4th UCAAT User Conference on Advanced Automated Testing

ETSI World Class Standards

# MODEL BASED TESTING AND COVERAGE OF XML REQUIREMENTS

Presented by Abderrazek Boufahja

KEREVAL

# Abderrazek Boufahja

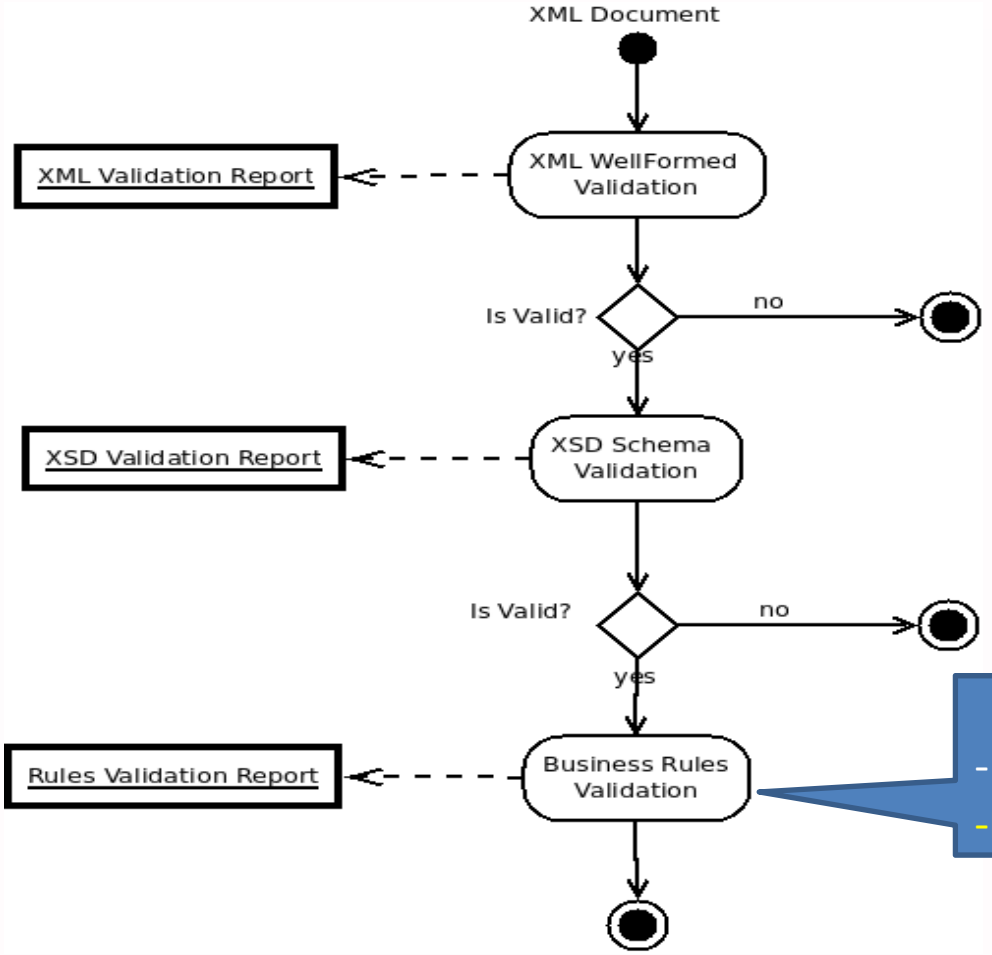
- IHE-Europe software consultant with gazelle team since 2009
- Expert in healthcare standards, UML modelization, and software testing
- Experienced with national and international healthcare specifications
- Certifications: ISTQB CTFL, CFTL-TM, REQB, OCUP



# Outline

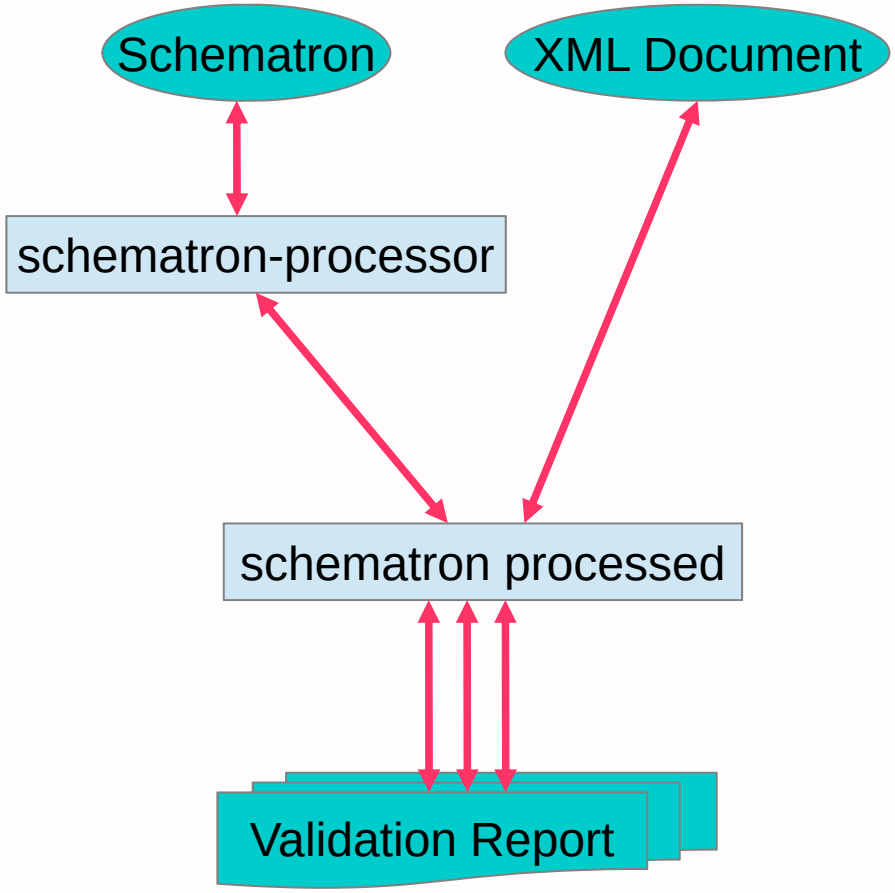
- Problematic : Why and where was the need?
  - Conformance validation steps
  - State of the Art
- Presentation and Architecture of model-based Validation
  - Objectives
  - Principles
- Results
- Conclusion

# Conformance validation steps of XML documents



# SCHEMATRON : What looks like?

```
<assert test="cda:recordTarget[cda:patientRole[cda:id[@root]]]"> ERR:
  ClinicalDocument/recordTarget/patientRole/id@root is missing </assert>

<report test="cda:recordTarget[cda:patientRole[cda:id[@root]]]"> CTX:
  ClinicalDocument/recordTarget/patientRole/id@root exists (PASS) </report>

<assert test="cda:recordTarget[cda:patientRole[cda:id[@extension]]]"> ERR:
  ClinicalDocument/recordTarget/patientRole/id@extension is missing </assert>

<report test="cda:recordTarget[cda:patientRole[cda:id[@extension]]]"> CTX:
  ClinicalDocument/recordTarget/patientRole/id@extension exists (PASS) </report>

<!-- ClinicalDocument/recordTarget/patientRole/addr is present with at least coun

<assert test="cda:recordTarget[cda:patientRole[cda:addr[cda:country]]]"> ERR:
  ClinicalDocument/recordTarget/patientRole/addr/country is missing </assert>

<report test="cda:recordTarget[cda:patientRole[cda:addr[cda:country]]]"> CTX:
  ClinicalDocument/recordTarget/patientRole/addr/country exists (PASS) </report>
```



# SCHEMATRON : Weakness

- Not easy to understand, once it is developed → *maintainability problems*
- The processing of schematron is too long. For complex XML documents, the processing and generation of validation report is too long (1000 checks => 1.5 seconds) → *performance problems*
- Coding is difficult, the assertions are based on xpath query
- The structure of schematrons over the world is not the same
- No concrete coupling between requirements and rules of schematrons
- IHE experience with schematron : very hard problems of maintainability

→ need to have new tool that tries to give a solution to all theses problems

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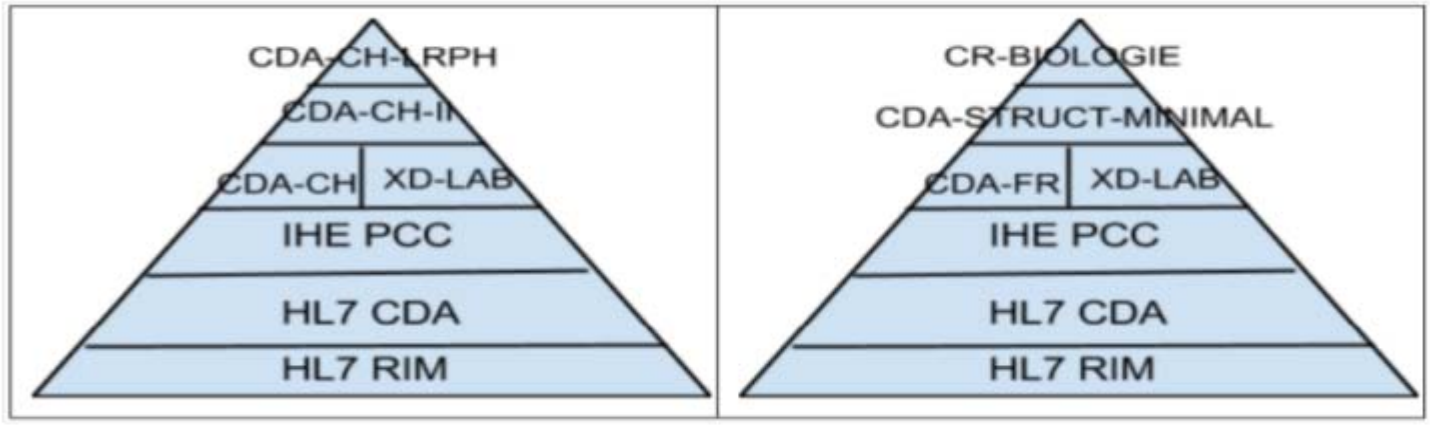
# Presentation

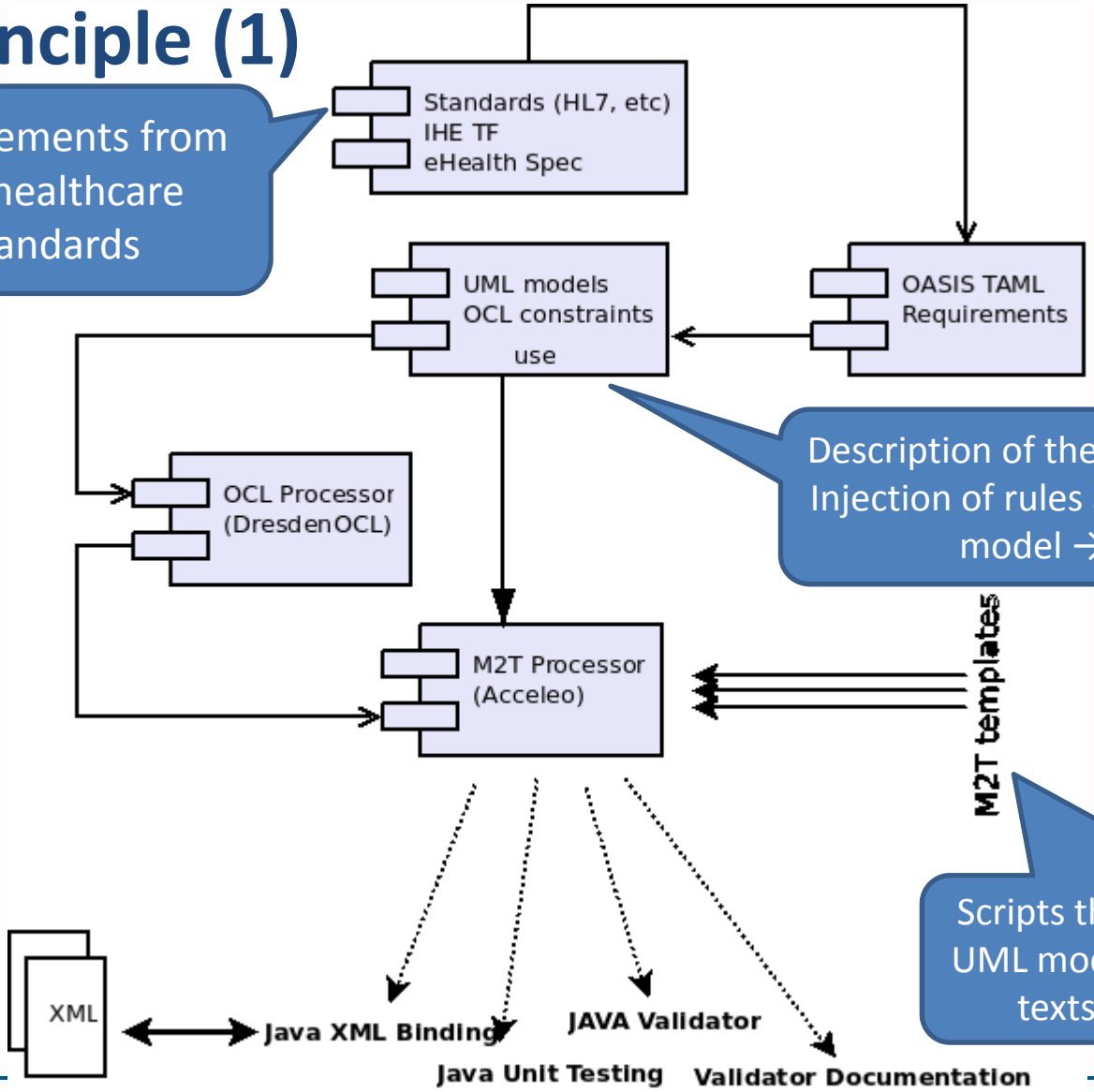
- A scalable methodology to validate any kind of healthcare specifications based on the XML standard
- This method allows also to :
  - Simplify the use and the manipulation of XML documents
  - Generate documentation of constraints
  - Improve the coupling between rules and requirements
  - Support the validation of inheritance between healthcare standards




Source : eHealth Suisse, Format d'échange, Rapports de laboratoire soumis à déclaration en Suisse (Projet)

# Principle (1)

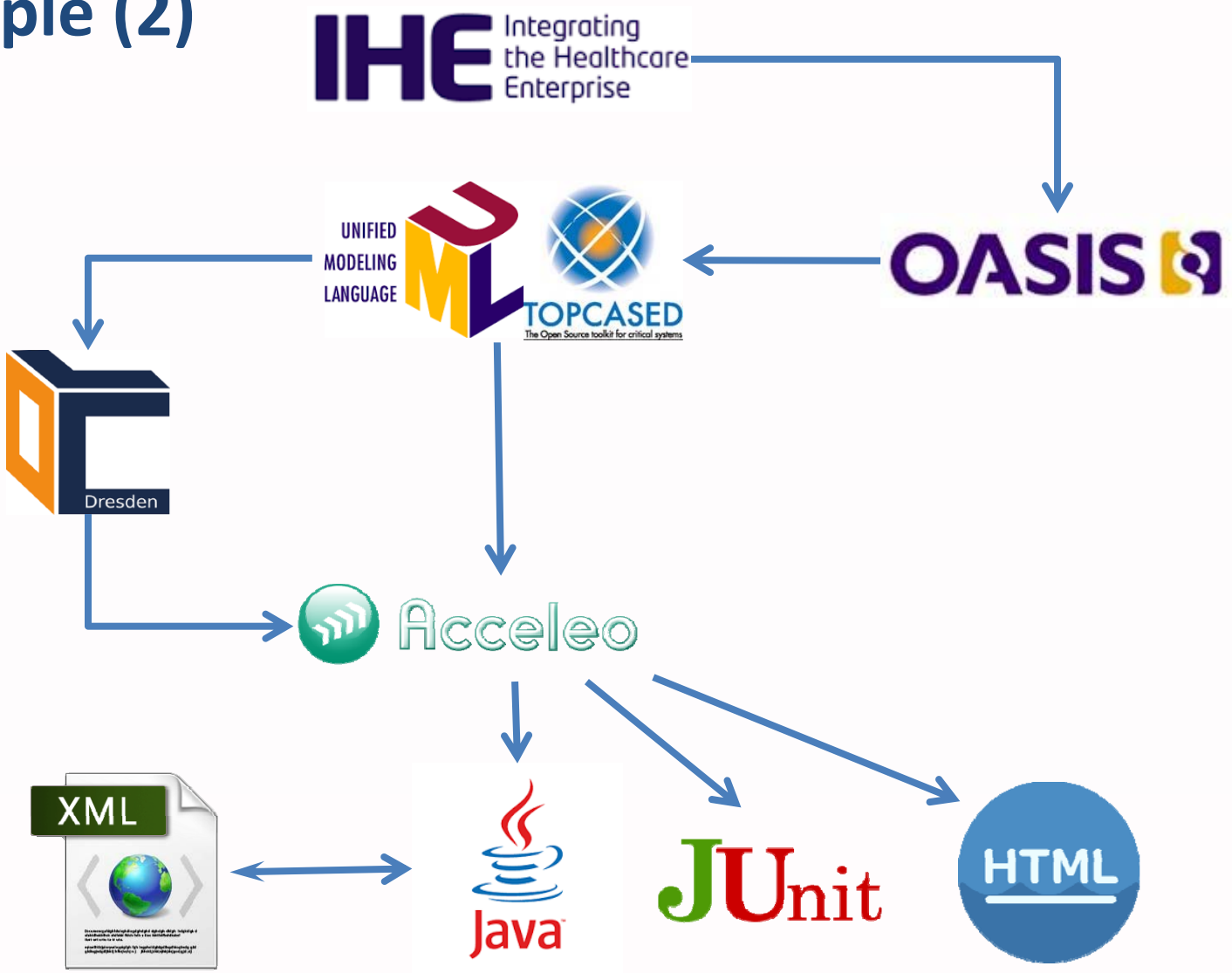
Requirements from the healthcare standards



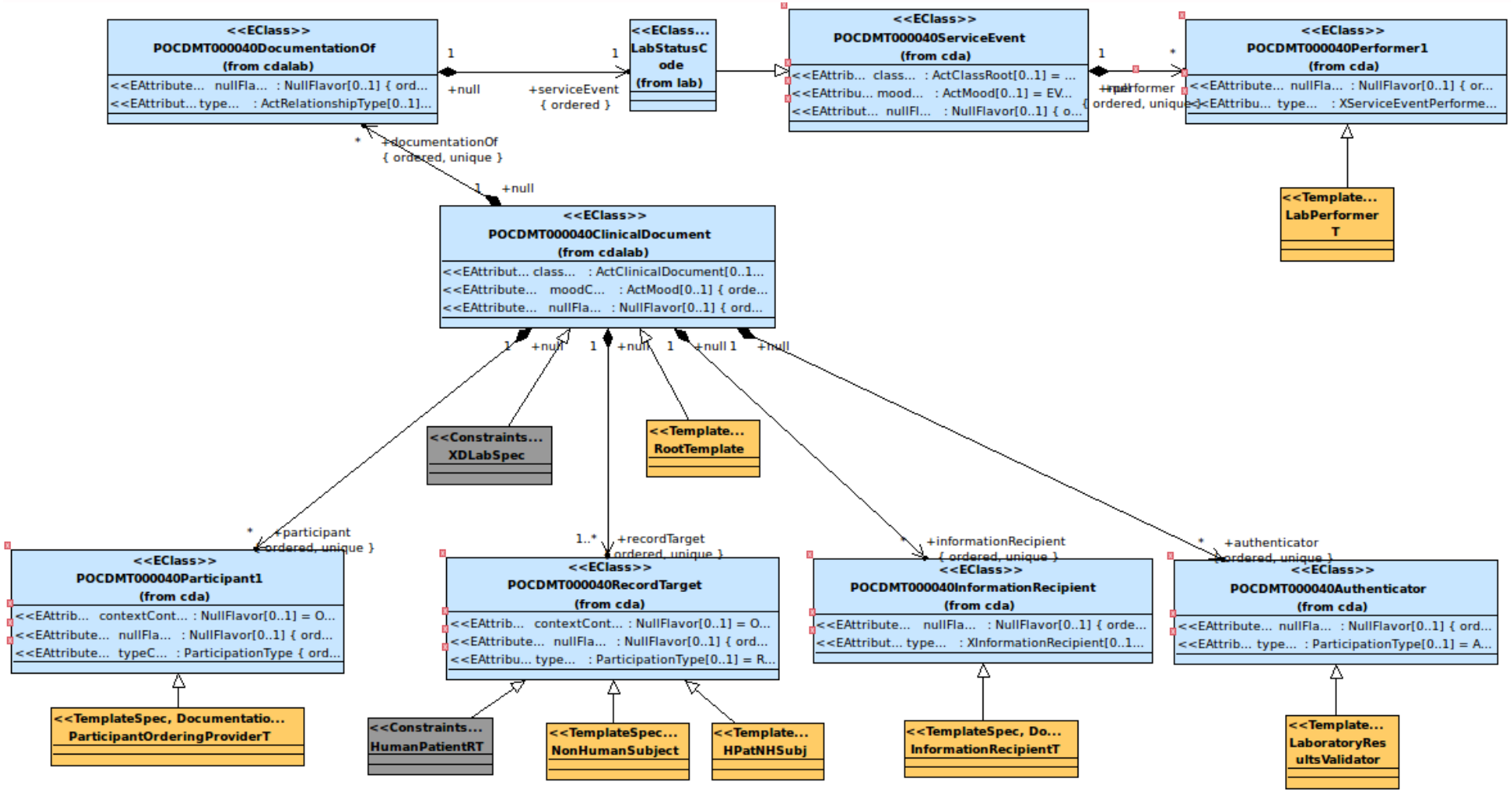

Description of the structure of the XML doc. Injection of rules and requirements into the model → OCL constraints

Scripts that extract information from UML models and generate structured texts related to these models

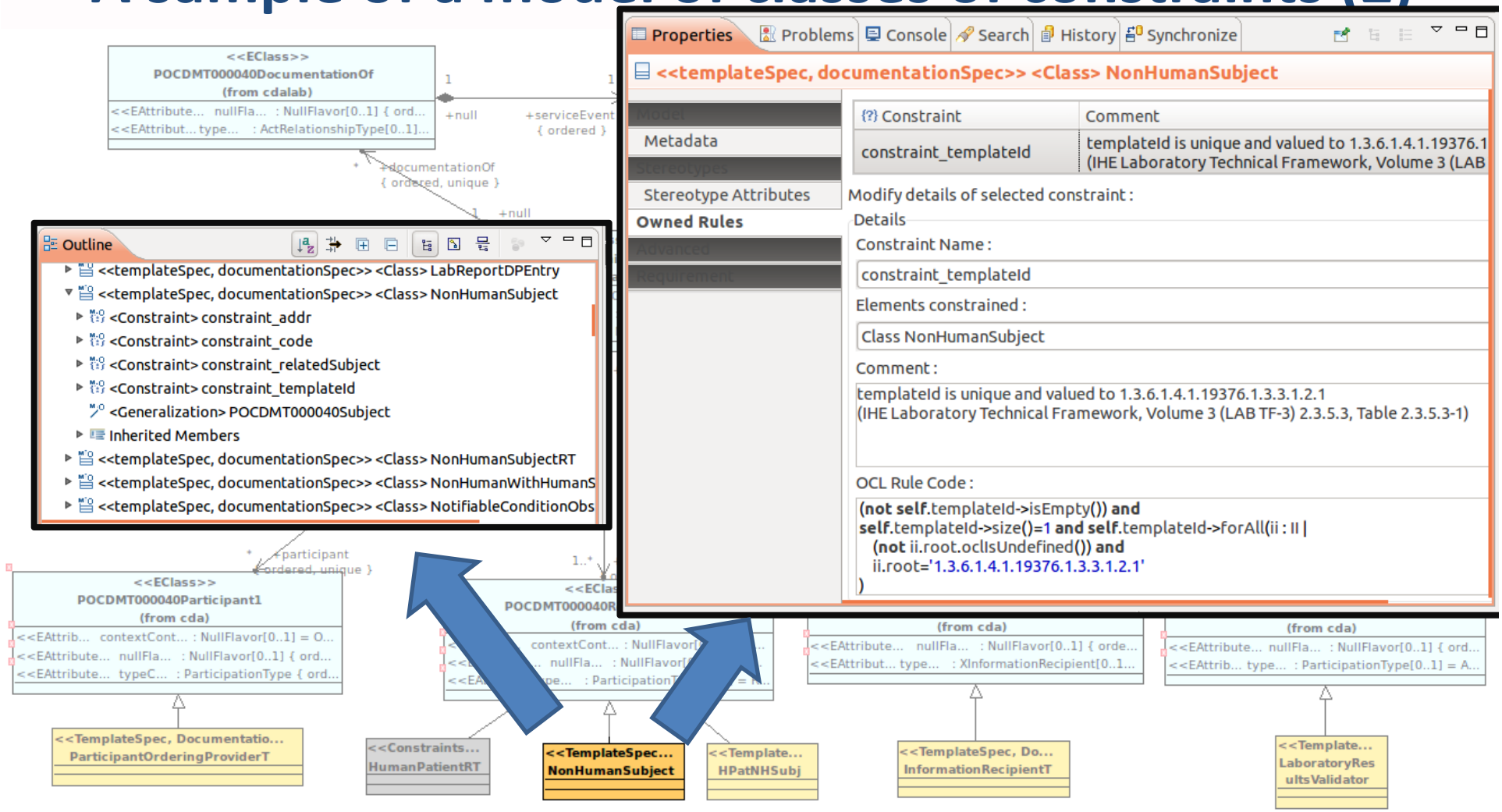
# Principle (2)



# A sample of a model of classes of constraints (1)



# A sample of a model of classes of constraints (2)



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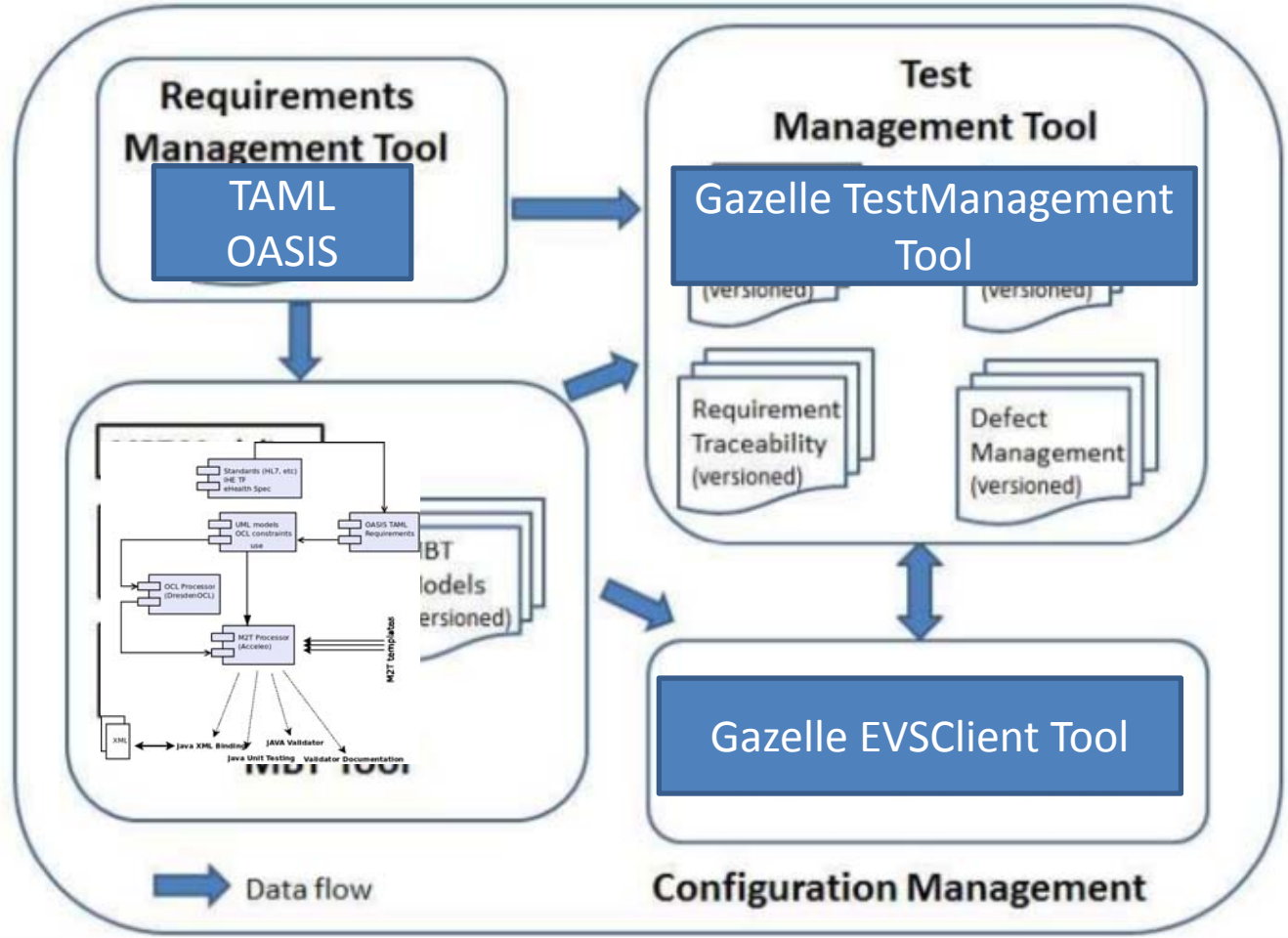
# Results

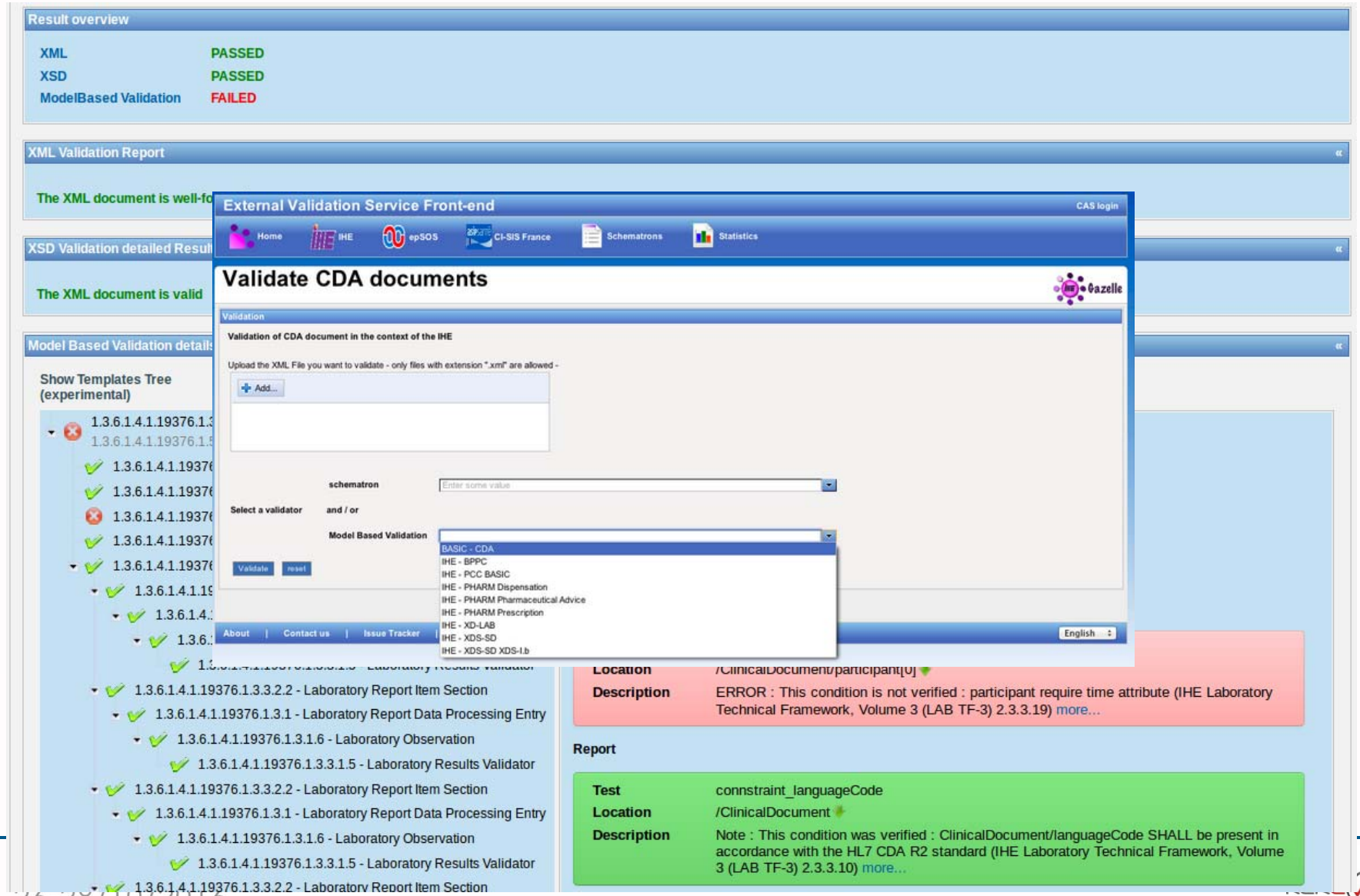
- More than 70 validators based on this methodology
- More than 50 000 XML documents validated
- Applied on dozens of structures of XML standards, with a success to adapt their models => generic model
- Fast validation tools
- Easy to maintain and to modify

# Integration of the validation tool in Gazelle Plateform



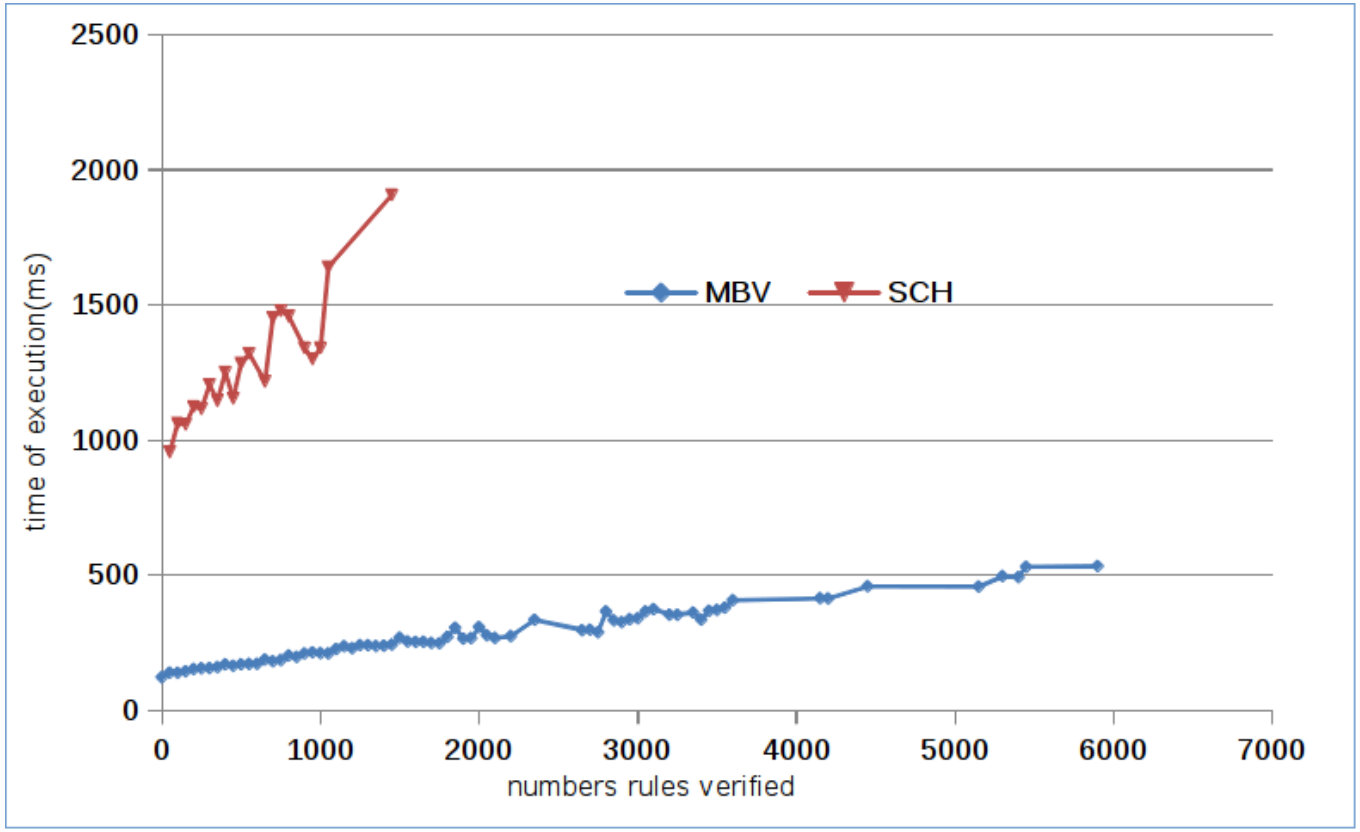

ISTQB Foundation Level Syllabus – Model-Based Tester

# EVSClient : front-end validation service



# Comparison to schematrons

- 1300 HL7 CDA documents from the epSOS project



# Conclusion

- A methodology of validation of XML documents on healthcare standards based on model based architecture
- Allows the management and the coupling between requirements and constraints
- Open source implementation with open source tools (Topcased, Acceleo, DresdenOCL)
- Other related topics :
  - Coupling with requirements meta-models editor tools (like ART-DECOR)
  - Application of the validation process on other fields than healthcare

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