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Requirements for Collaborative Process Design

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Abstract

Effective and successful support of collaborative process design in a distributed environment is largely dependent on the mutual intelligibility of processes for the involved parties. This requires an ICT-supported modelling framework that captures information provided by stakeholders and presents it in an accurate way to the other involved parties. We introduce a novel, distributed approach for process modelling, which allows to build abstract models of processes, business rules and constraints. The focus of this approach lays on enabling the creation of simple descriptions of enterprise internal processes and supporting refinement when necessary. This paper presents the underlying novel modelling notation and a list of identified requirements and research questions for a framework that ensures intelligibility and allows to interconnect the individual models.

1 Introduction

In a world, where businesses are forced to form spatially distributed and intersectoral networks and have to act in closely meshed structures to remain competitive, the demand for support on process design across organisational borders rises. The hierarchical supply chain model has shown to be insufficient for today's industry. It has to be replaced with a networked, distributed approach, considering the multiple connections between different enterprises. Such a model of networked enterprises needs a collaborative approach to process design.

With the manifold possibilities of ICT at hand, supporting software frameworks run the risk of forcing users into a tool-driven modelling approach rather than supporting stakeholders in mutually understanding, communicating and reflecting their processes. Our experiences show the need for an approach that ensures intelligibility of processes for all involved parties, thus establishing a basis for effective and efficient process formation.

In this paper, we first motivate the need for collaborative process design support in distributed environments and identify general requirements. We then present our approach in the form of a framework consisting of a novel, human-centred modelling notation and supportive ICT-assisted procedure models. After describing the concepts of the notation, we identify the requirements on the supportive procedure models. As this is part of current research, we close with the two major questions, which will form the focus of future work.

2 A Distributed Approach for increased Flexibility and Stability in Process Modelling

(Browne et.al. 1995) have identified pressures and trends that force companies to cooperate in a time efficient manner along the product life cycle. Based on similar observations (Piddiongton 2005) has identified that a pressure exists for shorter lead times and faster reaction to market demands, which requires a seamless business, product, and information flow between companies.

2.1 Distributed modelling

Enterprise and Process Modelling is an approach to support and automate the required flows between organisations. But these works to a large extend assume that there is a common enterprise and business model (e.g. SCOR (Supply Chain Council 2004)) used for modelling (Weichhart and Fessl 2005), service and process descriptions are specified with the same level of detail, detailed models (esp. process descriptions) are existing and services can either be replaced without consequences, or service and (product) process description exist in a level of detail that automated planning algorithms are able to determine if the desired good can be realised with a number of existing services. But detailed models of supply chains for better planning, monitoring, and performance measurement are very complex, optimisation is of NP-hard nature (cf. Karageorgos et. al. 2003), users of such model often do not get the necessary overview for making "good" decisions (Weichhart and Fessl 2005).

A decentralised and reactive modelling approach is needed for a better support of human decision makers. This approach needs to support a distribution of control and encapsulation of local information to support organisations to react to changed situations with new local plans without influencing other participants, and a distribution of current state information to all participating decision makers to predict impacts of local changes to others.

2.2 Levels of Abstraction

As described above the dynamics of the environment and the decentralised approach shows the need for some abstract descriptions to support the user to focus on her internal situation in the necessary level of detail and abstract away the details of the others - thus providing a personalised view on the process. Additionally modelling on a higher level of abstraction decrease the time needed for modelling and adapting models to changed situations and business goals. This is of advantage, as detailed models sometimes even get obsolete when being finished. (personal communication with Jaekel at the IFAC WC 2005 see also (Berio et. al. 2005)). Detailed models also make it hard to reach a common understanding and get an overview of processes within and across enterprises (Sternemann and Homann 2005).

This shows the necessity for novel methodologies and tools to support organisations to coordinate their services and processes and fast establish cross-organisational processes while keeping flexibility. According to the above arguments, some environment and tools support is needed, to allow modelling at a *higher level of abstraction* where, the models can be *designed faster*, and are more *resistant to change*.

3 A human-centred Approach for distributed Process Modelling and Refinement

Considering the requirements for process modelling in distributed environments specified above, the need for a novel framework to facilitate modelling across organisational borders becomes obvious. This framework comprises of a particular *notation* and a set of *computer-supported procedure models*, which enable organisations to represent their internal processes on different levels of abstraction as well as to collaborate with other organisations to evolutionary develop a crossorganisational process.

In (Oppl and Stary 2005) a diagrammatic representation scheme is presented, focusing on the aspect of intuitive intelligibility for stakeholders although providing means for both abstract and detailed modelling of processes. This notation has proven in practical test cases to serve its purpose and is presented in the following sections.

3.1 Basic Notation Concepts

The proposed notation consists of two building blocks complementing each other to form a powerful, flexible means for human-centred process modelling. These two building blocks are

- *Fundamental Modelling Elements* to model the traditional view of a process with all its aspects.

- *Contextual Information Types* to augment the model with additional information not expressible otherwise.

While the former remain stable for every modelling case, the latter may differ from model to model, as they also express knowledge about intraorganisational concepts and culture.

3.2 Fundamental Modelling Elements

The fundamental modelling elements are processes, goals, roles and data as well as different types of relationships between them. They remain stable and are used for modelling the respective processes with all their aspects, including involved roles and data as well as their goals.

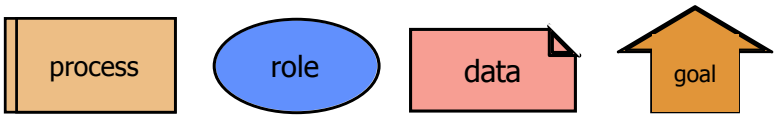


Figure 1: Fundamental Modeling Elements

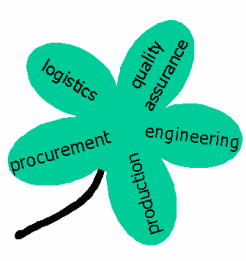
Process-, ***Role***- and ***Data***-Elements are used according to their traditional interpretation in process modelling as described in (Oppl and Stary 2005). They are linked using (undirected) *links* or (directed) *relations*. For reasons of intelligibility and interpretability, several additional elements where added.

The explicit modelling of ***goals*** of a process was identified as being crucial for human-centred process representation schemes. Information types, such as performance and quality constraints for task accomplishment, allow the stakeholders involved in the elicitation process to experience the explicated knowledge in its context.

Scopes provide the possibility to divide diagrams into a part that contains the modelled processes of the task at hand, and a part, which provides the context for those processes. In this way external influences and interfaces to processes can be captured (e.g. at organisational borders). Additionally, scopes allow the definition of contextual spheres, which determine the interpretation of the respective model in terms of rules and constraints to apply. Scopes are visualized through a circumscribing dashed line.

3.3 Contextual Information Types

Contextual information types are intended to express knowledge about an organization's philosophy and basic concepts that lie behind any of its business processes. They can be used to augment to traditional process notation with additional knowledge. Contextual information types thus can be used to specify rules and constraints necessary to provide support for users in a distributed process model.



Figur 2: Conceptual Information Type: Shamrock of involved departments

An example for a Contextual Information Type is the “shamrock of involved departments”, which denotes an enterprise-wide philosophy of the OEM, namely to involve the five contained departments in every decision-making process.

At first glance, it seems evident those five departments could also be modelled as a set of roles. But this form of representation lacks the additional context information that those five roles always have to be consulted as a whole and form an essential part of the organization’s decision-making culture.

4 Identified Requirements and Open Issues

The notation described in chapter 3 builds a sound foundation of the framework to support distributed modelling. With its open and flexible approach it has proven to be open for adoption on different levels of abstraction. However, a notation can only provide constructs to support modelling at the best, but to fully satisfy the general requirements specified in chapter 2, particular procedure models have to be specified using this notation thus adapting it for distributed modelling to support seamless business, product, and information flow between companies.

4.1 Identified Requirements

The development of the framework is subject of current research and raises fundamental questions regarding the modelling process itself (see (CrossWork 2005) and (Weichhart and Fessl 2005) (Oppl and Stary 2005)). In this section, the already identified requirements on distributed process modelling are given, followed by a discussion of still open research questions:

1. The framework has to provide individual views on the process for every participant, considering the respective relevant process parts in terms of abstraction as well as hiding irrelevant information.
2. The framework has to support users in iteratively refining their models when demand arises and allow them to keep control of the public visibility of their models.

3. The framework has to assure consistency between instances of process models where participants are (concurrently) working on by maintaining and updating internal process models and links to external process models on different levels of abstraction.
4. The framework has to support the use of Contextual Information types as a means for specifying business rules and constraints.

Ad 1.: To support distributed modelling involving participants from different organisations and application domains, it is necessary to provide users with an individual view on the overall process. This includes visualisation on different levels of abstraction dependent on the relevancy of the respective part of the process for the user as well as authorisation and ownership concepts.

Ad 2.: To support iterative refinement of abstract process models into more detailed models means to support the evolution of the models. To not affect other participants when changing minor details the visibility needs to be controlled. It may be necessary to tune one's processes with those of another partner in detail, allowing third parties to only see an abstract representation, leaving them unaffected by the change.

Ad 3.: In a distributed environment, it is likely that multiple users will concurrently work on the same process model. For this reason, it has to be assured that inconsistencies between models are avoided or at least are recognised (*horizontal consistency)*. Assistance for users maintaining the different levels of abstraction of their process models is necessary (*vertical consistency*). Also support for users in both refinement and abstraction by (semi-)automatic processing of available process data is required.

Ad 4.: Contextual Information Types as described in section 3.3 are a powerful means of specifying business rules and constrains as well as expressing organisational concepts and philosophy. However, their general approach makes it hard to add generic support to the framework. Although there are many open questions here (cf. section 4.2), it can by stated, that Contextual Information types will have to be translated into machine-readable rules and constraints to facilitate the automatic use of implicitly contained information.

4.2 Open Research Issues

The following questions are subject of current research:

1. What is the minimal amount of information that has to be (initially) specified to enable distributed modelling across organisational borders?
2. How can the Semantics of the Contextual Information Types be described
   - to allow computer support for processing this additional information?
   - that the information entered by one modeller is be made intelligible for others?

Ad 1.: This question is highly relevant as it determines the focus of the initial phase of a distributed modelling process. It aims at minimising the effort users have beforehand and is thus considered crucial for acceptance of this approach.

Ad 2.: As denoted above in section 3.3, Contextual Information Types are dependent on intraorganisational knowledge and culture and thus may differ between different organisations involved in distributed process formation. To avoid confusion, it is necessary to provide context sensitive explanation for other users, which will be derived from a formal semantic enabled description. To enable the automatic interpretation of contextual information types, a form of description will have to be found, which facilitates both, intuitive specification by the user and translation into machine-readable rules and constraints.

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