Dealing with Variability within a Family of Domain Specific Languages

Comparative Analysis of Different Techniques

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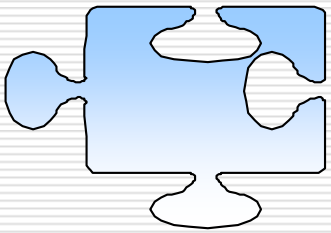
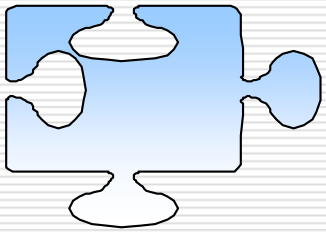
Source problem

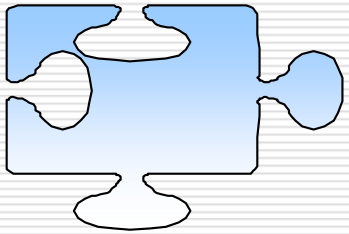
Related (yet different) languages need to be used together



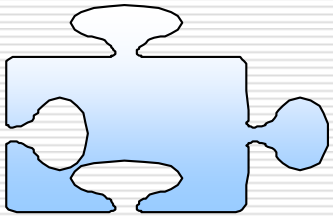
Pluto



Mois



Elisa

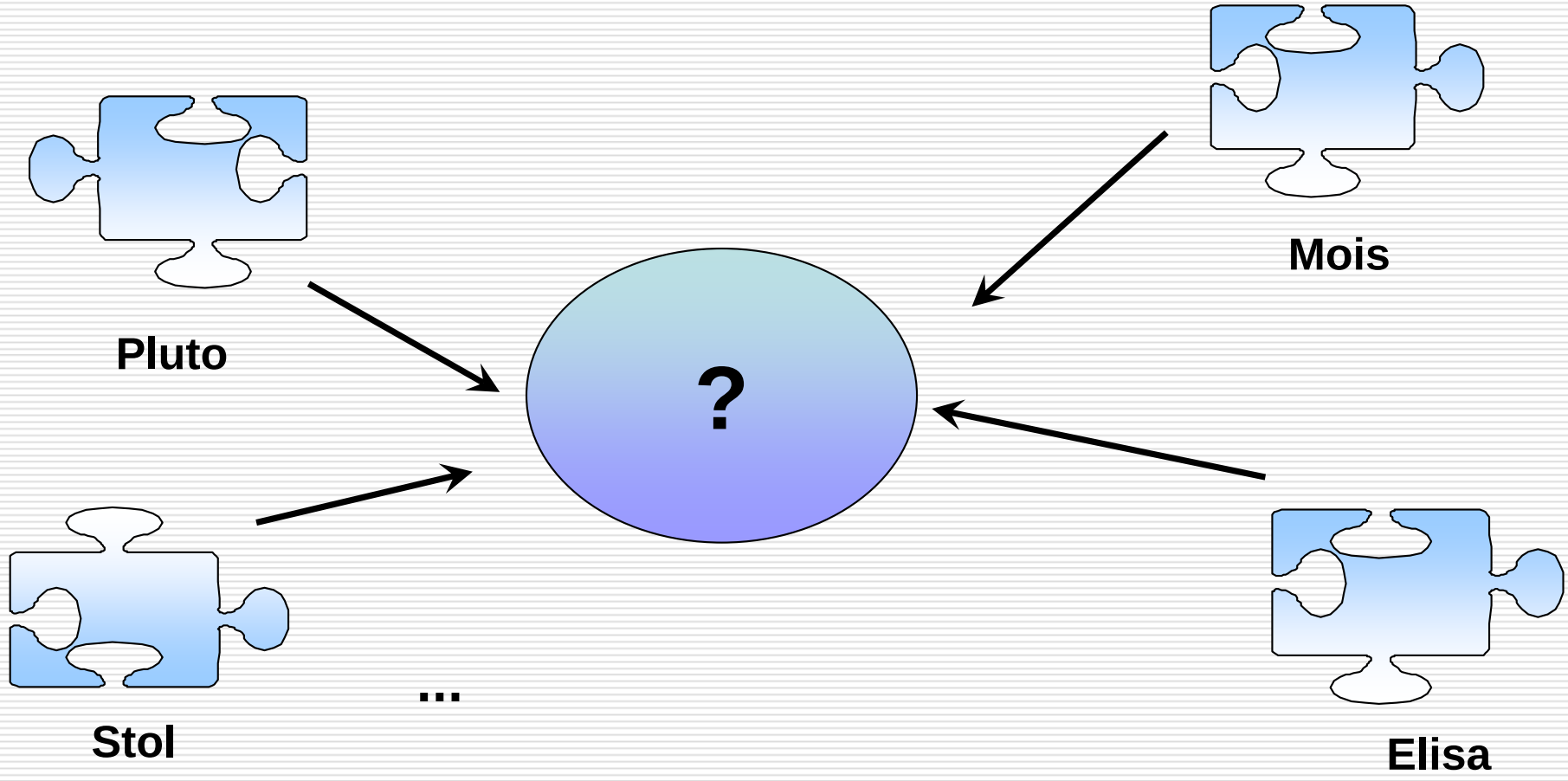


Stol

...

Specific spacecraft operations languages

What approach for interoperability ?



Overview

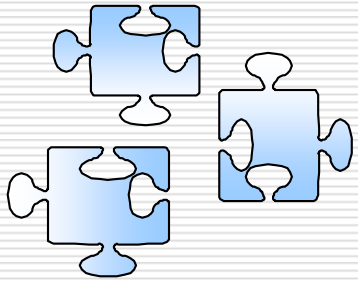
- Family of DSLs
- Unifying a family of DSLs
- Discussion
- Conclusion

Domain Specific Language

- Abstracts the concepts of a business domain
- Is a specialized and problem-oriented language
- Is accessible to domain engineers
- Has a reduced size
- Often combined with transformation tools

Family of DSLs

- Languages that cover a same domain
- Several DSLs for a specific domain
  - Similar concepts and operations
  - Similar hypotheses and requirements
  - Syntactical and semantical variations

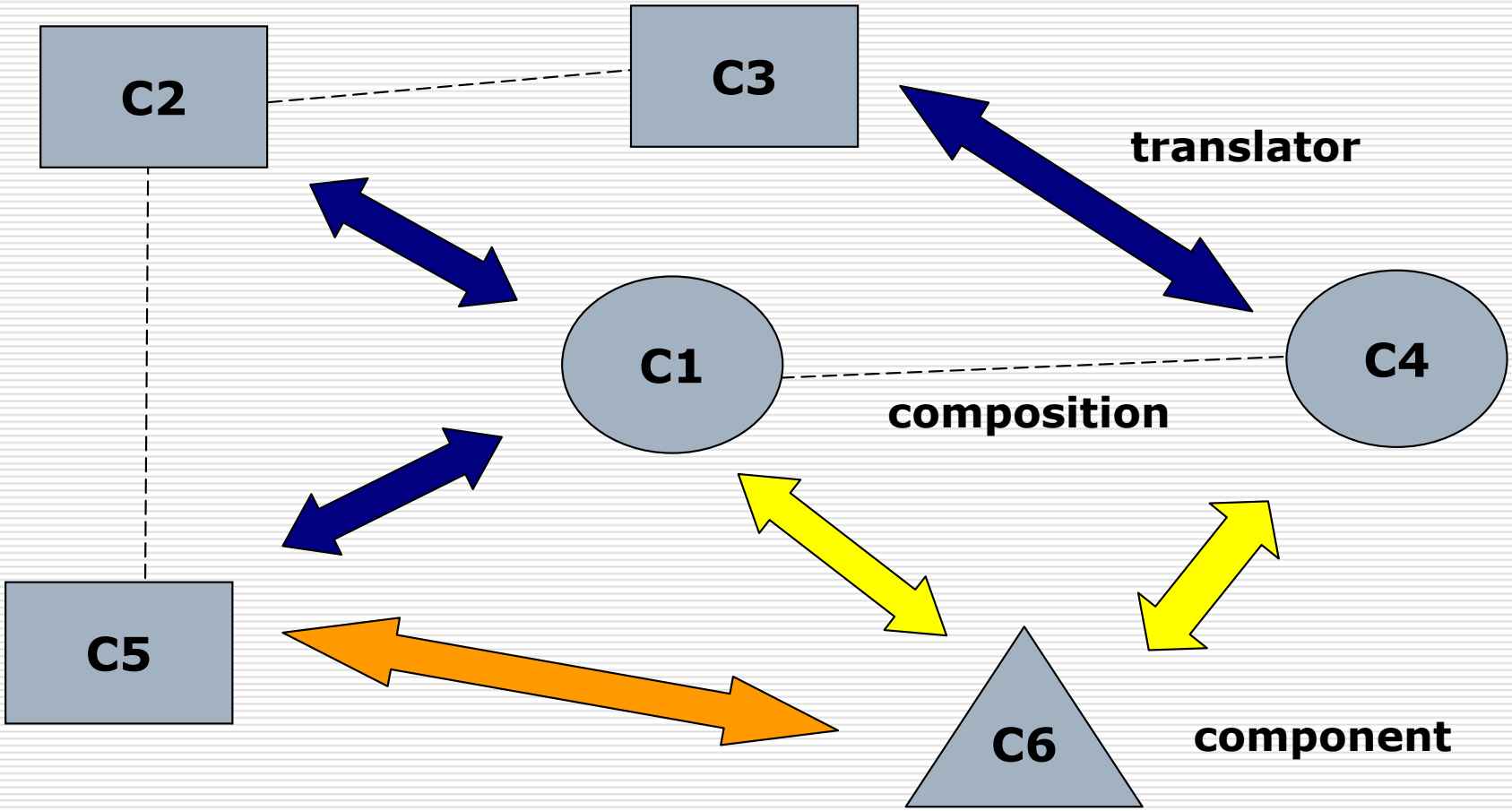


- Related concepts
- Focus on different aspects

Unifying a family of DSLs

- Various solutions
  - Traditional approach
  - Model based approach
  - Problem specific approach
  - Mixed approach

Traditional approach



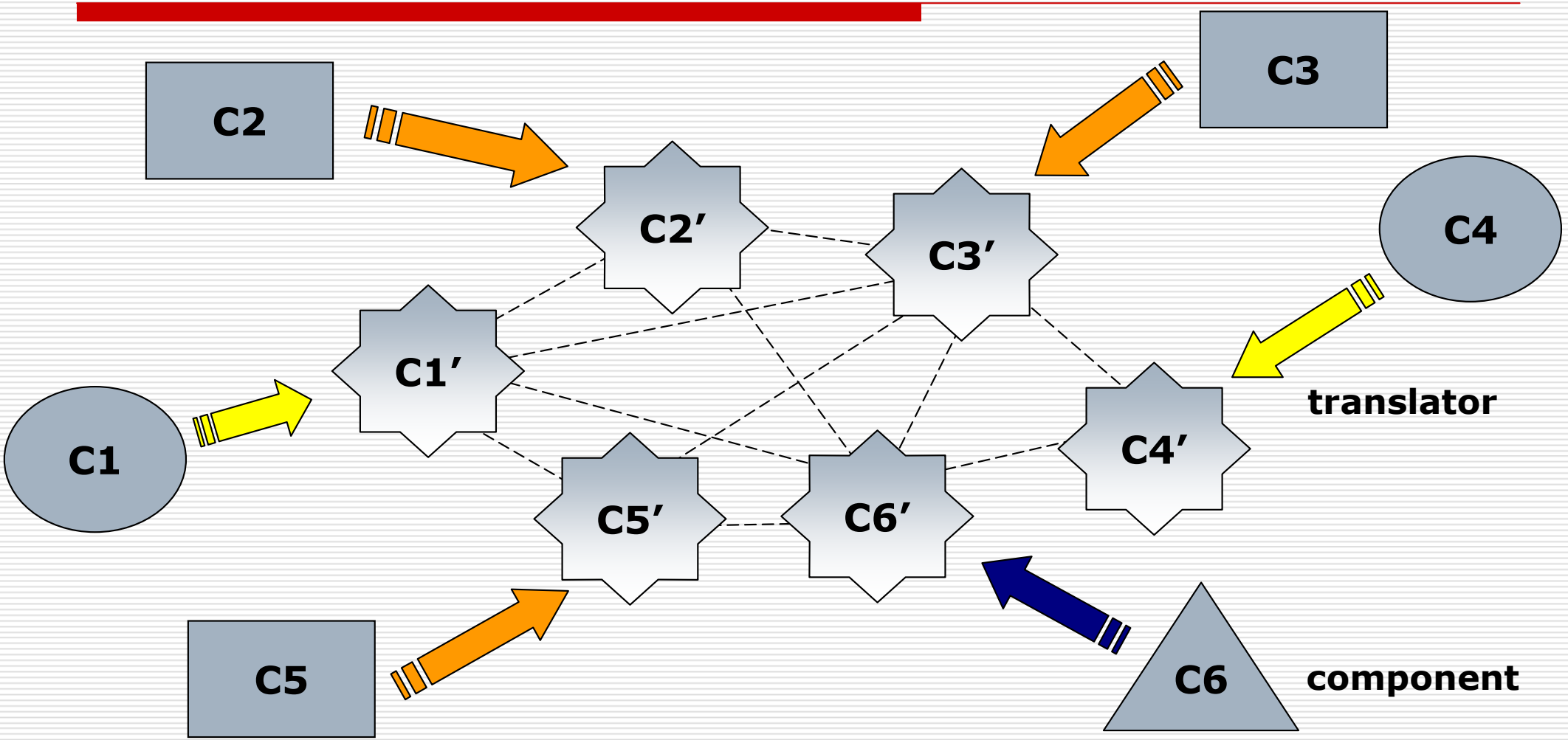
Traditional approach

- Advantages
  - Grammar engineering reuse

    attribute grammars, environments for languages definition (ASF+SDF)

- Drawbacks
  - Specific translator for each language pair
  - $O(n^2)$ complexity

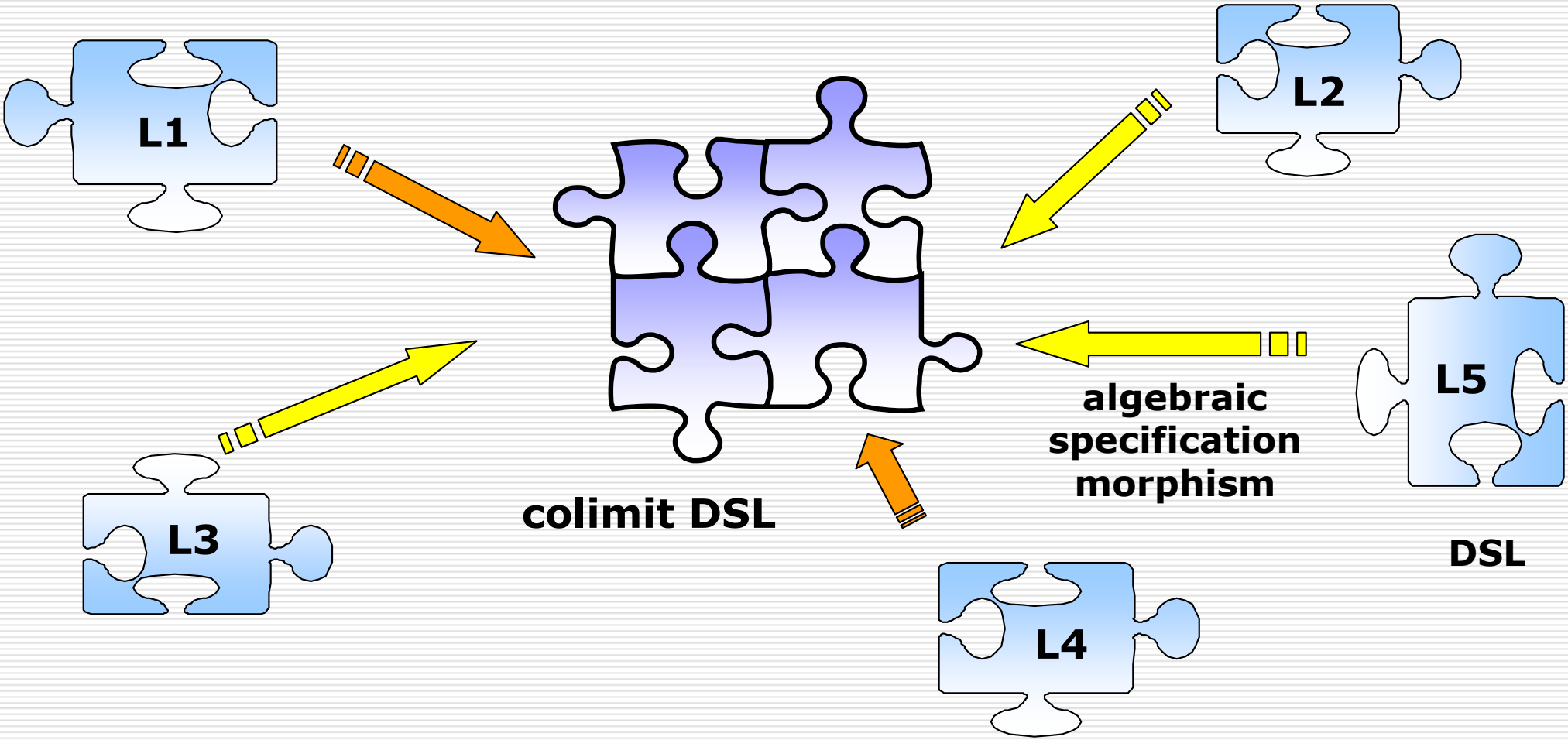
Model based approach



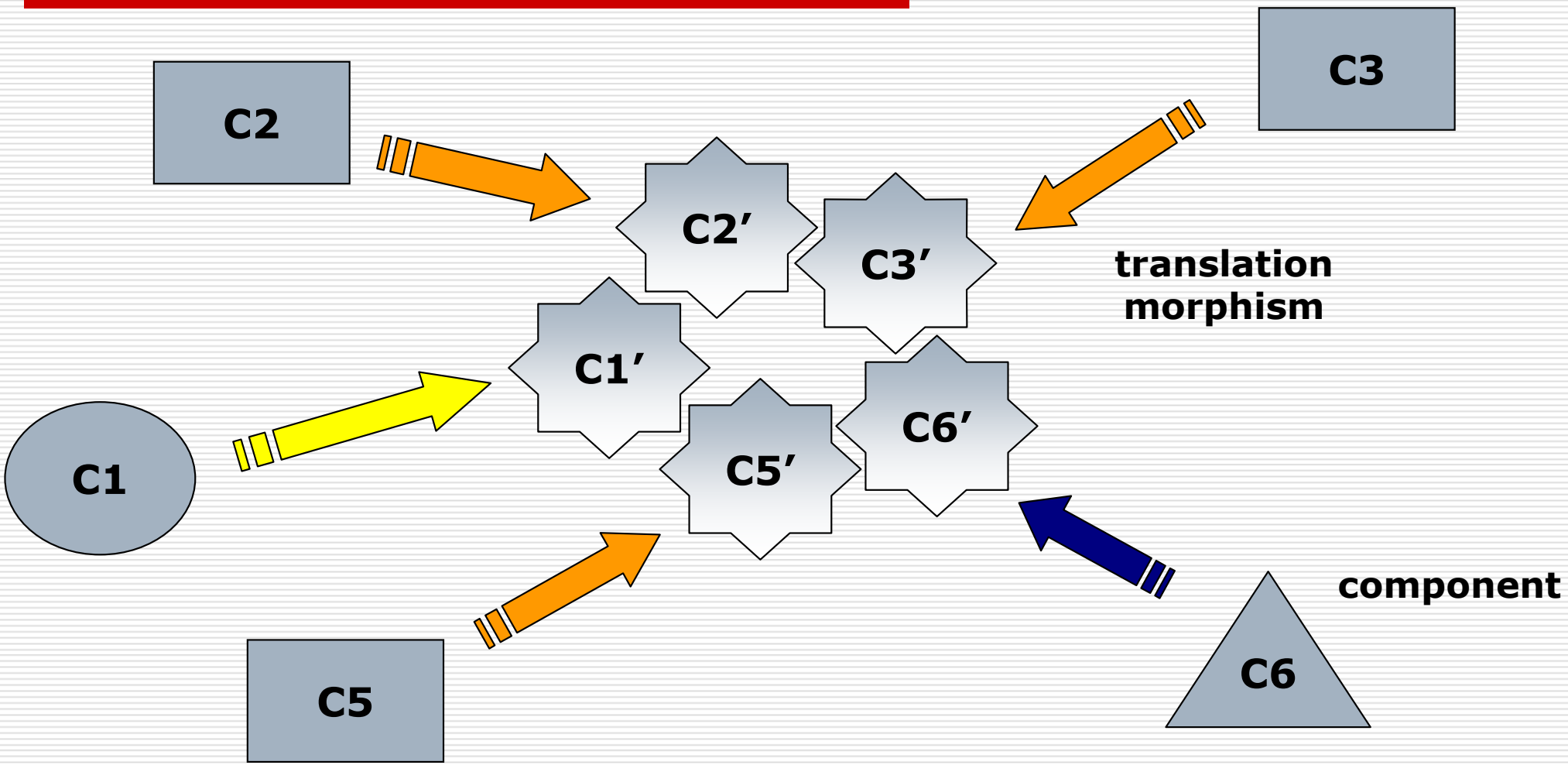
Model based approach

- Advantages
  - Explicit relationships between concepts
  - O(n) complexity
- Drawbacks
  - Difficult consensual definition of an unifying model

Problem specific approach



Problem specific approach

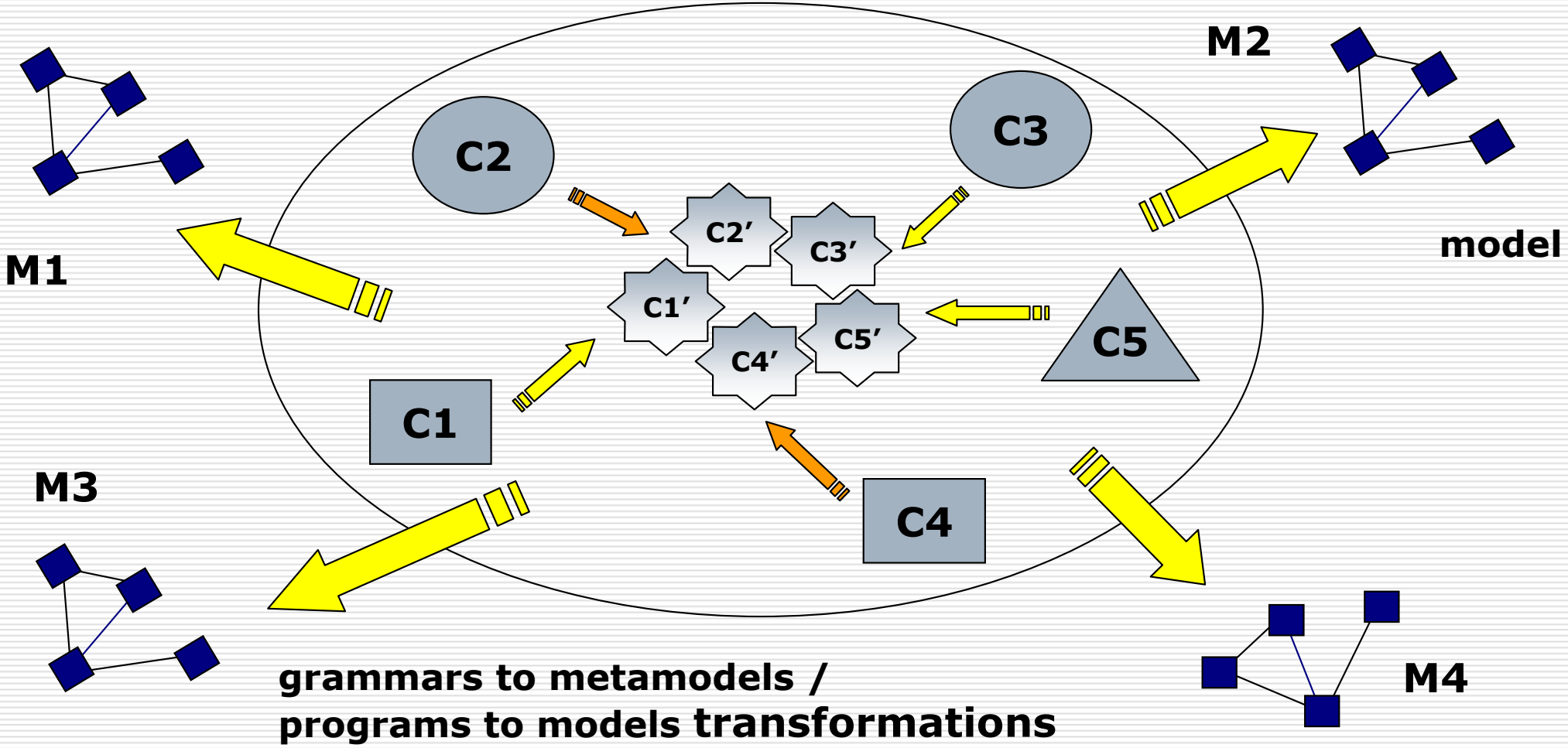


Problem specific approach

- Advantages
  - Formal definition of an unifying language

    algebraic specifications, category theory, colimits…
  - Properties preservation
- Drawbacks
  - Defining a matching between related concepts

Mixed approach



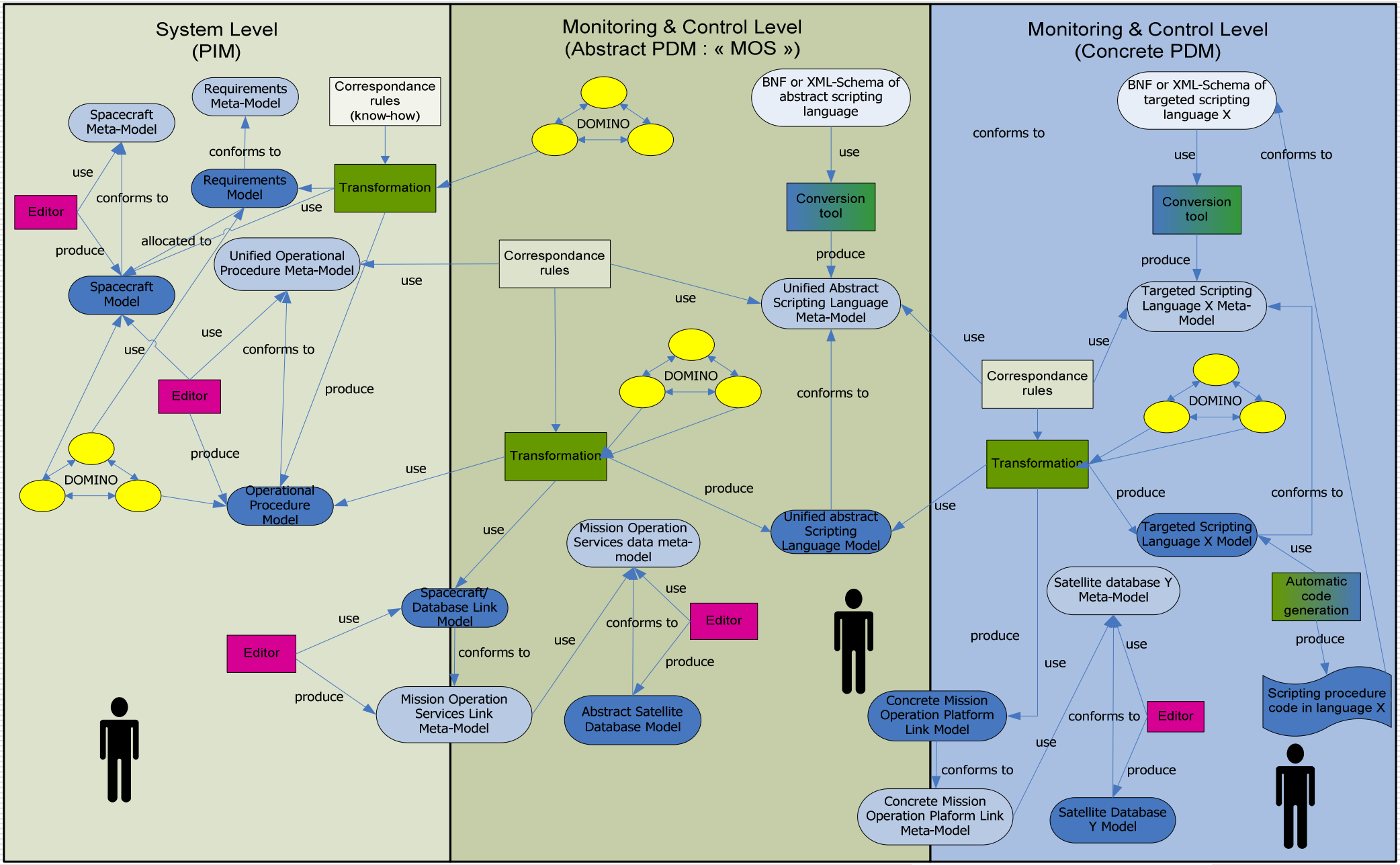
Mixed approach

- Advantages
  - Global view of the domain
  - Combines modeling techniques with a domain specific approach
- Drawbacks
  - Difficult definition of the right domain level information

Discussion… some influencing factors

- Project stage
  - Important reuse parts
- Development team composition
  - Capitalisation of domain engineers expertise
- Degree of variability
  - Draft RFP Common Variability Language (CVL) Technical Report, OMG, 2009

Conclusion


System Level
(PIM)
Monitoring & Control Level
(Abstract PDM : « MOS »)
Monitoring & Control Level
(Concrete PDM)
Requirements Meta-Model
Correspondance rules (know-how)
Spacecraft Meta-Model
conforms to
use
Requirements Model
Transformation
Editor
conforms to
use
allocated to
produce
Unified Operational Procedure Meta-Model
Spacecraft Model
use
use
conforms to
Editor
produce
produce
DOMINO
Operational Procedure Model
use
DOMINO
BNF or XML-Schema of abstract scripting language
use
Conversion tool
produce
Correspondance rules
use
Unified Abstract Scripting Language Meta-Model
DOMINO
conforms to
Transformation
produce
Unified abstract Scripting Language Model
use
Mission Operation Services data meta-model
use
Spacecraft/ Database Link Model
use
conforms to
Editor
Editor
use
conforms to
produce
produce
Mission Operation Services Link Meta-Model
Abstract Satellite Database Model
BNF or XML-Schema of targeted scripting language X
conforms to
use
conforms to
Conversion tool
produce
Targeted Scripting Language X Meta-Model
use
use
Correspondance rules
DOMINO
Transformation
produce
conforms to
Targeted Scripting Language X Model
use
Satellite database Y Meta-Model
Automatic code generation
produce
produce
use
use
Concrete Mission Operation Platform Link Model
conforms to
Editor
use
conforms to
produce
Concrete Mission Operation Plaform Link Meta-Model
Satellite Database Y Model
Scripting procedure code in language X

Questions