Requirements – Quo Vadis?

Southampton, July 17th 2009

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Topics

- Overview
- Approaches and Ideas
- What has been done
- Next Steps / Planned Research

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Requirements Considerations

- Goal vs. Requirement
- Problem vs. Solution
- Functional vs. Non-Functional
- Safety vs. Liveness
- Problem Domain vs. Environment

Objective

- Build the right thing!
- Improve Communication (with Stakeholders)
- Establish Traceability for...
  - Quality
  - Verification
  - Validation
  - Change Management
  - Variants
  - much more...

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Approaches

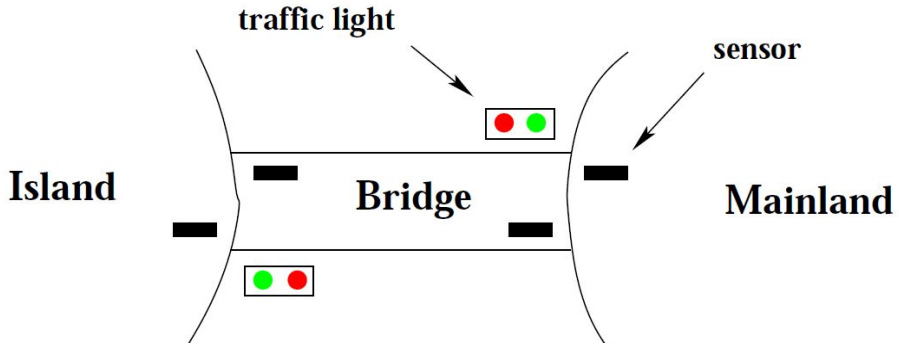
- Abrial-Method
-
- Problem Frames
-
- Natural-Language Requirements
- KAOS
- (there are more!)

Abrial-Approach

These sensors are supposed to detect the presence of cars intending to enter or leave the bridge. There are four such sensors. Two of them are situated on the bridge and the other two are situated on the mainland and in the island respectively.

The sensors are used to detect the presence of a car entering or leaving the bridge: "on" means that a car is willing to enter the bridge or to leave it	ENV-5

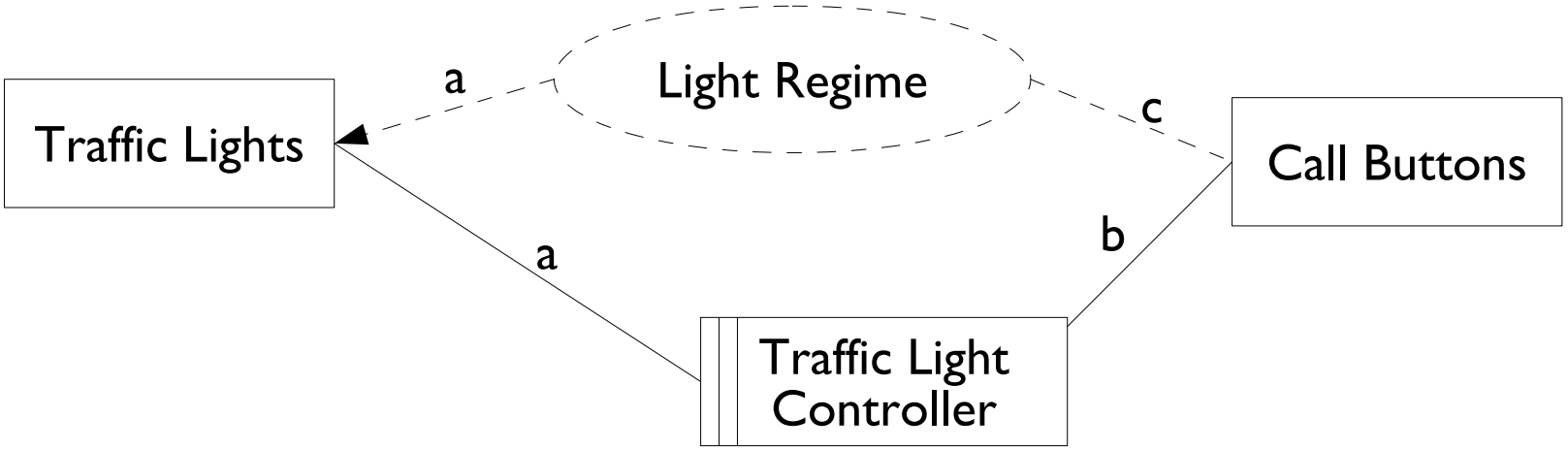
The pieces of equipment which have been described are illustrated in the following figure:



The system has two main additional constraints: the number of cars on the bridge and island is limited

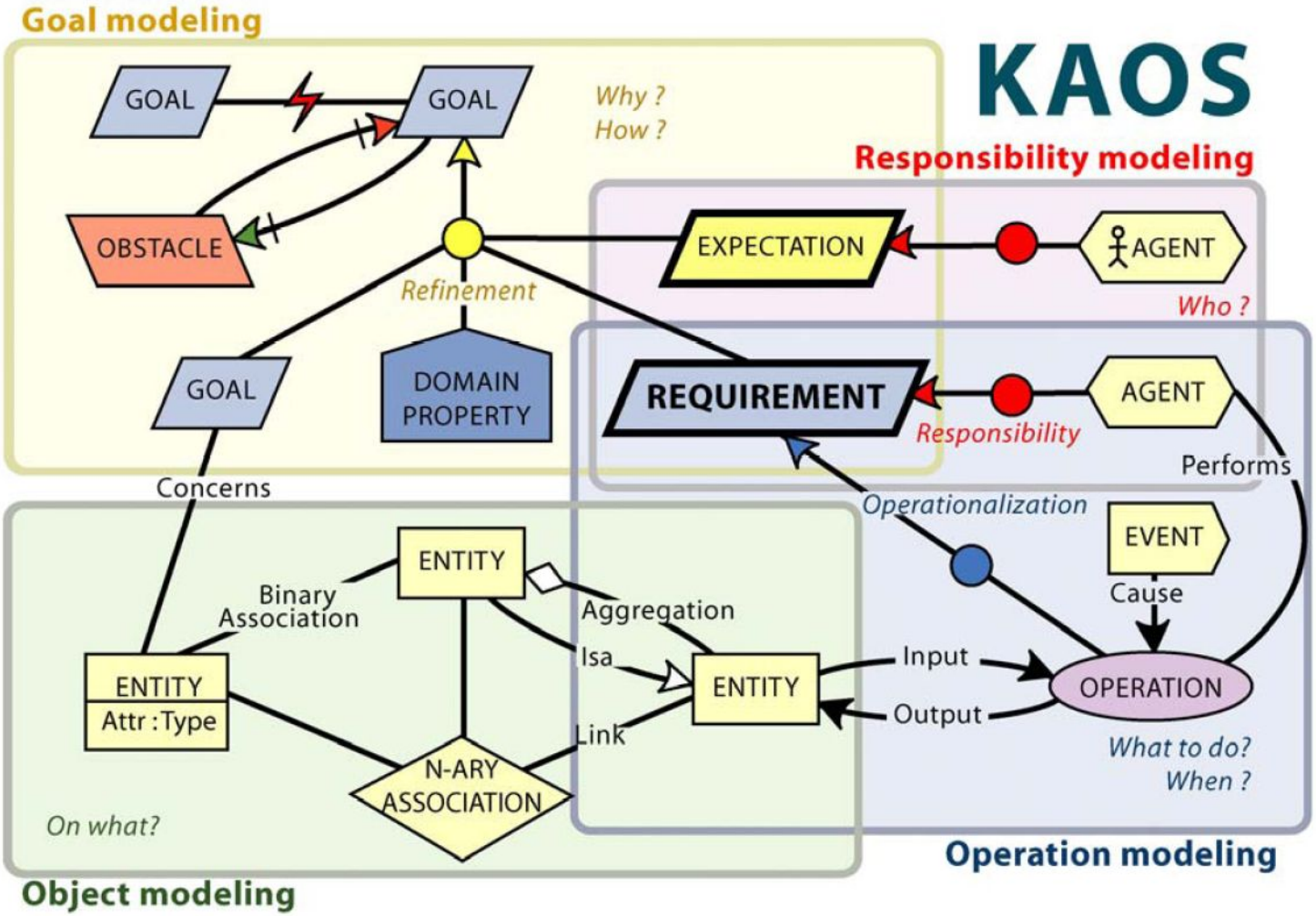
The number of cars on bridge and island is limited	FUN-3

Problem Frame Diagram



a: TL! {pedGo, pedStop, carGo, carStop}
c: CB! {lightRequest}

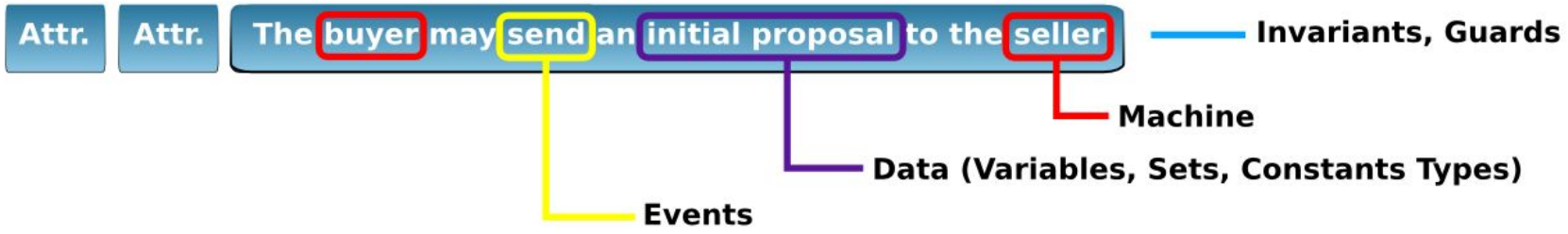
KAOS


Goal modeling
KAOS
GOAL
GOAL
Why ?
How ?
Responsibility modeling
OBSTACLE
EXPECTATION
AGENT
Refinement
Who ?
GOAL
DOMAIN PROPERTY
REQUIREMENT
AGENT
Responsibility
Performs
Concerns
Operationalization
EVENT
ENTITY
Cause
Binary Association
Aggregation
Isa
ENTITY
Input
OPERATION
ENTITY
Attr : Type
Output
Link
What to do?
When ?
N-ARY ASSOCIATION
On what?
Operation modeling
Object modeling

Natural Language Requirements (NLRs)

- (Almost) All Requirements start in Natural Language
- Heavily used in Industry
- (Almost) All Methods still deal with NLRs

Idea: Cross-Cutting through Requirements



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Bosch & Problem Frames

BOSCH

Invented for life

NLR Traceability (1)

- Categorize Requirements:
  - Functional, Safety
  - Functional, Lifeness
  - Environment
  - Non-Functional
- Establish Traceability
  - Invariants
  - UML-B State-Machines
  - LTL-Formulae

NLR Traceability (2)

LIV-9	Upon pressing the call buttons, the car light sequence is initiated until the light is red.

This requirement can be formulated in LTL as follows:

$$G(\{lightRequested = TRUE\} \implies F(\{lightsCars = \{red\}\}))$$

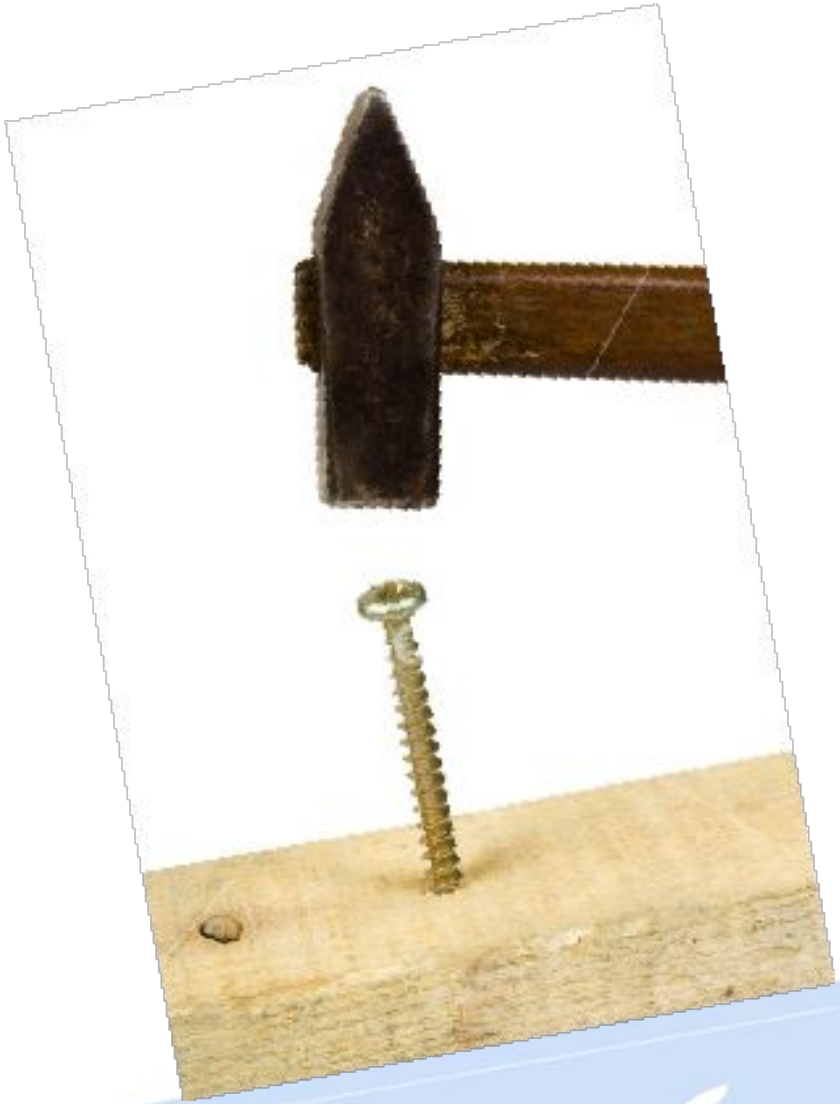
NLR Traceability (3)

- Promising approach, but...
- Heavily relies on “good” requirements
- Works only on Toy-Examples
- Temporal Logic cannot be proven with Rodin (today)
- May be a puzzle-piece for a more complete approach
- More work needed & planned

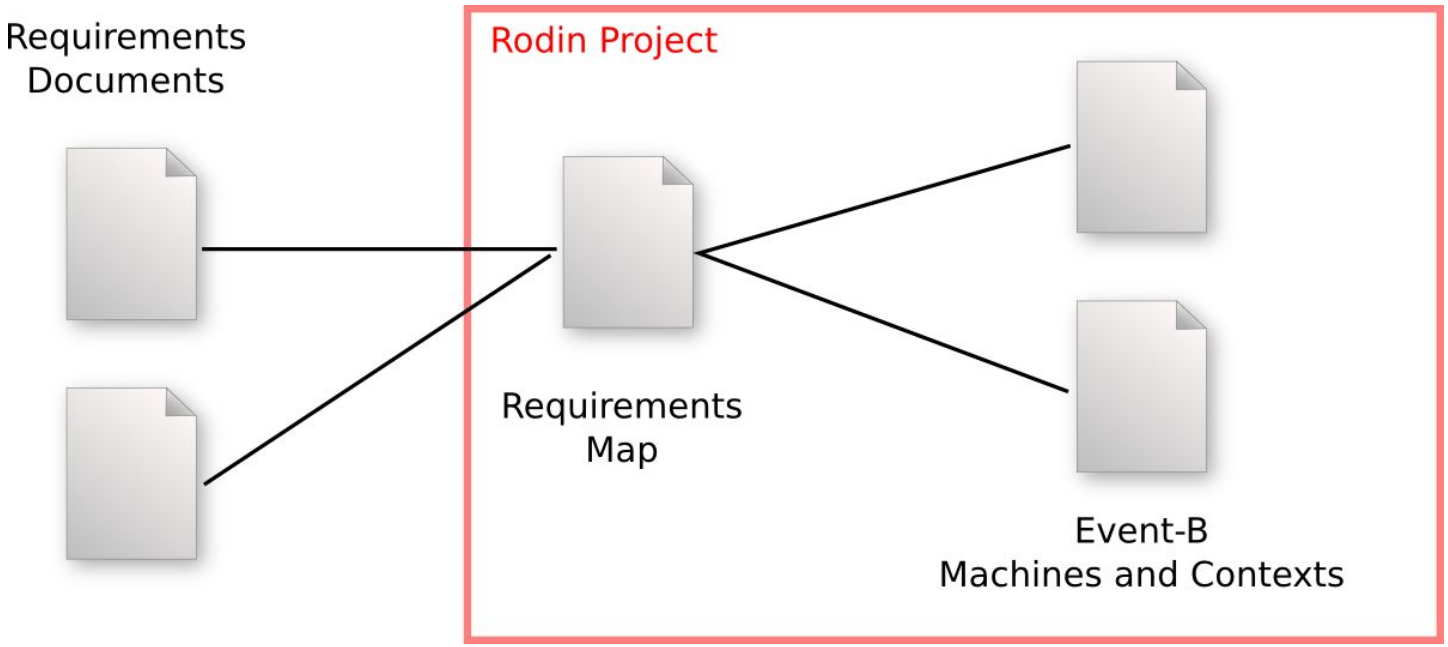
Re-Engineering of Models

- Take a clean Event-B Model
- Convert it to a Specification
- Observe

Tool Support



Rodin RE-Plug-In



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Next Steps / Planned Research

- Keep the whole process in mind ("seamless development")
  - Develop clean NLRs
  - Model
  - Trace
  - Iterate
  - Explore the needs for intermediate constructs
- Problem Frames may help to structure NLRs
- Patterns & Templates may help to establish Traceability
- Tell us your needs!

Conclusion

Thank you