Software Testability

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Summary

- Testability
- Current Work
  - Source code measures analysis
  - DIT to predict cost of testing
- Conclusion and perspectives

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What is the testability?

- Several definitions
- General idea
  - Testability is a system characteristic
  - Estimates the effort of testing

- IEEE definition:
  "The degree to which a **system** or **component** facilitates the establishment of test criteria and the performance of tests to determine whether those criteria have been met"

Why testability is important

Software testing is expensive
Costly in terms of time and funds

- **Solution**
  Design system / components easy to test = testable
  “Design for Testability”

Testability and hardware

- Testability is an old term.
  - 1 design is manufactured in lots of blocks
  - design is supposed to be correct
  - defect may be introduced during manufacturing
  - each block has to be tested

- Controllability and Observability
  - Controlling the inputs
  - Observing the outputs

Testability and Software

- Testing a hardware assumes complete functionality correctness
- Software testing assume the presence of functional faults

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Testability prediction and evaluation

- A large number of measures
  - Source code:
    - LOC, CC
    - Observability / Controllability, DRR, PIE, VC
    - C&K suite : DIT, WMC, NOC, CBO, RFC, LCOM
    - LCC, TCC, ICH, …
    - MIF, AIF…
    - Component's measures:
      - RCO, SCCr, SCCp…
    - Measures based on data flow / control graph
  - Design
- Anti-patterns testability

All roads lead to Rome !!!

- But not all measures lead to the testability…
- Which measure to choose?
- How much are they consistent?

Our work was analyzing several source code measures

Why all these measures

- Cost terms:
  - Quantity of tests (scope)
  - Effort required to test (Complexity)

- Several test techniques
  - Measures are more or less related to test methods
  - Hypotheses.

Examples

- Cyclomatic Complexity CC:
  - CC is the number of decision statements,
  - # test cases expected to carry out path coverage criteria.
- LOC :
  - Intuitively, the greater the number of lines, the greater complexity,
  - Difficulty of observation.
  - Increasing the possibility of errors.

On going work

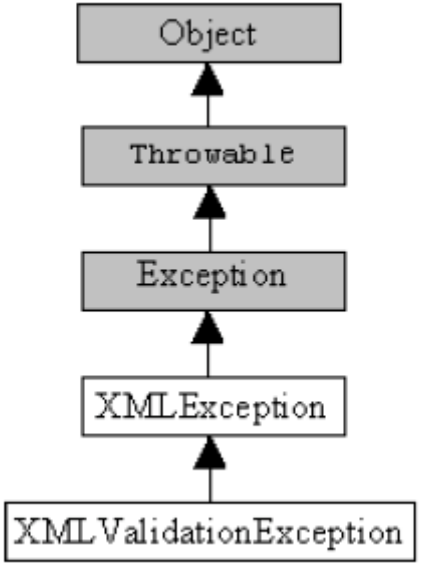
- Collecting measures / metrics
  - Source code
  - Design
- Analysis
  - Testability criteria
    - Coverage (linked to a testing method)
    - Assumptions / observations
  - What type of testing cost
    - Number of tests
    - Difficulty of testing
  - Empirical evaluation

Depth of Inheritance Tree - DIT

- DIT is one of C&K metric suite
- DIT is the length of the longest path from a given class to the root class of the inheritance hierarchy
- Intuitively the greater the depth of inheritance tree, the greater the number of inherited methods

Current work: DIT and cost of testing

- Cost of testing
  - the required number of methods to test
- Test strategies
  - Do not consider inheritance
  - Do consider inheritance (total/applicative)
- DIT_T vs. DIT_A
  - DIT_T: is the total depth of inheritance tree
  - DIT_A: is the depth of inheritance tree restricted to application's classes



Hypotheses & empirical validation

- Considering inheritance
  - # inherited methods in a class is influenced by DIT_T
  - # inherited methods in a class is influenced by DIT_A
- Without considering inheritance
  - # defined methods in a class is influenced by DIT_A/DIT_T

- Experiments
  - 6 open-source applications (1700 classes)

  - No correlation between DIT_T, DIT_A and # defined methods
  - DIT_A more relevant than DIT

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Conclusion & perspectives

- Measures analysis
  - Studying the different proposed measures.
  - Testability criteria: coverage/observations
  - Validation
  - Choice Grid (measures, test method)

- DIT
  - Formalization testability criteria
  - Validation by the experiments

Thanks for your attention

Feedbacks are welcome