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Conclusion

The research presented in this thesis covers a broad spectrum of the issues involved in organizational change. The spectrum ranges from the analysis of the performance of an existing organization, to the evaluation of an organizational change process, and of the steps in between.

The *analysis* of the performance of an existing organization is addressed from various perspectives, ranging from an analytic approach based upon labeled graph for the performance of organizations (Chapter 2), to models that identify the precise problems in the organization and suggest a possible new organization (Chapter 3, 4, and 5). To specify models that determine a possible new organization, a number of techniques are used, inspired by meta-reasoning (Chapter 3), the domain of organizational design (Chapter 4), and the algorithmic domain of graph theory and max flow networks (Chapter 5). Each technique presents a particular strength in the analysis. Chapter 2 focuses mainly on an extensive analysis of the detailed aspects of task performance, but does not address how the organization can be changed to perform correctly (if necessary). Chapter 5, using a graph based approach, abstracts away from the specific tasks in the analysis, to suggest an update to an organizational model based upon the problems identified. Specification of such an update mechanism using the extensive analysis method presented in Chapter 2 would certainly be possible using the approach presented in Chapter 5 by considering a separate graph for each specific task. In Chapter 3 the possible changes in the organization are assumed to be pre-specified, thereby mainly focusing on the choice between various possibilities to change the organization. Finally, Chapter 4 focuses on the specification of requirements of an organization based upon changing environmental conditions, It presents a specific component-based model for specifying knowledge on how such changes within the environment can be refined to a more operational level and how an organization can be changed in order to fulfill such requirements. The broad spectrum of techniques offered is shown to be effective in several domains, such as incident management, the naval domain, and large scale manufacturing organizations. The analysis techniques can easily be reused due to the abstraction level that has been used in the specification of these techniques. The combination thereof provides a basic set of reusable tools that enable analysis of the current organization and an investigation of potentially new organizations before going into the actual change process. As a result, these techniques contribute to a more effective analysis of the problems in organizations, resulting in more effective change processes as well.

Of course, a description of a potential new organization does not immediately result in that new organization being in place. The process of moving from one organization to another has therefore been addressed in this thesis as well. Again, it is addressed from several perspectives based upon the way the change process is directed. First of all, *centralized change processes* are addressed which focus on some central entity that directs the change process. Centralized change models are specified without addressing the specific agents, which makes them highly generic and reusable. For the creation of centralized models, inspiration was found in organization theory, due to the body of research that exists there. As a result, a model is created

based upon a popular theory for moving from one organization to another (Chapter 6). In order to evaluate the usefulness of the change model it has been evaluated in a number of case studies. For the naval domain, the model is used to describe and analyze changes in fleet formation (Chapter 7), whereas the model is also used in the domain of government organizations (Chapter 8). The evaluation of the model in these specific domains shows that an analysis using the model is useful, which was also acknowledged by for instance government employees that were involved in the modeling of their organizational change processes. Some domains however, do not have a central authority that can direct change, therefore, *decentralized change processes* are addressed in this thesis as well. In domains such as biology, such change processes are frequently observed, therefore, a model has been created for decentralized change drawing inspiration from honeybee colonies (Chapter 9). To make this model even more generic and reusable, a higher abstraction level is introduced, and specializations thereof, including both quantitative and qualitative specializations (Chapter 10). The model is shown to describe human organizations as well, namely in the field of incident management. Besides the specification of a reusable model for decentralized organizational change, the issue of populating such an organization is addressed as well by means of negotiation (Chapter 11 and 12). In these negotiation processes and strategies that are specified, both the preference (Chapter 11) as well as the efficiency of the solution (Chapter 12) are addressed. The different strategies are shown to be effective, and are thoroughly analyzed by using actual company data. As a result, both a model is specified that can be used by organization modelers who want to specify an organization exhibiting decentralized organization change, as well as approaches for the formation such an organization in an effective manner. Finally, also approaches are defined in this thesis that are generic in the sense that they can be used for both centralized and decentralized organization change; *mixed change processes*. First of all, an approach is presented which is able to evaluate centralized and decentralized change processes (Chapter 13), which is of crucial importance when designing an organizational model. Strategies that have been tested include well known approaches for coordination in an organization. In order to specify such coordination approaches, an extensive language is presented as well (Chapter 14).

The final topic addressed in this thesis is the *evaluation* of the effectiveness of organizational change. This has been addressed from the viewpoint of verifying traces of the functioning of the changed organization. Actually, this topic has been addressed as well in other parts of this thesis. For the domain of incident management however, dedicated approaches have been created that enable an analysis of critical event occurrences in such organizations. First of all, two approaches are presented that specify properties an incident management organization should satisfy (Chapter 15 and 16). The verification of such properties against empirical logs results in the identification of specific errors that need to be addressed. Chapter 15 thereby mainly focuses on the formalization of an empirical trace and the identification of what kind of properties to verify against an empirical trace. Chapter 16 uses the approach presented in Chapter 15 and extends it with verification using hierarchies of properties. Furthermore, Chapter 16 also identifies the types of errors that can be made by agents when they are playing a particular role. The domain of incident management is a suitable domain to perform these evaluations due to the logging of

information (i.e. disaster reports), as well as the description of properties that should hold within such organizations, which is done in great detail (i.e. disaster plans and disaster prevention plans). Finally, also plans for organizational change are evaluated, in the form of the evaluation of disaster plans (Chapter 17). The evaluation approaches presented are generic in the sense that they can easily be applied in other domains as well. Using such approaches after a change has been performed gives a good insight on the effectiveness of such a change, and can as a result be used by organizational experts and modelers as well.

To summarize, the contribution of this thesis is the introduction of models and techniques to describe and improve change within organizations. A broad spectrum of such models and techniques has been presented in this thesis, both focusing on the specification of the models and techniques themselves, as well as on the analysis thereof. To demonstrate the variety of applicability of these models and techniques, domains including social insects, business organizations, computer organizations, and government organizations have been used as case studies. The models and techniques have all been specified in a generic manner allowing for reuse of these models and techniques, and furthermore, they have been analyzed in some depth. Practitioners in the field of organizational change can use such models and techniques to improve the effectiveness of organizational change.