eeEmbedded

Newsletter Nr. 5

October 2015 – March 2016

WELCOME

Welcome to the fifth newsletter of our project: *"Collaborative Holistic Design Laboratory and Methodology for Energy-Efficient Embedded Buildings" (eeEmbedded),* funded by the 7th Framework Programme (FP7). Its duration is 4 years. It started on the 1st of October 2013 and has a budget of nearly 11 M€.

This semester's edition includes information about the intelligent Virtual Engineering Lab: the platform architecture and its software components, the innovative Multimodel approach, the new ontology-based interoperability system and the cloud-based simulation. As usual, we also provide news and upcoming events.

We hope you enjoy this newsletter.

IN THIS ISSUE

INTELLIGENT VIRTUAL ENGINEERING LAB (iVEL)

The intelligent Virtual Engineering Lab (iVEL) is a collaborative holistic platform to support architects, engineers, facility managers and decision makers to design energy efficient buildings embedded in their neighbourhood. iVEL integrates design/inspection tools existing in the market (e.g. Architectural CAD AllPlan, MEP-CAD System DDS-CAD) and analysis/simulation tools existing in the market (e.g. RIB iTWO) to avoid that every analysis model has to be set up by hand by means of intelligent BIM knowledge management. For that purpose, iVEL uses the innovative Multimodel approach and the new ontology-based interoperability system. Besides integrating a set of existing advanced ICT tools and providing them with an interoperability structure, iVEL complements them with a set of new supporting services and tools for process support, information management and decision-making. As result, the design process is more automated and optimised.

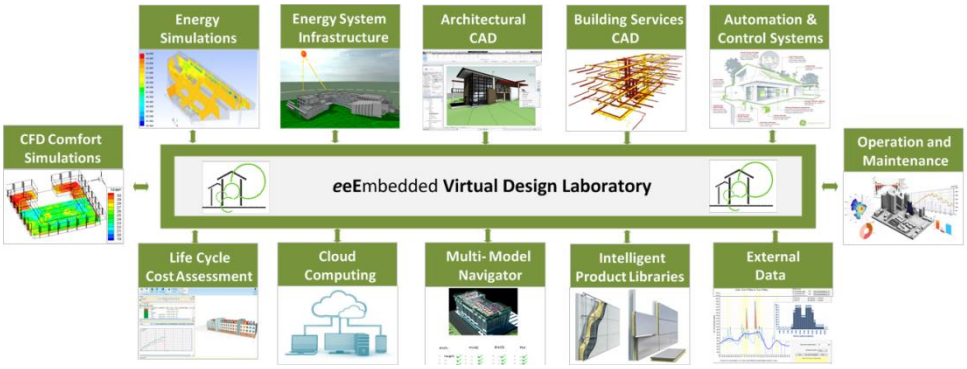


Figure1: The eeEmbedded Virtual Design Laboratory (iVEL)

eeE SOA PLATFORM & SOFTWARE COMPONENTS

The eeE SOA platform consists of a variety of software components which are organised in modules that are depicted in Figure 2. Users access the platform via authoring tools or via collaboration and decision support tools. Those tools utilize services provided by components of the Multimodel Management and Simulation/Analysis Management modules. These services again rely on other services from the Simulation and Analysis module and from the Collaboration and Resource Management module, providing access to computing and storage resources. The components are described in detail in *Deliverable 8.1 SOA Platform Architecture* while *Deliverable 8.2 Collaboration Methods* introduces methods & technologies of the Communication Layer. In Figure 3, this layer includes the service bus implemented via BCF (BIM Collaboration Format) REST API. The collaboration involves mainly three applications: Scenario Manager (workflow management, control functionality), bim+ Multimodel Navigator (model/data visualization) and BIM—it (manual collaboration capabilities).

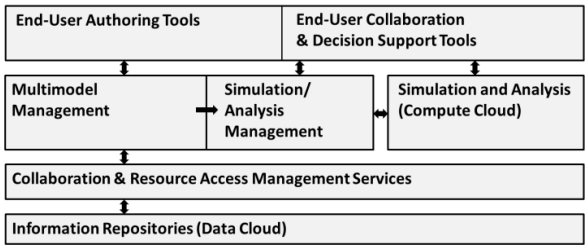


Figure 2: Simplified module overview

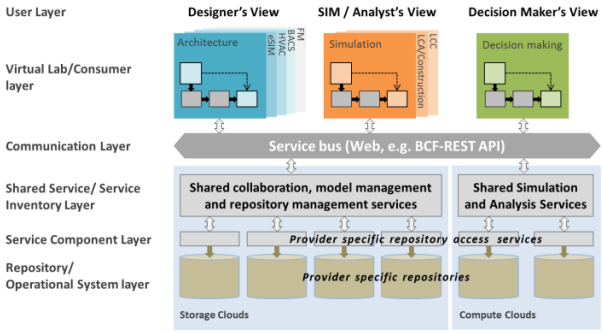


Figure 3: Layer structure of the eeE platform architecture

*ee*E MULTIMODEL APPROACH/THE LINK MODEL

The Multimodel (MM) approach and the Multimodel Container (MMC) concept aim at the integration of a variety of domain models in order to support the collaborative work during the entire planning and implementation phase of a building. The so called Link Model (LM) concept is utilized to link BIM models with other models and data, like for example with climate and user behaviour models, BACS and ESIM in a unified way. The MMC is sent as part of a BIM Collaboration Format (BCF) message. This MMC consists of at least one Elementary model (EM) and can contain LMs that store Links, each of them connecting a minimum of two elements from the EMs via their unique identifier. The LMs and EMs can be embedded in the MMC and thus delivered to the BCFs recipient as part of the message to ease the use. It is possible to send only references to larger EMs and let the recipient of the BCF gather only the linked elements from the server to prevent network overload. This so called Slim MMC is depicted in Figure 4. The LM approach is described in detail *in Deliverable 4.3 Link Model for Multi Model.*

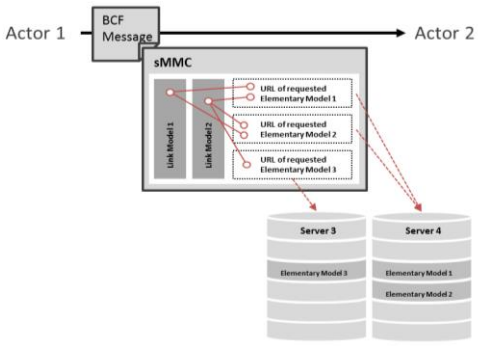


Figure 4: Slim Multimodel container sent via BCF, containing Link Models and references to Elementary Models

*ee*E Ontology Framework

The ontology framework is formed by a meta ontology embedding different sub ontologies, which cover the required domain models like the ESIM, the visualisation and interaction model for representing results and the process model describing the overall eeEmbedded design process. It is further formed by ontology rules and queries enabling inferencing, checking, mapping and creating views and by corresponding services summarized in a tool triggering such rules and queries. Thereby, the idea of the ontology usage is to support all participants in the eeEmbedded design process by consolidating and preparing the different inhomogeneous data for simulations, in optimising the determination procedure during the simulation phase and in assessing the simulation results and making design decisions.

Top down strategy for Ontology based Support

The usage of the ontology will follow the top down strategy established in the eeEmbedded design process starting on a very abstract level with the definition of the requirements and ending with the decision making of certain detailed building designs. Based on this the ontology will first provide predefined but configurable structures for rapid designing before it will operate on a certain building model and its certain geometry. The splitting into abstract support and certain support methods is established in project specific ontology support and cross project ontology support; from a more technical point of view the ontology issues can be grouped into two types of main issues: Schema generation and instances generation. In the first case the ontology supports the development of schemas like the formulation of the process, the Key Design Parameter/ Key Performance Indicator definition or the link model specification. This is a template based issue and is not only related to one project, but cross project related. The other issue type is a more detailed issue and working on instance level. This ontology issue is a project specific issue and a concretisation of the first issue.

Ontology controlled Process Workflow

The overall issue of the ontology is to support the approach of a controlled process workflow. So, for each process step a certain model schema – the To-Be Model - has to be defined, which will be referenced for the checking step and will be stored for cross project usage. The actual instances of the multi model describing a specific project situation and the current state of building model and its connected external models. For the checking procedure, the instances have to be transferred into the ontology multi model making the rule application possible. Cause of the fact that not all instances and relationships could be checked or are interesting for checking an abstraction step will reduce the ontology instances, so that the relevant instances set will be generated and ready for checking.

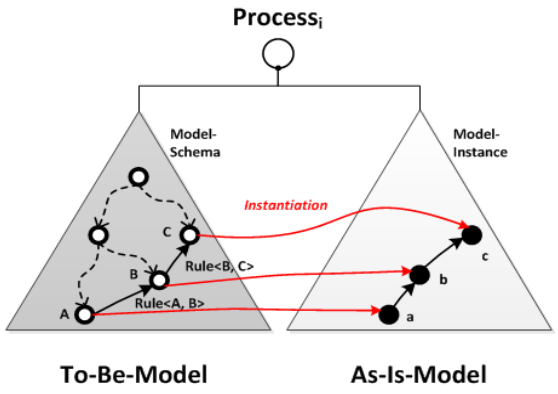


Figure 5: Ontology Controlled Workflow

Process Validation using Key Points

The validation in the eeE workflow is split into prerequisites and quality inspections. The prerequisites inspection comprises the inspection of the exchange requirements and of the linking of the domain models. Here, it will be checked if the given information is good enough to start a simulation. The quality inspection checks, if the simulation result fulfil predefined requirements and in this sense if they fulfil a certain quality. After this a selection step will follow.

*ee*E CLOUD-BASED SIMULATION

A cloud-based test-bed is being established on the basis of the requirements and use cases of iVEL, the KPI-based design method, the energy design targets, the data models for multi-physics energy simulations and the new ontology-based interoperability needs. Cloud computing power is properly utilized according to the needs of each simulation application towards the common target for the achievement of the optimum solution based on multidisciplinary criteria all quantified in specialized KPIs. To this end, a cloud framework abstraction was implemented that encompasses all major existing cloud Frameworks and can be extended for future cloud frameworks with minimal developer effort. This work develops a broker service that translates requests from the eeEmbedded service bus to various cloud frameworks, using plugins to implement different cloud engine interfaces. The use of specialized simulation software on the cloud for the energy performance and the thermal comfort of buildings embedded in their environment gives an extra value on the project's outcome following the trend for use of commercial specialized software in the cloud.

UPCOMING *ee*EMBEDDED EVENTS

2nd eeEmbedded Experts Seminar

CIB World Building Congress, 30 May - 3 June, 2016, Tampere (Finland)

The second experts´ seminar of eeEmbedded will take place in the framework of the 20th CIB World Building Congress 2016 in Tampere, Finland. eeEmbedded results up to date will be shown and active debates between expert attendants will be motivated as feedback to *eeE* developments.

The seminar/workshop is free of charge for congress attendants. We will have two sessions: **First session on Wednesday 1st of June from 11 a.m. to 12:30 p.m. and second session on Thursday 2nd of June from 11 a.m. to 12.30 p.m.** We kindly invite you to join the 2nd eeEmbedded experts' seminar that will address the following topics:

- Overview of the project including the Key Points Methodology for BIM based design
- The intelligent Virtual Engineering Lab: Platform architecture and interactive exhibitions of the tools that are already integrated
- The New Models and Interoperability System: ESIM, Multi-Model Approach, Ontology

Additionally, eeEmbedded will participate in the exhibition booth supported by EeB-CA2 CSA at the congress from 31.05.2016 to 03.06.2016. We will show posters and videos of our virtual lab and ICT based intelligent methodology. We encourage you to visit us.

eeEmbedded session in conference

11th European Conference on Product and Process Modelling, Limassol (Cyprus), 7-9 September 2016

eeEmbedded will organize a session within the ECPPM2016, 11th European Conference on Product & Process Modeling.

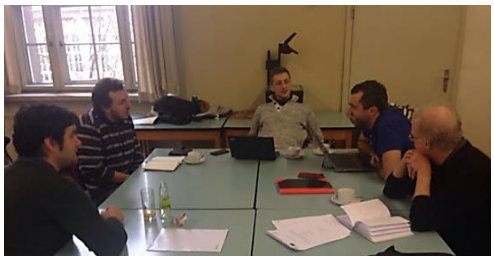
This conference is the oldest BIM conference and has provided a unique platform for the presentation and discussion of the most recent advances with regard to the ICT (Information and Communication Technology) applications in the AEC/FM (Architecture, Engineering, Construction and Facilities Management) domains. The conference will address the following thematic areas: Information and Knowledge Management, Construction Management ect.

MEETINGS IN THE CURRENT PERIOD

6th WORKSHOP AND GENERAL ASSEMBLY MEETING

9-11 September 2015, Dresden (Germany)

The sixth coordination workshop was held at the premises of the Technische Universität Dresden (Germany). The first day, the consortium was discussing on open issues related to the implementation plan.



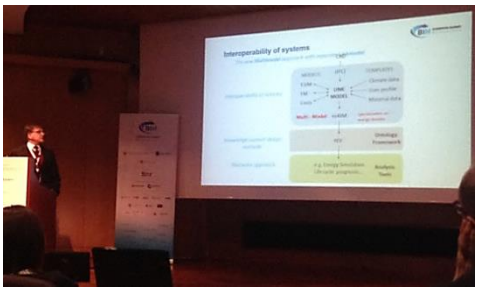
During the second day, an Exploitation Strategy Seminar (ESS) was organized with the support of the European Commission, who appointed to Mr. Andrea Di Anselmo from MetaGroup. The partners worked in 4 groups (construction companies, software developers, open platform and suppliers/consultants of energy efficient building automation solutions) on the characterization of business models, key exploitable results and on the identification of risks. As result, the exploitation plan will be updated.

Finally, the third day, partners defined the roadmap for the implementation plan in the next months and detailed the validation & verification plan using the pilots projects.

eeE PRESENTED AT…

…European BIM Summit 2016

Barcelona (Spain), 18th-19th February 2016



The event was successfully celebrated with an intensive participation of professionals in the sector. By means of experienced speakers, the Summit offered a top-level overview on a wide range of topics related to BIM: State of the Art in Spain, BIM implementation in Europe, collaborative protocols, BIM Industry, Case Studies, etc.

eeEmbedded project was presented in the Summit within the session Latest BIM Research by the coordinator Prof. R.J. Scherer who insisted in the importance of the joint between BIM and energy. Prof. Scherer provided a general outlook of the project and focused on the main contributions and products such as Multi-Model approach.

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