AOKell

OW Architecture Meeting
Fractal Workshop
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Plan

1. Research topics
2. AOKell
3. Conclusion
4. Perspectives

Research Topics

Aspects & components

Joint work with France Telecom R&D (T. Coupaye)

- Component: modularize vertical functionalities
- Aspect: modularize crosscutting functionalities
- Need both (at the component, object and architecture levels)

Current experiences around Fractal

- Aspects in the model: FAC -> Nicolas Pessemier
- Aspects for implementing the Fractal specifications: AOKell

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Techniques for implementing Fractal specifications

- Julia: mixins & bytecode engineering (ASM)
- AOKell: aspects for implementing controllers

Expected benefits

- Easier to develop, debug, maintain
- Better integration with IDEs
- Reducing the development time for writing new controllers
- Reducing the learning curve

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Requirements for controllers

- Feature injection (e.g. Binding controller interface)
- Interception (e.g. LifeCycle)

Our proposal

- 1 controller = 1 aspect
  - Feature injection = inter-type declaration
  - Interception = code advising
- Controller part of a Fractal component = aspects weaving

- AspectJ
  - « reference » aspect weaver
  - Compile-time weaving (perf ++)
  - Load-time weaving (and run-time in the near future)
  - Tooling, IDE & debugger integration

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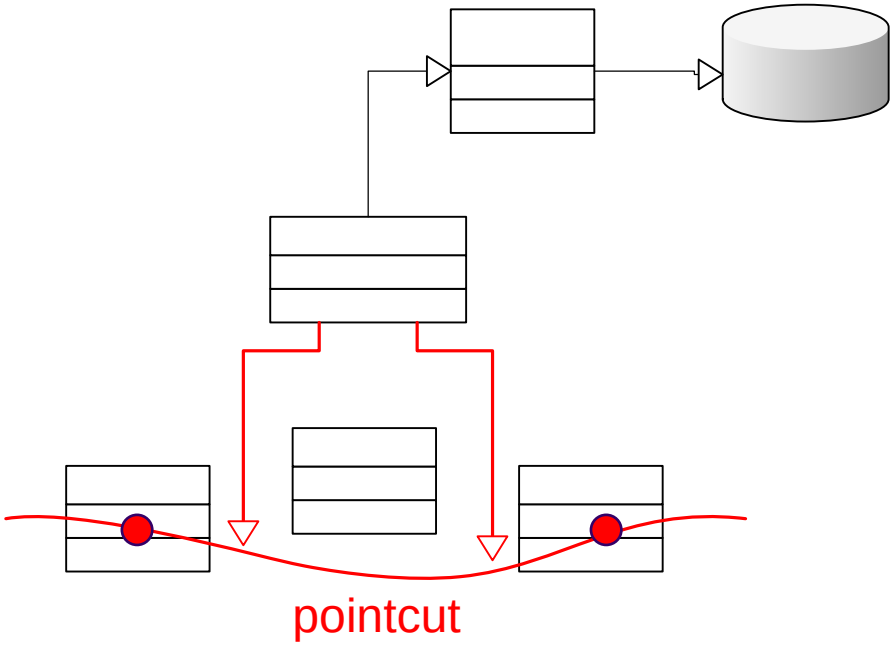
Aspects implement crosscutting concerns

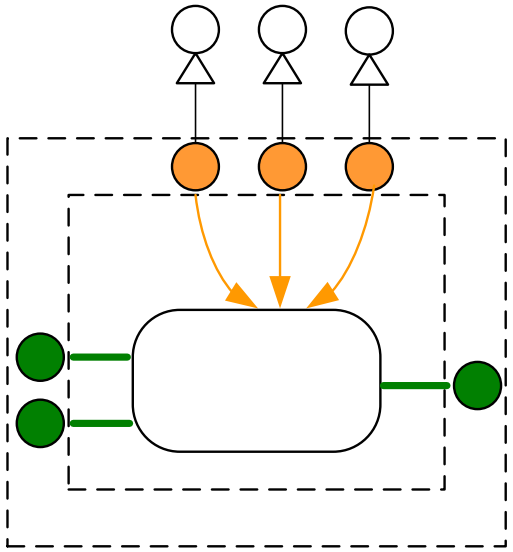
Best practice in AOP

- Aspects implement the integration logic
- Aspects delegates treatments



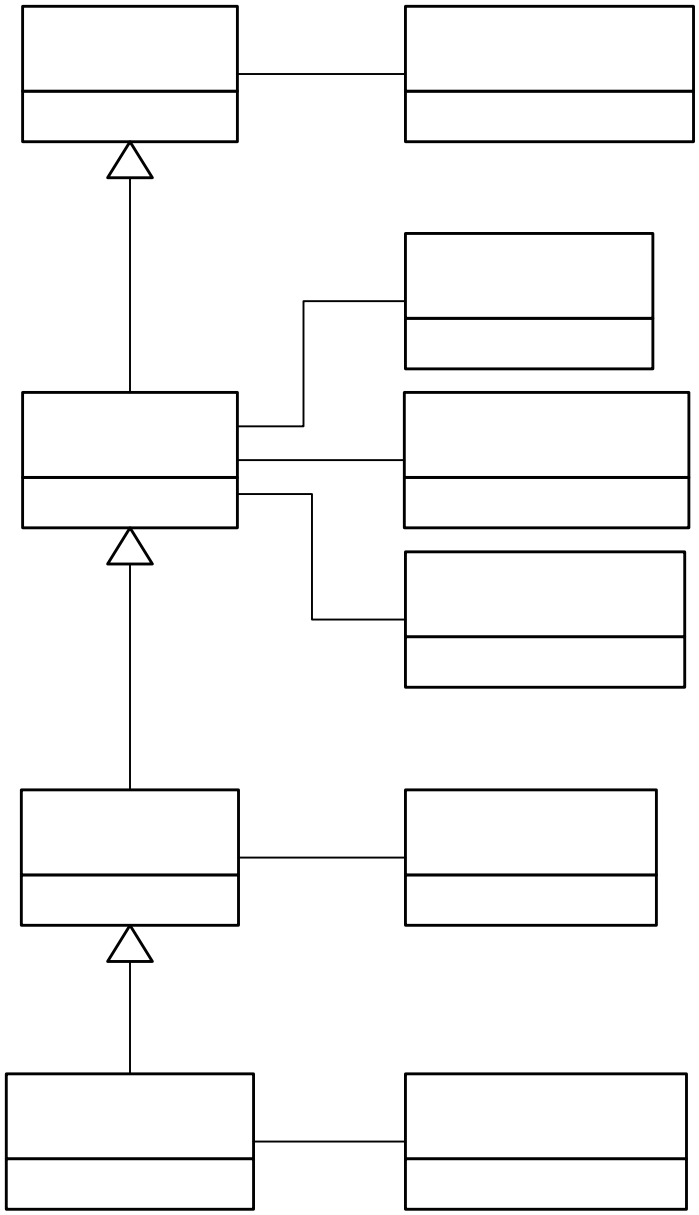
Solution

- 1 aspect per controller type
- 7 aspects
  - BC, LC, NC, CC, SC, Factory, Component

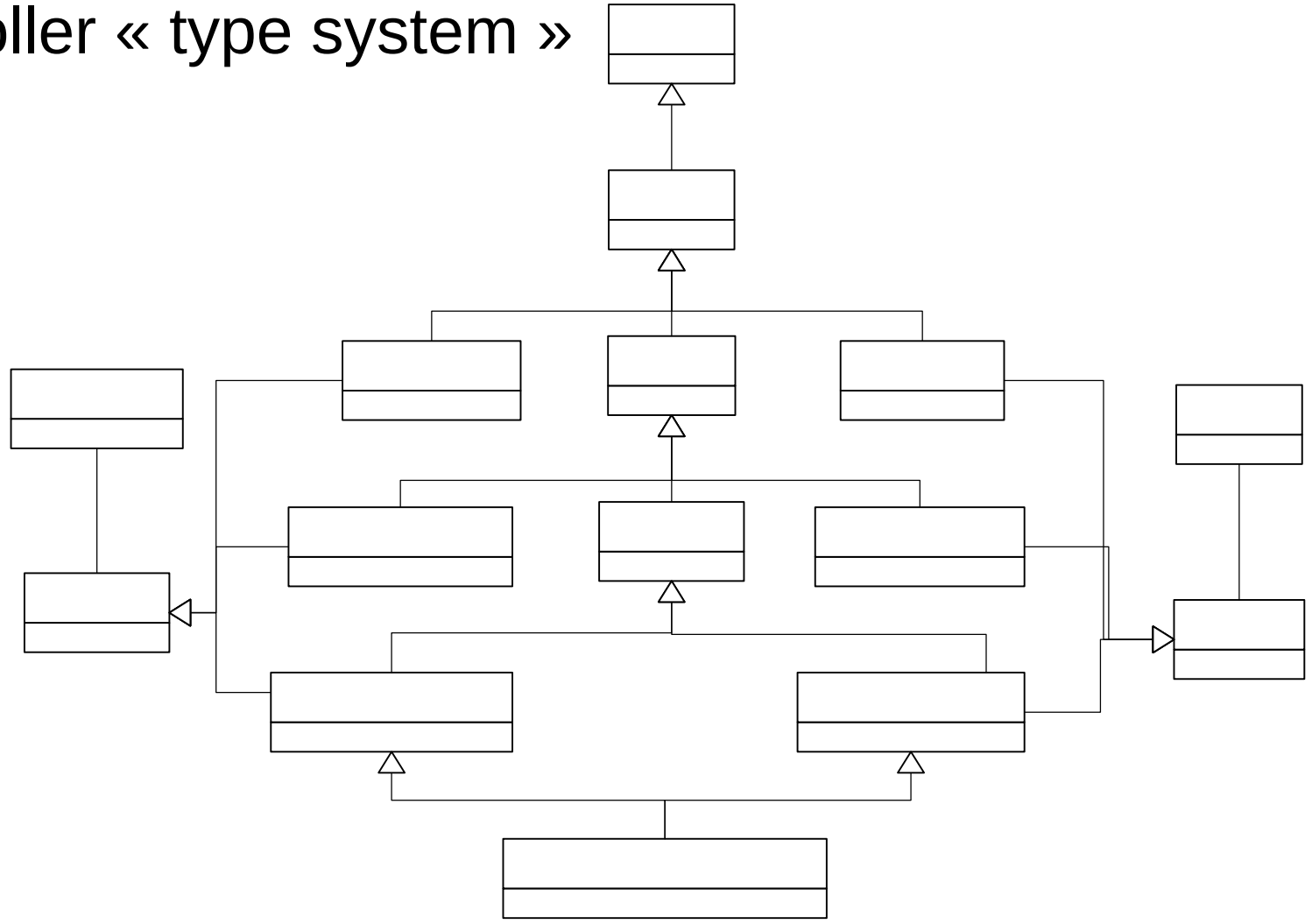


- Each aspect delegates the controller logic to a j.l.Object
- Pointcut definition based on a « type system » for controller

Controller « type system »



Controller « type system » Cont'd



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```
public aspect ANameController {

    private NameController FlatType._nc;

    public String FlatType.getFcName() {
        return _nc.getFcName();
    }

    public void FlatType.setFcName(String arg0) {
        _nc.setFcName(arg0);
    }

   public NameController FlatType.getFcNameController() { return _nc; }
   public void FlatType.setFcNameController(NameController nc) { _nc=nc; }
}
```

AspectJ
Inter-type declarations

Object implementation
of the name controller

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```
public aspect ALifeCycleController {

    private LifeCycleController FlatType._lc;

    public String FlatType.getFcState() { return _lc.getFcState(); }
    public void FlatType.startFc() throws IllegalLifeCycleException { _lc.startFc(); }
    public void FlatType.stopFc() throws IllegalLifeCycleException { _lc.stopFc(); }


    pointcut methodsUnderLifecycleControl( FlatType adviced ):
        execution( * FlatType+.*(..) ) && target(adviced) &&
        ! controllerMethodsExecution() && ! jlObjectMethodsExecution();

    before(FlatType adviced) : methodsUnderLifecycleControl(adviced) {

      if( adviced.getFcState().equals(LifeCycleController.STOPPED) ) {
        throw new RuntimeException("Components must be started before
                                              accepting method calls");
```

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Full implementation of the Fractal specifications

- API, ADL, template, …

Fractal/Julia junit conformance tests : 117 ok / total: 131

(14 failed: specific to Julia, or issues in interpreting the specs)

Performances similar to those of Julia JACBenchmark

- AOKell: 646 ms
- Julia (optim none): 679 ms
- Julia (optim mergeControllersInterceptorsAndContent): 552 ms

Further work: implementing the same optimization levels as Julia

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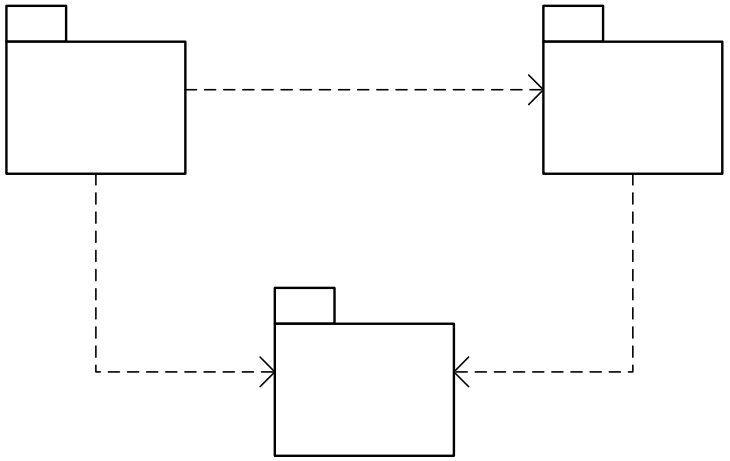
Project overview

.jar size: 189KB (154 + 35 for aspejrt.jar) (Julia 2.2 180KB)

Applications tested with AOKell

- hw API, ADL, templates, …
- Fractal RMI
- Fractal Explorer



- cache-controller

Further works

- other app (GoTM, Speedo, …)
- Dream controllers

Conclusion

- The experience worked
- Solution similar (perf, size) to Julia's

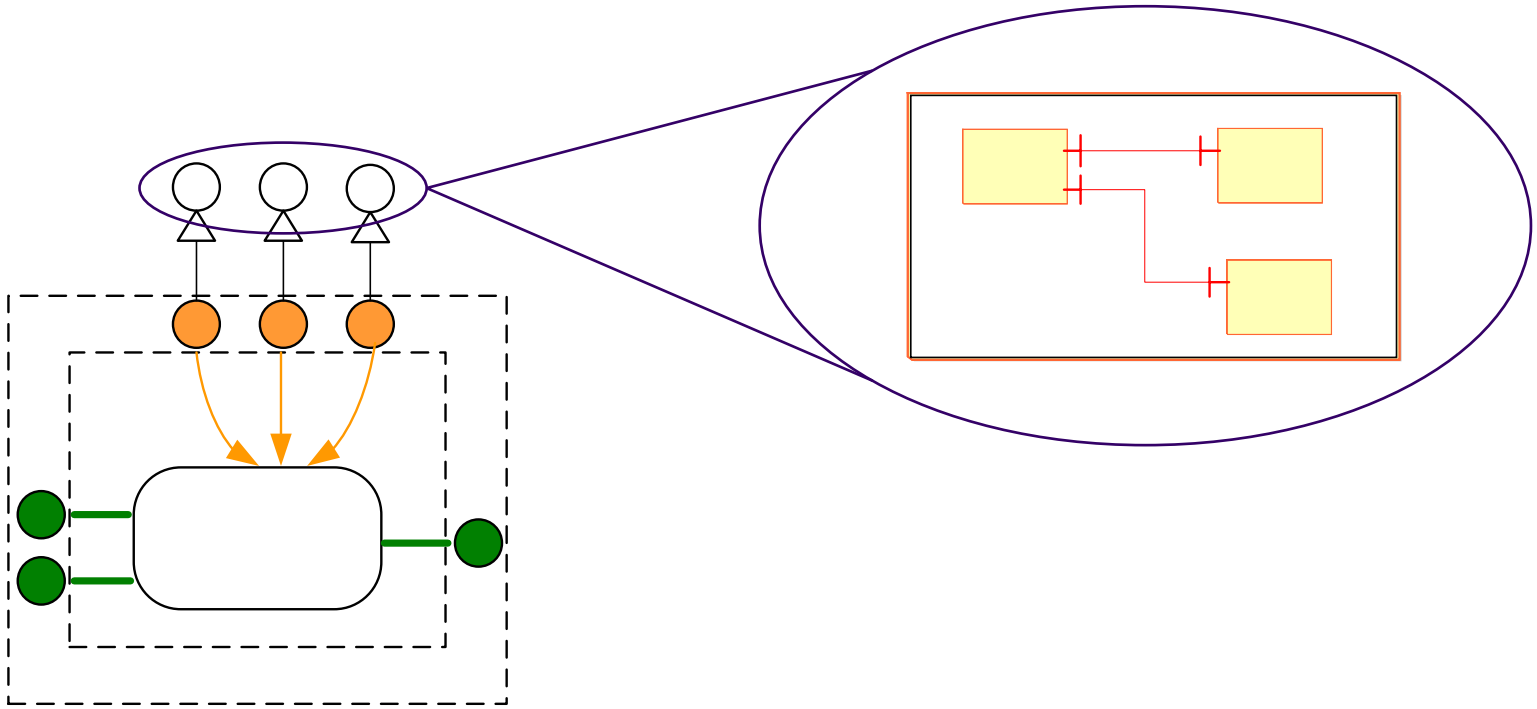
Future works

- Experiment the run time weaving features of Aspect (already done with load-time)
- Improve the writing of controller parts hidden dependencies (eg LifeCycle -> Content)
  - Aspectize it (already done by Julia with mix-in)
  - Provide a component oriented implementation

Perpectives
CBSD for controller parts

Expected benefits

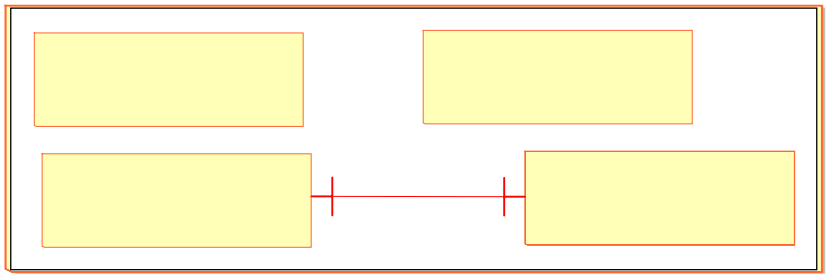
- … the same as for component based applications



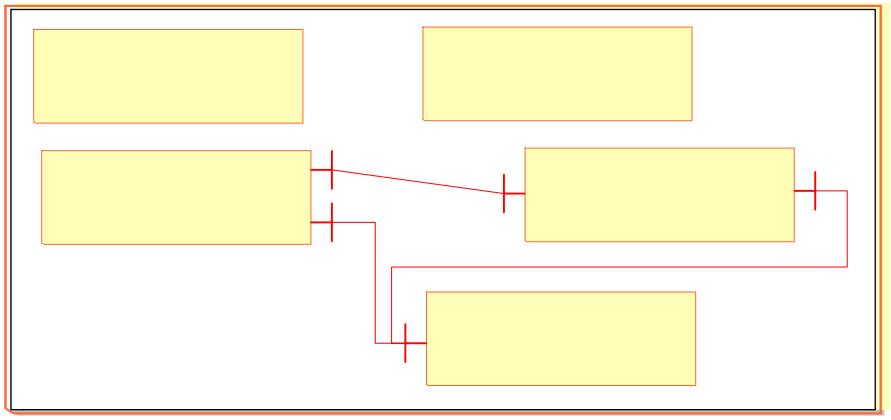
Perpectives
CBSD for controller parts

An architectural description for each controller part types (12)

primitive



composite



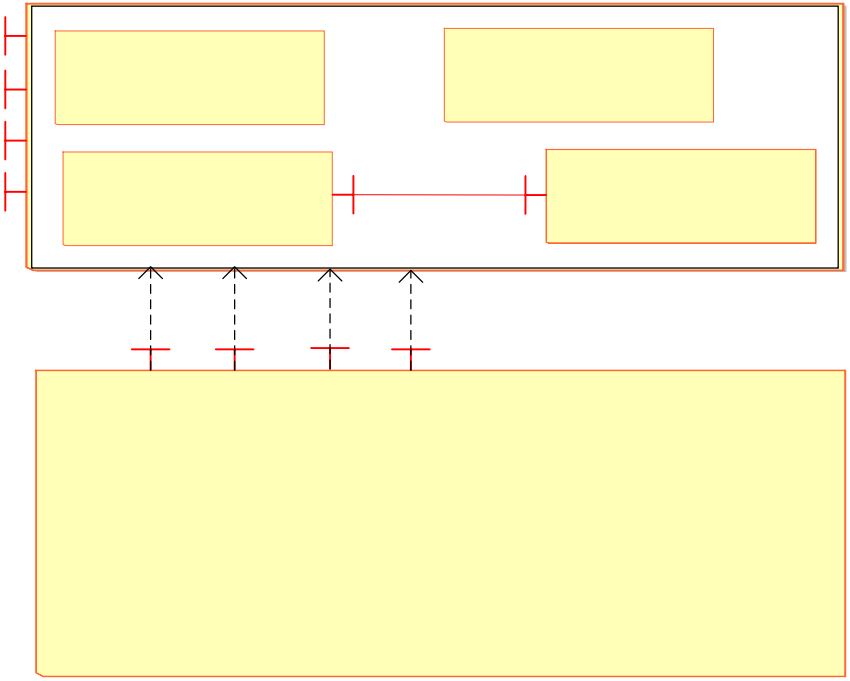
Perpectives
CBSD for controller parts

```
<definition name="aokell.lib.membrane.primitive.Primitive"
      extends="LifeCycleControllerType, BindingControllerType, ComponentControllerType,
      NameControllerType, SuperControllerType" >

      <component name="ComponentController"
            definition="aokell.lib.control.component.PrimitiveComponentController" />
      <component name="NC" definition="aokell.lib.control.name.NameController" />
      <component name="LC" definition="aokell.lib.control.lifecycle.NonCompositeLifeCycleController" />
      <component name="BC" definition="aokell.lib.control.binding.PrimitiveBindingController" />
      <component name="SC" definition="aokell.lib.control.superc.SuperController" />

      <binding client="this.//sComponent" server="ComponentController.//sComponent" />
      <binding client="this.//sName" server="NC.//sName" />
      <binding client="this.//sLifecycle" server="LC.//sLifecycle" />
      <binding client="this.//sBinding" server="BC.//sBinding" />
      <binding client="this.//sSuper" server="SC.//sSuper" />

      <binding client="BC.//cComponent" server="ComponentController.//sComponent" />
      <binding client="LC.//cBinding" server="BC.//sBinding" />
      <binding client="LC.//cComponent" server="ComponentController.//sComponent" />

      <attributes signature="aokell.lib.membrane.MembraneAttributeItf" />
</definition>
```

Perpectives
CBSD for controller parts

Component factory

- Creates an instance of the component
- Creates an instance of the controller part
  (from the ADL description – static Java backend)



Perpectives
CBSD for controller parts

Problem

- Controllers must themselves be controlled
- Interface signature clashes between interface signature of
  - The base level
  - The control level

E.g. binding controller and the BindingController interface

  - 1 for managing component bindings
  - 1 for managing bindings between controllers

- Solution
  - Naming conventions on interface names (// prefix)
  - Do we need a 3rd level to control the controller part?

Perpectives
CBSD for controller parts

Conclusion

- Feasible
- Existing version of AOKell
  - 12 ADL description of membrane
  - Performances JACBenchmark
    additional cost: +20% (can certainly be reduced)