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Utilizing the blackboard paradigm to implement a workflow engine

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Abstract

Workflow management has evolved into a mature field with numerous workflow management systems with scores of features. These systems are designed to automate business processes of organisations. However, many of these workflow engines struggle to support complex workflows. There has been relatively little research into building a workflow engine utilizing the blackboard paradigm. The blackboard paradigm can be characterized as specialists interacting with and updating a centralized data structure, namely the blackboard, with partial and complete solutions. The opportunistic control innate to the blackboard paradigm can be leveraged to support the execution of complex workflows. Furthermore, the blackboard architecture can be seen to accommodate comprehensive workflow functionality. This research aims to verify whether or not the blackboard paradigm can be used to build a workflow engine. To validate this research, a prototype was designed and developed following stringent guidelines in order to remain true to the blackboard paradigm. Four main perspectives of workflow management namely the functional, behavioural, informational and operational aspects with their quality indicators and requirements were used to evaluate the prototype. This evaluation approach was chosen since it is universally applicable to any workflow engine and thereby provides a common platform on which the prototype can be judged and compared against other workflow engines. The two most important quality indicators are the level of support a workflow engine can provide for 20 main workflow patterns and 40 main data patterns. Test cases based on these patterns were developed and executed within the prototype to determine the level of support. It was found that the prototype supports 85% of all the workflow patterns and 72.5% of all the data patterns. This reveals some functional limitations in the prototype and improvement suggestions are given that can boost these scores to 95% and 90% for workflow and data patterns respectively. The nature of the blackboard paradigm only prevents support of only 5% and 10% of the workflow and data patterns respectively. The prototype is shown to substantially outperform most other workflow engines in the level of patterns support. Besides support for these patterns, other less important quality indicators provided by the main aspects of workflow management are also found to be present in the prototype. Given the above evidence, it is possible to conclude that a workflow engine can be successfully built utilizing the blackboard paradigm.