INProVE

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CONTENT
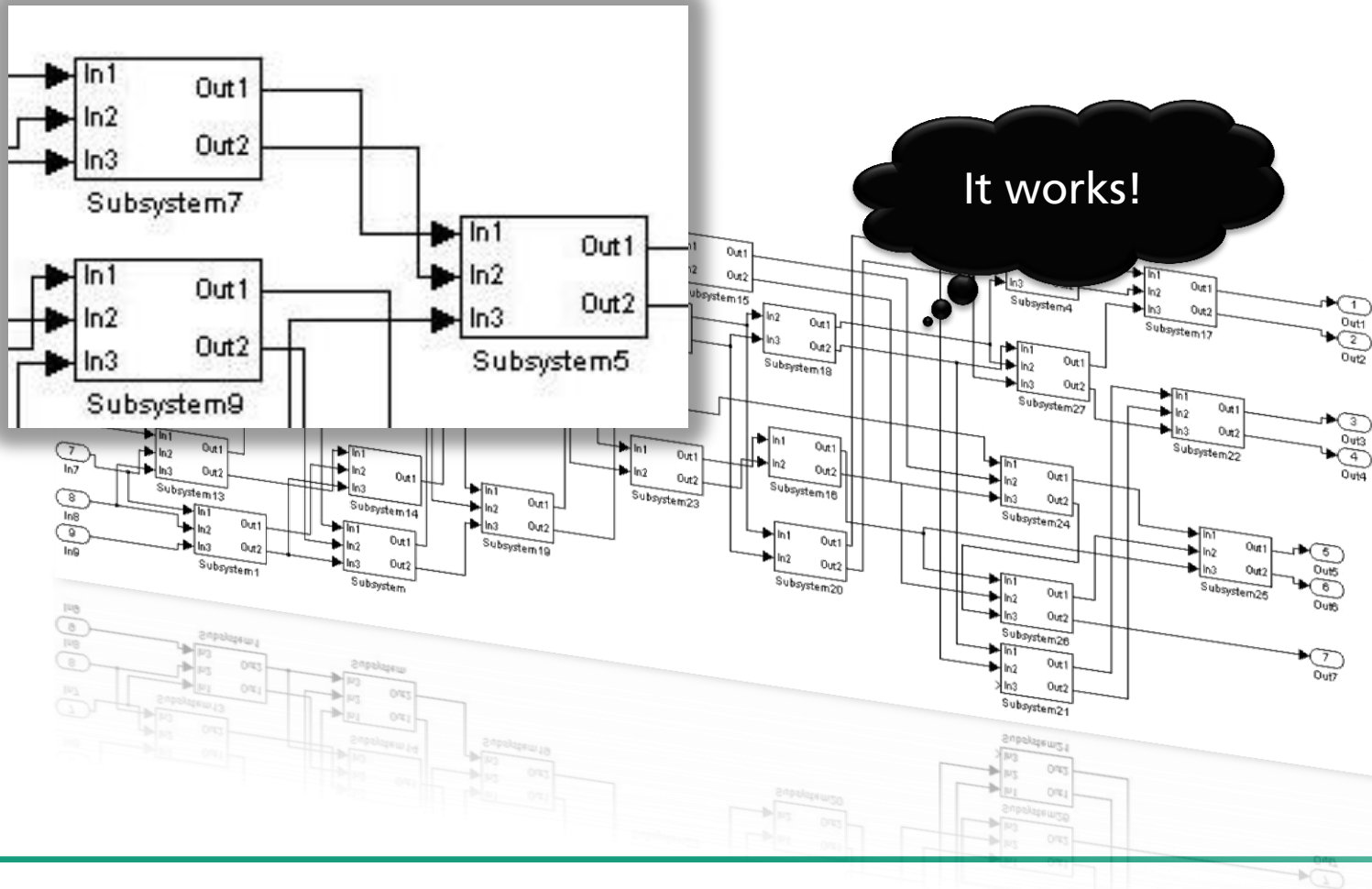
- Motivation

- Concept

- Indicators

- Example

- Conclusion

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Motivation

It works!

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Motivation

- Model quality is imperative
  - What is model quality?

- Functional correctness
  - No quality metric in our sense

- Model quality complements functional correctness
  - Maintainability, extensibility, compliance…
  - Hidden behind functional correctness
  - Affects functional correctness of future iterations

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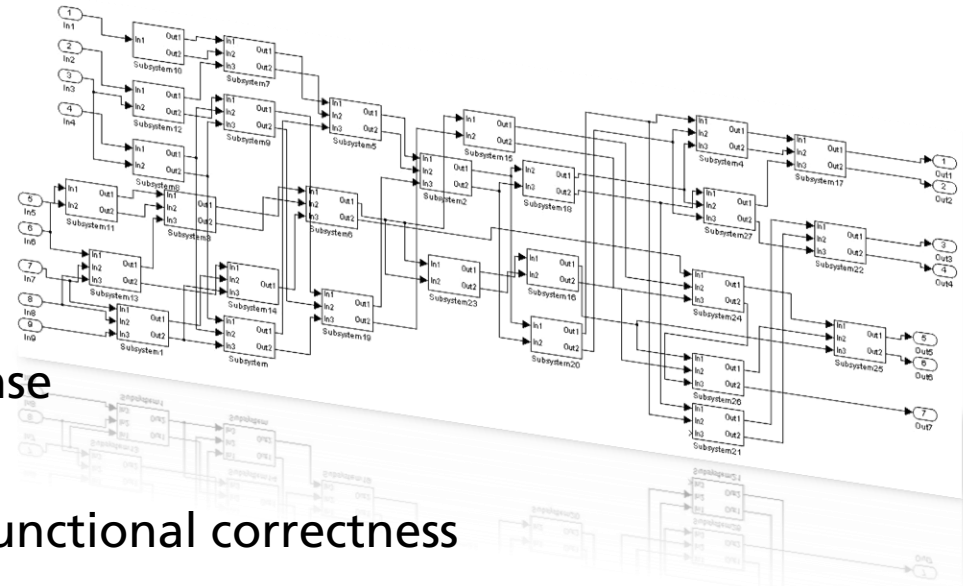
Motivation

- How to measure model quality?
  - Components should be self-contained and focused

- Generic metrics
  - Interface size, coupling, cohesion
  - Absence of pass connections

- Drawback
  - Blurry
  - Metrics do not really fit
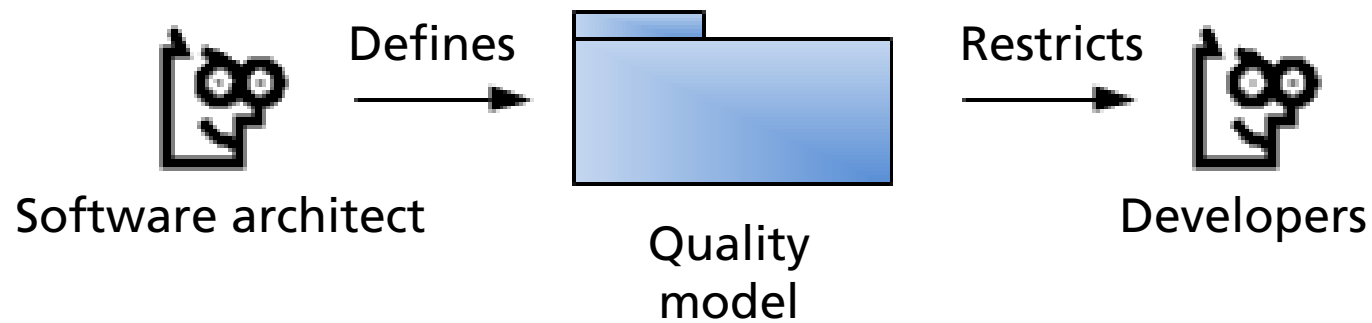 - Limited use

Motivation

- Customer specific quality attributes
  - ESP must communicate over defined interfaces only
  - Islands in motor control software models are not permitted
    - Those in ABS are okay and necessary
  - Interface size of block x should not exceed 10 input ports
  - Functions x and y must be realized in two independent components

- Tailored quality requirements
  - Domain requirements
  - Customer requirements
  - Requirements of modeling language

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Motivation

- Model quality is imperative

- Tailored quality metrics are more important than generic ones
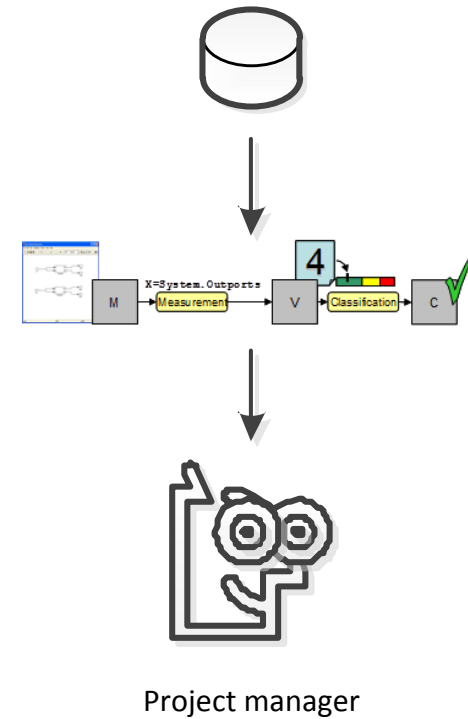
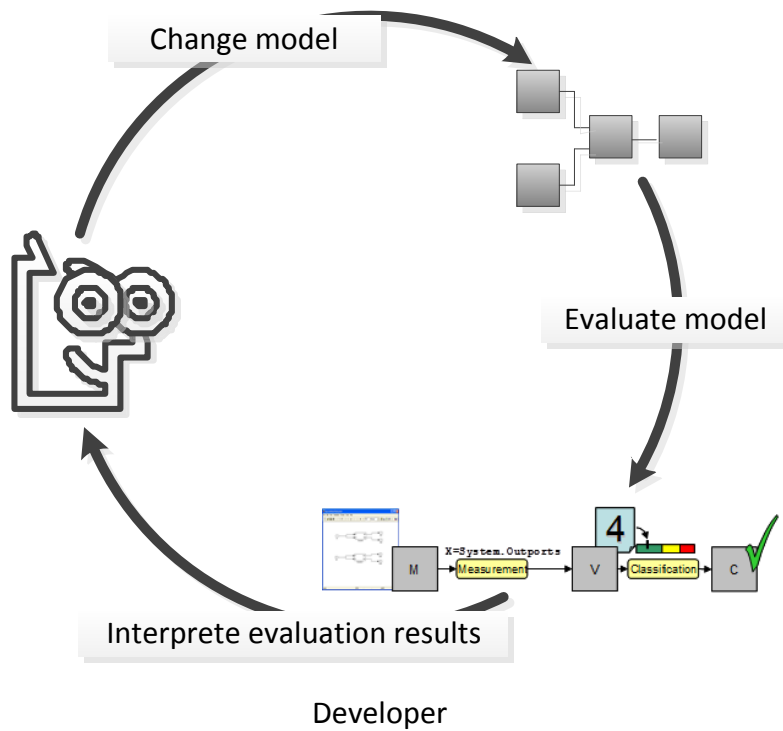- Need to support multiple modeling languages
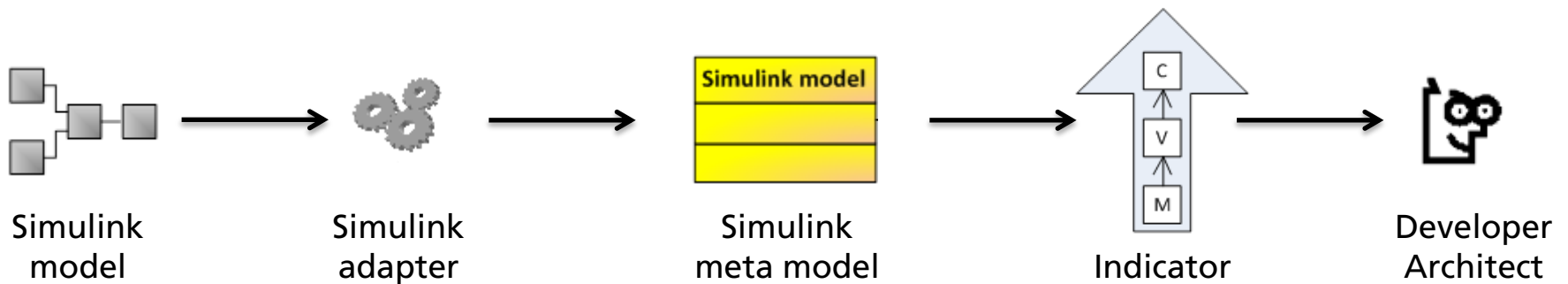
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Concept

- INProVE approach

Concept

■ INProVE approach

Concept

- INProVE concept

| Adapter | Parse Model | Meta model | Common data structure | Measure | Evaluate quality attribue | Visualize | Visualize results |

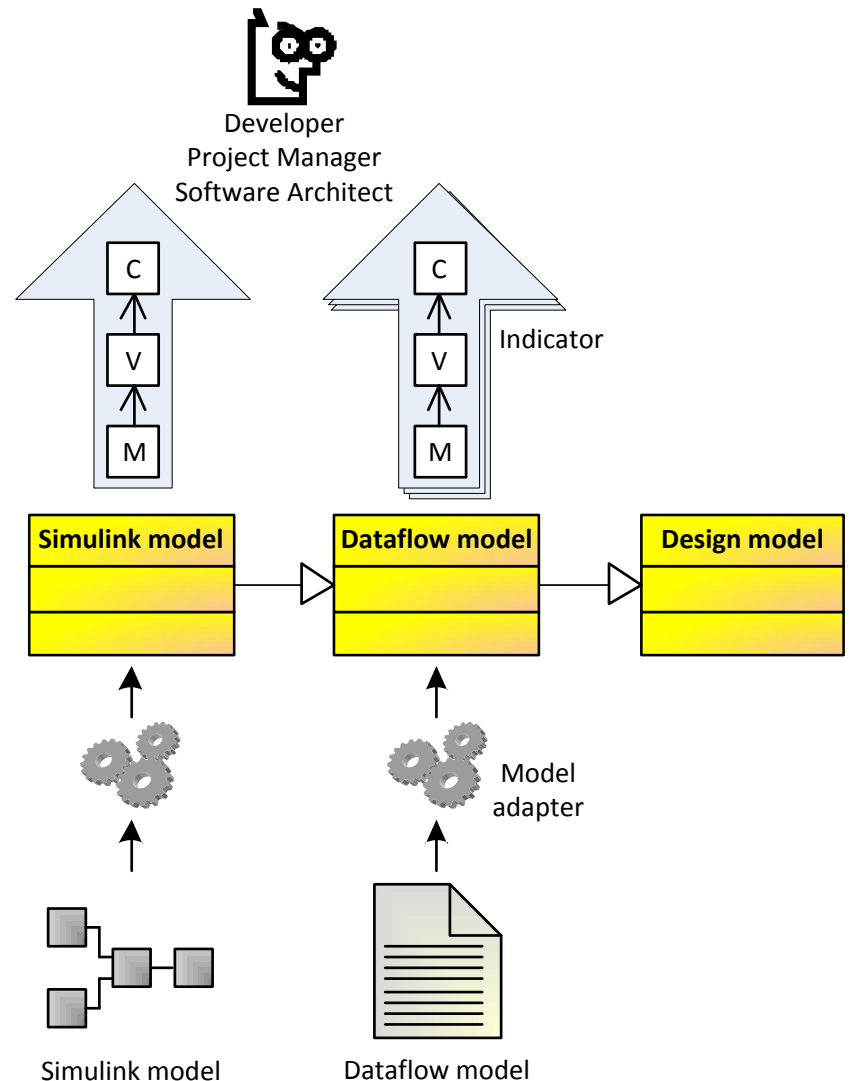Simulink model → Simulink adapter → Simulink meta model → Indicator → Developer Architect
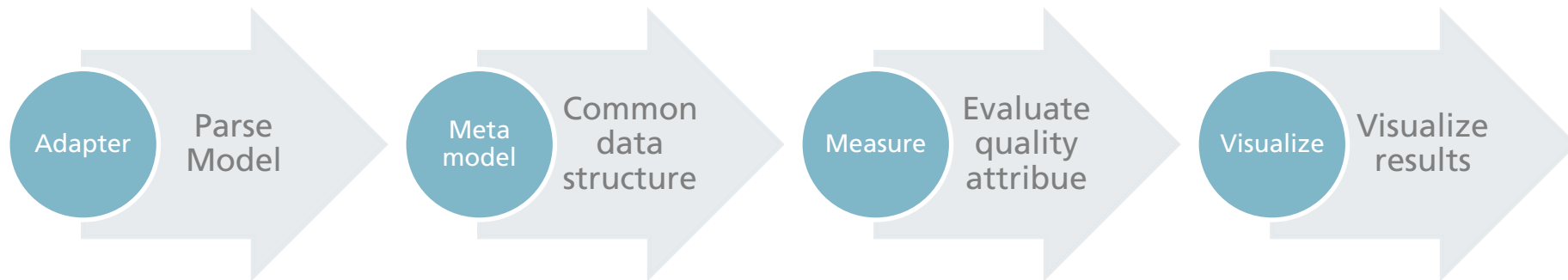
Concept

- INProVE adapters
  - Integrate modeling languages
  - Re-use meta models
  - Re-use indicators

- Example
  - Simulink & ASCET share concepts
  - Common domain indicators
  - Common generic meta model
  - Optional specializations

Developer
Project Manager
Software Architect

Indicator

Simulink model

Dataflow model

Design model

Model adapter

Simulink model

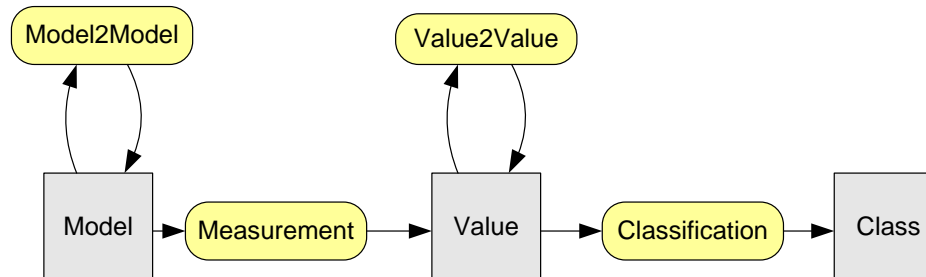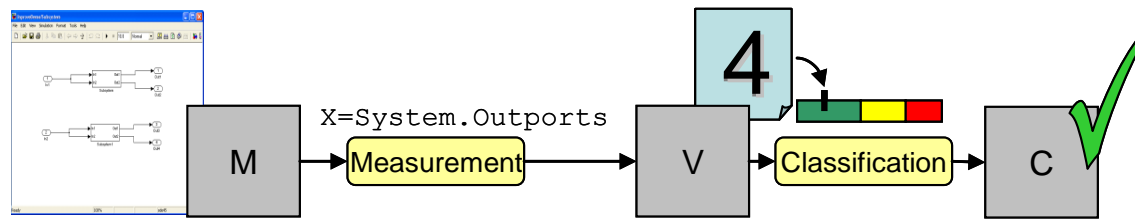Dataflow model

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Indicators

- How to capture quality knowledge?
  - Indicators capture expert knowledge
  - → Make implicit knowledge explicit

- What is a good way to define indicators?
  - Expert interviews yielded
    - Examples
    - Counter examples
    - Fuzzy rules
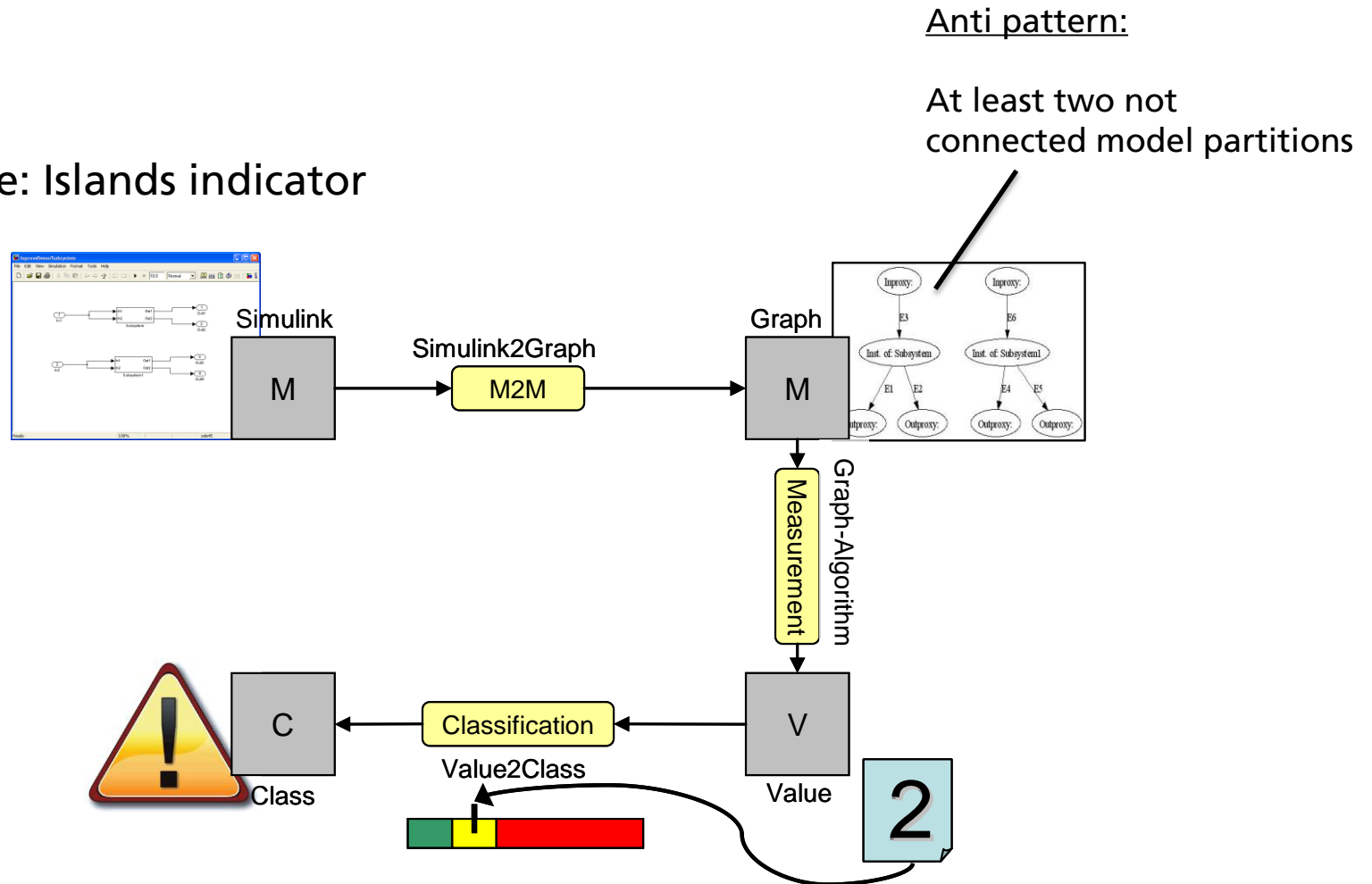   - Re-use of more basic indicators

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Indicators

- Basic indicator pipeline

Indicators

At least two not connected model partitions

■ Example: Islands indicator

Simulink

Simulink2Graph

M2M

Graph

M

Measurement

Graph-Algorithm

Classification

Value2Class

Class

C

V

Value

2

Indicators
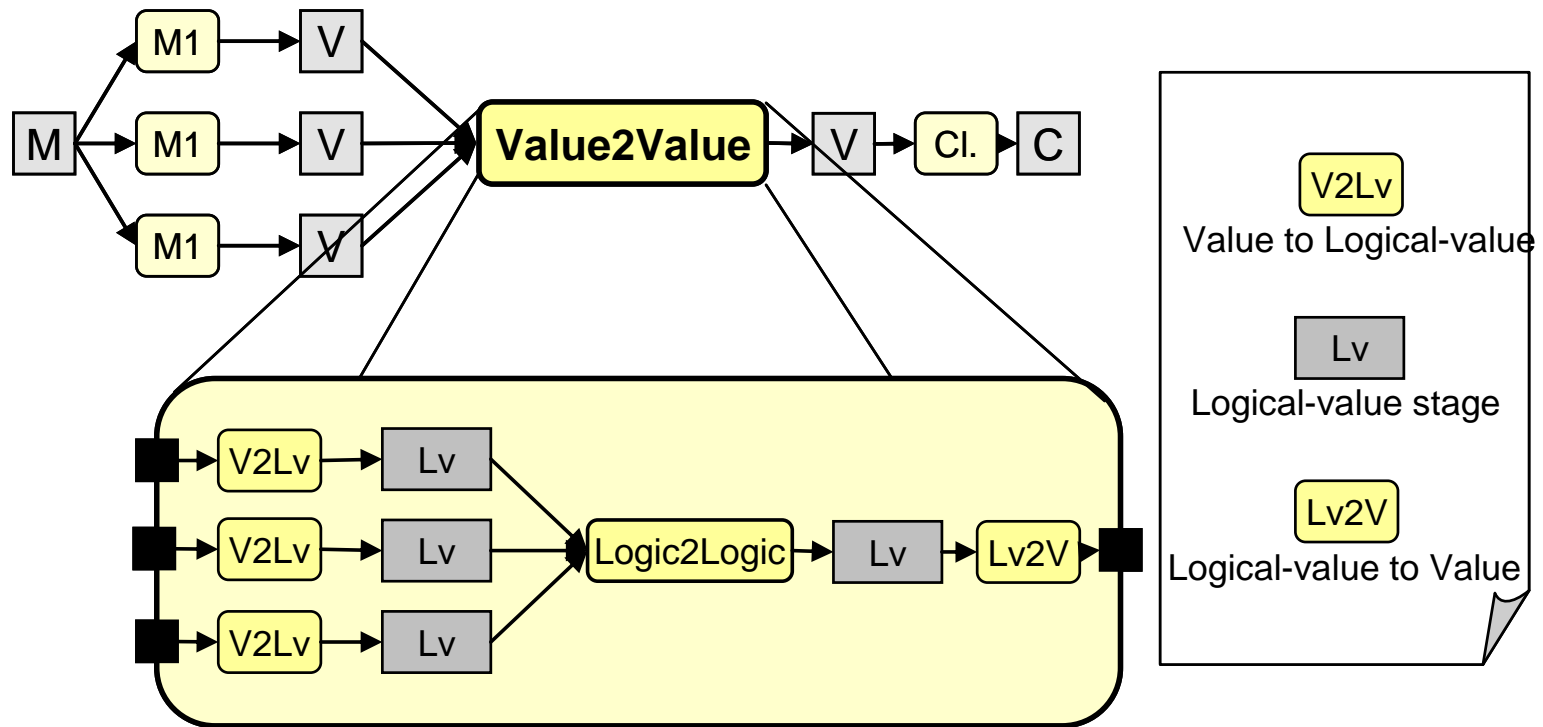
- Indicator definition
  - Define patterns, anti-patterns in design language
  - Define patterns, anti-patterns in DSL
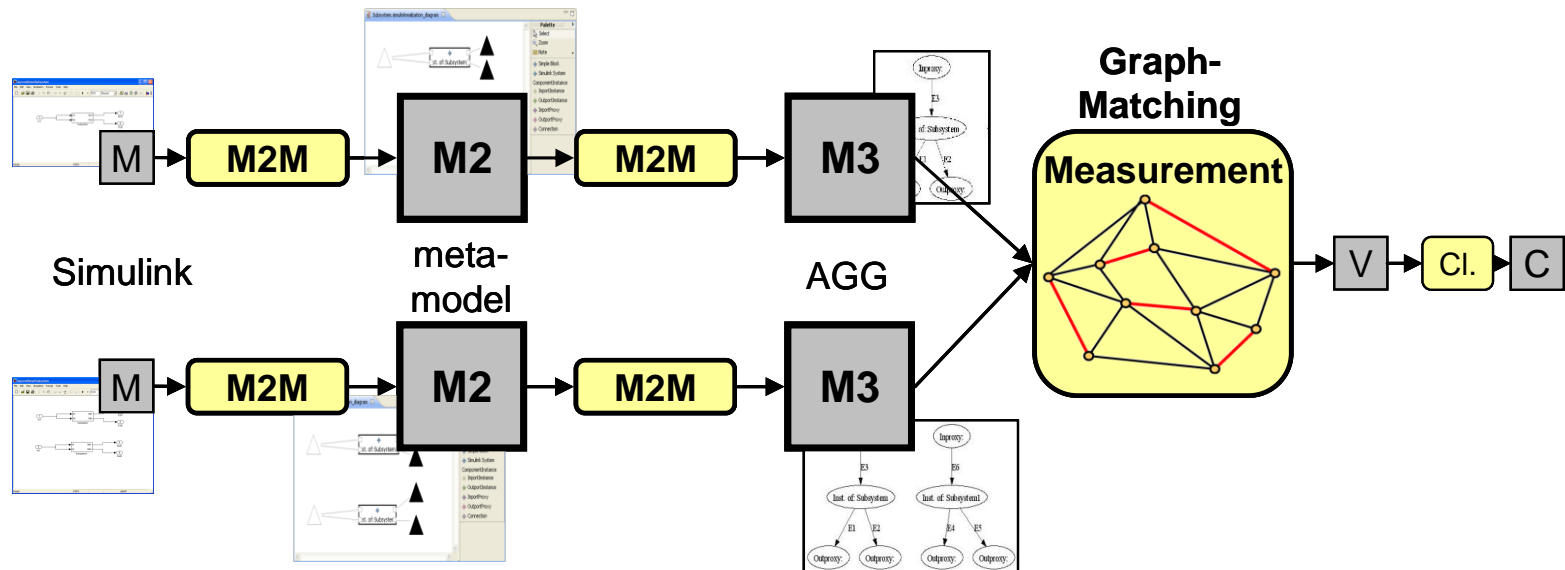
Indicators
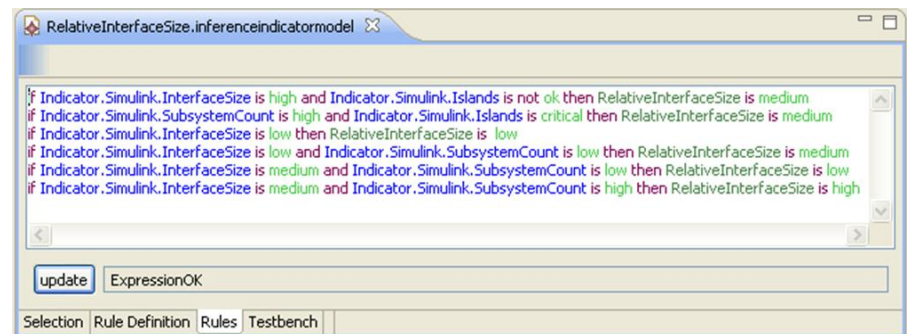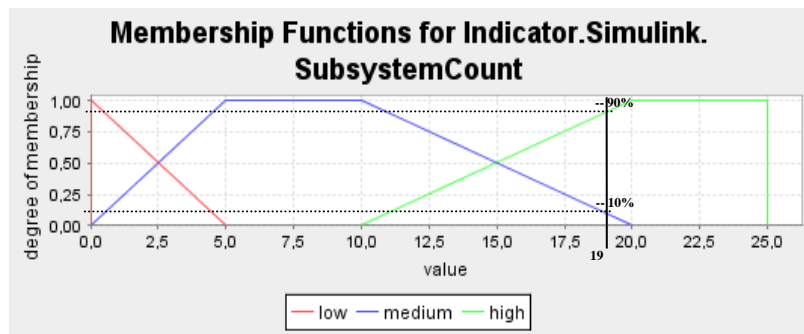
■ Integrate logic based decisions in indicators
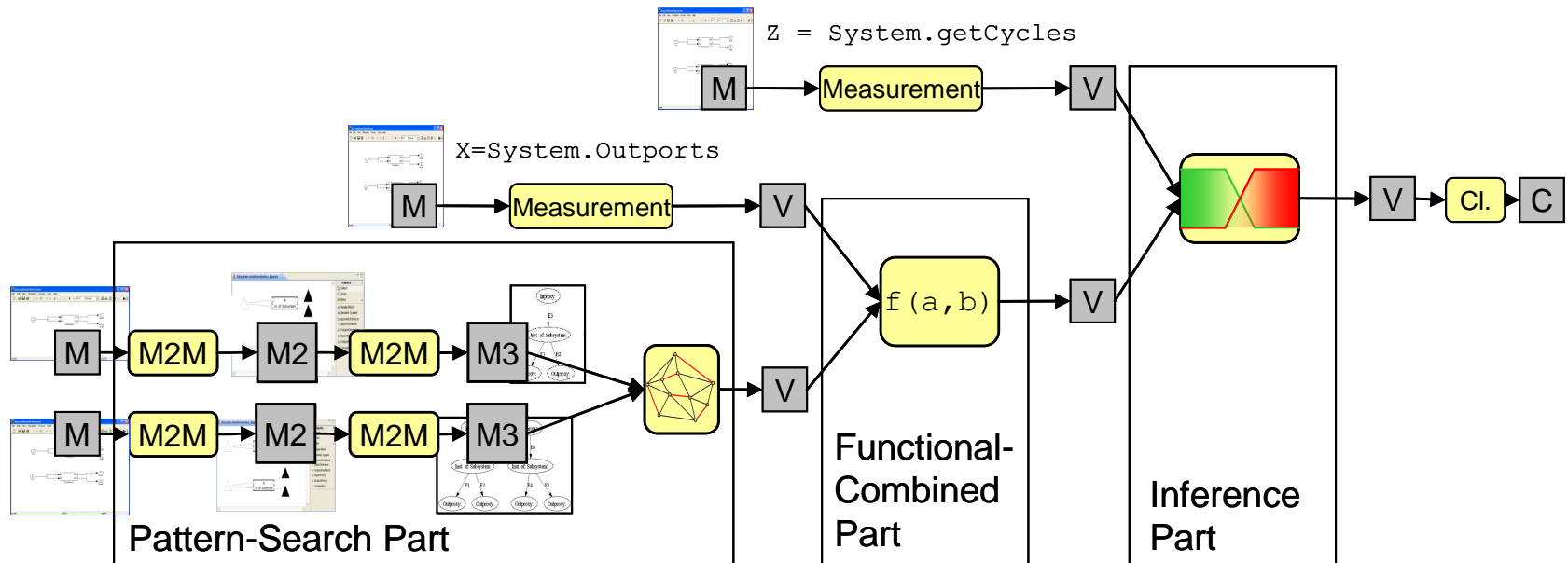
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Indicators

- Integrate fuzzy logic into indicator pipeline

    - Sharp decisions not always productive

    - Fuzzy logic represents human evaluation principles

    - Intuitive for software architects

Indicators

- Combine basic indicators into advanced indicators

Indicators

- Indicator definition

  - Indicator pipeline

  - Graph matiching

  - Logic operations

  - Fuzzy operations

  - Indicator aggregation and combination

INProVE - Example

- Example
  - Simulink
  - 3000 hierarchical subsystems
  - 2 hours analysis time
  - Only few false positives
  - System was high quality
  - Traces quality over time
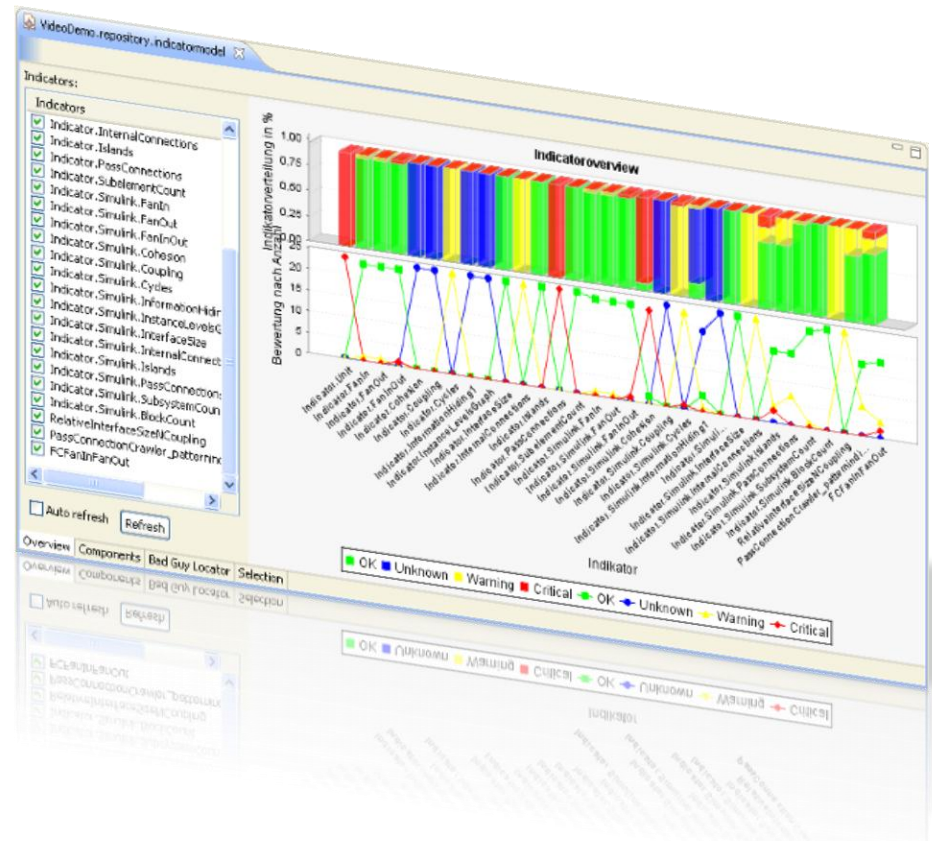
Conclusion

- Address model quality complementary to correctness
  - Customer and domain specific attributes
  - Multiple modeling languages

- INProVE
  - Adapters
  - Meta model
  - Indicators
  - Visualization

- Indicators
  - Pipeline
  - Model transformation, graph matching, logics, fuzzy logic, combination

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