Workflow Reconfiguration using Chains

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Workflows have become a common tool for modeling organizational activities. Research and practice of Workflow Management Systems (WfMS) involve ontological aspects (*e.g.*, the relevant constructs for modeling inter-organizational workflows [2, 1]), design aspects (*e.g.*, synchronization of concurrent workflow instances [4]), reverse engineering [3], and optimization. The latter has seen few advances, especially when it comes to dynamic workflow design, where organizations need to continuously revise their workflows. As an illustrative example, consider virtual enterprises, enterprises that are formed in a competitive market to respond to the need to improve cost/performance ratio by cross-organizational cooperation. Cross-organizational operations require a dynamic flexible mechanism that can handle the data flow among different partners [5, 6]. Therefore, if one partner delivers raw material to another partner for further processing, then whenever one partner changes the characteristics of the raw material (either a temporary or a permanent change) it should be reflected in the business process of the other (*e.g.*, machinery replacement). In environments that require fast response, an off-line update procedure decreases the efficiency of the organization and may cause unnecessary delays due to the need to restart the workflow engine with any new change. Therefore, an optimized process, involving online reconfiguration and flexible resource allocation, becomes an important feature of workflow management.

This work focuses on workflow optimization through task redesign. We have designed an algorithm for chain creation in workflows. A *chain* is a sequence of activities in a given workflow with no forks and joins. The proposed algorithm provides chains that maximize a measure of importance, combined from the priority a user assigns to a specific workflow outcome and the likelihood of such outcome, based on historical data. The use of chains is beneficial for several reasons. First, chain-based workflow design can improve process locality. Second, the generation of a chain increases local task management and reduces the role of a centralized workflow management system, thus improving system resiliency. As an

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example, consider the ability to affect customer satisfaction using workflow redesign. Customer satisfaction can be measured in multiple methods, from an explicit score a customer assigns to a completed transaction to implicit means such as wait-time and number of mid-process aborts. For the sake of simplification, suppose that the customer satisfaction is derived from the total processing time, and most orders are submitted by non-preferred customers. Since item query and purchase activity are independent activities, and the flow of data among the processes consumes bandwidth, lengthy processing time may incur. Dynamic workflow system, geared towards customer satisfaction, should identify reduction in customer satisfaction and switch to a mode in which both processes are localized to reduce bandwidth consumption, sometime at the expanse of more privileged customers. The proposed algorithm is designed to provide rapid response to continuously changing workflows, in that its polynomial performance allows online optimization.

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