Making SOFA Fractal level 2 compliant

Petr Hnětynka, František Plášil

DISTRIBUTED SYSTEMS RESEARCH GROUP
http://nenya.ms.mff.cuni.cz

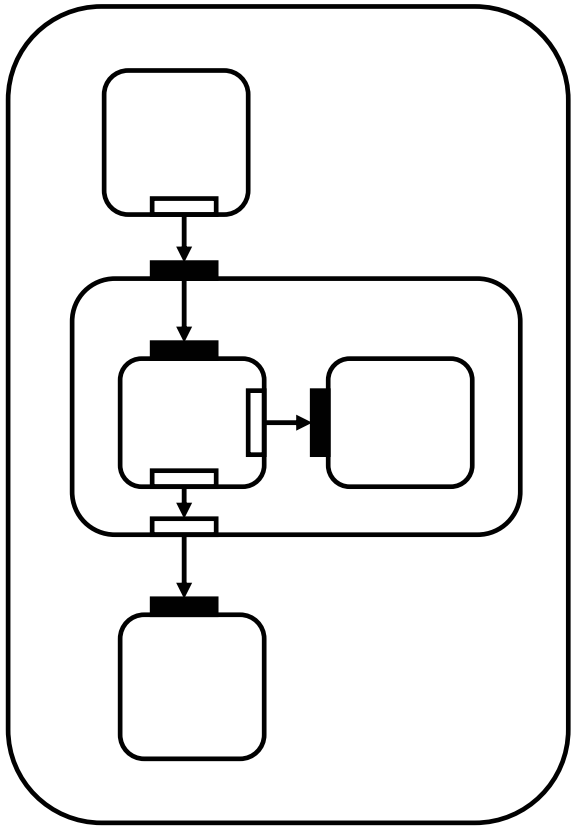
CHARLES UNIVERSITY PRAGUE
Faculty of Mathematics and Physics

Agenda

- SOFA overview
- Fractal conformance levels
- Making SOFA compliant with Fractal
  - level 1
  - level 2
- Results

SOFA overview

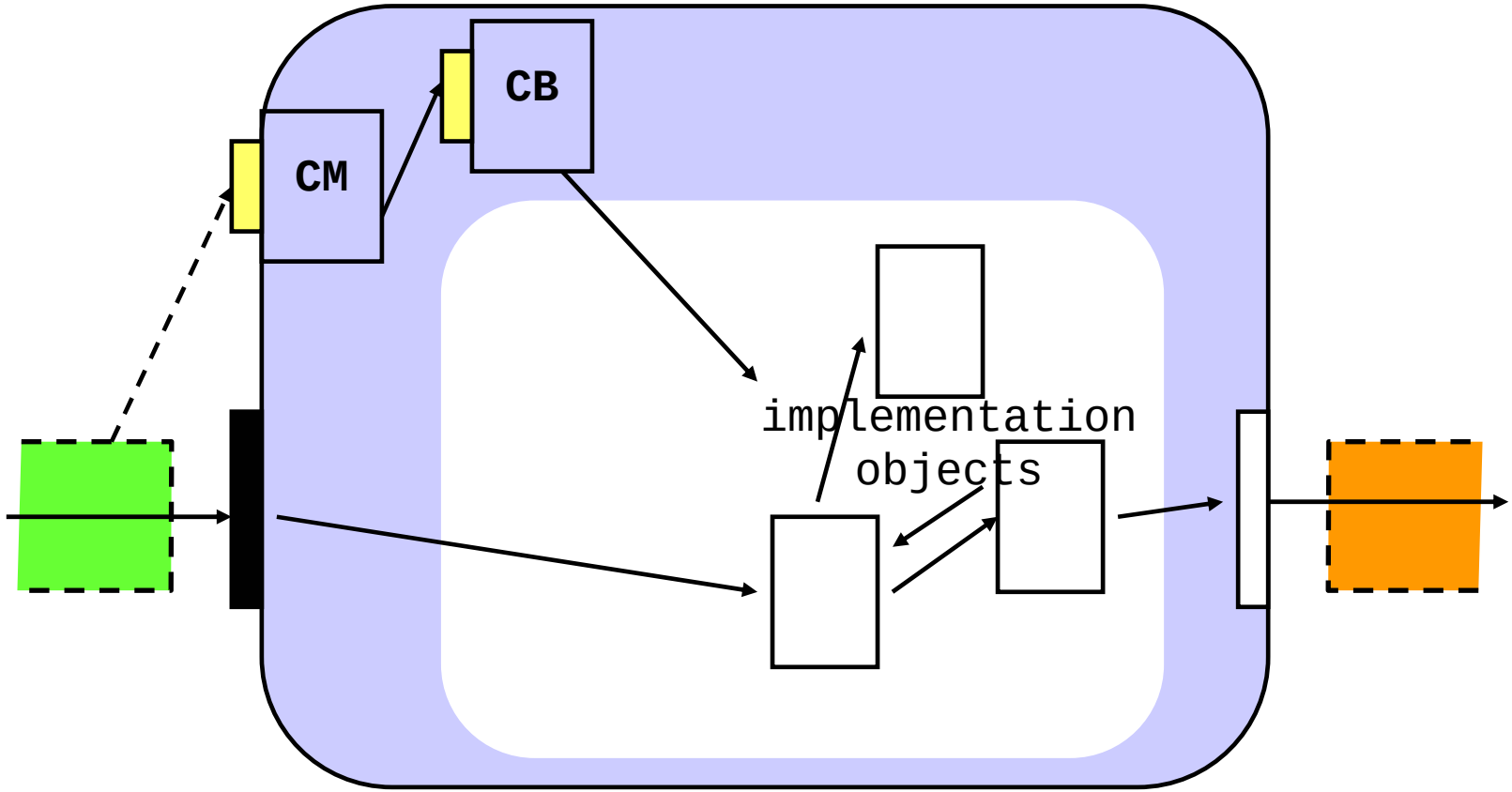
- SOFA
  - Software Appliances
- component model
  - DCUP
    - Dynamic Component Updating
- communication using connectors
- behavior specification
- component distribution/delivery
  - SOFA node(s)
- multiplatform
  - prototype in Java
- http://sofa.objectweb.org/



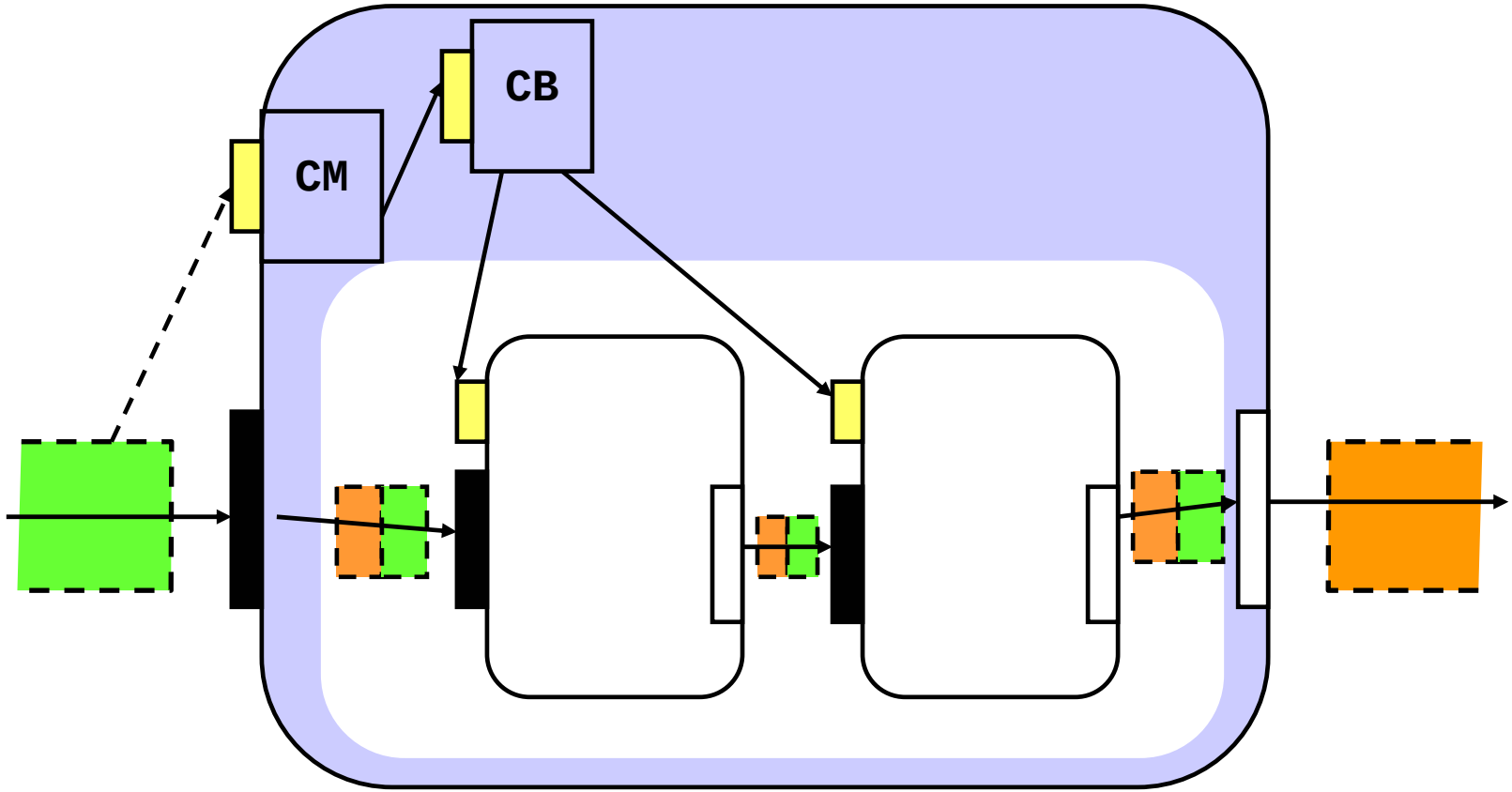
Development process

- CDL spec — done by hand
- Compiling CDL — done automatically
  - Check Protocol Compliance
- Generating Code fragments
  - Types
  - Component builders
  - Assembly descriptors
- Primitive components
- Assembling
  - Filling out Assembly descr
- Deploying application to Depl. Docks
  - Filling out Deployment plan
  - Connector generation
- Launching

Implementation of primitive component



Implementation of composed component



Fractal conformance levels

- Fractal – 4 levels of conformance
  0. nothing is mandatory
  1. components provide **Component** interface
  2. interfaces are castable to **Interface** interface
  3. components use *type system*

- SOFA conforms on level 0.
- but
  - SOFA and Fractal are very similar

  → higher level of conformance

Making SOFA compliant with Fractal

- level 1. and 2.
  - easy
  - providing **Component** interface and extending **Interface** interface
    - necessary – mapping from Fractal IDL to SOFA CDL
- level 3.
  - problematic
  - type system – definition of sub typing relation
  - SOFA sub typing defined via behavior protocols

Mapping: Fractal IDL → SOFA CDL

- straightforward
  - interface → interface
  - exception → exception
  - package → module
  - primitive types → primitive types
  - unbound array → unbound sequence

Fractal *Component* interface

```
package org.objectweb.fractal.api;

interface Component {
  any[] getFcInterfaces();
  any getFcInterface(string itfName)
        throws NoSuchInterfaceException;
  Type getFcType();
}

interface Type {
  boolean isFcSubtypeOf(Type t);
}
```

SOFA *Component* interface

```
module org {
  module objectweb {
    module fractal {
      module api {

        interface Type {
          boolean isFcSubtypeOf(in Type t);
        };

        typedef sequence<Object> Objects;

        interface Component {
          Objects getFcInterfaces();
          Object getFcInterface(in string itfName)
             raises (NoSuchInterfaceException);
          Type getFcType();
        };
      };
}; }; };
```

Fractal *Interface* interface

```
package org.objectweb.fractal.api;

interface Interface {
  string getFcItfName();
  Type getFcItfType();
  Component getFcItfOwner();
  boolean isFcInternalItf();
}
```

SOFA *Interface* interface

```
module org {
  module objectweb {
    module fractal {
      module api {

        interface Interface {
          string getFcItfName();
          Type getFcItfType();
          Component getFcItfOwner();
          boolean isFcInternalItf();
        };

      };
    };
  };
};
```

Level 1 conformance

- implemented
- Component manager implements interface **Component**
  - also implements **Type** interface
- getFcInterfaces, getFcInterface
  - returns connector role (role ~ connector ending)
    - pre-generated connectors
    - no on-the-fly generation
- minor change in mapping from CDL to Java
  - each generated interface/class contains static and final field with CDL full name
    - used for obtaining correct connector
- isFcSubtypeOf()
  - currently returns only *false*

Level 2 conformance

- implemented
- modified mapping from CDL to Java
  - all interfaces implicitly extends **Interface** interface
- modified connector generator
  - adding of methods from **Interface** interface
  - special handling of method *getFcItfOwner*
    - returns reference to Component manager
- problem
  - method *isFtInternalIft*()
    - no internal interface in SOFA
    - each time returns *false*

Achieved results

- SOFA conforms to Fractal on level 2
  - easier building heterogeneous component applications
- component introspection
- making component manager publicly accessible
  - dynamic architecture of components