

Interpreting a Successful Testing Process: Risk and Actual Coverage ^{*}

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Testing is inherently incomplete; no test suite can ever test all possible usage scenarios of a system. However, passing a well-designed test suite does increase the confidence in the correctness of a product. Therefore, it is important to assess the quality of test suites. Two fundamental concepts have been put forward: (1) *coverage metrics* determine which portion of the requirements and/or implementation-under-test has been exercised by the test suite, and (2) *risk-based metrics* assess the risk of putting a product into operation.

Although existing coverage measures give an indication of the quality of a test suite, higher coverage does not necessarily imply that more (severe) faults are detected. Risk-based testing methods do aim at reducing the expected number of faults, but are often informal or based on heuristics.

In this presentation, we present a framework in which risk and coverage can be defined, computed and optimised in a black-box manner, for systems exhibiting nondeterminism. Key properties are a rigorous mathematical treatment based on solid probabilistic models, and the result that lower risk (or higher coverage) implies a lower expected number of faults.

We introduce a method to compute the risk and coverage of a system after it successfully passes a test suite, and a way to calculate the quality of a given test suite with respect to risk or coverage. We also provide an optimisation strategy enabling the tester to obtain a test suite of a given size that will obtain minimal expected risk / maximal expected coverage.

^{*} To be presented by Mark Timmer.