

TOPAAS-model

The Dutch Directorate for Infrastructure and Water management is currently introducing probabilistic management to storm surge barriers and other objects. A risk analysis is the centre of this approach and gives direction to test intervals, maximal time to repair and modifications to the object. Software failure is also a component in this. Estimating software failure using existing methods however appeared to be not very reliable.

In order to address this problem, an expert group consisting from Det Norske Veritas, Rijkswaterstaat, Movares, Eindhoven University of Technology, Logica Mission Critical Systems, Refis Reliability Engineering and Intermedion have developed the TOPAAS¹ method. The method describes both the usage of failure tree analysis as the estimation of software failure and combines, besides the scientific knowledge, the experience of software reliability assessment in the field of nuclear safety, process industry, transport safety, avionics and primary water defences.

The principle idea of TOPAAS is that software can be divided into modules of which failure probability can be modelled in a failure tree. Failures can either be caused by unexpected input or by defects in logic and algorithms. Estimation of failure probability is based on a Bayesian approach using the expert judgement on a parametermodel with the following dimensions:

- a) Development process
- b) Product
- c) Requirements traceability
- d) Testing
- e) Operational use

The method has been calibrated using twenty reference projects. The overall conclusion is that the results of the model show a very strong correlation with the estimation by experts. And therefore that the method is a fairly reliable estimation of software failure probability.

Testdag presentation

1. Introduction:
 - why do we need a failure probability of software
2. The use of expert opinion
3. TOPAAS: a property driven model
 - Properties (with emphasis on "testing")
 - Fundamentals
 - Origin
 - Calibration
4. Conclusions
 - Work to be done
 - Calibration on an independent set of experts
 - Calibration against statistical data
 - Correlation between modules

Author

Ed Brandt is working in information technology since 1982. He specialized in software testing since 1996 and founded Refis in 2003, specialized in reliability engineering and software metrics. He is one of the authors of the Topaas-method.

¹ Task Oriented Probability of Abnormalities Analysis for Software