Modelling and Solving Configuration Problems on Business Processes Using a Multi-Level Constraint Satisfaction Approach

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Abstract: In this paper we present our ideas to apply constraint satisfaction on business processes. We propose a multi-level constraint satisfaction approach to handle different levels of abstraction in business process modelling.

1 Motivation

A main problem in the area of business process modelling is the management of the dependencies between processes. A lack of attention can easily result in inconsistent process models. Inconsistencies should be discovered in an early stage of modelling to reduce the amount of time and costs. The ordering of business processes depends in most cases on complex relations between the processes. Commonly there are no single business processes with no relations to other processes. Usually processes depend on each other and their input/output data respectively. While this scenario describes a sequential dependency there are hierarchical dependencies as well: One or more processes can be the sub-item(s) of a higher-ordered process. In this paper we propose an approach to employ constraint techniques to ensure the sequential and hierarchical consistency of business processes.

2 Consistent Configurations through Constraint Satisfaction

We aim at developing a solution process for handling different levels of nested business processes. Flexibility is an important criteria, because different kinds of problem and/or sub-problem dependencies require the flexibility to define different solution strategies and the application of problem specific solving algorithms.

During the modelling process of business processes there are static dependencies that can be checked to ensure a consistent configuration. Dependencies relate the data flow and the input/output interface of each process. We propose the application of AI methods out of the area of *knowledge based configuration* [Stu97] to build consistent configurations

of business processes. The *constraint satisfaction problem* (CSP) is an adequate way to model complex relations between components [Dec03]. CSPs have been in the focus of intensive research and experiences for decades which lead to efficient algorithms and heuristics. Main benefits are the reduction of problem size, the efficient generation of problem solutions and so the guarantee that specific relations hold.

Accordingly constraints have to be satisfied in order that processes are allowed to follow each other and represent a sequence of business processes. Another sort of constraints have to be defined to specify processes to be allowed to be nested sub-items of upper processes, in order to satisfy all requirements of super- and sub-processes. Different layers of processes in hierarchies define different sub-problems. For each sub-problem another solution strategy can be applied depending on the value domain of the involved variables and the problem structure. For the emerging *multi-level constraint problem* the integration of local solutions of sub-processes has to be done on the higher-ordered level leading to global solutions and hence consistent configurations.

3 Related Work

The paper proposes the application of constraint satisfaction to ensure the consistency in sequential and hierarchical relations of business processes. Related work to this approach therefore may be found in the domain of constraint satisfaction [Dec03]. Existing constraint satisfaction approaches may be employed to achieve to goals outlined in this paper. Hierarchies of constraint problems can be described by the *composite CSP* whose main application is in the configuration domain [SF96]. An interesting field is the research on the coordination of cooperative constraint solvers [AM98]. Planning algorithms (from the field of AI) would be an alternative to describe the orderings of sequences of business processes [RN02]. However CSP is more appropriate to handle hierarchies and provide more flexibility expressing consistency requirements.

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