SUPPORTING AGILITY IN MDE THROUGH MODELING LANGUAGE RELAXATION

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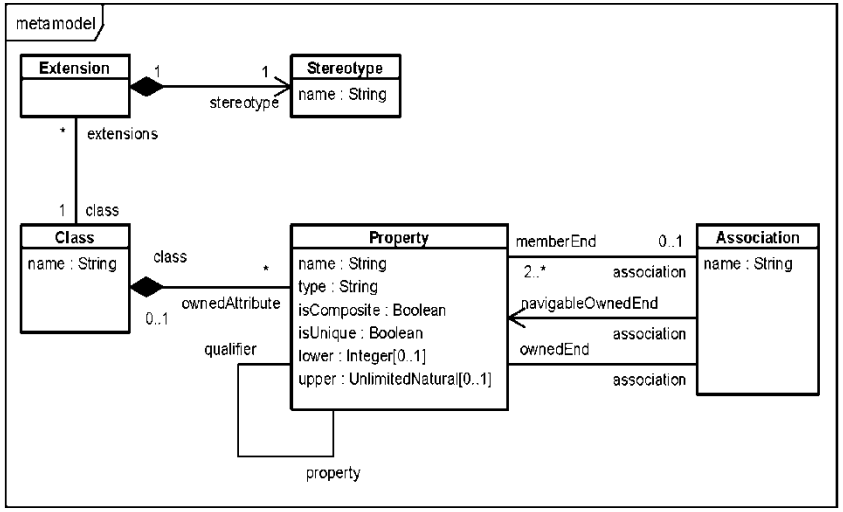
The Agility Conflict in MDE

Models are used by humans and programs

BUT

Humans want expressive freedom

Programs need well-defined constraints

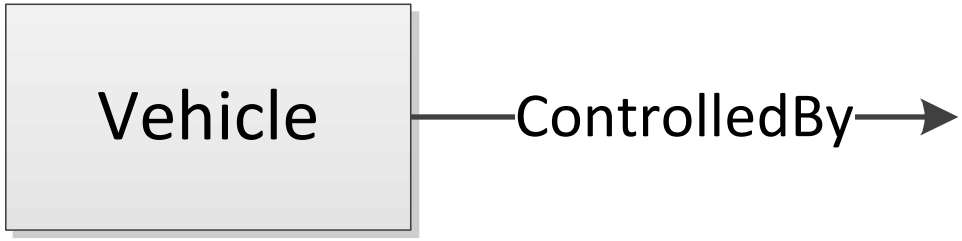


We focus in two types of agility

- Omission agility
  - Allowing the expressive freedom to omit information that is not relevant, certain, etc.
- Clarity Agility
  - Allowing the expressive freedom to present information in ways that are easier to understand.

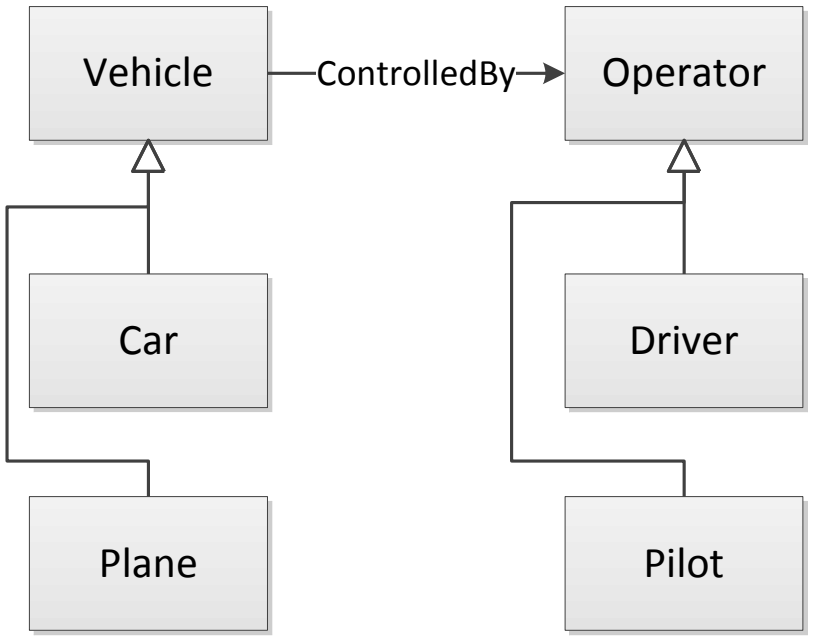
Agility requires the relaxation of the language

Example



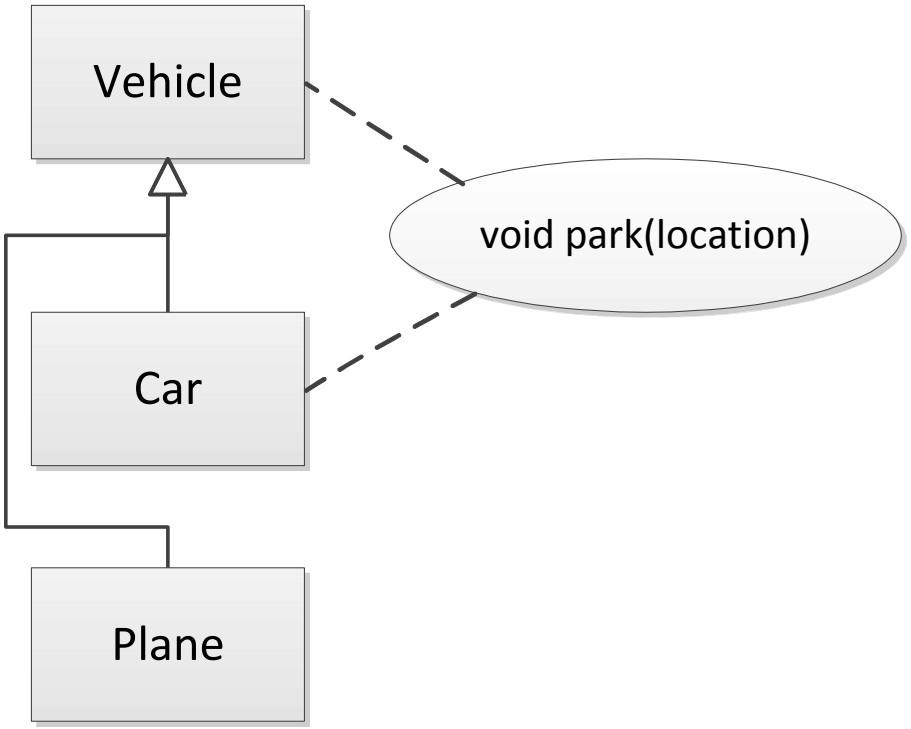
- Omission agility
  - Target of association is omitted because it is not yet known

Example



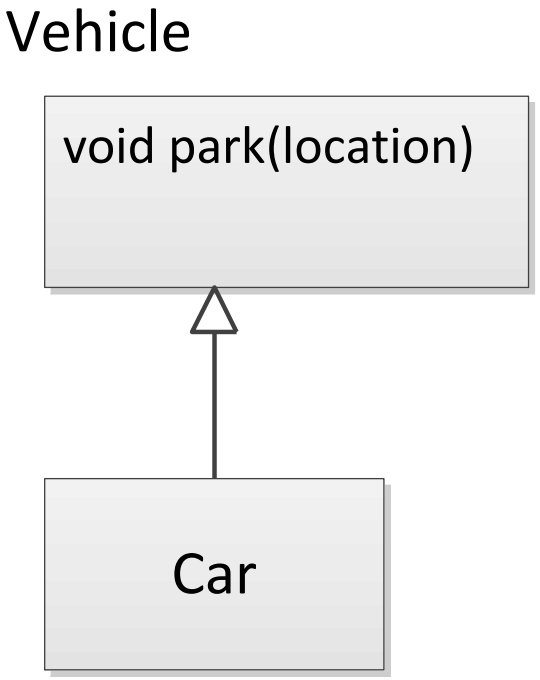
- Clarity agility
  - Classes in hierarchy are aligned to indicate how instances are paired
  - … rather than expressing this using OCL

Example



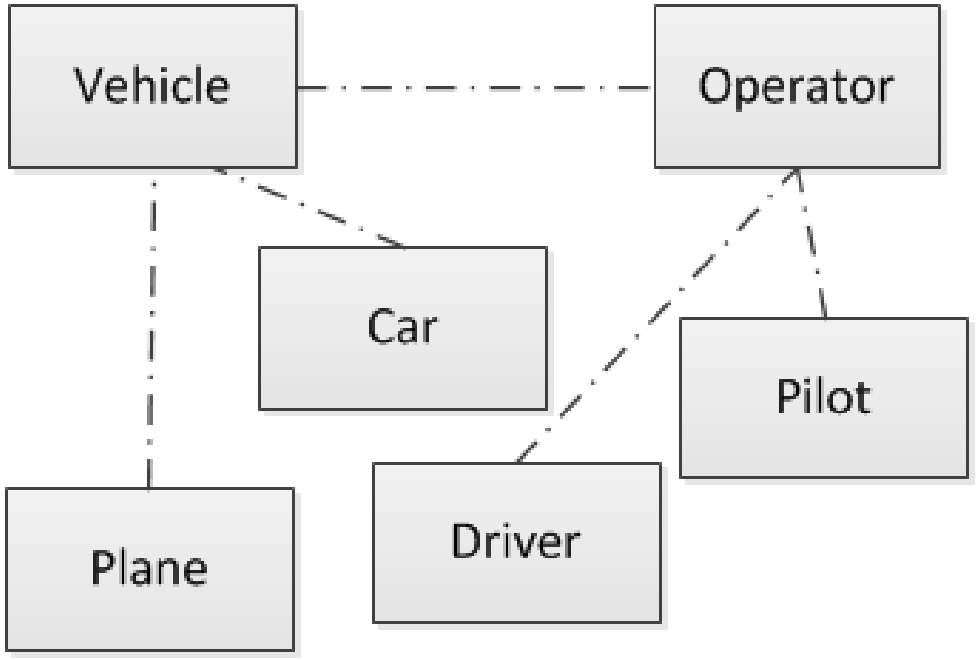
- Omission Agility
  - The exact class of “park(location)” operation is not known
- Clarity Agility
  - Use a single mention of the operation external to but linked to both

Example



- Clarity Agility
  - Put name of class outside of box to avoid clutter.

Example

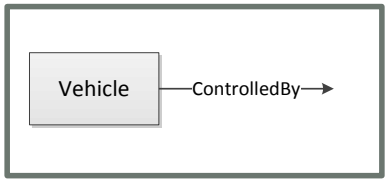


- Omission Agility
  - The precise relation types between these classes is irrelevant and so is omitted.

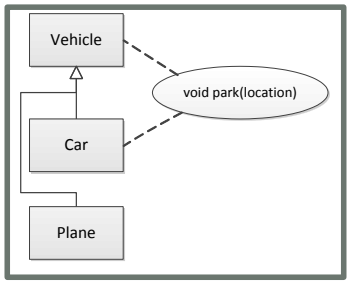
Summary

- Omission Agility

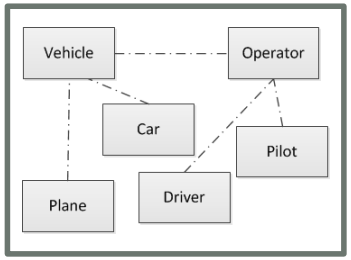
drop info



provide alternatives

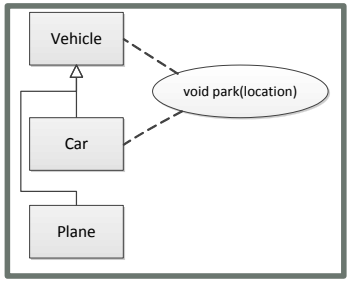


use abstraction

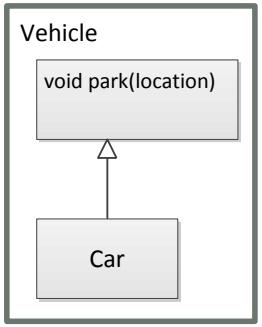


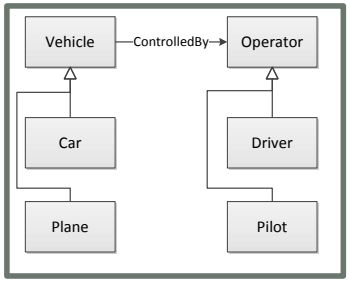
- Clarity Agility

adding notation

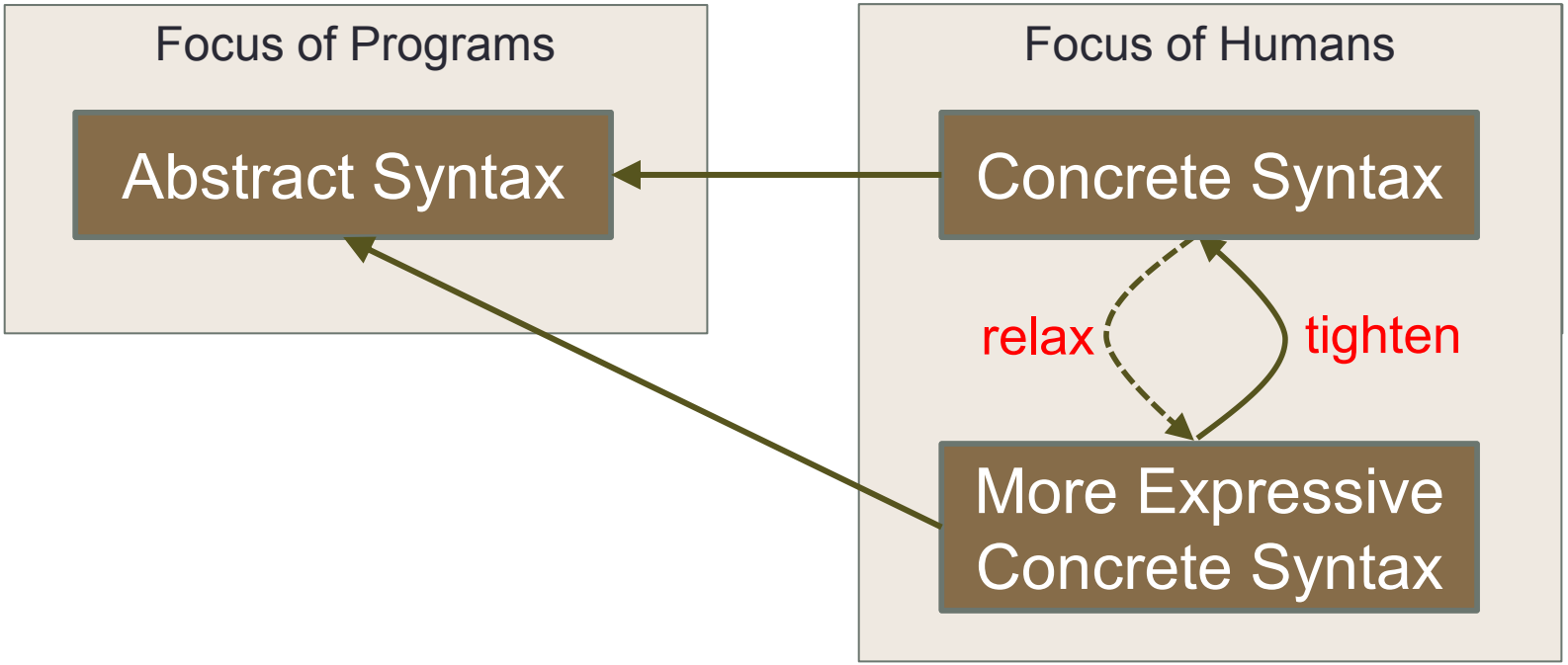


leveraging visual conventions



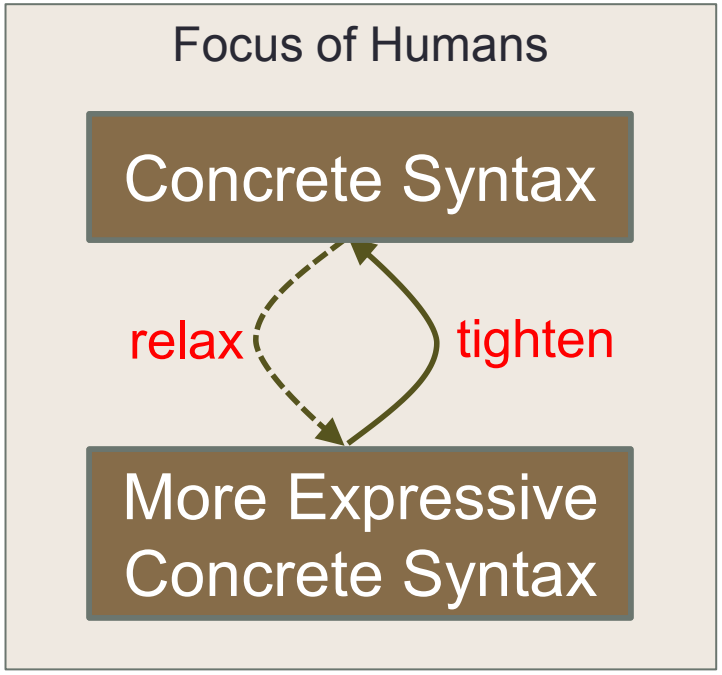


Generalizing from examples



Observation: Supporting agility in MDE requires transformations on concrete syntax!

Relaxation and tightening: language aspects



Modeling languages have a vocabulary and well-formedness constraints

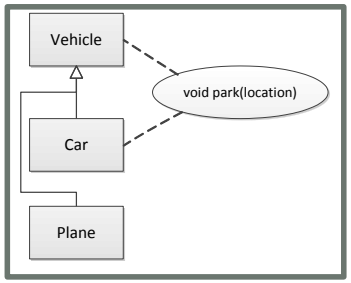
- Relaxation: Extending vocabulary - Tightening: Translate the extension
- Relaxation: Weakening constraints - Tightening: Repair violation

Applying to examples

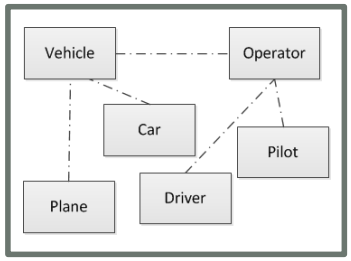
- Relaxation: Extend vocabulary; Tighten: Translate extension

  oval → operator

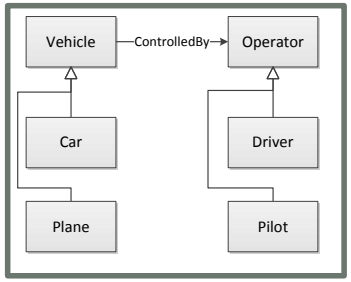
  link → containment



  dashed link → rel

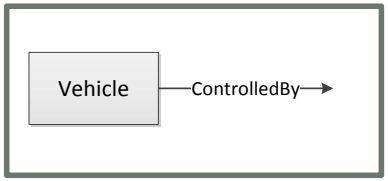


  alignment → OCL

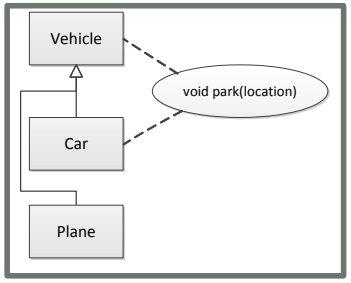


- Relaxation: Weakening constraints; Tighten: Repair violation

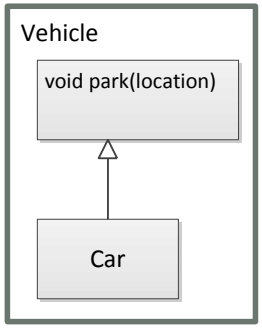
  add class



  remove ownership



  move class name



Applying to examples

- Relaxation: Extend vocabulary; Tighten: Translate extension

  oval → operator

  link → containment

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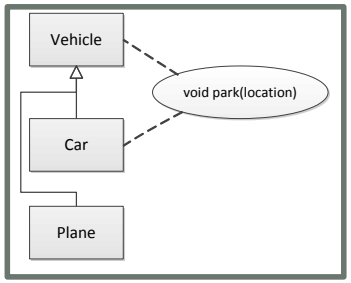
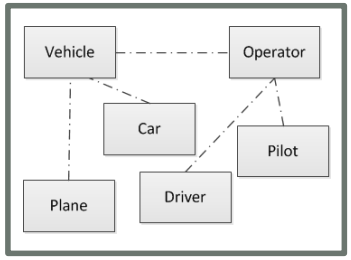
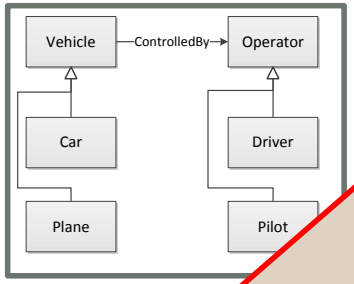




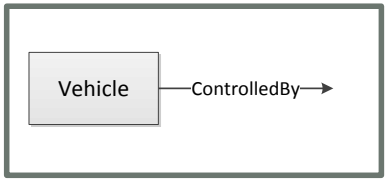


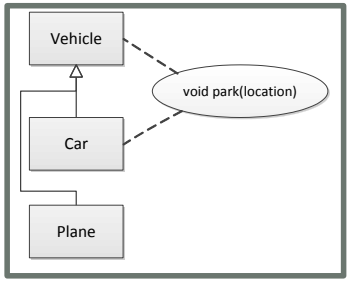
- Relaxation: Weakening constraints; Tighten: Repair

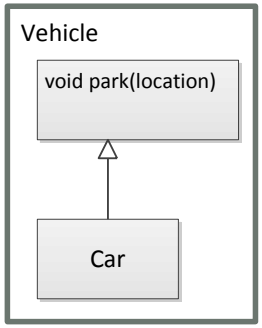
  add class

  remove ownership

  move class name







Some tightening requires choice

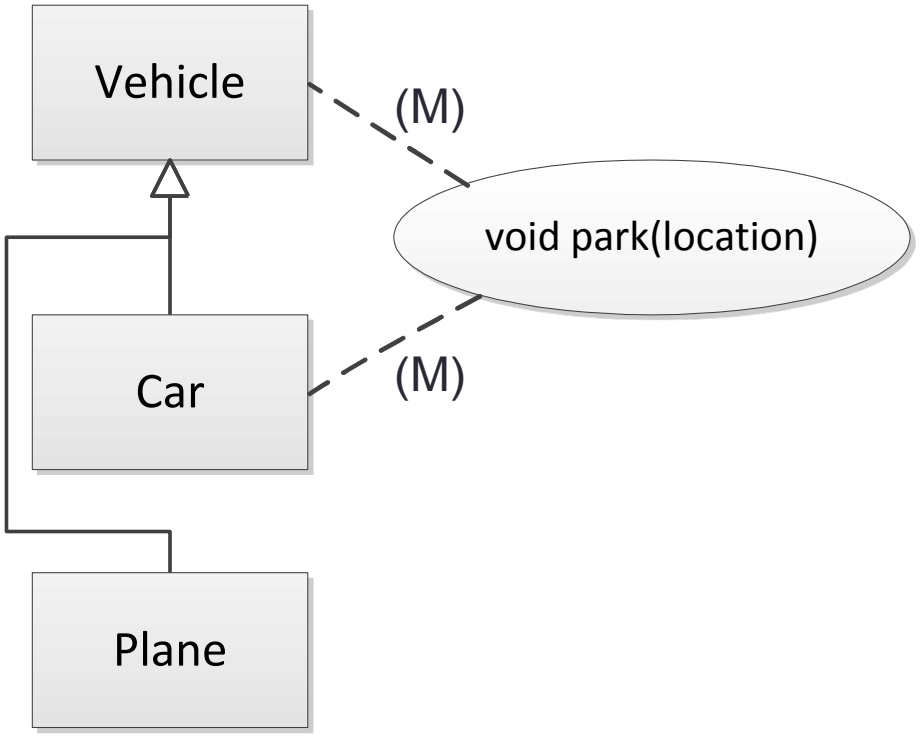
Alternative to choice: Partial modeling

- Rather than choosing one possibility, use a partial model to express all possibilities
- Partial models represent sets of models
  - Modal Transition Systems [Larsen and Thomsen '88]
    - Much follow-on work: Chechik, Uchitel, Ben-David, etc.
  - MAVO [Salay, Famelis and Chechik '12]
    - Generalizes from behavioral models
- But ..
  - Applying programs to partial models requires lifting the algorithm to sets of models
  - e.g., lifting transformations to partial models
    - "Transformation of Models Containing Uncertainty" [Famelis et. al. Models'13]

MAVO partial modeling example

- The V annotation means: treat the class C like a "variable class"
  - represents all possible well-formed models obtained by instantiating variable C with a particular class

MAVO partial modeling example



- The M annotation means: the link may or may not exist
  - Represents all possible well-formed models in which some of the links are present.

Towards Tool Support for Relaxation/Tightening

Relaxation

- Use a general drawing tool (e,g., Visio) that allows constraints to be selectively disabled or deferred.

Tightening

- For extended vocabulary
  - Identify: new symbols being used
    - Only possible automatically when it causes a concrete syntax change. In other cases, evident spatial relations may be a clue
  - Tighten: provide a tool for translating the new language construct in terms of existing ones (e.g. using ATL)
- For weakened constraints
  - Identify: constraint violation
  - Tighten: use existing approaches for computing the minimal repair to a constraint violation
    - e.g. [Xiong et. al 2009], [Reder et. al. 2012], etc.
- Optional: use partial modeling to handle choice

Summary

- There is an agility conflict in MDE
  - Humans want freedom; programs need structure
- We propose an approach to allow freedom and structure
  - Relax for humans; tighten for programs
    - Optionally use partial models to address choice
  - Focus on two kinds of agility:
    - Omission agility: freedom to leave out information
    - Clarity agility: freedom to express clearly
  - Start of a theory: vocabulary extension/constraint weakening
- Explored approach using examples
- Potential tool support with existing technologies
- Just the beginning …
  - Develop theory, test feasibility, extend to other kinds of agility, etc.

THANK YOU