

INNOVATION REPORT

Greater versatility for user interface design in multiple contexts of use



David Faure, Thales

Jean Vanderdonckt, Université Catholique de Louvain

While the EU offers a huge market for European companies, the many different languages and cultures, multiple organisations and numerous contexts of use (e.g., different users using various devices and computing platforms in different environments) remain strong constraints to the wide distribution of products developed for a single target. This is a particular problem in software-based systems, such as information systems. Here the key challenge for human-computer interaction is the design of simple and natural multimodal user interfaces – such as voice command, text to speech and gesture recognition – with enough features for users of different levels of expertise and capabilities.

Major breakthrough

The UsiXML ITEA 2 project developed an innovative model-driven engineering method to improve the user interface, or UI, design for the benefit of both industrial and academic end-users in terms of productivity and reusability. This method consists of a series of models that capture the context of use (i.e., user, platform, environment), the end user's task and user interface as well as the transformations between while ensuring some level of quality. Since a large proportion of today's infrastructure tools, software tools and interactive applications are implemented on top of mark-up languages, this project focused on enhancing the XML-based user interface extensible mark-up language (UsiXML) by adding versatile context-driven capabilities to take it far beyond the state of the art and lead to contributing to standardisation efforts.

The project's consortium involved the main contributors of the UsiXML community, industrial partners and academic partners. This consortium facilitated a challenging design and development process to enable the production of realistic and complex industrial applications. The impact of this on European markets in the next few decades will be significant and will apply to multiple segments in which a real gain can be achieved for European industries, employees and citizens.

The key innovation of this project could be described as the definition and standardisation of the UsiXML “ $\mu 7$ ” concept and the development of the UsiXML language and model-driven engineering method. The whole chain of different

abstraction levels in user interface design is covered and a comprehensive set of tools has been developed. Using the $\mu 7$ concept – multi-device, multi-user, multi-culturality/linguality, multi-organisation, multi-context, multi-modality and multi-platform – not only increases productivity and reusability but also improves usability and accessibility of industrial interactive applications. This is a major breakthrough as it will no longer be necessary to develop individual unique interface solutions for each application.

$\mu 7$

Multi-device

Multi-user

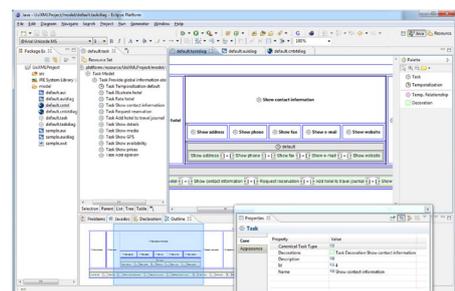
Multi-linguality

Multi-organisation

Multi-context

Multi-modality

Multi-platform



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A huge development effort resulted in the definition of a suite of nine meta-models that incorporate new aspects, including UI Commons (for model description) and configuration (for versioning). Furthermore, the semantics, syntax and stylistics along with meta-models for method engineering have been defined. For instance, implementations include ProDevelop's DashBoard (Eclipse Plug-in, Compatibility), UCL-UCLM' Eclipse model editors, Defimedia' DevBox (online) and UJF's D2Flex (Online) and some UI development life cycles have been validated. Finally, an evolving software architecture compatible with MDE principles opens doors beyond Service Oriented Architecture (SOA).

Impact on technology and commerce

The success of the ITEA 2 project will reduce total application costs and development time by enhancing the UsiXML interface modelling language through the addition of versatile context-driven capabilities. UsiXML is an XML-compliant mark-up language that describes a user interface for multiple contexts such as character, graphical, auditory or multimodal interfaces. Thanks to UsiXML, non-developers can shape the user interface of any new interactive application by specifying it in UsiXML, without requiring the programming skills usually found in mark-up and programming languages. This project offers a practical application of model-driven architecture (MDA) and engineering (MDE) that will show immediate benefits in day-to-day software engineering. The impact of UsiXML on European technological and commercial advancement will be mainly found in:

- Advancement of European state-of-the-art in modelling and model transformation techniques for human-computer interaction;
- Technological transfer from the academic partners to large and small industries;
- Stronger positioning in the standardisation bodies; and
- The very high performance/price ratio of the UsiXML solution as no hardware investment will be needed – giving the company's marketing it a strong edge.

Innovations in UsiXML will help European software vendors and industrial systems makers to increase productivity in software development and reduce development costs. The results will reduce time to market, speed-up productivity, improve factorisation, speed change propagation and better assess usability and accessibility. A Usi foundation will be setup to assure the continuation of the UsiXML results, in particular with the members of the UsiXML End User Club (more than 87 today, including Eclipse Foundation).

Standardisation

While standardisation is one of the key innovations of this ITEA 2 project, companies need to be shown that there is a

real benefit for them, in their domain and with the constraints they face in their everyday business. The pertinent issues for business people revolve around the kind of business model to deploy UsiXML solutions and the list of potential benefits of the UsiXML approach. Designers/developers need to know what the metrics are and how they must be computed/estimated. In the design of UI for specific end users, such as children and disabled people, it is crucial to determine the impact of a UsiXML-generated GUI.

A large number of demos and technical presentations were given to reveal the tangible benefits of the project's results. Examples include UsiCentral, a demo of DefBox and Domain Editor, D2Flex, a tool for designing flexible process models, UsiSketch, tools for high-level user interface design using hand-drawing, and SurMar, a maritime surveillance demonstrator. Such demonstrations will encourage the build up of the momentum required for the adoption of UsiXML as a general-purpose, user-interface definition language throughout Europe. Standardisation was achieved in several contexts: the OASIS Technical Committee on User Interface Modelling Language that resulted in UIML 4.0, the NESSI European platform, the FP7 Nexof-RA with the NEXOF-RA Reference Architecture, the COST 294 Action "MAUSE" on Usability, the ISO 24744 standard on Method Engineering (task and study) while standardisation efforts are ongoing in the W3C Group on Model-Based User Interface Design and OMG'IFML (through Thalès).

Dissemination

Extensive communication and dissemination include exhibitions, demonstrations, an End User Club with over 100 members and scientific papers, theses, working papers, demonstrations and two journal special issues as well as workshops. Furthermore, social media like Facebook (<https://www.facebook.com/UsiXML>), LinkedIn and Twitter as well as automatic newsletter extended dissemination to a wider public. A playlist of more than 100 videos (e.g., project description, presentation, software demos, and TV broadcasts) is available at http://www.youtube.com/playlist?list=PLn_SfKW8yXZAVuESKWEKUqwRQa16ORCi6

On 15 April, 2011, an UsiXML End User Club, a network of active players interested in UsiXML developments, was launched. It has three categories of user: the Observer, interested in the project, its goals, scientific results, methods, tools or demonstrators; the Supporter, interested in the specific results of the project; the Promoter, interested in UsiXML goals and in creating a demonstrator using the UsiXML language and tools. One End User Club member has already used UsiXML to cut 40% off its development time.

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The cooperation and technology transfer between academic partners and tool providers and end users was excellent throughout the project and the added value of the European dimension was apparent. In addition, the UsiXML project had some connections with the project DIY Smart Experience (ITEA 2) and FP7 projects (e.g., FP7 Human, FP7 Selfman, FP7 Serenoa) as well as with different national initiatives. One example of exploitation comes in the form of MiLab, a company established in Mexico, which is already using the UsiXML concept.

Impact

The development of a standard language and a universal engineering framework will provide benefits in terms of time-to-market, productivity, reuse, propagation-of-change and usability/accessibility guarantees. The impressive results will act as a user interface tool that moves the state-of-the-art



forward and that will have a strong worldwide impact through standardisation. UsiXML will help industries address the European market as a whole, instead of remaining in local niche markets. The next challenge will be to transform this high-end result into tangible economic activities and thus improve the competitiveness of European industries and enable the needs of European citizen to be better satisfied.

This challenge is being addressed in a number of ways, such as the W3C Group on Model-based User Interface Design that is pursuing its standardisation efforts, proceeding with other levels of abstraction and involving other models. The need to continue this effort to reach the final stage of W3C standardisation applies not just to existing meta-models but also to forthcoming ones. It is vital to establish a clear transition between the W3C future recommendation and its support through software so that companies interested in being compliant with the forthcoming W3C recommendation on model-based user interface design can start implementing import/export mechanisms and other types of software like model editors, M2M transformers and M2C generators in their own market. In addition, a procedure must be defined for checking standard compliance at different levels of abstraction and a market plan devised for promoting W3C standard compliance, including reporting on use cases where the technology has been successfully used. For this purpose, a UsiFoundation will be created to manage interests of the stakeholders for a nominal fee.

More information:

www.usixml.eu/