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Snapshot-Based Theory: An Interdisciplinary Approach

by
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In our work we take an interdisciplinary approach by applying mathematical techniques, based on graph theory and propositional logic to solve a problem from computer science.

Our main goal is to provide a new theoretical mathematical foundation that can describe and analyze workflows. A workflow is the formal definition of a process used to manage business processes, that consists in one or more tasks to be executed to reach a final goal. The tasks are represented with vertices and the partial ordering of tasks is modeled with arcs, known as transitions. Usually, workflows are defined using a graph structure that has one beginning and one end, and their execution can include human participants and software applications that have the responsability to carry out activities. Workflows require a precise modeling to ensure that they perform according to initial specifications. For example, it is important to verify if a workflow, such as sales order processing, will eventually terminate and be completed.

Workflows have been successfully depoyed to various domains, such as bioinformatics, healthcare, the telecommunications industry, the military, insurance, and school administration. Other areas, such as mobile computing, the Internet, application development, object technology, operating systems, and transaction management have also beneficed from the use of workflow technology.

A vast number of papers are available in the literature, investigating various formal aspects of workflows. However, more research is required especially with respect to modeling and analyzing workflows using graph theory. To cover this lack, we model and analyze the behavior of workflows using tri-logic acyclic directed graphs. Our approach is novel, and is based on a formalism that we call snapshot-based theory. This formalism has the advantage of capturing the different behaviors of each task present in a workflow and allows verifying an important structural property of workflows---their logical termination.

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