Doctoral Thesis Defense

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Title:	Formal and Quantitative Approach to Non-Functional Requirements Modeling and Assessment in Software Engineering
Date:	Monday, September 14, 2009
Time:	9:00 a.m.
Place:	EV 1.162

ABSTRACT

In the software market place, in which functionally equivalent products compete for the same customer, Non Functional Requirements (NFRs) become more important in distinguishing between the competing products. However, in practice, NFRs receive little attention relative to Functional Requirements (FRs). This is mainly because of the nature of these requirements which poses a challenge when taking the choice of treating them earlier in the software development. NFRs are subjective, relative and they become scattered among multiple modules when they are mapped from the n-dimensional requirements domain to the one dimensional solution space. Furthermore, NFRs can often interact, in the sense that attempts to achieve one NFR can help or hinder the achievement of other NFRs at particular software functionality. Such an interaction creates an extensive network of interdependencies and tradeoffs between NFRs which is not easy to trace or estimate.

This thesis contributes towards achieving the goal of managing the attainable scope and the changes of NFRs. The thesis proposes and empirically evaluates a formal and quantitative approach to modeling and assessing NFRs. Central to such an approach is the implementation of the proposed NFRs Ontology for capturing and structuring the knowledge on the software requirements (FRs and NFRs), their refinements, and their interdependencies.

In this thesis, we also propose a change management mechanism for tracing the impact of NFRs on the other constructs in the ontology and vice-versa. We provide a traceability mechanism using Datalog expressions to implement queries on the relational model-based representation for the ontology. An alternative implementation view using XML and XQuery is provided as well.

In addition, we propose a novel approach for the early requirements-based effort estimation, based on NFRs Ontology. The effort estimation approach complementarily uses one standard functional size measurement model, namely COSMIC, and a linear regression technique.