

# Architecture Compliance Checking of Semantically Rich Modular Architectures: A Comparative Study of Tool Support

Leo Pruijt, Christian Köppe HU Universtity of Applied Science Sjaak Brinkkemper University Utrecht

Utrecht, Netherlands

## Architecture Compliance Checking (ACC) of Semantically Rich Modular Architectures



- ACC verifies the conformance of implemented program code to highlevel models of architectural design
  - Accurate tool support is required
- Static ACC focuses on the modular architecture
  - Modular elements
  - Their Form
    - Properties & Relationships
- A Semantically Rich Modular Architecture (SRMA) is expressive
  - Modules of semantically different types
  - Constrained by rules of different types

Interaction Layer

HiWeb
HiWebApp
HiForms
HF-Kiosk

HiPanels
HP-Kiosk

HiPanels
HiManager
HiManager
HiManager
HimImp
HidInterface

Technology Layer

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## Agenda



- 1. Research Question
- 2. Method & Tools
- 3. Classification
- 4. Result Summary
- 5. Conclusion & Recommendations
- 6. Questions

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#### **Research Question**



Do static ACC-tools provide functional support for semantically rich modular architectures?



- Do ACC-tools provide support for:
  - a) Common types of modules and their semantics
    - E.g.: Are layers supported?
  - b) Common types of rules
    - E.g.: Are the rules of a layered architecture supported?
  - c) Inconsistency prevention within the architecture?
    - E.g.: Is it possible to define contradictory rules?

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#### **Method & Tools**



- Classification of common module & rule types
- Development of benchmark test
  - Test script + custom Java code
  - Available on request
- Testing of eight ACC-tools with our benchmark test
  - Explicit support: Matching with expected result
  - Partial support: Possible via workaround/interpretation
  - No support

ACC-Tool	Paid	Category	
Macker		Text based	
Sonar ARE		Text based	
dTangler		DSM	
Lattix	√	DSM	
ConQAT		Reflexion Model	
SAVE	√	Reflexion Model	
Sonargraph	√	Position based	
Structure101	√	Position based	

#### Classification of common ...



#### **Module Types**

- Physical cluster
- Logical cluster
- Layer
- Component
- Facade
- External system

#### Rule Types

- Property rule types
  - Naming convention
  - Responsibility convention
  - Visibility convention
  - Facade convention
  - Inheritance convention
- Relation rule types
  - Is not allowed to use
    - Back call ban
    - Skip call ban
  - Is allowed to use
    - Is only allowed to use
    - Is the only module allowed to use
    - Must use

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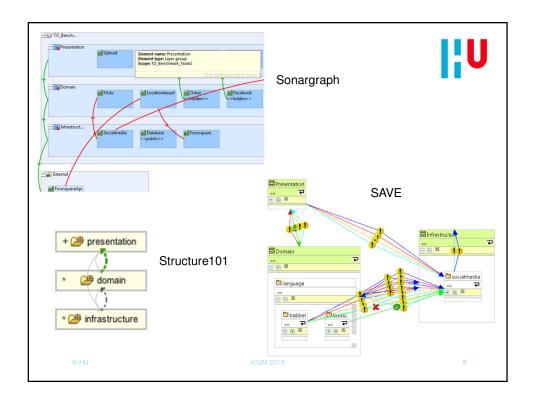
### Result Summary – Support of Semantically Rich Module Types



ACC-Tool	Layer	Component & Facade	External System
Macker			
Sonar ARE			
dTangler			
Lattix			
ConQAT			
SAVE	+	+	
Sonargraph	+	++	+
Structure101	++		

+ = Distinct Type; ++ = Distinct Type + Support of the Semantics of the Type

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# Result Summary – Support of Rule Types



- Property Rule Types
  - Explicit support: Facade convention (only Sonargraph)
  - Furthermore, very limited or no support
- Relation Rule Types
  - Explicit support for simple rule types:
    - Is not allowed to use, Is allowed to use (most tools)
    - Back call ban, Skip call ban (only Structure101)
    - Must use (only SAVE)
  - Only partial support for complex rule types:
    - Is only allowed to use
    - Is the only module allowed to use
    - Exception

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#### Result Summary – Prevention of Inconsistencies



- Most tools allow inconsistenties, like
  - A module with several parents
  - A module not mapped to existing code
  - Contradictory rules
- High scores: ConQAT, Lattix
- Low scores: dTangler, Macker, Sonar ARE

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#### **Conclusion & Recommendations**

- The eight tools provide useful support for ACC, but all could improve their support of SRMAs!
- Reduce the gap between the modular architecture in an SAD and the module-and-rule model in an ACC-tool
- Provide support, for:
  - Semantically rich module types
  - Complex, logical rule types
  - Transparent and consistent rule sets
- More-complete functional support of SRMAs might improve
  - The practice of ACC
  - The effectiveness of software architecture in practice

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#### Questions



- More information:
  - In the paper
  - Ask me: Leo Pruijt, leo.pruijt@hu.nl
- Thank you for your attention!
- Questions?

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