Marea

A Tool for Breaking Dependency Cycles Between Packages

Master Project
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University of Bern
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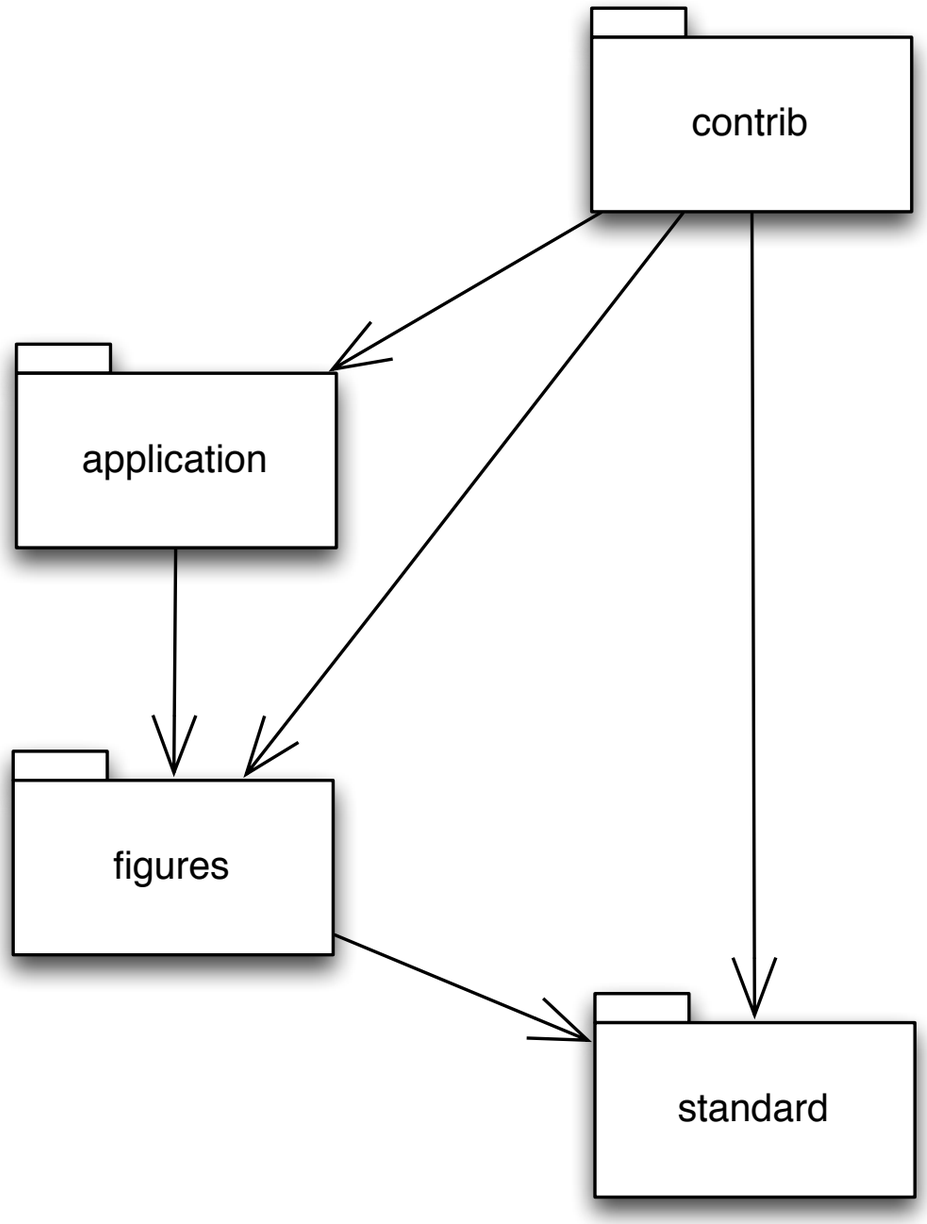
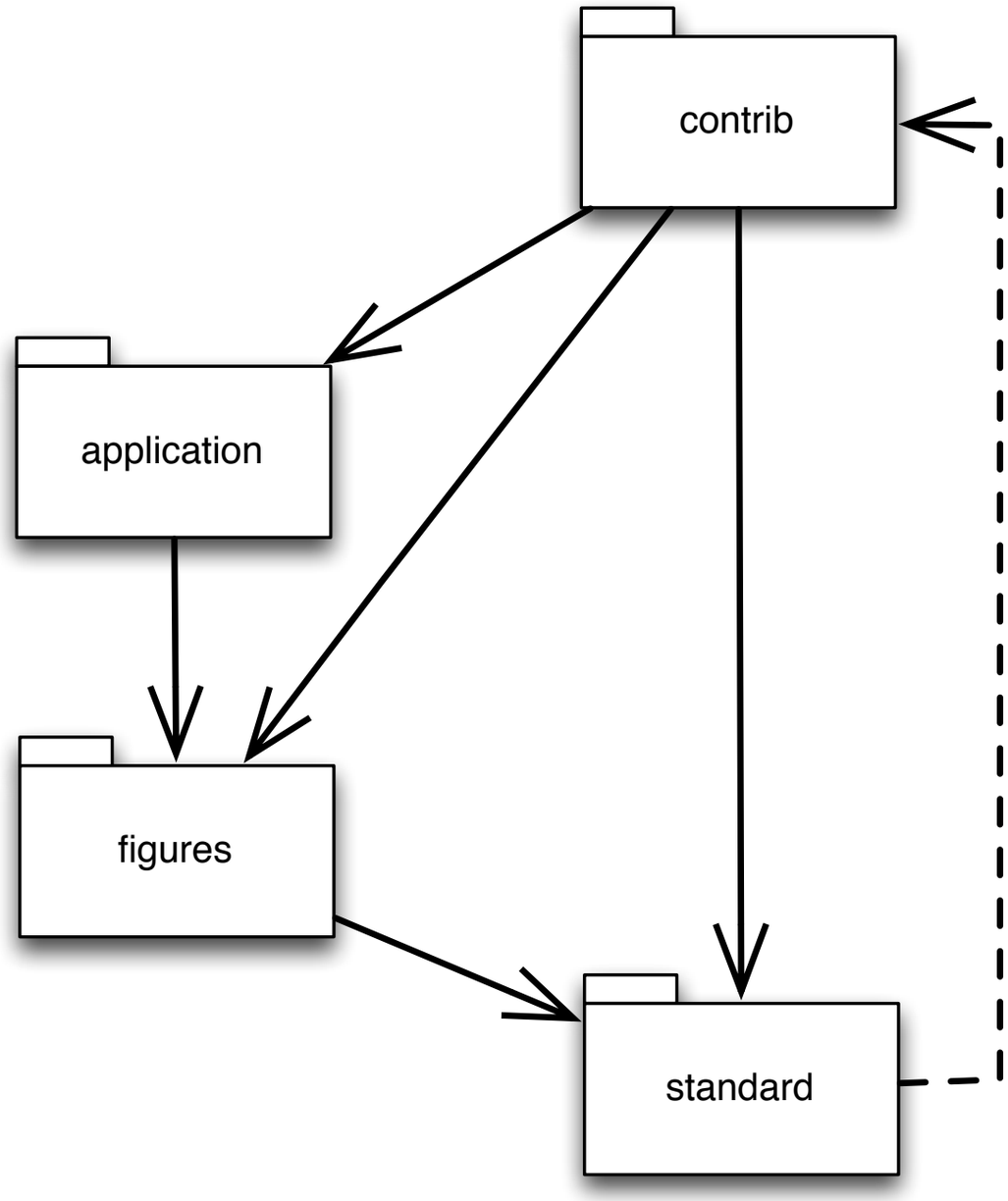
Dependency Cycles





Problems

- **Acyclic Design Principle**
- **Maintenance** and **Testing** costs
- **Modularity** and **Reuse**

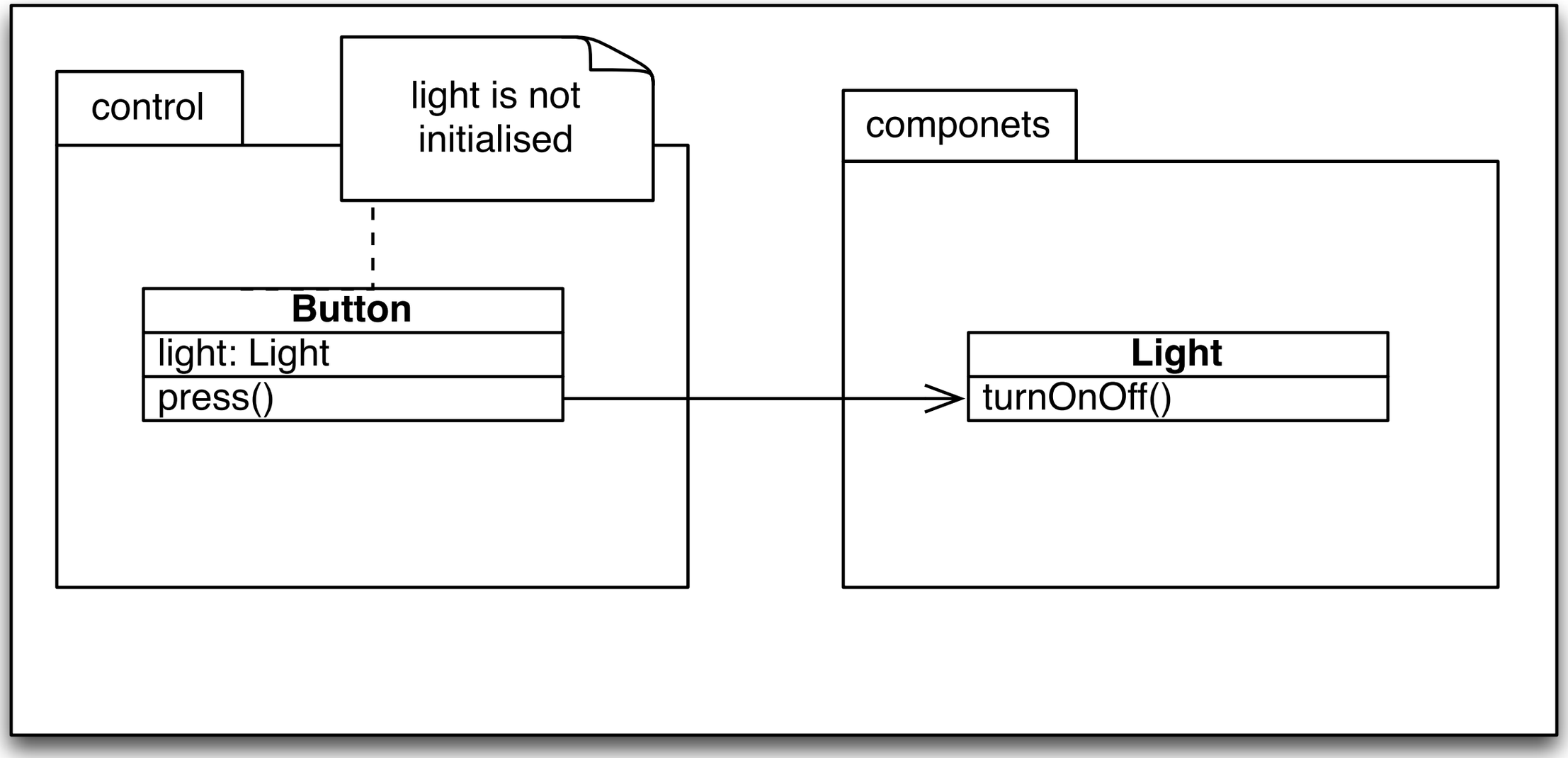
Dependency Types

- Reference
- Inheritance
- Invocation

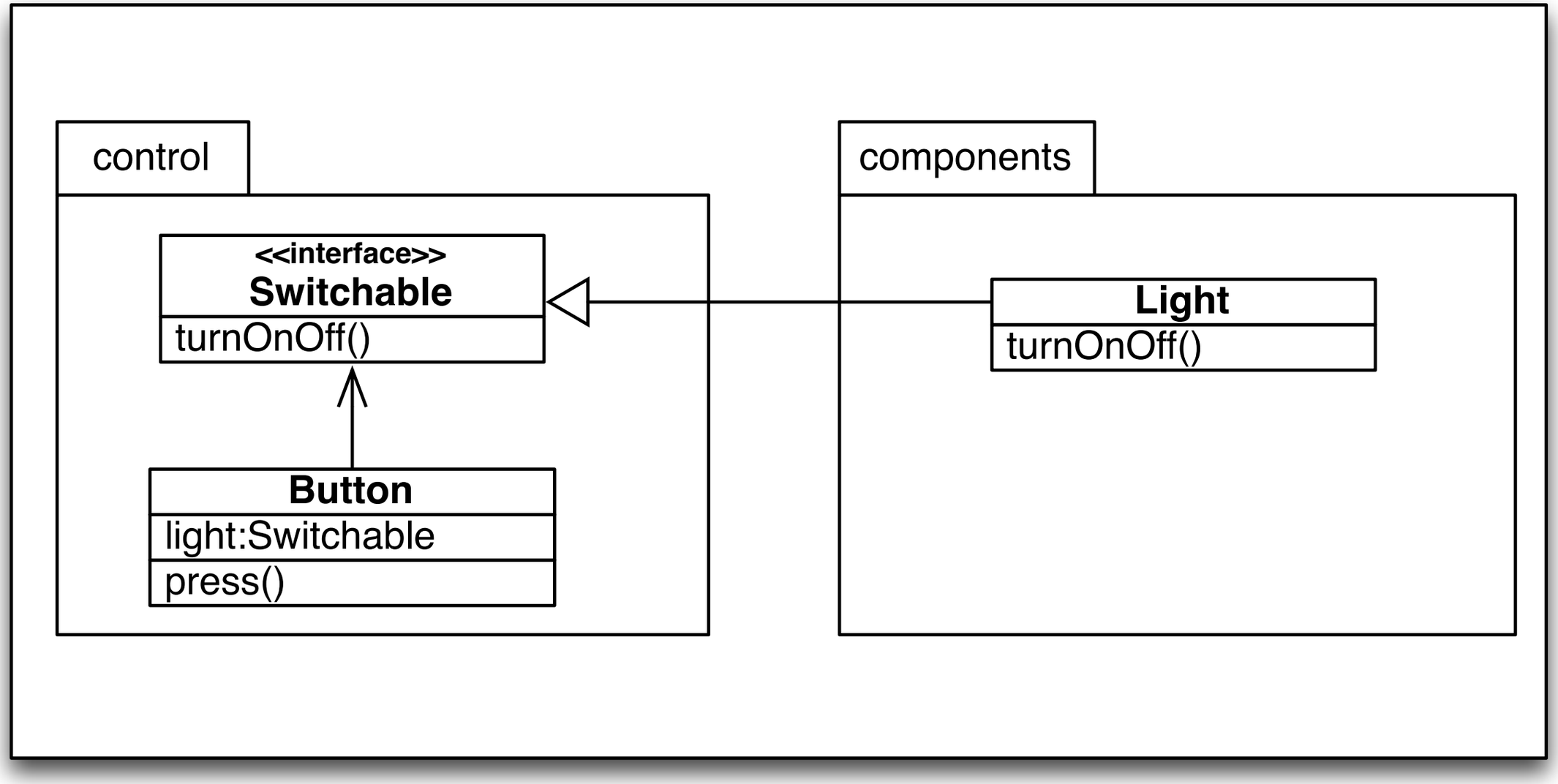
Refactoring Methods

- Move Class (*MC*)
- Move Method (*MM*)
- Using design patterns:
  - Abstract Server Pattern (*ASP*)
  - Dependency Injection (*DI*)

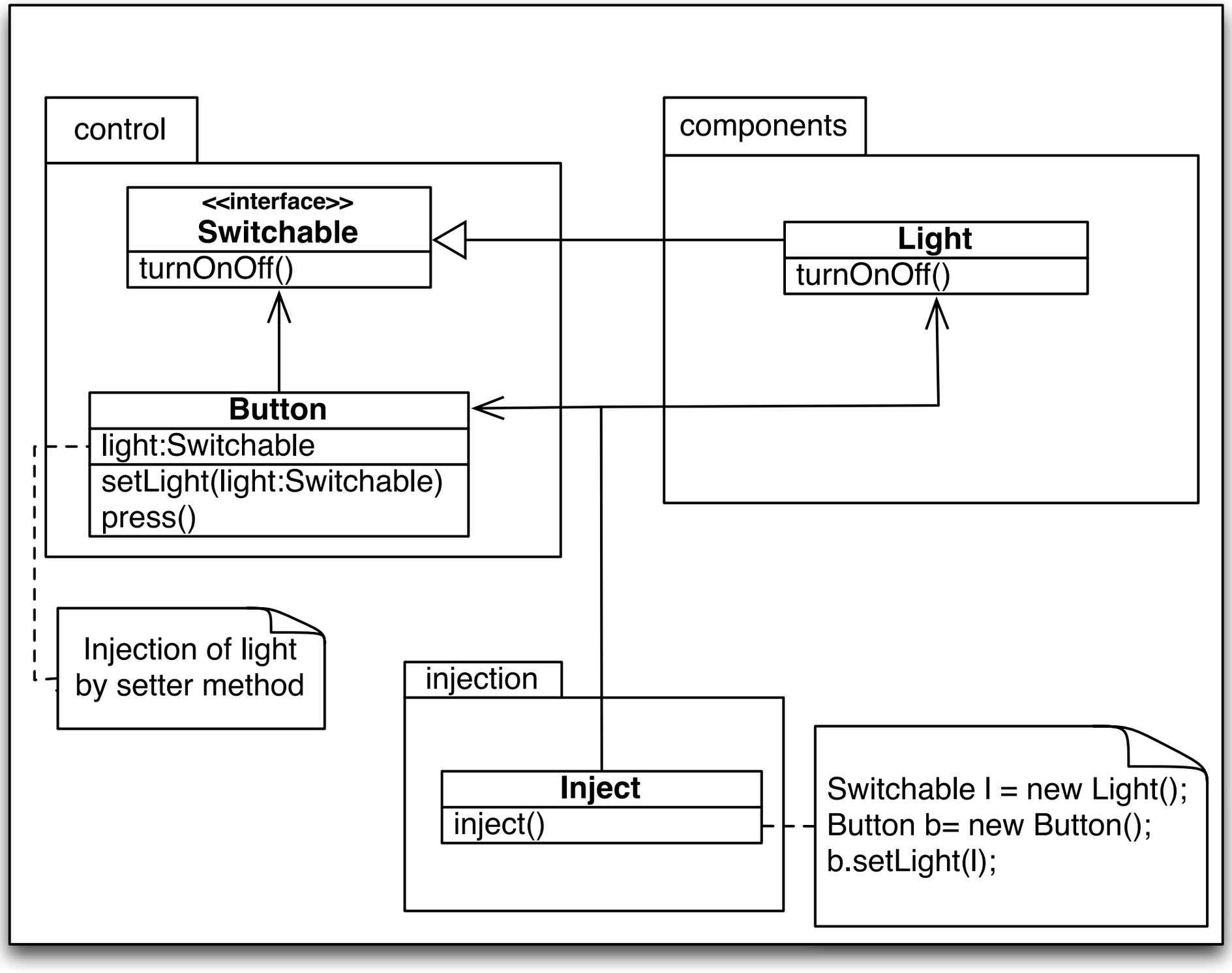
ASP Example


control
light is not initialised
Button
light: Light
press()
componets
Light
turnOnOff()

ASP Example


control
components
<<interface>>
Switchable
turnOnOff()
Light
turnOnOff()
Button
light:Switchable
press()

ASP + DI Example



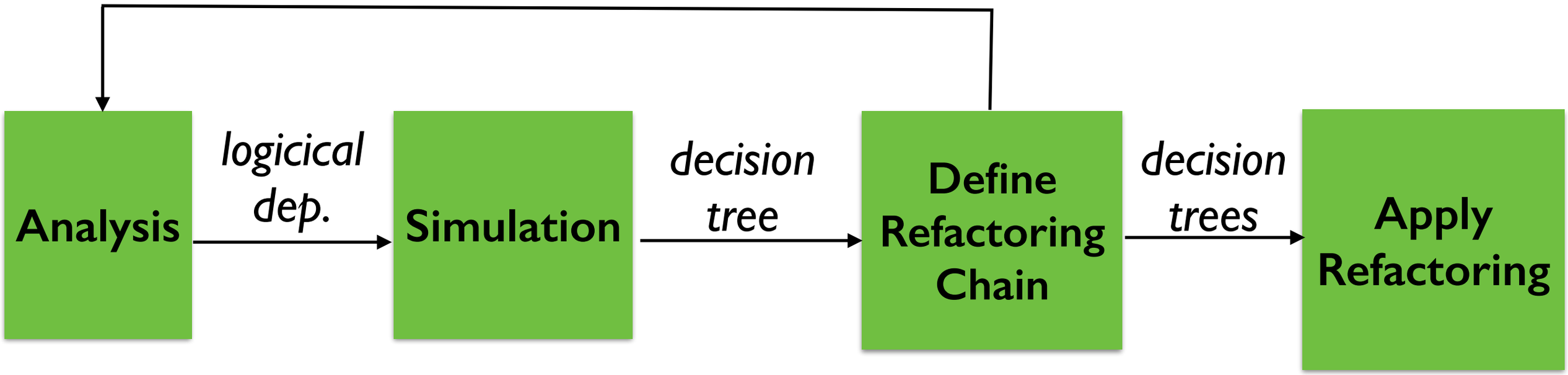
Applicability of Refactoring

———	Move Class	Move Method	ASP	ASP+DI
Inheritance	Yes	No	No	No
Class Variable	Yes	No	Yes	No
Initialised Class Variable	Yes	No	No	Yes
Local Variable	Yes	Yes (Limited)	Yes	No
Initialised Local Variable	Yes	Yes (Limited)	No	Yes
Parameter	Yes	Yes (Limited)	Yes	No
Return Type	Yes	Yes (Limited)	Yes	No
Invocation	Yes	Yes (Limited)	Yes (Limited)	No

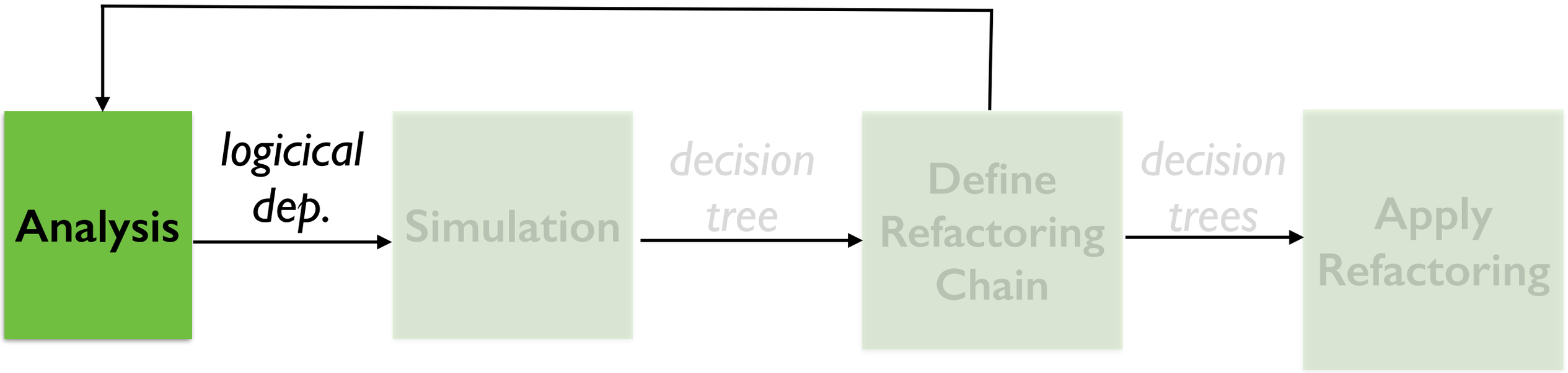
Existing Tools

———	Detection	Removal
JooJ	Yes	No
Jepends	Yes	No
Stan	Yes	No
Pasta	Yes	Yes
Lattix	Yes	Yes
Structure101	Yes	Yes
ECOO	Yes	Yes

Our Solution

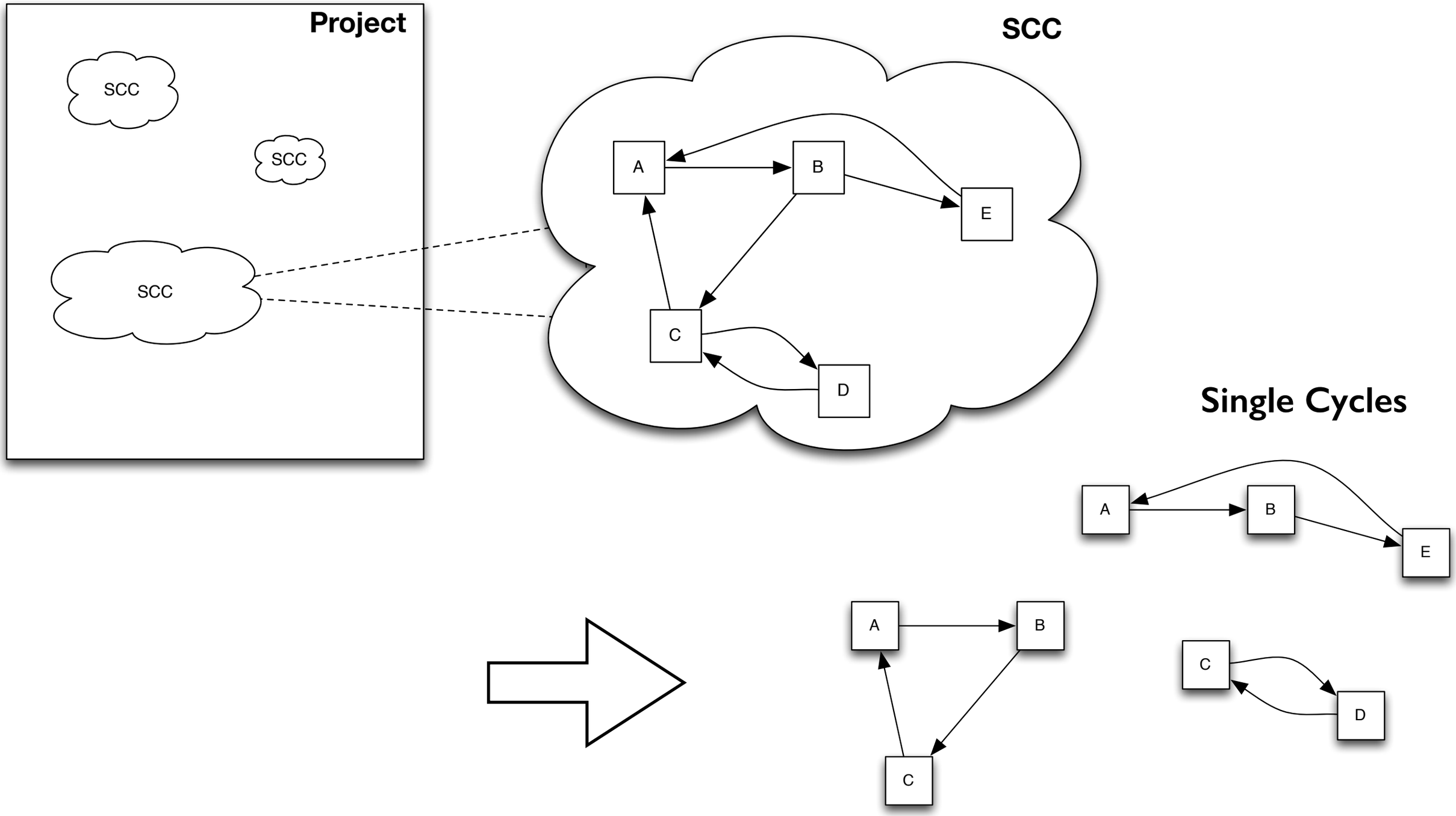


Our Solution



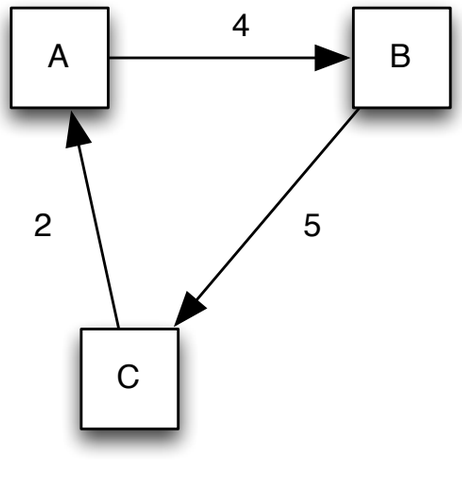
- Detect cycles
- Propose dependency to break

Cycle Detection



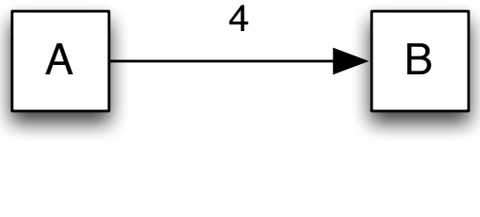
Dependencies

Cycle



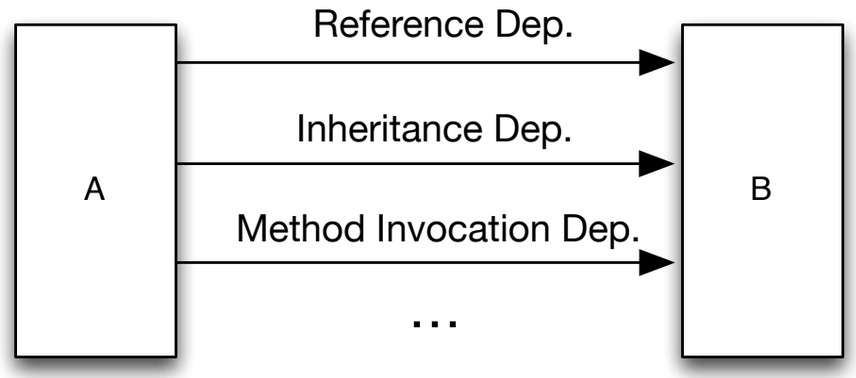
extract

Logical Dependencies



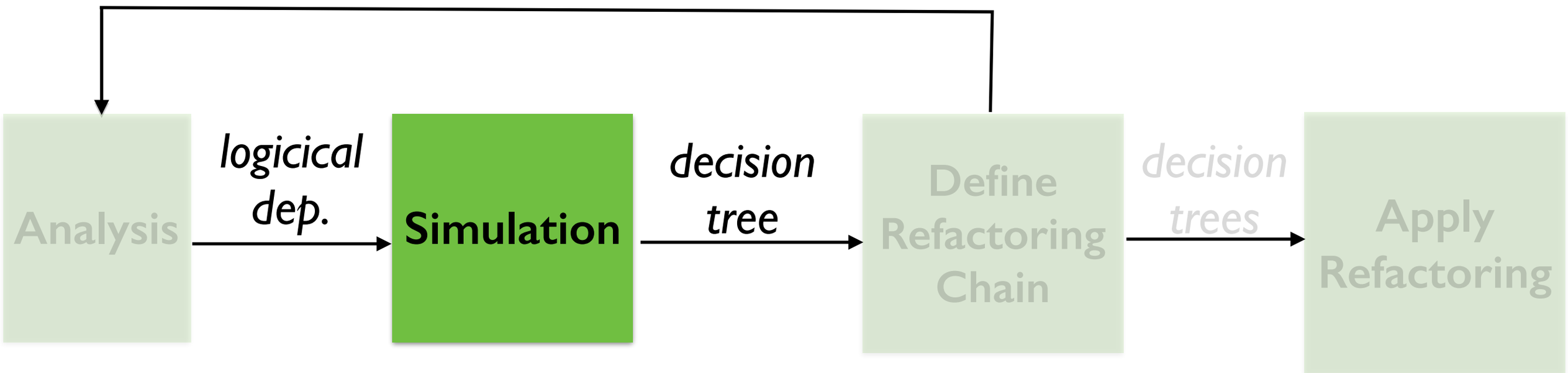
extract

Concrete Dependencies



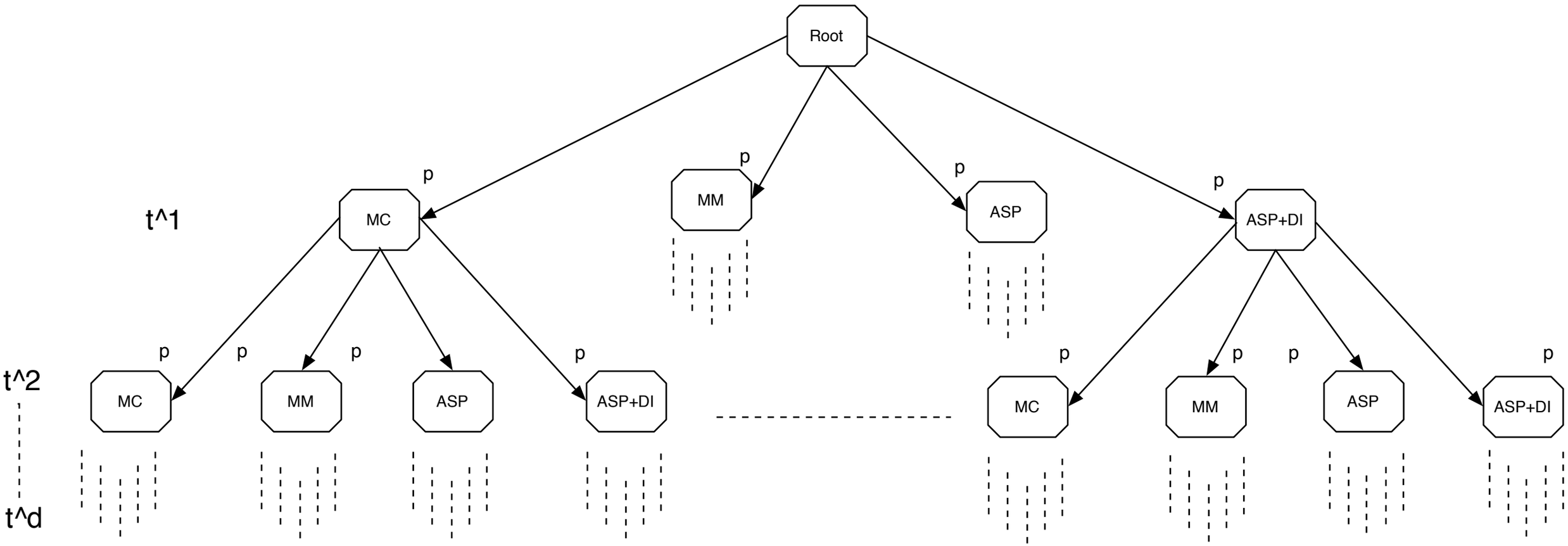
Sort Logical Dependencies by: % Shared Dependencies

Our Solution



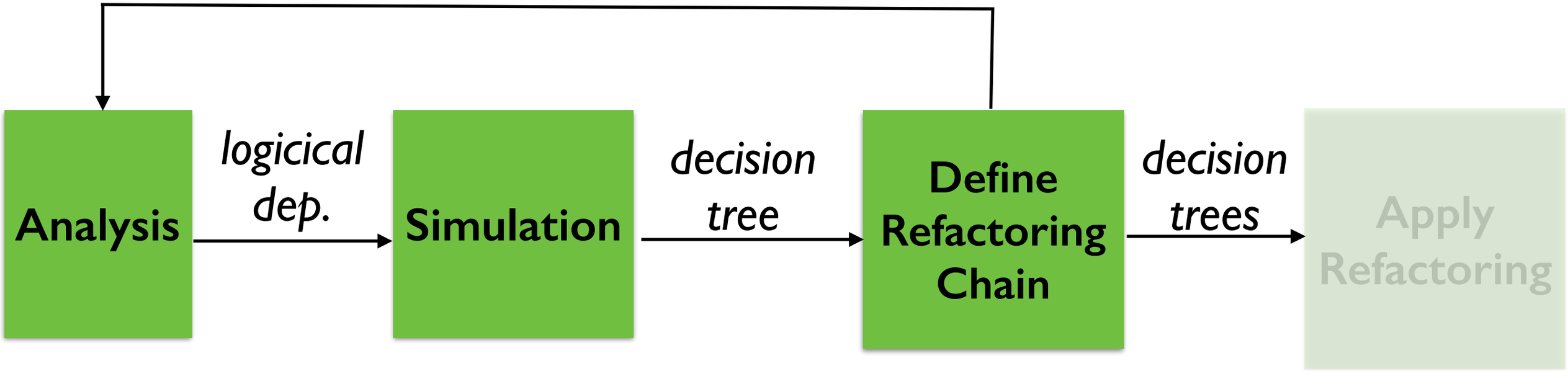
- Simulate refactorings
- Propose best refactoring sequence

Decisional Tree



$$P = w_c \times \frac{1}{\#\,\text{cycles} + 1} + w_d \times \frac{1}{\text{depth}} + w_i \times \frac{(1 - I_{from}) + (1 - I_{to})}{2} + w_a \times \frac{(A_{from}) + (A_{to})}{2}$$

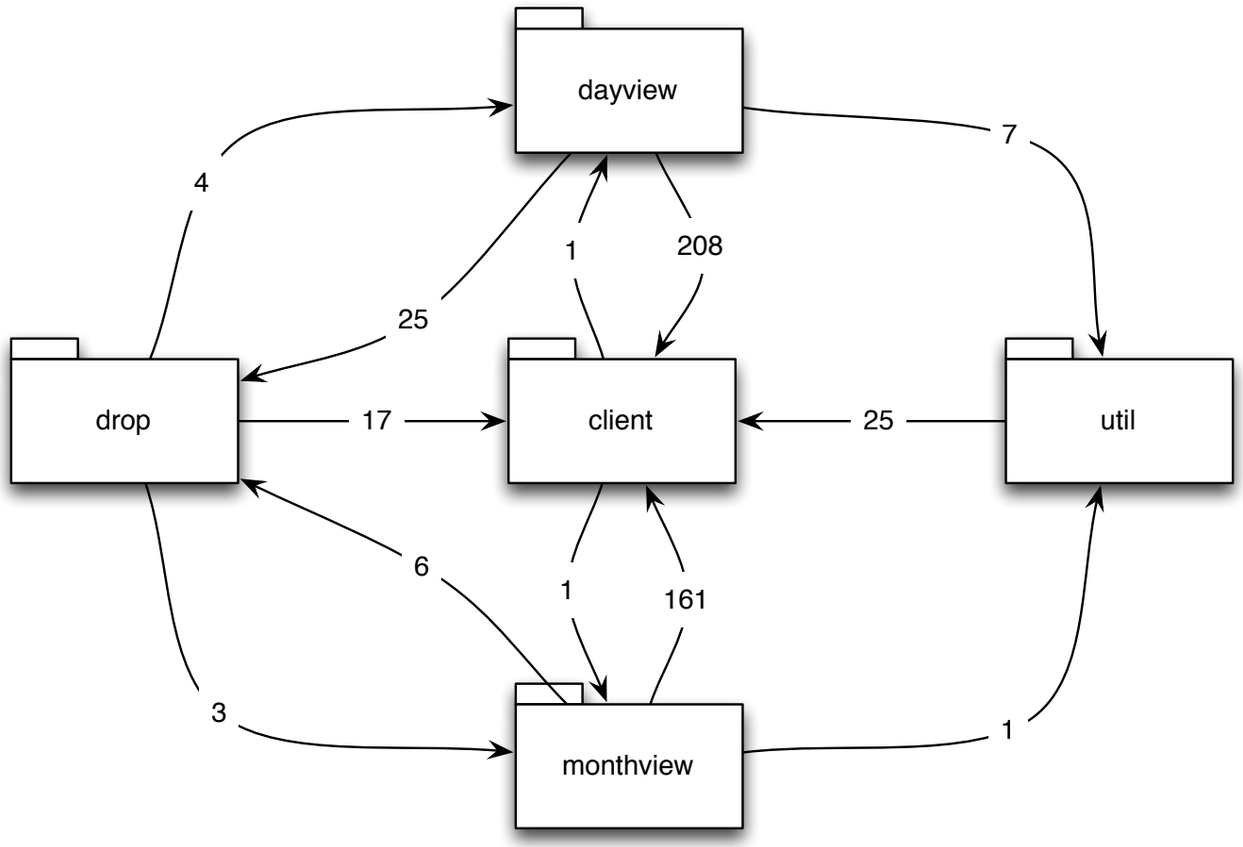
Our Solution

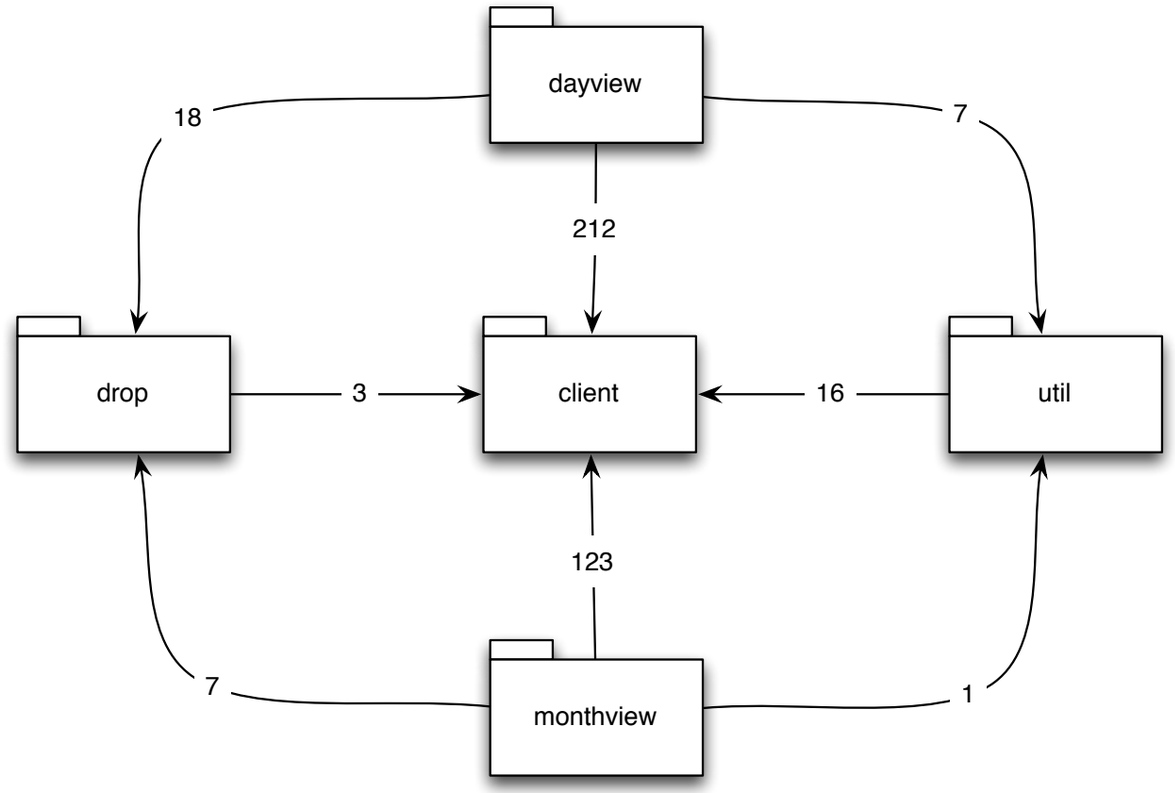


- Choice of the best path
- Repeat until no more cycles

DEMO

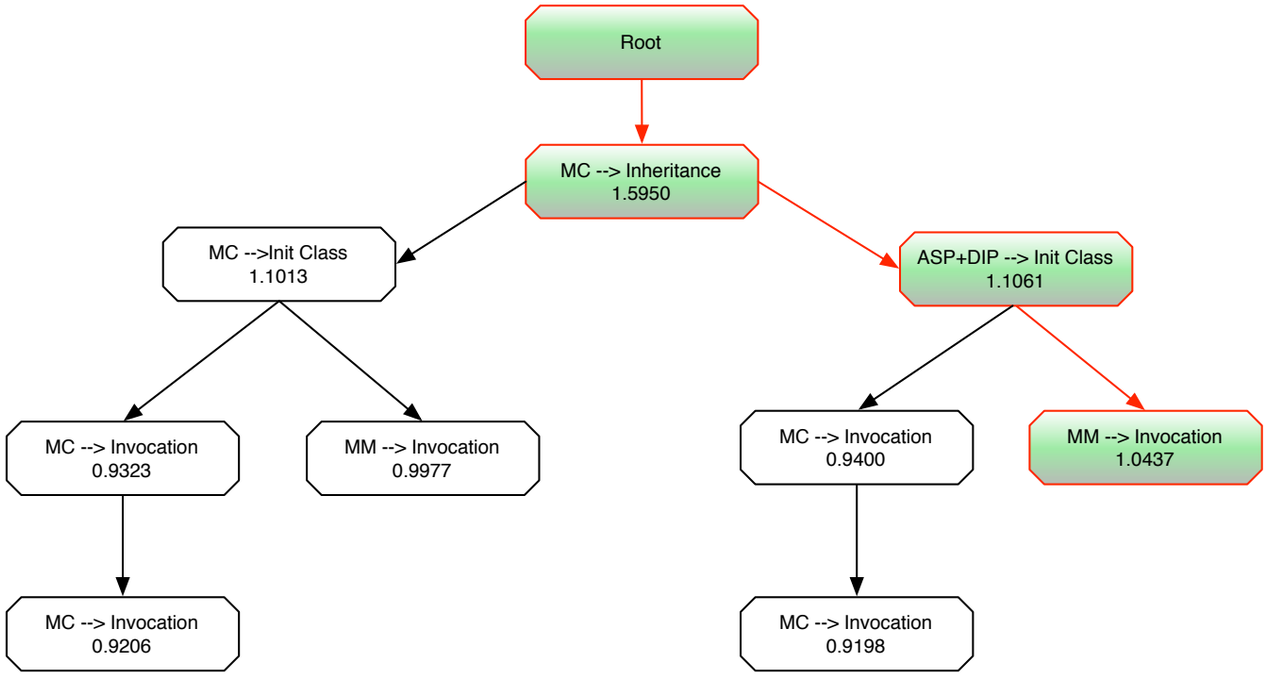
Case study su GWT Calendar



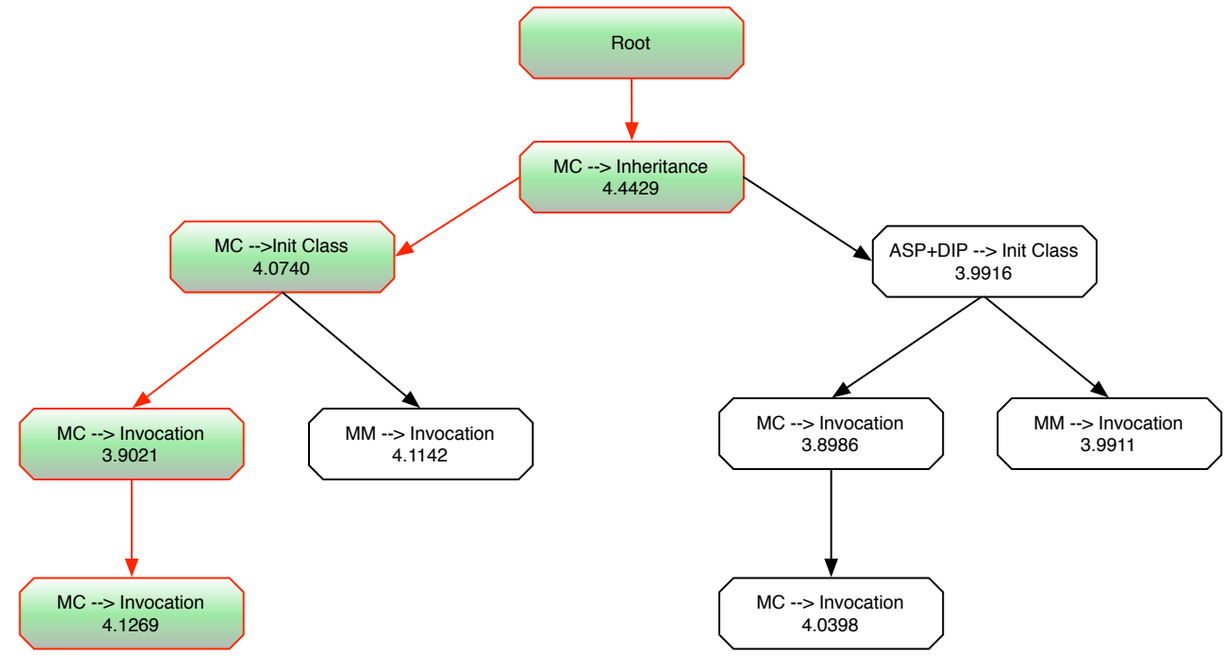


7 cycles → 5 refactoring actions, 4 iterations → 0 cycles

Case study su JHotDraw



stability + abstractness



stability

Integration with Dicto

```
<?xml version="1.0"?>
<results id="1422311583">
    <rules>
        <rule id="1" failed="true" value="Test cannot contain cycles">
            <subrule id="1001" failed="true" value="Test cannot contain cycles " testedBy="DIMareaCycles">
                <error>
                    <fix>Move Class [StandardDrawingView] from [org::jhotdraw::standard] to [org::jhotdraw::contrib]
                        Move Class [DragNDropTool] from [org::jhotdraw::standard] to [org::jhotdraw::contrib::dnd]
                        Move Class [javadraw] from [org::jhotdraw::contrib] to [org::jhotdraw::samples::javadraw]
                        ...
                    </fix>
                    <cause>org.jhotdraw.test containCycles  = True</cause>
                    <details>org::jhotdraw::test - org::jhotdraw::test::samples::javadraw
                            org::jhotdraw::test - org::jhotdraw::test::contrib
                            org::jhotdraw::test - org::jhotdraw::test::samples::pert
                            org::jhotdraw::test - org::jhotdraw::test::figures
                            org::jhotdraw::test - org::jhotdraw::test::standard
                            org::jhotdraw::test - org::jhotdraw::test::util
                    </details>
                </error>
            </subrule>
        </rule>
    </rules>
</results>
$
```

Future Work

- User interface interaction
- Export the decisional trees in a file
- Automate the refactoring decision integrating with Eclipse

Summary

- Dependency cycles difficult topic
- Without a proper tool support engineers cannot solve the problem
- Marea assistes engineers in resolving dependency cycles

Smalltalkhub: **BledarAga/Marea**