An approach based on feature models and quality criteria for adapting component-based systems

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Abstract. Feature modeling has been widely used in domain engineering for the development and configuration of software product lines. A feature model represents the set of possible products or configurations to apply in a given context. Recently, this formalism has been applied to the runtime (re-)configuration of systems with high variability and running in changing contexts. These systems must adapt by updating their component assembly configuration at runtime, while minimizing the impact of such changes on the quality of service. For this reason the selection of a good system configuration is seen as an optimization problem based on quality attribute criteria. We propose an approach for system adaptation based on the specification, measurement and optimization of quality attribute properties on feature models. Furthermore, we describe its integration into a platform for supporting the self-adaptation of component-based systems. Feature models are annotated with quality attribute properties and metrics, and then an efficient algorithm is used to deal with the optimization problem. Two performance properties –frame processing time and reconfiguration time– are estimated with our model against measurements obtained from the running system to show the accuracy of metrics on feature models for estimating quality attribute properties. The results show evidence that these metrics are reasonably accurate for measuring performance properties on a realistic component-based computer vision system.

Keywords. Feature models, Runtime adaptation, Quality attributes, Optimization, Component-based software engineering.