Communication with Models

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Abstract. In enterprise modeling focus has been on capturing the right level of information and how the models represent this information. This paper purposes a project, which aims to look at the stakeholder and their participation in the modeling process. The paper proposes a solution for how the stakeholders can be included in the process by drawing inspiration from knowledge of visual conceptual models, knowledge from industry modeling processes and digital interactive collaborative techniques. The result is a collaborative framework or methodology, which can make communication with models more flexible and engage a wider audience in the creation and maintenance of conceptual models.

Keywords: Visual Aspects, Enterprise Modeling, Mobile Application, Stakeholder participation

1 Background

One of the key tasks in Enterprise Architecture (EA) is to analyse the current situation and existing challenges in the enterprise with the active participation of domain experts and decision makers [12]. Two of the elicitation approaches used in this phase are interviews and participatory modeling workshops [12]. After an iteration of the aforementioned elicitation approaches, possibly in combination with other approaches [12], modelers create conceptual models of the knowledge captured [12]. The models are created using one or several different notations, e.g. Business Process Model and Notation (BPMN) [9], Unified Modeling Language (UML), ArchiMate[8] and/or other frameworks, e.g. Architecture of Integrated Information Systems (ARIS), Department of Defense Architecture Framework (DoDAF). One of the fundamental attributes of the methods and/or frameworks is the ability to circulate the captured knowledge back to the domain experts and decision makers, such that they can evaluate and use the created models.

Enterprises operate in an ever-changing marketplace; this means that, if the enterprises want to stay competitive, it is crucial that it rapidly responds to any changes. Creating, changing and updating an different enterprise model can be a challenging task, particularly as the number of stakeholders increases. The tasks become even more complicated, if the stakeholders are in different departments and/or subsidiaries. A third aspect, is that a change can be initiated by any of the

stakeholders, for which the model is relevant. This puts additional constraints on the process, which is used to change and update a model.

2 State of the art

Conceptual modeling of organizations is not a new concept. 2 of the pioneers of this topic were Young and Kent in 1958 [17,3]. Through the years, the topic has matured in complexity and application. In the 90s, the focus seemed to change from the question of the 80s: "What are we modeling?" to the questions: "Why are we modeling and how are we modeling?". Furthermore, the scope of the conceptual models changed from relatively well defined applications into vaguely defined conceptualized applications or organizations [3]. With the widened scope, there emerged different approaches for modeling the enterprise architecture for example: ARIS[1], DoDAF[2] and Zachman[3].

Among the common assumptions for these frameworks, is the notion that enterprise modeling, to a certain extent, is a collaborative process among modeling experts and stakeholders (domain experts and decision makers) [4,2]. Furthermore, they promote the idea of a single, consistent record of the enterprise model, which should allow for multiple viewpoints [7]. The EA3 cube [2], which builds on the Zachman framework, claims to be a holistic method to model the EA in a current state and one or several potential future states. This single model repository idea should improve the connection between the different conceptual models and concequently contribute valuable understanding of the purpose and usefulness of a model.

Visual conceptual models can be created by using a wide range of different modeling notations. Different modeling notations are usually used in different contexts: UML in computer science and BPMN is usually used to model business processes. In sociology, a boundary object is a piece of information, "which has different meaning in different social worlds, but the structure is common enough to more then one world to make them recognizable" [13]. Boundary objects can be used to create understanding between different contexts [1]. Based on the idea of boundary object, the question is how the current models and modeling notations can be used to create boundary objects, which can facilitate contextual information sharing across different knowledge domains. This should improve the the coherency of the model repository and consequently the whole organization.

Another aspect, which will influence contextual information sharing is the fact, that notations are different in their graphical construction and these constructions have an influence on how well, a model is understood by the stakeholders [11,14,5]. Therefore, this aspect needs to be analyzed, if we are to create conceptual models, which enhance cross-contextual communication.

Information sharing is considered an important approach to increasing organizational efficiency and performance [16]. With the advances in information

[1] http://www.softwareag.com/corporate/products/aris_alfabet/default.asp
[2] http://dodcio.defense.gov/Portals/0/Documents/DODAF/DoDAF_v2-02_web.pdf
[3] https://www.zachman.com/about-the-zachman-framework

and communication technology, sharing information across organizations can become even more effective. We have seen, how the internet has become a powerful information sharing tool in software development [15]. The question is, how can the internet and particularly mobile applications, support the usage of visual conceptual models in contexts, where these haven't been used before.

To summarize, the application space of conceptual models has continually increased since the 80-ties, in context, scope and size. A number of different frameworks have been proposed in order to manage and make the enterprise architecture models actionable. Given the increased application space of conceptual models and possibilities introduced by mobile devices, I will propose a research project, which aims to use conceptual models for cross-contextual communication. The rest of this paper is structured as follows: Section 3 describes the problem I intend to address, section 4 describes the methodology, section 5 describes the expected contributions and sections 6 and 7 describe the current status and the plan for the future.

3 Proposed Solution

Given the overview of enterprise modeling and visual conceptual models presented in section 2 and the background description in section 1. I conclude that, this area presents considerable exploration opportunities. Furthermore, I envision that my solution will take the path of empirically founded research, which will demonstrate and provide evidence for the stated claims.

The goal of this research project is to effectively and efficiently engage the stakeholders and modelers in cross-organizational collaboration, such that the organization can rapidly respond to any changes in the marketplace. I propose that we position the visual conceptual model at the heart of the conversation, such that the message is also the medium. I will elaborate with the following question:

1. How can visual conceptual models be used to communicate changes in an enterprise and how can all the relevant domain experts and decision makers be included in the communication?

From section 2, responding to rapid changes in the enterprise through stakeholder participation and using conceptual models to communicate the required changes, has not been researched before. To explore the different aspects, I have chosen to break, the overall question, down into the following sets of questions:

1. What are the main phases of a modeling process in a enterprise context?
   (a) Which stakeholders are involved in each phase?
   (b) What is their motivation?
   (c) Which tools are used in the each phase?
2. What do we know about comprehension of visual conceptual models?
3. What do we know about collaborative creation of visual conceptual models?

First, we need to establish, what the different phases are in a modeling process in a certain context, which stakeholders are involved, their motivation and which tools they use. This is necessary, in order to establish an initial state or the current state of affairs. Dialog with modelers, seems to indicate that there are 3 different phases: knowledge elicitation, model creation and circulation. I have not been able to find any empirical evidence for this statement, therefore it would be interesting to see, if this holds true.

Secondly, there are several different visual conceptual modeling languages, e.g. UML, BPMN and Event-driven Process Chains (EPC). I have chosen to base my focus on empirical studies regarding visual aspects of UML. The intent is to identify the existing knowledge about visual aspects of UML models and their correlation to human comprehension. This knowledge could be used as a building block, when evaluating visual aspects and their influence on visual conceptual model construction.

Enterprise modeling is a collaboration between modelers and stakeholders (see section 2). The keyword is collaboration and this will add the third dimension to this research project. In [10], the author explores the topic of subject-oriented business process modeling and how this can enable people to represent their knowledge about their individual ways of performing parts of a cooperative work process. This article provides and interesting insight into mental models and their externalizations. In [15], the author examines the role of social media artifacts in collaborative software development. The thesis defines the role of social media artifacts as the timely dissemination of scenarios and concerns to a diverse audience ... triggered by questions from users or articulation work. The question is, can we draw inspiration from social media artifacts, subject-oriented modeling techniques and boundary objects to enhance cross-enterprise communication with visual models, such that it improves stakeholder participation and the quality and the relevance of the enterprise models?

4 Methodology

In order to evaluate and validate the outcome of this project, I plan to use a empirical approach. The idea is to conduct an ethnographic study in a enterprise setting, such that I can establish a initial state or more formally a null hypothesis. In this study, I plan to observe, how models are created and continually updated in an enterprise. The strength of this approach is that it gives very precise insights into a certain context and population. A weakness is that the insight gained, might be influenced by aspects, which are outside the scope of the research. Nevertheless, the intent is to find a model of the process, which is used to create conceptual model.

In order to establish a foundation regarding visual aspects of conceptual models and their correlation to human comprehension, I plan to conduct a Structured Literature Review (SLR) on the empirical studies of visual aspect of UML models. This will provide the basis for me to explore, how visual aspects affect com-

munication with models. The strength of conducting a SLR is that the literature is searched in a structured manner, which done properly could be repeated.

It is clear that in any collaboration, there are human factors, which affect the collaboration paradigm [6]. It is therefore, important to consider and evaluate factors, which can influence the communication with models. In particular, it is important to identify any social factors, which could influence the participation in collaboration. To identify and human factors, the plan is to conduct a qualitative interview study, with stakeholders involved in the ethnographic study.

Technical solutions, which could be used to enable cross-enterprise collaboration; such as social networks [15], blogs[15], wikis [15] or digitally augmented table-tops [10] is another area, which inspiration can be drawn from. The plan is to develop a mobile application (phone or tablet) in order to evaluate different collaboration approach. These approaches will draw inspiration from the before mentioned social artifacts. The mobile application is expected to be a part of the product portfolio of QualiWare ApS.

5 Expected Contributions

The expected contributions of this research project are the following:

1. A Structured Literature Review on empirical research of visual aspects of UML models.
2. A case study, which studies the process of conceptual modeling in a given context.
3. A study that focuses on the visual aspects, which affect comprehension/understanding of conceptual models.
4. A study that focuses on which stakeholder aspects, which can influence participation in conceptual model creation.
5. A framework for creation and maintenance of conceptual models in a distributed environment.
6. A mobile application, which implements the framework in **5**.

The contributions above have relevance in different fields. The SLR has relevance in the UML and empirical research communities in computer science. A study on how conceptual models are created in industry, could provide an interesting insight in a wide range of different conceptual modeling communities; e.g BPMN and EA. An study into, which aspects can influence stakeholders participation in a modeling process can provide profound insight, for the development of a collaborative framework and also a base for the evaluation of the same framework. The framework aims to answer the overarching question of this thesis and as such its focus is on the aspects, which motivate and engage stakeholder participation in the collaborative creation of visual conceptual models and providing the functionality for updating and continually evaluating the created models. The mobile application is the concrete instantiation of the framework and is intended to empirically evaluate it.

The insight gained form this research project could potentially contribute to a wide range of different modeling communities, because the question of this thesis can be applied to software development, information systems and obviously enterprise modeling.

6 Current status

The emphasis of this project has, up until this point, been 2 different activities. The first activity is an SLR. The SLR aims to identify, which visual aspects of UML models have been evaluated empirically, in addition to the identification, the SLR aims to collect and map the results from the different studies. This should result in a condense overview of the empirical studies, which have been conducted and also identify areas, that could be explored further. The SLR will also provide valuable insight into, which visual aspects could influence the understanding and communication with visual models.

The second activity has been the development of a mobile application with the primary functionality of showing stakeholders the conceptual models, which address their concerns. The application also provides functionality, such that the stakeholder can provide feedback and/or request a change to be made to a given visual model. The first version of the application was demonstrated in a industrial conference hosted by QualiWare on the 05 - 06.05.2015.

7 Future

The table 7 shows the current time-line for this project. The time line is split up in to half-year periods where the major focus points of that period are described. The focus of the time-line are the research activities, which are planned in that half-year. Industrial and academic commitments such as courses and other activities are not considered. At this early stage of the project the time-line is subject to possible changes.

Half-year	Project outline
Autumn 2014	Started working on SLR with the aim of a publication in Spring 2015. Develop a mobile application, with the aim of a demonstration in Spring 2015. Conduct interviews with enterprise modelers in order to gain familiarity with the industry, possibly use the interviews as a pilot study.
Spring 2015	Finish SLR and prepare mobile application for industry conference hosted by QualiWare. Prepare for ethnographic study and establish industry contacts, possibly inside the MADE research project.
Autumn 2015	Conduct ethnographic study and present observations in an article. Explore digital interactive collaboration techniques and evaluate their usefulness in an enterprise setting.
Spring 2016	Research stay at foreign university with an interest in digital interactive collaboration.
Automn 2016	Synthesising research results from SLR, the ethnographic study and the digiral interactive collaboration in to a framework or method. This can then be empirically evaluated in an industry setting and possibly contrasting to an academic or other industry setting.
Spring 2017	Writing thesis and further empirical evaluation.
Spring 2017	Writing and submitting thesis.

Table 1. Project time-line

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