On bytecode slicing and AspectJ interferences

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Outline

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Aspects and modularization

- Aspects describe crosscutting computations, referring to an abstract view of the system
- Composition is performed by the weaving process
- Code affected by an aspect is oblivious about that (it does not contain any clue about if an aspect might be advised on it)
- As a result while aspect code units are physically separated they might unwittingly be not logically distinct

Aspect interference

- We defined a notion of aspect interference
- To quantify aspect interference we focused on the portion of a program affected by an aspect
- Our definition is based on the observation of the system state

Definition

An aspect *A* does not interfere with a code unit *C* if and only if every interesting predicate on the state manipulated by *C* is not changed by the application of *A*.

Interference for AspectJ programs

- We derived an operative test for AspectJ programs
- Our test is based on backward static slicing
- Given a criterion the backward static slice is the set of instructions in the source code that influence the criterion

Definition

- A_1 and A_2 are two aspects
- S_1 and S_2 the corresponding backward slices obtained by using all the statements defined in A_1 and A_2 as slicing criteria
- A_1 does not interfere with A_2 if $A_1 \cap S_2 = \emptyset$.

Outline

A bytecode level slicer featuring AspectJ constructs

- To verify our operative condition we built XCutter
- It is a bytecode level slicer that can analyze both Java and AspectJ programs

Main features

- Based on Soot[a]
- Uses an IR to do analysis
- Features our space efficient slicing algorithm
- More details in our master thesis [b]

[a]http://www.sable.mcgill.ca/soot/
[b]http://www.elet.polimi.it/upload/cavallaro/thesis/thesis.pdf

Outline

What we expected vs what we found

Expected result

- Given two pieces of advice A_1 and A_2
- If A_1 reads a variable x and A_2 writes the same x
- A_1 does not interfere with A_2

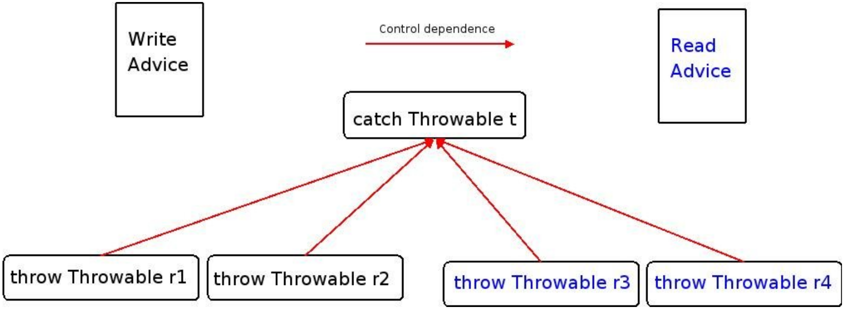
Obtained result

We have interference also in this case

The after finally advice

- The tool detects spurious interferences in presence of `after finally` pieces of advice
- The translation introduces control dependencies between aspect bytecode instructions
- These dependencies may not be interesting for the programmer

The after finally advice



Outline

What we can do

- Using annotations, the tool could ignore these dependencies
- Deciding if ignoring weaving introduced dependencies is safe is not trivial
- In our examples they were not significative
- A formal analysis of the problem is needed

Future work

- A deeper study on correctness of ignoring dependencies is needed
- The proposed system is easy to implement
- It can be unsafe
- Even if unsafe this analysis could discover other useful information

The End

Thanks for your attention