AN ARCHITECTURAL SMELL EVALUATION IN AN INDUSTRIAL CONTEXT

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Ilaria Pigazzini is currently a Ph.D. student in computer science at the Department of Computer Science, Systems and Communications, University of Milano-Bicocca. She has received her B.Sc. and M.Sc. degrees from the University of Milano-Bicocca in Computer Science in 2016 and 2018, respectively. Her research interests include reverse engineering, architectural smell detection and refactoring of Object Oriented systems.
Architectural Smells (AS) are design decisions which negatively impact on the system internal quality.

Investigate the perception of architectural smells in an industrial context

Hints on how to conduct smell refactoring from practitioners’ experience

Identification of the most critical type of smell, in the practitioners’ opinion
ARCHITECTURAL SMELLS

HUB LIKE DEPENDENCY (HL)
UNSTABLE DEPENDENCY (UD)
CYCLIC DEPENDENCY (CD)
GOD COMPONENT (GC)
DENSE STRUCTURE (GC)
SCATTERED FUNCTIONALITY (SF)
FEATURE CONCENTRATION (FC)
INSUFFICIENT PACKAGE COHESION (IPC)
ARCAN: TOOL FOR ARCHITECTURAL SMELL DETECTION

Represents the architecture as a dependency graph

Nodes: classes or packages

Edges: relationships among classes and packages
CASE STUDY DESIGN (1)

Analysed project

- Domain: Business Management System
- Language: Java
- Architecture: monolithic

Project size

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<thead>
<tr>
<th>NOC</th>
<th>NOP</th>
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<tbody>
<tr>
<td>1343</td>
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Class level smells

<table>
<thead>
<tr>
<th>CD</th>
<th>HL</th>
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</thead>
<tbody>
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<td>135</td>
<td>3</td>
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</table>

Package level smells

<table>
<thead>
<tr>
<th>CD</th>
<th>HL</th>
<th>UD</th>
<th>GC</th>
<th>DS</th>
<th>IPC</th>
<th>FC</th>
<th>SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
<td>19</td>
<td>10</td>
<td>1</td>
<td>107</td>
<td>4</td>
<td>81</td>
</tr>
</tbody>
</table>
CASE STUDY DESIGN (2)

Survey with 12 questions, 3 Anoki developers with different developing experiences.

Detection and awareness

4 questions to evaluate the precision of Arcan detection and investigate the awareness of practitioners on the smell presence.

Refactoring

3 questions to understand when refactoring should be conducted and which type to apply

Impact

2 questions to investigate the perceived impact of smells on software quality attributes

Severity, priority and refactoring effort

3 questions to evaluate the effort/time needed and to investigate if smells can be ranked depending on their severity
RESULTS (1): How are architectural smells perceived in an industrial context?

19 smells presented in the survey: 6 false positives → 70% precision

- Developers did not know about the concept of AS, however they reported that they were aware of some of them;
- AS have a negative impact on maintainability;
- Developers recognized usefulness of automatic tools to spot AS.

- HL: utility classes designed on purpose
- GC: designed on purpose to avoid boilerplate code
- SF: in some cases it was due to the layer organization of the architecture
RESULTS (2): What practitioners suggest according to the refactoring of the smells?

Developers would not refactor some smells. Why?

- the refactoring activities could be too expensive
- the smell could represent the only possible solution

Feature Concentration, Scattered Functionality and Insufficient Package Cohesion: the refactoring of such smells is useful, when the system architecture is layered, to prepare the migration towards microservices.
RESULTS (3): Which are the most critical smells according to the practitioners perception?

Most critical smell: **Hub Like Dependency on classes**

which is also one of the smell which gets worse the most, as time passes.

Less critical smell: **Insufficient Package Cohesion**

Smell with highest refactoring priority: **Cyclic Dependency**

Smell with highest refactoring effort: **Dense structure**

*Other insights*

We found also relationships among metrics used for the smell detection and the smell severity indicated by the developers.
CONCLUSIONS

- Concrete feedback for Arcan developers to improve the detection of architectural smells;
- Useful data on smells’ criticality, smells’ impact on maintainability and smells’ refactoring effort;
- Helpful insights for Anoki practitioners on how their architecture evolved and which spots require more attention from now on to avoid architecture erosion.
An Architectural Smell Evaluation in an Industrial Context

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Thank you