



INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

Project-Team WAM

Web, Adaptation and Multimedia

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2. Overall Objectives

The WAM project-team (Web, Adaptation and Multimedia) was created in January 2003 to explore the field of adaptive multimedia on the Web, with a special focus on XML document processing.

2.1. The Multimedia Web

Diversity on the Web increases steadily, be it the diversity of information, the diversity of access devices and communication networks or the diversity of the audience. Diversity of information comes from the multimedia Web. Information shared on the Web consists of text for a significant part, but also of pictures, drawings, video, animations, music, voice, etc. These contents can just stand independently from each other, like a movie or a song that can be played for itself. The multimedia documents we consider in our research are compound documents that tightly integrate pieces of information from different media. In these multimedia documents, the various components have to be rigorously choreographed to make sense as a whole.

Devices also are multiple. The workstation or personal computer that was typically used in the early days of the Web is no longer the dominant access device. In Japan, for instance, more cell phones than PCs are now used to access the Web, and this is the same in many developing countries. TV sets are also following this trend. Recent developments in the TV industry clearly show the convergence between television and the Web. Web users can watch TV programs on their desktops while TV sets can be used to access Web sites. The digital television technology is borrowing more and more techniques from the Web, such as XML, for instance. The automotive industry is also developing embedded devices that provide access to the Web. The Web is now ubiquitous and all sorts of devices with very different capabilities are involved in Web access.

Simultaneously, these devices are using new kinds of networks, ranging from personal networks, such as Bluetooth, to the global Internet. In the broad range of communication technologies, wireless and mobile networks (UMTS, WiFi) are taking an increasing part. Their specific features make a big change from the traditional wired Internet and have a strong impact on the way information is exchanged over the Web.

It is commonly accepted that the audience of the Web has reached a billion users in 2006, mainly in the northern hemisphere. Analysts now predict that half of the world population will be connected by 2015. This means that in the next few years the web will reach new parts of the world and consequently its audience will increase in diversity.

2.2. Document Creation and Adaptation

The increasing diversity of information, devices, networks and users makes the original scheme of the Web inefficient. The usual model of a single Web page designed for a large color screen accessed through a high speed network with a powerful computer does not work any more. The approach is to create information in a format that allows documents to be transformed and adapted to the environment where they are actually used. The WAM project-team aims at developing models, methods, formats, languages that allow content to be used freely in any context. In this approach, no restriction is put on the type of information that has to be adapted; multimedia information is considered with the broad diversity of media that are now commonplace on the Web.

Content adaptation is not something that comes into play at the last moment, when information is delivered to the client. To enable efficient adaptation, the original information must present some features that make adaptation easier or even possible at all. This means that the production methods should also be involved in the whole process of content adaptation. The WAM project-team is especially interested in authoring tools for the Web, with the perspective of creating multimedia documents that ease adaptation and improve device independence. Several editors are currently under development. LimSee3 is dedicated to the production of multimedia documents where time and synchronization play a key role. Amaya addresses multi-namespace, compound XML documents containing text, mathematics, animated graphics and using style sheets. Tools for manipulating spatialized sound in multimedia documents, including games on cell phones, are also under development.

2.3. XML Processing

It is clear that a major means to adapt documents is to transform them according to the actual context where they are used. The project-team focuses on structured documents represented as XML structures. Regarding transformations, the objective is to characterize the theoretical and practical tools needed for efficiently processing XML structures, and to develop the relevant models, formalisms and algorithms.

A strong motivation for this research is to adapt web multimedia content, but processing of XML documents and data has actually a broader range of applications. Structured XML information is ubiquitous on the Web, and processing it ranges from formatting or web search to re-purposing and life-cycle management.

3. Scientific Foundations

3.1. Transformations and XML Processing

Keywords: *XML structure transformations, XPath, automata, document processing, document models, logic, modal logic, path expressions, query languages.*

Participants: Everardo Bárcenas-Patiño, Pierre Genevès, Nabil Layaïda, Vincent Quint.

Structure transformation is a specific domain that can be approached following different abstraction levels with respect to programming specifications. The lowest level is based on general purpose languages, such as Python or Java, associated with dedicated libraries and toolkits that implement a standard structure manipulation API, typically the DOM. At the other end of the spectrum, there are dedicated languages, such as XSLT, which abstract over data and control complexity through a tree-based data model and a powerful execution model. Our research follows the later approach.

Some properties are expected from specialized languages in order to help solving the most common problems: expressiveness, verifiability, efficiency, modularity, reusability, scalability, succinctness, correctness, etc. These properties are studied using the fundamental connection between language theory, mathematical logic, structured languages and query languages. Most of our theoretical work follows this approach.

The goal of the research published so far in the literature is limited to establishing new theoretical properties and complexity bounds. Our research differs in that we seek, in addition to these goals, efficient implementation techniques and concrete design that may be directly applied to XML systems. We also consider that some properties are of particular importance for XML structure transformations, namely:

- *Type checking*: The types we consider are structural constraints over documents expressed in formalisms such as DTD, XML Schema or Relax-NG. Few techniques are able to exploit typing information of the input or output documents to provide type-safe transformations. In this domain, algorithmic advances have led to the creation of research languages, such as XDuce, based on efficient containment of regular tree types. However, many challenges remain. While type-checking full XSLT or XQuery is theoretically impossible (these are Turing-complete languages), one challenge is to push the “decidability envelope” further for type-checking standard XML transformations. In particular, one of the most difficult issue is to find techniques for analyzing XPath queries with regular tree types. Another challenge is to provide effective algorithms usable in practice for realistic scenarios.
- *Efficiency*: Transformation languages may benefit from static analysis whenever performance is a concern. Static analysis techniques usually take advantage of robust formal semantics to help development of optimized compilers and runtimes.

3.2. Adaptation

Keywords: *World Wide Web, adaptation, adaptive multimedia, authoring, device independence, document formats, multimedia.*

Participants: Sébastien Laborie, Nabil Layaïda.

The purpose of multimedia document adaptation on the Web is to customize content for the variety of devices and networks that are now sharing the Web with traditional desktop computers. As a result of these changes, the Web infrastructure needs to be reconsidered as a device-independent architecture, where information resources can be efficiently accessed with various types of devices and networks.

There is no general solution to the problem of device independence today. Most efforts are rather dedicated to the development of good practices. After some work on device-independent architectures, the WAM project-team now focuses on automatic content adaptation to make progress towards a solution.

With this approach, content would be ideally created or generated in a single universal format that could be delivered “as is” to any conceivable device. In practice this seems impossible, so the real techniques seek to minimize the number of variants needed, each variant being targeted at a range of devices as wide as possible. The variants have then to be adapted to the delivery context.

To transform multimedia documents for adaptation, one can rely on their semantics. The semantics considered here does not deal with the document content or meaning, but with the composition that is made explicit in a Web document:

- *Temporal semantics*: in what order and when should each piece of information be presented to the user.
- *Spatial semantics*: what are the relative positions of the document components on the display space.
- *Navigational semantics*: how are pieces of information related in the hypertext network.

With this approach, adaptation can be done in very general semantic terms, independently from the multimedia objects. This makes it also possible to abstract (model) existing content into a unified representation, and then to facilitate the adaptation process.

3.3. Multimedia Documents Authoring

Keywords: *authoring environments, document editing, document templates, multimedia, structured editing.*

Participants: Émilien Kia, Yohan Lasorsa, Jacques Lemordant, Jan Mikáč, Vincent Quint, Cécile Roisin, Irène Vatton.

We are working on interactive authoring environments. Developing such environments is a challenging issue: structured multimedia documents are complex and the process of creating and updating them is complex too. Well-established paradigms for static office or technical documents do not work. The traditional WYSIWYG approach is useless in a context where the final form of the document (What You Get) is dynamic, variable and unknown at creation time. In addition, writing down the description of a document in some multimedia document language is extremely difficult, given the various levels of representation that are involved: content, logical structure, layout, style, synchronization, hypertext structure, navigation paths, dynamic behaviours, etc. New approaches are needed.

On the Web, multimedia documents are based on XML. They are considered through several types of structures: layout, time, navigation links, animations. We are working on techniques that allow users to manipulate all these structures in homogeneous environments. The key idea is to present simultaneously several views of the document, each view showing a particular structure, and allowing the user to manipulate each view directly and efficiently. As the various structures of a document are not independent from each other, views are “synchronized” to reflect the consequences of every change in all views. The XML markup, although it can be accessed at any time, is handled by the tools, and the author does not have to worry about syntactical issues.

Two editing tools based on this concept are under development, Amaya and LimSee3. In Amaya the emphasis is put on the integration of several XML vocabularies and associated technologies, and on direct interaction on the Web: users can edit remote documents in exactly the same way as local files. With LimSee3 the focus is on the time dimension of multimedia documents and their continuous media contents, such as sound and video.

3.3.1. Authoring Models and Templates

Even with tools providing views for direct manipulation of various structures, the authoring task is often considered as too complex for most users because it requires a deep understanding of the semantics of the document format (e.g. the SMIL timing model, or the most advanced features of XHTML). We are therefore working on a new authoring model for multimedia documents that would provide a strong basis for creating generic or dedicated authoring tools with appropriate user-friendly GUI.

Our approach is first to focus on the logical structure of the document while keeping some semantics of proven technologies such as SMIL. The second core idea is to tightly integrate template definitions in this document model: the template is itself a document constrained by a schema-like syntax. The continuum between templates and document instances permits to edit templates generically as any other document and within the same environment. It also allows a more natural authoring process where documents can be created step by step from existing templates up to a final state where all place-holders are filled and all options are decided: during this process, the document status evolves between a pure template and a completed instance.

The LimSee3 model, based on these concepts, is now almost complete and provides a generic platform for the development of dedicated authoring tools.

The same kind of model is implemented in Amaya, where it covers the very wide variety of Web documents: institutional pages, technical reports, slide shows, personal pages, address books, etc. The specific components of all these documents can be represented by the model in terms of lower-level languages such as XHTML. Authors can then handle documents in terms of these specific components while finally producing standard-conforming documents.

3.3.2. Editing Compound Documents through Databinding

Compound documents integrate pieces of information expressed in different document languages or formats (typically XML namespaces). When compounding by reference, the pieces are separate resources, each expressed in its own language, linked together by references. This allows different languages to work together,

while implementations of the languages are kept separate. Compound documents can be authored by a variety of means and we are interested in multimedia-centric authoring tools that can create time-based, interactive content.

We study the creation of such authoring tools through databinding. We are considering databinding for compounding document formats by reference. Strongly typed references and access to different documents are well supported by the Eclipse Modeling Framework (EMF) schema compiler. This is a great advantage when it comes to building a graphical editing tool for compound documents and we have adopted it. We are specifically interested in problems related to events flow in a multi-document environment and how different languages should cooperate in rendering on the same screen and auditory space.

3.4. Multimedia Document Formats

Keywords: *audio formats, document formats, document models, document query, document templates, microformat, multimedia.*

Participants: Jacques Lemordant, Vincent Quint, Cécile Roisin, Irène Vatton.

Specific formats for audio are an important work item in the project-team. More specifically, we are participating in IAsig (Interactive Audio special interest group), an international initiative for creating a new format for interactive audio. The future iXMF standard (interactive eXtensible Music Format) from IAsig is now in public review. We have defined an XML tiny version of iXMF (without scripting, but with integrated 3D audio rendering). Our audio engine is running this tiny iXMF, adapted to embedded systems and based on OpenSL/ES (open Sound Library for Embedded Systems). In the mean time, a layer above OpenSL/ES, called openKode, is being defined by the Khronos Group to allow portability of audio applications above several embedded systems (Symbian UIQ, LIMO, Qtopia, Windows Mobile and Android). This is interesting for us because Symbian and Android (with the iPhone) are part of our audio engine target platforms. Concerning this audio engine, a new scheduler has been designed for a faster response to events at the expense of using more memory as provided by the last generation of smart phones. Work on the audio authoring system is focused on finding the best UI component from the usability point of view.

Regarding discrete media in multimedia documents, popular document languages such as XHTML can represent a very broad range of documents, because they contain very general elements that can be used in many different situations. This advantage comes at the price of a very low-level of representation. The concepts of microformats and semantic XHTML were developed to tackle this weakness. More recently, RDFa was introduced with the same goal. These formats add semantics to Web pages while taking advantage of the existing (X)HTML infrastructure. This approach enables new applications that can be deployed smoothly on the Web. But authors of Web pages have very little help for creating and encoding this kind of semantic markup. A language that addresses these issues is developed and implemented in the WAM project-team. Called XTiger, its role is to specify semantically rich XML languages in terms of other, less expressive XML languages, such as XHTML.

4. Software

4.1. Amaya

Participants: Émilien Kia, Irène Vatton.

Amaya is an open source Web editor, i.e. a tool used to create and update documents directly on the Web. Browsing features are seamlessly integrated with editing features in a uniform environment that allows users to save files locally and on remote servers as well. This follows the original vision of the Web as a space for collaboration and not just a one-way publishing medium.

Work on Amaya is a joint effort with **W3C**. It started to showcase Web technologies in a fully-featured Web client. The main motivation for developing Amaya was originally to provide a framework that can integrate many web technologies during their development, with the goal of demonstrating these technologies in action while taking advantage of their combination in a single, consistent environment.

Amaya started in 1996 as a HTML editor. Support for the creation and debugging of **CSS** style sheets was added soon. It was then extended to support **XML** and an increasing number of XML applications such as the **XHTML** family, **MathML** (for mathematical expressions), and **SVG** (for vector graphics). It now allows all those vocabularies to be edited simultaneously in compound documents. Amaya includes a **collaborative annotation** application based on the Resource Description Framework (**RDF**), **XLink**, and **XPointer**.

Now that a number of document languages are implemented in the editor, developments focus on accessibility and usability. The latest extensions are oriented towards robustness, completeness and ease of use. Many contributions are received from several external developers and have to be coordinated with the project-team. They concern localization in various languages, including eastern languages, tests and adaptations to various platforms. Other contributions provide improvements and new features.

The template-driven editing feature enabled by the XTiger language (see section 3.4) was complemented this year by a mechanism for creating and updating templates. This allows end-users to easily define the templates they need for editing their own types of web documents. This development is part of our contribution to the Palette project (see section 7.2.1).

Two **public releases** were made in 2008, in February and December.

4.2. LimSee3

Participants: Jan Mikáč, Cécile Roisin.

LimSee3 is a new generation open source multimedia authoring tool developed in the context of the European Project Palette (see section 7.2.1). It aims at flexibility and easiness of use through extensive use of document templates. LimSee3 developments benefit from the project-team's experience acquired with LimSee2, an already well-established SMIL editor.

Existing multimedia authoring tools can be classified in two broad categories:

- **General purpose tools** make it possible to edit various kinds of multimedia documents and allow authors to precisely manipulate the underlying structures. Such tools are indeed very powerful, yet they remain exceedingly complex and require special skills and serious training to be used efficiently. LimSee2 fits in this category.
- **Dedicated tools** are tailored for some particular domain or document type. They are easily accessible to casual users, thanks to their simplified approach to document authoring. Their main advantage lies in the simplicity and automation of some treatments, but users often find themselves trapped in a rigid framework that imposes strong limitations. In addition, they have to use multiple tools to manipulate different types of documents.

Taking a different perspective, LimSee3 brings multimedia authoring at the reach of non-expert users while allowing very different types of documents to be produced. The main idea is to provide template-based authoring tools while keeping rich composition capabilities and smooth adaptability. Based on the semantics of multimedia objects, LimSee3 allows authors to work in their own terms. With the integration of templates, users are guided in the production of sensible multimedia documents. Different templates allow authors to produce different types of documents.

As opposed to LimSee2, which sticks to the **SMIL language**, LimSee3 is language-independent. It is based on a component-oriented document model integrating homogeneously logical, time and spatial structures in a language-neutral way. Templates are defined as constraints on these structures. Based on this logical structuring of multimedia documents, LimSee3 can generate different representations of the same document, in different languages or formats.

LimSee3 was developed as an entirely new open source project in the European Project Palette (see section 7.2.1). Developing from scratch had the inconvenience of being lengthy, but it allowed developers to integrate user comments and requests along the road. For instance, version 1.0 of LimSee3 (February 2008) resulted from an intensive collaboration phase with the ePrep community of practice in order to provide two templates and associated services. As a more technical contribution, the document model has also evolved to allow documents to be exported into different formats.

The latest version of LimSee3 (version 2.0) released in December 2008 provides a set of improvements that are derived both from the Palette usability analysis and from experiments done by users from two communities of practice. It introduces two new categories of features:

- Several common tools that are permanently present, and are active or not depending on the current context or the user request: alignment tool, resizing tool, export and packaging tool.
- Specific tools to cover a new multimedia service, namely an annotated audio service. It is provided thanks to a new template that has been added to the set of available templates.

5. New Results

5.1. Static Analysis Techniques for XML Processing

Work on the static analysis of XML programs was continued in 2008. In particular, we worked on a tool for the static analysis of XPath queries and XML Schemas, based on our theoretical results presented in [4] about a tree logic adapted for XML. The tool introduces techniques used in the field of verification (such as binary decision diagrams) in order to efficiently solve XPath query satisfiability, containment, and equivalence, in the presence of real-world XML Schemas. The tool can be used in query optimizers, in order to prove soundness of query rewriting. It can also be used in type-checkers and optimizing compilers that need to perform all kinds of compile-time analyses involving XPath queries and XML tree constraints.

The tool consists in the combination of several software components:

- a parser for reading the text file problem description. The syntax combines queries expressed with the standard XPath syntax, references to schemas (expressed using DTD, XML Schema or Relax NG). The problem is then formulated with logical connectives;
- compilers for translating schemas and queries into their logical representations;
- an optimized solver first described in [4] for checking satisfiability of logical formulas in time $2^{O(n)}$ where n is the size of the formula;
- and a counter-example XML tree generator.

The novelty of this tool is that it is the first capable of proving exact properties over such a large class of schemas and XPath features. Furthermore, the tool is fairly efficient. The cost ranges from several milliseconds for comparison of XPath queries without tree types, to several seconds for queries under very large, heavily recursive, type constraints, such as the XHTML DTD. In addition, the analyzer generates XML counter-examples which allow observing and reproducing the program defects independently from the analyzer.

Based on these advances, we proposed a logical framework and tool for verifying forward/backward compatibility issues involving schemas and queries. First, it makes it possible to analyze relations between schemas. Second, it allows XML application designers to identify queries that must be reformulated in order to produce the expected results across successive schema versions. Third, it allows examining more precisely the impact of schema changes over queries, therefore facilitating their reformulation [5].

In addition, some preliminary theoretical work was conducted towards extending the logic presented in [4] for supporting a class of counting constraints in trees. We proposed a tree logic capable of expressing simple cardinality constraints on the number of nodes selected by an arbitrarily deep regular path with backward navigation. Specifically, we showed how a sublogic of the alternation-free μ -calculus with converse for finite trees can be extended with a counting operator in order to reason on the cardinality of node sets. Also, we developed a bottom-up tableau-based satisfiability-checking algorithm, which resulted to have the same complexity as the logic without the counting operator: a simple exponential in the size of a formula. These results [1] can be seen as an extension of the so-called graded-modalities, which allows counting constraints only on immediate successors, with conditions on the number of nodes accessible by an arbitrary recursive and multidirectional path.

5.2. Content Adaptation

Currently, multimedia documents may have to be executed on multiple devices such as mobile phones, PDAs, desktop computers, set-top boxes, etc. Hence, usage and platform diversity requires document adaptation according to execution contexts, sometimes unpredictable at design time. We propose to abstract from format specific details by defining a structure which expresses a set of objects and the relations between them. In order to capture the spatio-temporal and hypermedia dimensions of the document, we take into account that these objects are multimedia objects and hypermedia links, and that relations between them are spatio-temporal. In this context, adapting amounts to modify in a minimal way the document abstraction according to the target device constraints. In order to show the applicability of our framework, we have fully implemented a prototype which adapts SMIL documents. The system now includes quadratic solvers that covers the quantitative aspects of the adaptation in addition to the qualitative ones. More precisely, spatial and temporal positioning are now more consistent with the semantic and qualitative reasoning [3].

5.3. Multimedia Authoring

Most of the new work on multimedia authoring is done in the context of the Palette European Project (see section 7.2.1) where the main objective is to support activities in communities of practice (CoP). While the authoring step is often a single-user activity, the resulting multimedia resources and documents aim at being retrieved, shared and reused by CoP members. For that purpose, we have focused multimedia authoring activities on the production of sharable content. This has been addressed in considering both the external document level (export/publish services of multimedia documents) and the internal document level (where the document itself aims at sharing user's experience).

5.3.1. Amaya

Work on Amaya has focused this year on three topics: user interface, template creation and graphics editing.

Regarding the user interface, the main objective was to support new advances in document formats without making the authoring task more complex. This is achieved through template-based authoring and a new user interface. The user interface was improved and made highly configurable, allowing end-users to tailor the tool to their own needs, removing all the features they do not need. This leads to a light weight user interface containing only the commands that a user can understand.

The template-driven editing feature of Amaya developed previously was complemented with a templates creation feature. Previously templates had to be written "by hand", which required particular skills from users, and then restricted the use of templates to communities where a trained user was able to create the appropriate templates. With the new feature, several CoPs in Palette were able to specify the document types they need. Being implemented within the general-purpose editor, the template editor offers a familiar user interface and takes advantage of existing features. In particular, the parts of a template that are simply fragments of HTML structures are created exactly in the same way as HTML documents. A few specific commands, all gathered in a single palette, allow users to insert the XTiger elements that turn a XHTML document into a template.

The graphics editor allows authors to create 2D graphics that are represented in the SVG language. The graphics editor too is implemented within the general editor. This allows users to move freely from text to graphics and back while they are working on a document. Moreover, the graphics are completely integrated in the document and they are edited within the document itself, at their natural position.

5.3.2. *LimSee3*

The main results this year for LimSee3 are an export architecture and new document production services.

The export architecture was motivated by the rapid spread of rich web applications in various domains (leisure, education, trading, advertising, individual communication) together with the emergence of new multimedia technologies and formats. This requires to separate authoring services from publication formats. We have worked in this direction and defined an architecture that enables such a separation [2], and thus allows documents to be exported in various formats. The kernel of the solution is an Intermediate Export Format that aims at carrying as much data as possible about the document for subsequent transformation agents, while preserving all presentational semantics from the source document. More precisely, it provides a projection of the document on five different axes (meta-data, spatial layout, timing, internal dependencies, external dependencies).

In addition to the SMIL 3.0 transformation agent already available, another one was developed this year for XHTML. The output format is XHTML and timing is expressed as SMIL 3.0 element and attribute handled by some Javascript code that implements the **Timesheets** proposed by W3C. A Timesheet scheduler was implemented, which supports several continuous media (thanks to the VLC Mozilla plug-in) and takes into account various user interactions. This scheduler has been proposed as a reference implementation for the W3C Timesheet specification. Finally in order to allow Palette services users to easily retrieve and share their documents, the export service has been extended for automatically storing documents and resources in the common resource repository of Palette and in SweetWiki (a Palette wiki built around a semantic web server).

One of the main results of the Palette project, is the definition of several generic scenarios for CoPs, i.e. scenarios addressing similar needs of various CoPs. Among them, the reification scenario is related to the production, enrichment, search for, and reuse of resources. Based on the LimSee3 platform and its generic authoring services, we have made several multimedia document production services available for CoPs users. This year we have added a new audio/video annotation service based on the requirements expressed by the ePrep CoP:

- Creating live text annotations by a teacher while a student oral presentation is recorded (sound track only).
- Editing the annotated audio for adding annotations and adjusting their synchronization with the audio track.
- Generating a multimedia document in a standard format to allow its publication on multimedia platforms.

Some recent research tools provide audio/video annotation services like Project Pad, videoANT, Ligne de Temps and MediaMatrix, but none of them do cover live annotation needs where simplicity and rapidity together with navigation facilities inside the resulting multimedia documents are of high priority. That's what is provided with the LimSee3 Annotated Audio service.

Another step in the instrumentation of CoPs for the reification scenario through multimedia annotations is being realized with the Did@cTIC CoP. In this CoP, practice is recorded as reusable traces that are then analyzed and compared in order to let new practice emerge. For instance, in order to understand and enhance teaching practice (how to start a session in order to capture attention from the audience? how to make my course more lively and interactive?), short teaching sessions are simulated between teachers to be then analyzed and discussed. Till now part of the material was lost because while the simulation is recorded the notes and discussions are not stored (they are on paper sheets). New annotation and document integration services are provided with LimSee3.

5.3.3. Audio editor

The prototype editor to be used by audio designers is being revisited to take into account the building of audio guides for indoor navigation with the help of specific auditioning tools. These auditioning tools will depend on the format designed to represent paths inside a building.

5.4. Document Formats

The XTiger language, created by the project-team in 2006, was updated to take into account new applications developed in the Palette project. In particular, XTiger templates are used by our partners of EPFL and University of Fribourg (Switzerland) to drive automatic transformations of documents, in order to reuse legacy documents with advanced tools based on XHTML.

The XML format for Interactive Audio has been enhanced to take into account the needs of a new class of applications: audio-vocal guides for indoor navigation. For this kind of application, some testing has been done with an Inertial Measurement Unit (IMU) connected to a mobile phone and sending events to the embedded audio engine. Following this experiment, we have finalized a Minalogic project with ST Microelectronics and some local SMEs. The workpackage, whose WAM is the leader, will use a mobile RFID reader, active RFID tags and an IMU to realize an indoor navigation system to help people with different capabilities to find their way in a building. An output of this workpackage will be a language for the description of buildings with all the information necessary for audio-vocal navigation.

6. Contracts and Grants with Industry

None currently.

7. Other Grants and Activities

7.1. National Grants and Collaborations

WAM participates in the **Web intelligence** project supported by the Rhône-Alpes region.

7.2. European Initiatives

7.2.1. Palette

Participants: Émilien Kia, Jan Mikáč, Vincent Quint, Cécile Roisin, Irène Vatton.

Palette (Pedagogically sustained Adaptive Learning through the Exploitation of Tacit and Explicit knowledge) is a European IST FP-6 Integrated Project. It aims at developing an extensible set of innovative, interoperable and standard-based services that enhance the learning process in communities of practice. These services are validated through various pedagogical scenarios fostering the emergence of new learning practices that remove barriers for the exploitation of mental models, knowledge resources and competences of individuals inside and outside communities.

The main contributions of the WAM project-team concern document models and authoring tools. More specifically, templating mechanisms are designed, developed and experimented in the context of communities of practice. These developments and experiments are based both on Amaya (see section 4.1) and LimSee3 (see section 4.2).

7.3. International Initiatives

WAM contributes to the **Urakawa** project with **NRC** (National Rehabilitation Center for Persons with Disabilities, Japan), **CWI** (The Netherlands), and the **DAISY** Consortium (Digital Accessible Information SYstems). This software project aims at providing a multimedia authoring toolkit for designing content that is fully accessible to persons with disabilities.

The Amaya web editor is developed jointly with **W3C**. The software is distributed by W3C.

8. Dissemination

8.1. Leadership within Scientific Community

Vincent Quint is a member of the **W3C** Advisory Committee. Nabil Layaïda is a member of the **W3C Synchronized Multimedia** working group.

Jacques Lemordant is a member of **IASIG** (Interactive Audio Special Interest Group).

Pierre Genevès received the Best Ph.D. thesis award from Grenoble INP on 21 May 2008, and was a finalist for the **ERCIM Cor-Baayen Award 2008**.

8.2. Conferences, Meetings and Tutorial Organization

Cécile Roisin is a member of the steering committee of the **ACM Symposium on Document Engineering**.

Vincent Quint is on the steering committee of the **H2PTM** conference series.

8.3. Teaching

Pierre Genevès and Nabil Layaïda give Master lectures on Core XML technologies and their theoretical foundations at UJF (University of Grenoble), ENSIMAG/Telecom 3A, and EPFL (Lausanne).

Jacques Lemordant teaches XML Technologies at the L3 level of MIAGE (UJF, Grenoble), on Multimedia Technologies at the M1 level of RICM (Polytech, Grenoble) and Web Technology at the M2 level of IICAO (UJF, Grenoble).

Vincent Quint gave a lecture at the **Web Intelligence Summer School** in July 2008

8.4. Conference and Workshop Committees, Invited Conferences

Members of the WAM project-team were on the following program committees and editorial boards: **Document numérique**, **DocEng2008** (ACM Symposium on Document Engineering), **H2PTM** (Hypertextes-Hypermédia), **Information - Interaction - Intelligence**,

Members of the WAM project-team have served as reviewers for the following venues in 2008: ICFP 2008 (The ACM SIGPLAN International Conference on Functional Programming), PLAN-X 2008 (ACM SIGPLAN Workshop on Programming Language Techniques for XML), LATA 2009 (3rd International Conference on Language and Automata Theory and Applications), TKDE (IEEE Transactions on Knowledge and Data Engineering), Multimedia Systems (Springer).

Members of the WAM project-team gave several seminars: P. Genevès at ENS Cachan, November 25th, 2008, and at **Colloque en l'honneur de Louis Bolliet**, May 2008.

Members of the WAM project-team served as project reviewer for Qatar National Research Foundation (QNRF), project evaluator for the International Scientific Cooperation Program Argentina-INRIA/CNRS (SE-CYT), members of the tenure Committee of the Computer Science Department at the Worcester Polytechnic Institute, MA, USA, Scientific Advisor for RaisePartner S.A, an INRIA spin-off.

9. Bibliography

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- [2] C. ROISIN, J. MIKÁČ, B. LE DUC. *An export architecture for a multimedia authoring environment*, in "DocEng'08: Proceedings of the eight ACM Symposium on Document Engineering", D. BULTERMAN, F. SOARES, M. PIMENTEL (editors), ACM Press, September 2008, p. 28-31, <http://hal.inria.fr/inria-00325692>.

National Peer-Reviewed Conference/Proceedings

- [3] S. LABORIE, J. EUZENAT, N. LAYAÏDA. *Adaptation spatio-temporelle et hypermédia de documents multimédia*, in "Atelier Représentation et Raisonnement sur le Temps et l'espace (RTE)", Hermès, June 2008, p. 1-13, <http://www.inrialpes.fr/exmo/people/laborie/Papiers/laborie-RTE08.pdf>.

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- [4] P. GENEVÈS, N. LAYAÏDA, A. SCHMITT. *Efficient Static Analysis of XML Paths and Types*, Research Report 6590, INRIA, July 2008, <http://hal.inria.fr/inria-00305302>.
- [5] V. QUINT, P. GENEVÈS, N. LAYAÏDA. *Ensuring Query Compatibility with Evolving XML Schemas*, Research Report 6711, INRIA, November 2008, <http://hal.inria.fr/inria-00336360>.