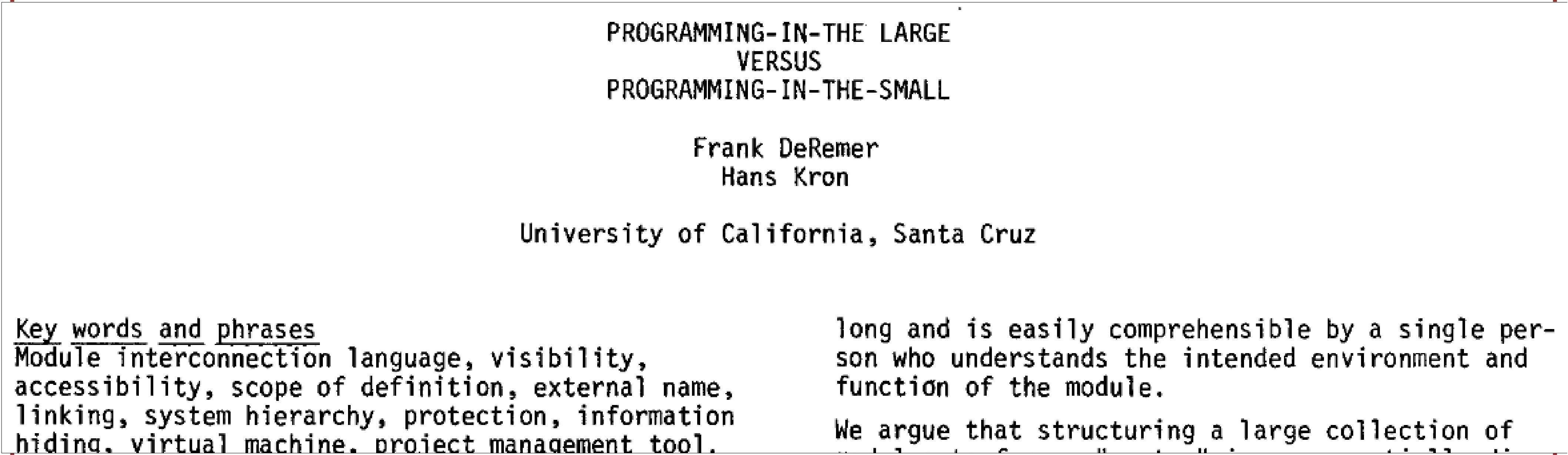
Large Scale Restructuring

Nicolas Anquetil

Motivation

- Large scale “refactoring”
  - Once in a while, systems need to be completely redesigned
  - e.g. Apparition of internet, cloud, tablets
  - New business opportunity

Programming in the large vs in the small



PROGRAMMING-IN-THE LARGE
VERSUS
PROGRAMMING-IN-THE-SMALL

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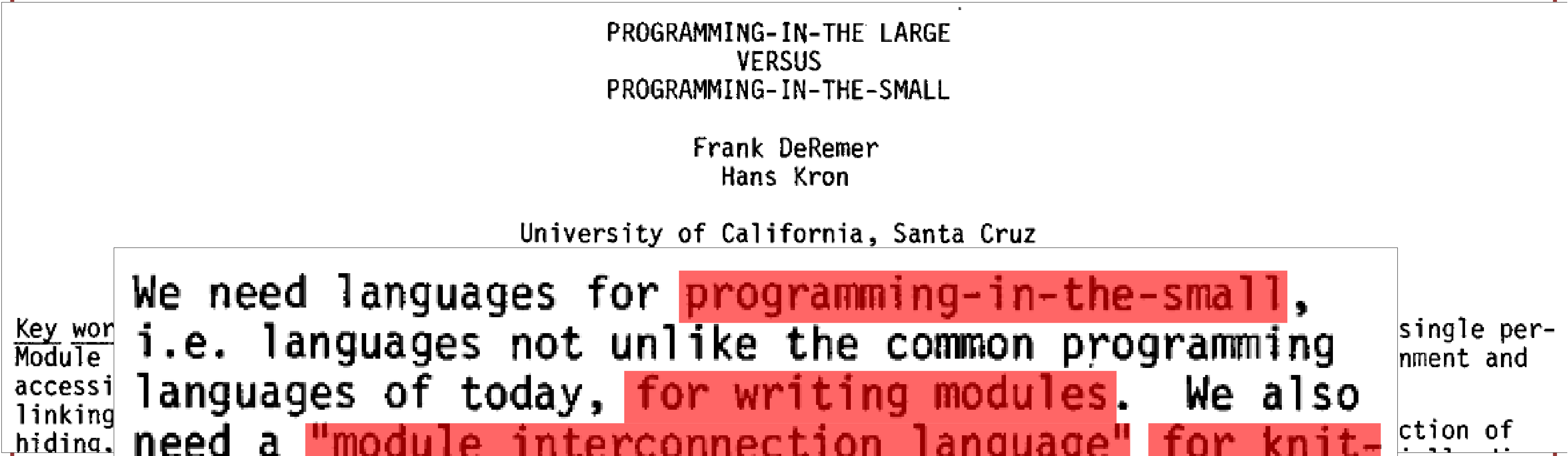
Key words and phrases
Module interconnection language, visibility, accessibility, scope of definition, external name, linking, system hierarchy, protection, information hiding, virtual machine, project management tool,

long and is easily comprehensible by a single person who understands the intended environment and function of the module.

We argue that structuring a large collection of

F.DeRemer, H.Kron, "Programming-in-the-Large versus Programming-in-the-small", ACM SIGPLAN Notices, Volume 10, Issue 6, June 1975

Programming in the large vs in the small



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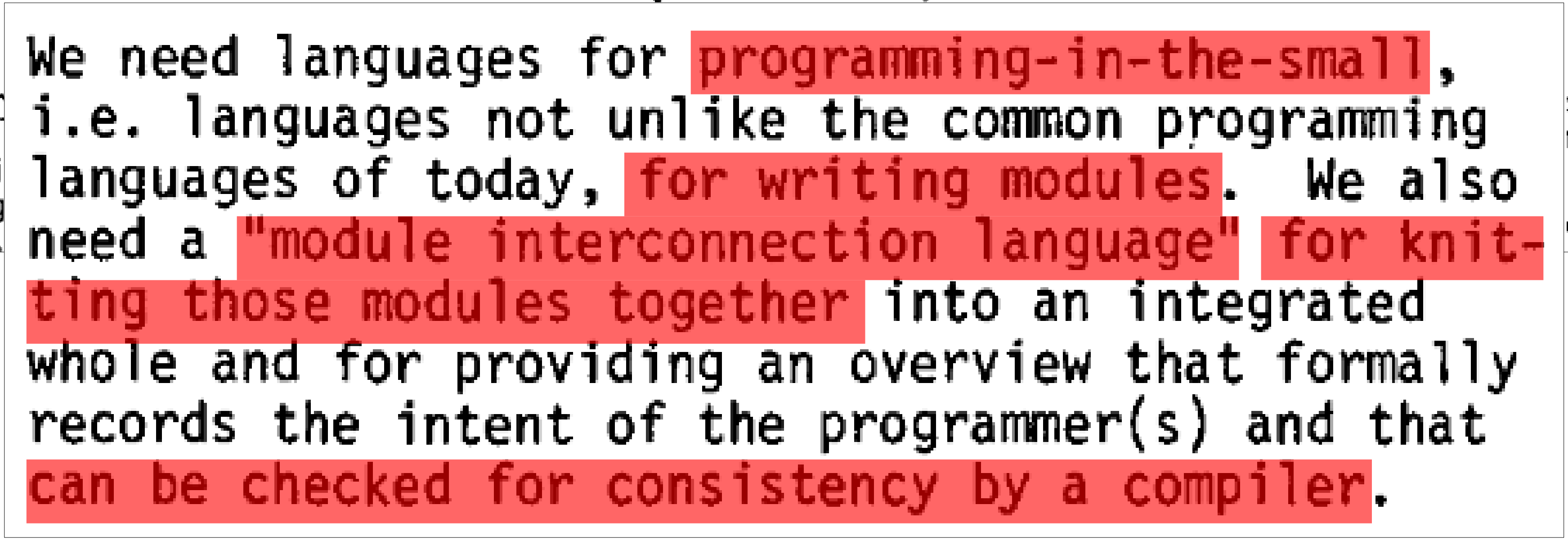


We need languages for programming-in-the-small, i.e. languages not unlike the common programming languages of today, for writing modules. We also need a "module interconnection language" for knitting those modules together into an integrated whole and for providing an overview that formally records the intent of the programmer(s) and that can be checked for consistency by a compiler.

Refactoring in the large vs in the small

- Current IDEs offer refactorings in the small, at the level of single entities (class, method, variable)
  - Rename
  - Move
  - Extract
  - ...

Refactoring in the large vs in the small

- We want "refactoring" tools in the large
  - At the level of system, or multi-entities
  - Rename in batch
  - Move several entities to create a new module
  - Extract a (small) class from a big one
  - Complex "refactorings" involving various steps
  - ...

Large scale “refactorings”

G. Santos, A. Etien, N. Anquetil, S. Ducasse, M.T. Valente. “Recording and Replaying System Specific, Source Code Transformations”. SCAM 2015

- Help programmers perform systematic code transformations

"Refactoring" with macros

- PackageManager 0.58 → 0.59

Applied **19** times

```
- platform
- package addPlatformRequirement: #'pharo'.
- package addProvision: #'Grease-Core-Platform'
```

```
+ platformRequirements
+     ^ #( #'pharo' )
+ provisions
+     ^ #( #'Grease-Core-Platform' )
```

```
- platform
- package addPlatformRequirement: #'pharo2.x'.
- package addProvision: #'Seaside-Canvas-Platform'
```

```
+ platformRequirements
+     ^ #( #'pharo2.x' )
+ provisions
+     ^ #( #'Seaside-Canvas-Platform' )
```

“Refactoring” with macros

- Problems:
  - Complex
  - Tedious
  - Error prone
- Proposition:
  - Manually perform the changes once + record
  - Generalize the recorded changes
  - Replay the changes in other locations

Large scale “refactorings”

- Refactoring + intelligent follow-up
  - Refactoring in-the-small
  - + additional checks on the system:
    - Did you notice that … ?
    - Would you like to also … ?

System restructuring (1)

B. Govin (Thales)

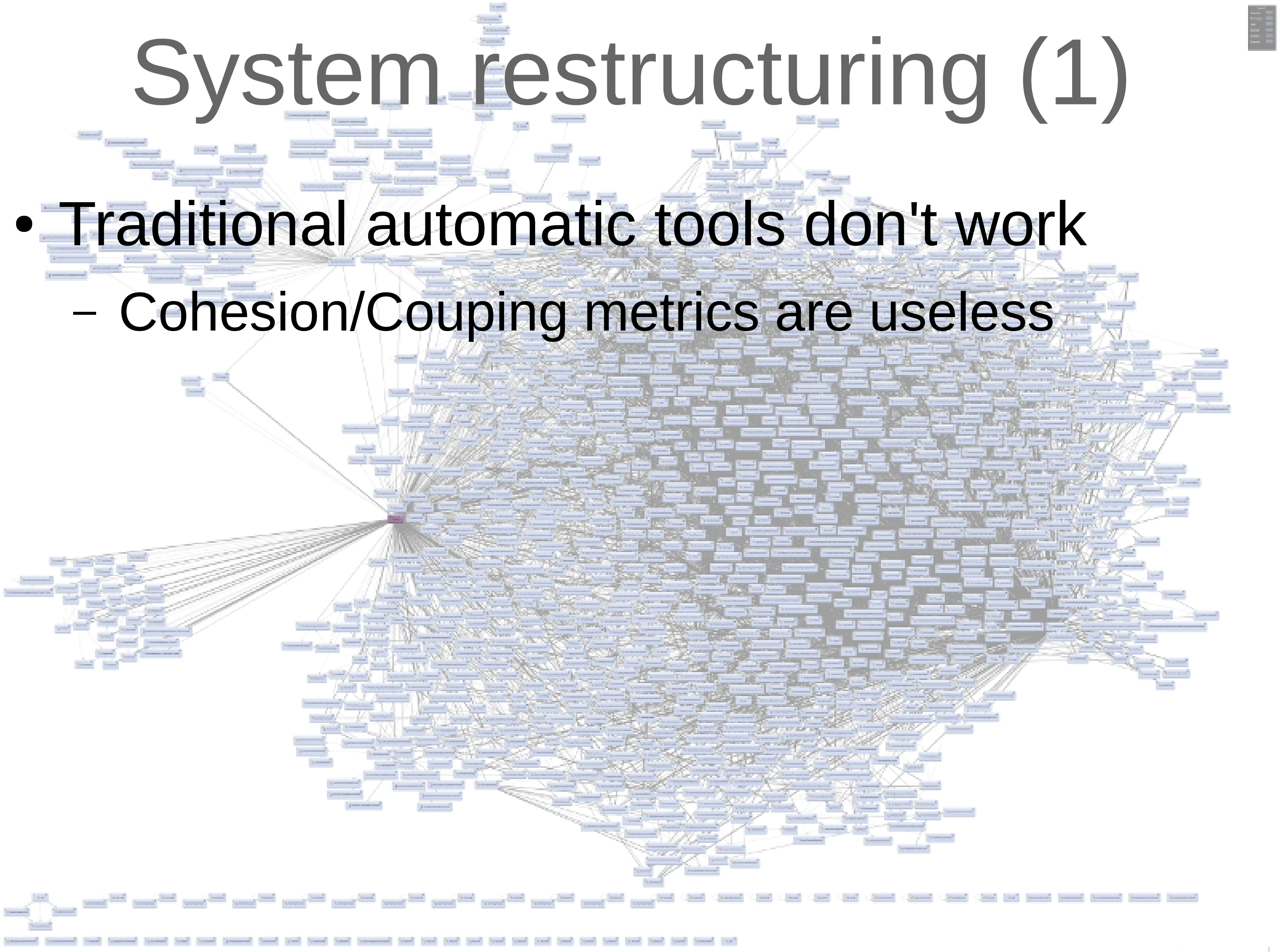
- Help programmers re-define the architecture of a system
- Extract component software architecture from a real time, embedded system

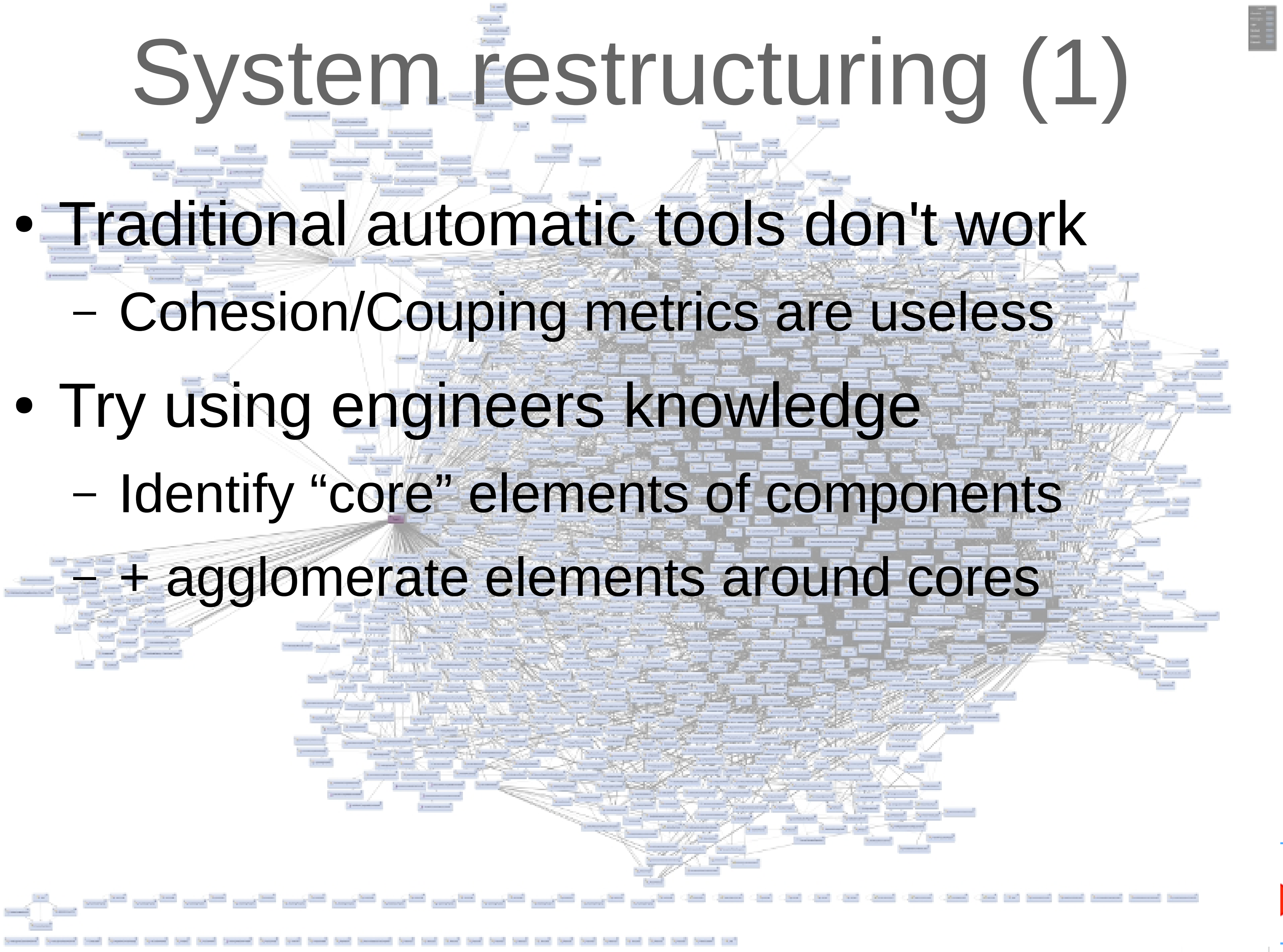
System restructuring (1)

- Help programmers re-define the architecture of a system
  - Process and tools to help engineers
  - Work at all levels:
    from packages to individual function calls

System restructuring (1)

- Traditional automatic tools don't work
  - Cohesion/Couping metrics are useless





System restructuring (1)

- Traditional automatic tools don't work
  - Cohesion/Couping metrics are useless
- Try using engineers knowledge
  - Identify “core” elements of components
  - + agglomerate elements around cores

RMod

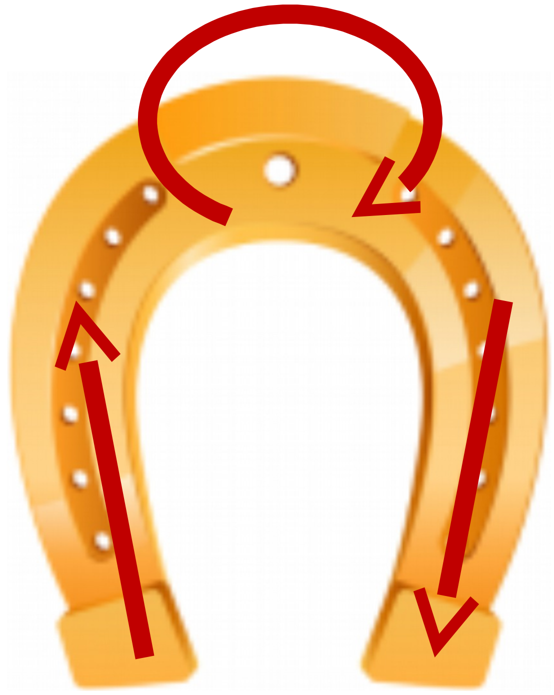
System restructuring (2)

G. Santos, N. Anquetil, A. Etien, S. Ducasse, M.T. Valente. “OrionPlanning: Improving Modularization and Checking Consistency on Software Architecture”. VISOFT 2015

- Help programmers restructure the architecture of a system

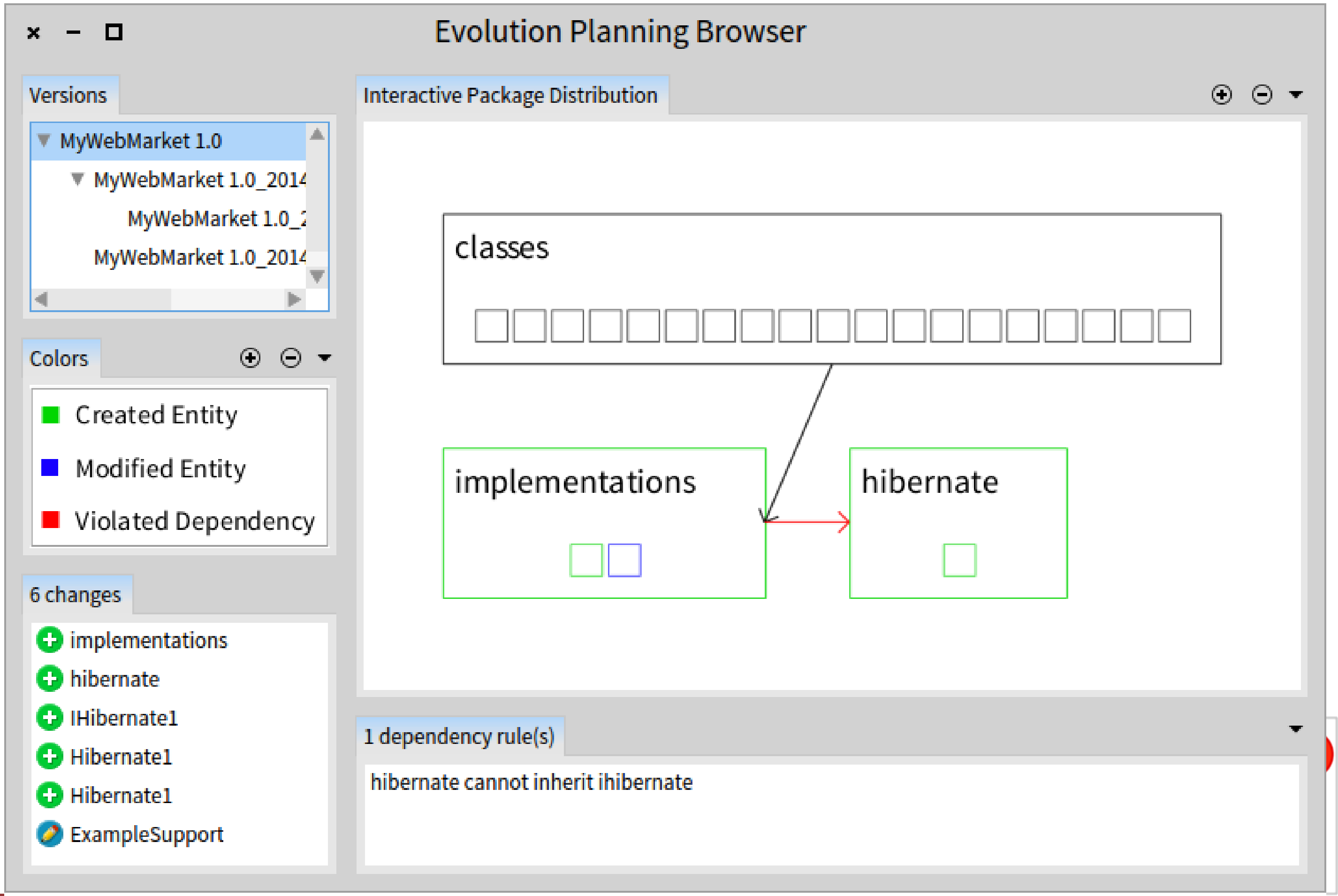
System restructuring (2)

- Horseshoe approach:
  - From source code to model
  - Work on the model
  - Propagate changes back to the code



System restructuring (2)

- Orion planner
  - Define wished architecture
  - Try things
  - Check validity


Evolution Planning Browser

Versions
- MyWebMarket 1.0
  - MyWebMarket 1.0_2014
    - MyWebMarket 1.0_2
  - MyWebMarket 1.0_2014

Colors
- 🟩 Created Entity
- 🟦 Modified Entity
- 🟥 Violated Dependency

6 changes
- implementations
- hibernate
- IHibernate1
- Hibernate1
- Hibernate1
- ExampleSupport

Interactive Package Distribution

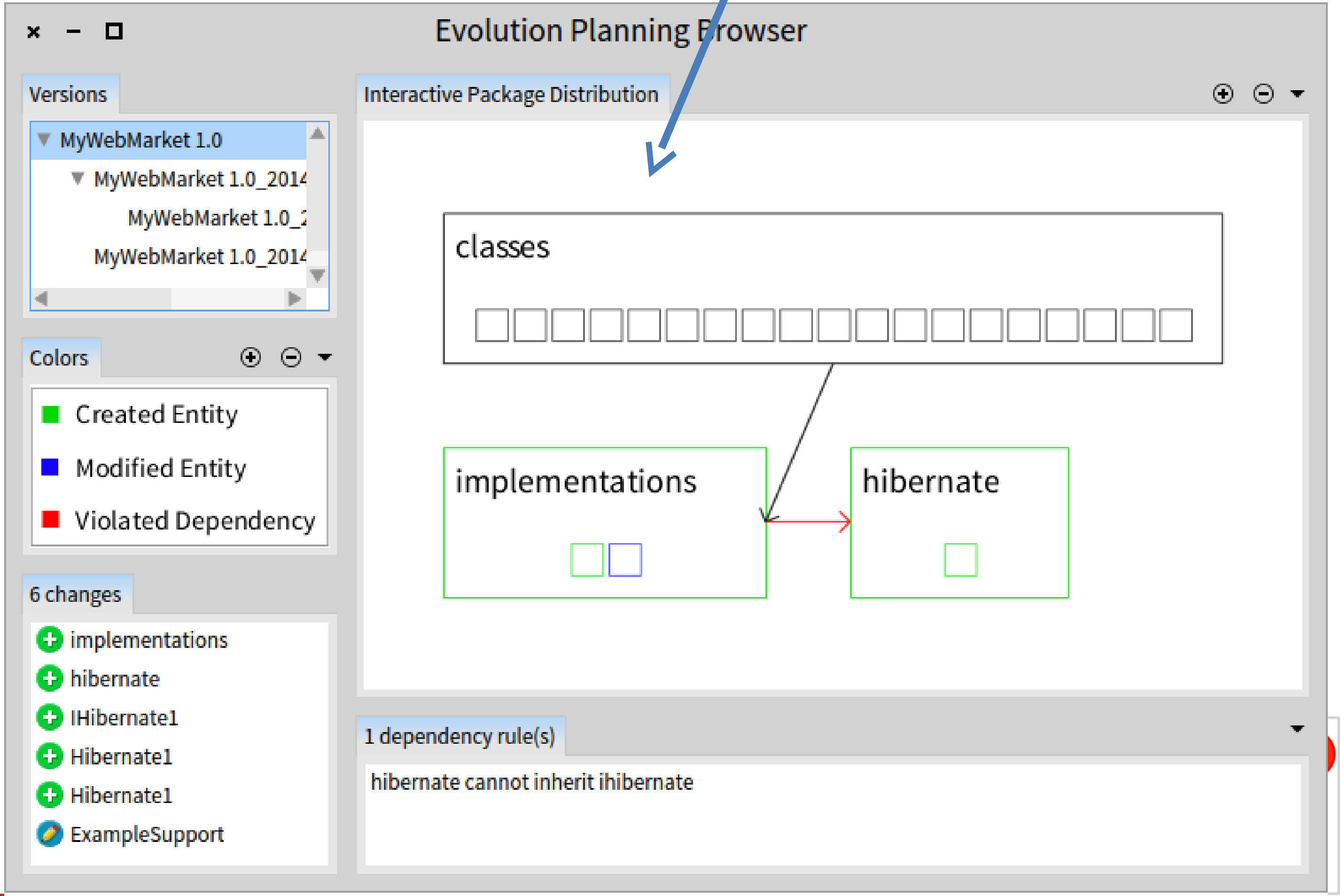
1 dependency rule(s)

hibernate cannot inherit ihibernate

System restructuring (2)

- Orion planner
  - Define wished architecture
  - Try things

Model of the system (architecture) editable



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System restructuring (2)

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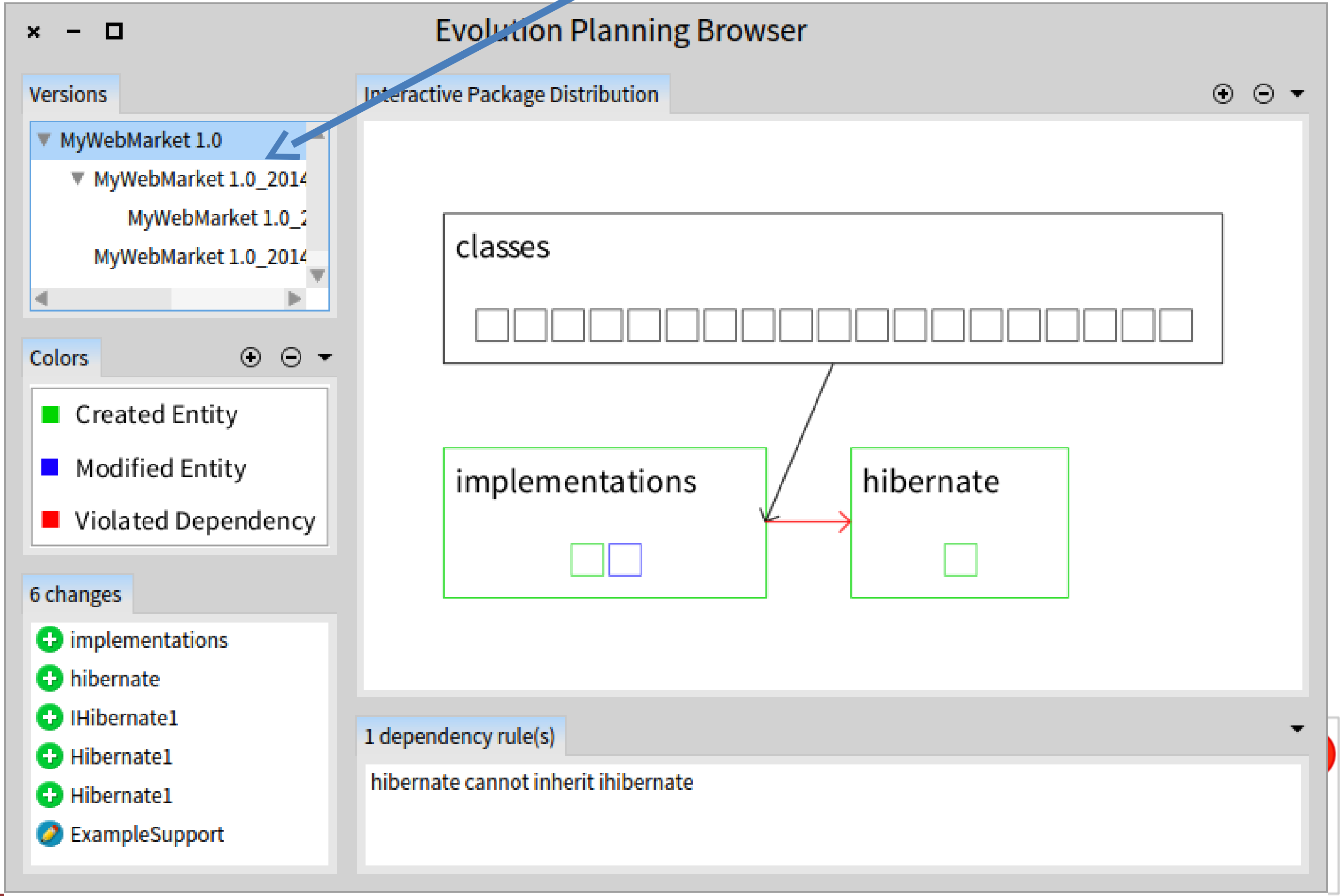
  - Try things

Versions of model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System restructuring (2)

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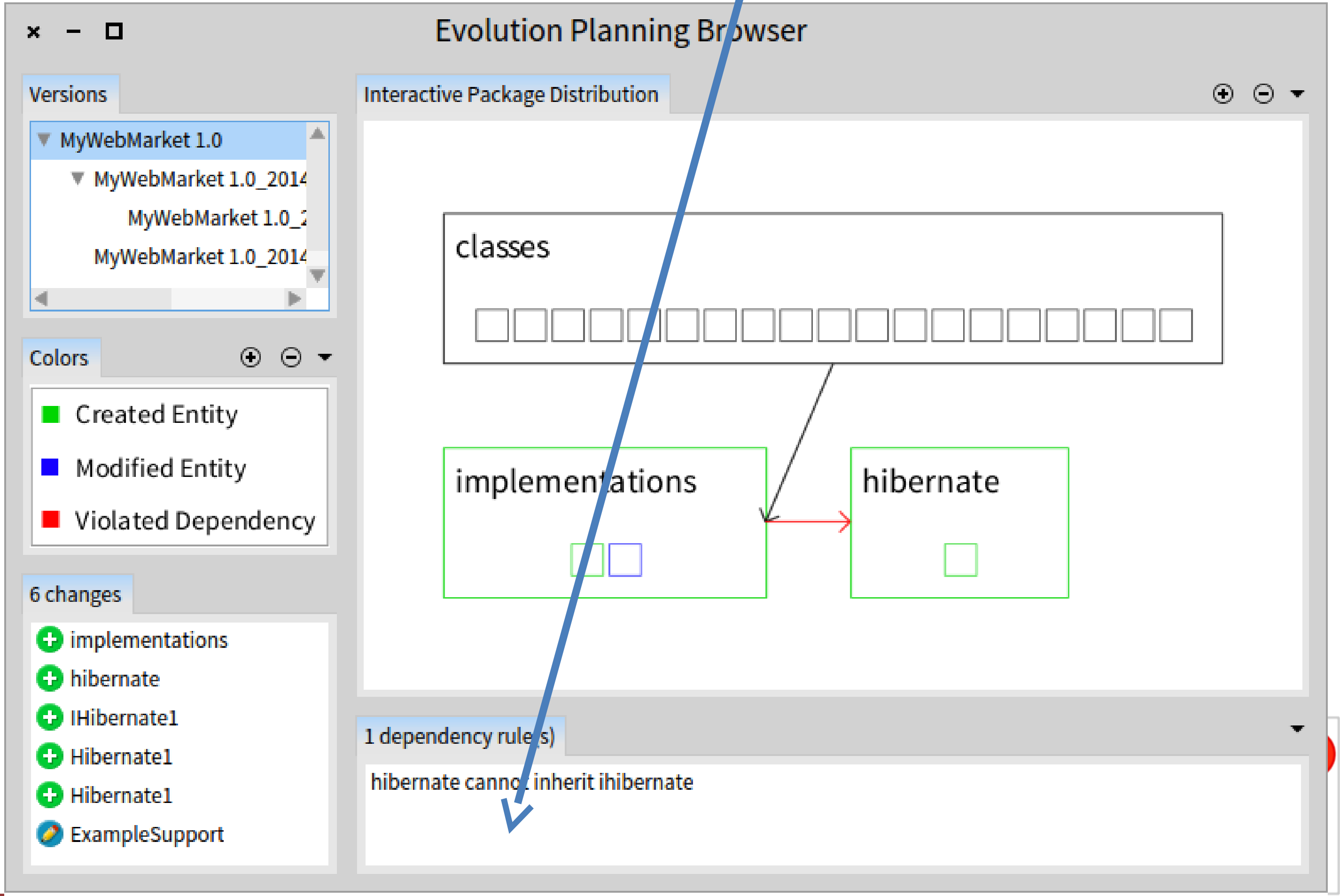
Validation (architectural rules)



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System restructuring (2)

- Still missing: “Do-it” button