

# Identifying Trends in Accessible Content Processing

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## Abstract

The European Accessible Information Network (EUAIN) is currently examining issues relating to accessible content processing. With the support of key European publishers, it has been possible to begin to identify key trends in accessible content processing which are likely to be of some importance in the coming years. This paper also describes some related standards activities and identifies a need for accessibility to be embedded within content creation and production processes at the earliest stages.

**Keywords:** accessibility; visually impaired; publishers; standards

## 1 Introduction

The European Accessible Information Network (EUAIN) brings together the different actors in the content creation and publishing industries around a common set of objectives relating to the provision of accessible information. Accessibility for print impaired people can be an increasingly integrated component of the document management and publishing process and should not be a specialized, additional service. The EUAIN network benefits greatly from having as a partner the Federation of European Publishers [1] who represent the collective interests of approximately 85% of all European print publishers.

In order to ensure that the EUAIN network addresses issues central to publishers and content providers, an Expert User Group (EUG) was established. This group advises the network and provides commentary and feedback on key deliverables. By way of illustration, the group currently contains representatives from industry including EDITIS, Giunti Multimedia and the D'Agostini Group.

This paper examines some recent activities and provides an overview of some of the emerging trends in accessible content processing. Information is provided on several standards related activities and the work of the CEN WS/DPA is considered. A number of emerging issues in accessible content processing are identified and their relationship to competitiveness with publishing is considered.

## 2 Accessible Structures

We are all familiar with the word ‘accessibility’, but what does it actually mean? When we talk about accessible content, for whom are we providing this content? Are we talking about a small percentage of users who are blind (about 1%) or do we include people with dyslexia (about 10%), or do we mean the 40% of users who use some kind of assistive technology on their computers?

Accessibility is changing from being an afterthought that was considered at the end of the information provision process, to a catalyst for change. The technology is emerging which allows content providers to structure their information in such a way that it complies with existing accessibility legislation and in so doing opens up new markets for that content. By integrating existing technologies within processing systems, it is possible actively to include the changing needs of end-users, and in so doing open new opportunities. And by structuring content more clearly, powerful new navigational possibilities emerge which are of benefit to all users.

Structured information is the first big step towards high-quality accessible information. A document whose internal structure can be defined and its elements isolated and classified, without losing sight of the overall structure of the document, is a document that can be navigated.

Most adaptive technology allows the user to access a document, and to read it following the "outer" structure of the original. If that structure is left to a range of visual cues, like bold capital letters for the title of a chapter and bold italics for the heading of a subchapter, the adaptive device will surely flatten that visual structure, leaving a document with no structure at all. But if the same document has also an "inner" structure that makes possible for the adaptive device to distinguish between a paragraph and a footnote, between a chapter and a subchapter, then the level of accessibility of the whole document will be greatly enhanced, allowing the user to move through it in the same way those without disabilities do when looking at the printed document, following the same "logic". In an ideal world, any document made available in electronic format should contain that inside structure that benefits to everyone. Highly structured documents are becoming more and more popular due to reasons that very seldom have to do with making it accessible to persons with disabilities.

Some of the largest publishers are converting their old electronic texts into full XML documents so that it will allow them to look for certain portions of text that they can reuse in further editions, as well as to help them avoid double-production of the same text. Whatever the reasons behind those decisions are, the use of highly-structured information is of great benefit to anybody accessing them, for whatever purpose. This then provides for:

- Consistency in the description of structural elements
- Understanding and predictability of structures
- Interaction with other standards
- Technical compliance with different devices
- Exchange of materials
- Flexibility and evolution

### 3 Accessible Standards

Standards are needed for many reasons, but probably the most relevant one is that they tell manufacturers how to make their products accessible in a detailed, coherent way. Legislation promotes the existence of standards, and can advocate the use of "accessible" technology or information, but it is standards that provide the technical specifications of how this accessibility can be implemented and tested.

#### 3.1 The Need for Standards

The existence of standards does not imply that accessibility will be implemented in the same way or with the same results in all products. The existence of a number of standards for producing the same product (such as a document) may occasionally lead to two different levels of accessibility for the same "accessible" final product. Even within the same standard it may happen that some features are considered essential while others may be considered expendable. As a result of this, the application of the same standard with different views about what is needed and what is not needed to make a document accessible may provide a wide range of accessibility levels for the same product, making it fully accessible for some users and just slightly accessible for others. It is also important to note that the higher the level of accessibility we want to apply to a document, the higher the cost. Therefore, it is of great importance to decide beforehand the level of accessibility to apply to a certain document according to different variables:

- The depth of the structure that the document allows/needs to make it sufficiently navigable
- The level of navigability actually needed by the potential user/s
- The resources available to make a document accessible

It may also happen that different standards are developed for the same purpose and though they deliver the same level of accessibility they are not compatible. This usually leads to confusion for manufacturers and service providers while it also "divides" users between the different existing standards (we all remember the Beta vs. VHS example). We can distinguish between formal (or *de jure*) standards and *de facto* standards. The former are those who have been "formalized" by standards organizations, while the latter are technical solutions that have been adopted informally by users due to their usefulness and/or reliability. Among these *de facto* standards, we also have two categories – proprietary standards (those developed by a commercial company) and open standards (outside vendors' control, freely developed and updated by independent programmers). There are also

many different standardization agencies around the world, but what is considered to be fully accessible in the United Kingdom may not be seen as accessible in the same degree in Australia. Hence the adoption of Universal Design Principles helps to create products that can be considered accessible everywhere.

EUAIN relies on the existence and the promotion of accessibility standards to prove that accessibility can be built in from the first stage of production. Design For All can be applied to emerging standards so that all the features needed to grant accessibility to the final product are built into the system right from the beginning, instead of the traditional approach of adding those features at a later stage.

### 3.2 CEN WS/DPA

In order to work towards greater unification in this area, EUAIN has supported the establishment of the CEN Workshop on Document Processing for Accessibility (WS/DPA) [2]. This workshop aims to:

- To bring together all the players in the information provision and e-publishing chain in order to achieve the critical mass significantly to enhance the provision of accessible information at a European level;
- To provide guidelines on integrating accessibility components within the document management and publishing process rather than as just a specialized, additional service;
- To raise awareness and stimulate the adoption at local, regional, national and European levels of the emerging formats and standards for the provision of accessible information and to find ways of ensuring that technological protection measures do not inadvertently impede legitimate access to information by people with print impairments.

Several key liaisons have been established with other related standards, for example with EdeAN (European Design for All e-Accessibility Network) [3], ISO/IEC Special Working Group on Accessibility [4], DAISY [5] and the MPEG [6] group.

## 4 Emerging Issues in Accessible Content Processing

The work of the EUAIN network has lead to some interesting discussions and several key themes have emerged. Many of these topics are present in the work being undertaken by several standardization bodies at both a European and international level. EUAIN aims to establish a fluent communication of competencies and experience and the knowledge gained from this new level of *explicit* knowledge on accessibility and inclusion, creates the opportunity to add these new insights into emerging standards or create additional packages to existing standards that enhance the accessibility features of these standards.

It has been reported elsewhere [7] that:

*“With the exception of a few projects, a lack of standardization has been noted. It takes three forms: the first one is really an ignorance of the requirement for standardization...or a feeling of no concern by the partners of the project. The second is the fact that the value of standards is ignored, although it could bring the people with special needs, whom the projects should help, easy and affordable access to the Information Society. The third is a lack of awareness of the importance that standards harmonization plays in driving industry implementation of accessibility support in ICT.”*

As this is a wide area, these themes cover issues relating to emerging standards and the need for the better application of existing standards and frameworks in order better to incorporate notions of accessible processes within mainstream environments.

### 4.1 A Single File Format

The file formats in which information is given to agencies producing information in alternative formats is not always the most useful, and sometimes cannot be used. The software used by publishing companies is very specific to the work they are doing and the output formats are different from one another, which makes it very difficult for publishers of alternative formats to automate their production processes. Even when delivered in highly tagged formats like XML, the existing fragmentation caused by the many XML dialects used just adds up another difficulty to automated processes of information. Even those well-structured documents that comply with the relevant standards may not be useful for accessibility requirements. This leads to contradictory situations in which it may be easier to scan the whole book and start *from scratch* than trying to “clean” the files given by the content holder.

In these circumstances, a desirable solution to this problem would be to agree on a file format that is useful for both publishers/content holders and agencies working for persons with disabilities. For example, Z39.86 [5] has been adopted as the standard to be used by publishers in the United States of America to comply with the Instructional Materials Accessibility Act (2002). Every publisher producing books for public schools in that country has to make the original files available in a format that can be used by institutions giving services to persons with disabilities in order to produce accessible formats. A sub-set of the DAISY standard was proposed as the National File Format and in 2004 it was declared the "National Instructional Materials Accessibility Standard" (NIMAS) [8]. Specifications for NIMAS 1.0 are already available, and it includes both a Baseline Element Set that has to be met by any publisher producing files according to the NIMAS standard, and a set of optional elements.

The NIMAS solution adopted in the US may provide a solution at a European level, knowing that it has already proved very difficult to find a single tagset that provides all things to all people. It is also clear that trans-national differences among countries in Europe are probably wider than the differences we may find within different regions in the United States.

Most European publishers have already moved to XML and many institutions and organizations producing information in alternative formats use also this structured file format. Besides, 7 out of 12 Full Members of the DAISY Consortium (and nearly 30 of its Associate Members) are based in Europe, and NIMAS is nothing but a subset of the standard used by this Consortium for producing their digital talking books. It is very likely that those tools developed by the US members to help them go from a NIMAS file to a Braille file or a DAISY Digital Talking Book will be made available to the rest of the Consortium members. The same goes for publishers – the tools needed by the US publishers to comply with the NIMAS DTD will be perfectly valid for publishers in Europe.

## 4.2 Towards a Global Library

A global use of the same standard for producing content, plus a global use of standardized and internationally recognized rules for classifying the content produced leads to a very simple conclusion – a global repository of documents that are readable and usable for everyone, reachable from anywhere in the world. That is, a global library.

Some of the leading agencies working for blind and visually impaired persons have already taken the first steps towards this objective. A first forum took place in Redmond, WA, (8-10 November 2004) sponsored by Microsoft and co-hosted by the DAISY Consortium. There, representatives from libraries from the blind around the world started planning the establishment of universal information accessibility through a global digital library. The summit ("Libraries for the Blind and Print Disabled: Moving Toward a Digital Future") gathered representatives from twenty countries, agencies working in developing countries, the international publishing community and international bodies including the United Nations, the World Intellectual Property Organization and the World Health Organization. Forum participants made a joint commitment to work together to develop and implement a global accessible library, to provide timely access to information, resulting in a worldwide collection of accessible reading materials. The core idea is to reach agreements at a global level that benefit everybody:

- The Users – granting them access to a global database of accessible documents produced following the same standard;
- The Producers of accessible materials – avoiding double-production of costly accessible documents that are available somewhere else in the language and the layout required by the users;
- The Publishing Industry – reaching agreements with publishers' associations that allow them to produce documents that are accessible right from the first stages of their production, in a standard way, granting them a wider community of potential clients;
- The Copyright Holders – making sure that their rights are not hindered in any way.

## 4.3 Making Metadata Accessible

There is an ongoing need to identify and investigate the ways in which metadata can help achieve efficient and future-proof solutions to accessibility. It is assumed that this encompasses the provision of adequate access to information for people with disabilities and for everyone in a multilingual and multicultural environment. In order to make this perceived information useful, it must be represented within an architecture that allows the accessibility requirements to be questioned in more than one way. Such architecture must enable both the core

system to adapt to new and changing representation requirements, and to allow (theoretically) infinite user requirements.

People compress information. People decompress information. The compression procedure involves filtering out redundant information based on the perspective of the user. How do we decide which redundant data entities are relevant for the user? What to use? On what requirements are these redundant data entities based? Whose requirements? How do we marry the existence of these accessibility metadata entities with the requirements as described in “common” metadata entities? More importantly, how do we ensure a synchronized and therefore valid coupling between any kind of content with these metadata entities? How do we ensure that any metatags themselves remain accessible? What is the context of any accessibility metatags that are to be conceived?

How then can we make sure that the context remains consistent? If we describe the knowledge that is applied to enable processes to exist in a digital system that parallels analogue organizational systems, knowledge is transferred from the individual participants to a shared information framework. The use of knowledge can be separated into three parts: the body of information that is contained inside knowledge structures; static information about the knowledge processing, which is also known as meta-information or metatags; dynamic information that is used to describe the processes and procedures to retrieve, transform or use the content. By introducing metatags that aim to address the needs for accessible information processing, it is mandatory to describe the procedures that will meaningfully interpret these metatags to communicate the content in a way which enables every person to appreciate the content. Creating meaningful mappings between the static redundant information –the metatags- and the dynamic processes.

Many people believe structure to be static: from a metamodelling perspective this is not the case. It is well known that if the representation of the information at hand is perceived by the system and mapped onto a framework, the information is then usable in a multitude of ways: and for this reason non-programmers will often promote the use of XML. However, this markup and the set of tools that surround it are simply a set of tools which exist to achieve this objective. If the architecture of the system does not answer the wider range of needs, requirements and questions, the markup cannot paper over the cracks. In order to build extensibility into a system, the architecture should be such that every element used for processing the information is adaptable. This can be achieved by building a representation layer which builds an object oriented structure from the information and which is free to adapt the meta relationships and hierarchies intrinsic in that data genus. This is defined by identifying the parameters upon which the structure is built, and ensuring they are interconnected in such a way that promotes future adaptability without degrading the system: which is to say, using the right parameters for accessible information processing.

The goal should be to anticipate the changes in user requirements. These changes can occur in the very nature of the requirements, such as new functional groups or in the definition of the existing requirements, such as additional details. These aims should be pursued by adding redundant information in the form of metatags, thus augmenting the quality of the content. The content itself and the existing metatag structures, including their mapping to the metamodelling domain, is not allowed to change. From a metamodelling perspective, this allows us to meet changing requirements for the future, because if the requirements demand additional detail in the form of features or metadata, we can unveil the metadata that is available. Such a system architecture allows us to deduce where the dynamic structures have to be taken in by analyzing the static configuring structure. As systems are developed, the static configuring structures also exist to overview the processes and the relations between processes that can be used for future or similar developments in relation to user requirements.

#### **4.4 Copyright and DRM**

The European Council in 1994 stressed the need to create a general and flexible legal framework at Community level in order to foster the development of the information society in Europe. Important Community legislation to ensure such a regulatory framework is already in place or its adoption is well under way. Copyright and related rights play an important role in this context as they protect and stimulate the development and marketing of new products and services and the creation and exploitation of their creative content. A harmonized legal framework on copyright and related rights, through increased legal certainty and while providing for a high level of protection of intellectual property, will foster substantial investment in creativity and innovation, including network infrastructure, and lead in turn to growth and increased competitiveness of European industry in the area of content provision and information technology.

A Digital Rights Management System (DRMS) is a means of delivering content. However, DRMS are frequently seen only as a Technical Protection Measure i.e. a technical means of enabling right holders to

deliver digital content in a controlled way, preventing users from having access to the content unless they meet the requirements of the right holder, be it financial or otherwise, and preventing users from using the accessed content in ways other than the right holder has given permission for.

Libraries and other information providers are already involved in the clearance and management of rights. A properly managed introduction of DRMS, in its widest sense, could assist these institutions in managing their services. However, a restrictive definition of a DRMS, which focuses on protection rather than management, may hinder them in managing access to their services.

Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonization of certain aspects of copyright and related rights in the information society addresses these issues and contains exceptions that facilitate the introduction of DRMS. DRMS must respect these exceptions, the application of which is limited by Article 5.5 of the Directive.

Attention has already been focused on the barriers which copyright can create if inappropriately exercised. Within the context of international treaties and the European Copyright Directive, individual states are finding legal or voluntary solutions to this issue.

However, both the European Blind Union (EBU) and the Federation of European Publishers (FEP) are committed to doing whatever they can to increase the proportion of published material available in accessible formats. They believe that there is scope for achieving a major increase through active collaboration between rights holders (especially publishers) and agencies serving blind, partially sighted and other “print disabled” people. Some voluntary agreements between individual publishers or publishers associations on the one hand and agencies serving blind and partially sighted people on the other already exist.

#### **4.5 Innovation in Accessible Information Processing**

The communication of digital content is predicated upon the assumption that participants in the information chain are generally able to interact with that content in a manner with which they are comfortable and where their specific preferences regarding comprehension, usability and applicability are coherent and sustainable. Naturally these preferences may become requirements over time, for whatever reasons, and the changes in the demands of participants must be reflected in easy to use and easy to re-use information processing technologies. These shifts will be reflected in the marketplace as businesses strive for accessible repositories of processing resources. Without access to such resources, however, the cost of incorporating accessibility notions into products, services and research goals will remain prohibitively high and the fundamental connection with accessibility will be lost, just as populations grow older and encounter information consumption difficulties.

The approach we are describing can be called accessibility from scratch [9]. By building on recognized Design For All methodologies, systems should be built in such a way that the mainstream solution can be easily adaptable and extensible to add functionality for niche markets. As a result of the comprehensive lack of understanding of this concept at the fundamental design level, and strict deadlines to complete software projects, most accessible solutions become appended onto an ill-suited system as an afterthought: the accessible solution is then itself ill-conceived and unlikely to meet the needs of the end user. This often raises the question (though rarely explicitly) of whether the specialized needs of the niche market merit the effort involved in providing a solution.

Requirements never stay the same over time: requirements change for all users of any service. The end user's sight or other senses might deteriorate over time, their needs being met with appropriate features in accessible media. The differentiation of user requirements in general might grow, forcing the system to deal with a broader variety of processing possibilities with which it cannot cope. The processing system itself might in due time signal changes in memory requirements. The consumer base might be expanded to cater not only for visually impaired users, but also for dyslexic users. How can we anticipate fundamental changes like this? On the other hand, there exists a dynamic group of accessible information producers who are pressed to keep up with the new media technology possibilities. The changing nature of requirements- and with that the potential design of any system- is a fundamental issue in the design of an inclusive world.

The various MPEG family members operate at different abstraction levels with some communication between these abstraction levels. The process of contriving a procedure to interface the various processing levels should be based on use. The difficulty lies in achieving a level of description of the user requirements that allows re-description in technological terms. This re-description ideally leads to specifications and ultimately

implementations. These implementations ‘prove’ the viability of the concept: it is the proof of the hypothesis. The process of standardization that runs in parallel with this ensures extraction of higher level descriptions and these are aggregated down to the earlier family members. Using this built-in feature to provide ‘slots’ for common and specialized accessibility requirements would create what we refer to as accessibility from scratch. If embedded in the family tradition of the MPEG initiative, accessibility might become a commonly available feature instead of a workaround necessity.

The representation of the interplay between the various user groups should always remain accessible. If all relevant entities in a representation system remain accessible, creating meaningful mappings is a matter of connecting the appropriate entities. For this reason, accessibility from scratch is of fundamental importance.

#### 4.6 Accessibility within Emerging Multimedia Environments

The integration of accessibility notions into the MPEG family would provide previously unavailable opportunities in the provision of accessible multimedia information systems. It would open up modern information services and provide them to all types and levels of users, in both the software and the hardware domain. In particular, the work being undertaken by MPEG would provide access to multimedia content for print impaired users. Additionally, new consumption and production devices and environments can be addressed from this platform and this would provide very useful information provision opportunities indeed, such as information on mobile devices with additional speech assistance.

MPEG has several advantages over other multimedia content formats. The advanced level of integration affords the common user the ability to personalize their use of the content in many ways. This can take place at several levels of abstraction throughout the content. For example, rather than a raw audio file, a single track can be chunked according to user preferences and rich metadata affords the user more information for cataloguing searching and general use. The future of internet-based solutions for content delivery is further enhanced by MPEG through greater choice in the content with which the user can choose to interact. In structured audio books, for example, a specific chapter from a textbook can be provided in a specific form. Business solutions can also be incorporated through the use of DRM, allowing several user types or profiles to co-exist in one revenue stream. At a consumption level, the common user can then specify how that content is delivered and save these preferences for their particular user scenario.

For the common user, MPEG facilitates multimedia consumption of content; navigation through digital content; preference modeling for content consumption; and provides a DRM framework. To date, there appears to have been very little consideration of the requirements of print impaired users. With the exception of some work on color blindness addressed to Digital Item Adaptation, accessibility requirements have been largely neglected. It appears to be the case that for specialized device or user transformation, DIA is the appropriate tool. The questions still remain, however, as to how this might be done. What is the foundation framework for structuring an accessibility modeling approach? How do specialized requirements fit into the existing common user usage scenarios?

### 5 Publishing and Competitiveness

This section looks at some recent European Commission initiatives in the publishing sector and at the need for the wider adoption of open standards.

#### 5.1 Recent EC Initiatives

It is essential for the European publishing industry to focus on accessible content processing as this brings significant economic and social benefits to all stakeholders. The i2010 communication [10] relies heavily on the digitization of all existing documents that are relevant to European citizens. Libraries are, therefore, seen as the main repositories of these source documents. Publishers could help in the digitization process by providing access against payment to their archives of source material in digital formats. Equally, the publishing industry could be seen as the main source of digital material of works published in the last 10-20 years and those to be published in the future. A legal deposit of digital materials (even of those subsequently published in paper format) guarantees preservation of all publications within the EU. It is important that any subsequent access be ruled through contractual agreements between libraries and rights holders.

Preferably all the materials archived in libraries should be stored using the same standards, which provide access to people with print impairments. In order to avoid imposing any single format, it is preferable that there is

consistency between the storage format and the medium, and that this should not hinder the use of multiple output formats based on the central content. In this way all people can be served by consistent accessible content processing, delivered to the end user in their preferred format through non-destructive filtering. The provision of accessible material can thus be integrated into existing and emerging supply chains.

There are already existing standards that contribute to this need, and one such standard is DAISY, based on XML and already accepted for the print-impaired community all around the world. XML is also a standard widely used by the publishing industry. As noted above, a subset of the XML used within this standard (NIMAS) has recently been adopted by publishers in the USA as the National File Format to be used to provide primary students with alternate format versions of the educational materials they publish.

## **5.2 Wider Application of Standards for Content Processing**

The adoption of open and accessible standards to produce digital content needs to be a high-priority objective for all publishers and content-providers. One of the major threats may be the adoption of closed, inaccessible formats that cannot be re-used in the future.

There exists a need for access to cultural, educational and scholarly content for all EU citizens in member and candidate states. It is our belief that this activity can only be successful when addressed at a European level and when fully integrated with existing technologies in all branches of content creation, learning and standardization processes. The role of the publishing industry will therefore be central to this endeavor over the coming ten years.

There is also a need to broaden the definitions of accessibility to represent “the ability to access” which in itself begins with “the ability to perceive”, and this needs to be embedded within European cultural preservation and presentation strategies. With this “intelligent” multimodal content, we need to provide suitable frameworks and environments that can take the key criteria required for (accessible) content management and create preservation of this content for the future.

We also need to provide technologies that provide functionality for content representation and can link with suitable infrastructures that allow for the creation, representation and preservation of content to occur at a higher level of complexity. In this way, content providers can also provide context and semantics to end users with the intention of meeting the needs of generic accessibility. In this way we can raise awareness of the concepts behind information rich content and provide clear methods, means and guidelines that allow consumers of this technology to appreciate the benefits of these innovations.

## **6 Conclusions**

The need for policies, standards and guidelines is clear. In order to widen the delivery of accessible information and achieve greater harmony between consumption and production tools, there is a strong need for a framework that contains policies and guidelines, which can help anyone interested in investing in this domain -in any way- quickly to find their point of focus and establish an overview of the required resources and competences.

New open standards arise on a regular basis and there is an increasing focus on issues relating to accessibility. Several of these standards work on solutions for distribution and representation problems. These standards are usually open and therefore extensible. However, in order to be able to create extensions to these standards, we first need to know which areas need to be extended, how this should be done and indeed why this is necessary.

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