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INVENTIVE

Semi-Automated Instance Migration between Evolving Ontologies

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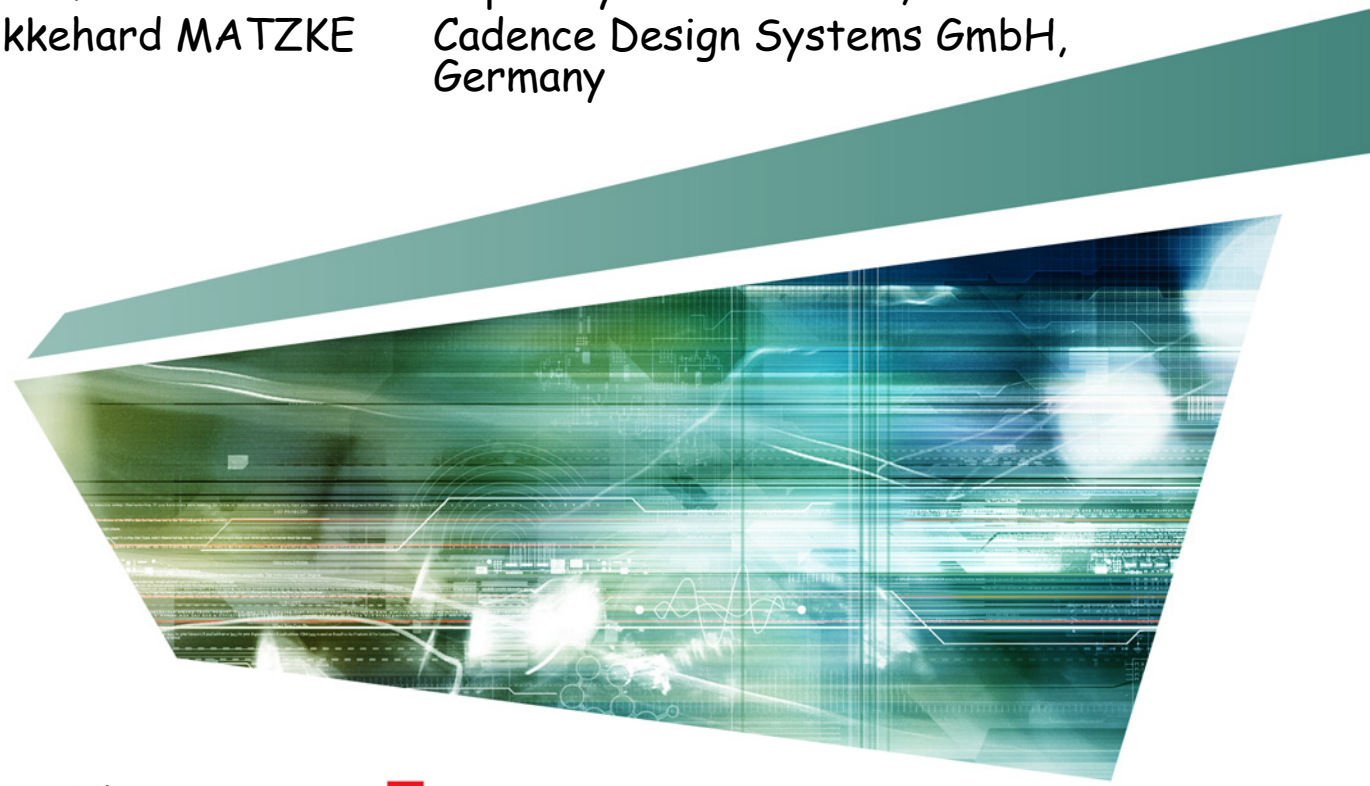


May 23, 2007, Kharkiv, Ukraine

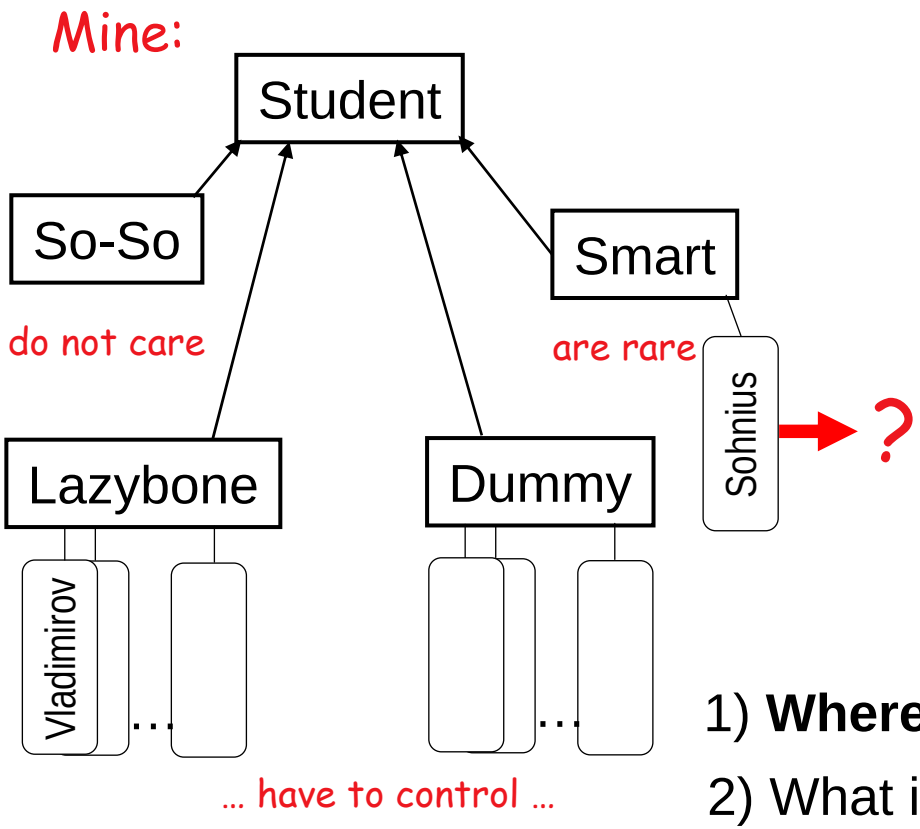
Outline

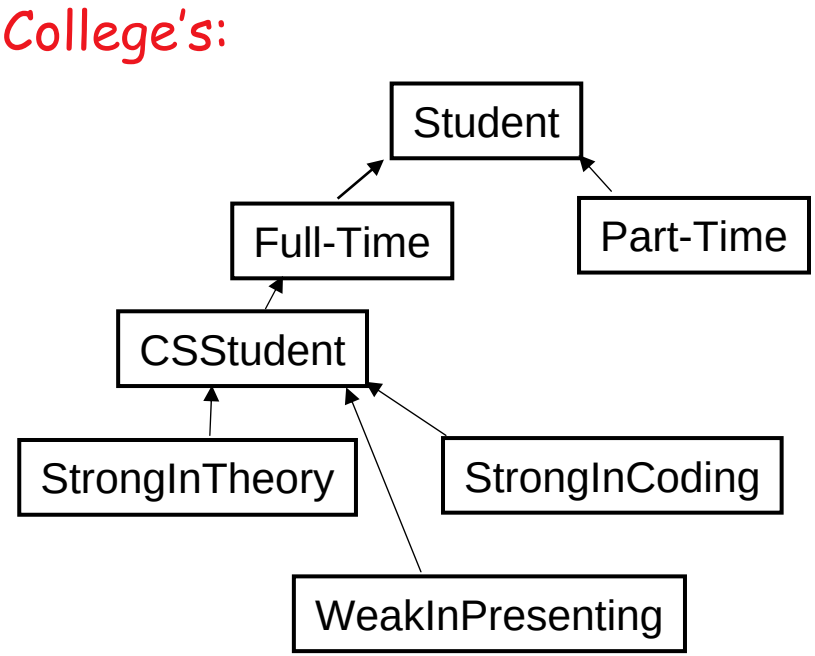
- Why do we need instance migration between ontologies?
- Performance Simulation Initiative (PSI)
  - Why do we need instance migration in PSI?
- How did we do it before: PSI KB Instance Population Script
  - Weak and strong points …
- How do we do it now:
  - PSI Instance Migration – Proof-of-Concept Prototype
- Conclusions and Outlook

No deep technical details in 15 min. Focus on motivation and high-level presentation.

Why Instances migrate?

Reason 1: I found a "better" conceptualization than my own …





1) **Where** an Instance goes?

2) What is the **change in** its **content**?

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Why Instances migrate?

Reason 2: I refined my conceptualization myself …

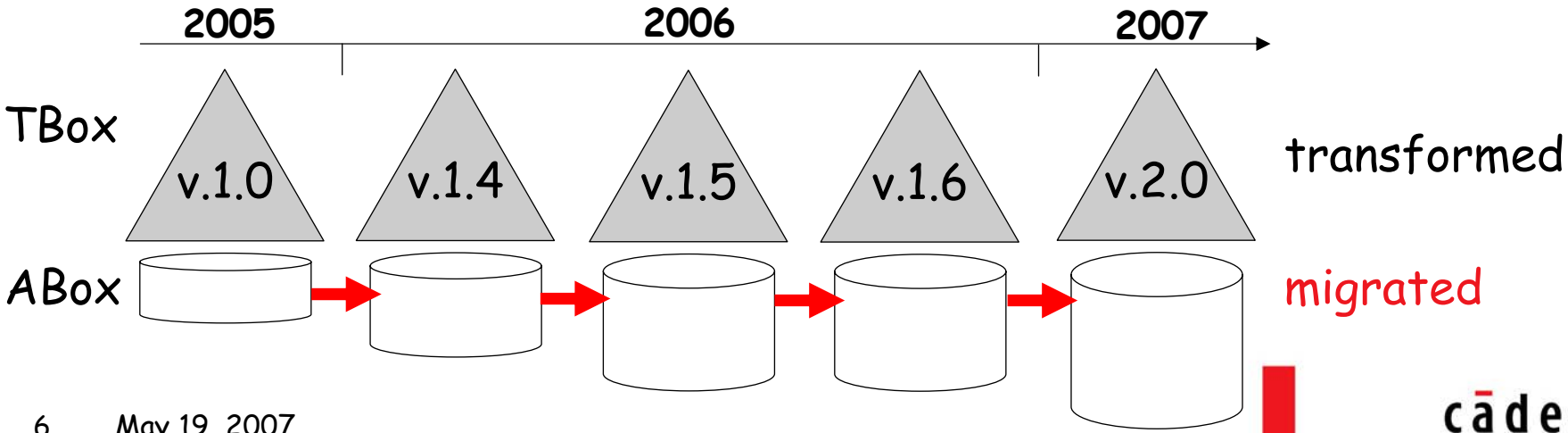
- Same problems between different versions of an evolving ontology
- Constraints are more stiff:
  - Loss of content in instances is not acceptable if not approved by evolution
- Mind distributed scenarios …
  - We collaboratively refined …

Performance Simulation Initiative (PSI)

- Internal Initiative of Cadence Design Systems, GmbH
- Research and Development in Engineering Design Performance Assessment and Management
- A horizontal framework for R&D cooperation
  - E.g., PRODUKTIV+ project (German Federal Ministry of Education and Research)
- Current PSI partners:
  - VCAD, Cadence Design Systems, GmbH
  - Dept of Cybernetics and Gerstner Lab, Czech Technical Uni
  - CERTICON Corp.
  - Intelligent Systems Research Group, Zaporozhye National Uni
- ZNU does knowledge modeling and management

Why do we need instance migration in PSI?

- We have an evolving Suite of Ontologies
- PSI Suite is developed collaboratively
  - PSI and PRODUKTIV+ projects
  - Several European partners: AMD, Bosch, Cadence, Infineon, IMS, FSU, OFFIS, ZNU
- PSI knowledge base (instances) is expanded and refined incrementally



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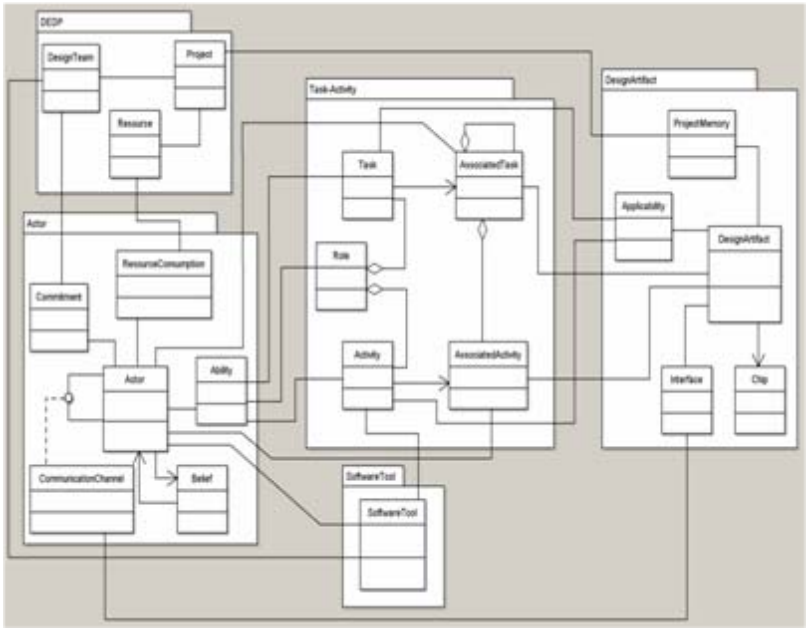
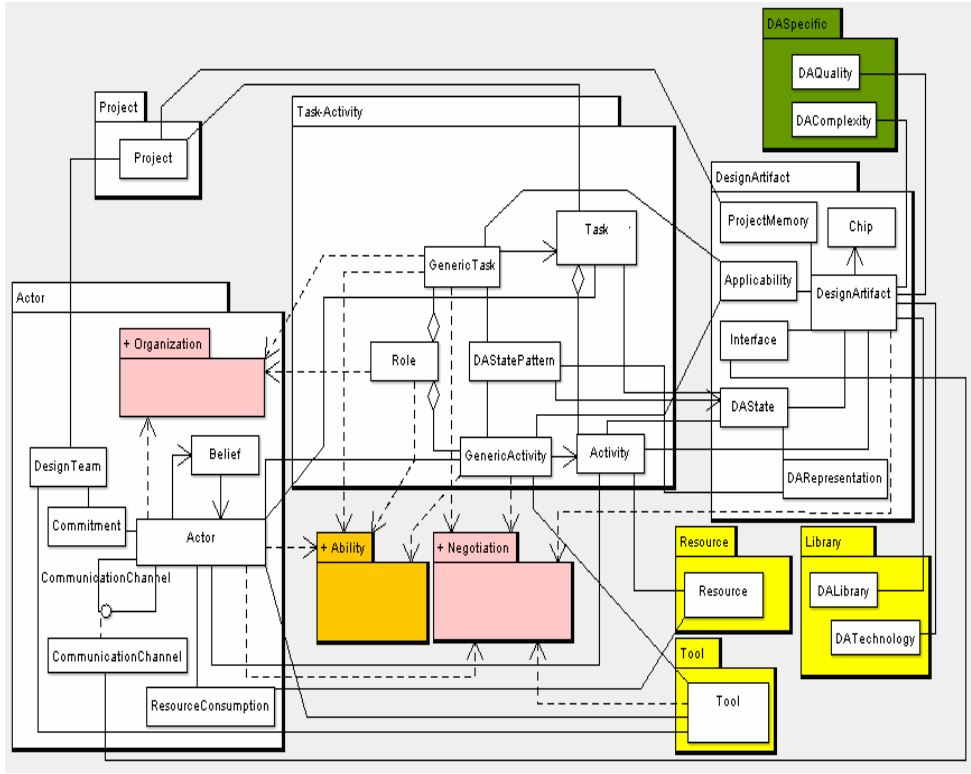
TBox Transformation …



v.1.4



v.2.0

High-level overview pictures are taken from Reference Specifications of v.1.4 and v.2.0

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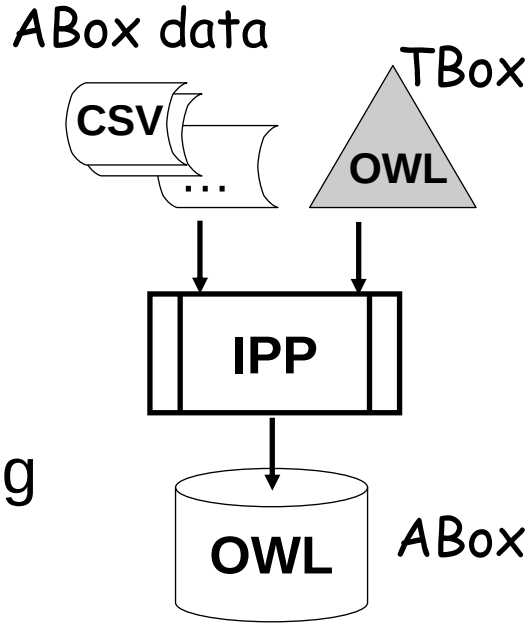
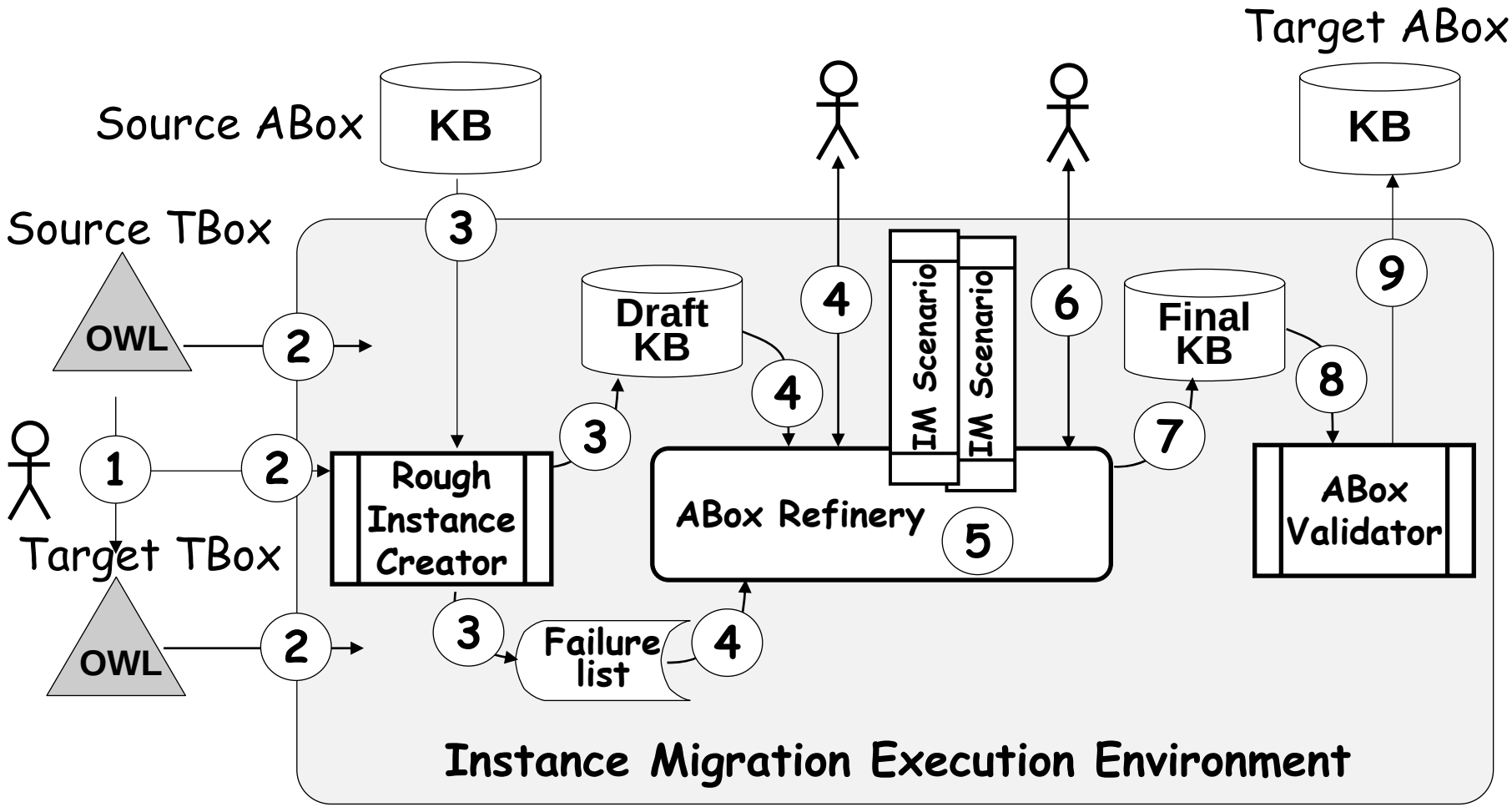
PSI KB Instance Population Program

- Does not migrate instances – populates ABox from CSV source
  - Bad if OWL KB is further updated
- Semantics is hard-wired in Perl script
  - Requires manual re-programming if TBox is changed
- Only changed parts need re-programming
- Later versions can load OWL TBox
- Contains KB validation code



Instance Migration Procedure at a Glance



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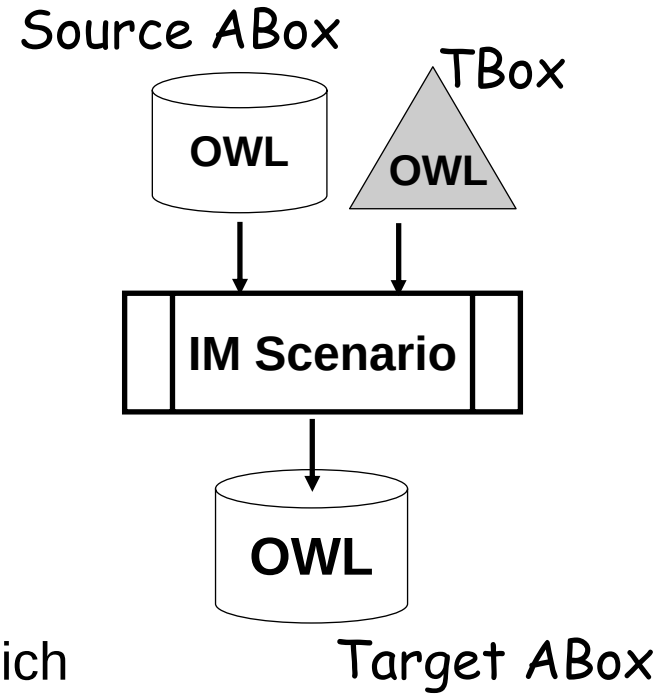
Instance Migration Execution Environment

- Functions
  - Read and save ontology files in OWL format
  - Manage ontology model
    - Concepts, instances, set data and object properties
  - Load mapping rules
  - Execute instance mapping algorithms coded in Python
- Components
  - Jena API – ontology management library
  - Jython – to bridge Jena API with Python scripts
  - Mapping patterns library – set (incl. custom ones) of instance to instance mapping algorithms for different ontology mapping cases

Instance Migration Scenario Script

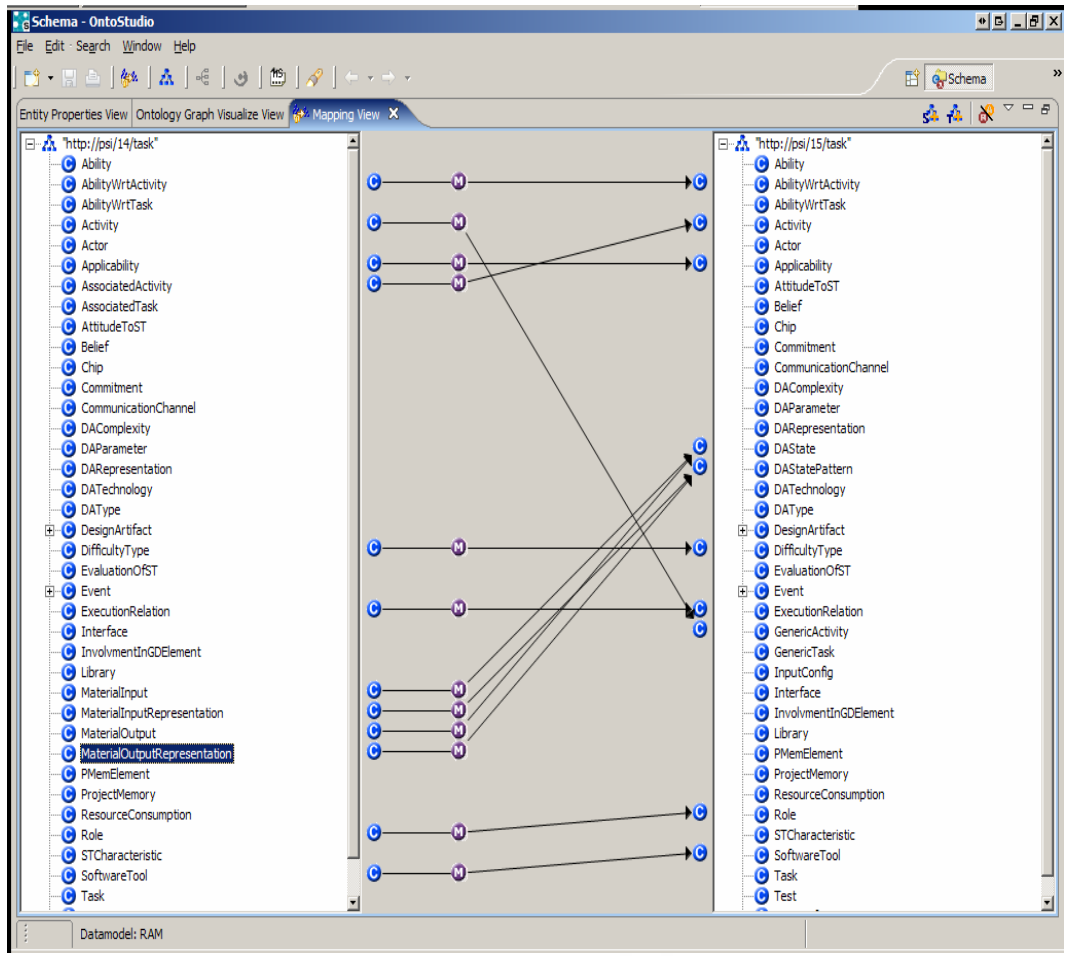


- Very similar to IPP
- Differences:
  - Uses Jython and Jena API
  - Reads OWL, but not CSV
  - Scope is MUCH narrower – maps only a small part of ABox
- Complex Mapping Pattern
  - Used to code (and perform) mappings which can't be coded in OntoMap language
- Runs in Instance Migration Execution Environment
- A programmatic interface for an "advanced" user
- May be re-used
- Collected in the Library

3-d Party Technologies: Mappings

Using Ontoprise OntoStudio with OntoMap plugin
(SEKT IP: http://sekt.semanticweb.org/)

- OntoMap – ontology mapping language
- 3 types of mapping rules:
  - CCMapping
  - AAMapping
  - RRMapping
- Only simple mappings
- Complex – to be coded manually
  - IM Scenario



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Concluding Remarks

- Automated ontology instance migration
  - Is hard
  - Is must-have for many real-world intelligent applications
- So far we do it only semi-automatically
- We also provide tool support for manual steps
- Proof-of-Concept implementation is done
  - Tested on the pair of versions of PSI Ontology Suite (v.1.4 to v.1.5)
  - Result encourages future work

Future Work

- Further development of the tools for manual steps:
  - Refine mappings
  - Add missing instances
- Refinement of mapping language to cope with:
  - Property type, data pattern, length changes
  - Property value aggregations
- Incremental development of the Library of re-usable Instance Migration Scenario Scripts
- Performance issues
- Scalability issues
- Evaluation on “heterogeneous” TBoxes

Resources:

PSI: http://ermolayev.com/ISRG/ISRG-projects-PSI.htm

E-paper: http://ermolayev.com/eva_personal/PS/PSI-ISTA2007-IM-Draft.pdf

This presentation: http://ermolayev.com/eva_personal/PS/PSI-ISTA2007-IM-Slides.pdf

Questions please