A New Coupling Metric: Blending Structural and Semantic Relations

Mamdouh Alenezi and Kenneth Magel

Abstract

Coupling metrics represent the relationships between source code artifacts in software systems. Coupling is considered an important concept in measuring design quality and maintainability. Many coupling measures have been proposed in the context of object-oriented systems. A popular way to measure coupling is through structural properties and static code analysis. Another way to measure coupling is through semantic information encoded in identifiers and comments. However, there is still much to be understood about which aspects of coupling affect quality or other external attributes of software. This paper presents a new coupling metric for object-oriented systems that analyze both structural and semantic relationships between methods and classes. A study is performed on open source software systems to compare the new metric with existing structural and semantic coupling metrics. The study shows that the new metric captures new dimensions of coupling, which are not captured by existing coupling metrics. This paper investigates the use of the new proposed coupling metrics during change impact analysis. By comparing our new metric to other coupling metrics, we show that our new metric is a better predictor for classes impacted by changes.

Keywords

Software Metrics, Software Maintenance and Quality Issues, Object Oriented Systems, Structural Coupling, Semantic Coupling

Conclusion

The paper defines a novel set of coupling measures, which are theoretically and empirically validated, that capture both structural and semantic relations of software entities. A comprehensive case study showed that these metrics capture new dimensions in coupling measurement, compared to existing structural and semantic metrics. Our new measure SSCM, appears to be a superior indicator of change ripple effects as compared to other coupling measures and can be effectively used to rank classes in the course of impact analysis in a large OO system. In the future, we are investigating the applications of this new measure in change proneness and refactoring.