduces a slightly more complex example (at least in terms of music notation functionality) related with music education and interactive courseware. Of course many other application scenarios could be presented, following the template of this document.

#### Scenario 1. “Enhanced” karaoke

In this scenario, the purpose is conveying to the user a set of multimedia objects so that he may be allowed to interact with this content by selecting or stopping part of it and replace the stopped components by local performances. Since karaoke is a successful application only dealing with audio and lyrics, we call this application “enhanced karaoke”, since it also involves musical instruments other than voice, and it also involves more interaction with the end-users.

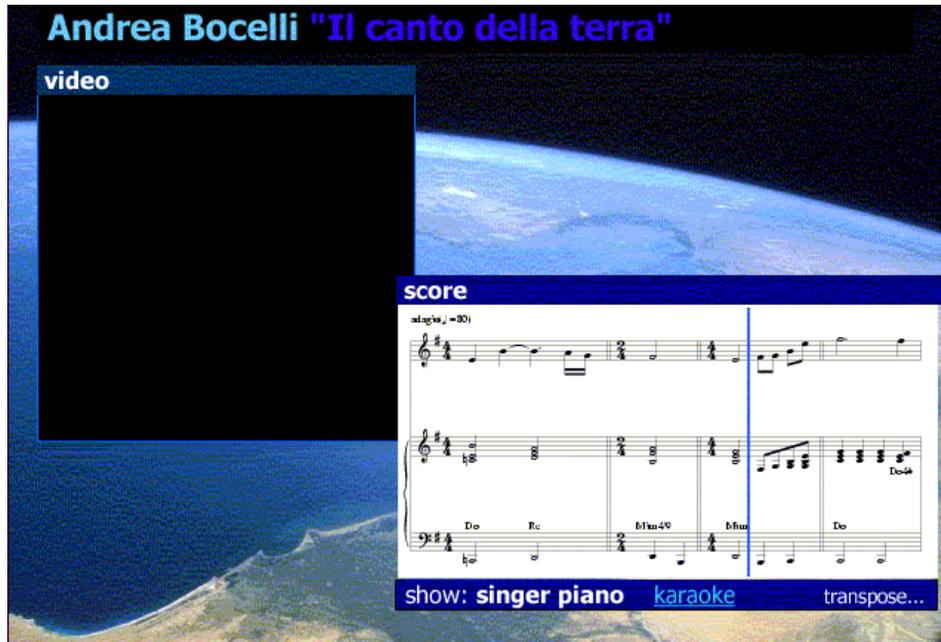
#### *Involved objects and content*

In this scenario, several objects are involved in relationship to one song. For what concerns audio, three stereo AAC objects may be used to encode the singer’s voice, a guitar and piano; a fourth object, e.g. an SA object, is used to synthesize in real-time the bass through access units carrying non time-stamped SASL commands (so the decoding time stamp of the access unit is used to synchronize the events). Four other main objects are present, a video accompanying the song (the video may report the scene of the opera or the simple clip of the song), a text containing lyrics, music notation content and a scene description including graphic shapes acting as selection buttons and interaction sensors and routings.

#### *Scene description and interaction*

The scene description allows the display of the accompanying video (e.g. a singer), and it contains some icons to be used for the selection of the different instruments and voices and of the text. By default all the AAC and SA objects are active and the text display is not active. Finally, the music notation decoder is active and displays a score with all the parts. If the user does not click on one or more of the icons, a line moves over the visualized score in synchronization with the musical

DE3.1.3 – AXMEDIS Content Aspects Specification & Specification of Training and Demonstration content. A scene mock-up with just voice and one audio track is shown in the following picture.



If the user clicks on the voice icon (“singer”, in the picture), the video is minimized and text is displayed synchronized with the music, so that a normal karaoke application is enabled. If the user clicks on one or more of the instrument icons, whatever is the state of the text display, that instrument is muted and the music notation decoder highlights (either by changing colour or by a new window) the part that has been muted, always with a line /cursor moving on it synchronously with the rest of the sounds to highlight which music notation symbol has to be played. If two or more sound parts are muted a similar behaviour occurs for all of them. Whenever the user clicks again on the corresponding icon the previous situation is restored in relationship with that particular part or text. The following picture is another mock-up of the same application scenario.



In addition, the user has a button allowing him to transpose (music transposition), since users have not always the same voice as the original singer, or dispose of an instrument slightly different

from the original, for example a tenor saxophone instead of an alto saxophone, in which case he has also to see the score part transposed. To this purpose, all music objects must be transposed (not difficult if those objects are SA ones, some processing may be required for AAC in AudioFX or different tracks may be available), and the MN object must be transposed too.

### **Scenario 2. Interactive music “tutor”**

In this scenario the purpose is having the user look for a training category in an archive of courseware and subsequently download multimedia interactive content matching the search criteria. In this case the user has the possibility to access multimedia sequences containing a required feature and interactively work with this content to learn and compare his/her ability by this content. The way in which an eventual live performance may be compared or measured against the downloaded interactive presentation (e.g. scoring) is outside the scope of the standardization and it is related to any individual application that may automate the evaluation process based on the available content. Nevertheless, a suitable model must be available to describe musical notation in a way to allow with the required precision this comparison.

#### *Involved objects and content*

In this scenario the user tool has access to a possibly wide library containing performances of music pieces for educational purposes. All the available material is annotated by suitable descriptors according to the MPEG-7 standard with additional features related to notation. The available material is encoded in multimedia files composed by several objects each. Concerning audio, each instrument that is supposed to have a main role in the performance is encoded as an independent audio object (e.g. AAC LC). Each of these instruments also has a close-up video recording. Audio is passing through a processing node offering the possibility to slow or accelerate the performance (factor 0.5 to 1.5) without altering the pitch. Finally music notation is available, and a scene description for content composition and user interaction is provided.

#### *Query, scene description and interaction*

The user has the possibility to query the database for the particular skill to exercise he/she is looking for. For instance chromatic scales on the violin, or staccatos on the piano, and so on. The search will provide him links to material available for download and view examples and possibly exercise the desired features.

Each scene description allows the display of the accompanying videos (close-up of the instruments), and it contains different control icons to be used -- e.g. to affect the speed of the performance or completely mute parts in the performance. By default all the AAC objects are active and the different close-up videos are available as small resolution movies (the video may show the movements of the hands of a reference player, or the gesture of the conductor to be followed, etc.). Finally, the music notation decoder is active and displays a score with all the parts. If the user does not click on one or more of the video pictures, a line moves over the visualized score in synchronization with the musical content, like in the following picture.

The screenshot displays a music software interface for W.A. Mozart's "eine kleine nachtmusik". The title "W.A. Mozart - eine kleine nachtmusik" is at the top. Below it, the "Conductor Score" is shown with five staves: Violin I, Violin II, Viola, Violoncello, and Basso. A vertical red line indicates the current playback position. A "Velocity" slider is visible at the bottom left. On the right side, there are five red rectangular buttons labeled "Violin I", "Violin II", "Viola", "Violoncello", and "Basso", which are used to magnify the selected instrument's part.

If the user clicks on the picture of the instrument he/she is interested in, the video is magnified for that instrument, the music notation is reformatted to present only the selected part and not the main score with all the parts anymore (always with a line moving on it synchronously with the rest of the sounds), the sound of that instrument is enhanced in intensity over other instruments. Other parts may also be muted or reduced in volume. The user also has the possibility to control the execution speed of the performance through suitable control icons (like sliders). In this case the sound is slowed down by an AudioFX node implementing a speed\_change effect and the music notation tool behaves accordingly maintaining synchronization with the audio. The user is also usually interested in repeating some sections, marking them and restarting from the marked point several times (sound can be buffered, but this is a feature possibly related to a non normative use of the normative file; indeed a precise synchronization between score and other media, especially sound, is a strong requirement). Whenever the user clicks again on the corresponding video the previous situation is restored in relationship with that particular part and instrument. The following pictures show another view (magnified instrument) of this scenario and a block diagram summarizing the main blocks involved.

**W.A. Mozart - eine kleine nachtmusik**

**Violin I score**

Allgemein = 148

**Violin I - video**

**Violin I**

**Violin II**

**Viola**

**Violoncello**

**Basso**

**Velocity**

**Annotations**

### *Main requirements for Music Notation*

As in the previous example, first of all it is necessary to have a flexible music notation format with its normative decoding process. This format must support all the necessary functionality to correctly display music notation information, particularly in synchronization with other media in the scene. This means, as said earlier, having a format carrying the music notation and in addition a different chunk offering the possibility to describe proper synchronization between score “events” and times. More than this, a suitable “subset” of the music notation functionality should be “visible” at the MPEG-7 description layer, in order to allow a query on relevant aspects of a score that may be worth searching for. The main requirements are:

- Production of main score and parts from the same synchronized music notation model
- Definition of sections
- Stop and play
- Accelerate and decelerate the execution rate
- Score alignment with live performance (similar to the first case)
- The MN object must be able to represent in a synthetic manner music objects. Music objects are essentially notes, but also more synthetic objects such as trills, arpeggios, portandos, and so on which should not be represented as the notes actually played, but as single objects.
- Description of musical content: it shall include all elements needed to describe music notation at a high level, including details of execution such as dynamics (staccato, pizzicato, legato, slurs, fingering, bowing...), rhythmic and meter details (tempo, rhythm, time signature...).
- Query by example: it shall be possible to select a segment of music notation to search for similar music, at the notation level.

Interaction is necessary between the user and the downloaded media. This means having the music notation decoder interfaced to the scene with one or more nodes with suitable fields able to receive necessary information to drive the decoder and at the same time delivering information from the decoder to other fields of relevance. In this second example a field is required containing on/off state for each of the parts (to be possibly routed to AudioSource nodes or to an AudioMix node for the audio object enhancement). In addition a field is necessary to control the speed of the score line

display. To summarize the main interaction requirements:

- Showing selected single part with needed visualization parameters.
- Showing main score with required visualization parameters.
- Transposing the selected parts to be played with a different instrument
- Selecting parts to be muted or reduced in volume
- Accelerating and decelerating the execution rate for the music notation
- Adding some execution annotations such as fingering, bowing etc. that are typically added to the music notation during the rehearsal and during music studying.

### 3.6.5 MPEG-4 model and capabilities (EPFL)

The MPEG-4 standard provides a set of standardized technologies to:

1. represent units of aural, visual or audiovisual content, called “media objects” (of natural or synthetic origin; that is either recorded with a camera or microphone, or generated with a computer);
2. describe the composition of objects to create compound media objects that form audiovisual scenes;
3. multiplex and synchronize the data associated with media objects, so that they can be transported over network channels providing a QoS appropriate for the nature of the specific media objects; and
4. interact with the audiovisual scene generated at the receiver’s end.

MPEG-4 audiovisual scenes are composed of several media objects, organized in a hierarchical fashion. At the leaves of the hierarchy, we find primitive media objects, such as:

- Still images (e.g. as a fixed background);
- Video objects (e.g. a talking person - without the background);
- Audio objects (e.g. the voice associated with that person, background music).

MPEG-4 standardizes a number of such primitive media objects, capable of representing both natural and synthetic content types, which can be either 2- or 3-dimensional. In addition, MPEG-4 defines the coded representation of objects such as:

- Text and graphics;
- Talking synthetic heads and associated text used to synthesize the speech and animate the head; animated bodies to go with the faces;
- Synthetic sound.

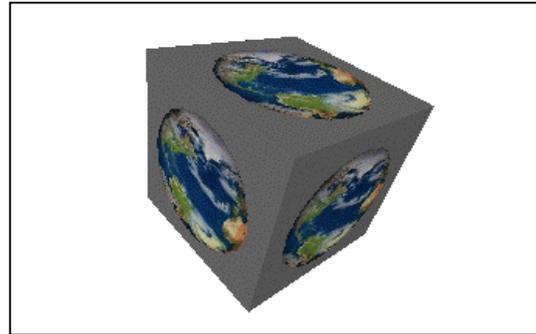
A media object, in its coded form, consists of descriptive elements that allow handling the object in an audiovisual scene as well as of associated streaming data, if needed. It is important to note that in its coded form, each media object can be represented independent of its surroundings or background. Media objects may need streaming data, which is conveyed in one or more elementary streams. An object descriptor identifies all streams associated to one media object. This allows handling hierarchically encoded data as well as the association of meta-information about the content (called ‘object content information’) and the intellectual property rights associated with it. Each stream itself is characterized by a set of descriptors for configuration information, e.g., to determine the required decoder resources and the precision of encoded timing information. Synchronization of elementary streams is achieved through time stamping of individual access units within elementary streams. The synchronization layer manages the identification of such access units and the time stamping. Independent of the media type, this layer allows identification of the type of access unit (e.g., video or audio frames, scene description commands) in elementary streams, recovery of the media object’s or scene description’s time base, and it enables synchronization among them. The syntax of this layer is configurable in a large number of ways, allowing use in a broad spectrum of systems. As far as a single media object is concerned individually (an MPEG-4 video, and MPEG-4 graphic animation, and so on), its integration and control does not differ in principle from the integration of other previous MPEG standards like MP3 or MPEG-2 Video; for instance MPEG-4 Video is used in the *divx* format, etc. At the same time, MPEG-4 provides a standardized way to describe a scene (grouping) allowing for example to construct complex scenes and to enable consumers to manipulate meaningful (sets of) objects:

- Place media objects anywhere in a given coordinate system;
- Apply transforms to change the geometrical or acoustical appearance of a media object;

### DE3.1.3 – AXMEDIS Content Aspects Specification & Specification of Training and Demonstration

- Group primitive media objects in order to form compound media objects;
- Apply streamed data to media objects, in order to modify their attributes (e.g. a sound, a moving texture belonging to an object; animation parameters driving a synthetic face);
- Change, interactively, the user’s viewing and listening points anywhere in the scene.

The scene description builds on several concepts from the Virtual Reality Modeling Language (VRML) in terms of both its structure and the functionality of object composition nodes and extends it to fully enable the above mentioned features. The following two pictures are snapshots of possible MPEG-4 based 3D scenes including visual and graphic media objects.



In general, the user observes a scene that is composed following the design of the scene’s author. Depending on the degree of freedom allowed by the author, however, the user has the possibility to interact with the scene. Operations a user may be allowed to perform include:

- Change the viewing/listening point of the scene, e.g. by navigation through a scene
- Drag objects in the scene to a different position
- Trigger a cascade of events by clicking on a specific object, e.g. starting or stopping a video stream
- Select the desired language when multiple language tracks are available

MPEG-4 standardizes the way in which a decoder/player deals with user interaction; at the same time no standard way is defined in which a conformant player can automatically expose the scene description to upper layer tools for control by external interfaces. This can be programmed by content providers if the available tools support MPEG-J, a is a programmatic system (as opposed to the parametric system offered by the first version of MPEG-4) which specifies API for interoperation of MPEG-4 media players with Java code. By combining MPEG-4 media and safe executable code, content creators may embed complex control and data processing mechanisms with their media data to intelligently manage the operation of the audio-visual session. When available, the Java application is delivered as a separate elementary stream to the MPEG-4 terminal. There it will be directed to the MPEG-J run time environment, from where the MPEG-J program will have access to the various components and data of the MPEG-4 player, in addition to the basic packages of the language (java.lang, java.io, java.util). MPEG-J specifically does *not* support downloadable decoders. For the above-mentioned reason, MPEG has defined a set of APIs with different scopes. In particular for the Scene graph API the objective is to provide access to the scene graph: to inspect the graph, to alter nodes and their fields, and to add and remove nodes within the graph. Finally, it is important to have the possibility to identify intellectual property in MPEG-4 media objects. Therefore, MPEG has worked with representatives of different creative industries in the definition of syntax and tools to support this. A full elaboration of the requirements for the identification of intellectual property can be found in ‘Management and Protection of Intellectual Property in MPEG-4, which is publicly available from the MPEG home page<sup>1</sup>. At the same page it is possible to find the complete version of the document N4668 “MPEG-4 Overview”, from which this section has been derived and which contains more detailed overviews of parts that may be of interest to the reader.

<sup>1</sup> <http://www.chiariglione.org/mpeg/>

### 3.6.6 MPEG21 Model and capabilities (EPFL, DSI)

Parts of this section are excerpts from the working draft of the ISO/IEC 21000-10 WD to provide the latest development on MPEG21 model and capabilities.

Many elements exist to build an infrastructure for the delivery and consumption of multimedia content. The aim for ISO/IEC 21000 (MPEG-21) is to describe how these various elements fit together, in the sense that the main purpose of MPEG-21 is to define a multimedia framework to enable transparent and augmented use of multimedia resources across a wide range of networks and devices used by different communities. A key concept of a multimedia framework is the Digital Item. In MPEG-21 a Digital Item is a structured digital object with a standard representation, identification, and metadata. An equally important concept in a multimedia framework is the notion of the User. In MPEG-21 a User is any entity that interacts with the multimedia framework and as such includes all members of the value chain (e.g., creator, rights holders, distributors and consumers of Digital Items) and includes, for example, individuals, consumers, communities, organizations, corporations, consortia, and governments. Part 2 of MPEG-21 specifies the mechanism for declaring the structure and makeup of Digital Items. Such Digital Item Declarations (DID) are static by nature. Part 10 of MPEG-21 entitled Digital Item Processing (DIP), specifies tools enabling users to provide suggested interactions with Digital Items, thereby enabling the inclusion of a dynamic aspect to the static declaration of Digital Items. The standardization of Digital Item Processing enables interoperability at the processing level. A key component of Digital Item Processing is the Digital Item Method (DIM). A Digital Item Method is the tool whereby a User specifies suggested interactions with the Digital Item. As such, Digital Item Methods provide a way for a User to specify a selection of suggested procedures for *processing a Digital Item at the level of the Digital Item itself*. For example, a Digital Item representing a music album can contain a Digital Item Method to add a new music track to the album. Such a Digital Item Method can be used to ensure that the new music track is added to the Digital Item while maintaining a suggested format for the Digital Item Declaration of such a music album Digital Item (i.e. elements added in the correct place in the Digital Item Declaration structure, correct Descriptors are included, etc.). *DIMs are not intended to be utilized for implementing the processing of media resources themselves*. For example, Digital Item Methods are not intended to be used for implementing transcoding of media resources; however Digital Item Methods might be used for *adaptations of the Digital Item Declaration at the Digital Item Declaration level*. Digital Item Methods should be viewed from a User perspective; they are intended to be related to User interaction with a Digital Item. For example, Digital Item Methods could be used to specify a suggested sequence of User interaction with a Digital Item (through appropriate usage of the REL and IPMP). The interface through which a User interacts with a Digital Item using Digital Item Processing is implementation dependent. Some implementations might support specification of aspects of the interface by metadata included in the Digital Item. Some possible scenarios are the following:

- On receipt of a Digital Item Declaration, a list of Digital Item Methods that can be applied to the Digital Item can be made available to the User. The User can choose a Digital Item Method that is then executed by the Digital Item Processing engine.
- On receipt of a Digital Item Declaration, a list of Objects is presented based on the presence of Identifiers of the DII XML Namespace. The User chooses one or more of these Object(s). A list of Digital Item Methods that takes as arguments the (set of) Object(s) is then presented to the User. The User selects a Digital Item Method that is then executed by the Digital Item Processing engine.

A DIM is expressed using the Digital Item Method Language (DIML) which includes a binding for Digital Item Base Operations. The DIML provides the basic syntax, control flow constructs, etc for authoring a DIM. The Digital Item Base Operations (DIBOs) are the functional building blocks utilized by a Digital Item Method. They can be considered somewhat analogous to the standard library of functions of a programming language. Digital Item Methods are defined by the DIBOs they use to accomplish the handling of the Digital Item according to the intentions of the DIM author. Digital Item Methods and the Digital Item Base Operations that define them can be considered as requests to the Digital Item Processing engine to process the Digital Item in some manner, or to execute some action. The syntax and semantics for Digital Item Base Operations are specified in MPEG-21 following the structure of other parts (DIBOs for DID, for DIP, for REL, etc.). However the details of how the semantics of the DIBOs are implemented are left to the

implementer. For example, the `Play` DIBO requests the playing of an *item*, *component*, or *descriptor*, but the implementer of the DIBO is able to play the specified DID Model entity in a manner decided by them.

Overall processing of a Digital Item remains largely open for an application. Digital Items are intended to be used throughout the delivery chain, and thus different applications and different Users will perform different overall processing of a Digital Item. Digital Item Methods can be regarded as a ‘menu’ of User interaction possibilities. Digital Item Methods can then be used during processing of Digital Items to understand the Digital Item Method author’s suggested manner of User interaction with a Digital Item. Different Digital Item Methods can be authored to provide different suggested interactions appropriate for different Users at various junctures in the delivery chain. Part 10 of MPEG-21 specifies how to author Digital Item Methods and integrate them in a Digital Item Declaration. It does not specify how to restrict access to a Digital Item Method. This can be achieved, by utilizing other parts of MPEG-21 such as ISO/IEC 21000-5 (Part 5, Right Expression Language or REL).

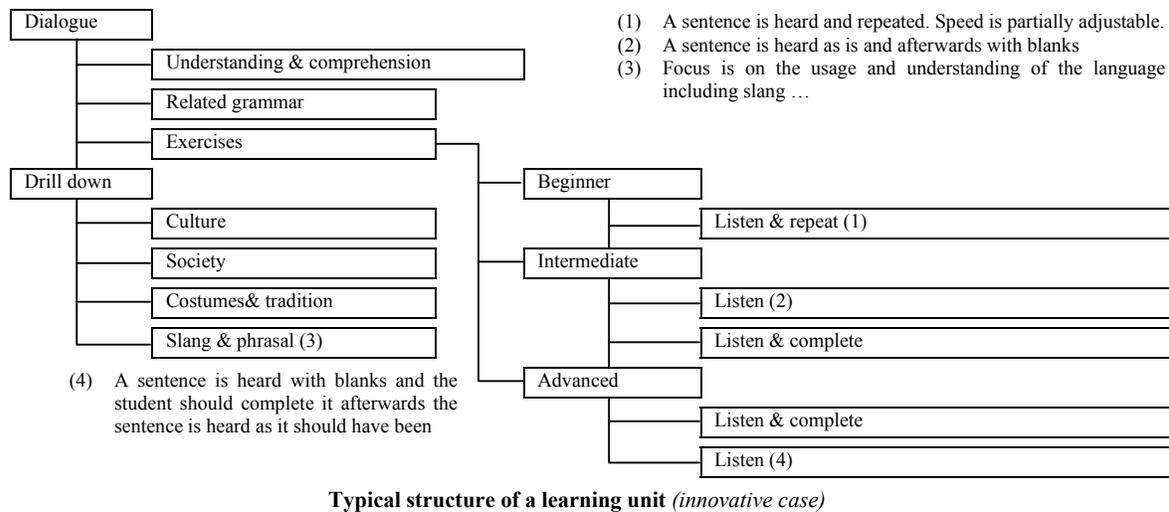
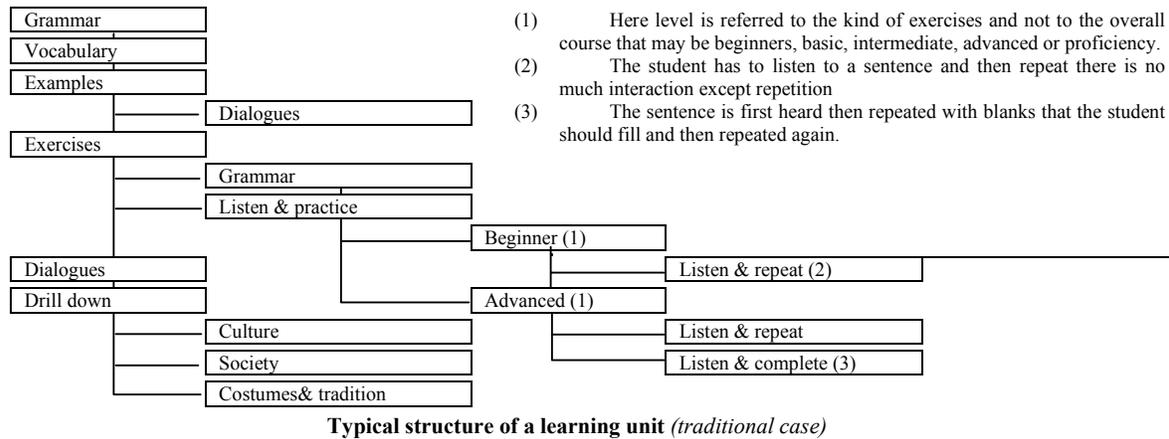
### **3.7 Authoring Tools and E-Learning Content Development Applications**

According to Brandon & Hall over 40% of companies use an e-learning solution to provide services to own personnel including language learning. This happens more and more frequently due to globalization. Most e-learning solutions adopted are used to provide self-paced e-learning courses and live e-learning sessions using virtual classroom applications while tracking results using a learning management system (LMS).

Unlike conventional training, a good instructor cannot rescue bad on-line learning; the materials live and die by the quality of their design. Therefore in e-learning, content and design have remained the most critical dimensions of success. Not surprisingly, the shortage of well-designed, engaging and relevant e-learning products is still high on the list of reasons for limited acceptance of e-learning in many organizations. Furthermore most self-paced learning courses (and nominally almost all e-learning based language courses) still reflect a traditional course structure.

Traditionally e-learning based language courses are structured according a very classical approach that foresees grammar and vocabulary as the core of the teaching; dialogues and drill downs are considered as complementary or support activities just like exercises. Usually dialogues are linked also to curiosities and hints on culture and civilization related to the studied language.

This is somehow a harsh generalization, still reflects both our experience and knowledge of the market offer. There are of course products very different from these just mentioned. In these latter products usually dialogue is the center of the attention and grammar is provided in form of explanation of the characteristics and peculiarities emerging from the dialogue under exam. This second category of training courses tries also to convey to the learner a much wider spectrum of information on culture and tradition related to the language.



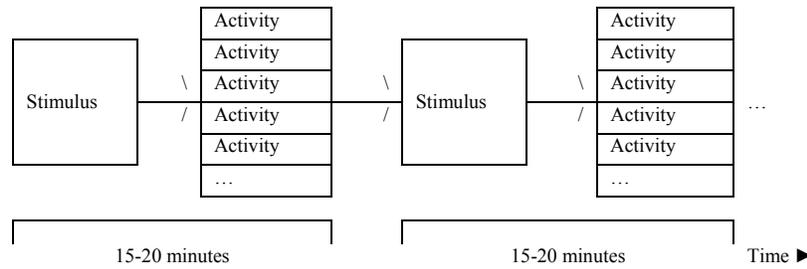
The difference in structure is quite apparent from the previously reported schemas. It is also relevant to note that a few products on the market are offering the user the chance to listen and modify voice samples/dialogues playback speed. This is just a little thing if compared with the aims of FLIC, still is in the same direction as it shows a special attention to the learner's need and difficulties.

Some of the most effective on-line language courses for Latin-based speaker willing to learn foreign languages focus on reading/listening comprehension grammar and vocabulary. Users are provided with some feedback on achieved performances and exploit a pedagogical philosophy based on the following principles:

- student centered approach (user chose own learning path);
- each course level revolves around a central theme;
- activities have a pedagogical rationale;
- the content is interesting and related activities are challenging.

Usually languages are divided in at least four different levels organized on about six courses. On the average each course is composed of more than ten units plus a unit test. Units are in turn organized in a way to consist of several stimuli with an average of five activities per stimulus plus tests. The course becomes progressively harder while progressing through units.

For e-learning solutions that foresee both the adoption of CD/internet based content delivery it is worth limiting the duration of each learning session to around 15-20 minutes for usability reasons. This brings to the following structure:

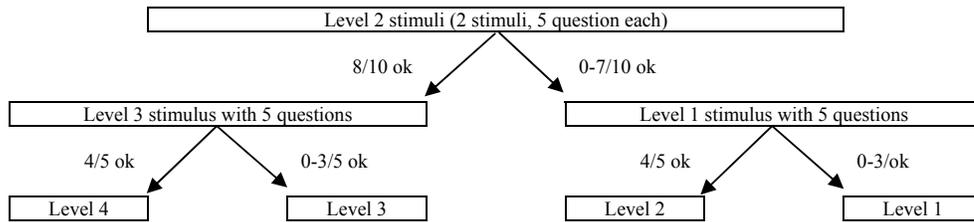


**Typical fruition scheme of a learning unit (innovative case)**

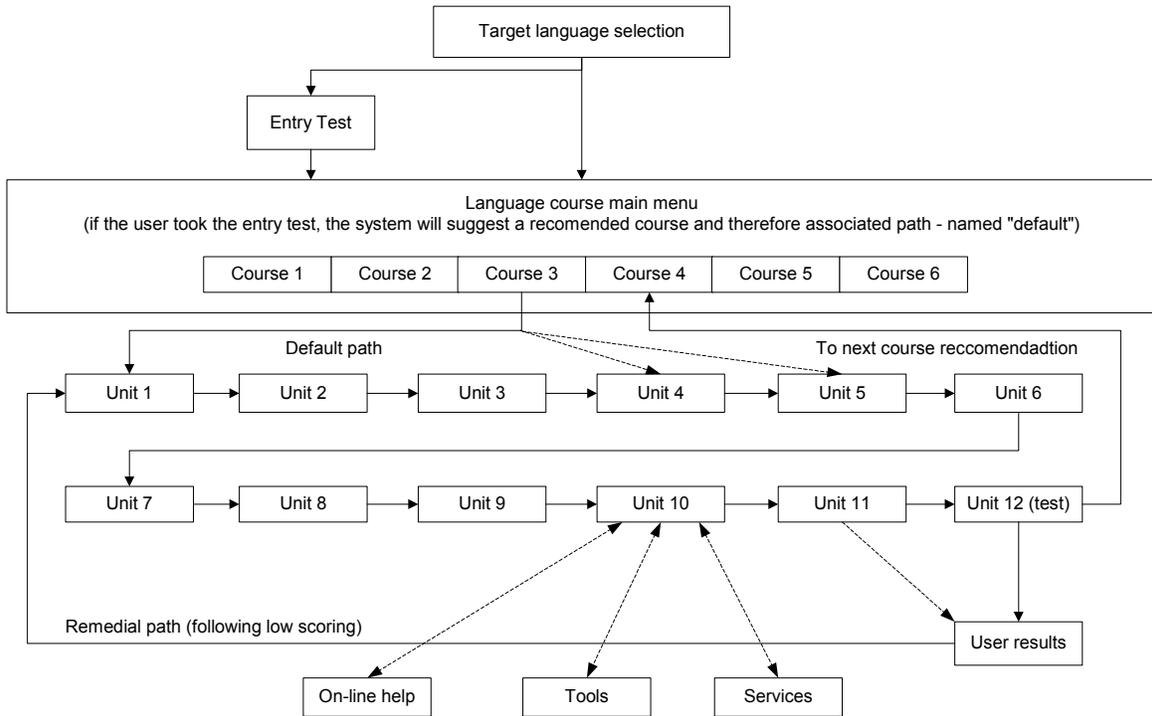
Usually each stimulus is accompanied by a set of activities focused on different sub-skills related to the various abilities plus grammar and vocabulary. Listening is taught using slide shows, videos or pictures with captions, while reading comprehension and/or grammar are taught using texts.

Test units usually are presented at the end of a set of unit aiming to provide feedback on what learned. Such units may be repeated several times and usually should last no more than thirty minutes each. The structure will comprise a set of stimuli each followed by a set of questions. At the end of the session a score is provided as feedback. Usually the provided score is in the format X out of Y correct answers (i.e. 3/5). Usually if the same exercise is repeated several times only the best score is reported.

Usually there are also entry test units focused on comprehension and containing at least three graded texts. They should last no more than twenty minutes be timed and drawn from a bank containing several version of the test (at least three). Such units assign both a level and a course to the user upon completion. This is usually accomplished based on the following decision schema:



From all that has been presented till now is easy to derive the structure of a typical learning course. Please note that in most environments the courseware structure is structured in levels according to the “European Council Curriculum” and to Flesch-Kincaid Grade Level Score or to Flesch Readability Ease Score (at least as far as English language is concerned).



Typical navigation scheme of a language course level structured (innovative case)

### 3.8 Authoring and Content development for E-Learning applications

Producing multimedia applications, especially in the educational field, is a complex, time consuming and costly task. In more detail it is necessary to take into account that even if available content may be extremely rich and valuable for producing learning content, there are plenty of issues related to copyrights and content usability to be taken into account, nominally:

- Images are available but covered by copyrights and the clearance procedure is quite complex;
- Multimedia content (video, audio...) presents the same copyright problem as images;
- Text is available from many sources (from literature to newspapers...) but also in this case there is need for copyrights clearance;
- Content should be suitable for web-based applications (images, audio and video formats...) therefore may need adequate post-processing.

The editorial board following directions of the pedagogues involved in the course design usually performs content selection. The legal department performs copyright clearance once the list of chosen contents has been finalised. These are preliminary steps that apply to the courseware overall design. Then takes place the typical e-learning authoring process, which is structured as follows (please note that in this phase people involved and called authors are usually skilled both in education and programming or at least in the usage of the adopted authoring tool):

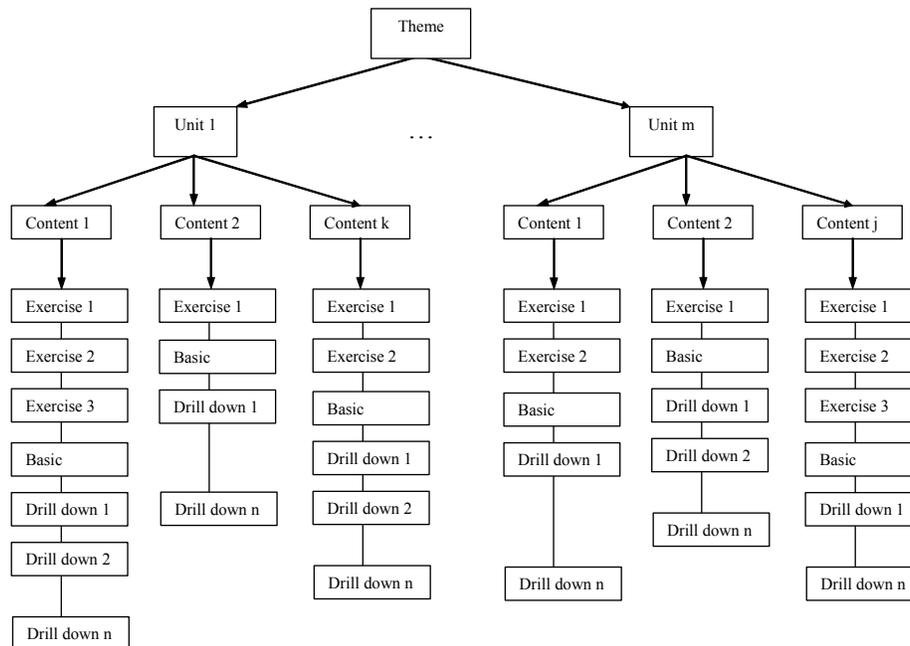
- An author begins the development process by choosing from a library of page templates or content wizards or by opening a blank page and selecting the navigation buttons, text placeholders, and other objects from a catalogue. A template contains placeholders for the text and media that an author wants to display and usually contains a common navigation mechanism and background image.
- Next, the author adds text, graphics and other media to the object placeholders in the page templates. All of the object placeholders can be modified by setting properties that define the appearance for each object.
- To create interactive content, an author can build a quiz or test by selecting question objects from a catalogue. The author can enter feedback for each response to a question. The feedback can be text, media, animations or other types of instructional material. The behaviour of a course can be based on the learner interactions with test questions.

- Authors can use the preview feature at any time to see the content in action from the perspective of a learner.
- When the content is ready for deployment, authors can publish it as Web-based content.

This implies that suitable basic assets are already available and catalogued. Often this is not the case and is necessary to deal with the process of making content available, nominally how to transform in learning objects structured and unstructured content. Also this process is usually performed by personnel usually skilled both in education and programming or at least in the usage of the adopted authoring tool with the specific support of graphics experts...

The first step would be to properly select and classify content. Then it will be necessary to take textual content and turn it into smaller self-consistent chunks. During this step glossaries of terms will have to be defined and populated. Such glossaries will be available then as complementary/support units.

Textual content may present a chapter/paragraph-oriented structure and such sub elements can be either logically related but self confined or logically related and interdependent. In the first case it will be simply necessary to segment text to the smallest self-confined/functional level and transform it into a learning object. In the other case it will be necessary to segment it, structure it and produce a set of interdependent objects (via pre-requisites). Finally it will be necessary also to provide relevant metadata and associate it to produced objects in order to grant easiness in the search & retrieve process.



**A possible content structure delivered in units with exercises & drill downs**

According to SCORM standards a tracked course foresees that the user completes the full unit before being granted the chance to proceed any further. Moreover if there are exercises for knowledge assessment usually they can be also condition the overall navigation procedure. It could be possible to prevent the user from accessing any other section of the content until the present one has been completed and related tests passed positively. Content should be interesting and appealing. Tests should stimulate user curiosity and willingness to access the available content, performing a drill down on the issues that present the higher interest.

## 4 Channel related content issues (ILABS, SEJER, XIM, TISCALI, OD2, DSI)

In this section we point out the most relevant issues that have to be taken into account when dealing with simple and compound objects that have to be distributed either to end users or to intermediate users. The production process can ignore the distribution process only up to a certain extent as content can be adapted on the fly. In any case the style, look and feel and overall format of delivered content will deeply depend on the production process. What is needed here is mainly to point out basic constraints that have to be applied (especially to combined objects) in relation to distribution. It is necessary to take into account that with AXMEDIS content production and distribution has to be facilitated and related costs dropped. This requires that content is produced in a way to foster re-usage and cross-channel distribution so to maximize revenue possibilities. Authors shall be able to find best of breed content but will have to be aware of distribution related issues such as for example, compound objects which may require different dimensions, rendering formats, etc. for each distribution channel. In summary: the purpose of this section is to point out the impact of the distribution channel on the content production, specifically: content aggregation.

It is necessary to take into account that despite nowadays tendency to “go digital” there are traditions and habits that are so radiated into everyday’s life to influence customers behaviours no matter the real technical possibilities. A clear example is provided by the music market where despite the presence of devices like MP3players, CD players, iPods... yet we still talk of albums, singles, compilations... The constraints of “album” and “single” and other traditional formats are prevalent in the market place. Although they need not be constraints in the digital world. The majority of these constraints originate from the total storage capacity of the carrying medium. With the dawn of digital, there is already a movement to new formats, such as the single track “radio single”. Artists have alluded to the possibilities of music in a digital format and being able to release work beyond the constraints of the traditional variations, however certainly from a commercial perspective, the traditional formats will remain popular for some time to come.

Music charts have traditionally restricted products to within the traditional formats in order to qualify, thus perpetuating the constraints even further. For example, in order to qualify for the UK singles chart, the longest versions of each individual track on the release are not allowed to exceed twenty minutes in duration. (If multiple versions of the same track are included, only the longest version is counted). While rules such as these exist, the majority of commercial releases will comply, even though the constraint is artificial.

Traditional music formats:

- Single track (radio single 3-5 minutes)
- Album (40 – 70 minutes, 8-16 tracks)
- Maxi Single / Extended Player (up to 20 minutes, 2-5 tracks)
- Double Album or other multiple (including box sets)

Distribution channels for digital schoolbooks is mainly Internet. Content is not produced on the fly. Therefore the distribution channel has practically no impact on the schoolbook design. What may impact is the target device. See later.

### 4.1 Creating multimedia content from existing material

There are four key issues related to developing content from existing material:

- **Ownership and clearance** - The first implication of using existing material is the need to clear usage rights and if necessary gain clearance for the use of the content in the new production and for the new channel. Currently one of the key delays in today's production workflow, the peer-to-peer model being developed within AMXEDIS promises to eliminate many of the problems of clearance, ambiguity of usage rights, etc.
- **Interrelated media** - A common feature for this type of content production is that the content created is often strongly related to another piece of content (e.g. a movie that the content is promoting). This interrelationship sets strict constraints in terms of obtaining clearance from the original content producers and owners for the use of images, footage, logos, music, soundtrack clips, etc. It also adds a further level of sign-off/approval to the workflow where not only the clients (e.g. movie distributors) who are commissioning the multimedia content require sign-off, but also the original

content producers - and in some cases the film stars and other stakeholders - require sign-off before content can be distributed on a new channel or in a new format.

- **Repurposing** - Another vital aspect of creating multimedia from existing content is the issue of repurposing, that is adapting content developed for one medium/channel to suit a different delivery channel, viewing device and context. The general principle for this process is to start with the highest available quality copy of the source material, as artefacts and distortion introduced by reduction, resizing and compression tend to amplify any imperfections in the content. A simple example is compressing an image to display on the web, where a compressed source Jpeg image, if re-compressed can look unacceptable with heavy Jpeg artefacts, while the same size output file compressed directly from a high resolution uncompressed bitmap source will be of a significantly higher quality.

This principle also applies to video and audio, for example, converting a movie trailer from a high quality source such as DigiBeta with PCM audio soundtrack into a small streamed QuickTime or Windows Media clip can create a smaller file size yet greater quality than if the same trailer were created from an already compressed format such as consumer DV tape.

The process of repurposing can be highly labour intensive, and is one that the AXMEDIS tools promise to significantly automate to reduce costs and production lead times.

- **Integration** - Although the multimedia integration process is similar for both new and existing material, the incorporation of existing material often requires customized styling and look and feel, as well as customization of any new content elements in order to closely match the existing material. For example content developed to promote a movie must be closely aligned in terms of colours, styling and 'tone of voice' to the clips, stills and other elements incorporated from the movie itself. This constraint necessitates a more manual production process with customization, although once the styling for the project is defined, templates and reusable sub-components can be defined for the project such as icons, navigation components, screen layout grids, etc.

Another problem with integrating existing material can be the gaps or missing elements, for example missing suitable shots of an actor to be used on a film website. This can impact the production workflow and often requires rethinking the entire design to avoid needing the missing content.

## 4.2 Supported content (TISCALI, EXITECH, COMVERSE, EUTELSAT, ILABS, SEJER, OD2)

Taken into account the specific nature of each distribution channel it is necessary to point out which are at present the best choice / combination of formats for each channel, part of this has been defined in the requirements but is nevertheless necessary to recall it here in order to ensure best possible design indication to ensure effective and efficient content production achieving the highest possible aspect quality and possibly ensuring therefore the highest possible profitability for all actors involved

When talking of supported content is necessary to analyse the difference among content to be used for education and content to be used for tourism, leisure, entertainment... for each the same basic raw assets can be exploited but then different sets of composition, aggregation and formatting rules have to be applied. Moreover (just as you say) is also necessary to take into account the fruition device. We would also add that all this will not be significant unless we also take into consideration the business model and fruition modality (pay per use/view, rental, purchase, subscription...). For example a reproduction of the "Guernica" painting by Picasso can be used in a course about Spanish Civil War (JPG, Low definition), in a virtual art Gallery (PNG, High definition) etc. However, in our vision adapting the format to the context of use should be performed by an explicit Rule like "adapt format", which should be sufficient to answer any need regarding distribution channel, context of use, terminal etc. as this will empower authors with the maximum flexibility. Anyway, nowadays this operation works as follows: simple atomic operations, put together by a human in more complex rules defined to resolve a "functional" constraint, and since authors' audience and distribution channel are usually quite limited and well defined, is such content adaptation is avoided.

Although most commercial audio releases will comply with the formats already mentioned above, there is no need to restrict the creative process to those formats. In fact many recording artists have indicated that they will make use of the digital format to experiment creatively.

### **4.3 Constraints (TISCALI, EXITECH, COMVERSE, EUTELSAT, ILABS, SEJER, OD2)**

In this section are be pointed out the constraints coming from specific device or delivery format in order to better support the development team in defining proper templates and procedures to handle data during editing. Part of this is also reflected in content selection guidelines as once the system will be in place the end user (in this specific instance we refer to the B2B user) will be aware of the constraints related to a specific object. This applies mainly to objects that might be aggregated for further usage.

Different kind of devices have different capabilities. For schoolbooks, we are mostly interested by three types of devices: PC, Tablet-PC and potentially PDA. PC obviously does not impose restriction on the content aspect and production, since it is the primary target and the content is basically conceived for PC. The tablet PC does not require any adaptation of content, since it has approximately the same capacities than an old PC. However, GUI part of the multimedia content has to respect some rules to be more usable on Tablet-PC (see requirements on the player about these constraints).

The PDA is more problematic, since it has really lower capacities than a PC or Tablet-PC : small screen, small processor, storage capacities etc. Thus, content has to be adapted: reducing video resolution, audio resolution, modifying text size, lightening documents. Frankly, ideally the schoolbook should be completely redesigned for the PDA, and producing a "downgraded version" by removing too heavy medias or animations and lightening the content is quite a poor solution. Unless somebody somehow produce efficient ways to adapt the content to the PDA, downgrading a PC schoolbook for making it usable on PDA must always be considered as a last hope solution.

#### **4.3.1 Terminal & Fruition (COMVERSE, TISCALI, EUTELSAT, ILABS, SEJER, OD2)**

In the overall content production process is always necessary to take into account peculiarities related to fruition of a specific content onto a specific kind of terminal. As a matter of facts it is important to highlight which content can be badly affected by usage on the specific device and which is left basically unchanged. In terms of fruition is important to take into account the concept of "readability" and "understandability" which are not to be restricted to text as also an image or an audio can be "un-readable" if the rendering is too poor. In a similar manner whatsoever content can be turned into "un-understandable" if rendering, fruition pace or intelligibility level is too poor or inadequate for the target end-user.

#### **4.3.2 Connection bandwidth (COMVERSE, TISCALI, EUTELSAT, ILABS, SEJER, OD2)**

An other major issue to be taken into account is the set of constraints that have to be applied for proper fruition of content in dependence of the fruition device when transmission is taken into account. It is not relevant if we are talking of streaming or downloads, as quality and / or connection usage time depends, in both cases, on available bandwidth and content dimension. As in B2B usage of AXMEDIS an object can be used to build an other one it is essential to ensure that fruition of the result is still granted while respecting the specified level of service quality. More specifically a video with certain characteristics is not suitable for vision on a mobile phone screen ensuring the same level of quality as achievable on a TV or computer screen.

#### **4.3.3 Readability & understandability of content (XIM, ILABS, SEJER, OD2, TISCALI, COMVERSE)**

As already mentioned elsewhere, in terms of fruition is important to take into account the concept of "readability" and "understandability" which are not to be restricted to a specific content like text as also every other kind of content can be "un-readable" if the rendering is too poor, or it can be "un-understandable" if rendering, fruition pace or intelligibility level is too poor or inadequate for the target end-user.

This problem can arise from a series of causes, which are summarised in the table below.

<b>Production-Distribution Workflow Stage</b>	<b>Cause</b>
Poor design	making font size or images too small, cramming too much information into a single page or screen, etc.
Poor rendering	combining or transforming the content with inappropriate settings for the medium.
Inappropriate selection of content for a medium	trying to pass too much content in a single file through a narrow channel (e.g. trying to prepare large movie intended for dial-up modem download)
Poor quality source content	e.g. re-compressing already compressed content (which emphasises lossy compression artefacts) or working with inadequate source resolution
Poor compression	using incorrect settings or codecs when compressing content
Channel corruption or congestion	e.g. across a busy internet bridge
Client device performance problems	e.g. pages not appearing correctly on a certain web browser or a PDA. This can be minimised again by effective design.

#### **4.3.4 Subtitling & synchronisation (EPFL, DSI, UNIVLEEDS)**

For some specific content like Video, Audio and their combination, it may be necessary to have subtitling in order to achieve content accessibility for the end user. The people involved in the authoring of combined AXMEDIS objects have to be aware of such need and adopt relevant solutions to ensure this.

Following standardized multimedia frameworks, rendering of synchronized text should be well suitable for different kinds of different devices. Coding of synchronized text in contexts such as MPEG-4, or SMIL, is not necessarily constrained by visual features such as screen coordinates but it is instead coded on the basis of timing information with graphic rendering issues in most cases open to implementers of end-user platforms (as in all model-based media representations).

In this case it is advisable for authors to care about limiting the amount of text to be associated to e.g. a single time stamp, allowing a finer grain in the splitting of “sentences”; this may result in a more precise display and also better readability on limited devices. In many cases it may be possible for more powerful platforms to enlarge the “time window” increasing the amount of displayed text, if desired by implementers.

#### **4.3.5 Audio compression & quality (OD2, UNILEEDS, DSI, ...)**

As far as audio is concerned it is necessary to point out, once again, that the rendering result will depend on fruition device and that it will also be deeply influenced by the applied compression. For example a 128Kbs MP3 will be more than acceptable on a PDA or mobile, but may turn out to be not fully satisfactory on a PC or set-top-box connected to a home theatre.

There is a relationship between codec, compression rate and file quality. A 128Kbps file encoded in Windows Media 9 codec will be approximately equivalent to a 192Kbps file encoded in MP3 format.

File formats for discovery and sampling will not be required at such a high format as those used for final delivery to the consumer.

If synchronisation of media between multiple devices is allowed within the consumer rights, it might be necessary to transcode between compression rates depending on the target platform. So for example, a piece of music downloaded to a PC, then synchronised with a portable audio player may need to exist in 192Kbps on the PC, but 64Kbps on the portable audio player.

#### **4.3.6 Multi platform delivery (TISCALI, ILABS , EXITECH)**

Further constraints may emerge when taking into account the possibility to handle to multi-platform delivery. In more detail it may be necessary to evaluate, for example, the fact that if the specified content requires adaptation according to fruition device this may be achieved either on-the-fly or off-line. In the former case this implies specific computational capabilities for the delivery server while the latter simply required storage capabilities as the same content should be available already in the possible formats.

#### **4.3.7 Common issues (FUPF, DSI, ILABS)**

Under this section, we collect all constraints related to metadata, packaging for delivery and content classification keywords which are in essence common issues related to whatsoever packaged object that has to be retrieved via browsing and should be somehow described to the end user who in turn can be an other editor, an aggregator, a retailer (for the B2B kind of relation) or an end-user in the B2C scenario.

#### 4.3.7.1 Metadata (UNIVLEEDS, DSI, ILABS, SEJER, OD2, AFI, ANSC, FUPF, ....)

Metadata is an important feature for digital object management. AXMEDIS object is designed with a two parts structure, where one of the part consists of AXMEDIS metadata. AXMEDIS uses the support provided by MPEG-21 to host any kind of XML encoded metadata. AXMEDIS Object has to contain a DII identifier element, Dublin core metadata encoded in XML and a specific element called AXINFO, containing information specific for AXMEDIS Object life cycle management like:

- Creator information (AXCID, Name, Company, URLs, ...)
- Distributor information (AXDID, Name, URLs, ...)
- Access information (read only or read/write)
- Creation and modification times
- The History of the object (version/revision, commands performed on the object)
- The Workflow information, etc.
- Fingerprinting information (algorithm identification)
- Potential Available Rights (PAR) for the object and licensing information
- Metadata certification information used to check metadata consistency

Metadata stored in AXInfo and in other descriptors can be used from Query Support in order to search for specific objects. Since AXMEDIS supports import/export to/from other digital objects in a variety of formats, the metadata has to be appropriately “translated”. AXMEDIS is to provide tools for metadata adaptation, for example, to translate metadata between different standards for different distribution channels, and also tools for metadata editing to allow update, correction, validation of the information.

For an example of the AXMEDIS Object, please see Appendix III in the other part of this document which consists of all the Appendixes.

Metadata are the most delicate and tricky aspect of a digital object were it a simple asset or a structured complex object. This is mainly due to the fact that metadata are used to describe an object, to ease up the search and retrieval process, to describe the usage, the technical implication and, above all, the DRM, copyrights and IPR info related to the object itself. Unless metadata are properly structured, filled, and easy to remap across different standards (Dublin Core, LOM...) they are of little help for proper content search, selection, retrieval and usage. As will be more apparent when taking into account the issue of classification keywords metadata insertion is a highly error-prone and human dependent process that has to be checked for consistency and quality if a real profitable usage can be achieved.

For example for ANSC metadata have to be compliant with national standards suggested by ICCU (i.e. The Italian Minister of Cultural Activities). At present MAG schema (Metadati amministrativi Gestionali – Administrative-managing metadata) are at release 1.5 and mainly concern with images. Release 2.0 is currently available (although this is not for public at the time of writing) with standard metadata for audio too. MAG schema is of course based on Dublin Core set, as can be seen from what follows:

```
<?xml version="1.0" encoding="UTF-8" ?>
- <!-- controllato e validato il 2004-05-10 -->
- <!-- l'esempio è stato realizzato grazie alla collaborazione dell'Istituto e Museo di Storia della scienza -->
- <!-- metadigit xmlns="http://www.iccu.sbn.it/metaAG1.pdf" xmlns:targetNamespace="http://www.iccu.sbn.it/metaAG1.pdf"
  xmlns:xlink="http://www.w3.org/TR/xlink" xmlns:niso="http://www.niso.org/pdfs/DataDict.pdf"
  xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.iccu.sbn.it/metaAG1.pdf metadigit.xsd" version="1.5">
- <gen creation="2003-04-27T10:30:22" last_update="2003-04-27T10:30:22">
  <stprog>http://www.imss.fi.it/biblio/iracopus.html</stprog>
  <agency>IMSS</agency>
  <access_rights>0</access_rights>
  <completeness>0</completeness>
</gen>
- <bib level="a">
  - <!-- <dc:identifier xsi:type="IMSS">900436</dc:identifier> - corretto, ma xsi:type non è supportato da "some
    schema-validating XML parsers". Vedi: http://dublincore.org/schemas/xmls/qdc/2003/04/02/notes/ -->
  <dc:identifier>900436</dc:identifier>
  <dc:title>Schediasmi due Del Signor Conte Giulio Carlo De Fagnani</dc:title>
  <dc:creator>Fagnano, Giulio Carlo</dc:creator>
</bib>
- <stru>
  - <!-- stru in versione 1.5 -->
```

```

<sequence_number>1</sequence_number>
- <element>
  - <!--
    <dc:identifier xsi:type="IMSS">323811</dc:identifier> corretto, ma vedi sopra
    -->
    <dc:identifier>323811</dc:identifier>
  - <!-- riferimento all'identificativo del periodico che ospita la parte componente alla quale il presente spoglio
    si riferisce -->
  - <piece>
    - <!-- riferimento al fascicolo che contiene lo spoglio -->
    <year>1730</year>
    <issue>3</issue>
  </piece>
  <start_sequence_number="29" />
  <stop_sequence_number="58" />
  - <!-- start e stop si riferiscono per default alla sezione IMG del documento MAG esterno identificato
    tramite il tag piece -riferimento al volume 1730/3 - e il tag dc:identifier 323811 -->
</element>
</stru>
</metadigit>

```

What follows is an other brief example while a more extended one can be found in Appendix II.

```

<?xml version="1.0" encoding="UTF-8" ?>
- <!-- L'esempio e' stato realizzato grazie alla collaborazione di Casalini Libri -->
- <metadigit xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:niso="http://www.niso.org/pdfs/DataDict.pdf"
  xmlns:xlink="http://www.w3.org/TR/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.iccu.sbn.it/metaAG1.pdf" xsi:schemaLocation="http://www.iccu.sbn.it/metaAG1.pdf metadigit.xsd"
  version="1.0">
- <gen>
  <stprog>http://www.casalini.it/ilibri</stprog>
  <agency>IT:BNCF</agency>
  <access_rights>0</access_rights>
  <completeness>1</completeness>
</gen>
- <bib level="m">
  <dc:identifier xsi:type="SBN">TO01050554</dc:identifier>
  <dc:identifier xsi:type="BNI">2002-12943</dc:identifier>
  <dc:title>Marketing in rete : analisi e decisioni nell'economia digitale</dc:title>
  <dc:creator>Prandelli, Emanuela</dc:creator>
  <dc:creator>Verona, Gianmario</dc:creator>
  <dc:publisher>Milano : McGraw-Hill, 2002</dc:publisher>
</bib>
- <doc>
  <sequence_number>1</sequence_number>
  <nomenclature>Indice</nomenclature>
  <file Location="URL" xlink:href="./TO01050554/DOC/Toc_pdf_02_02909550.pdf" />
  <md5>b96ef66e4cb7f199a4ba4e99b07c89a9</md5>
  - <format>
    <niso:name>PDF 1.3 (Acrobat 4.x)</niso:name>
    <niso:mime>application/pdf</niso:mime>
  </format>
  <datetimecreated>2002-07-22T14:36:10</datetimecreated>
</doc>
</metadigit>

```

What follows is a clear example of a XML instance for audio metadata as it is managed on a regular basis by OD2:

```

<?xml version="1.0" encoding="ISO-8859-1" ?>
- <collection loudEyeMediaId="" physicalProductUPC="" duration="" needsQAIndicator="N" digitalProductUPC="" genre=""
  explicitLyrics="n" originalReleaseYear="" type="" priceBand="" currency="" parentalAdvisory=""
  recommendRetailPrice="" label="" actionType="" exclusiveIndicator="N" countryOfOrigin="" primaryRightsHolder=""
  completeProduct="Y" partnerProductId="" originalReleaseDate="" dealerPrice="" physicalTrackCount=""
  promoReference="" cLine="" od2VersionNumber="" pLine="" seriesName="" labelPrice="" title="">
- <offerings>
  <offering releaseDate="" territory="GB" priceBand="" recommendRetailPrice="" currency="EUR" dealerPrice=""
    deleteDate="" labelPrice="" type="Alacarte" promoDate="" />
</offerings>
- <collectionDescriptions>
  <collectionDescription type="" language="" description="" />
</collectionDescriptions>
- <collectionMediaItems>
  <collectionMediaItem value="" type="" />
</collectionMediaItems>
- <artists>
  <artist knownAs="" isPrimary="True" fileAs="" role="" />

```

```

</artists>
- <rights rightsProfile="">
  <right type="" value="" />
</rights>
- <thirdParties>
  <thirdParty type="" name="" />
</thirdParties>
- <volumes totalNumberOfVolumes="">
  - <volume sequenceNumber="">
    - <tracks>
      - <track loudeyeTrackId="" duration="" trackSequenceVolumeNumber="" explicitLyrics="N" genre=""
        originalReleaseYear="" priceBand="" currency="" parentalAdvisory=""
        recommendRetailPrice="" countryOfOrigin="" partnerProductId="" originalReleaseDate=""
        trackSequenceCollectionNumber="" dealerPrice="" clipOffsetEnd="" clipOffsetStart=""
        promoReference="" cLine="" hiddenTrackIndicator="False" pLine="" labelPrice="" isrc=""
        explicitEdited="N" title="">
      - <offerings>
        <offering releaseDate="" territory="GB" priceBand="" recommendRetailPrice=""
          currency="EUR" dealerPrice="" deleteDate="" labelPrice="" type="Alacarte"
          promoDate="" />
      </offerings>
      - <trackDescriptions>
        <trackDescription type="" language="" description="" />
      </trackDescriptions>
      - <trackMedialItems>
        <trackMedialItem type="" value="" />
      </trackMedialItems>
      - <artists>
        <artist knownAs="" isPrimary="True" fileAs="" role="" />
      </artists>
      - <rights rightsProfile="">
        <right type="" value="" />
      </rights>
      - <avMedialItems>
        <avMedialItem duration="" location="" bitrate="128" bitDepth="" sampleRate=""
          length="" fileSize="" format="WMA" numChannels="" name="" />
      </avMedialItems>
    </track>
  </tracks>
</volume>
</volumes>
</collection>

```

As far as packaging of e-learning content is concerned is possible to have also several other formats, more or less compliant to the IEEE standard LO/LOM, for example SEJER is using a custom metadata set, inspired by the LOM, by some work from French university and internal work. However, since the structure and the main fields are inspired by the LOM, any tool having the capacity to manipulate or display the LOM should be able to manipulate/display such metadata. In order to achieve the widest diffusion and acceptance by user is better to require that at least a common subset of metadata (mappable on LOM) is reported in the object metadata structure. This aspect, once properly taken into account at production level, will enable an easier management of metadata also in the rendering phase.

An other extremely relevant set of metadata that have to be taken into account are the one related to Digital Rights Management or DRM. This set is crucial as it ensures proper usage of the content and can also enable enforcements of the desired or possible rights on a specific piece of content. In more detail DRM can be expressed in XML language by means of licenses. What follow is a basic example.

```

<?xml version="1.0" encoding="UTF-8" ?>
- <r:license xmlns:dsig="http://www.w3.org/2000/09/xmldsig#" xmlns:mx="urn:mpeg:mpeg21:2003:01-REL-MX-NS"
  xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS" xmlns:sx="urn:mpeg:mpeg21:2003:01-REL-SX-NS"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="urn:mpeg:mpeg21:2003:01-REL-R-NS
  ../schemas/rel-r.xsd urn:mpeg:mpeg21:2003:01-REL-SX-NS ../schemas/rel-sx.xsd urn:mpeg:mpeg21:2003:01-REL-MX-
  NS ../schemas/rel-mx.xsd">
  - <r:grant>
    <r:forall varName="principal" />
    <r:principal varRef="principal" />
    <mx:enhance />
    - <mx:diReference>
      <mx:identifier>Principal</mx:identifier>
    </mx:diReference>
  </r:grant>
- <r:issuer>
  - <r:keyHolder>

```

```

- :<r:info>
  <dsig:KeyName>KeyForPrincipal</dsig:KeyName>
</r:info>
</r:keyHolder>
</r:issuer>
</r:license>

```

Further examples, as used in ANSC’s photographic archive, which based on the standard “SCHEMA F” from ICCD (an institute of the Italian Ministry of Cultural Activities can be found in Appendix IV in the other part of this document which consists of all the Appendixes, together with other examples on MAG audio metadata, MAG video metadata and NISO.

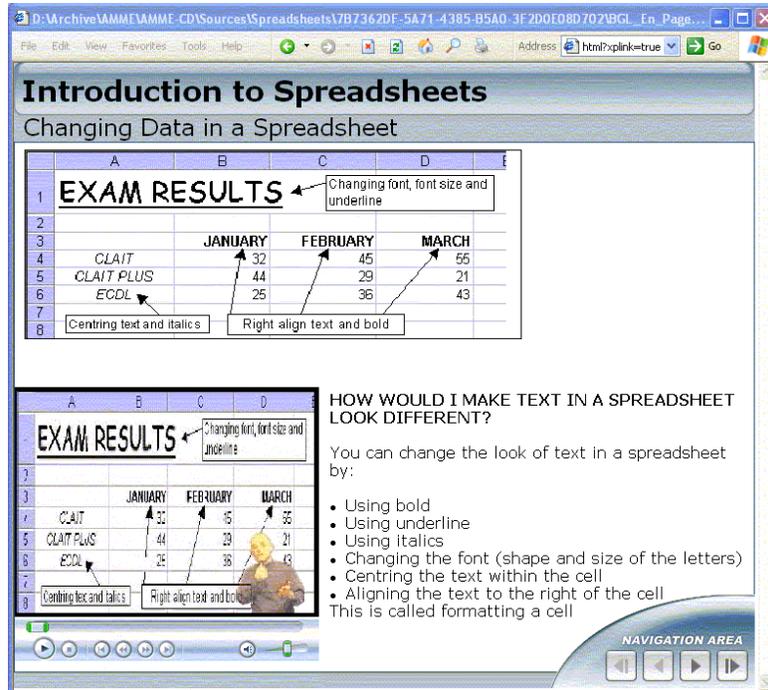
**4.3.7.2 Delivery packaging features (DSI, ILABS, FUPF, ....)**

Appendix V of the other part of this document presents an example of XML instances for an OpenSky package description.

Appendix VI of the other part of this document presents an example of XML instances for LO package description (manifest) and related metadata according to standards. In more detail the first example refers to a package (as defined in IMS standard) related to a compound object represented by a HTML page with some text, an image, a video and a set of buttons for managing the navigation within the object.

The XML example of Appendix VI is discussed soon after the LOM sample along with an actual screenshot in the section below.

The XML sample in Appendix VI represents the package description for a simple lesson on the usage of spreadsheets composed of 5 pages like the one represented in the following image: spreadsheet section of interest picture, text describing exposed concept and a video presenting the concept through an animation and a speaker (using the sign language to grant content accessibility to the widest possible audience).



Packaging content is somehow different from describing it, therefore in the hereafter is reported the XML representation of the same page just presented here and described in terms of packaging earlier on:

```

<?xml version="1.0" encoding="utf-8" ?>
- <!-- XML file generated by eXact Packager -->
- <!-- eXact Packager licensed to: Amme - Giunti Interactive Labs S.r.l. -->

```

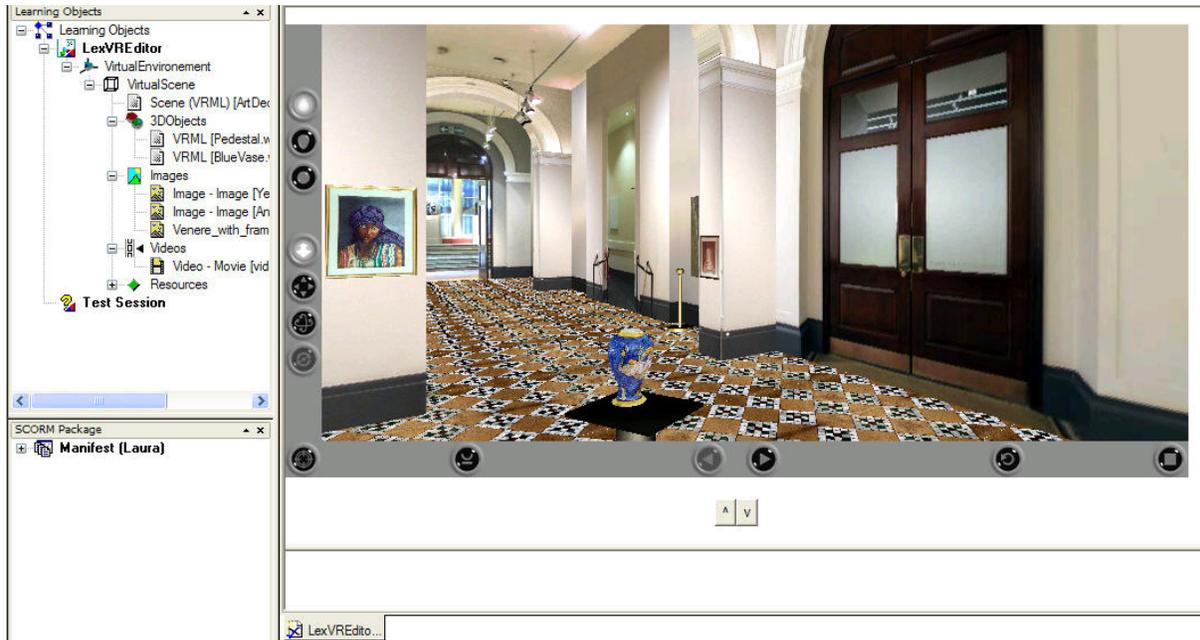
```

- <xp:group xp:deliverytype="SCORM" xlink:label="L1907" xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xp="http://www.giuntlabs.com/exact/xp_v1d0">
  - <style xmlns="http://www.giuntlabs.com/exact/xp_v1d0">
    <colours c1="#000000" c2="#FFFFFF" c3="#D4D4D6" c4="#005FAE" c5="#003060" c6="#01D4FA" />
    <linkcolors normal="#0000FF" visited="#800080" active="#FF0000" />
    <tracking>None</tracking>
    <pagesize width="760" height="640" type="1" />
    - <textstyles>
      - <textstyle type="Title">
        <normal fontface="Arial" fontsize="28" colour="#000000" bold="false" italic="false" underline="false" />
        <emph fontface="Arial" fontsize="28" colour="#000000" bold="false" italic="true" underline="false" />
        <moreemph fontface="Arial" fontsize="28" colour="#000000" bold="true" italic="false" underline="false" />
      </textstyle>
      ...
    </textstyles>
  </style>
  - <title xlink:label="L1908">
    <b>Introduction to Spreadsheets</b>
  </title>
  - <xp:group xp:deliverytype="SCORM" xlink:label="L1909">
    <title xlink:label="L1910">Changing Data in a Spreadsheet</title>
    - <xp:page xp:deliverytype="SCORM" xlink:label="L1911" href="BGL_En_PageText2.html" xp:level="1" xp:navmode="closed"
      xp:width="760" xp:height="640">
      - <text xlink:label="L1912">
        <b>HOW WOULD I MAKE TEXT IN A SPREADSHEET LOOK DIFFERENT?</b>
        <br />
        <br />
        You can change the look of text in a spreadsheet by:
        <br />
        <br />
        <li>Using bold</li>
        <li>Using underline</li>
        <li>Using italics</li>
        <li>Changing the font (shape and size of the letters)</li>
        <li>Centring the text within the cell</li>
        <li>Aligning the text to the right of the cell</li>
        <br />
        This is called formatting a cell
        <br />
        <br />
        <br />
      </text>
      - <sp2vid8>
        <xp:mov xlink:label="L1913" href="../../Section 2/sp2vid8.avi" alt="" />
      </sp2vid8>
      - <sp2pic8 xlink:label="L1914" alt="">
        <xp:img href="../../Section 2/sp2pic8.jpg" width="460" height="179" />
      </sp2pic8>
    </xp:page>
    ...
  </xp:group>
</xp:group>
- <!-- End of XML file generated by eXact Packager -->

```

The above section would not work unless proper formatting could be granted. Therefore several additional files are produced to allow the browser properly manage the content (in this case we are talking of HTML pages). The related style sheets file (.css and .xslt) are respectively reported in Appendix for reference:

What follows here is an other sample of a IMS package description in XML for a compound object comprising a VRML structure hosting images, video and some 3D active objects (allowing interaction). The screen shot has been taken in the editing environment (Learn eXact Packager), and is reported hereafter just before the actual XML code.



Representation of the compound object inside Learn eXact Packager  
(on the left side the object structure & components are perceivable)

```
<?xml version="1.0" encoding="utf-8" ?>
- <!-- IMS Manifest 1.1 generated by eXact Packager -->
- <!-- eXact Packager licensed to: Andrea Lorenzon -->
<manifest identifier="Laura" xmlns="http://www.imsproject.org/xsd/imscp_rootv1p1p2"
  xmlns:adlcp="http://www.adlnet.org/xsd/adlcp_rootv1p2" xmlns:xp="http://www.giuntlabs.com/exact/xp_v1d0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.imsproject.org/xsd/imscp_rootv1p1p2 imscp_rootv1p1p2.xsd
  http://www.imsglobal.org/xsd/imsm_d_v1p2 imsm_d_v1p2p2.xsd http://www.adlnet.org/xsd/adlcp_rootv1p2 adlcp_rootv1p2.xsd
  http://www.giuntlabs.com/exact/xp_v1d0 xp_v1d0.xsd" version="1.0">
  <organizations default="xp_man0_toc1">
    <organization identifier="xp_man0_toc1">
      <title>default</title>
      <item identifier="xp_man0_toc1_2275" identifierref="res13" isvisible="true">
        <title>LexVREditor</title>
      </item>
      <item identifier="xp_man0_toc1_2541" identifierref="res4212" isvisible="true">
        <title>Annunciazione_with_frame</title>
        <adlcp:prerequisites type="aicc_script">xp_man0_toc1_2275="passed"</adlcp:prerequisites>
      </item>
    </organization>
  </organizations>
  <resources>
    <resource identifier="res13" xp:type="lo" adlcp:scormtype="sco" href="57949890-1A62-4F40-BB32-
      C9A9AEAD6CEA/LexVREditor/13/LexVREditor.html" type="webcontent">
      <file href="57949890-1A62-4F40-BB32-C9A9AEAD6CEA/LexVREditor/13/LexVREditor.html" xp:outfile="true" />
      <file href="57949890-1A62-4F40-BB32-C9A9AEAD6CEA/LexVREditor/13/lexvr.wrl" xp:outfile="true" />
      <file href="57949890-1A62-4F40-BB32-C9A9AEAD6CEA/LexVREditor/13/aacm.js" xp:outfile="true" />
      ...
      <file href="57949890-1A62-4F40-BB32-C9A9AEAD6CEA/LexVREditor/13/LexVREditor.xml" xp:outfile="true" />
      <file href="Yemenita_girl_with_frame.jpg" />
      <file href="Annunciazione_with_frame.jpg" />
      <file href="Venere_with_frame.jpg" />
      <file href="video.mpg" />
      <file href="LeonardoDaVinciBiography.pdf" />
      <file href="57949890-1A62-4F40-BB32-C9A9AEAD6CEA/lo_13.xpl" />
      <dependency identifierref="res4074" />
      <dependency identifierref="res4087" />
      <dependency identifierref="res4090" />
      <dependency identifierref="res2197" />
    </resource>
    <resource identifier="res4074" adlcp:scormtype="asset" href="ArtDecoGallery.wrl" type="webcontent">
      <file href="ArtDecoGallery.wrl" />
      ...
      <file href="images/img_0002_1_segment.jpg" />
    </resource>
  </resources>
</manifest>
```

```

- <resource identifier="res4087" adlcp:scormtype="asset" href="Pedestal.wrl" type="webcontent">
  <file href="Pedestal.wrl" />
  <file href="maps03/piano.jpg" />
</resource>
- <resource identifier="res4090" adlcp:scormtype="asset" href="BlueVase.wrl" type="webcontent">
  <file href="BlueVase.wrl" />
  <file href="mov97870_texture.0.jpg" />
</resource>
...
- <resource identifier="res4212" adlcp:scormtype="asset" href="Annunciazione_with_frame.jpg" type="webcontent">
  <file href="Annunciazione_with_frame.jpg" />
</resource>
</resources>
</manifest>
- <!-- End of IMS Manifest 1.1 generated by eXact Packager -->

```

Below is an example of an XSL file developed in order to manage an ActiveX object:

```

<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xp="http://www.giuntlabs.com/exact/xp_v1d0" xmlns:msxsl="urn:schemas-microsoft-com:xsl"
xmlns:xpmap="http://www.giuntlabs.com/exact/mapeditor" version="1.0">
<xsl:output method="html" encoding="iso-8859-15" />
<msxsl:script language="JScript" implements-prefix="xpfunction">
  function render(root)
  {
    var myObject;
    try
    {
      myObject = new ActiveXObject("MyObjectProgID");

      myObject.id=root.nextNode().nodeValue;
      return myObject.MyRenderFunction();
    }
    catch(e)
    {
      return "Error: "+e.description;
    }
  }
</msxsl:script>
<xsl:template match="/">
  <html>
    <head>
      <title>
        My Learning Object
      </title>
    </head>
    <body leftmargin="0" rightmargin="0">
      <xsl:choose>
        <xsl:when test="mapeditor/@Mode='Edit'">
          <object ID="MyObject" PROGID="MyObjectProgID" CLASSID="clsid:MyCLASSID" WIDTH="100%"
            HEIGHT="100%">
            <param name="id">
              <xsl:attribute name="value"><xsl:value-of select="XPTtagroot/@xlink:label"/></xsl:attribute>
            </param>
            <param name="deliverypath">
              <xsl:attribute name="value"><xsl:value-of select="XPTtagroot/@xp:deliverypath"/></xsl:attribute>
            </param>
          </object>
        </xsl:when>
        <xsl:otherwise>
          <xsl:value-of disable-output-escaping="yes" select="xpfunction:render(XPTtagroot/@xlink:label)"/>
        </xsl:otherwise>
      </xsl:choose>
    </body>
  </html>
</xsl:template>
</xsl:stylesheet>

```

An example XML which reproduces the XSD Schema file developed in order to define the “semantic” type element can be found in Appendix VII of the other part of this document which contains all the appendices.

### 4.3.7.3 Classification keywords (ILABS, SEJER, OD2, AFI, ANSC, FUPF, DSI....)

Classification keywords insertion is one of the most difficult tasks to be performed during metadata insertion. Usually the person digitising and / or storing the asset performs this process. In some cases the process may be revised and / or controlled by other persons. This direct dependence from human operators is reflected in the fact that despite the adoption of a specific standard for vocabulary or domain definition the same object may end up having a different set of keywords when managed by different people; just as an example is worth mentioning the results of a search for a famous painting from Leonardo da Vinci: the Monna Lisa also named Gioconda. Now if you place on Google a simple query for Gioconda in the top ten results the first 2 refer actually to the selected / searched painting, while if you place the same query for “Monna Lisa” the result is quite astonishing as in the top ten result there is a reference to the painting ranked as the sixth in the list while all the other nine refer just to hotels in Florence. If the same query is placed on an image data bank the result is again surprising. If you take into account SCALA archives (probably the largest archive of art images) and ALINARI archives (the oldest photographic archive world while) the query result is quite surprising as summarised in the following table:

**Search for “Gioconda”**

Archive	Images	Notes
ALINARI	4	The 1 <sup>st</sup> refers to a painting of Marchel Duchamp depicting Leonardo painting, the second is a detail of Leonardo painting the other images of Leonardo painting. In this case the common factor is the presence in the metadata of the word “Gioconda” either as title or as colloquial name for the subject
SCALA	2	The 1 <sup>st</sup> image is Leonardo painting the second is a picture related to an opera named “La Gioconda”

**Search for “Monna lisa”**

Archive	Images	Notes
ALINARI	2 / 33	When searching in “art” the result is: just 2 images of Leonardo painting. When searching in “all” were found all art images bearing the description “Gioconda” and also images related to TV fiction on Leonardo and the events that affected the painting
SCALA	4	The 1 <sup>st</sup> image is a head of statue of the Baghdad Museum the 2 <sup>nd</sup> and 3 <sup>rd</sup> are images from Andy Warhol related to Leonardo painting and the last refers to a relevant painting located in a hotel named Monna Lisa

The issue is quite complex and presents many facets especially taking into account different market segments. For example in the educational environment, even if often there is the habit to avoid any formalized keyword system to classify content in e-school books, it is easy to deduce what such a system would be by examining the "manual" classification of the resources as they are mainly classified by:

- ❑ **Classes:** 6, 5, 4, 3, 2, 1, T etc. (this is an example of names of the scholar classes in the French scholar system)
- ❑ **Course:** Maths, French, SVT, etc.

In the archive environment this issue is taken into account in depth and yet there are many different approaches adopted. While newspapers and libraries have each a standard covering the overall needs there are many different implementations as far as details and set of standardised keys use (for example in relation with main sector of involvement (economy, science, literature...). In the case of archives the issue can be even more complex as the archive may handle different kind of resources. For example in ANSC (dealing with both documents and recording), the effort is to match classification keywords in metadata with classification keywords in cataloguing records. We have to point out that there should be a common way to describe “a content” at least at national level.

For musical contents we have to stress the lack of common agreement on keywords / subjects) among sector operators. This problem is also reflected in CMS of the various institutions managing archives, just as an example is worth taking into account that at present there is no common agreement on subjects in ethnomusicology (probably this is also due to the fact that defining musical and textual forms is a challenging activity). A similar situation applies also to description of musical score (manuscript or printed) as is not clear how to describe every possible content instance in terms of standard keywording. We think that AXMEDIS could be also an important starting point to push this kind of cooperation among content owners especially as every media has its own classification keywords (and in case of books more than one) and the P2P infrastructure proposed will foster cooperation among players coming and operating in different markets segments.

Although there are many uses for music, music's pre-eminent functions are social and psychological. Consequently, we can expect that the most useful retrieval indexes will be those that facilitate searching

according to such social and psychological functions. Typically, such indexes will focus on stylistics, mood, and similarity information. In each of these domains, a cognitive approach provides opportunities to better understand the salient issues and so better design appropriate access tools

In indexing such decentralized musical materials, authors have to deal with music content in a manner which is basically analogous to what is done when dealing with keyword in context indexing. In other words, one must open up the document (recording) and attempt to characterize the music from the sound function itself. A useful musical web crawler might attempt to decipher information such as the following:

- Determine whether the sound is music, sound effects, or other.
- In the case of music, determine whether there is a voice present.
- If possible, estimate whether the voice is male or female.
- Characterize the musical style.
- Characterize the instrumentation.
- Characterize the tempo.
- Characterize the mood.
- Characterize the culture.
- Estimate the sound quality.
- Determine the total duration.

In the case of music, many of the ways in which users wish to access information is highly subjective, such as finding music that is "similar" to other music, music that has a certain emotional content, or music in some specified style or texture. These subjective motivations highlight the need for sophisticated indexing methods.

#### **4.3.8 Specific issues (FUPF, DSI, ILABS, SEJER, OD2, UNILEEDS)**

In this section are pointed out some more specific issues related to metadata that have a high impact in the overall fruition process as they have a direct impact on the possibility to implement the underlying business model in the most efficient way.

##### **4.3.8.1 Supported languages**

The issue of supported language has a multi-fold aspect: on a side there are the languages intrinsically supported by the object (a multi-language presentation...), then there are languages that can be added via subtitling and finally there is the issue of language related requirements (specific language support may require additional font or OS extensions or even plug-ins...). Apparently this may seem unrelated to content aspect, yet if subtitling is needed the object should be structured consequently and have a proper interface for subtitling management, or at least all the information (metadata) needed to achieve this result via the object rendering tool.

##### **4.3.8.2 Accessibility**

Content aspect cannot avoid taking into account accessibility issues as they can deeply influence the end user perception of the content itself. Just as an example take into account a HTML page, in order to be W3C-AAA [7] compliant the designer has to take into account many constraints and it would be desirable that info related to accessibility aspects (level, kind of supported/required feature/tools...) were reported in the object metadata. Moreover there are other issues related to accessibility that go beyond the aspect of impairment support. For example an indication of the level of complexity of the object should be reported too.

Accessibility good practice also encourages multiple presentations of the same content, for example a text-only version of a graphic or animation that can be spoken by a text-to-speech package, or subtitles accompanying an audio commentary.

Good design discipline also assists accessibility, in terms of keeping content clearly presented without irrelevant images or verbose text, especially for web or print-targeted content.

##### **4.3.8.3 Traceability**

In the e-learning context traceability is extremely important and has implications both in the object metadata structure and in the rendering tool as there is a set of information that should be collected, processed and stored during user fruition of the content itself. This implies for example that if the object is traceable there

should be buttons or widgets to handle such aspect.

**4.3.8.4 Billing**

Metadata related to billing procedure should be taken into account and valued especially when taking into account content result for aggregation, re-shaping and re-publishing. Very much probably such metadata could be complementary to the DRM ones (detailed afterwards along with IPR). When taking into account this aspect is quite evident that such metadata should be clearly visible even when objects are presented for browsing (in other words it should be possible to have some indication about the related billing: immediate, deferred, pay per view, pay per download, invoiced purchase, prepaid fruition...)

**4.3.8.5 IPR Metadata**

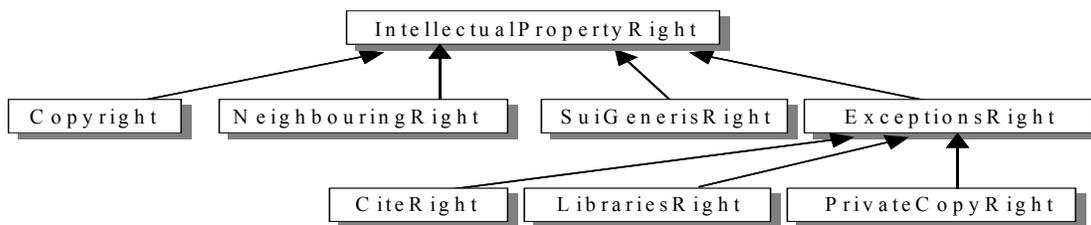
We have distinguished IPR from copyrights as they are usually dealt with in a very different manner. In most cases it will be necessary to have a clear statement / disclaimer on copyrights holder, but in some case it will be necessary also to have something similar for IPR, which means that the rendering system should be able to handle these metadata and present them somehow to the user once accessing the content. This does not imply nor intend to replace “credits” that may be present and displayed as part of the object (usually a complex / structured one allowing navigation). The basic rationale for this is clearly stated below and should be taken into account both at design and rendering time of a content due to its high relevance.

Any digital resource and by extent, any creation, can be seen as an intellectual property. For an informal definition we can say that intellectual property refers to the intangible or intellectual nature of works or creations and the body of laws governing such property. An intellectual property can be exploited commercially, based on the intellectual property rights applying to it. The rights holder can provide licenses to allow the exploitation. The terms of licenses may be either predefined or subject to negotiation.

The rest of this section presents the different intellectual property rights and their relationship according to some international organisations, conventions and treaties, like Berne Convention [1], the WIPO Copyright Treaty [2] or the EC Directive on Copyright 2001/29/EC [3] or the US Digital Millennium Copyright Act [4]. These relationships were defined in IPRonto [5], an ontology which represents the relationship among any entity related to intellectual property rights (IPR).

Intellectual Property Rights (IPR) are legal instruments that provide a limited monopolistic right to the owner of things such as patents, trademarks or copyrighted works. They provide an incentive for the creation of and investment in new works (music, films, print media, software, performances, broadcasts, etc.) and their exploitation, thereby contributing to improved competitiveness, employment and innovation.

The following figure shows the Intellectual Property Right together with its dependent rights. In the context of copyrighted works, IPR includes author’s rights, which will be explained in more detail later, “sui generis” rights (applicable to databases) and neighbouring rights (especially concerning artist-interpreters, phonographic producers and broadcaster organisations).

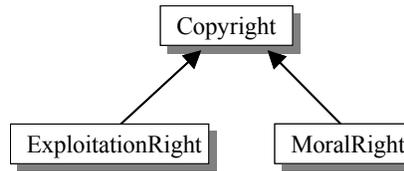


**Intellectual Property Right and its dependent rights**

While the concept of neighbouring rights originated from analogue technologies, it faces a substantial change in its scope in response to rapid developments in digital technologies which consist of digital, satellite communications and so on. Since digital technologies brought about new concepts like digital reproduction, on-line transmission, satellite broadcasting, public performance connected to computer network and the like, it is clear that the related (or neighbouring) rights must be taken into particular consideration when analyzing the implications of digital technology for the exploitation of protected works and achievements.

The producer rights are identified by the following three elements included in each track: a circled capital letter P (P); the name of the owner of the exclusive rights; the year of first publication of the recording

The Copyright is automatically given to originators of works (creators) by the simple fact of their authorship. They include Moral rights that are independent of the author’s economic rights and even after their transfer and Exploitation rights (economic rights), which are oriented to guarantee financial profit to originators of works. The following figure shows the relationship between Copyright, Exploitation Right and Moral Right.

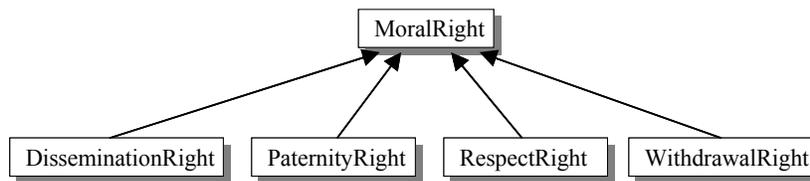


**Copyright and its dependent rights**

Moral rights are independent of the author’s economic rights, and even after their transfer, the author has the following rights:

1. Dissemination Right: Exclusive right to disclose the work.
2. Paternity Right: Exclusive right to claim authorship of the work.
3. Respect Right: Exclusive right to object to any modification to the work prejudicial to his reputation.
4. Withdrawal Right: Exclusive right to withdraw the work.

The next figure shows the Moral Right together with its dependent rights.

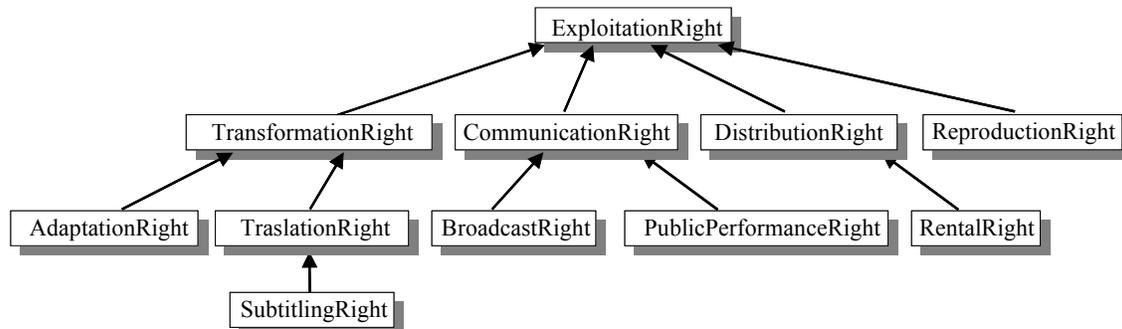


**Moral right and its dependent rights**

Exploitation rights (so called economic rights) are oriented to guarantee financial profit to originators of works. They include:

1. Reproduction Right: Exclusive right to authorize the reproduction, direct and indirect, permanent or temporary, in any manner or form.
2. Communication to the Public Right: Exclusive right for the authorisation of any communication to the public of their works. These includes that members of the public may access them from a place and at a time individually chosen by them. Examples are: public performance, broadcasting, interactive on-demand transmission, etc.
3. Distribution Right: Exclusive right to authorize the making available to the public of the original or copies of the work by sale or other transfer of ownership. Relevant only to tangible objects.
4. Transformation Right: Exclusive right to authorize the manipulation of their works in any manner or form.

The next figure shows the exploitation right and the relationship with its dependent rights.



**Exploitation right and its dependent rights**

#### 4.3.8.6 DRM Metadata

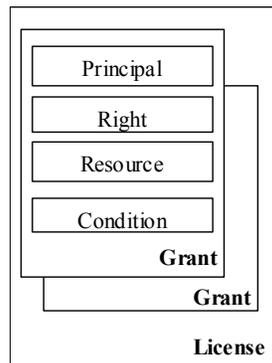
These are the most important metadata for objects, as they will condition their fruition. Please take into account that DRM metadata will affect also content aspect as if it is stated there that no degradation is allowed then (taking the example of a image) panning may be necessary during fruition on a device depending on screen dimension....

DRM metadata includes different kinds of information regarding AXMEDIS objects. From the one side, we can have protection information about how an object is protected and how we can control this protection. From the other side, we can have rights expressions information, including the semantics of the rights expressions that indicate how an AXMEDIS object is governed.

In order to express protection information or rights expressions information, there are several standard initiatives, which describe the format of this information and the information that can be expressed. One of these standard initiatives is MPEG-21. Three parts of this standard are directly related with protection and governance information: Part 4, Intellectual Property Management and Protection (IPMP), Part 5, Rights Expression Language (REL) and Part 6, Rights Data Dictionary (RDD).

There is also another international standard initiative for the definition of an open standard for the Digital Rights Management expression language, the Open Digital Rights Language (ODRL) Initiative. The Open Mobile Alliance is using this language as its DRM REL. Rights expression languages (RELS) have been proposed to express rights and conditions of use of digital content. RELs can be used for example to describe an agreement between a content provider and a distributor, or between a distributor and an end user.

Part 5 of the MPEG-21 standard specifies the syntax and semantics of a Rights Expression Language (REL). In particular, it specifies the syntax and semantics of the language for issuing rights for users to act on Digital Items. One important concept in REL is the License, which could be considered as DRM metadata. A License is a container of grants that are formed by a principal that has the permission to exercise a right against a resource under some conditions that must be previously fulfilled. Next figure shows the structure of a REL License.



REL License

Inside a REL license, the most important element is the Grant. A Grant is an XML structure that is formed by four elements:

- **Principal** represents the unique identification of an entity involved in the granting or exercising of Rights.
- **Right** specifies an action or activity that a Principal may perform on, or using, some associated Resource.
- **Resource** represents the object against which the Principal of a Grant has the Right to perform.
- **Condition** represents grammatical terms, conditions and obligations that a Principal must satisfy before it may take advantage of an authorisation conveyed to it in a Grant.
- A **Grant** expresses that some Principal may exercise some Right against some Resource, subject, possibly, to some Condition.

MPEG-21 REL makes use of the Rights Data Dictionary, part 6 of the MPEG-21 standard, that comprises a set of clear, consistent, structured, integrated and uniquely identified terms. The structure of the RDD is designed to provide a set of well-defined terms for use in rights expressions.

Another part of MPEG-21 that could have in the future some impact in DRM metadata is part 4. The aim of

this part, Intellectual Property Management and Protection (IPMP), is to allow controls on the flow and usage of digital items throughout their lifecycle. It is currently in a draft status.

This standard considers two different concepts:

1. IPMP Digital Item Declaration Language, which provides for a protected representation of the DID Model, allowing both protection and governance of digital items.
2. IPMP Information schemas, structures for expressing information relating to the protection of content, including tools, mechanisms and licenses

The impact of IPMP in DRM metadata regarding AXMEDIS project has to be evaluated along its development, as the evolution of the standard is currently not clear. Nevertheless, AXMEDIS partners are involved in the specification of this standard part.

## **5 Introduction to the Specification of Training and Demonstration (ALL)**

This is the second part of the document. This section of the Deliverable presents the specifications and guidelines for AXMEDIS training and demonstration activities. This report constitutes a starting point for actual work to be performed in WP7 including training on DRM rules definition, training for production of Content using the automatic tools, publication of Training materials and others. These guidelines specify work plan for the several training and demonstration activities, including model of documentations, scheduling, and others.

The purpose of the AXMEDIS Training and demonstration activities is to provide easy access to basic technologies developed by the project, to accelerate the adaptation of the AXMEDIS platform. In this context, SMEs represent one of the key target domains for the adaptation. Hence it is an important activity to promote and stimulate the adoption of the AXMEDIS framework in several contexts by SMEs and by other large institutions with dissemination, demonstration and training activities. These processes can be very effective due to the very exciting demonstrators that are planned. These demonstrators will be built by using large content collection, in collaborations with active institutions and industries. This process will be also be further stimulated by the specific call for making small take-up actions.

General validation can also be supported through the demonstrators and real service setup. Various Demonstrations using the AXMEDIS framework and tools will be developed with the implementation of some demonstrators and their presentations to the public. The demonstrators will show the capabilities of the AXMEDIS technologies and the advantages of using AXMEDIS to implement a wide range of solutions, to build innovative services provided by relevant digital collections, and to allow effective cross-media multi-channel distribution from the contents to end-users.

Training activities, alongside with the demonstration and dissemination activities, will be a vehicle to increase confidence and awareness of the potential end-user. Training and learning is a major threshold for the acceptance of new IT applications in professional activities: A critical mass must be reached in the diverse user groups and organisations involved. Professionals and end users (for various reasons) are reluctant to test new ways of working. In addition to the high cost of learning, which reduces productive time, risking client acceptance and jeopardizing quality is unacceptable for professionals. In entertainment applications, very little initial learning is accepted by users.

A vision of the future workflows will be elaborated initially on a scenario level, and will be updated and concretised continuously. Although it is desirable in principle to understand user needs early, there are limitations as long as the final configuration and attributes of the solutions are not fully known. As a consequence, the analysis of user needs and the application vision is elaborated iteratively as the result of user feedback to technical concepts and prototypes. Part of the innovation is not technical per se, but is a development of the customer processes and workflows, as is the innovation of content production, distribution and protection aspects and models based on IT solutions. These will be developed as process descriptions in appropriate form (vision, formal process descriptions, and finally user manuals), which are presented to decision makers and in workshops and training material to users.

As a result, a basis for the introduction of the applications should be present by the end of the project. Training will address decision makers and managers in the potential user community, and will introduce a wide audience external to the project to the user aspects of taking up the AXMEDIS technology. Additional feedback about the needs of industry will be collected as a side effect, training will serve as a sounding board to obtain early feedback, and to prepare the user community for uptake of the technology.

The activities of training and Demonstrations will be performed together with those of dissemination. This will permit to optimise the effort and to attract more people at the events. These demonstrations are based on WP4 and WP5 activities of research and to present the results to other technicians demonstrating the strengths of the AXMEDIS solution. Besides normal training and demonstration materials and documentations (as discussed in the later section), we intend to collect and compile relevant information and guidelines to widen the scope of target people. These include relevant information such as digitisation for images, digitisation for audio, documents archiving and others.

## 6 Target People (ALL)

The objectives of AXMEDIS training and demonstration activities include:

- to further the current skill and knowledge and the awareness of AXMEDIS of the participants;
- to raise the level of understanding and awareness of the participants, in different aspects of the AXMEDIS tools and how to apply this innovative technologies for the benefit of the participants and their companies;
- to provide the participants with the opportunities to enhance their skill and proficiencies in using AXMEDIS tools.

Due to the effected domains of the project, the following people are targeted for the training in order to accelerate the adaptation of the AXMEDIS platform effectively:

- (i) content producer technicians specialising in the new AXMEDIS technologies, processes and related tools for content production and distribution,
- (ii) managers for better identifying and assessing the new solutions for content production and distribution, reducing production costs and decreasing distribution time and costs,
- (iii) technicians in about the new technologies for developing AXMEDIS compliant systems and tools,
- (iv) content distributors for the exploitation of AXMEDIS solutions and tools for automatic formatting, reducing production and distribution costs, for producing/formatting content on demand.

Hence training courses will be designed and created with these people in mind.

The selection of partners for covering the following activities of training has been done on the basis of their skill with the aim of putting in front to the people to be trained people that have more or less the same background. This will reduce the gap and thus will increase the acceptance.

The training activities will be mainly dedicated to:

- technical people for producing content. This activity will be very important to get consensus from people and experts that presently are unsatisfied for the lack of suitable tools. This will be done by CPR, DSI, EXITECH, DIPITA, EPFL, and AFI.
- management people for exploiting the business capabilities of the innovations introduced by AXMEDIS. This activity will be very important to convince the chief management board of publishers, content distributors and aggregators, which could be interested in adopting one or all the AXMEDIS innovation and tools. These activities of training will be made by FUPF, which has also managed the activities related to DRM and business models, and by ILABS, OD2, and EPFL, which provide managers for this task.
- researchers that would like to know more about the innovative algorithms and solutions at the basis of the AXMEDIS project in the several areas of intervention. The researchers can be interested to the new knowledge produced by the consortium and to exploit the AXMEDIS framework for developing their research, or using the collected content for validating and testing their research results. These activities of training will be made by EPFL, DSI, CPR, DIPITA, EXITECH, UNIVLEEDS, FHGIGD, FUPF, CRS4, etc., and in general by research institutes involved in the project. This kind of training will include the presentation of review and state of the art analysis in the several research and technological

areas.

- SMEs with their technicians that can be interested in exploiting the results produced by AXMEDIS for developing AXMEDIS compliant applications on the basis of the AXMEDIS framework and by using the content for validation and test. These activities of training will be made by DSI, EXITECH, AFI, IRC, ACIT, (which is an SME), CPR (which has performed several times activities of technology transfer), EUTELSAT, HP, COMVERSE, SEJER, TISCALI, OD2 and XIM which are relevant industries. This activity will be also performed to stimulate the participation of SMEs to the take up actions.

The partners planed also to perform cross training activity during the whole duration of the project among the project partners in order to better integrate the information shared in the consortium and to increase the global knowledge of the project for all partners. These activities will be performed at any meeting. At each meeting specific time slot will be reserved to this cross fertilisation among partners. This will avoid the effects that typically occur in large projects in which some partners perfectly know the status of the project while others have only a partial view. The attendance of these activities of continuous training and updating activities will be mandatory for all partners. The scheduling of the specific argument will depend on the project evolution and moment. A general view of the project status with the state of the art and the work planned for the successive months will be always prepared by DSI. This activity will be performed every 6 months since the beginning of the project.

## **7 Access to Training Resources (EXITECH & ALL)**

An unique section of the web portal will be setup for Training resources and materials with a front page to keep an updated list of latest available tutorial for download and distribution. Each Tutorial/Training pack must contain the following items:

- Requirement check-list
- Support contact
- Installation Guide
- Tutorial (a complete step-by-step guide to follow the tutorial designed with all the necessary data)

All the material will be publicly accessible (so it will be placed on the web portal public area). The documents will be organised in several categories and the section administrator will have a tool for signing the deprecated elements. Some statistics about the number of downloads should be performed.

Beside online access, these online training resources could also be use to create CD/DVD, flyers or other materials for distribution during workshop or other relevant or related events.

The training materials, mainly slides and documents, will be produced and distributed at meetings. The training meeting will be open to all, while a registration will be requested in order to tune the services (documentation, catering, etc.) and the room size according to the needs. Cross fertilisation to related networks of excellence will be also done.

Workshops and seminars will be carried out targeted at potential users to enabling them to decide on the uptake of the AXMEDIS production tools.

## **8 Guidelines for Training Courses Production (ALL)**

In order to ensure a wide usage, distribution and effective adaptation of the AXMEDIS platform, it is important to create tutorials with the following features:

- easy to follow
  - use simple and clear English; short sentences; ...
  - step-by-step guide
  - use pictures or screen snapshots to demonstrate steps, if possible
- complete and with clear purpose
- include some form of validation to measure the user's progress and understanding

All AXMEDIS tutorial should consist of the following elements:

- Introduction
  - Short introduction to the AXMEDIS project with project URL and contact.

- Clearly state
  - the purpose of this tutorial (aims and objectives)
  - how this tutorial fits into the scope and structure of AXMEDIS (i.e. setting the context)
  - the expected learning outcomes on completion of the session
- Preparation
  - Resources (facilities and equipments) required
    - Platform on which they have to work
    - Minimal hardware and software requirements
    - Any online or network (e.g. download) requirements
  - Installation guide (if necessary)
  - Support contact
    - Email and/or other contacts (web or mailing-list) for the tutee to seek help
    - URL for any additional materials for this tutorial (e.g. FAQ, etc) or the latest update for this tutorial
- Step-by-step tutorial
- A short Questionnaire to collect feedback from the user of the tutorial
  - The intentions for this Questionnaire include:
    - to see if there are any problems that have been identified,
    - any suggestion/comments for future improvements and enhancements
- Relevant references
  - For further reading or more detail information on the technologies used
- Glossary
  - For all domain specific terminologies used, to clarify the intended meaning and usage
- Relevant appendixes
  - For any further information or data that are not essential for the main body to keep the main part of the material simpler to follow

When technically possible, the training activity should be supported by some demos and demonstration of the tools produced. It is also recommended to use practical examples where possible, ideally drawn from real life cases that are relevant to each target audience.

For each training sessions organised, the following tasks should be carried out and all data collected should be returned to the Training manager (UNIVLEEDS) or to the Project coordinator (DSI):

- Attendance records with a list of participants;
- Evaluation forms collected (to provide feedback to further enhance the session)

## **8.1 Documentation (ALL, UNIVLEEDS)**

All training materials such as tutorial notes and course documentation must confirm to a standard style. A Word file template for producing these material will be finalise and available on the project website. UNIVLEEDS and DSI will be available to support general editing duties.

## **8.2 WP7.2 -- Publication of Training Material (UNIVLEEDS)**

Publication of training material is planned to take place during M12 to M48, using simple custom process. This is managed by UNIVLEEDS. Some of the training materials will be transformed in Books for the general market with the support of ILABS. With the development of the training materials, it will further the establishment of relations with relevant user organisations. This activity will be replicated once every 8 months.

## **9 Plan and Schedule (ALL)**

The guidelines and specifications as discussed in this section of the document are to be realised in WP7. The activities of training and Demonstrations will be performed together, in parallel, in order to allow the optimisation of the effort, to attract more people to the events and to increase the awareness of the new and innovative solutions created by the AXMEDIS project.

The activities of training will start from M12 and will continue for the rest of the project. The first version of training material will be available for M14. A training course will be organised with the conference at M16.

The first public activity of training will be performed for the first time in 2005 together with the first AXMEDIS conference. Other activities of training after the first 18 months will be scheduled every 6 months in association with other relevant events: mainly in May and October-November of every year. These periods have been selected on the basis of the presence and lack of conference and fairs of the sector.

The development of the Demonstrators will start on M10 and will produce a first mock up version for the M18. The demonstrators will be used for the real delivering of content to end user during the last year of the project. The P2P network for B2B distribution will be set up for demonstration during the second year of the project in its early version, M17. It is planned that initial version of the demonstrator will be available within the first 18 months of the project.

The training material will be distributed at meetings (mainly organised in collaboration of major conferences), and on the public part of the www site of AXMEDIS. The Dissemination by demonstration will start after the production of the first version of the AXMEDIS framework. This activity will be mainly focussed on demonstrating the mechanism and the advantages of the model.

The demonstrators will be capable of showing that AXMEDIS can be used to implement a wide range of solutions for creating and distributing content, reducing costs of production by 30% and of distribution by 15%. Innovative aspects are those related to fast content production, content sharing, and content distribution, supporting P2P (on B2B and C2C levels), different transaction models and multi-channel distribution: i-TV, PC, PDA, Cellular phones, Kiosk, etc. The demonstrators will be realized, installed and validated with real activities. Industrial partners are the project leaders of these activities. Simple demonstration and figures about the AXMEDIS advantages will be given at relevant conferences and fairs.

AXMEDIS training plan:

- It is intended to organised around two training sessions per year, which ideally to be co-located with relevant conferences or fairs;
- This activity will start from the second year of the project, to be co-located with the first AXMEDIS conference (November/December 2005);
- The number of attendees are expected to grow from around 20 people in the second year to around 40 people in the forth year of the AXMEDIS project;
- All training events are designed and planned with a general duration between 1 to 2 days due to the general expectation of the targeted people ;
- It is hoped that around 4 to 5 tutors would be available at the training session to allow a low tutee to tutor ratio.

## **10 Guidelines and Requirements for Demonstration**

### **10.1 Setting Up and Creation of Content for Demonstrators (ILABS)**

WP8 states that one of the main goals of the WP is the setting up and creation of content to be used by the demonstrators produced in WP9. This content will include simple content components and complex digital objects for their distribution in pushing or on-demand. It will be used for validating the innovative models of content production and formatting on demand toward the multi-channel environment.

In order to fully test and demonstrate the AXMEDIS framework for its multi-channel, rights-managed capability, it is necessary to bring together content from a variety of sources, along with some new content that will test its limits. In accordance to WP8.5, content integrator, XIM, will develop some rich media interactive content that will be designed to fully utilise AXMEDIS to be deployed across all of the target platforms (internet, mobile, PDA, i-TV, PC), which will be used in addition to a range of audio, text, multimedia and visual content provided by the consortium partners which is suitable for multi-channel delivery.

The content for validation and demonstration will be designed to address the required test cases, both based on a detailed test plan. This will ensure that all key characteristics and parameters are tested, including measurable parameters such as performance, bandwidth, application footprint, etc, and softer characteristics,

such as usability for the end-user.

A first version of the set of content for multiple channels will be produced for M24 and the final version for M36. For both of these versions, a set of styles for formatting and for on-demand production will be produced according to the AXMEDIS formats and tools.

For completeness in testing the AXMEDIS results effectiveness and attractiveness for the market, it is necessary to address content production under several aspects. As already stated in this document, there are issues related to communication efficiency and effectiveness that have to be taken into account and also formatting and composition aspects that are directly dependent from these just mentioned aspects. In addition it is necessary to verify system performance. We believe that the best way to achieve desired results is to start from basic object (text, images, audio, video and animations) and to pass then to compound (multimedia) ones; this approach will grant a smooth start-up of the testing activities and also a more efficient evaluation of results. Once covered the issue of basic object it will be necessary to focus on compound ones, taking into account that apart from the simplest one like text plus audio... when there is a navigation structure or a hierarchy all becomes far more complex. As mentioned earlier, for multimedia objects it will be necessary to grant different navigation paths both linear and hyper-textual ones.

## 10.2 Demonstration Activities (UNIVLEEDS, ALL)

With the collaboration of almost all partners. In the period (M12-M48), the WP7 has to plan demonstration activities related to the AXMEDIS framework.

The Demonstration subWP will start from M12 after the production of the first version of the AXMEDIS framework. The demonstration activity will be mainly focussed on demonstrating the framework and the advantages of the solutions for automating the content production and P2P tools for cooperative production of content. The Training activities will start in parallel to the demonstration activities, and will be organised to provide and train SMEs on the basic technologies developed and studies in the project and to accelerate the adoption of AXMEDIS platform. The activities of training and Demonstrations will be performed together with those of dissemination. This will permit to optimisation of the effort and to attract more people to the events.

The Demonstration activity is located in WP9 and WP7:

- **Aspects related to AXMEDIS framework and tool demonstration (WP7.2 and 7.3)**
- **AXMEDIS validation via demonstrator development and usage (WP9)**

### Relationships of the demonstrators and research activities, contingency plan

The demonstrators of WP7 and WP9 are both strongly related to the results of the research activities since they are related to the results that will be produced by WP4 and WP5.

In general, the demonstrators will be quite transparent for the final users that will have the possibility of receiving more content and content more interactive by using the same channels and business models that are adopted by their distributors. This will reduce the risk of acceptability for the final user.

Current plans for the AXMEDIS demonstration activities can be divided into the following key sections:

- AXMEDIS Architecture and Framework (FUPF, CRS4, DSI, HP, ...)
- Tools (DSI, EXITECH, UNIVLEEDS, ...)
  - mainly AXMEDIS tools in content production, formatting, and aggregation (DSI)
  - Content management system integration and feedback (EXITECH)
  - Automating content production and formatting into CMS of integrators (DSI)
- Functionalities
  - Content Production and Distribution Channels (TISCALI, EUTELSAT, COMVERSE, ILABS)
- Scenarios (ALL)
  - Content Modelling and Managing
  - Content Indexing, monitoring and querying
  - Content composition and formatting
  - Content sharing and production on P2P
  - Content protection and Supervision
  - Content distribution

- And others

Scenarios demonstration can make use of the information compiled and Use-cases collected with mock-ups (such as continuous running animation) to present the potential applications scenarios.

Selected parts of these demonstrations are to be used to demonstrate AXMEDIS initially to the participants of the 1<sup>st</sup> AXMEDIS International Conference, with one or more tutorial sessions.

For the demonstration and training, test contents will need to be collected:

- content produced with WP8 and
- that available in the digital archives of the content providers involved in the projects: AFI, ANSC, ILABS, OD2, XIM, SEJER

### **10.3 AXMEDIS Framework Demonstration (FUPF)**

WP7.3 is to be managed by FUPF and to be performed during M14 -M48. The activity of this WP will be of demonstrating the functionalities of the AXMEDIS framework to content providers, aggregators and content producers.

The demonstrations will be performed by CRS4, DSI, and HP. The Demonstration subWP will start from M13 after the production of the first version of the AXMEDIS framework. The demonstration activity will be mainly focussed on demonstrating the mechanisms and the advantages of the model and pilot tools implemented. It could also include some sessions about how content providers, aggregators or content producers can make use of AXMEDIS framework.

The Training activities will start in parallel to the demonstration activities, and will be organised to provide and train SMEs on the basic technologies developed and studies in the project and to accelerate the adoption of AXMEDIS platform.

The demonstration of this WP is totally based on WP4 and WP5 activities of research. This demonstration activity is mainly devoted to present the results to other technicians in order to convince them about the power of the AXMEDIS solution.

This demonstration will show different aspects of the tools developed inside the AXMEDIS Framework, including modularity and how to integrate and enhance them..

As this activity lasts for many months (from 14 to 48), the demonstration should evolve as the AXMEDIS Framework does, including:

- initial demonstration of the pilot tools developed in the framework
- demonstration of the integration of pilot tools
- demonstration of the improved version of the tools, forming part of greater systems

### **10.4 AXMEDIS Basic Demonstrations (UNIVLEEDS)**

The basic demonstrations activities is to be managed by UNIVLEEDS. Period: M30–M48. In cooperation with the WP9, the activity of this WP will take place between M30 to M48 of the project and it will involve demonstrating the functionalities of the AXMEDIS framework related to content production. This activity of this demonstration is mainly based on the tools developed in WP5 and WP9. It is mainly focussed to present the capabilities of the AXMEDIS tools in content production, formatting, and aggregation. This activity will use the content for test and validation that has been prepared into the WP8.

This demonstration will show the basic concepts, applications and overall working using the AXMEDIS framework. The demonstration will provide an overview to the new functionalities, with highlights to various aspects of the framework, from Query to programme making to multi-channel distribution.

## **10.5 Demonstration on Content Production and Distribution Channels (TISCALI)**

This section introduces demonstration plans involving content production using four different distribution channels. The demonstrators will make use of the content produced with WP8 and that available in the digital archives of the content providers involved in the projects: AFI, ANSC, ILABS, OD2, XIM, SEJER.

### **10.5.1 Content production and distribution in push and on-demand for i-TV (EUTELSAT)**

Demonstration of content distribution in push and on-demand for i-TV is performed in two steps. Starting from the content produced according to the WP8, collateral information is extracted from the metadata of the AXMEDIS Object to suite the push system requirements, and format packages to be scheduled for distribution. The transmission via satellite will use the band allocated by EUTELSAT for these tests. Content is directed to receiving stations expressly set up to some defined partners.

Once the content is received, the demonstration focuses on the validation of this distribution process. Using the B2C Client Application, the user accesses the Object: querying the PMS and the AXCS to obtain the rights and decrypt it, the content, correctly received, can be regularly consumed.

### **10.5.2 Content production and distribution in push and on-demand for PC (TISCALI)**

Demonstration of content distribution in push on-demand for PC is supporting both B2C and P2P. Utilising the content produced under WP8, this demonstration make use of a number of selected AXMEDIS Objects to explain and demonstrate the push system requirements and formatting requirements.

For this demonstration, selected objects are scheduled for distribution via the internet using an experimental implementation of the Media Center (the experimental channel) with a corresponding distribution channel within the TISCALI web offering.

### **10.5.3 Content production and distribution in push and on-demand for Mobile phones, and new generation PDAs (COMVERSE)**

Demonstration for content distribution in push on-demand for Mobile phones and new generation PDAs demonstrates the use of the AXMEDIS tools for content trans-coding for mobile distribution, and the DRM support from user clients.

Utilising the content produced in accordance to WP8, this demonstration make use of a number of selected AXMEDIS objects in order to show and demonstrate the push and on-demand functionalities in AXMEDIS. This will explain and show the system requirements and solutions by using AXMEDIS content transcoding and scheduling for distribution towards mobile and new generation PDAs. The distribution tools will use a corresponding distribution channel within the COMVERSE offering.

### **10.5.4 Content production and distribution to kiosks and local PDAs (ILABS)**

ILABS is responsible for this activity, therefore, as a starting point is worth considering contents presently available from ILABS. Basically such contents consist in different types of learning objects and courses directly related to the e-learning infrastructure (covering the whole value chain from editing to delivery of educational content) that has been developed in past times by ILABS, which also offers to customers the possibility of “content development on demand” as in the case of major chemical companies, banks and other industrial companies for whom ILABS has developed ad hoc training. So in the overall ILABS content covers the following kind of contents:

- ❑ **Art:** fruition, understanding and restoration of art objects (to this category will belong most of the sample objects for the test case).
- ❑ **Medical:** clinical training on breast cancer / first emergency intervention / privacy management in medical environment
- ❑ **Other:** training courses for banks / financial institutions; maintenance courses to be used on wearable computing.

### DE3.1.3 – AXMEDIS Content Aspects Specification & Specification of Training and Demonstration

For the demonstration purpose a selection of the various identified set of basic components (text, audio, images, video and animations) will be used as samples for testing all operations (editing, composition, aggregation, formatting, protection and licensing).

The abovementioned set of basic content will be completed by samples of complex compound objects like the one presented earlier in this document.

Focus will be twofold: 1) on a side content production will be addressed in the kiosk factory while 2) content distribution will be addressed at the kiosk.

In both case care will be taken to ensure that selected content will prove suitable to exploit to the most the exposed functionalities and tools granting the highest level of coverage in terms of functionality testing. Training activities on sample content for production will have to be performed too, therefore sample and reference objects (for training purpose) will be provided.

What follows is a simple list of sample content that will have to be developed for the test activities and that will then also be available as reference for the training activity. They are basically classified in terms of storage and basic components comprised. In more detail:

AXMEDIS content:

- ❑ AXMEDIS object stored in the local AXDBM
  - ❑ Sample 1 = Image + Text
  - ❑ Sample 2 = Image + Audio
  - ❑ Sample 3 = Video + Audio
  - ❑ Sample 4 = Text + Image + Audio
  - ❑ Sample 5 = Audio + Text
  - ❑ Sample 6 = Animation + Audio + Text
- ❑ AXMEDIS object exposed on the AXEPTool
  - ❑ Sample 7 = Image + Text
  - ❑ Sample 8 = Image + Text
  - ❑ Sample 9 = Image + Audio
  - ❑ Sample 10 = Image + Audio
  - ❑ Sample 11 = Text + Image + Audio
  - ❑ Sample 12 = Text + Image + Audio
  - ❑ Sample 13 = Video + Audio
  - ❑ Sample 14 = Video + Audio + Text
- ❑ Top-ten AXMEDIS objects stored locally
  - ❑ any of the previously mentioned objects or: Sample 1- 14

To these objects will necessarily be associated also other objects that will have to be handled, more specifically there will be AXMEDIS content and kiosk specific one as apparent from the following list:

- ❑ AXMEDIS Certifier & Supervisor user management data
- ❑ Licenses of the AXMEDIS governed object
- ❑ Composition & formatting rules
- ❑ DRM rules
- ❑ Selected Content List for Kiosk
- ❑ The kiosk applications
- ❑ The kiosk procedures
- ❑ The kiosk catalogue
- ❑ The kiosk local user management data

## 10.6 Integration (TISCALI)

This section covers activities related to demonstration of the integration of AXMEDIS tools (AXEPTools), CSM and related interfaces. The two demonstrations focus on: CMS integration for managing queries and their results and the on-demand processing of the requests (mainly as far as administrative issues are concerned); and the demonstration of integrating content production and formatting into the production process .

### **10.6.1 Content management system integration and feedback (EXITECH)**

AXMEDIS system has to interact with factory CMS at several different levels. The level at which the contribution of Exitech is more evident is related to administrative information collection and dispatching.

This task is critical since administrative bills and invoices to customers will be sent according to what has been stated in the action-logs that are collected by the administrative information integrator.

In order to build a demonstrator that will be capable of giving an added value to the companies that adopt AXMEDIS system, it is necessary to collect the following information regarding the CMS that are the target for the demonstrators:

- Type of the CMS in terms of interface (web service, shared area and so on)
- Format accepted for exchanging data (text, xml, binary and so on)
- Methods for exchanging data

Once these parameters are known the demonstrators can be set up. The first versions of the demonstrators will be realized on a file exchange basis in order to cover the needs of the most diffused CMS.

The main format used for exporting will be XML and several XSL can be provided to cover the different needs of the different target CMS.

### **10.6.2 Automating content production and formatting into CMS of integrators (DSI)**

This WP is coordinated by DSI and will be performed during the period M19-M48. The demonstration will be focused to explain protocols and interfaces for the automated content production and formatting.

The demonstrator implemented in this WP will involve:

- content interfaces for some CMS technologies.
- formatting interfaces for some distribution technologies.
- interfaces and their individual components to guarantee a workable solution.

For the deployment of the demonstrator, it is planned to install the demonstration system so that it is available in several factories such as the factories of ILABS, SEJER, OD2, ANSC. The resulting composition/formatting systems will be demonstrated at suitable events to the scientific community and to commercial partners not only for dissemination also as a feedback.

## **11 Specification Training (ALL)**

Training for potential users of the AXMEDIS tools will take place in the second year (M12-48) to customise their Content Management Systems to become AXMEDIS compliant. The objective is to demonstrate company the AXMEDIS P2P production process and advise on updating the distribution process to cope with AXMEDIS protected objects and to exploit the automatic formatting mechanisms of AXMEDIS with DRM for production on demand.

The Courses shall provide technical training on how to: operate, install, configure and provision, and maintain and manage the system.

The courses will focus on: the system architecture, hardware, software tools, procedures and relevant documentation, as well as content management and upload. It explains the basic interrelationship of the configuration of each interfaced product, as well as system monitoring, sanity checks.

Practical assignments will be devised to provide skills and give the participant the opportunity to practice for client usage, content management/upload, general networking, system backup, archive and restore, and system installation and configuration.

- Training for potential users to introduce decision makers, management and technical experts to the user aspect of the AXMEDIS applications, including a vision of future workflows, human resource

requirements, business benefits and trends.

- To empower users to make early decisions about the adoption of AXMEDIS production tools.

A schedule of workshops and seminars will be established to introduce users, decision makers and managers from potential user organizations to the envisioned AXMEDIS applications. This information will empower users to assess the benefits and added value of AXEMEDIS applications for their domain. Further feedback from users about their needs and expectations will be obtained in these workshops. Early information will be collected from analysis of applications and application context. High quality training material for the non-technical aspects of the uptake of AXMEDIS tools will be developed. The activities will be integrated closely with technical training, and will include coordination and the fostering of cooperation with other relevant IST projects.

The current Training courses planned can be divided into the following sections:

- AXMEDIS infrastructure and architecture (DSI....)
- AXMEDIS content (ILABS .....
- AXMEDIS Business (TISCALI...)
- AXMEDIS Overview (ANSC, XIM, UNIVLEEDS, DSI, ...)

In addition to the above sections, further Training courses anticipated include:

- AXMEDIS system installation and configuration (DSI, EXITECH ...)
- AXMEDIS system maintenance and management (e.g. backup, archiving and system monitoring) (DSI, EXITECH, ...)
- Working with the AXMEDIS system (DSI, ... ALL)
- AXMEDIS content management and AXMEDIS compliant CMS (TISCALI, EXITECH, DSI, ...)
- AXMEDIS protection aspects (working with AXMEDIS protected objects, DRM, ...) and tools including DRM rules definition (FUPF, FHGIGD, ...)
- AXMEDIS distribution: setup, management and operation (TISCALI, EUTELSAT, COMVERSE, ILABS, ....)

The training courses will be divided into two streams for different target:

- Decision Makers
- Technical Experts

For Decision makers, the courses will include overview sections to discuss the benefits and values of the AXMEDIS applications, with a vision of new workflows, human resource requirements, business benefits and trends.

For Technical experts, the courses will be focused on the procedures and steps on how to carry out the work, and further technical details.

## **11.1 Training and courses for Technical Experts**

The training courses devised for technical experts will include the technical aspects of AXMEDIS and provide an understanding of the system architecture, hardware, software tools, procedures and documentation. This course is to be devised to provide tutorials on the following topics. These courses are to be prepared and supported by various project partners as presented in the following sections.

### **11.1.1 AXMEDIS infrastructure and architecture (DSI, EXITECH ...)**

#### **Course objectives**

The aim of the course is to provide general information about AXMEDIS architecture and its integration in several different productive and distribution contexts to the participant of the course. The main concepts of this particular course is to provide in-depth operative details to the technical experts on how to create, protect, distribute the content using the AXMEDIS infrastructure and architecture.

### **Course content**

The training course on AXMEDIS Infrastructure and architecture will have the following structure and argument addressed:

- General overview of AXMEDIS goals
- AXMEDIS impacts on the value chain
  - Crawling
  - AXMEDIS Factory
  - AXPTool and AXMEDIS factory integration
  - Publication and distribution
  - AXMEDIS Certification and Verification
  - AXMEDIS database
- The AXMEDIS Content Model
  - What is an AXMEDIS object
- The main AXMEDIS Scenarios
- The application of AXMEDIS
- The distribution channels of AXMEDIS
- AXMEDIS editors and viewers

The responsible partner who will lead the preparation and presentation of this course is DSI.

### **11.1.2 AXMEDIS Content Production (DSI)**

#### **Course objectives**

The aim of the course is to give at the attendees a better idea of what can be created with AXMEDIS Factory and which are the benefits.

#### **Course content**

The training course will have the following structure and argument addressed:

- The AXMEDIS objects
  - Structure and evolution
- Crawling Scenarios
- AXMEDIS Content Processing scenarios
- Acting with the database, make a query
- The main tools:
  - AXMEDIS Editor
  - Integration with external editor and viewers
- The Main processing functionalities
  - Composition
  - Formatting
  - Adaptation
  - Protection
- Automating the process
  - Scripting and scheduling
- AXMEDIS CP Scheduler and GRID
- Relationships with your database

The responsible partner who will lead the preparation and presentation of this course is DSI.

### **11.1.3 AXMEDIS content (ILABS)**

This course is focused on how to prepare and create the content rather than on the whole mechanism to make the content in automatic manner. This last point is addressed in the section above.

The aim of the course is to give at the attendees a better idea of how content can be created both at general level and in line with AXMEDIS.

### **Course content**

The training course will have the following structure and argument addressed:

- Introduction to content design
- Myths & metropolitan legends about content design
- Kind of content and related issues
  - Text
  - Images
  - Audio
  - Multimedia
- Content design tips
  - Style & appearance
  - Notes & extensions
  - Drilldowns & additional info
  - Navigation
  - Accessibility
  - Device dependency
- Common issues
  - Tools & applications
  - Design problems
  - Content related problems
  - Content look & feel
- Things to avoid
  - Lack of clarity
  - Excess of emphasis
  - Too crowded content
  - Too complex language
  - Too complex interfaces
  - Too little help / support information
- Recommendations
- Self assessment
- Glossary

The responsible partner who will lead the preparation and presentation of this course is ILABS.

### **11.1.4 AXMEDIS Business (TISCALI)**

This course will provide information and guidelines concerning business applications, scenarios and other business related issues. The responsible partner who will lead the preparation and presentation of this course is TISCALI.

Main goal will be to guide AXMEDIS actors on how to benefit in terms of business value by the use of the tools and models provided by the Axmedis framework.

Primarily the training will be focused on business model tools and market analysis instruments required in order to assess the economic opportunities provided by Axmedis.

Training sessions may provide the definition of business models and relevant Key Performance Indicators based on production, distribution of content as well as licensing and integration of applications. They may also include also business cases as analyzed within the Axmedis project.

### DE3.1.3 – AXMEDIS Content Aspects Specification & Specification of Training and Demonstration

In this activity several training material will be developed, including training sessions to the specified target users. The activity is planned to be replicated every 8 months. Training material developed will include:

- Manuals for describing of the different business models and business cases available
- Training sessions for:
  - o How to determine the KPIs in content production
  - o How to determine the KPIs in content distribution
  - o How to determine the KPIs in software licensing and integration
  - o Which market analysis instruments are better suited for the market assessment in content production
  - o Which market analysis instruments are better suited for the market assessment in content distribution
  - o Which market analysis instruments are better suited for the market assessment in software licensing and integration

The training material will evolve as more tools and business models are supported by Axmedis, based on the periodicity of this activity.

#### **11.1.5 AXMEDIS Overview (ANSC, XIM, UNIVLEEDS, DSI, ...)**

This is an overview training course which provide overall high-level interlocation to the AXMEDIS Framework, starting from the overall project aim and objects and provide various holistic views to show the potential applications and plausible usage with examples.

##### **Intended audience**

Although the course will present the “big picture” of AXMEDIS from a mainly technical perspective, it will do so at a sufficiently high level and with minimal jargon for it to be relevant to business and end-user audiences as well as technical experts.

##### **Course objectives**

By the end of the course, attendees will understand:

- the core AXMEDIS concepts of peer-to-peer for collaborative business-to-business production, automatic content formatting, DRM and workflow management
- the basic lifecycle of an AXMEDIS object through a typical workflow from production, through aggregation/integration and cross-channel distribution to the consumer
- the components of the AXMEDIS Framework and their respective functions and relationships
- suitable applications of AXMEDIS tools in content creation, integration and distribution
- an overview of the schedule of AXMEDIS training courses being developed, and therefore where to look for more detailed information, for example concerning AXMEDIS APIs, business issues, etc.

##### **Course content**

The course will include many practical examples, case studies and scenarios in order to explain the physical operation of the AXMEDIS Framework in practice, as well as presenting at a high level the theory and technology behind AXMEDIS including

- MPEG21
- DRM
- workflow management
- automated formatting
- specific targeted courses including courses for libraries, archives, museums and theatres
- etc.

Responsible partner(s) who will prepare and present the course include ANSC, XIM, UNIVLEEDS and DSI.

#### **11.1.6 Training for producing Content with the automatic Tools (UNIVLEEDS)**

WP7.5 is to be managed by UNIVLEEDS during M19–M48. WP7.5 on Training for producing content with the automated AXMEDIS tools is scheduled to take place during M19 to M48 of the project, and it include the following areas: content production, content modelling, formatting modelling, insertion of technical metadata, exploitation of metadata, usability training, definition of new formats, definition of new content production styles, set up and customise the process for content production on demand.

In this subWP, UNIVLEEDS will collaborate with all the relevant partners to develop the training materials and established relations with relevant user organisations to promote this training. Up-to-date AXMEDIS prototypes and modules will be collected and studies in order to create a set of training materials. These materials aim to provide the awareness and understanding of AXMEDIS tools and technologies, and to provide training to relevant users on how to use them. This activity is planned to be replicated every 6 months.

#### **11.1.7 Training about DRM rules definition (FUPF)**

WP7.4 is to be managed by FUPF during the period of M19-M48.

This activity will cope with the description of how DRM rules can be used for the definition of business models for different kinds of content, distribution channel, etc.

They may include the definition of licensing models for different distribution channels, different rights of usage and conditions associated to them, tracking of the actions licensed, and, in general, how we can define DRM rules over content that is later on monitored and finally exploited. The use of the DRM model at all levels of the distribution chain, but specially on the end user device and tools will be a critical issue.

In this activity several training material will be developed, including training sessions to the specified target users. The activity is planned to be replicated every 8 months. Training material developed will include:

- Manuals for describing the definition of DRM rules
- Training sessions for:
  - o Explaining how to define business models using DRM rules
  - o Explaining how to use tools implemented for the definition of DRM rules
- Manuals for the training sessions

The training material will evolve as more tools and business models are supported by the DRM rules, based on the periodicity of this activity.

### **11.2 Training and courses for Decision Makers (DSI, EXITECH, TISCALI, XIM, ACIT, CRS4, FUPF, ILABS, EUTELSAT, FHGIGD, UNIVLEEDS, COMVERSE)**

#### **Intended audience**

This course is aimed at Decision Makers, i.e. potential future buyers and adopters of AXMEDIS-derived tools, technologies and services. Decision Makers may have technical backgrounds, but may also be from creative, publishing or distribution business backgrounds, and hence the course will be designed to be of value to non-technical as well as technical Decision Makers.

#### **Course objectives**

The aim of the course for decision makers is to provide an understanding of the system architecture, hardware, software tools, procedures and the documentation for AXMEDIS. This course is designed to make potential users aware of the AXMEDIS applications from a user perspective.

#### **Course content**

This course will refer to the workflow and business process of the users and demonstrate the benefits and added value of AXMEDIS applications integrated into their domain. By taking practical examples with relevant 'hot topics' (for example, the challenge of competing with illegal P2P consumer downloads), the course will provide awareness of costs, risks, and benefits of adopting AXMEDIS.

The same Training courses as in the above section for Technical Experts will be used to create the Training courses for Decision Makers, with the additional focus on business related materials while reducing the technical coverage and explanation which will be provided by reference to the Technical Training courses. For Decision makers, the courses will include overview sections to discuss the benefits and values of the AXMEDIS applications, with a vision of new workflows, human resource requirements, business benefits and trends

Partners to be committed to setting up and maintaining tutorials include DSI, EXITECH, TISCALI, XIM, CRS4, FUPF, ILABS, EUTELSAT, FHGIGD, UNIVLEEDS, and COMVERSE.

### **11.2.1 Training Course for user-centred product creation and validation (ACIT)**

The objective of this course is to complement the other courses which introduce to the AXMEDIS framework and applications. This course will introduce to basic knowledge in user-centred product creation and provide hands-on training and experience in user validation and appropriate methods.

The objectives of the course are:

- to empower decision makers to make early decisions about the adoption of AXMEDIS framework and applications based on the validation results.
- to ensure that managers are aware of usability quality and commit themselves to user validation
- to build key skills needed to plan the validation of the AXMEDIS framework and applications and of demonstrators within the AXMEDIS project, in Take-up-actions and in other, external projects

The course will be integrated closely with technical training, and will include coordination and the fostering of cooperation with other relevant FP6 projects.

#### **Intended audience**

The course will be relevant to potential users - technology/business-users as well as end-users. The main focus will be on users from SMEs. Decision makers, managers and technical experts will be introduced to the quality of use issues of the AXMEDIS framework and applications.

#### **Course objectives**

Participants from prospective user companies will learn to test and validate the AXMEDIS framework and applications in order to assess the benefits and added value for their domain and to generate further feedback about their needs and expectations. By the end of the course, attendees will understand:

- how to plan and manage user validation
- the major steps involved in planning and carrying out user validation
- how to select and apply appropriate methods and tools

#### **Course content**

The course will consist of the following themes together with practical examples:

- Introduction to user-centred product creation
- User needs and requirements analysis techniques
- Usability inspection
- User testing with focus on the evaluation of efficiency and effectiveness
- User satisfaction measurements
- Cost / benefit analysis

Responsible partner(s) who will prepare and present the course include ACIT and XIM.

## **12 Conclusion**

This Deliverable consists of two documents. This is the main document, with an accompanying document which contains all the Appendixes. This main Document is further dichotomised into two sections. Section one described specifications related to the Content aspects. Section two of this main document presents the specifications and guidelines for AXMEDIS training and demonstration activities. It specifies work plan for

the several training and demonstration activities, including models of documentation, scheduling, and others.

## 13 References & Standards (ALL)

In this sections are reported the more relevant reference and standards that have to be taken into account when selecting content either for re-editing / publishing or distribution purposes. The reader will find here quick reference information and links to more in depth info. Cataloguing of all media: all records are planned to be in XML format.

### 13.1 IMAGES

- Conservative (off line)
- TIFF not compressed 24 bit 600 dpi for images within the A4 size. TIFF not compressed 24 bit 400 dpi for images larger than A4 size.
- Public
- JPEGs 24 bit 300 dpi for intranet
- JPEGs 150 dpi or less for internet

### 13.2 AUDIO

- WAVE 24 bit 96Khz for conservative activity (offline)
- MP3 128 kbit for intranet and internet
- WAV files for offline unencrypted archiving purposes
- Windows Media v9 128/192Kbps for PC downloads
- Windows Media v9 128Kbps / 64KBps / 32Kbps for PC streaming
- Windows Media v9 32Kbps for 30 second clip streaming
- WindowsMedia 64Kbps, AAC 64 Kbps for prototype over the air delivery to GSM/GPRS mobile platforms

### 13.3 VIDEO

- For any content that is likely to be broadcast in Europe, video content needs to conform to PAL/EBU standards for colour space (a very limited colour gamut for TV compared with computer monitors), aspect ratio and 'safe area' (the central zone of screen area which can be assumed to appear on the majority of viewers' screens). Many other standards also apply, a good reference document for these is provided by the UK BBC at:  
[http://www.bbc.co.uk/wales/info/commissioning/delivery\\_tv/documents/technical\\_standards\\_englang.pdf](http://www.bbc.co.uk/wales/info/commissioning/delivery_tv/documents/technical_standards_englang.pdf)

### 13.4 BOOKS

- UNIMARC RECORDS (textual cataloguing information that has to be decoded)

### 13.5 WEB CONTENT

- Accessibility - for online content, it is important to refer to accessibility guidelines, such as those developed by the W3C organisation (see reference [7]).
- Browser compatibility - web content must also meet open standards to ensure the widest possible browser compatibility; these again can be found at the World Wide Web consortium ([www.w3c.org](http://www.w3c.org))

### 13.6 LO Metadata and e-learning (ILABS)

#### 13.6.1 How to specify languages

Wherever it is necessary to specify a language such as in data element 'General.Language' or in any language string the following coding can be used:

1. use a 2 letter code from ISO 639-1
2. use a 3 letter code from ISO 639-2 (see: <http://www.loc.gov/standards/iso639-2/normtext.html>, it does not matter between bibliographic & terminology since they only differ for languages that have

- 2-letter codes)
- 3. add the ISO Country code [ISO3166] when necessary, separated by a dash.
- 4. use IANA registered language tags, prefixed with **i-**
- 5. use SIL Ethnologue 3-letter codes, prefixed with **x-E-**
- 6. make up a name for token languages prefixed with **x-T-**
- 7. make up a name, prefixed with **x-** for user defined languages

All the above are acceptable but partners should prefer 1, 2, or 3; in the following table some examples are provided:

Type	Coding	Description
ISO 639-1	nl	Dutch
ISO 639-2	aus	Australian Languages
ISO 3166	IT	Italian
IANA	i-xxxxx	IANA registered xxxxx
SIL Ethnologue	x-E-pcd	Picard
SIL Ethnologue	x-T-ELR	The ELR Token Language
SIL Ethnologue	x-none	Not possible to identify a language

### 13.6.2 Data Types

There are five data types in the LOM information model briefly, LOM types are:

- ❑ **CharacterString:** text can be entered in the element directly.
- ❑ **LangString:** the text must identify its language and there can be one or more character strings in the element.
- ❑ **DateTime:** the element contains date and time information and there can also be textual information about this point in time.
- ❑ **Duration:** the element contains information about an interval in time and there can also be textual information about the duration.
- ❑ **Vocabulary:** the element contains source and value where source is a reference to publicly sourced and maintained value set and value is a value from that set.

### 13.6.3 Metadata structure

In the following section are reported the principal metadata associated to a LO and their partitioning in are of major relevance. There are several areas and for each there is a set of values. It is nevertheless possible to modify this structure adding or removing data. Both operations have to be performed following IMS standards in order to avoid ending up with a metadata structure no more compliant. In the packager interface most relevant metadata have been grouped for easier input. In the advanced view is possible to insert, modify or delete data following the regular structure foreseen in IMS. Such structure and related meaning is reported hereafter:

### 13.6.4 Mandatory Elements

In the following paragraph are reported the metadata field that should be considered mandatory when compiling metadata. These are basically the fields that will enable efficient search and retrieval of LO.

**General.Identifier** - is intended to give the LO a unique label to identify the LO and its origin. This element is for administrative purposes only and should not be exposed to common users.

**General.Title** - is intended to give the LO a human readable name. It is a LangString element which provides a possibility to define the used language.

**General.Language** - is intended to identify languages used within the LO. Value space for this element has been described previously. Please note that “x-none” is an acceptable value unlike in other language elements. “x-none” is an actual value stored with the element but it is mapped to an appropriate language word in user interfaces. Every language used to communicate with a user in a LO should be described. Languages are not exposed to users as codes and tokens used by machines but in human readable form. The applications, e.g. search engines and metadata tagging tools, are mapping codes to words which are then shown to users by their respective user interfaces. Value “x-none” should be used when it is not possible to identify any language for a LO (e.g. the picture of a flower).

**General.Description** - is intended to provide summarizing description of the LO. It is a LangString element which gives a possibility to define the LO overall description and can be up to 2000

character long.

**Technical.Location** - is intended to provide information where the LO is physically located. It is CharacterString and there can be up to ten values. If there are multiple values the first one should be the one that is most preferred. It is also possible to give a direct URL pointing to a LO in this element. To avoid manual input, values for this element should be captured from or supplied by an electronic system whenever possible

**Educational.Intended End User Role** - is intended to indicate the typical user of the LO. The value space for this element consists of four values (Author, Learner, Manager and Teacher) reported hereafter:

- Author** - creates or publishes a LO (LOM).
- Learner** - works with a LO in order to learn something (LOM).
- Manager** - manages the delivery of a LO (LOM).
- Teacher** - One who or that which teaches or instructs; an instructor (OED).

**Educational.Typical Age Range** - is intended to indicate the typical age of the user of the LO. The value space for this element is a minimum to maximum age range expressed in integral years and separated by a hyphen. Either minimum or maximum value can be set to U (undefined) meaning that then the range is extended in that way. Used with 'Educational.Context' element it is possible to indicate e.g. school levels and grades with enough precision. Because of very different school systems in different countries it seems impossible to make comprehensive vocabularies that meet the needs of each country.

**Rights.Copyright and Other Restrictions'** - is intended to indicate if any copyright or other restrictions apply to the LO. The value space for this element is a LOM Vocabulary whose values are reported hereafter:

- Yes** - Copyright and/or other restrictions apply to a LO.
- No** - No copyright or other restrictions apply to a LO.

**Rights.Description** - is intended to provide a textual description of copyrights or other restrictions that apply to the LO. 'It is a LangString element which provide a possibility to define copyrights and other restrictions applying to the LO. If the value of element is "Yes", there has to be textual information about those copyrights and restrictions, i.e. then this is a mandatory element.

**Classification.Keyword** - is intended to describe the LO content via keywords. This element is a child of 'Classification' container elements. Up to 40 values could be used and the order of them is not meaningful.

### 13.6.5 Recommended Elements

Recommended elements are those that would be very useful to have filled in for every metadata instance that is exposed, but they could be left unfilled.

**General.Keyword** - is intended to provide free text keywords describing the LO's content. General.Keyword elements and data type LangString permits ten different languages for each individual element. The tagging user interface should be designed so that it provides the possibility of entering individual keywords in different languages in one element. The most specific terms descriptive of the LO's content should be used. Each term or phrase should use a separate keyword element and lengthy phrases should be avoided.

**General.Structure** - is intended to provide information about the structure of the LO. The value space for this element is a LOM Vocabulary with the following values:

- Atomic** - something that is indivisible (in this context). Individual picture, sound etc. files are considered always 'Atomic'.
- Collection** - a set of items with no specified (navigational) relationship between them. An HTML page containing assorted picture files can be considered 'Collection' type.
- Networked** - a set of items that are linked together with no clearly defined path.  
NOTE: Because only one value is permitted to this element, objects containing multiple features from this vocabulary should be defined as 'Networked'.
- Hierarchical** - a set of objects that are linked together with tree structure path.
- Linear** - a set of LOs that are linked together with clearly defined single sequence path.

**Life Cycle.Contribute** - is intended to describe who has contributed to the LO. It is a container element. It permits up to 30 elements. If this element is used, then elements like 'Life Cycle.Contribute.Role' and 'Life Cycle.Contribute.Entity' have to be instantiated (i.e. they are

mandatory), while use of ‘Life Cycle.Contribute.Date’ is recommended but not mandatory. Moreover this element concerns the contributors of the LO. Element ‘Meta-Metadata.Contribute’ concerns the contributors of the metadata instance itself.

**Life Cycle.Contribute.Role** - is intended to describe the role of the contributor. The value space for this element is a LOM Vocabulary with the following possible values:

- ❑ **Author** - An entity primarily responsible for making the content of the LO. An author can be a person, institution, group or other entity. If a team has made the LO usually only then there is need for identifying other roles than ‘Author’ (e.g. ‘ Graphical designer’, ‘Technical implementer’, etc.).
- ❑ **Publisher** - The individual or organization responsible for making the LO available in its present form, such as a publishing house, a university department, or a corporate entity (Dublin Core).
- ❑ **Unknown** - The individual or organization whose role of contribution is not known.
- ❑ **Initiator** - The person, institution, or funding agency responsible for originally causing the development process.
- ❑ **Terminator** - The person or entity responsible for intentionally removing access to the LO.
- ❑ **Validator** - The person or entity responsible for confirming the overall integrity of the LO.
- ❑ **Editor** - The person or entity responsible for the revision of the LO for the purposes of publication or public presentation.
- ❑ **Graphical designer** - The specialist or entity responsible for the construction of the visual elements of a LO.
- ❑ **Technical implementer** - The specialist or entity responsible for the construction of the technical elements of a LO (usually software programmer).
- ❑ **Content provider** - The person or entity that is supplying content for the LO.
- ❑ **Technical validator** - The person or entity responsible for confirming the technical integrity of the LO.
- ❑ **Educational validator** - The person or entity responsible for confirming the educational integrity of the LO.
- ❑ **Script writer** - The person or entity responsible for the creation of a text read or performed in an audio, video, and/or interactive learning resource.
- ❑ **Instructional designer** - The specialist or entity responsible for applying research-based principles to the design of the LO.

**Life Cycle.Contribute.Entity** - is intended for identification of and information about entities (i.e., people, organizations) contributing to the LO. The value space for this element is a IMC vCard 3.0. Up to 40 elements are allowed.

**Life Cycle.Contribute.Date** - is intended for the date of contribution. The value space for this element is DateTime data type.

**Meta-Metadata** - is intended to describe who has contributed to the metadata instance. The ‘Meta-Metadata.Contribute’ is a container element. Up to ten ‘Meta-Metadata.Contribute’ elements are allowed. If this element is used, then elements ‘Meta-Metadata.Contribute.Role’, ‘Meta-Metadata.Contribute.Entity’ and ‘Life Cycle.Contribute.Date’ have to be instantiated, i.e. then they are mandatory elements. Please note that this element concerns the contributors of the metadata instance. ‘Life Cycle.Contribute’ concerns the contributors of the LO.

**Meta-Metadata.Contribute.Role** - is intended to describe the role of the contributor. The value space for this element is a LOM Vocabulary with the following values:

- ❑ **Creator** - the entity (person, organization, or indexing system) primarily responsible for making the content of the metadata record. A creator can be a person, institution, group, or other entity.
- ❑ **Validator** - the entity that is primarily responsible for ensuring the syntactic and semantic integrity of the metadata record according to the rules and recommendations of the metadata schemas and quality control mechanisms. A validator can be a person, institution, group or other entity.

**Meta-Metadata.Contribute.Entity** - is intended for identification of and information about entities (i.e., people, organizations) contributing to the metadata instance. The value space for this element is a IMC vCard 3.0. Up to ten such elements are permitted.

NOTE: Minimum information about a person: name (first and last) and affiliation. Minimum information about organization: name and web page address.

**Meta-Metadata.Date** - is intended for the date of contribution. The value space for this element is DateTime data type.

**Meta-Metadata.Language** - is intended to describe the language of the metadata instance.

NOTE: This element concerns the language of the metadata instance. Element 'General.Language' concerns the language of the LO. The value space for 'Meta-Metadata.Language' element has been previously described in detail and there can be only one value. The choice of language used in this element is used as the default language of the all LangString data types in a metadata instance unless otherwise specified.

**Technical.Format** - is intended to provide information about software needed to access the LO. Value space for this element is described in some detail hereafter and there can be up to 40 values. MIME Types (actual values, e.g. "application/x-pn-realmedia") are not necessarily exposed to users but they may be shown in amore human readable text. The applications, e.g. search engines and metadata tagging tools, are mapping MIME Types to words that are then shown to users by user interfaces. All the components of a LO should be described. If a LO comprises several MIME types (e.g. a Web page with images and videos), all types should be listed. If the format of a learning object is a content package, then this data element describes all the formats inside a package and the information about a package is provided in the element 'Technical.Facet'. If there are additional information needed for technical format of a LO (e.g. "FlashPlayer 6 required"), it should be described as free text in 'Technical.Description'.

**Technical.Size** - is intended to provide information about the actual file size of the LO. The value is expressed in bytes and there can be only one value. Although the actual value is in bytes, user interfaces should give users more friendly view of this data. If the LO is compressed, then this element should refer to the uncompressed size.

**Technical.Facet** - is intended for classifying technical requirements of the LO. This is a container element and up to fifteen such elements are allowed. If this element is used, in elements 'Technical.Facet.Name' and 'Technical.Facet.Value' has to be instantiated, i.e. then they are mandatory elements. 'Technical.Facet.Name' identifies the name of a technical facet of the learning object. The value space for 'Technical.Facet.Name' element is a vocabulary with values:

- ❑ **Packaged format** - A LO is a content package.
- ❑ **SCORM 1.2** - A LO contains SCORM 1.2 API features.

**Technical.Facet.Value** - is intended to give the value of a technical facet of the learning object. The value space for this element is a vocabulary whose values depend on chosen 'Technical.Facet.Name', nominally:

1. Vocabulary values for 'Packaged format':
  - **Application/zip** - A content package is in zip format.
2. Vocabulary values for 'SCORM 1.2':
  - **Enhanced** - LO is enhanced when a SCORM 1.2 compatible player is available.
  - **Required** - LO requires a SCORM 1.2 compatible player.

**Educational.Learning Resource Type** - is intended to indicate the potential educational use(s) or type(s) of the LO. The value space for this element is a vocabulary. Adopted Information Model permits eight different kind of such elements. It should be noted that many LOs have features from more than one of the following categories. Guides and glossaries are information resources and exploration LOs can contain drill and practice elements. Templates can be tagged as tools or guides and the use of free keywords for further description is recommended. One or more (up to eight) values from a vocabulary should be selected for this element. Elements are ordered so the first value is a most dominant kind. There is no information concerning to whom a LO is intended in this element. 'Educational.Intended End User Role' is intended to indicate the typical user of the LO. Foreseen vocabulary values:

- ❑ **Assessment** - Assessment and evaluation items. Exams and tests. Any LO whose primary purpose is the evaluation of the user's actions or input or to support teacher design or development of such materials. Used e.g. for assess learner performance or self-assessment.
- ❑ **Drill and practice** - Simple exercises and games. Exercises (drills) that perform skill training are very condition and action specific. They usually contain only simple IF-THEN

logic rules. Many ‘educational’ games belong to this category if they concentrate on specific skills.

- ❑ **Exploration** - Simulations and experiments. Simulations are imitating the behaviour of some situation or by means of a suitably analogous situation or apparatus. Experiments are actions or operations undertaken in order to discover something unknown, to test a hypothesis, or establish or illustrate some known truth.
- ❑ **Glossary** - Dictionaries and vocabularies. Collection of specialized terms and their meanings usually arranged in some stated order.
- ❑ **Guide** - Manuals and tutorials. Manuals provide guidance on the particular topic (e.g. roadmap, hints, etc.) and are usually also intended to be kept at hand for reference. Tutorials are resources that provide guided, practical information about a specific subject.
- ❑ **Information resource** - Pictures, texts, videos, presentations, collections and databases. Any presentation or informative content that is ‘raw’ material for learning.
- ❑ **Open activity** - Artistic projects and creative exercises. Projects and exercises that are not very confined or limited. Many more complicated games that require more than simple logic belong to this category.
- ❑ **Tool** - Editors and other kind of programs for producing something. Editors can process e.g. text or pictures and they can be used for creating and editing other LOs. Tools can also perform calculations or conversions.

**Educational.Learning Context** - is intended to indicate the institutional environment or the level of education appropriate for use of the LO. The value space for this element is a vocabulary. Adopted information model permits 12 different elements. This vocabulary should be used in conjunction with element ‘Typical Age Range’ in order to express the full context. For example the value “Compulsory education” will be interpreted differently in different countries but is meant to indicate the regular schooling and other education after kindergarten and before higher education. In user interfaces the terms applicable in each country should be used and/or alternative vocabularies that map to this vocabulary could also be used.

- ❑ **Pre-school** - A kindergarten or nursery school for children of preschool age. (OED)
- ❑ **Compulsory education** - Regular schooling and other education after kindergarten and before higher education.
- ❑ **Special education** - Designed or provided for persons who have special educational needs which prevent them from receiving (wholly) mainstream education. This value can be selected together with any other values in this vocabulary in order to express special need in any context.
- ❑ **Vocational education** - Training or education that is pertaining or relating to a vocation or occupation.
- ❑ **Higher education** - Education provided by a college or university.
- ❑ **Distance education** - Instructional delivery that does not constrain the student to be physically present in the same location as the instructor.
- ❑ **Adult / continuing education** - further education of those over ordinary school age. Adult / continuing education is not related to job training in this context.
- ❑ **Professional development** - Training or education that is related to improving professional skills.
- ❑ **School libraries / documentation center** - places where the information skills are taught and the access to learning services, books, and multimedia resources in a school environment are organized.
- ❑ **Educational administration** - Management and administration of educational and training institutions.
- ❑ **Policy making** - Makers of policy decisions. This value is intended to higher levels than local institutions management.

**Educational.Typical Learning Time** - is intended to indicate how long it will likely take a learner or other user to use the LO. This element is especially useful for audio and video clips. Because the actual value is in Duration data type form, user interfaces should give users a more friendly view on this data.

**Educational.Description** - is intended to provide a textual description of educational uses of the LO. It is a LangString element that provides a possibility to define the used language. Adopted

information model permits ten different elements and data type LangString ten different languages for each individual element. Each description can be up to 1000 character long. There can be multiple values element but they must be each in a different language. This element is for describing the use of a LO. A description of a LO and its content should be provided in ‘General.Description’.

<b>lom</b>	<b>general</b>	<b>identifier</b>		
		<b>title</b>		
		<b>catalogentry</b>	<b>catalogue</b>	
		<b>language</b>	<b>entry</b>	
		<b>description</b>		
		<b>keywords</b>		
		<b>coverage</b>		
		<b>structure</b>		
		<b>aggregationlevel</b>		
		<b>lifecycle</b>	<b>version</b>	<b>role</b>
			<b>status</b>	<b>entity</b>
			<b>contribute</b>	<b>date</b>
		<b>metametadata</b>	<b>identifier</b>	<b>catalog</b>
			<b>catalogentry</b>	<b>entry</b>
			<b>contribute</b>	<b>role</b>
			<b>metedatascheme</b>	<b>centity</b>
			<b>language</b>	<b>date</b>
		<b>technical</b>	<b>format</b>	
			<b>size</b>	<b>type</b>
			<b>location</b>	<b>name</b>
		<b>requirement</b>	<b>mimumversion</b>	
		<b>installationremarks</b>	<b>maximumversion</b>	
		<b>otherplatformrequirements</b>		
		<b>duration</b>		
	<b>educational</b>	<b>interactivitytype</b>		
		<b>learningsourcetype</b>		
		<b>interactivitylevel</b>		
		<b>semanticdensity</b>		
		<b>intendedenduserrole</b>		
		<b>context</b>		
		<b>typicalagerange</b>		
		<b>difficulty</b>		
		<b>typicallearningtime</b>		
		<b>description</b>		
		<b>language</b>		
	<b>rights</b>	<b>cost</b>		
		<b>copyrightandotherrestrictions</b>		
		<b>description</b>		
	<b>relation</b>	<b>kind</b>	<b>identifier</b>	
		<b>resource</b>	<b>description</b>	
			<b>catalog</b>	
			<b>entry</b>	
	<b>annotation</b>	<b>person</b>		
		<b>date</b>		
		<b>description</b>		
	<b>classification</b>	<b>purpose</b>	<b>source</b>	
		<b>taxonpath</b>	<b>taxon</b>	
		<b>description</b>	<b>id</b>	
		<b>keywords</b>	<b>entry</b>	
			<b>taxon</b>	

### 13.7 e-learning background knowledge reflected in LO metadata (ILABS)

#### 13.7.1 Exploiting the user prior knowledge

There is a general agreement that learning is also based on previously acquired knowledge and skills. However, learning is not a simple cumulative process in which all new contents and skills components can be added to prior ones. Prior knowledge has a much more fundamental significance in the human knowledge construction process, because its structures and conceptions are actively involved in the information

processing. For example previous knowledge structures (mental models, mental presentations) tend to focus human perception and interpretation of perceived information. In other words, when new information is provided, learners try to interpret it in the context of their already existing representations. Because the activation of learners' prior knowledge has a significant role in the learning of new content, it's important to bear that in mind in the design of LO, these are possible suggestions in this respect:

- Stimulate the learner to think at & revise what s/he already knows about the content being learned. This awakening can be made in the form of questions. Questions should provoke learners' interests in the issues; therefore questions nature should be thought-provoking and not a measurement of the level of the learners' prior knowledge
- Help the learner to evaluate limitations of own understanding on the issue. Prior knowledge can be activated also by presenting information that challenges user thinking. A good way to do this is to present scientifically proven information yet conflicting with the typical mental models of target learners.
- Help reflecting how the issue is connected to the other related issues already known. A good way to achieve this is to anchor the content being learned to problems and contexts that spring directly from learners' everyday experience. When the context of learning is familiar, it is easier to recall ideas, related to already learned issues.

In other words it is crucial to wake up learners' motivation toward proposed issues, in addition to activating their thinking. The whole approach of the LO can be constructed in a way that it guides learners to discover issues being learned by solving problems that are familiar.

### 13.7.2 Conceptual change

Presumptions are often the cause of learning failure. Sometimes faulty assumptions can hinder learning new content; it is therefore necessary to design LO and content so as to foster conceptual change. This means that learners' pre-instructional conceptual structures have to be fundamentally restructured and reformulated in order to allow understanding of the intended knowledge, this requires specific stimulation. Furthermore, in order to revise preconceptions, learners need to become aware of them, that is, they have to develop their meta-conceptual awareness. There are number of ways to support such process of conceptual change. Here are just presented some suggestions on how these can be achieved in the design of LO.

- Activate learners' prior knowledge about the issue at hand. The learner needs to become aware of own limited interpretations and understanding in order to be able to revise it. This can be accomplished by confronting some data that challenges own current beliefs.
- Challenge learners' thinking by asking questions and/or presenting conflicting data or multiple perspectives. One promising way to produce such confrontation is to present competing predictions of other peers that can challenge learner's thinking.
- Give learners an opportunity to express themselves and get feedback on their action. It's important that learners can express their own ideas on the content being learned, and then compare them to those of others. In the design of LOs or LO packages this can be implemented for example by using tools like mind map, whiteboard, discussion forums or chat. Afterwards learners should be given an opportunity to obtain feedback and compare their own products with others' products or with the sample of example products.
- Give learners a chance to interact with the content. The stimulation to learn new concepts and reformulate prior ones can be accomplished by using interactive tools (e.g. simulations) with which learners can manipulate abstract concepts, test their own assumptions about them and see the consequences of their own actions.
- Present content by using multiple representations and link them together. The understanding of content being learned may benefit from using multiple representations and the potential offered by hypermedia. By using multiple representations the abstract concepts can be made more concrete and easier to understand. The concepts and different representations can also be linked together to explicate the interconnection between them.
- Provide scaffolding throughout the process. As stated earlier, conceptual change needs scaffolding, which can be provided either by teacher, more advanced peers or even by the LO. The main point in scaffolding is that it doesn't give straight answers and solutions to learners, but engages them with thinking and only subtly leads towards preferred directions. If the scaffolding is included in the design of the LO, it can be made in a form of activating questions or advices to reflect the work done. The implementation of intelligent tutoring system inside the LO is not a

realistic option.

### 13.7.3 Expert models and guidance

In a learning process, learners acquire deeper understanding, if they can compare their performance against an ideal one (expert's performance or even better). This works as a model for the learners. Typically a teacher or a textbook gives a model, but they often too limited. Content / topics should be explained and presented so that the learner can find differences in respect to their own performance and understanding. To achieve this is possible to try what follows:

- Show how different experts think about the topic, e.g. statements, examples, interviews...
- Give expert models e.g. in video clips, pictures or voice, explaining critical points.
- If the LO consists of tasks, show also how an expert would solve the task and why.
- Provide support, just-in-time guidance and modelling of appropriate action to the learners (scaffolding). This can either be provided by a teacher or by the LO. In the LO the scaffolding can mainly be done in a form of activating questions and summaries, or hints and recommendations, which prompt learners to reflect their own learning and ways of working with the LO. Modelling of appropriate progression can also be made e.g. in a form of tutorial which can show what kind of discovery processes experts do with the experimenting tools (simulation).

### 13.7.4 Complexity of the content

Too often learning contents are presented just as clean models or simplified truths. For learning this can be a wrong approach because it doesn't help the learner to recognize the phenomenon in real life and the connection between model and phenomenon itself. Sometimes it is necessary to face the complexity of the content. It means that the learning process, content, activities and tools emphasize knowledge and understanding in real life situations. There are several ways of tackling the problem and several perspectives to take into account. It is also essential that the content is not thought too narrow-minded but it combines all necessary domains. Facing the complexity can be brought in to a LO in several means:

- Support authentic problems, which are not ready-made problems, but wide and they offer various approaches to some phenomenon, and represent the information in a way that raises questions
- Help to understand the complexity of a problem. Accept several ways for defining a problem, and solutions as well. Help to understand that there are even problems, which cannot be solved.
- Help to relate the content to other LOs and materials,
- Help to relate the learning in the previous work of the domain, e.g. by saving and reusing former student products
- Support content and activities that are authentic also to the learner and close e.g. own age, culture and thinking.

### 13.7.5 Multiple representations

Learning often involves the acquisition and use of complex systems of symbolic expressions often represented in different media. Real learning requires, in many situations, the ability to manipulate, connect, and understand the meaning and interrelationship of different kinds of external representations. However, such skills are difficult to acquire. Students often fail to understand the relationship that exists between symbolic expressions and the situations to which they refer. There is often the risk to learn the subject by imitation and memorization of the mechanical procedures and symbolic expressions. By providing multiple representations of the same phenomena in different contexts and externalizing the relationships between different models we can facilitate students' thinking. Computers can be very helpful in this as they allow

- Simultaneous representations of the same phenomena in multiple formats: Text, digital video, images, or immersive virtual realities, etc. They all have representational properties that are more suitable in one context than in other. Simultaneously using many media one can better clarify the properties of a phenomenon. Different media thus complement one another.
- Externalize informal representations. Link graphs and symbolic representations to the qualitative representations formed by experts, as well as literal aspects of the situation to which they refer. This facilitates understanding of abstract concepts by integrating them with a visual representation of a normally invisible process.
- Top-down and bottom-up representations: Novices are frequently constrained by the surface features of the problem and fail to see / understand the relevant conceptual deep structure. To address this issue how structural dimensions of knowledge (i.e., abstract domain concepts) apply in various cases or problem contexts should be made explicit. Furthermore, multiple cases we

should be also provided.

### 13.7.6 Collaboration

Cognitive research indicates that advancement of learning can be substantially elicited by relying on socially distributed cognitive resources, emerging through social interaction between learners, and collaborative efforts to advance shared understanding. In a shared problem-solving process, agents who have partial but different information about the problem in question appear both to improve their understanding through social interaction. Through social interaction, contradictions, inconsistencies, and limitations of students' explanations become available because it forces them to perceive conceptualizations from different points of view. Deep conceptual understanding is also fostered through explaining a problem to other inquirers. In order to explain one's view to his or her peers, an individual student has to commit cognitively to some ideas, explicate own beliefs, as well as organize and reorganize own knowledge. A crucial aspect of collaborative learning is to guide students to pose questions or problems that direct their work. It appears that themes and questions that arise from the students' own interests have a special value in collaborative learning. Here are some examples in the e-learning world:

- A collaborative learning object can be a meaningful, asynchronous discourse tool (knowledge building area) that has built-in supports. The support can be, for instance, in the form of guiding learners to categorize their computer entries (posting to the database on learning environment in question) according to essential aspects of work. The discourse tool can also include templates, examples or instructions for labelling the postings or organizing the collaborative process, such as: What do I still need to know? Can I explain what I mean with this?
- A collaborative learning object, for building knowledge or for fostering social awareness and community feeling, can also be a synchronous tool: chat function, writing template, graphical tool or "white board" that makes it possible for a group of students to author or edit collaboratively the same shared artefact at the same time.
- Even though there are no collaborative tools or functions in a LO, the learning tasks, and the recommendations for carrying them out, can be designed to encourage, and even require collaborative effort of a group of learners, such as a joint research task or a school journal.

### 13.7.7 Visualization of thinking

Students often face difficulties in monitoring their own learning processes. They find it difficult to remember or distinguish between different phases of their work (reasoning), which then causes problems in correcting their reasoning when they for example fail to complete some task in a desired manner. Students also often find it hard to keep more than one complex hypothesis activated at a time. By providing appropriate visualization tools these problems can be diminished. For example a graphical (e.g. tree-like) representation can work as a cognitive map for a user to explore the steps of own reasoning process more easily, and allow back and forth navigation whenever needed without disturbing the actual problem solving process. The graphical representation projected on the student screen can also serve as a shared point of reference that can help a group of students to better focus on the task at hand. This can also help teachers to monitor and more adequately support students' problem solving process. Some hints are:

- Provide tools (LOs) which record every action (e.g. decision) made by a student and represent that action graphically (e.g. tree-like concept map).
- The tool could also include a feature for student notes etc, which can make student's thinking even more visible.
- Work of individual student should be made accessible for everyone: monitoring of the progress made by others helps students to evaluate her/his own work.
- The tool should also allow students to commenting on the different phases of each other's work.
- Track the changes feature; the tool could also be organized in such manner that the same representation would simultaneously show the work (modifications) of different participants (individuals or/and groups) on the same task (e.g. object).

Concept maps, modelling of the process, advanced visualization & design tools are typically tools that help to visualize thinking processes.

### 13.7.8 Analogical reasoning

Solving complex problems and making sound decisions are difficult processes for all of us. Studies of problem solving reveal that people often don't retrieve relevant knowledge when needed. And furthermore, even if one can retrieve it there may be obstacles in implementing such knowledge in novel-appearing

problems and situations. Thus it could happen that having solved one problem does not offer much help in solving a similar one when the two come from very different context. One of the most relevant issue in knowledge transfer is access previous knowledge bearing surface, rather than structural, similarity. Often these surface features are constraining and can prevent recognizing relevant conceptual structure. To bypass this issue is necessary to encourage analogical reasoning, that is, to draw a comparison between two or more situations. If successful analogical transfer relies on perceived similarities between current and stored experiences, perhaps the abstraction of general principles during learning can form the basis for a perception of similarities in new situations involving the same principles. People seem to draw such abstractions readily when explicitly asked to compare. However, often this kind of comparison does not occur automatically, and the encouragement to compare is crucial. The abstraction of common structures can be achieved by focusing on shared aspects between sample problems with different surface features. After constructing abstractions of common structures of sample problems, these abstractions can be used retrieved and applied in future. Furthermore, this kind of analogical comparison can help understanding which aspects of the problem are relevant and which are not at first glance. Some suggestions while designing LO, in this respect, are:

- Present several examples of problems situations/contexts to the learners, which have:
  1. same deep structure and surface features,
  2. same deep structure, but different surface structures,
  3. different deep structure, but same surface features, and
  4. different deep structure and surface features.

These examples of situations can be presented either simultaneously or sequentially (bear in mind the limitations of human information processing). This can be done for example with animations or video clips presenting different problems to the learners

- Facilitate the comparison by asking explicitly the learners to compare the examples. It is very effective to present motivating questions, which requires the learners to compare previously represented examples. Comparison can also be facilitated by pointing out some interesting differences or similarities to learners, which they barely see without prompting.
- Encourage the learners to find out similarities and differences between different examples. This can also be made in a form of questions that especially require finding similarities and differences (e.g. in what way these matters are different from each others etc.)
- Highlight the relevant deep structure of given examples. Important aspects can be highlighted by using technology support; relevant features of example problems can be emphasized visually or verbally.
- Facilitate the ownership of working, that is, to give the learners an opportunity to solve the problem by themselves with their own methods. There should be tools available with which learners can make their own discoveries and experimentations with example problems. Especially highly interactive simulations can be appropriate means for students-led discoveries.
- Provide support, just-in-time guidance and modelling of appropriate action to the learners (scaffolding). Scaffolding can either be provided by a teacher or by the LO. In the LO the scaffolding can mainly be done in a form of activating questions and summaries, which prompt learners to reflect their own learning and ways of working with the LO. Modelling of appropriate progression can also be made e.g. in a form of tutorial which can show what kind of discovery processes experts do with the experimenting tools (simulation).

### 13.7.9 Skill training

A skill is defined as learned ability of associating an optimal action with the task process state or its characteristics. Skill training is based on repetition and reinforcement that fosters the adaptation of a new skill or enables and improves specific task performance. In practice, exercises (drills) that perform skill training are very condition and action specific. They usually contain only simple IF-THEN logic rules that make them easy to implement. Although contemporary learning research doesn't favour the idea of skill training, there are still many domains, in which fundamental skills are critical to acquire before more advanced activities can occur. Further, there are certainly basic skills that can be trained very easily and efficiently with computers. Foreign language vocabulary, arithmetic facts, reading and basic calculations are obvious examples. Some possible hints here are:

- A drill should focus on one or two well-defined skills rather than on several simultaneously.
- A drill should produce immediate, easy and brief responses on user actions.
- A drill should provide feedback regarding user's performance.

- ❑ A drill should remediate those skills that users do not perform well.
- ❑ The user should be able to change the difficulty level / complexity and presentation speed of the drill items.

### 13.7.10 Meta-cognition

With this term is referred the act of thinking about thinking, using the knowledge of cognition in order to control and supervise cognitive operations (meta-cognitive control processes). The basic meta-cognitive strategies are:

1. Connecting new information to former knowledge.
2. Selecting thinking strategies deliberately.
3. Planning, monitoring, and evaluating thinking processes.

A learner uses meta-cognitive strategies to define a problem / situation and to search for alternative solutions. S/he tailors information search to time and energy constraints. S/he monitors, controls and judges own thinking. S/he evaluates and decides when a problem is solved to a satisfactory degree or when the demands of daily life take a temporary or permanent higher priority. Learning how to learn, and developing a repertoire of thinking processes that can be applied to solve problems imply meta-cognitive behaviour. Meta-cognitive skills are mostly needed when habitual responses are not successful. Guidance in recognizing, and practice in applying meta-cognitive strategies, will help learners to successfully solve problems throughout their lives. It's crucial to assist learners in becoming aware of their own thinking processes. When learners are aware of their learning strategies, they will begin to transfer learning strategies to new situations. When designing LO is necessary to take into account what follows:

1. Establish process goals, in addition to content goals, in order to make learners discover that understanding and transferring thinking processes improves learning;
2. Focus student attention on how tasks are accomplished;
3. Make learners identify "what they know" and "what they don't know" about the topic.
4. Give learners the opportunity to reflect upon their thinking, make note of their awareness of ambiguities and inconsistencies, and comment on how they have dealt with difficulties (learning log), both in a context of an individual and of cooperative learning.
5. Stimulate learners to estimate time requirements, to organize materials that are provided, to schedule the procedures necessary to complete the activity
6. Include the possibility for learners to review their activity:
  - a. identifying the cognitive strategies used (for instance by checklists focusing on cognitive processes);
  - b. evaluating their success/failure, discarding inappropriate strategies, identifying those valuable for future use, and seeking promising alternative approaches.

### 13.7.11 Metadata

There are two types of element subsets defined here: the elements that should be filled in every metadata instance (mandatory elements) and the elements that would be very useful to be filled (recommended elements). All other elements of our full element set are considered as optional and there is also information about some optional elements. In addition to element explanations this section contains full listings of the vocabularies defined by the project and the data types to be used as value spaces of metadata elements. The purpose of the Metadata Application Profile is to support the exchange of information about online digital resources (Learning Objects) between partners. The metadata described in this application profile supports a variety of LO uses including:

- ❑ Management
- ❑ Searching and finding
- ❑ Technical interoperability

and description of properties of individual LOs including:

- ❑ Educational attributes
- ❑ Digital rights
- ❑ Technical features

IEEE Learning Object Metadata standard (LOM) has been selected as basis for the set of adopted metadata and to support interoperability with other metadata schemes. The information model for the metadata is similar to that of LOM where metadata for a described LO is stored in a metadata element and actual content of an element is called a value. Values can be entered as free text, inserted in predefined format or they are selected from set lists, which are called vocabularies.

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## 15 Terminology (ALL)

For a complete set of terms description please refer to AXMEDIS-DE3-1-2J-AXFW-Spec-(Definitions-Terms-Tables-Links)-Part-J. some terms potentially not reported in there are listed hereafter:

Term	Explanation (including source if available)
Word length	The number of bits and hence the resolution and quality of a digital audio or image file. In the case of audio, this relates to the dynamic range of the audio, in the case of graphics this relates to the resolution of intensity for each primary colour. Normal values are in 8 bit groups (8,16, 24...).
Sample rate	The number of samples taken per second of digital audio within a file.
Frame rate	The number of still frames per second within a video file