Measurement & Quality model to support Software Evolution

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Talk Overview

• Quality models – Empirical Studies – Measurement: WHY?

• Ongoing projects: Research Axes
  • Fundamental issues: validity of measurement methods
  • Qualities at the “design model” level
  • Quality of Open Source Systems: Evolvability …

• Potential contributions to the IAP
Quality models – Empirical Studies – Measurement: WHY?

- Maturity of the discipline as an “engineering” (Principles, Laws …)
  - The need for quantification
  - The need for well-founded measurement methods
  - The need for validation

- Example
  - “Software intensive systems are among the most complex artifacts ever built …………………… reduce complexity”
  - Complexity ?
  - Reduction ?
On going research- 1 : Fundamental issues

• Long-term research
  • Framework for measurement (Ontology…)
  • Complete validation schema

• Mid-term
  • Validity issues (Critical studies of some existing « measurement »)
    • Theoretical validity : measuring what is supposed to be
    • Empirical validity
    • Case studies : CCN / Size / O.O. metrics suite

• Short term : opportunistic empirical studies
  • Following the evolution (degradation…) of some systems
  • …
On going research- 1 : Fundamental issues

- Example : Validity of a “complexity” measurement (CCN)
  - At the definition level
    - the model(s) used / the artifact being measured
    - the scale
    - the additivity
  - At the use level
    - the context of use : Fortran → Java
    - the thresholds
    - the prediction : testability / maintainability /…/ effort
    - utilization as measurement of “size”
  - At the implementation level
    - different tools → different “numbers”
On going research- 2 : Quality the “design” model level

• The idea
  • Take into account different abstraction levels
    (the different “models” as first-class citizens)
  • Measure as early as possible
  • → “quality model” *
  • Ex distinction
    qualities of a model “per se”  < >   “as an abstraction of”

•  * Attributes to be measured and their relationship ➔ Quality model
  • “model for quality”  < > quality of models
On going research- 2 : Quality the “design” model level

- Quality attributes of the software with different status:
  - Size
  - Maintainability?
- The “design” is classically seen as the “design” of the code
On going research- 2 : Quality the “design” model level

Consider the “design model”

- design diagram(s) as a *product by itself*:
  - ex. Readability..
- “design” as an *abstraction/representation* of the “code” artifact
  - Ex: complexity
  - preservation of the “same” complexity (in which condition ???)
  - “complexity of the design predict complexity of the code (which prediction ???)
- \{ “design” & “code” & … \} as a whole *composite* artifact
On going research- 2 : Quality the “design” model level

- Different kinds of “quality attributes”
- Investigate the “derivation” relationship $\rightarrow$ (prediction / preservation…)

Model

Software

$\text{Model}_1$ $\rightarrow$ $\text{Model}_2$ $\rightarrow$ $\text{Model}_3$

$\text{Req}$ $\rightarrow$ $\text{Design}$ $\rightarrow$ $\text{Code}$

$\text{mapping} \rightarrow \text{Numbers}$
FP6 Strep Project QUALOSS

8 Partners:

- Precise (Univ. Namur)
- Fraunhofer IESE (Kaiserslautern)
- URJC (Univ. Madrid)
- Merit – (Univ. Maastricht)

Goal: build & evaluate a “quality model” for OSS

Focus: two qualities: Evolvability & Robustness
On going research- 3 : Open & Free Source Systems

- Iterative elaboration & empirical validation based on the methodology: “G.Q.M.” (Basili et al)
  - definition of the properties - the intended use  
  - operational definition  
  - propose some measurements  
  - Validate / Refine

**Goal**
- operational definition

**Questions**
- propose some measurements

**Metrics**
- Validate / Refine
On going research- 3 : Open & Free Source Systems

• Iterative elaboration of a “quality model” for “evolvability”
  • First definition of “evolvability”
    • = “ability of an F/OSS project to deliver useful product (…) over an extended period of time”
  • Identify (potential) basic qualities
    • readability (…) / testability / project maturity (…)
  • Identify measurement methods
  • Built a first model
  • Test – Validate – Calibrate (through empirical studies)

• !!! Large view :
  combine “product” + “process (community)” data
IAP connections

• WP 2 - Topic 3

• Assessing the effect of model refactoring on the quality of models.

• Assessing the effect of model refactoring on the quality
Quality & Evolution

Linguistic issues: 
- semantics attributes preservation
- consistency
- representativeness
- structural properties: traceability
Questions related to the evolvability

1st kind of questions (the evolvability ?)
- which “attributes” of which “artefacts” contributes to it
- how to measure each of them (existing/new measures)
- how this contributes to the “evolvability” of the whole
- how to measure this “global evolvability”

Towards a “model for the evolvability”
Questions related to the evolvability

- 2nd kind of questions (the evolution → Qualities ?)
  - Impact of evolution on “qualities” attributes
    empirical studies of some of the laws of evolution
    ex. restructuring / patterns /… impact
  - The role of “models” : how models evolve (co-evolve)
    which artifact(s) to study
  - What about « incomplete » representation ????

Diagram:

1. **Requirement**
   - Use Case
   - ...

2. **Design**
   - Structural Mode
     Ex. « Class Diag »
   - Behavioral Model
     Ex: state trans diag
   - Concerns Mode
     Ex. Features Diag
   - ...

3. **Code**
   - Packages
   - Classes
   - …
Potential use of “measurement” for evolution

• The need of precise, consensual, operational definitions for the properties (*) & measurement methods accepted by the community

• the IAP as an OPPORTUNITY

• (*) Potential properties to define / choose / track
  • Complexity (at different levels …..)
  • Well-structuredness/ ill-structuredness
  • Bad smells – patterns use – anti pattern use
  • …
Thank you!

Any questions?