Measurement of Business Rules Specified as Reusable Components:
Exploratory Study of its Impact on the Functional Size of Software Projects

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• Description of the case study
• Measurement outcome and recording adjustment
• Analyzing reuse level
• Discussion
Introduction

• Software process improvements initiatives in a growing number
  – More organizations are measuring and benchmarking their software process productivity
  – Reusability often chosen as a means to improve productivity
  – Let’s explore the measurement of reuse in that context!

Description of the case study:
Strategy phase

Measurement context:
• Stable SW development process (re: assessment)
• Upcoming major changes in their SW process → going Agile!

Purpose: establish a productivity baseline and benchmark results

Scope: 6 projects in 2 business lines
→ Changes to existing applications:
  • Adding new functionalities
  • Changing existing functionalities
  • Fixing defects
Description of the case study: Measuring requirements

Software Requirements Documents → Application Layer → Service Layer: Business Rules (BR)

Triggering Entry → FP → OOI / DG → DM → Size!

Description of the case study: Recording & verifying measurement

<table>
<thead>
<tr>
<th>Change type</th>
<th>System</th>
<th>Ref#</th>
<th>Functional Process</th>
<th>Data Groups</th>
<th>Movement Types</th>
<th>Entry</th>
<th>Exit</th>
<th>Read</th>
<th>Write</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>New</td>
<td>SAG/GIS</td>
<td>21281</td>
<td>BR-RSP-Validate the presence of mandatory coverages</td>
<td>Vehicle</td>
<td>Trig</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<td>New</td>
<td>SYNCRA</td>
<td>21281</td>
<td>Creation of Claim Information</td>
<td>BR – Last grid step generated</td>
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<td>0</td>
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<td>SAG/GIS</td>
<td>23998</td>
<td>Prepare the IBC Claim Transaction</td>
<td>Insured unit driver</td>
<td>RW</td>
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<td>0</td>
<td>1</td>
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<td>2</td>
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<tr>
<td>Modified</td>
<td>SYNCRA</td>
<td>23998</td>
<td>BR-HAB-Applicable Insurance Amount</td>
<td>Vehicle owner</td>
<td>RW</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
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</tbody>
</table>
**Measurement outcome and recording adjustment: Question...**

- **New field**
- Significant number of BR defined or used

<table>
<thead>
<tr>
<th>Change type</th>
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<th>Layer</th>
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<th>Functional Process</th>
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<tr>
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<td>SYNCRA</td>
<td>BR</td>
<td>23998</td>
<td>BR-HAB-Applicable Insurance Amount</td>
</tr>
</tbody>
</table>

Q: What can be learned about the reusability of BR from functional size data, which could help software architects and analysts to better specify reusable software components?

**Measurement outcome: Reuse measurement results and effort**

<table>
<thead>
<tr>
<th>Project ID</th>
<th># POSW</th>
<th># FP</th>
<th># BR used</th>
<th>Size # CFP</th>
<th>% of New CFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>90</td>
<td>24</td>
<td>393</td>
<td>35%</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>102</td>
<td>27</td>
<td>678</td>
<td>45%</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>69</td>
<td>14</td>
<td>258</td>
<td>24%</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>14</td>
<td>0</td>
<td>83</td>
<td>52%</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>13</td>
<td>4</td>
<td>109</td>
<td>100%</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>186</td>
<td>256</td>
<td>1782</td>
<td>94%</td>
</tr>
<tr>
<td>Total:</td>
<td>17</td>
<td>474</td>
<td>325</td>
<td>3301</td>
<td>--</td>
</tr>
</tbody>
</table>

256 BR used in project F:
- 127 developed within F
- 129 reused from previous projects

Total effort of 7035 minutes (117.25 hours):
→ 2.1 min/CFP on average

Using the template
Analyzing reuse level:
Measuring reuse occurrence

242 BR used only once:
- 132 new BR
- 110 from previous projects

<table>
<thead>
<tr>
<th>Project ID</th>
<th># of times BR were used</th>
<th>Total # BR used</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>16 2 2 - - 4 -</td>
<td>24</td>
</tr>
<tr>
<td>B</td>
<td>10 6 3 5 1 1 14</td>
<td>27</td>
</tr>
<tr>
<td>C</td>
<td>9 4 - - - - 14</td>
<td>14</td>
</tr>
<tr>
<td>D</td>
<td>- - - - - - -</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>2 2 - - - - 4</td>
<td>4</td>
</tr>
<tr>
<td>F</td>
<td>205 38 4 5 3 - 14</td>
<td>256</td>
</tr>
<tr>
<td>Total</td>
<td>242 52 9 10 4 5 3</td>
<td>325</td>
</tr>
<tr>
<td>%</td>
<td>74% 16% 3% 3% 1% 2% 1% 100%</td>
<td></td>
</tr>
</tbody>
</table>

Analysis across projects too difficult due to tool limitation!

Example with BR of 2 CFP:

- FP-1 ex 8 CFP (6+2)
- BR ex 2 CFP
- FP-2 ex 8 CFP (6+2)
- FP-3 ex 8 CFP (6+2)
- There is an overhead of 4 CFP with the BR!
- Size keep increasing with small BR reused!
Analyzing reuse level:
Impact of reuse on functional size

Example with BR of 8 CFP

- FP-1 ex 8 CFP (6+2)
- FP-2 ex 8 CFP (6+2)
- FP-3 ex 8 CFP (6+2)
- BR ex 8 CFP (6+2)

Size without BR

- FP-1 ex 12 CFP
- FP-2 ex 12 CFP
- FP-3 ex 12 CFP
- BR ex 8 CFP (6+2)

6 CFP already within FP-1 + 6 CFP that could have been in a BR

24 CFP

With a BR of 8 CFP, there is a null impact on size when reused twice

24 CFP

36 CFP

32 CFP

16 CFP

6 R

Storage

IWSM/Mensura 2013

Analyzing reuse level: then why reuse \(\rightarrow\) reuse criteria

- ‘Reuse effectiveness’: isolating change-prone SW components in BR to be tested independently
  - Increased maintainability and robustness
- ‘Reuse efficiency’:
  - Actually be reused to limit increasing size artificially
    - The larger BR is, the smaller number of times it needs to be reused to have a null impact on size, examples:
      - BR=8 CFP or more \(\rightarrow 2\text{nd\ reuse}; BR=6 CFP \rightarrow 3\text{rd\ reuse}; BR=5 CFP \rightarrow 5\text{th\ reuse};\)
      - BR=4 CFP \(\rightarrow\) always net impact of 4 CFP;
      - BR=3 CFP or less \(\rightarrow\) growing size impact with each reuse
- May have an impact when benchmarking
Discussion

• 5 out of 6 projects measured had reusable functionalities defined in the requirements
  – 71% of reusable SW components were used only once
  • Better tool required for reuse analysis across projects
  • Manual analysis showed 41% may have been used only once

• For every BR not reused, size appeared artificially increased by 4 CFP
  – 132 BR used only once → potential size increased by 528 CFP or 16% of total measured size

• Criteria for ‘reuse effectiveness’ and ‘reuse efficiency’ were discussed

Acknowledgments

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Questions