Integration of Conceptual Data Modelling Languages

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joint work with Maria Keet[2]

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Preliminaries

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- Dept. of Computer Science and Engineering, Universidad Nacional del Sur

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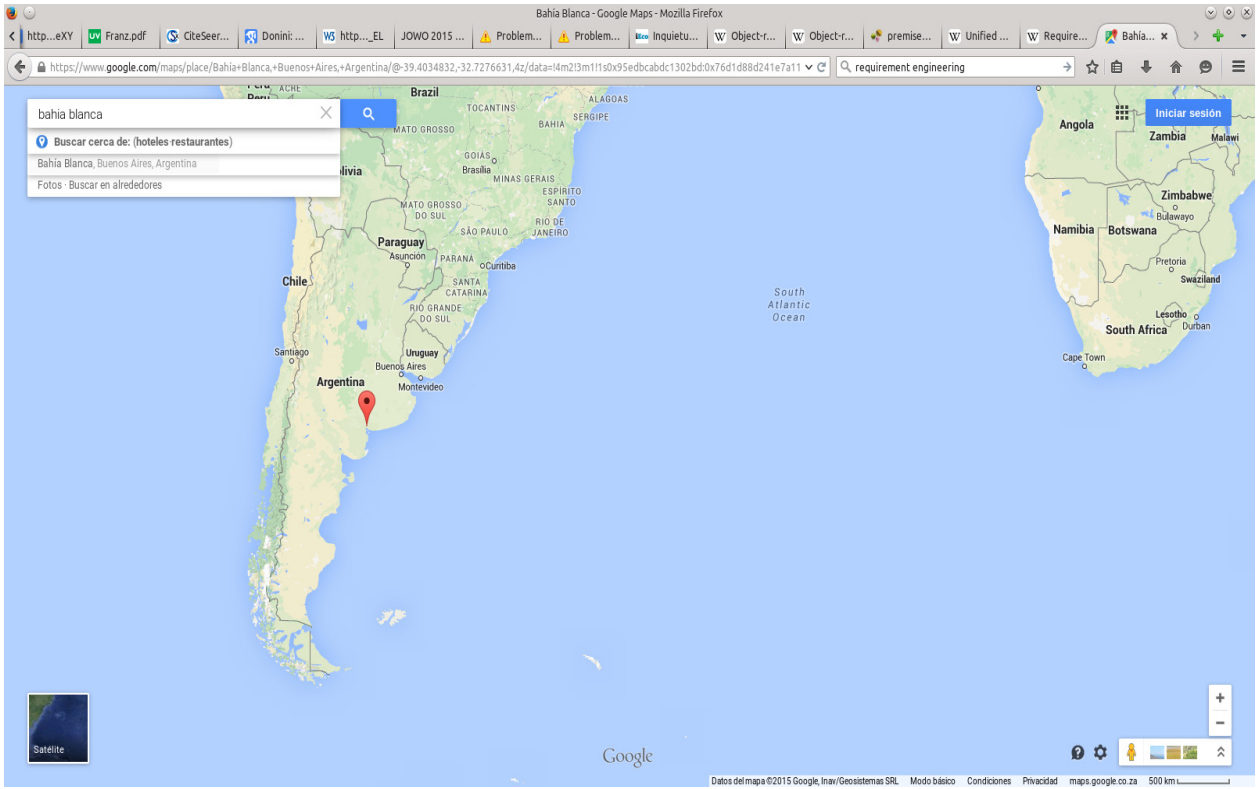

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- present our work in the bilateral AR-ZA project (2012-2014)
- conceptual modelling
- languages for conceptual modelling
- develop formal basis for model integration tools and techniques

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Context

- applications of conceptual modelling
- conceptual modelling language families:
  - EER
  - ORM
  - UML class diagrams
- conceptual modelling tools

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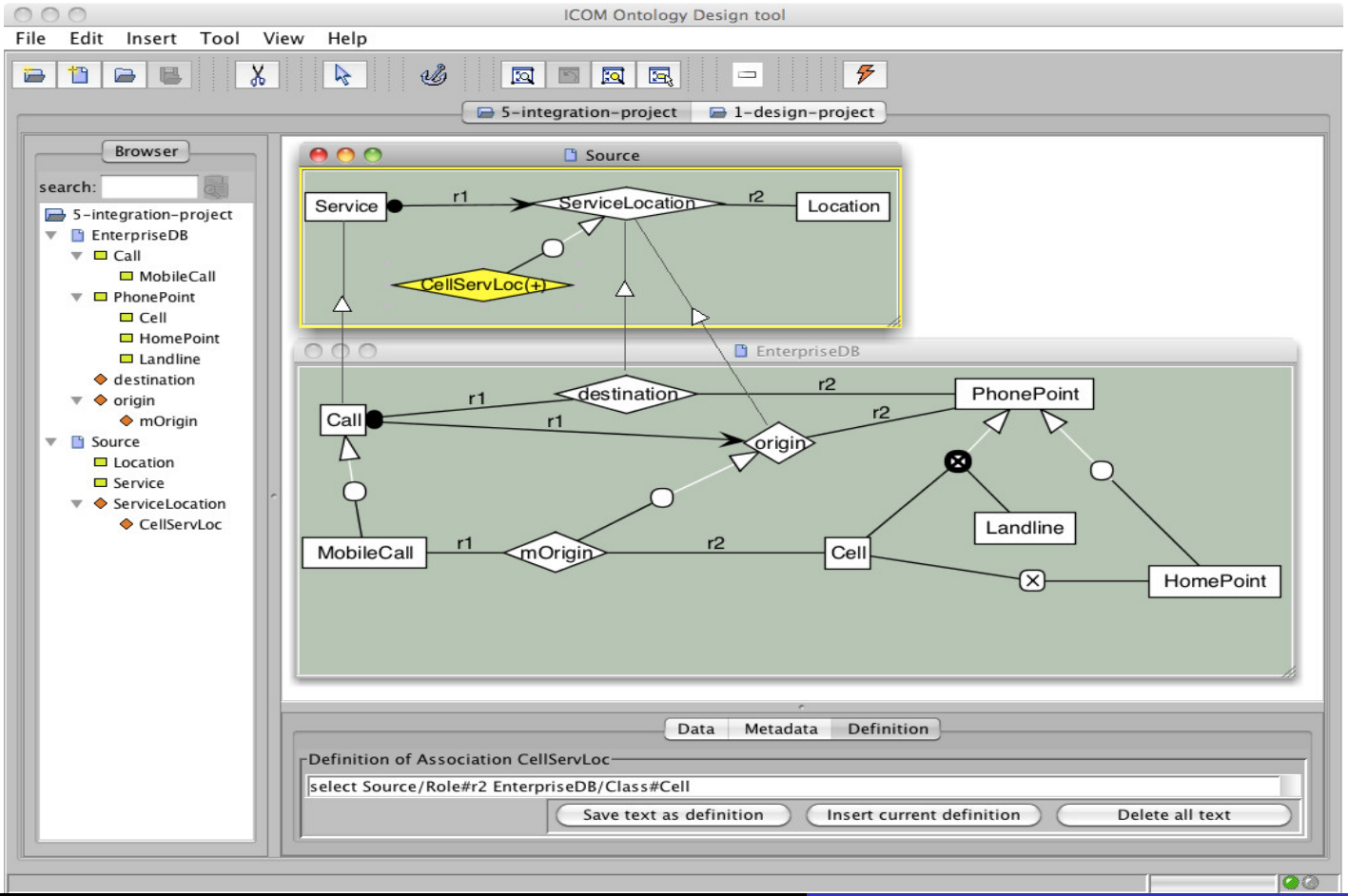

ICOM methodology concept

- graphically design and integrate multiple ontology, with inter-ontology assertions
- complete logical reasoning support, not only to verify properties, but to show implicit facts and devise stricter constraints
- pluggable DL reasoner
- graphic language can express full ALCQI in an intuitive manner

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- apply conceptual modelling techniques to analyze conceptual modelling languages
- what's behind them? is it possible to integrate them?
- check effectiveness of graphical syntax, need for reasoning support

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Integration of Conceptual Data Modelling Languages

Metamodel

- captures all structural elements in the languages
- also their relations and constraints
- describes the rules in which they may be combined
- the metamodel is formalized in FOL and OWL

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Static entities

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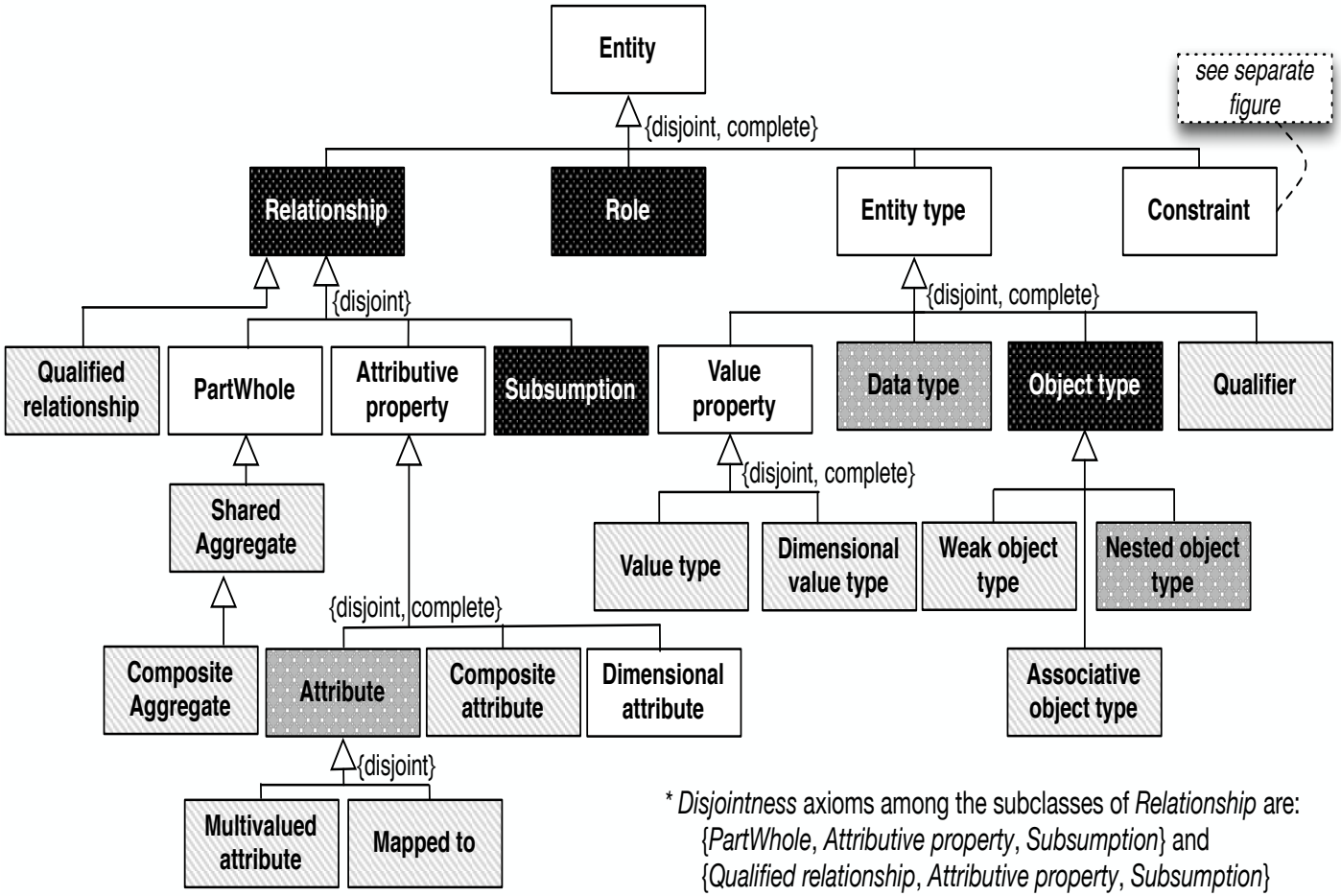

* *Disjointness* axioms among the subclasses of *Relationship* are:
{*PartWhole*, *Attributive property*, *Subsumption*} and
{*Qualified relationship*, *Attributive property*, *Subsumption*}

Constraints

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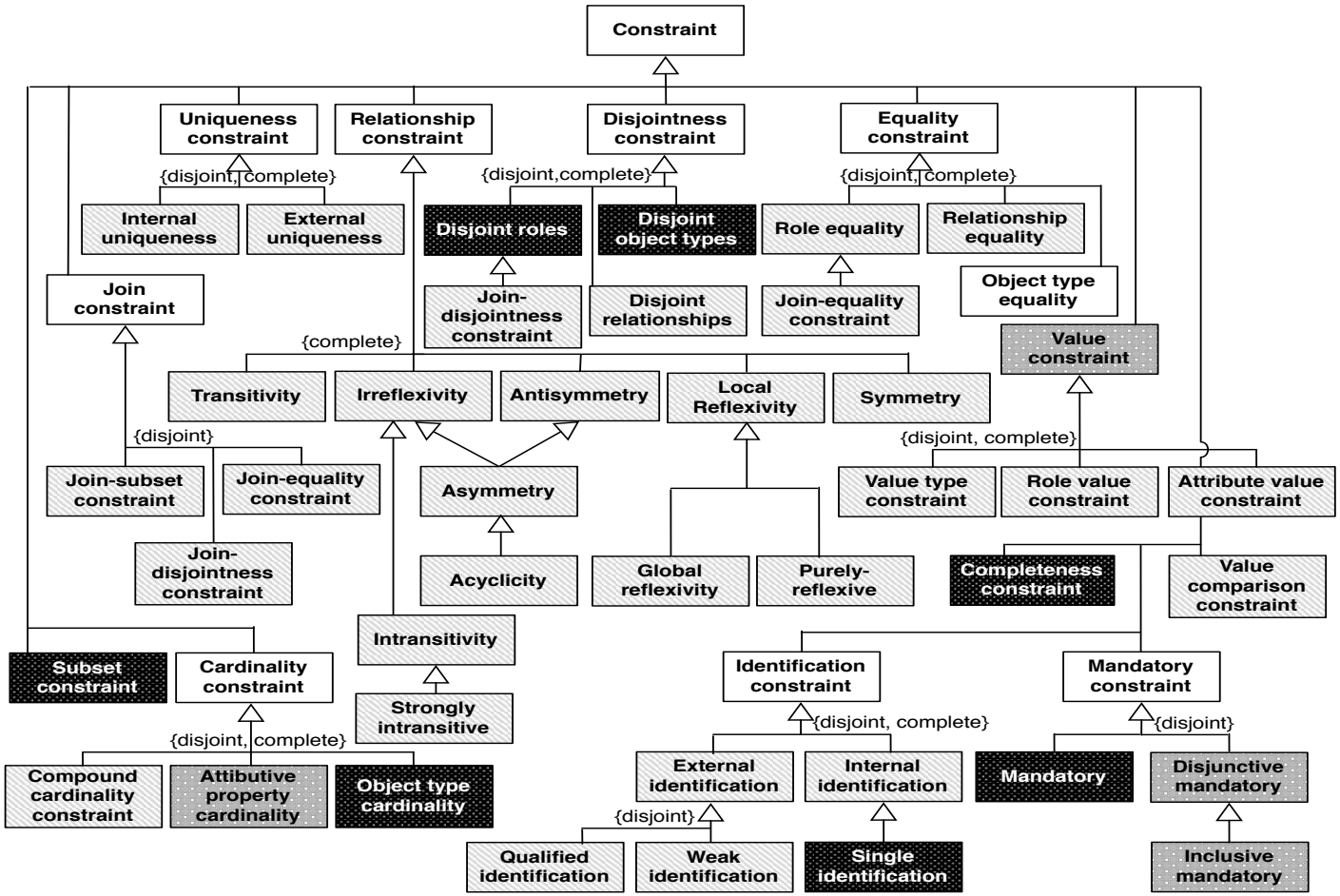

Combination rules

- speciy how entities and constraints can be related

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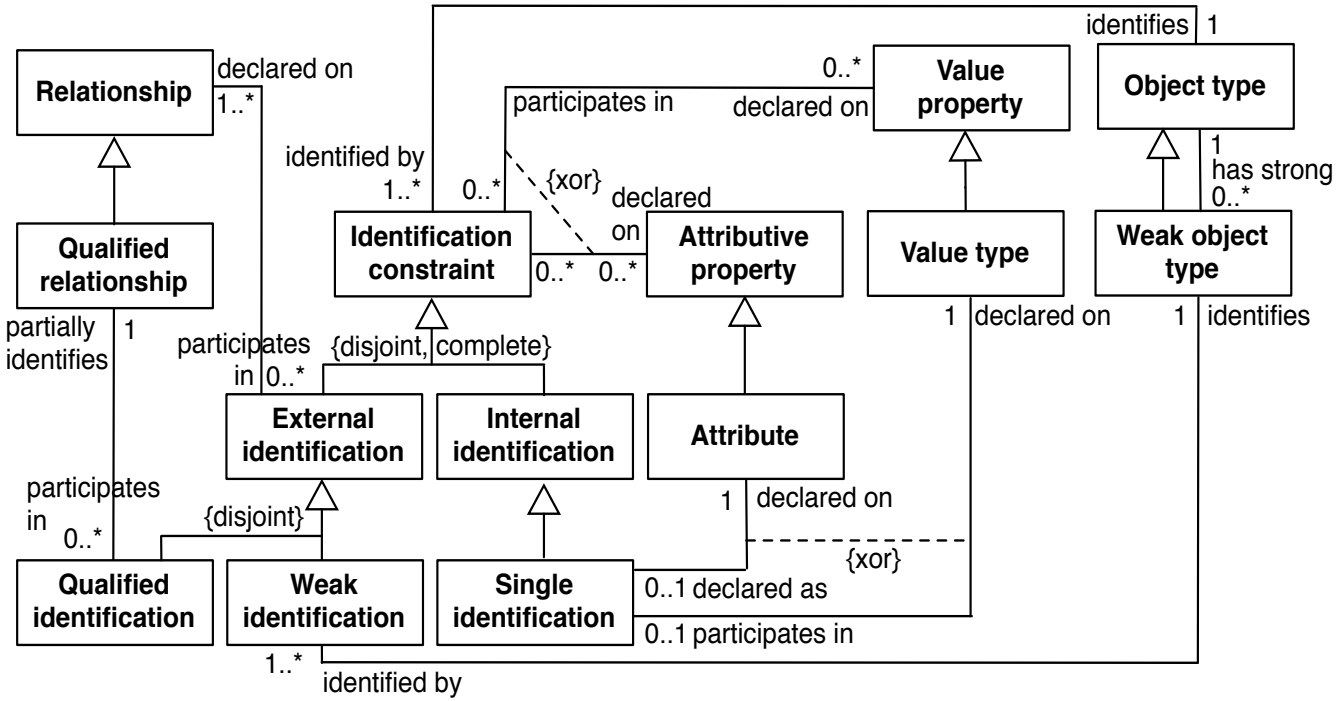

* A *Weak identification* is a combination of one or more *Attributive property* of the *Weak object type* it *identifies* together with the *Identification constraint* of the *Object type* it has a *Relationship* with and this *Object type* is disjoint with the *Weak object type*.
* The *Single identification* has a *Mandatory* and a 1:1 *Cardinality constraint*.
* *Qualified identification* and *External identification* are *declared on* only *Attributive property*.
* A *Qualified relationship participates in* a *Qualified identification* only if the *Cardinality constraint* is 1.

Transformation Rules

- a process for linking and translating models
- based on different kinds of rules: mappings, transformations, approximations
- together with the metamodel, it can be used to verify inter-model assertions

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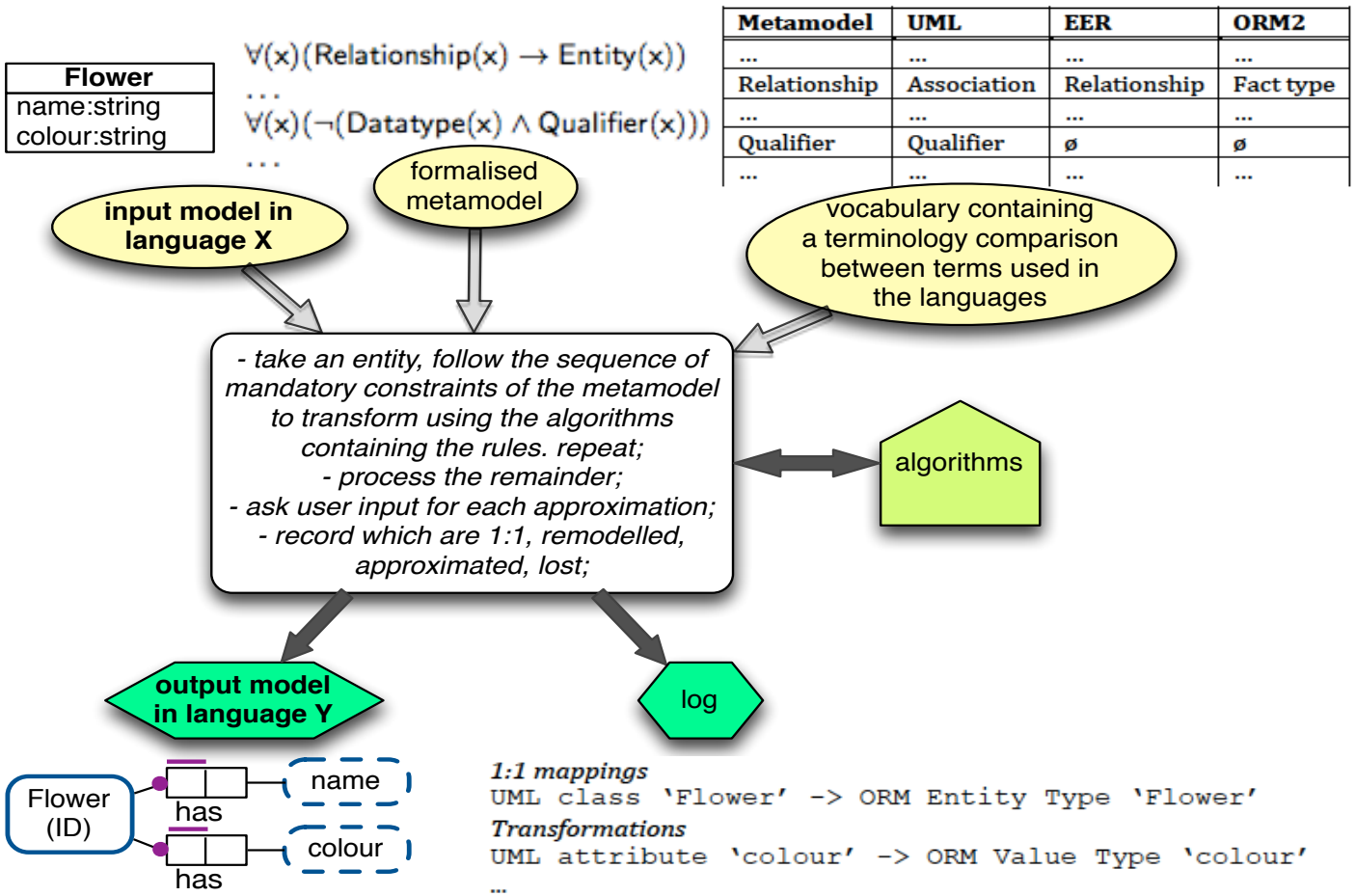

Metamodel	UML	EER	ORM2
...	...	...	...
Relationship	Association	Relationship	Fact type
...	...	...	...
Qualifier	Qualifier	ø	ø
...	...	...	...

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Is expressiveness everything?

- very few elements belong to the three languages
- is it worth trying to integrate their models?
- we collect available models on each language, and study the usage of metamodel elements on them (approx. 35 on each language)

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Common Features

- classes (object types)
- attributes (or value type transformations)
- binary relationships
- class subsumption
- cardinality constraints on roles
- mandatory constraints
- single attribute identification
- all these elements represent more than 87 % of use of all elements

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Salient Features of Each Family

- UML: object oriented, almost only binary relationships, no key, can express some constraints, but very few are used, relatively more use of isas
- ORM: relationship oriented, n-ary relationships, hidden attributes and less used, a lot of constraints can be expressed but rarely used (except for cardinalities), mainly single attribute identification
- EER: database oriented, n-ary relationships, different attributes and kinds of keys are more often used

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