Mapping system properties to ISO/IEC-9126
Maintainability Characteristics

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About us:
Software Improvement Group

Who are we?

- Highly specialized research company for quality of software, founded in 2000 as a spin-off of the Center for Mathematics and Information Technology
- Independent and therefore able to give objective advice
- Decorated with the Innovator Award 2007 and ICT Regie Award 2008

What do we do?

- Fact-based consultancy supported by our automated toolset for source code analysis
- Assessment across technologies by use of technology-independent methods
What is the frame of reference we use?

ISO 9126 - International standard for the evaluation of software product quality

- Functionality
- Reliability
- Maintainability
- Efficiency
- Usability
- Portability

- Analysability
- Changeability
- Stability
- Testability

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Our Model

### Current Mapping

- **Binary:** A property either influences a characteristic or not
- **Empirical:**
  - Based on the expertise of its authors
  - Been in operation for more than 5 years

<table>
<thead>
<tr>
<th></th>
<th>Volume</th>
<th>Duplication</th>
<th>Unit complexity</th>
<th>Unit interfacing</th>
<th>Test quality</th>
<th>Inward coupling</th>
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<th>Exception handling</th>
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Objective - Approach

Objective
- Refine the current mapping into a weighted one

Approach
- Mapping as a multi-criteria decision making problem
- Analytic Hierarchy Process (AHP) as an instrument

Research Questions
1. Does the weighted mapping represent agreement among the experts?
2. How similar are the weighted and binary mappings?
3. Can the model be improved based on the derived weights?
Why we used AHP?

• Leverages the human ability to compare single properties or alternatives
• Easy to explain and use
• Yields reliable results
• Tolerant to inconsistencies
Experiment

22 Experts

Pair-wise Comparisons
Likert Scale 1-5
(45 minutes)

AHP

Statistical Analysis
- Central tendency of the data: Median
- Dispersion: Median Absolute Deviation
- Data reduction: Inconsistency ratio

The New Matrix
Example of a questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Volume</th>
<th>Duplication</th>
<th>Unit Size</th>
<th>Unit Complexity</th>
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Examples of Consensus

Unit Size on Stability

Unit Complexity on Testability

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Example of Overall Disagreement:
Volume on Analysability

More cases:
- Test Quality on Changeability
- Test Quality on Testability
Example of Polarised Opinions: Exception Handling on Stability

More cases:
- Unit Complexity on Analysability
- Test Quality on Analysability
- Inward Coupling on Stability
New mapping

Exceeds the 11.1% uniform mapping

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1. The weighted matrix partially represents agreement between the experts
   • More than 2/3 of the relations are consensual

2. Weighted mapping is relatively close to binary
   • 72% relations are the same

3. Whole substitution of the binary mapping is not yet deemed justifiable
   1. Stronger consensus
   2. Less variation among experts
About the survey

• Different perception about the system properties and their impact to maintainability
• Sheer number of comparisons may lead to lack of concentration
  • Sometimes the latter comparisons were neglected

About the AHP

• Tiring process as participants had to repeat the same task 5 times
• Difficult to scale up as the number of system properties can grow
• Trustworthy
• Ratio scale allows for eliciting weights
Not so future work

New Survey

- Familiarise the participants with system properties
- Bigger audience from different domains and industries
- Different method for weights elicitation that allows for uncontrolled experiment

We welcome you to participate: http://tinyurl.com/nbbldg
Questions? More information?

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