References


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Appendix A: System Characteristics

This appendix presents the main characteristics of the target systems considered in the empirical studies. In order to present these characteristics, the following acronyms are used:

HW = Health Watcher;
AW = Aspectual Watcher;
MM=MobileMedia;
AM = Aspectual Media;
CE = Code Elements (classes and aspects);
AE = Architectural Elements (components and interfaces);
CA = Code Anomalies;
PC = Page Controller;
AE = Architecture Elements (modules and interfaces);
AD= Aspect Design.

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Appendix B: Detection Strategies and Thresholds

This appendix details the definitions of the conventional strategies applied in our studies as well as the used thresholds (Table B-1). The appendix also presents the thresholds used in the architecture-sensitive detection strategies for both conventional (Table B-2) and architecture-sensitive metrics (Table B-3).

Conventional Detection Strategies

Shotgun Surgery = CC > LOW and CM > MANY
   CM (Changing Method): counts the number of distinct methods that call the measured method.
   CC (Changing Class): counts the number of classes in which the method that call the measured method are defined.

Feature Envy = ATFD > FEW and LAA > ONE THIRD and FDP < FEW
   ATFD (Access to Foreign Data): counts the number of distinct attributes the measured element accesses.
   LAA (Locality of Attribute Accesses): the relative number of attributes that a method accesses on its class.
   FDP (Foreign Data Providers): the number of classes where the accessed attributes belong to.

Long Method = LOC > VERY_HIGH and CYCLO > HIGH
   LOC (Lines Of Code) counts the number of Lines Of Code.
   CC (Cyclomatic Complexity): represents McCabe's Cyclomatic Complexity.

Disperse Coupling = CINT > FEW and CDISP > FEW
   CINT (Coupling Intensity): The number of distinct methods called by the measured method.
   CDISP (Coupling Dispersion): The number of classes in which the called methods are defined divided by CINT.
Intensive Coupling = CINT > FEW and CDISP < FEW

CINT (Coupling Intensity): The number of distinct methods called by the measured method.

CDISP (Coupling Dispersion): The number of classes in which the called methods are defined divided by CINT.

God Class = ATFD > LOW and WMC > VERY_HIGH and TCC < THIRD

ATFD (Access To Foreign Data): counts the number of attributes from unrelated classes that are accessed directly or by invoking accessor methods

TCC (Tight Class Cohesion): counts the relative number of method pairs of a class that access in common at least one attribute of the measured class.

WMC (Weighted Method Count): represents the sum of the statical complexity of all methods of a class.

Misplaced Class = CL > THIRD and NOED > HIGH and DD > LOW

NOED (Number Of External Dependencies): counts the number of classes from other packages on which the measured class depends on.

CL (Class Locality): counts the relative number of dependencies that a class has on its own package.

DD (Dependency Dispersion): counts the number of other packages on which the class depends.

Table B-1: Thresholds used in the conventional strategies.

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<td>6</td>
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<th>CDISP</th>
<th>CINT</th>
<th>CM</th>
<th>CYCLO</th>
<th>DD</th>
<th>FDP</th>
<th>LOC</th>
<th>NOED</th>
<th>WMC</th>
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<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
</tr>
<tr>
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<td>4</td>
<td>3</td>
<td>2</td>
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<tr>
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Table B-3: Thresholds used for the architecture-sensitive metrics in the architecture-sensitive strategies.

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<th>NAC</th>
<th>CoL</th>
<th>CoC</th>
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<td></td>
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</table>
Appendix C:
BNF SCOOP Grammar

The BNF description uses the bold font to display terminal symbols and the first characters of non-terminal symbols are shown in upper-case format. The symbols '[A]', '(A)+' and ()A'*' respectively impose the cardinalities: optional (0 or 1); at least one; and zero or more to a the symbol A.

DetectionStrategy ::= constraints += Constraint *
Constraint ::= code anomaly <ElementType> ID = LogicExpression ;
ElementType ::= package | class | method
LogicExpression ::= NumExpression (LogicOperator LogicExpression)?
NumExpression ::= ( LogicExpression ) | CompExpression | NotExpression | ConstraintExpression
ConstraintExpression ::= [Constraint]
NotExpression ::= not NumExpression
CompExpression ::= Metric CompOperator INT;
CompOperator ::= < | > | = | ≤ | ≥
Metric ::= NEE | EFO | EFI | ACL | NAC | CoL | CoC | LOC | LCON | CC | CM | CO
LogicOperator ::= or | and
Appendix D: SCOOP Rules File

By editing the Rules.ds file, engineers can modify or create the detection strategies that will be applied in SCOOP. In the following, we present a fragment example of this file.

```plaintext
code anomaly <method> DisperseCoupling = CINT > 4 and CDISP > 5
code anomaly <method> IntensiveCoupling = CINT > 4 and CDISP < 5
code anomaly <method> LongMethod = LOC > 30 and
                     CYCLO > 3
code anomaly <method> ShotgunSurgery = CC > 4 and CM > 7
code anomaly <method> FeatureEnvy = (ATFD > 4 or NEE > 3) and
                          (LAA > 0.33 or ACL < 0.33) and
                          (FDP < 4 or EFO < 3)

code anomaly <class> God Class = (WMC > 150 and NAC > 1 and
                              CoC < 0.5)

code anomaly <class> MisplacedClass = (CoL > 0.5) and (NAC > 1)
```