IEEE RCIS 2016

Developing Web applications for different architectures: The MoWebA approach

MAGALI GONZALEZ, LUCA CERNUZZI, NATHALIE AQUINO, OSCAR PASTOR

Department of Electronics and Computer Science
Catholic University "Nuestra Señora de la Asunción"
Asunción, Paraguay

Research Center on Software Production Methods
Universitat Politècnica de València
Valencia, Spain

This work has been partially developed with the support of CONACYT under the project "Mejorando el proceso de desarrollo de software: propuesta basada en MDD" (14-INV-056)

AGENDA

- Introduction and motivation
- MoWebA
  - Modeling and transformation processes
  - Architecture Specific Model (ASM)
  - ASM for Rich Internet Applications (RIA)
- Experiences with the ASM of MoWebA: a preliminary validation
- Final considerations and future works

INTRODUCTION AND MOTIVATION

Technology Evolution

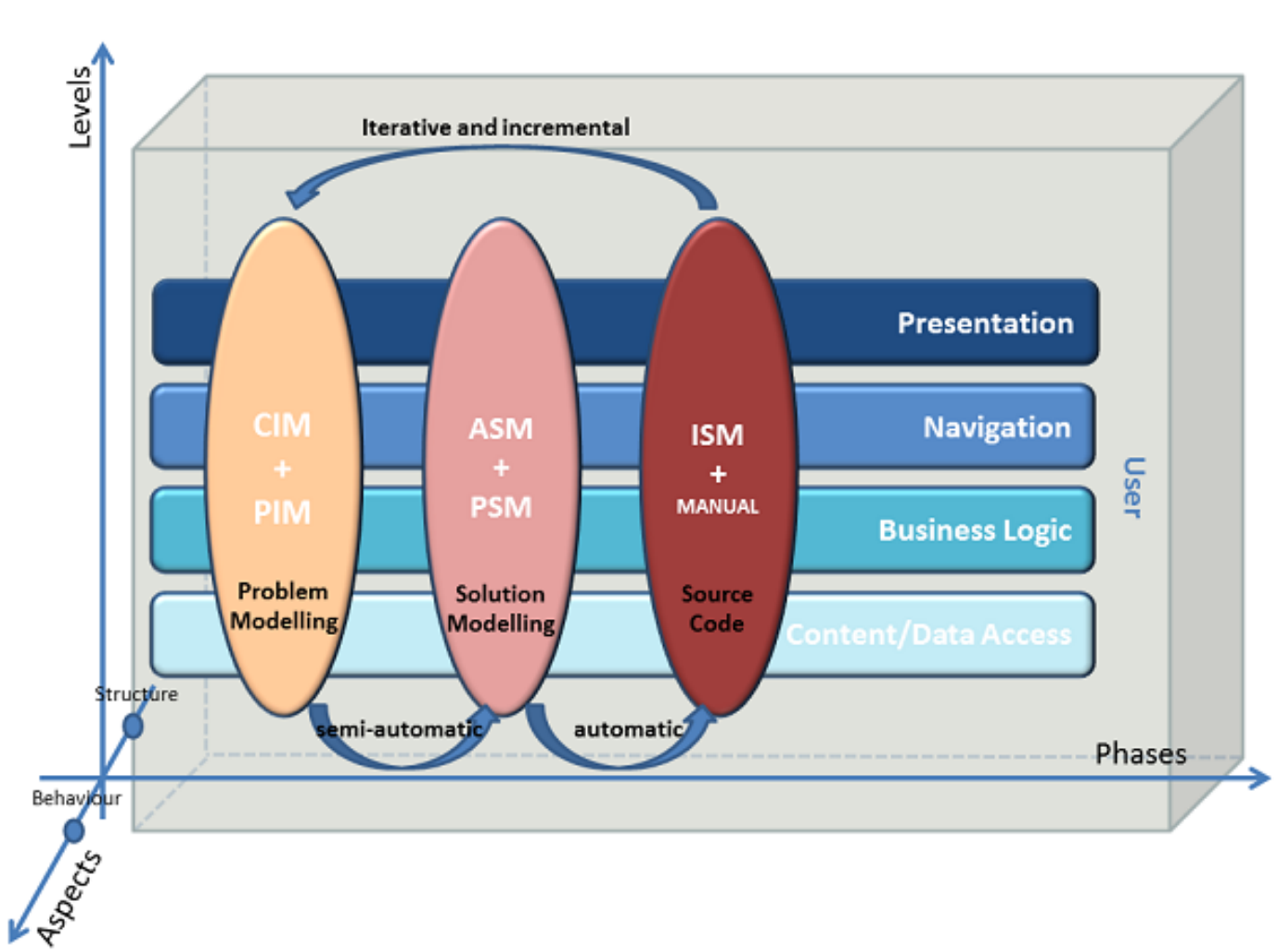
INTRODUCTION AND MOTIVATION

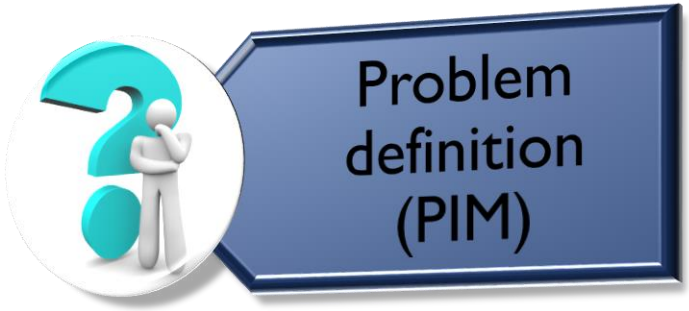
- Evolution in current web applications
  - Coverage of different domains
  - Adoption of different technologies
  - Changes in functional or non-functional requirements
- Web methodologies are dealing with the evolution in different ways

INTRODUCTION AND MOTIVATION

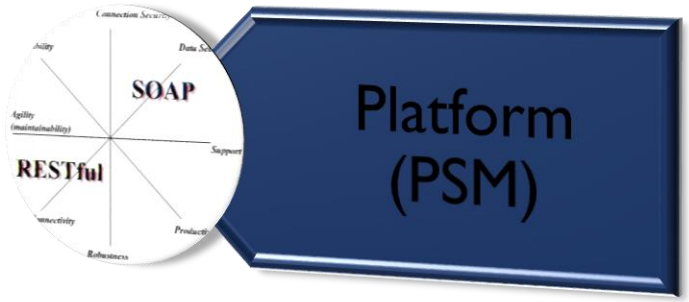
- Model-driven development as a possible way to consider several of these aspects
- Concerns related to model-driven, web engineering methodologies:
  - Platform Independent Models (PIM) are enriched with architectural aspects
    - PIM loses its "independence"
  - The development process starts at an abstraction level in which architectural/platform aspects are taken into account
- Proposed solution
  - MoWebA and its Architecture Specific Model (ASM)

MOWEBA

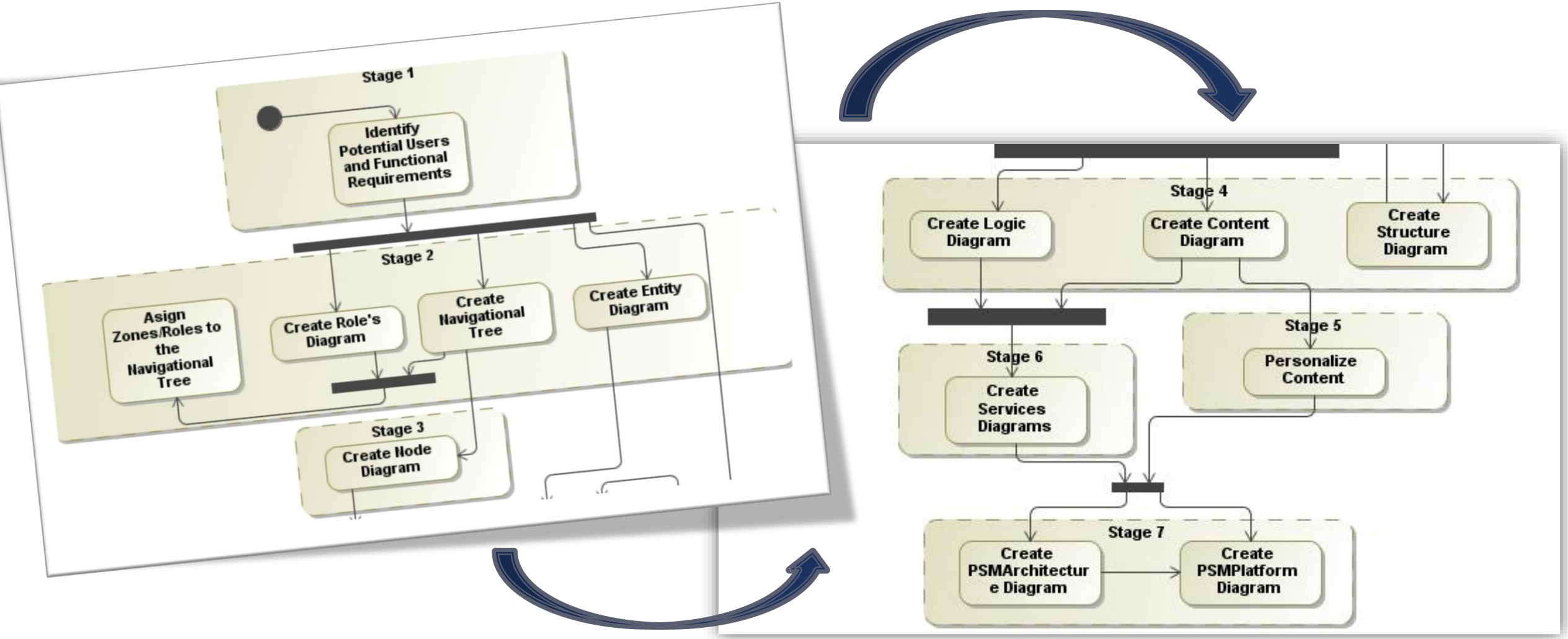

Levels
Iterative and incremental
CIM
+
PIM
Problem
Modelling
ASM
+
PSM
Solution
Modelling
ISM
+
MANUAL
Source
Code
Presentation
Navigation
Business Logic
Content/Data Access
User
semi-automatic
automatic
Phases
Structure
Behaviour
Aspects


Problem
definition
(PIM)

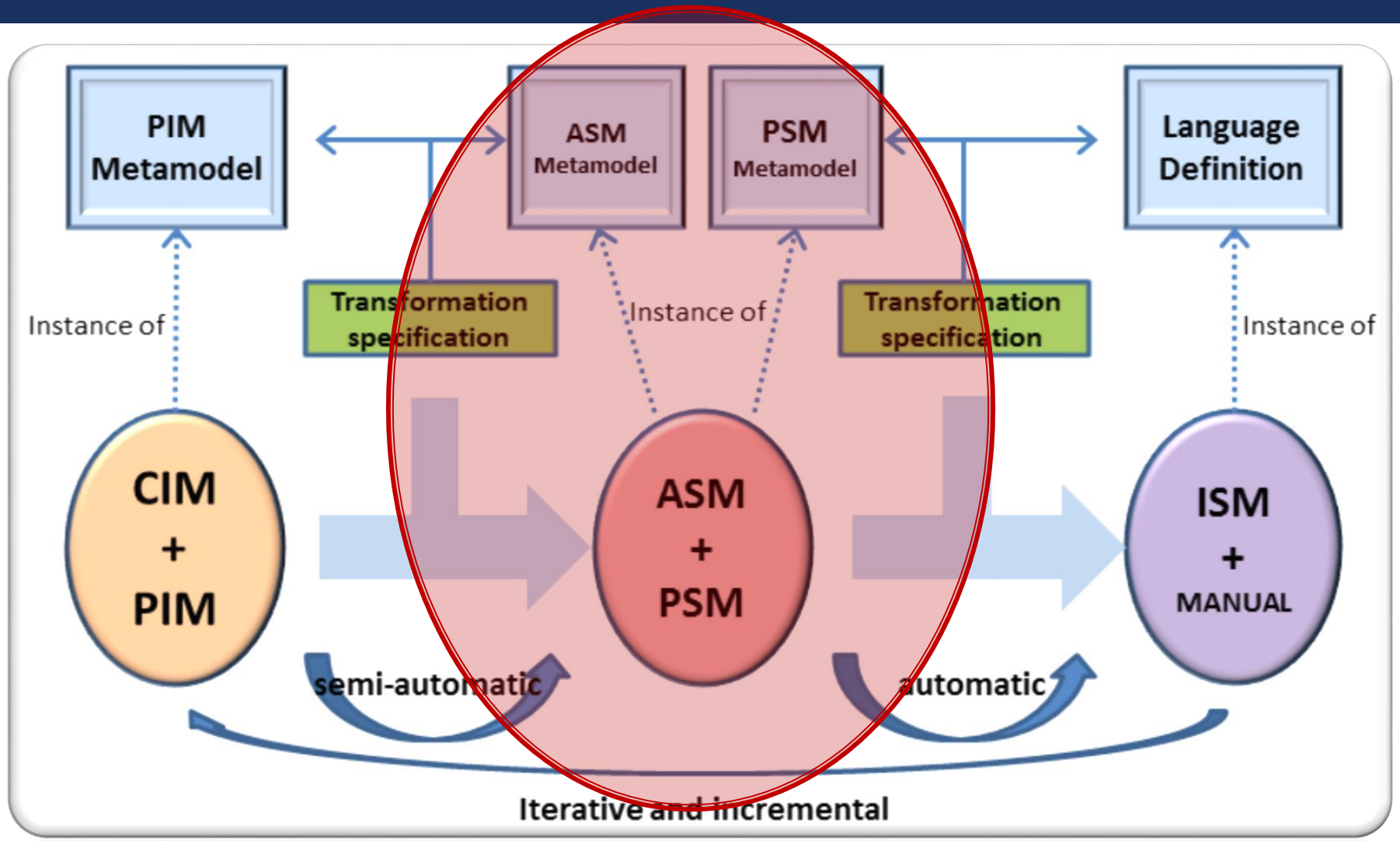

Architecture
(ASM)


SOAP
RESTful
Platform
(PSM)

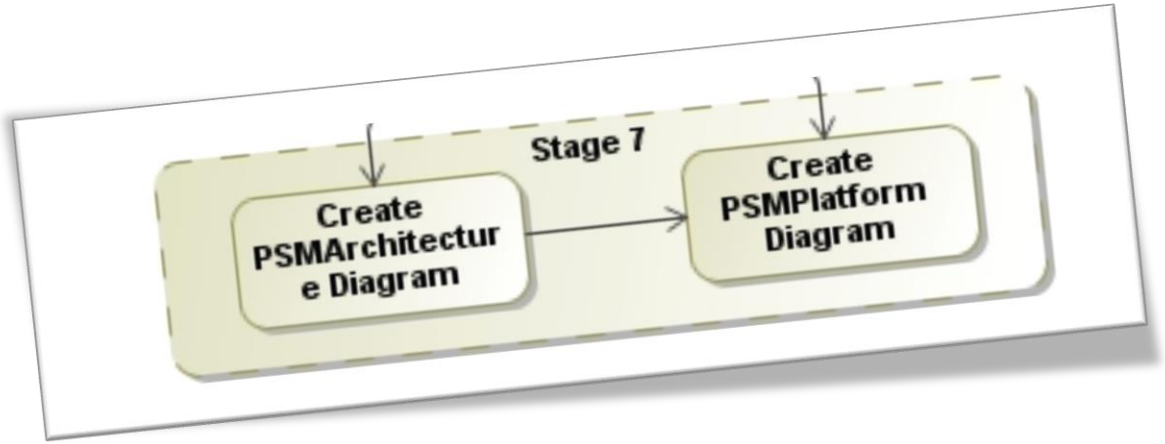
MOWEBA: MODELING PROCESS



MOWEBA: TRANSFORMATION PROCESS



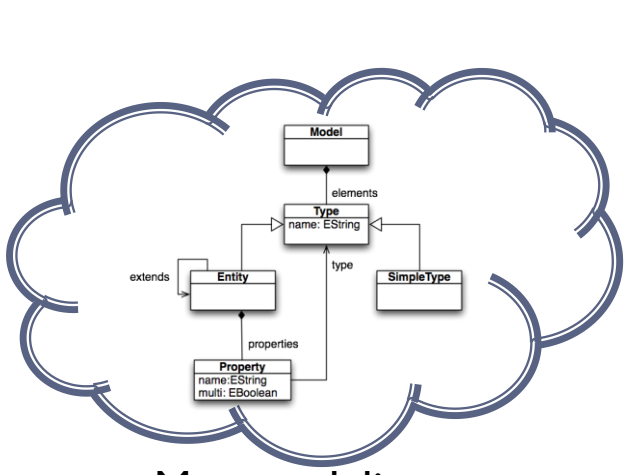
MOWEBA: ARCHITECTURE SPECIFIC MODEL (ASM)



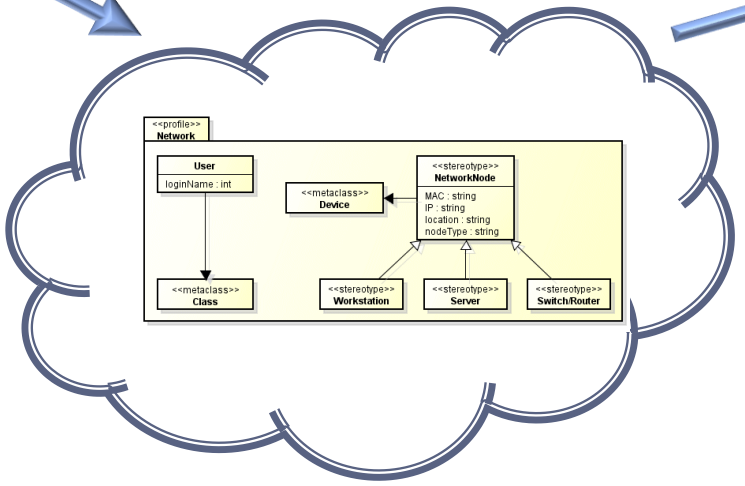
- Stage 7 of the MoWebA modeling process
- Semi-automatically generated from PIM
- Enriches previous models with additional information related to the system architecture (e.g. RIA, mobile, SOA)

MOWEBA: ASM DEFINITION

- If the ASM for a given architecture does not exist, it must be defined first

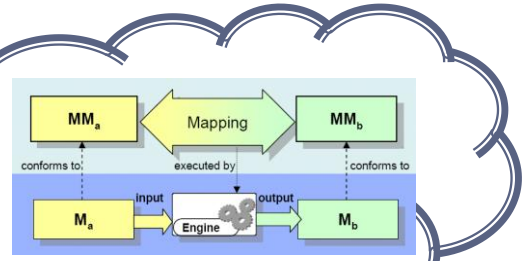


Metamodeling



UML Profile

M2M Transformation rules

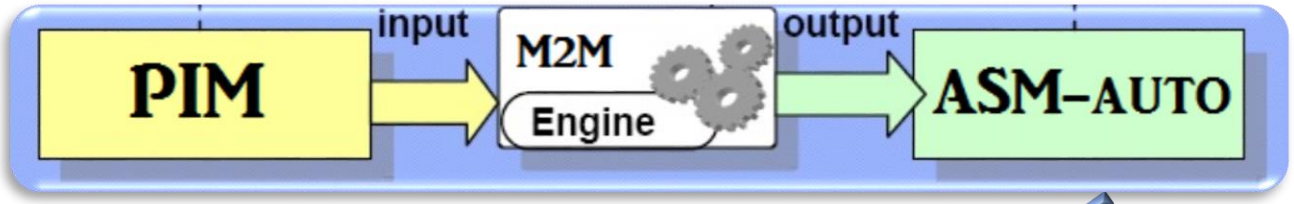


ATL

OMG
OBJECT MANAGEMENT GROUP

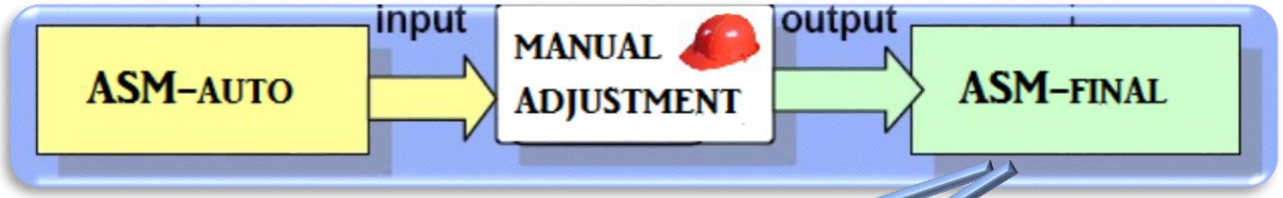
Query / View / Transformation

MOWEBA: APPLYING THE ASM PROCESS

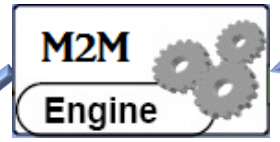


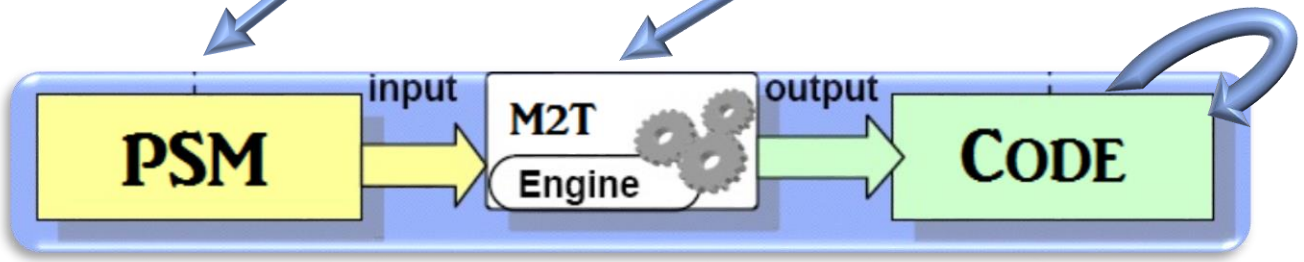
M2M transformation rules are executed to obtain a first version of the ASM model

Manual adjustments are made to complete the ASM model



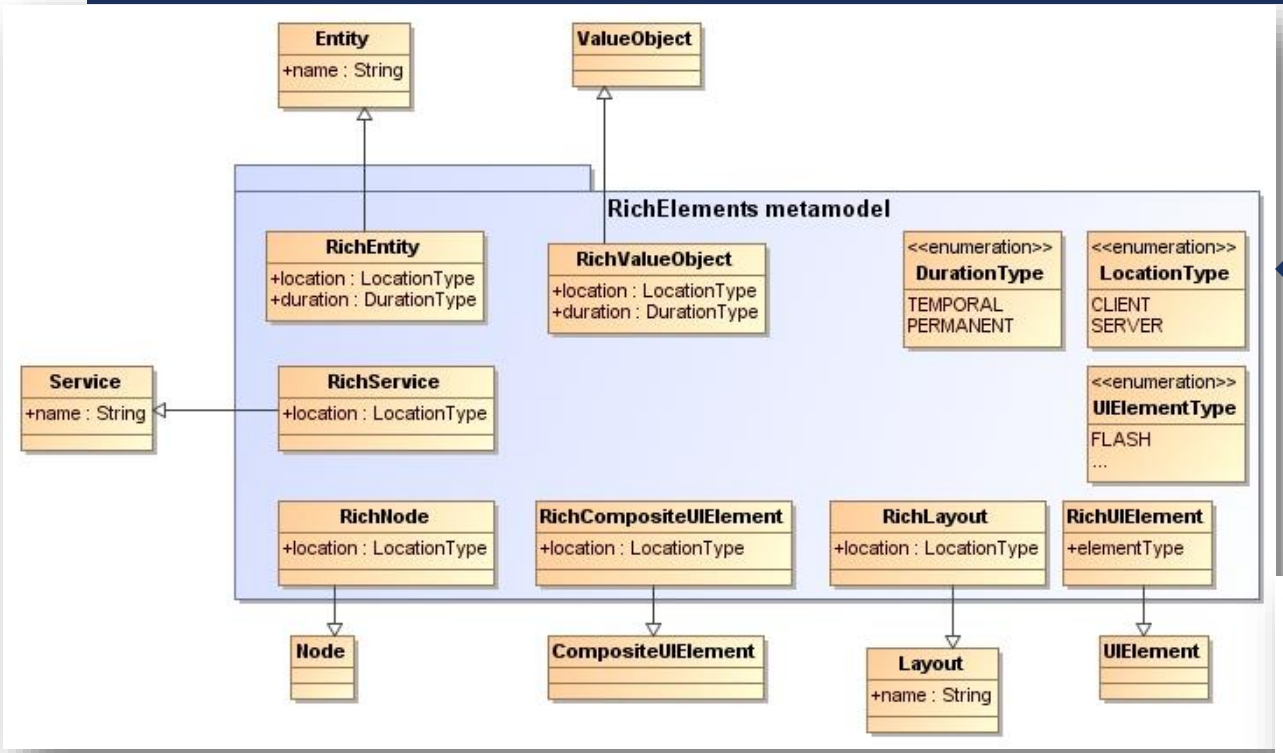
M2M or M2T transformation rules are applied to generate PSM models and/or final code for selected platforms





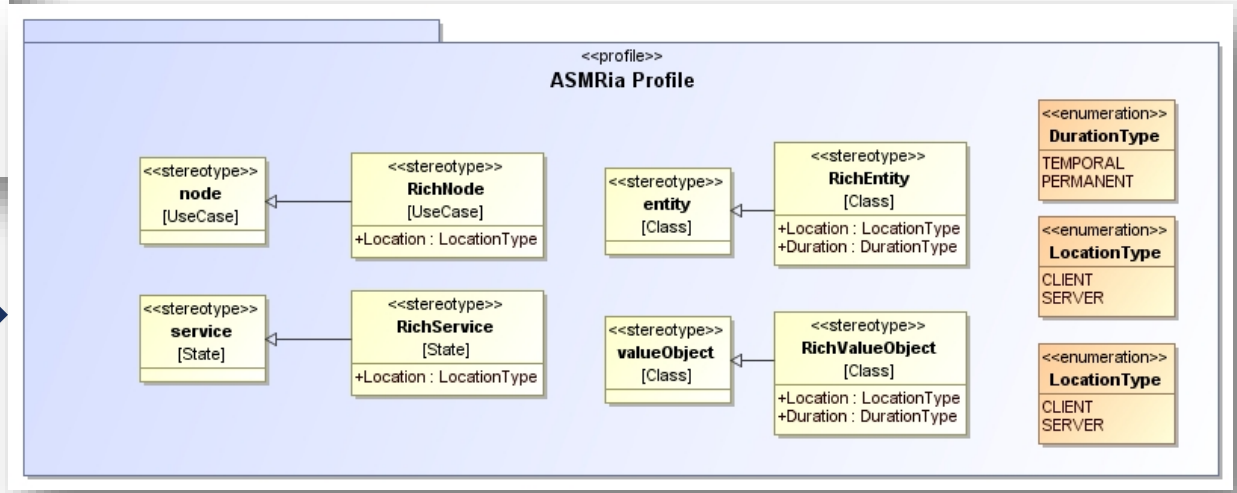
If necessary, final code is manually adjusted

ASMRIA: METAMODEL AND PROFILE



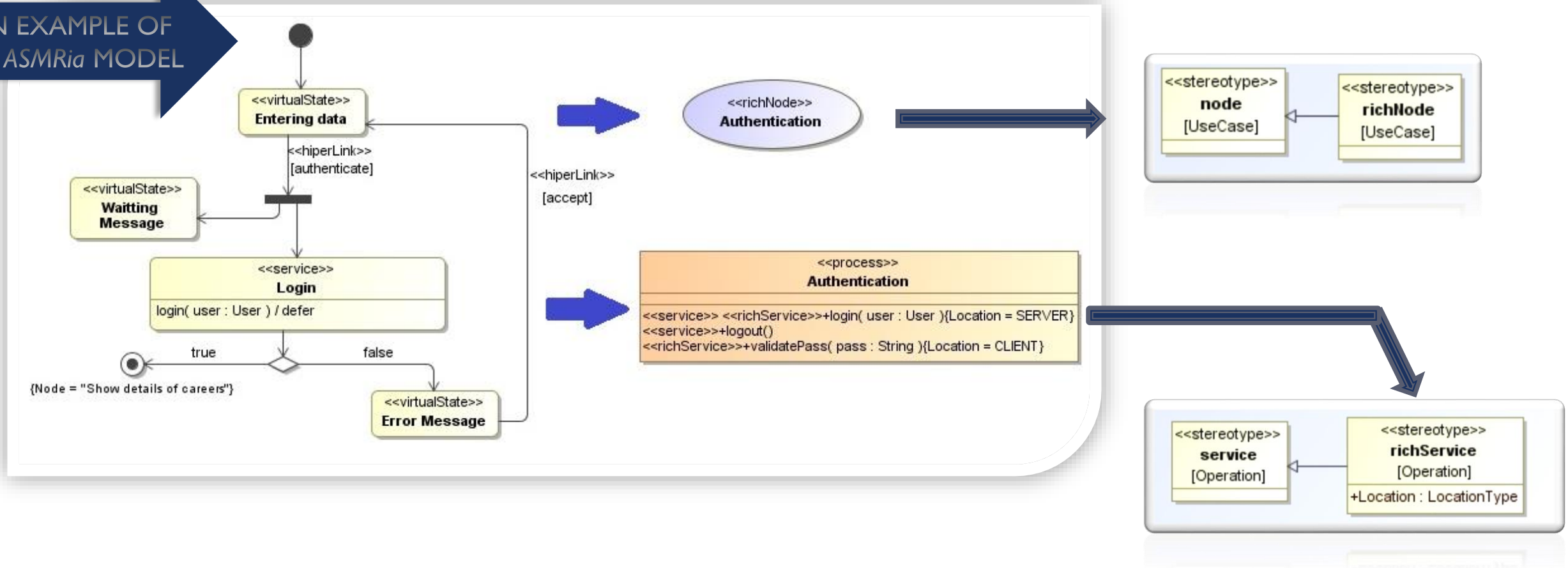
A SIMPLIFIED VERSION OF THE *ASMRia* METAMODEL

A SIMPLIFIED VERSION OF THE *ASMRia* UML PROFILE



ASMRIA: MODEL

AN EXAMPLE OF AN *ASMRia* MODEL

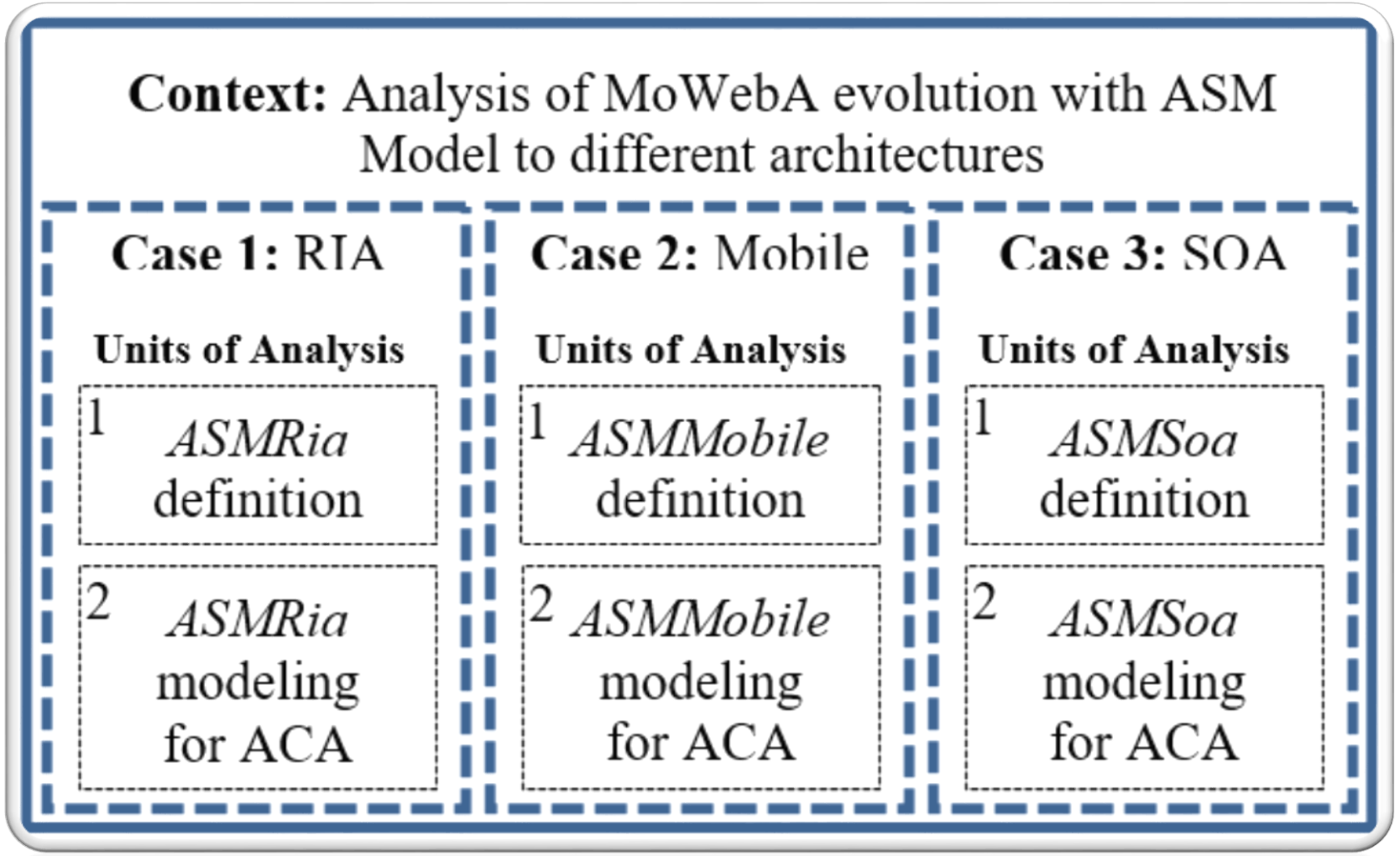


EXPERIENCES WITH THE ASM OF MOWEBA: A PRELIMINARY VALIDATION

EXPERIENCES WITH THE ASM OF MOWEBA MOTIVATION AND GOAL

- Investigate how the ASM model defined in MoWebA can help to easily evolve the development of web applications

EXPERIENCES WITH THE ASM OF MOWEBA CASES AND UNITS OF ANALYSIS



EXPERIENCES WITH THE ASM OF MOWEBA RESEARCH QUESTIONS

- RQ1: Can the same PIM model be used for different architectures?
- RQ2: Is it possible to specify clear limits between platform independent models (PIM) and architectural specific models (ASM)?
- RQ3: How does an architectural specific model facilitate the transformation rules definition?

EXPERIENCES WITH THE ASM OF MOWEBA DATA COLLECTION

Stage 1: Overal presentation

- Data collection methods: focus group, open and semi-structure interviews
- Materials: slide presentation
- Outputs: groups defined, architecture selected, final platform selected

Stage 2: PIM modeling

- Data collection methods: observation, archival data
- Materials: Magic Draw, MoWebA specification, Internet
- Outputs: ACA PIM model, theoretical framework and state of the art

Stage 3: Metamodel and UML Profile

- Data collection methods: observation, archival data
- Materials: Magic Draw, metamodel specification, UML Profile specification
- Outputs: MOF definition, UML profile, documentation

Stage 4: ASM Modeling

- Data collection methods: observation, archival data
- Materials: Magic Draw
- Outputs: ASM model for ACA, mapping rules

Stage 5: Transformation

- Data collection methods: observation, archival data
- Materials: Acceleo
- Output: transformation rules in Acceleo, generated code

Stage 6: Final presentation

- Data collection methods: focus groups, open and semi-structured interviews
- Materials: slides, Acceleo
- Output: documentation

EXPERIENCES WITH THE ASM OF MOWEBA
THREATS TO VALIDITY

- Academic environment

- Sufficient knowledge about MoWebA approach?

  - Students had previous experiences, including modeling of a complete application and its subsequent implementation
  - A unified PIM model was used by every group
- Level of knowledge of the adopted architecture
  - We considered on deepening knowledge on the architectural problem (stage 2)

- The ACA (Academic Credits Application)

  - Well-known for every participant of the experience
  - Reasonable degree of complexity
- MDD knowledge
  - Theoretical and practical classes on the subject were lectured by MDD experts

EXPERIENCES WITH THE ASM OF MOWEBA DATA ANALYSIS

Data Analysis				
Criteria/Architecture		**RIA**	**SOA**	**Mobile**
1	Understanding of architecture	90%	100%	80%
2	Quality of MoWebA PIM models[a]	95%	95%	95%
3	Number of elements defined in the metamodel	19	15	18
4	What percentage of the defined concepts are specific to the architecture?	80%	98%	95%
5	Are the PIM-ASM mappings clear?	Yes	Yes	Yes
6	Was it necessary to extend the PIM to represent concepts not considered in the metamodel?	No	No	No
7	Quality of metamodels	98%	100%	80%
8	Quality of ASM profiles	100%	100%	80%
9	Quality of ASM models	100%	100%	70%
10	Possible degree of PIM-ASM automation	92%	93%	50%
11	Quality of transformation rules	90%	100%	30%
12	Number of final platforms	1	2	1
13	LOC of transformation rules	301	109-44	92
14	Quality of generated code	90%	100%	30%
15	LOC of generated code	396	142-106	666
16	Degree of coverage of the code generated regarding the architectural specifications	95%	98%	50%

EXPERIENCES WITH THE ASM OF MOWEBA DATA ANALYSIS

- **RQ1:** Can the same PIM model be used for different architectures? (points 4 and 6)
  - The same PIM model was used for three different architectures without modifications
  - The ASM metamodel has reflected the specific concepts of the architecture
- **RQ2:** Is it possible to specify clear limits between platform independent models (PIM) and architectural specific models (ASM)? (points 3, 5, 7 and 9)
  - Metamodels and ASM profiles were good enough for mapping purposes and ASM modeling
  - A considerable good number of concepts of ASM models can be generated in a semi-automated way, from the PIM model
- **RQ3:** How does an architectural specific model facilitate the transformation rules definition? (points 11, 12, 13, 14, 15, 16)
  - The inclusion of ASM has facilitated final code generation and its quality
- **Points 1, 2, 8 are related to threats to validity**

FINAL CONSIDERATIONS

- In the experience carried out, regardless of the chosen architecture, there was no need to make changes to the PIM
- Degree of automation (PIM-ASM) had some variations depending on the adopted architecture
- The percentage of ASM elements that were automatically obtained from the PIM is quite significant
- We are positive about the usefulness of the ASM in the way prescribed by MoWebA
- However, more structured and formal experiments should offer a better insight about the proposal

FUTURE WORKS

- New on-going experiences, case studies and more rigorous experiments
- Definition of ASM for other architectures
- Comparison of MoWebA and other approaches (UWE, OOHDM, OO-H, WebML, OOWS) as well as against approaches which are not based on models and automatic transformations
- Inclusion of architectural non-functional qualities such as maintainability, adaptability, understandability, among others

Developing Web applications for different architectures: The Moweba approach

MAGALI GONZALEZ, LUCA CERNUZZI, NATHALIE AQUINO, OSCAR PASTOR

Thank you very much for your attention!

IEEE RCIS 2016

Questions?

mgonzalez@uca.edu.py