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UNIVERSITATEA BABEŞ-BOLYAI

OMiLAB4FoF workshop,
June 27 2016, Troyes, France
(in conjunction with the 8th IFAC MIM Conference)

The Modelling of Requirements for Mobile Maintenance

- results from the ComVantage FP7 project (http://comvantage.eu)-

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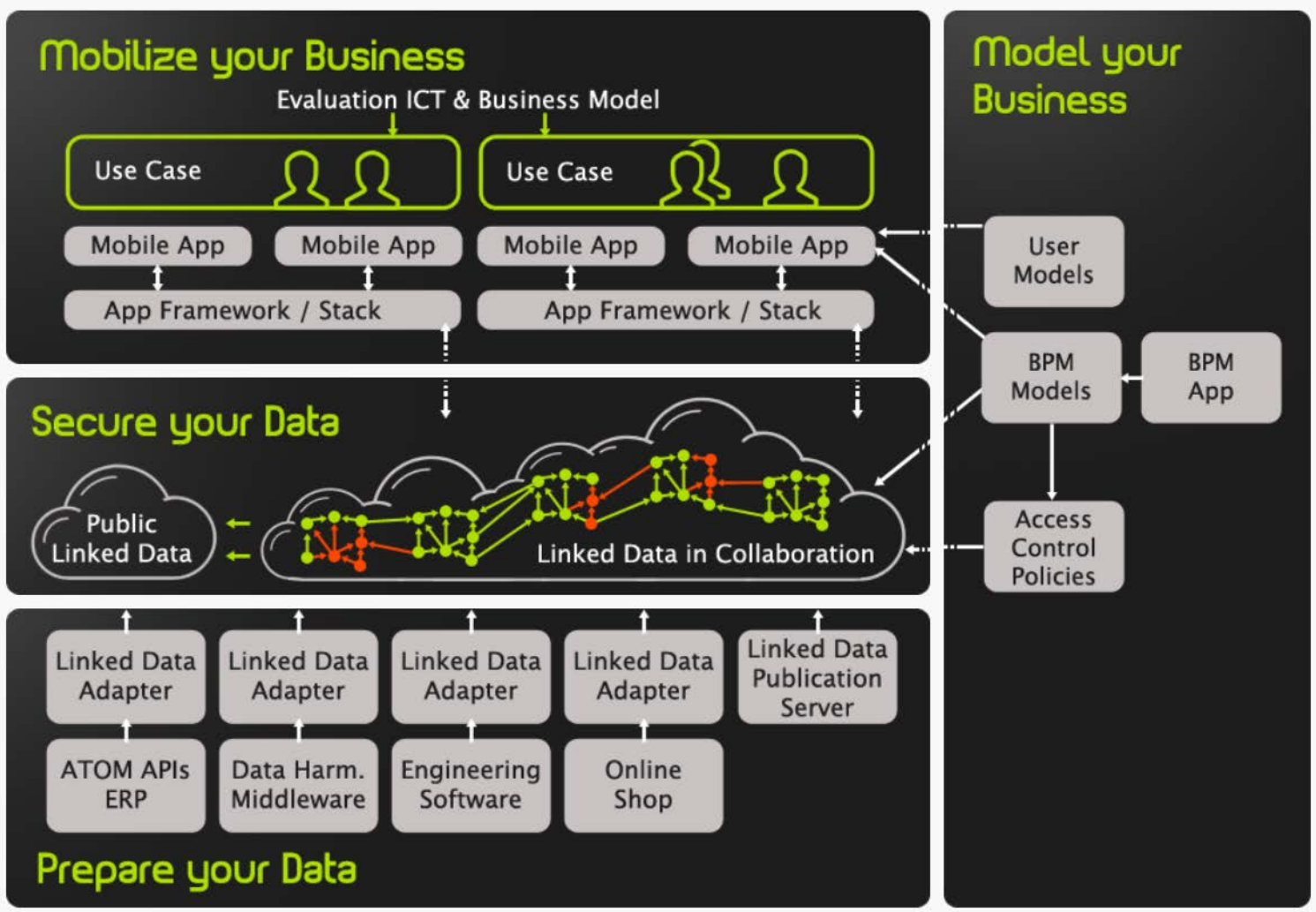
Agenda

- **The Context**
  - The Project: ComVantage
  - The Scenario: Mobile Maintenance
- **Concepts and Technologies**
  - The Modelling Method concept
  - The Metamodelling technology: ADOxx
  - The Linked Data technology: RDF
- **Approach and Examples**
  - The ComVantage modelling prototype
  - Semantic linking of models
  - Metamodelling and Linked Data
  - RDF vocabulary for model description
  - Demo examples
- **Enablers**
  - The Environment: OMiLAB
  - The Framework: AMME
- **Conclusions**

The Project: ComVantage*

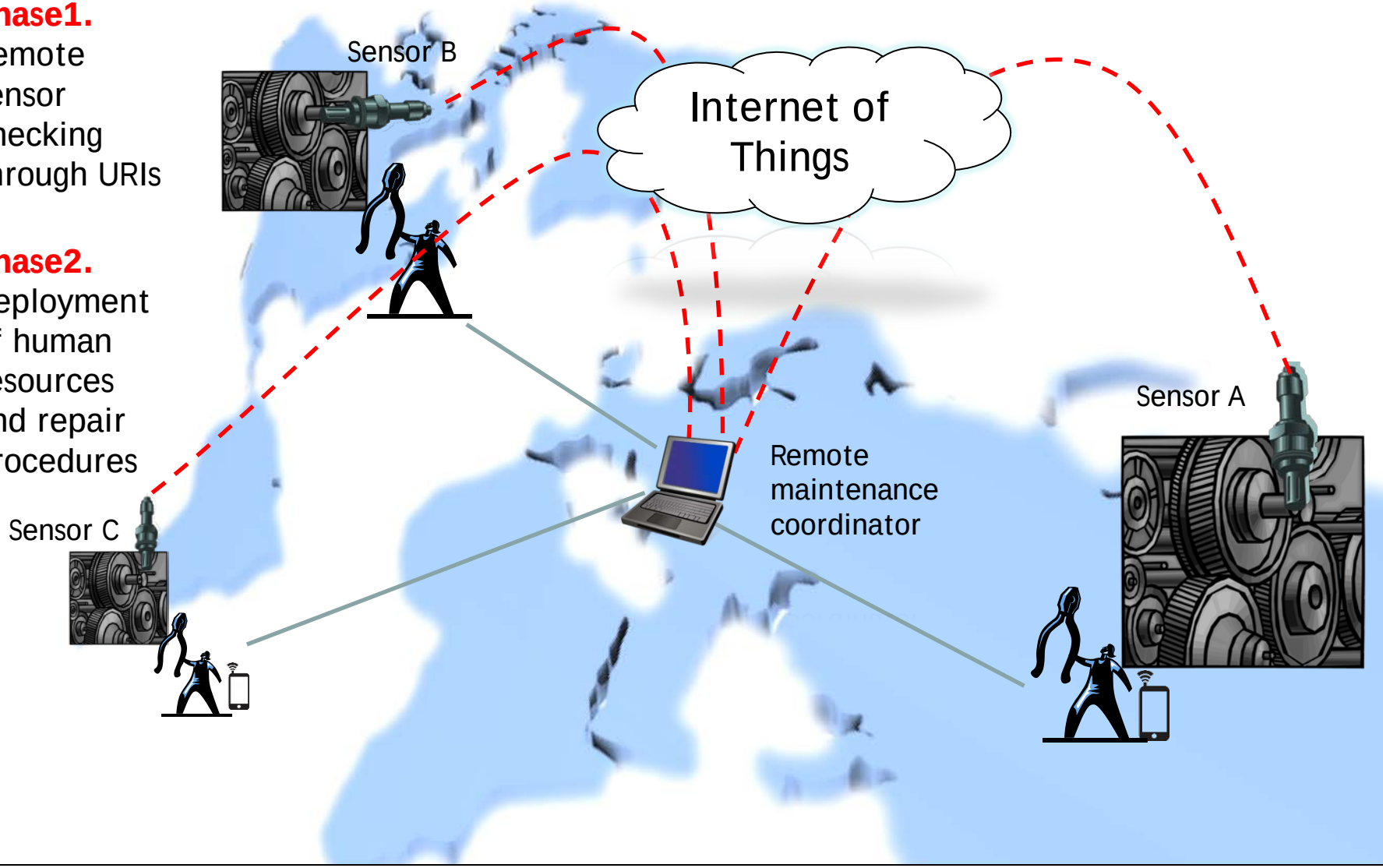


*http://comvantage.eu

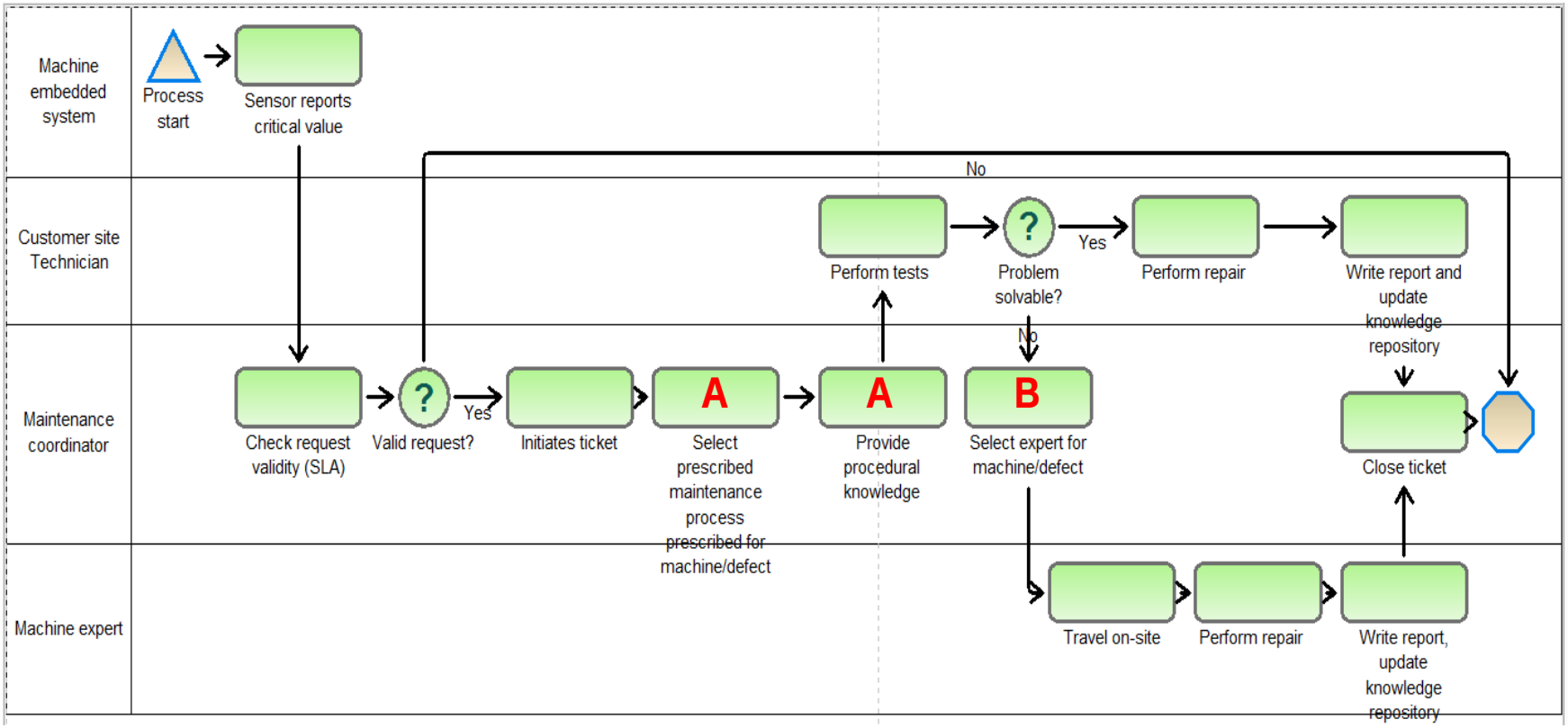
The Scenario: Mobile Maintenance

Phase1.
Remote sensor checking through URIs

Phase2.
Deployment of human resources and repair procedures



The Scenario: Mobile Maintenance



Challenges:

A. automatically recommend maintenance procedures

B. automatically select & notify relevant technician

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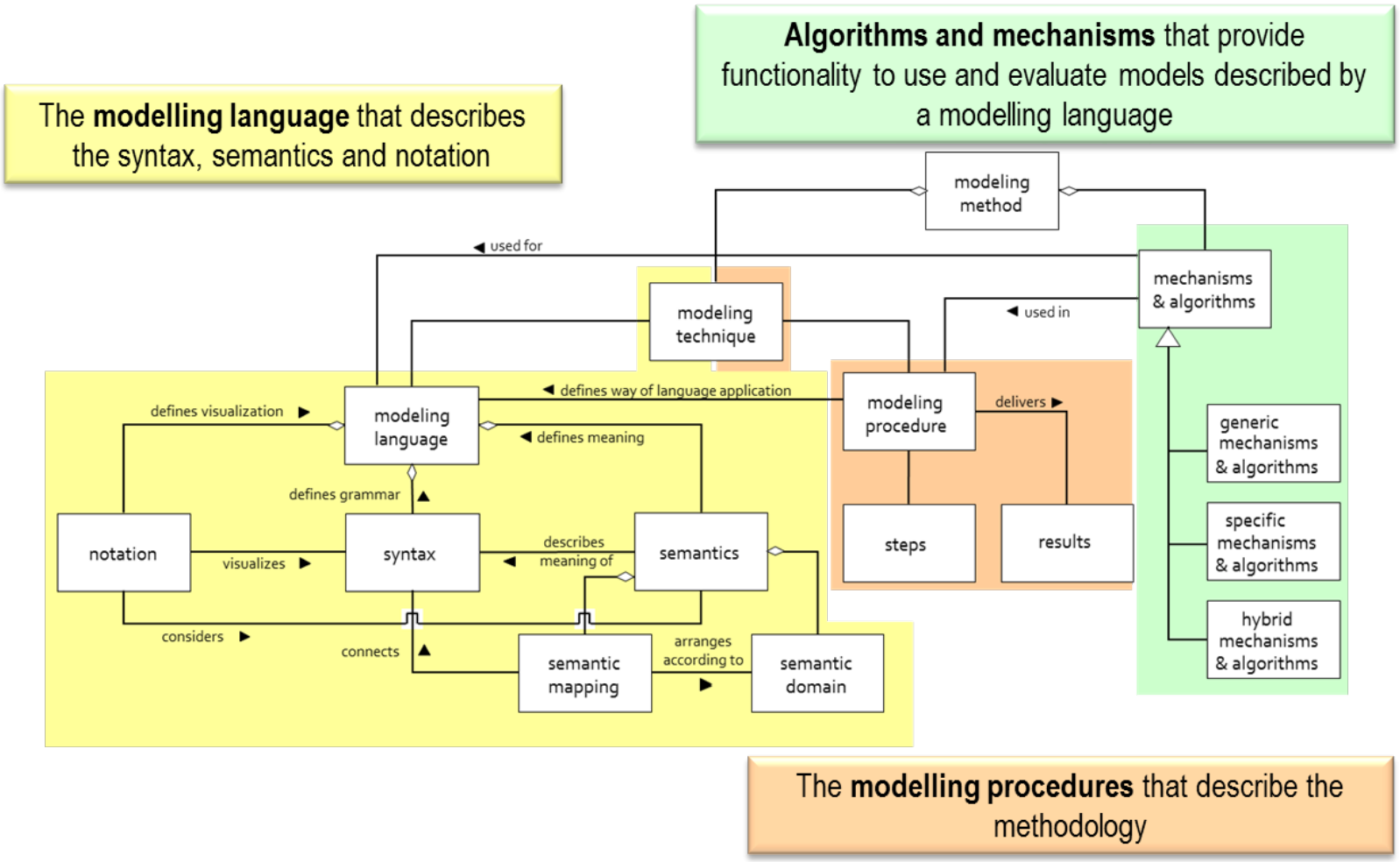
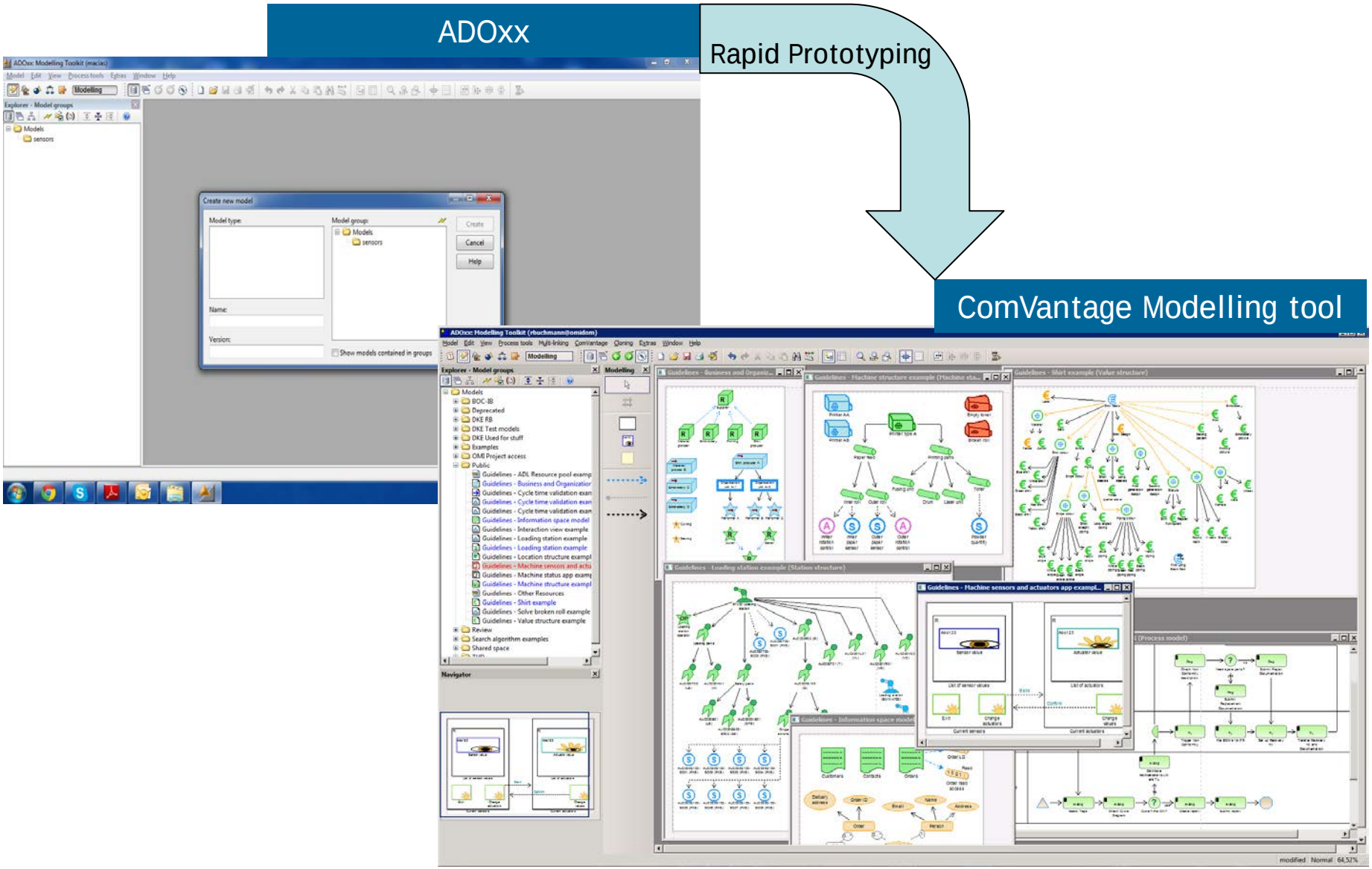
The Modelling Method concept



cf. Karagiannis, D., Kühn, H.: Metamodelling platforms. In: Bauknecht, K., Tjoa, A.M., Quirchmayr, G. (eds.), Proceedings of the Third International Conference EC-Web 2002 – DEXA 2002. LNCS 2455, pp 182, Springer (2002)

The Metamodelling Technology: ADOxx

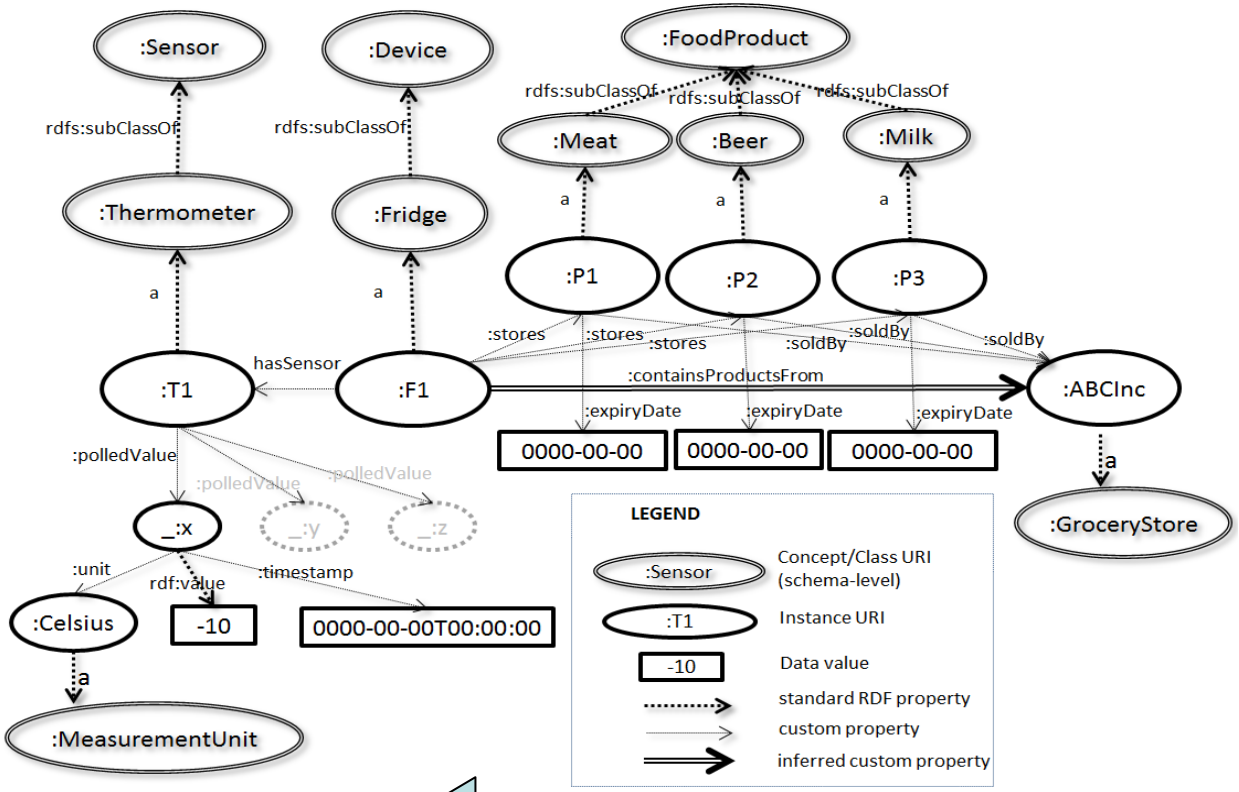


The Metamodelling Technology: ADOxx*

*www.adoxx.org

The Linked Data Technology

The RDF data model (graph-based):



RDF servers

SPARQL queries:

Retrieval query: SELECT ?d WHERE {:F1 :stores/:expiryDate ?d}

Rule query: CONSTRUCT {?x :containsProductsFrom ?y} WHERE {?x :stores/:soldBy ?y}

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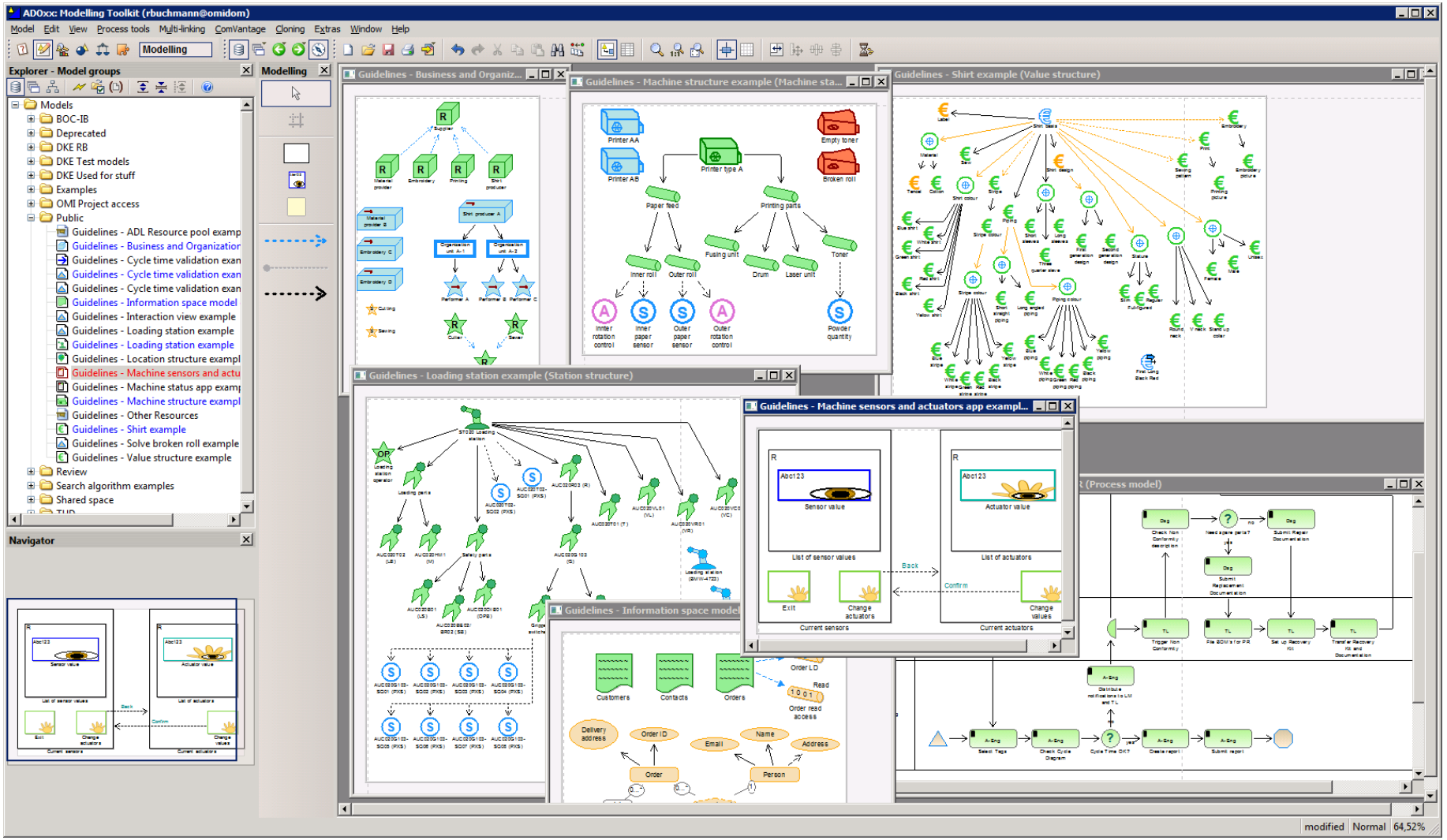
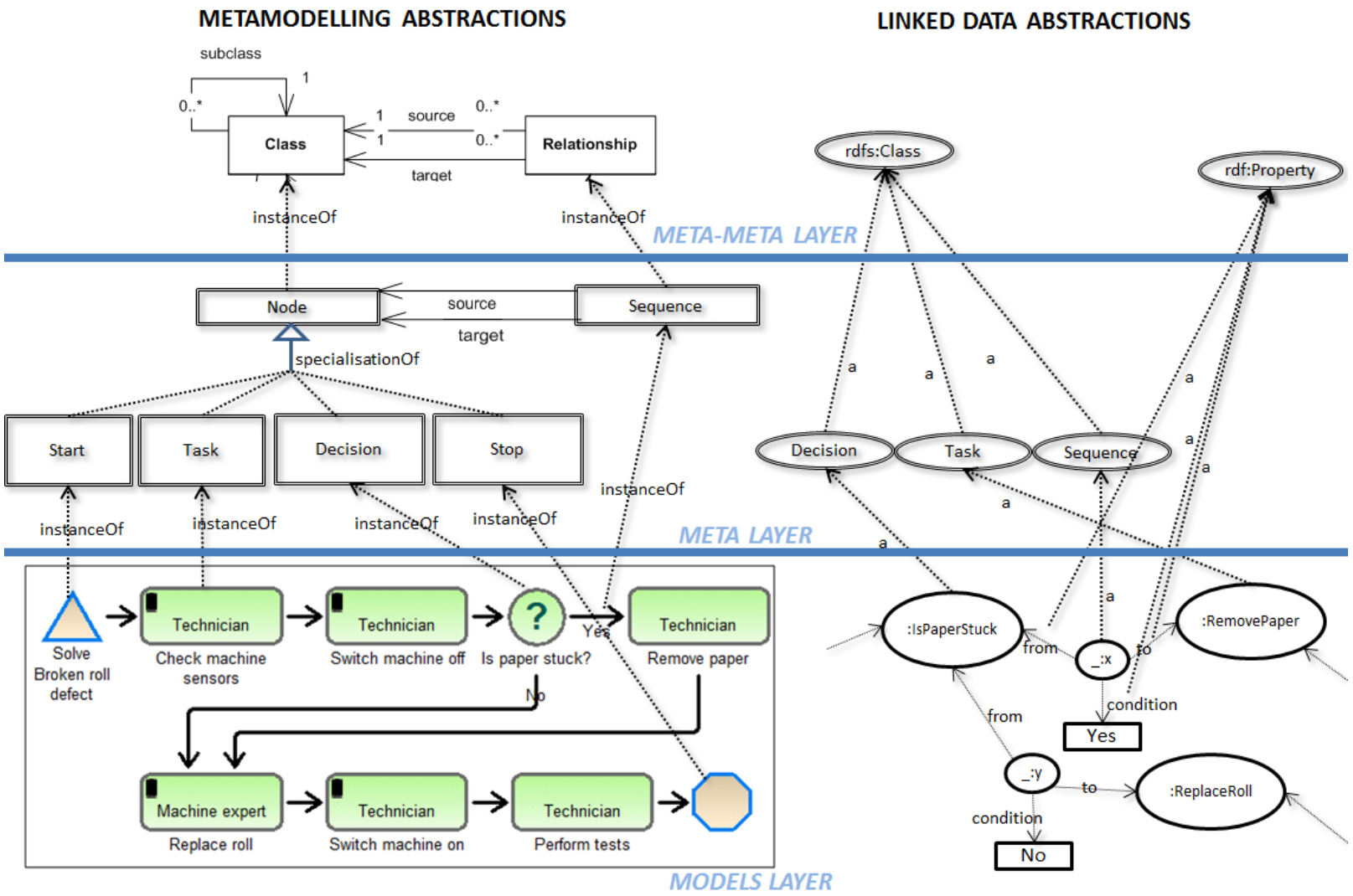
The ComVantage modelling prototype*

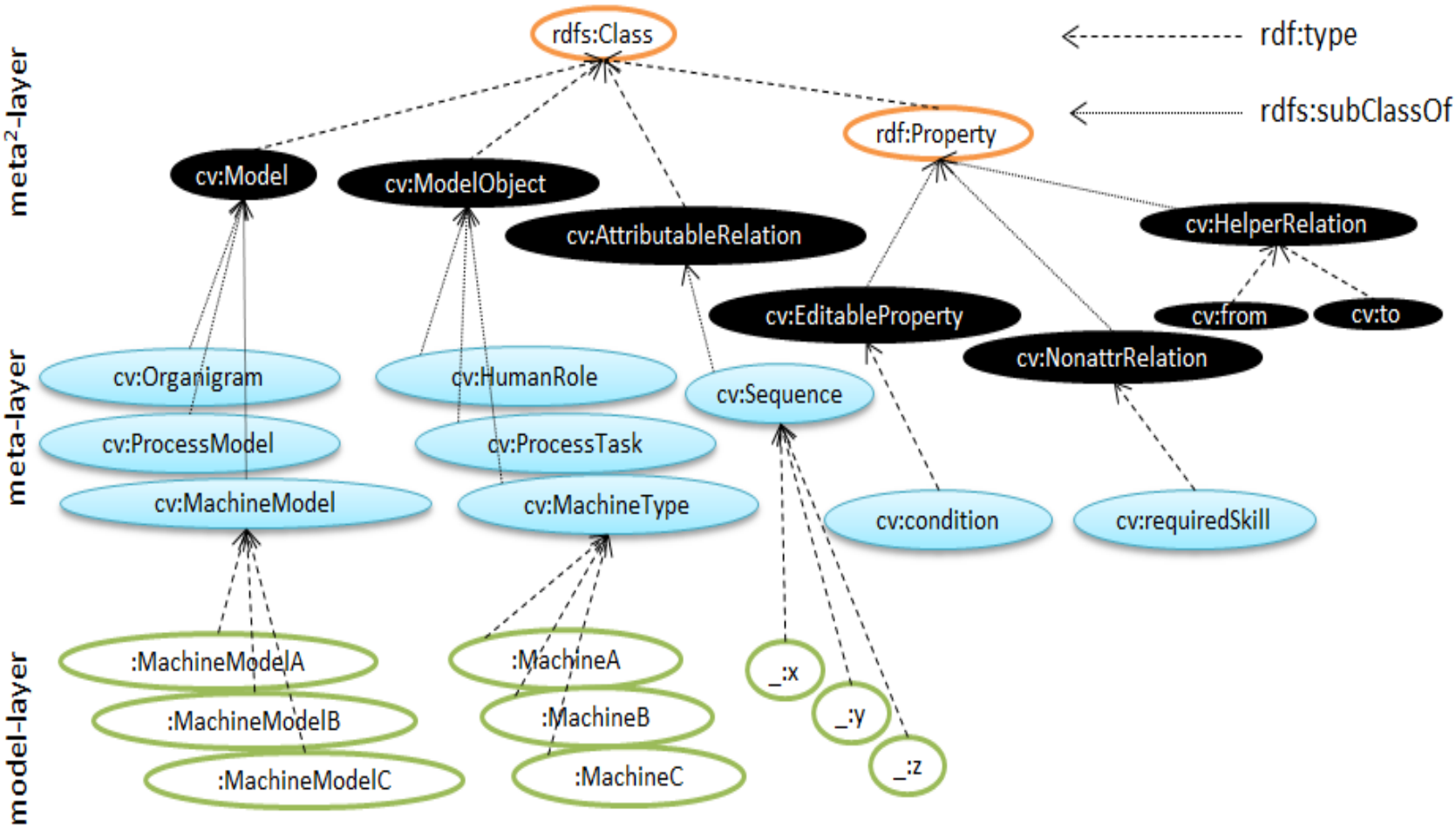
*http://www.omilab.org/web/comvantage



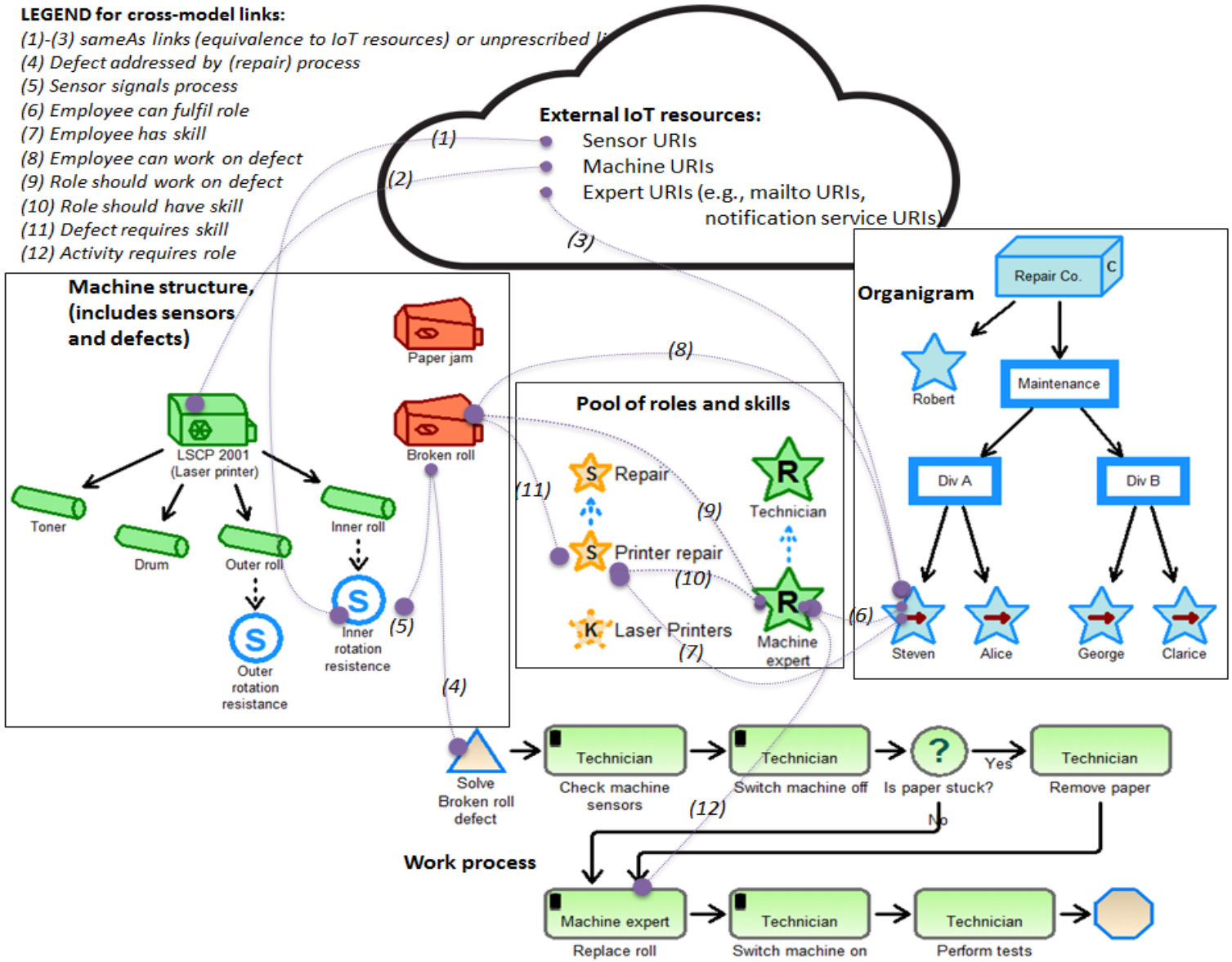
Approach:
Conversion of diagrammatic models to RDF graphs



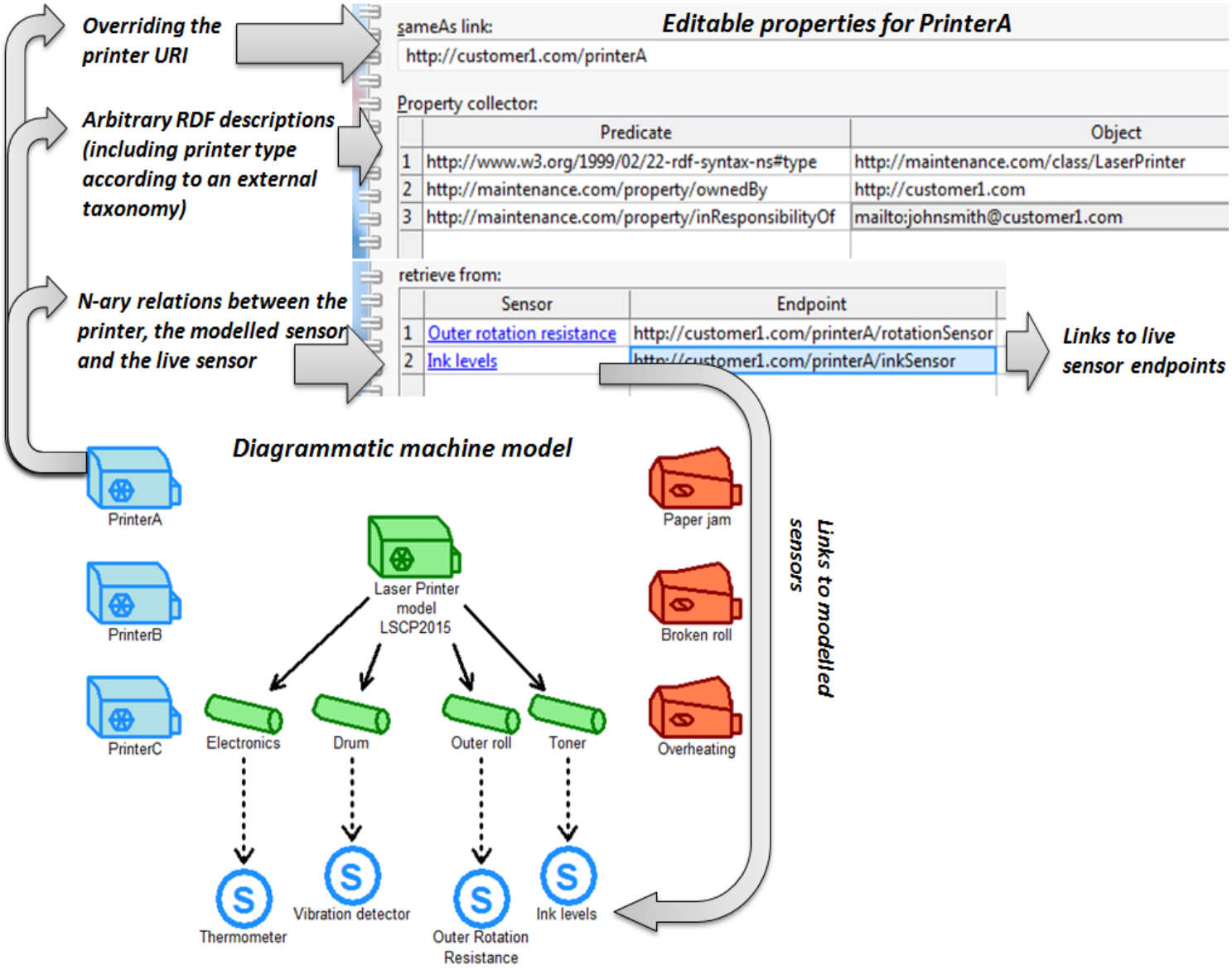
RDF vocabulary for Model Description



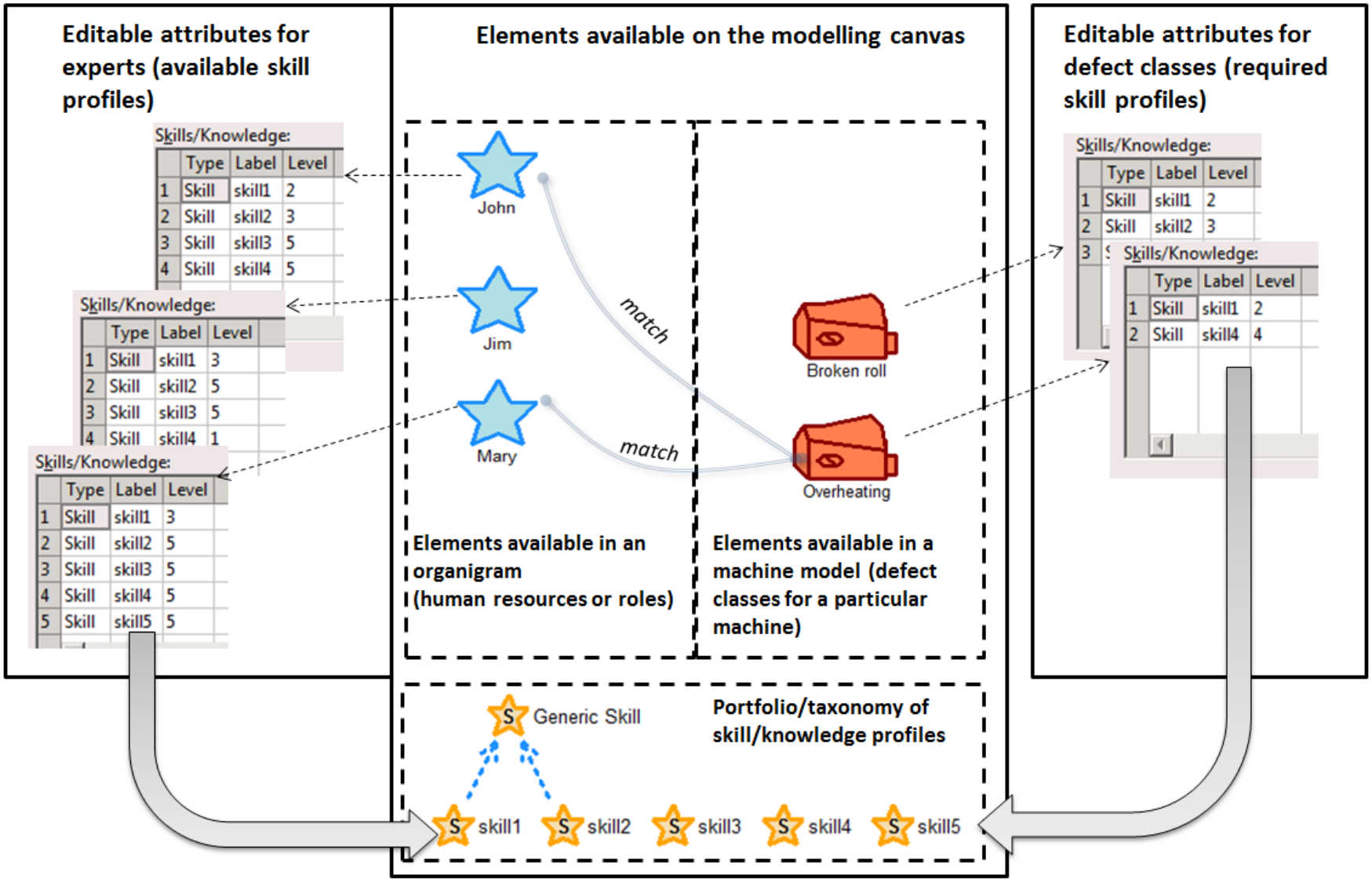
Cross-model Semantic Linking



Linking Models to live Sensor Networks



Minimal running example: Skill profile matching

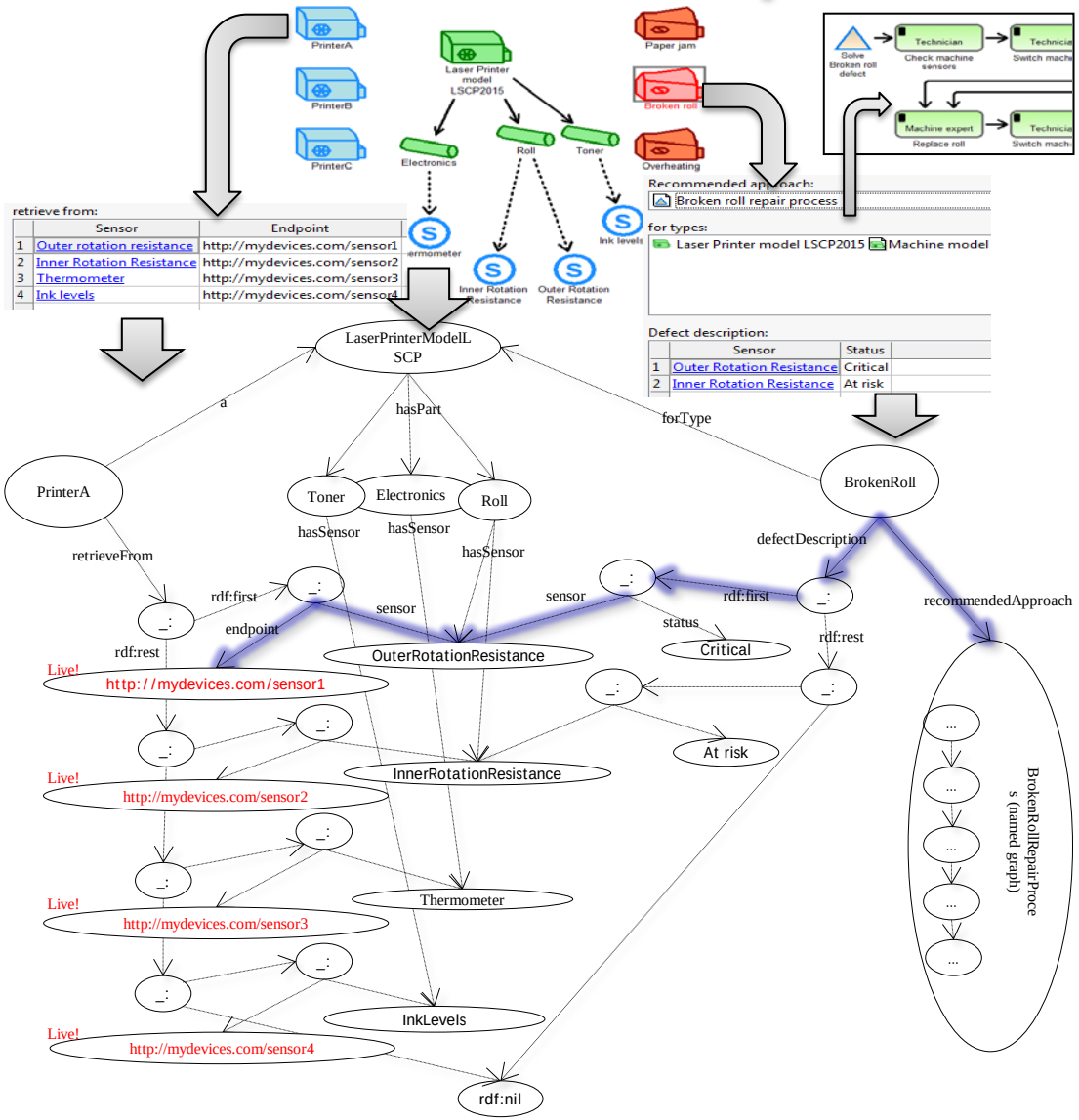


SPARQL* query to perform the match

```
SELECT ?def ?reqCount ?perf (COUNT(?avaSkill) AS ?avaCount)
WHERE {
# The inner query counts how many skills are required by the defect class
 {
  SELECT ?def (COUNT(?reqSkill) AS ?reqCount)
  WHERE {
# The BIND statement provides (in the ?def variable) the URI of the defect class that requires an expert with matching skills (higher than the required ones)
    BIND (<http://test.org#MachineType-365603-Machine_1> AS ?def)
    ?def cv:SkillsKnowledge ?reqList .
    ?reqList rdf:rest*/rdf:first ?reqSkill .
  }
  GROUP BY ?def
 }
# The next lines find what specific skills are required by the defect class
# Notice that the skill table is captured as an RDF ordered list of records
  ?def cv:SkillsKnowledge ?reqList .
  ?reqList rdf:rest*/rdf:first ?reqSkill .
  ?reqSkill cv:Type ?reqSkillTyp .
  ?reqSkill cv:Label ?reqSkillLab .
  ?reqSkill cv:Level ?reqSkillLev .
# The next lines find the experts with matching skills (skill levels higher than those required)
  ?perf rdf:type cv:Performer .
  ?perf cv:SkillsKnowledge ?avaList .
  ?avaList rdf:rest*/rdf:first ?avaSkill .
  ?avaSkill cv:Type ?avaSkillTyp .
  ?avaSkill cv:Label ?avaSkillLab .
  ?avaSkill cv:Level ?avaSkillLev .
  FILTER(?avaSkillTyp = ?reqSkillTyp)
  FILTER(?avaSkillLab = ?reqSkillLab)
  FILTER(?avaSkillLev >= ?reqSkillLev)
}
GROUP BY ?perf ?def ?reqCount
HAVING (COUNT(?avaSkill) = ?reqCount)
# The last line keeps only the results where the number of required skills is equal to the count of matching skills (from experts)
```

*see https://www.w3.org/TR/sparql11-overview/

Traversing the RDF graph from live sensor to maintenance procedure



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The Environment: OMiLAB

- Physical and virtual research laboratory for the conceptualisation, development and deployment of modelling methods and the models designed with them.
- Project space for Associated Organisations interested in the engineering ot modelling methoc and tools
- Community of researchers and practitioners sharin a common understanding about model value
- Repository of reusable resources for AMME

Organization:

University of Vienna,
Faculty of Computer Science

Research Group:

Knowledge Engineering

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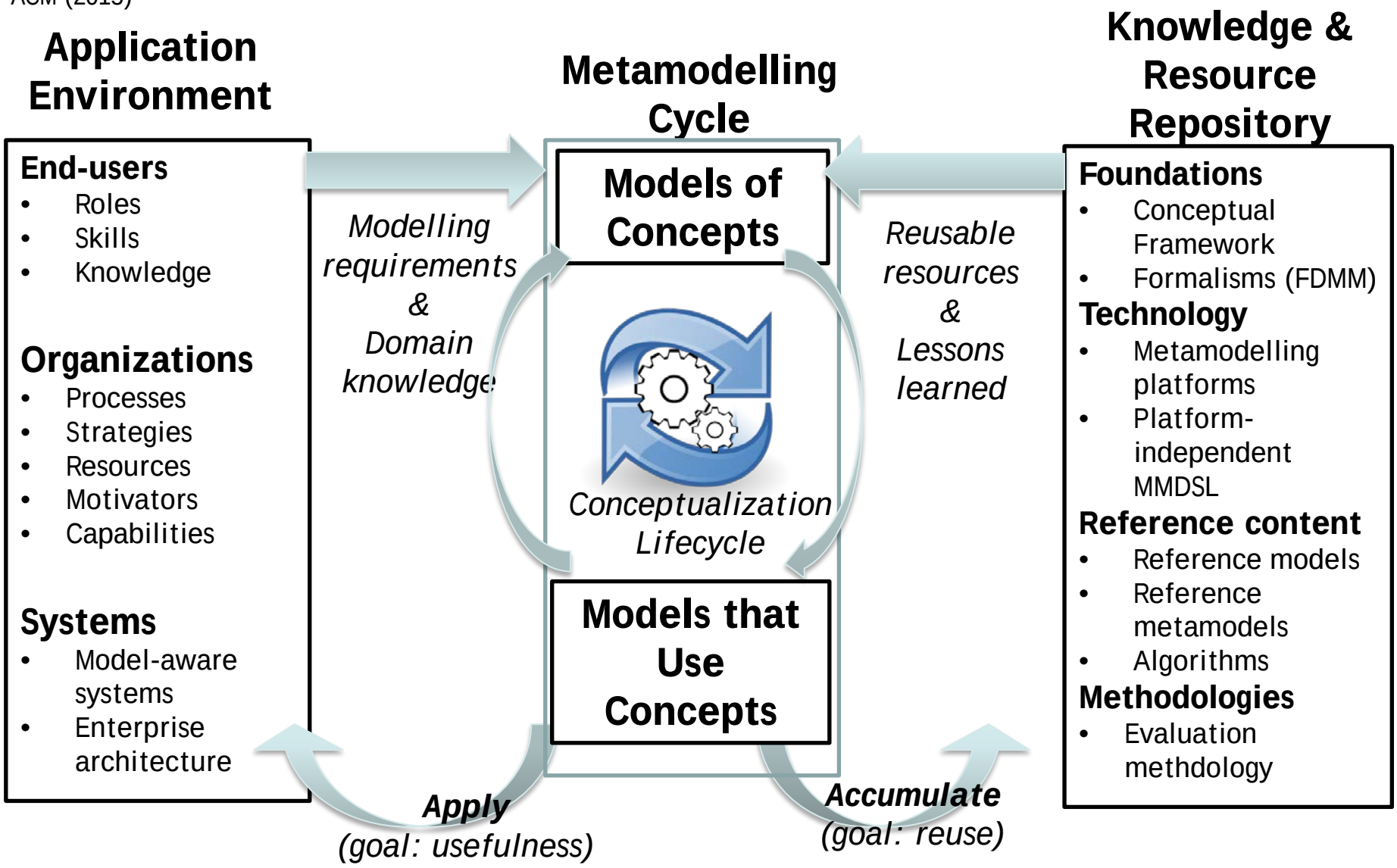
Währinger Str. 29, 1090 Vienna, Austria

The Framework: Agile Modelling Method Engineering*

*cf. Karagiannis, D.: Agile Modeling Method Engineering. In: Proceedings of PCI 2015, Athens Greece, p. 5-10, ACM (2015)



Conclusions

- The proposal enriches run-time data with design-time diagrammatic semantics (requirements models may drive execution)
- Exporting diagrammatic models as RDF semantic graphs opens a wide array of opportunities for mashing-up data and model information (even in the absence of fully-fledged ontologies)
- The iterative application of AMME will evolve the modelling language semantics to fit requirements propagating from "model-aware clients"