Final Publishable Summary Report

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Today we're witnessing a change in the role of IT from that of an enabler to that of an industrial sector in its own right. This project developed an IT-Socket that realizes the vision of businesses "plugging-in" to IT.

Three demonstration scenarios dealt with: (1) "Certification" of IT infrastructure staying compliant with regulations, (2) "Virtual Organisation" by evolving current service orientation to a higher, business driven abstraction, as well as, (3) "Governance" of IT infrastructure introducing business context into highly distributed and complex systems. The IT-Socket follows a model-driven approach by introducing graphical modelling languages as mediators between the domain experts and formal semantic knowledge representation. The challenge was to link human-interpretable models with machine-interpretable formalisms in order to enable an advanced knowledge management system for business and IT alignment.

This challenge was addressed by the Next Generation Modelling Framework enabling the hybrid usage of concept models for different domains using different formalisms. A new method in knowledge harvesting has been developed to tighter involve the domain expert. It has been applied to the use cases and was found useful, time efficient and cost efficient. With a minimum of guidance domain experts were able to externalise their knowledge in form of graphical models. The creation of formal correct semantic descriptions still requires the support of a knowledge engineer, but the expert's involvement concerning time and complexity has been reduced massively.

The use of different modelling languages for different views on the IT-Socket and hence the communication via models has been realised using the metamodel concept, semantic lifting, and the orchestration via semantic workflows. The most challenging part – which is still performed by the human expert – is the semantic lifting of models, i.e. the translation of graphical models into formal, semantic representations. The framework is flexible in providing transformation and communication flows between domain experts through the service-oriented approach. A set of different services and workflows enable the transformation, comparison or assimilation of graphical models between different domains. It was demonstrated how services compare business processes, find most appropriate IT architecture, notify the IT solution modeller on relevant changes in business requests or enable the intelligent search on best fitting Service Level Agreements.

Graphical representation of semantics was developed and demonstrated to the relevant extend necessary to be applicable for graphical models. This includes assimilating results of semantic queries into graphical models as well as enabling graphical representation language of semantic matching results.

The technical platform integrates different modelling languages using a service-oriented middleware that is responsible for technical integration of modelling tools. Semantic kernel is responsible for conceptual integration of different modelling languages. Web-modelling platform provides a common user interaction to underlying modelling tools.

First, different user interaction technologies have been analysed ranging from Web-Modeller, Internet Modeller, Hybrid Modeller and Remote Application to Rich Client Application, providing interactions for each technology. Second, tool functionality has been transformed into independent modelling services that can be orchestrated by a service-oriented middleware enabling distributed and heterogeneous provision of a Next Generation Modelling Framework. Workflows enable the transformation and communication between models by invoking semantic kernel services. Third, a metamodel platform realises a model repository, providing a transparent access on modelling languages and models.

The results of the use cases are provided in form of success stories at the knowledge portal of plugIT. The services realising the Next Generation Modelling Framework are provided on the plugIT open source platform, whereas conceptual results are provided in the Open Models Initiative (http://www.openmodels.at).

1 Summary of Project Context and Objectives

Summary description of the objectives

Today we're witnessing the necessity to align Business and Information Technology (IT) as well as a change in the role of IT from an enabler to an industrial sector in its own right. The reasons for this are manifold: legal aspects, regulations, business requirements, economic factors, etc. Technological trends such as SOA, Software as a Service and Virtualisation are influencing the way in which IT services are rendered. Model-based approaches and ITGovernance are prominent candidates to bridge evolving business contexts and IT, in order to adapt the provisioning of IT for business needs. This challenge can be met by capitalizing on semantic technologies for IT-Governance. Based on the assumption that businesses in different sectors of the economy will require IT for different reasons and in different ways, plugIT aspires to develop an IT-Socket. Based on concrete end-user scenarios, the ITSocket that will realize the vision of businesses "plugging-in" to IT as illustrated in Figure 1.

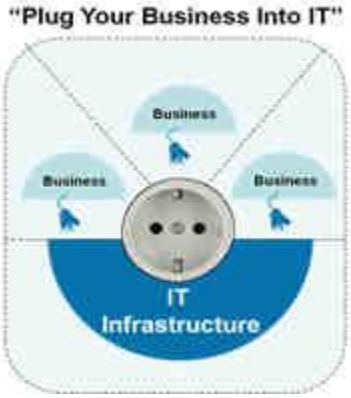

Figure 1 The IT-Socket idea

For the development of the "IT-Socket" a model-based approach is applied. The rationale is as follows: as graphical models can be interpreted by the domain expert in the form of semiformal graphical representations and hence can act as mediator between domain experts and formal semantic representation that can be interpreted by machines.

plugIT will develop concepts, tools and methods summarized within the "Next Generation Modelling Framework" that allow experts from both business and IT domains to use modelling languages that fit to their concrete needs.

This development relies on

- a tighter involvement of domain experts when expressing formal knowledge by using graphical modelling languages as input,
- different graphical modelling languages for the IT-Socket to provide modelling languages the domain expert is used to work with, as well as
- a domain specific notation for semantics by integrating formal concepts of semantics with the graphic notation from modelling languages.

plugIT proposes a "Conceptual Integration" and a "Technical Integration".

Conceptual Integration targets the integration of modelling languages currently existing on the market (e.g. business process modelling languages such as EPC, BPMN, ADONIS®, UML Activity Diagrams, BPEL), or new modelling languages that need to be developed and integrated.

The integration within the "Next Generation Modelling Framework" targets the translation possibilities between different modelling languages.

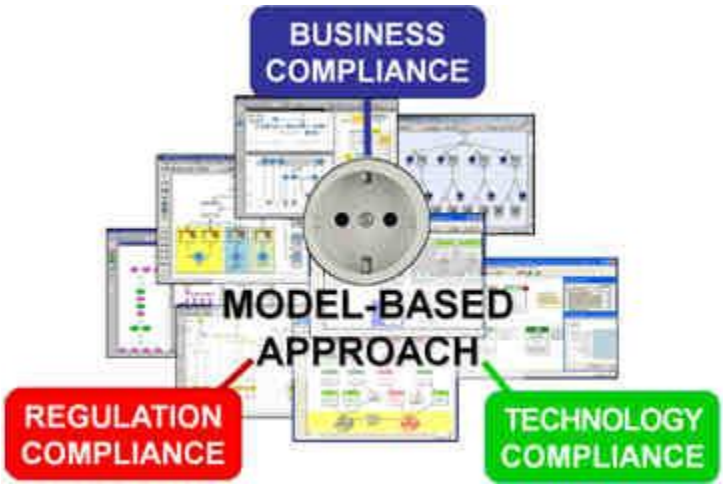

Figure 2 The Model-Based Approach

Technical Integration enables the usage of different modelling tools. The service-oriented middleware is responsible for the technical integration of heterogeneous modelling tools, whereas the semantic kernel implements for the conceptual integration of different modelling languages.

The Use Case Demonstration

plugIT demonstrates the applicability of the results achieved within 3 use cases: (1) Certification, (2) Virtual Organizations and (3) Governance. The “Certification Use Case” demonstrates how the alignment between business and IT during the certification process for regulations such as SOX, EuroSOX, ITIL®, CoBIT®, ISO20000 or BASEL II can be established. The “Virtual Organization Use Case” demonstrates how virtual organizations can be supported using business context in the semantic description for SLAs. The “Governances Use Case” demonstrates how intelligent agents are used to identify the business required IT infrastructure in distributed and complex data centre.

This IT-Socket specification was performed by literature research, experimental studies by research partners and onsite visits at the end users site. Based on these activities a generic specification of an IT-Socket has been created. Each use case partner specified its IT-Socket considering different perspectives, identified an appropriated deployment for the demonstration phase and defining measurement criteria for each of the user cases. Public description of the use case results are published in form of success stories.

After the specification of the IT-Socket a model-based approach using different modelling languages was applied. Each end user defined its set of modelling languages for the different perspectives of the IT-Socket and modelled the IT-Socket resulting in some hundred public available IT-Socket models. This set of models enables the creation of semantic description in form of domain ontologies and model ontologies.

A key challenge was to introduce the IT-Socket and the model-based approach at the use case site. In the iTG use case, existing business process modelling toolkits that are currently used by consultants, are the legacy applications that are extended by parts of the NGMF. HLRS identifies the Open Proposal Submission System (OPS) as the legacy application that is currently used by the academic clients of HLRS, which is extended by parts of the NGMF. CINECA identifies its CCMDB and the according tool family as the legacy applications that are extended by parts of the NGMF.

The integration within the legacy applications have been performed using the service-oriented approach. Videos on individual show cases and a public show case are provided.

Objective 1: The Next Generation Modelling Framework - The Specification and Research:

A new modelling method has been developed that introduces the semi-formal graphical modelling approach when creating or maintaining formal models. This method has been developed by literature research combined with argumentative approaches from the research and reflections by use case partners that applied the method within their testbed. It has been applied at the use cases and was found useful, time and cost efficient. With a minimum of guidance domain experts were able to externalise their knowledge in form of graphical models. The creation of formal correct semantic descriptions still requires the support of a knowledge engineer, but the expert's involvement concerning time and complexity has been reduced massively.

Specification of the conceptual integration – the so called Next Generation Modelling Framework - was developed by applying explorative research by the research partners. In Internet workshops, face-to-face, collaborative work on the specifications as well as through prototyping by research partners a common specification for the integration has been defined. This common specification was continuously cross-checked with the IT-Socket specification from the use cases and with technical partners.

A set of different Next Generation Modelling Framework solutions enable the transformation, comparison or assimilation of graphical models with or into graphical models form a different domain. Through the service oriented approach, the framework is flexible in providing transformation and communication flows between domain experts. Different services and workflows demonstrate how business processes are compared and appropriate IT-Architecture is identified. IT-solution modeller is notified on relevant changes in business requests, as well as intelligent search on best fitting Service Level Agreements are enabled.

The domain specific graphical notation approach has been developed and published. After a survey on relevant approaches the graphical notations of concepts have been divided in two aspects. First aspect is, conveying additional meaning into models, like the introduction of colour codes depending on the semantic matching results. Second approach is providing an abstract view on concepts, like graphical representation of IT elements of the CCMDB and their – implicit – relations.

Prototypes for the graphical notations have been implemented and published on the Open Models Initiative. Modelling Method Engineering is supported by searching for graphical notations of similar modelling concepts and by downloading the notation implementation. Application of modelling methods is supported as graphical notations can either (a) generate an abstract view on models that do not explicitly exist, but are the result of the semantic processing (e.g. in the abstraction scenario), as well as (b) change the graphical notation of existing models for additional meaning (e.g. by colour coding parts of the models).

Objective 2: The Next Generation Modelling Framework - The Tool Implementation

The implementation of the Next Generation Modelling Framework was divided in two development cycles, where the first cycle is performed in the first year and the second cycle is performed during the second project's period.

First cycle dealt with different user interaction technologies ranging from Web-Modeller, Internet Modeller, Hybrid Modeller, Remote Application to Rich Client Application providing different interactions for each technology. Tool functionality has been transformed into independent modelling services that are orchestrated by a service-oriented middleware enabling the distributed and heterogeneous provision of a Next Generation Modelling Framework. A meta model platform realises a repository, providing a transparent access on modelling languages and models. The second cycle of the project developed the so-called semantic modelling kernel as an orchestration engine enabling workflows applying semantic services such as for transformation and communication between models. The sequence of semantic processing can be defined to arrange workflows of semantic services. Two integration aspects have been considered, first the integration of the semantic modelling kernel into modelling tools and second the integration of the semantic modelling kernel into the legacy application of the use case sites. The results of the use case are provided in form

of success stories at the knowledge portal of plugIT. The services realising the Next Generation Modelling Framework are provided on the plugIT open source platform, whereas conceptual results are provided in the Open Models Initiative.

Results by the end of the project

The Use Case Demonstration

Three IT-solution demonstrated the model-driven IT-Socket realising an advanced knowledge management system. The method has been applied, several hundreds of models are published, domain ontologies have been created, legacy applications have been integrated and the overall approach has been applied and assessed. Results can be seen on use case videos, success stories, the reference business process repository and the public show case.

Objective1: The Next Generation Modelling Framework-The Specification and Research

Next Generation Modelling Method has been developed, described and demonstrated. Semantic lifting have been implemented and improvements are suggested.

Conceptual integration via Next Generation Modelling Framework has been developed in form of publications, prototypes, and open source services. Key result are workflows that orchestrate service to transform, communicate and assimilate models using semantic technology.

Different graphical representations of semantic descriptions have been analysed and the Abstract Notation Language has been developed. Mechanisms, workflows and services have been developed to represent semantic models in form of graphical representations.

Objective2: The Next Generation Modelling Framework - The Tool Implementation

Next Generation Modelling Frameworks prototype consists of (a) different user interaction technology, (b) a set of modelling and semantic services, (c) an orchestration middleware and (d) a meta model repository.

Services are published in form of open source and open use. Sample configurations are deployed in form of prototypes. Special IT-Socket configurations are provided for three use cases as well as for the public show case.

Potential Impact

plugIT exploits results from the use case demonstration in form of a knowledge portal, introducing the IT-Socket and providing teaching material, show cases and documentations. plugIT uses the Open Model Initiative (OMI, www.openmodels.at) as joint exploitation platform. IT applies the open source concepts for models and modelling language.

Business and IT alignment approaches, modelling methods and tools can be exchanged in a similar way like software is exchanged in open source community. The results from the Specification of the Next Generation Modelling Framework are published by the Open Knowledge Models (OKM) project as well as by the CIDOC project on OMI. Parts of these mechanisms are open source, parts are open use and parts are under specific licensing models.

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