Proficient

Semantic web platform and interfaces

Executive Summary

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PROFICIENT; SME network business model for collective self-organised processes in the construction and retrofit of energy-efficient residential districts
The Proficient project is co-financed by the European Commission under the seventh research framework programme (FP7-2012-NMP-ENV-ENERGY-ICT-EeB; GA No. 312219)

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Colophon

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Publishable executive summary

The aim of the **Proficient** project, funded under the FP7 programme 'Energy efficient Buildings' (EeB) is to facilitate and promote Collective Self-Organised (CSO) housing for energy-efficient neighbourhoods. In CSO housing, a group of individuals organize themselves within a contractual agreement on a collective level for the realization of their settlement, either newly built or retrofitted. The target group of the project consists of end users on the demand side of products and services and SMEs on the supply side.

In order to bring demand and supply together, a Semantic Web Platform called the 'e-Marketplace' will be developed. One of the important parts of the e-Marketplace is the so called 'design configurator', allowing end users to modify a 3D representation of their dwelling. This tool, shown as a prototype in Figure 1, builds on the principles of a newly developed open standard called 'CMO with extensions'.

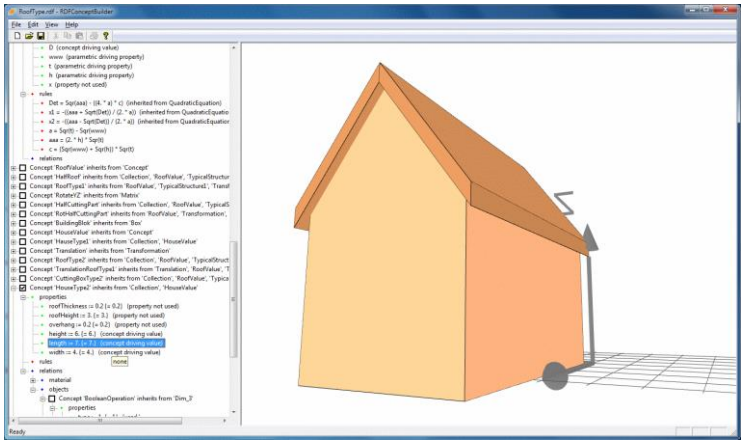

Figure 1. Design configurator tool in the e-Marketplace

Semantic Web and 'CMO with Extensions'

The Semantic Web is a collaborative movement led by international standards body the World Wide Web Consortium (W3C). By encouraging the inclusion of semantic content in web pages, the Semantic Web aims at converting the current web, dominated by unstructured and semi-structured documents into a "web of data". The Semantic Web stack builds on the W3C's Resource Description Framework (RDF).

According to the W3C, "The Semantic Web provides a common framework that allows data to be shared and reused across applications, enterprises, and community boundaries." The term was coined by Tim Berners-Lee for a web of data that can be processed by machines.

While its critics have questioned its feasibility, proponents argue that applications in industry, biology and human sciences research have already proven the validity of the original concept. Scholars have explored the social potential of the semantic web in the business and health sectors, and for social networking. (source: http://en.wikipedia.org/wiki/Semantic_Web).

The technology behind Semantic Web is based on an Open World Assumption. Without going to deep into what this technically means, it contradicts to the technology behind most standards that are based on a Closed World Assumption. The basic principles of product and process modelling in Closed World Assumption standards have been identified to create a standard called 'CMO (Concept Modelling Ontology)' on top of Semantic Web, i.e. CMO is based on the Open World Assumption, however with the ability to cover functionality needed for product and process modelling. Within Proficient we created and extended CMO with parametric knowledge and geometrical representation. This open standard will be called 'CMO with Extensions'.

The Semantic Web Platform

The Semantic Web Platform for Proficient is based on the open standard CMO with Extension. Therefore he Semantic Web Platform (the 'e-Marketplace') inherits all benefits from Semantic Web technology and all available tools for this technology are automatically also available for Proficient. The present Deliverable D6.2 gives an insight in Semantic Web, its layered approach and what the consequences are of having an Open World Assumption. The layered approach, illustrated in

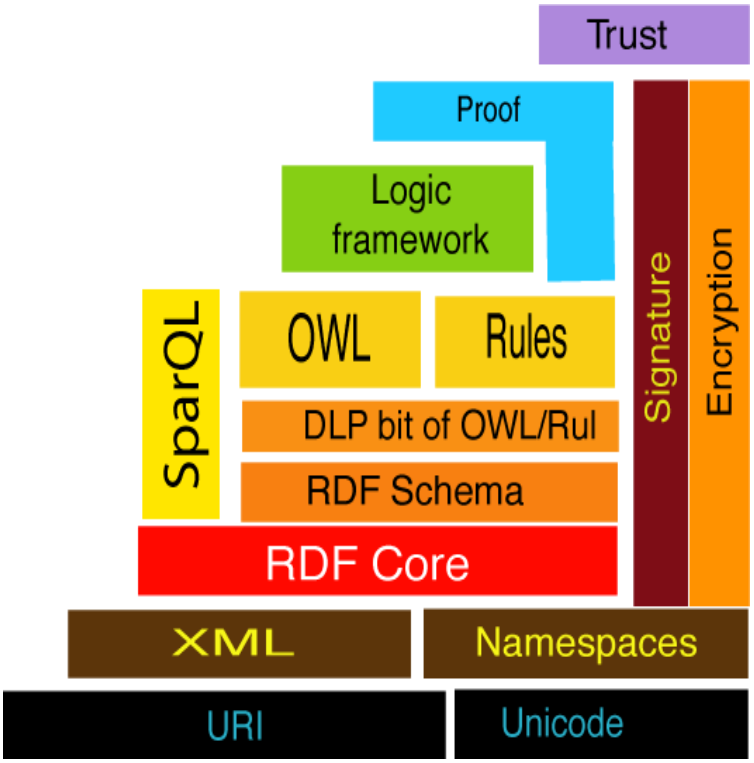

Figure 2, is described in detail in chapter 2.

Figure 2. Layered approach underlying the Semantic Web Platform.

The Semantic Web Platform is based on CMO with Extensions where in the context of

Figure 2, CMO is a minimal extension of OWL and the Extensions part is an alternative to current solutions for rules in a way that also geometrical representations can be represented.

Within Proficient the OWL 2 DL variant is selected. OWL 2 is the most recent version of OWL and DL can be seen as a degree of freedom; the more freedom is given (with maximum freedom within OWL 2 Full) the less derived information can be retrieved in an automated way. OWL 2 DL ontologies are strict enough for reasoners to quite well understand and interpret the information given. A reasoner is a generic software package that is able to make conclusions and answer questions based on a set of information (i.e. an ontology).

CMO (Concept Modelling Ontology)

Technically CMO is an ontology based on OWL 2 DL. CMO enables representing typical knowledge stored in standards based on a closed world assumption. CMO is created by combining and reusing well known existing ontologies. One of the main contributions of CMO towards standard OWL is a clear definition of decomposition. Where OWL only defines

generic relations (called object type properties), CMO adds a clear distinction between decomposition relations and other relations. Within existing standards decomposition relations are often specialized further. CMO only distinguishes between direct/indirect decomposition and class/instance decomposition but enables ontologies to make further specializations.

CMO with Extensions

One of the major contributions of Proficient towards standardization is the development of the open standard CMO with Extensions. Where CMO supports product and process modelling in the context of Semantic Web, CMO with Extension adds support for parametric behavior and geometrical representations. The latter allows the functionality of the 'design configurator' in the e-marketplace.

Being able to store parametric behavior in combination with geometry is not completely new for open standards. However storing the parametric knowledge in the same open standard was not possible before. The exact difference based on a T-Profile example, benefits of this new way of storing and why it typically is possible in a standard based on an Open World Assumption can be found in chapter 3.5 of this deliverable. Applications were already able to offer part of this freedom, but always stored within a closed format in such a way that exchange of this knowledge to other systems was very complex, requiring dedicated APIs (Application Programming Interfaces).

Also the full technical definition of this open standard CMO with Extensions can be found in D6.2 and its appendixes.

Technical Interfaces

All content in the Semantic Web Platform will be based on CMO with Extensions and therefore is 100% compatible with Semantic Web standards OWL2, RDFS and RDF. This means that all available tools and APIs that handle OWL2, RDFS and/or RDF can be used to interface with Semantic Web Platform. Chapter 4.1 of this deliverable describes a number of such currently available tools.

For professional parties in the Building and Construction, CMO and Semantic Web are generally unknown standards and interfacing with them directly is not possible through existing tools and content. Within the Building and Construction sector one of the best known and supported open standards is IFC from the organization BuildingSMART. To make interfacing between existing tools and content possible with the Semantic Web Platform, two prototype converters are being developed. One is converting CMO to IFC and the other converts the other way around, i.e. converting CMO towards IFC. As both open standard IFC and the Semantic Web are well known developments for the research industry, several parties are developing conversions between IFC and Semantic Web. In the prototype developments for

Proficient, the work on conversions incorporated existing developments and new work was focused on parts that are not expected to be solved by other parties in the near future.

User interfaces

Although the context of the present deliverable is mainly technical and focuses on the connection to existing applications and content, one important interface is the interface to the end user. It is in the nature of Semantic Web to enable the interface via the Web, i.e. a web browser. The Semantic Web Platform therefore will enable a user interface via the web and for geometrical information use the WebGL standard. What and how exactly information is interfaced is something to be defined based on input from other Work Packages.

Modelling Guidelines

As CMO with Extensions is a completely new way of modelling parametric content it possibly introduces also different behaviour and modelling solutions. Part of the standardization work done within WP6 focusses on finding typical limitations, possibilities and modelling guidelines.

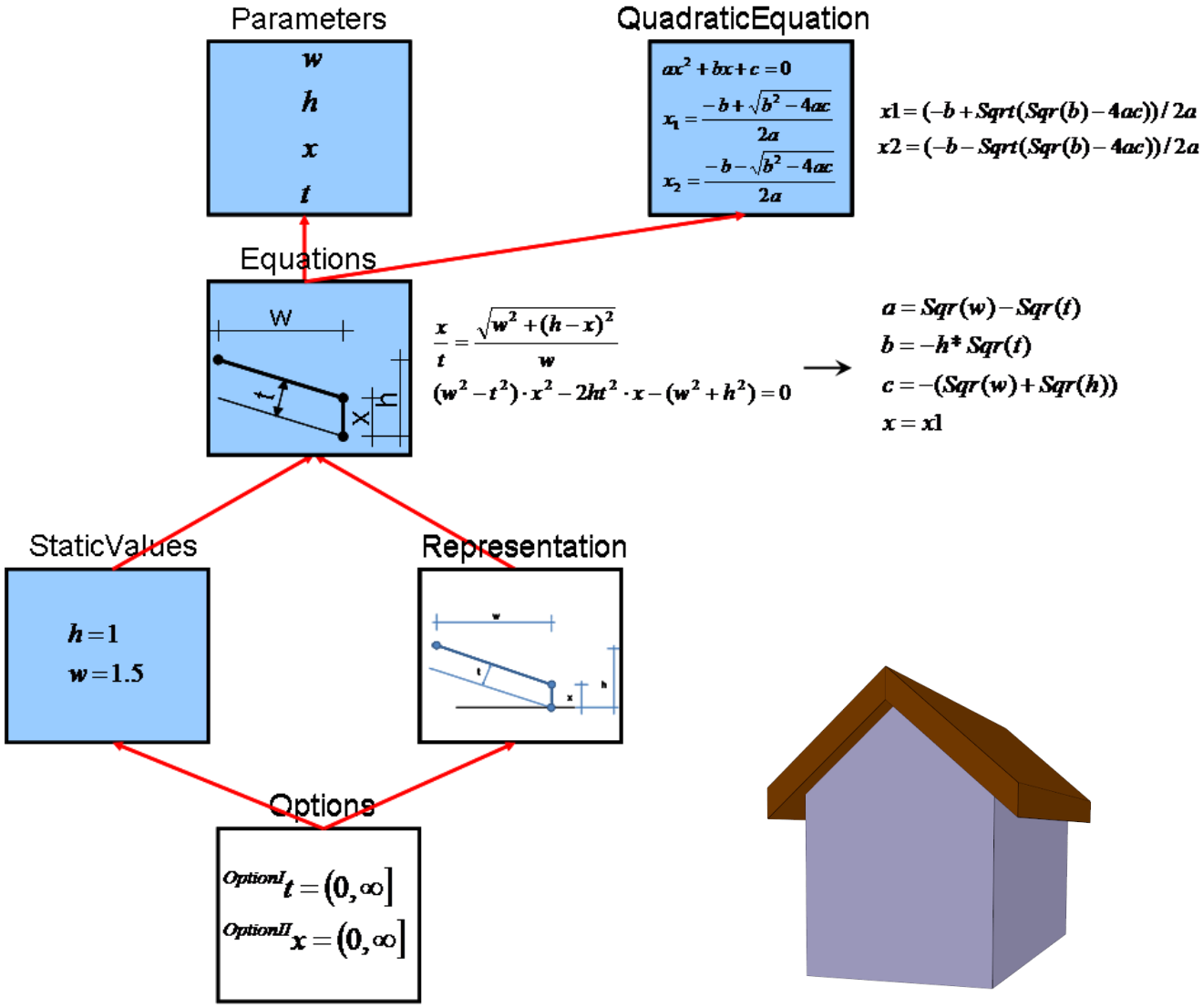

Figure3. Modelling structures required to model a simple roof.

Even a relatively simple example like modelling a simple roof introduces complex modelling structures illustrated in Figure3. The modelling guidelines in D6.2 give a first version of experiences with modelling content in CMO with Extensions.