



JAC Java Aspect Components

OW conference 2003

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www.objectweb.org



1. Who are we?
2. What is AOP?
3. JAC AOP model
4. Conclusion & Future works

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S2 - 21/11/2003



Open-source (LGPL) project since 09/2000
OW project since 06/2003

Contributors

- AOPSYS (www.aopsys.com french software company)
- LIFL, LIP6, CEDRIC (.fr), Rensselaer (.edu)

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S3 - 21/11/2003



Aspect Oriented Programming

[Kiczales 97]

Separation of concerns design/programming concept

[Parnas 72]

- divide-and-conquer
- middleware: separate business & technical codes

Expectations

- increase modularity
- decrease development/maintenance/evolution costs

Languages/frameworks for AOP

- Java: (>10) AspectJ, AspectWekrz, Caesar, EAOP, JAC, JBoss AOP, ...
- others: AspectS/C++/C#/S, Apostole, AOP/ST, ...

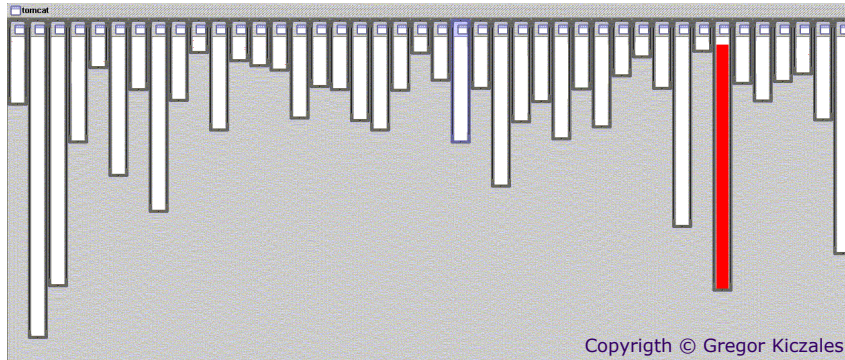
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What is AOP? AOP founding case

XML parsing in org.apache.tomcat

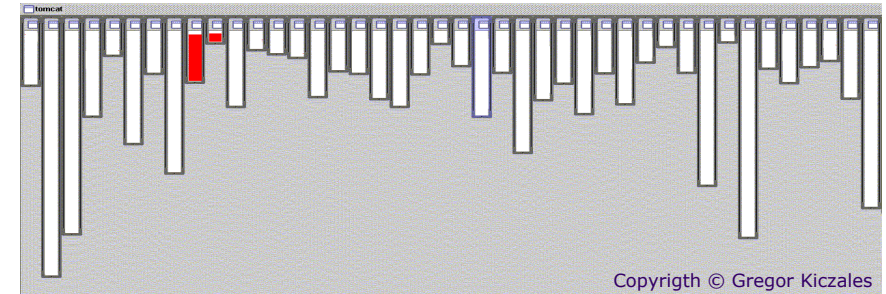
- red shows relevant lines of code
- nicely fits in one box



What is AOP? AOP founding case

URL pattern matching in org.apache.tomcat

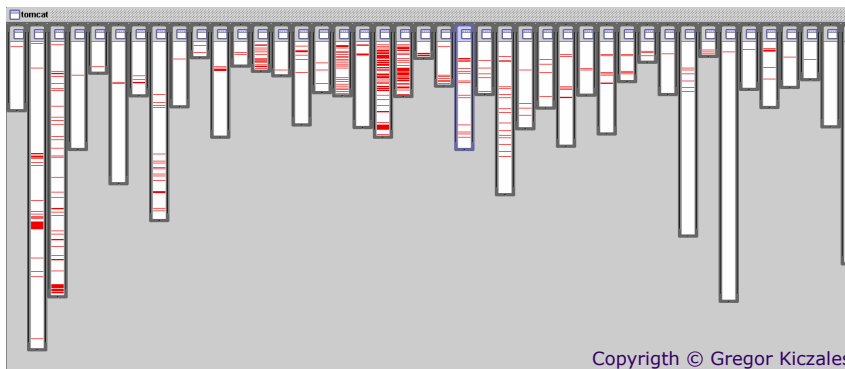
- nicely fits in two boxes (using inheritance)



What is AOP? AOP founding case

Where is logging in org.apache.tomcat

- not in just one place
- not even in a small number of places



What is AOP? AOP founding case

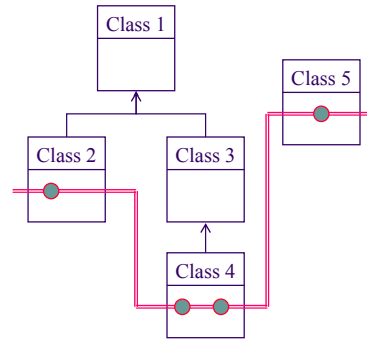
Same pattern for: session expiration, etc.

- **crosscutting** concerns
- not a flaw in OO design
- some concerns are inherently crosscutting (e.g. logging)
- modularize them in a software entity (aspect)
- declaratively define their crosscut policy
- dependency inversion
 - OOP: business code uses technical code
 - AOP: technical code aspectizes business code

What is AOP? Definitions

Joinpoint

- point in the execution flow of a program
- ≈ breakpoint for debugging
- but too fine grained
 - methods call, begin, return
 - fields set/get
 - exceptions throw/catch
 - etc.



Pointcut descriptor

- define a set of logically connected joinpoints (a crosscut)

Aspect

- set of (pointcut descriptor + advice code)

What is AOP? Implementation

AOP weaver

- static (AspectJ, ...) aspects are **compile-time** entities
- dynamic (JAC, ...) aspects are **runtime** entities

performance vs flexibility

AOP & standards

- no standard yet
- AOP Alliance aopalliance.sourceforge.net
 - JAC, Spring, PROSE, ...
 - interceptors & aspects API

JAC AOP model Overview

Open container

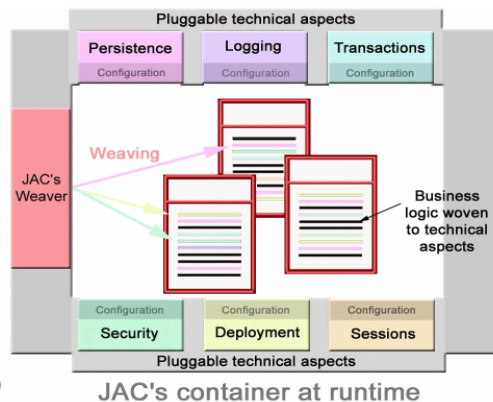
- business + aspect code: 100% Java
- API for aspects definition
- dynamic chains of aspects

JAC weaver

- class loader
- business + aspects code
- bytecode manipulator

JAC weaver accessibility

- locally
- remotely (RMI & CORBA itfs)



JAC AOP model RAD Tool

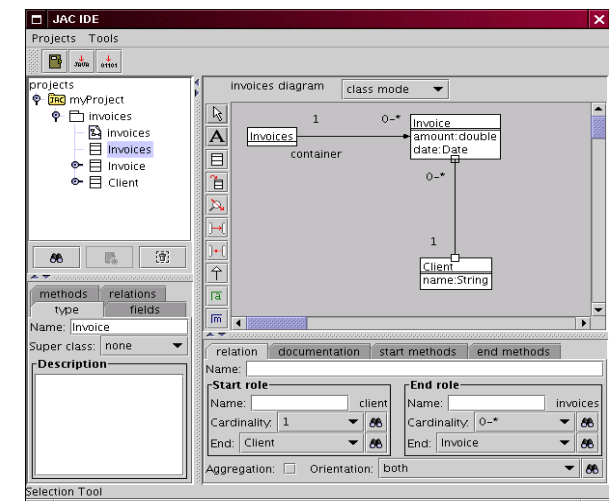
- IDE
- library of aspects

IDE (UMLAF)

- project management
- extended UML notation for aspects

Library of aspects

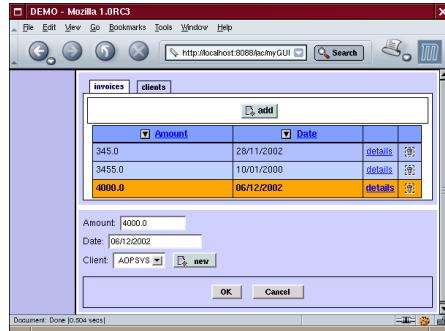
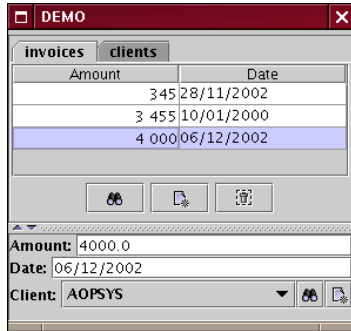
- 15 technical aspects
- transac (JOTM), ...
- GUI



JAC AOP model RAD Tool

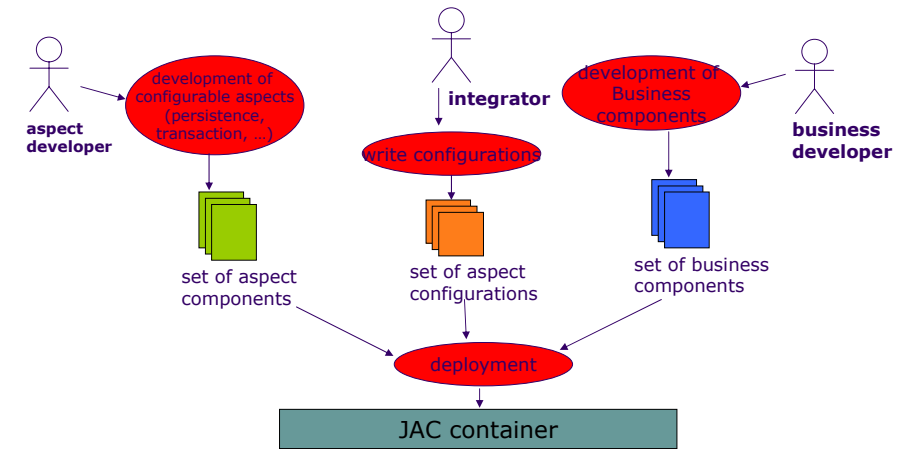
GUI aspect

- remove the presentation code from the business code
- render the presentation either with Swing or HTML/servlet



JAC AOP model

Development process



JAC AOP model

Programming model

- aspect definition
- pointcut descriptor
- advice code
- metadata
- aspect configuration
- application description

JAC AOP model Programming model

- aspect definition
- pointcut descriptor

```

import org.objectweb.jac.core.AspectComponent;

public class MyTraceAC extends AspectComponent {
    public MyTraceAC() {
        pointcut ( // define a pointcut
            ".*", // object regexp
            "my.MyClass", // class regexp
            "get():int", // method regexp
            "foo.jac.com", // container regexp

            MyWrapper.class // wrapping class
        );
    }
}
  
```

method regexp
eg: get.* || set.*
keywords: SETTERS,
MODIFIERS, ...

JAC AOP model Programming model

- advice code
 - chains of wrappers around pointcuts
 - define before/after code
 - can be added removed dynamically

```
import org.aopalliance.intercept.MethodInvocation;
import org.objectweb.jac.core.Wrapper;

public class MyWrapper extends Wrapper {

    public Object invoke( MethodInvocation mi ) {
        // ... before code ...
        Object ret = ((Interaction)mi).proceed(); // next wrapper
                                                // or business object

        // ... after code ...
        return ret;
    }
}
```

JAC AOP model Programming model

- metadata
 - runtime structural reflection of the business code
 - API to
 - navigate
 - add/remove tag on elements (class, method, field)

```
import org.objectweb.jac.core.rtti.ClassRepository;
import org.objectweb.jac.core.rtti.ClassItem;
import org.objectweb.jac.core.rtti.MethodItem;

ClassItem ci = ClassRepository.get().getClass("my.MyClass");
MethodItem[] mi = ci.getMethods("foo");
mi[0].setAttribute( "persistent", new Boolean(true) );
```

JAC AOP model Programming model

- aspect configuration
 - scripting the configuration of aspects
 - application independant (eg JDBC URL for persistence)
 - application dependant (eg which field is persistent)
 - sequence of calls to the aspect methods

Example : gui.acc

```
setTitle myGUI "DEMO";
setSubPanelsGeometry myGUI 2 HORIZONTAL {false,false};
setPaneContent myGUI 0 Object {invoices0};
addReferenceToPane myGUI invoices.Invoices invoices 1;
addReferenceToPane myGUI invoices.Invoices clients 1;
setPosition myGUI 0 0 60 60;
setSplitterLocation myGUI 0 0.6;
```

JAC AOP model Programming model

- application description
 - launching code
 - aspects initially woven

Example : bank.jac

```
applicationName: distransbank
launchingClass: org.objectweb.jac.samples.distransbank.Account
aspects: distrans distrans.acc true
```

- "AOP is about capturing a crosscutting concerns"
- "AOP is the future of middleware"
- a solution for separating business & technical code

[Kiczales]

[Fleury]

JAC vs others (AspectJ, JBoss AOP, ...)

- 100% Java, no syntax extensions
- dynamic & remote deploy/undeploy
- UMLAF RAD tool (IDE, library of aspects)
- GUI aspect (Swing or HTML/servlet)

Future directions

- JAC as a Fractal ADL
- JAC for JOnAS
- Eclipse IDE