Advanced Topics in Software Engineering (02265)

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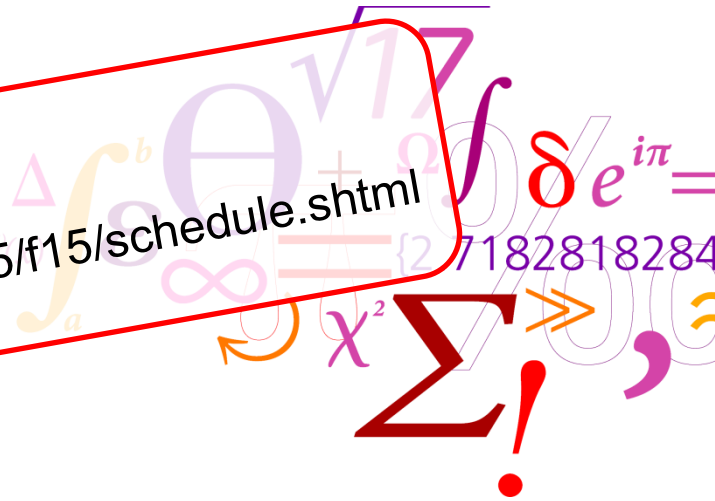
Department of Informatics and Mathematical Modeling

All presentations available at:
http://www2.compute.dtu.dk/courses/02265/f15/schedule.shtml



Recapitulation
(I. Introduction)

Levels of models

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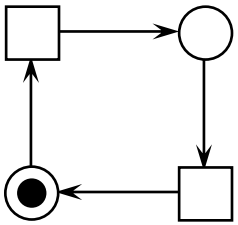
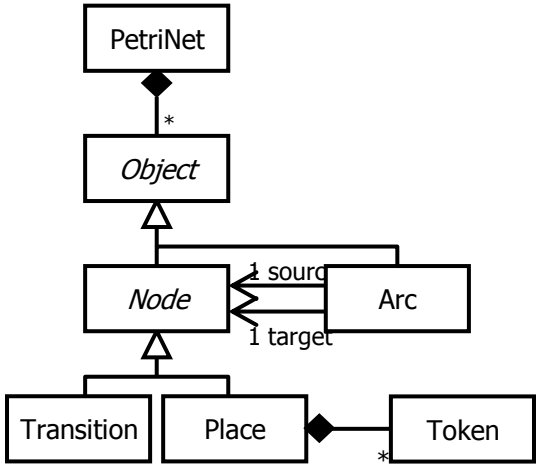
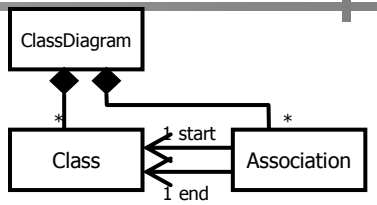
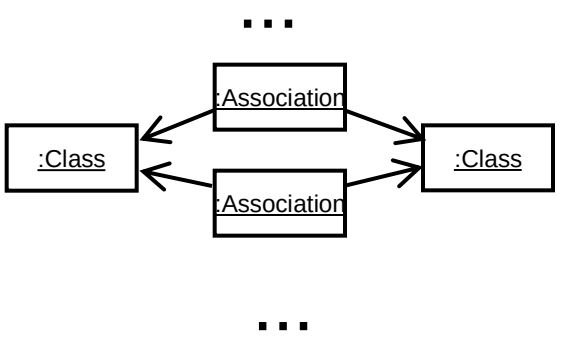
is an instance of

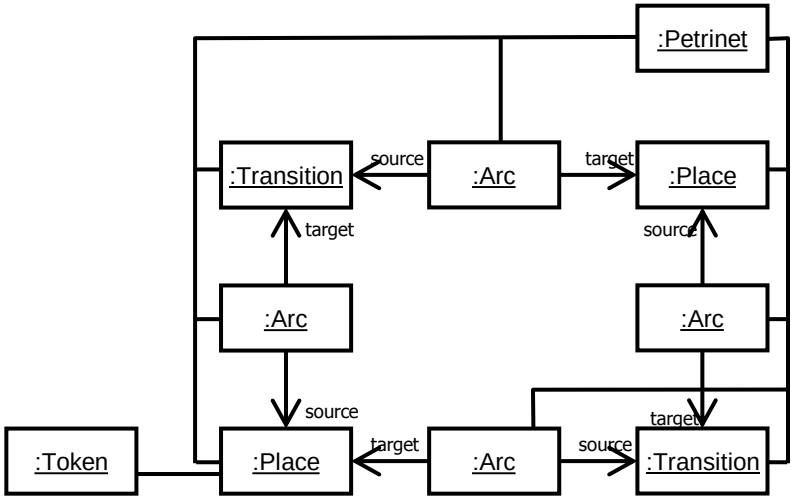
concrete syntax reprs. for











Goals of this course

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- Acquiring a bit more experience!

- Learn what is behind the scenes!
  - Understand concepts and technology
  - Apply (some of) them
  - Experiment and evaluate technology

- Contribute to MBSE?
  - Extend (and develop new) technology
  - Combine them in a new way
  - Formalize and analyze them

Understand and work on the **meta-level**

EMF/GMF Technology

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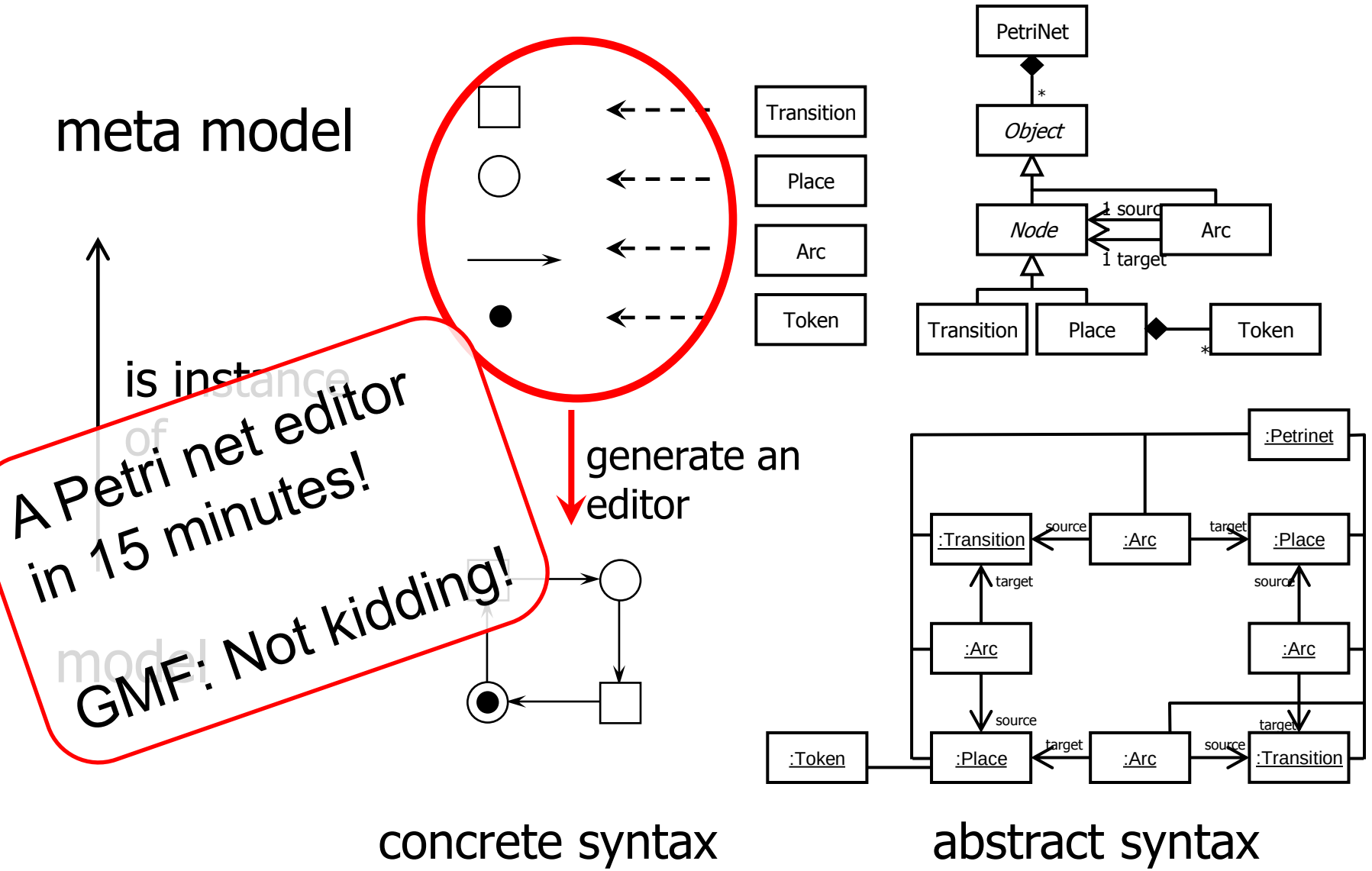

Basic terminology

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- Concept
- Formalism
- Method / methodology
- Model / meta-model
- Notation
- Principle
- Technique
- Technology
- Tool

- Software engineering

- Taxonomy
- Ontology

- Framework
- Approach

Course organisation

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- Lecture part:
  - Concepts and underlying theory of Model-based Software Engineering (with focus on the meta-level)
  - Relation between the concepts and rationale behind them
- Tutorial part:
  - Use of basic technology (Eclipse/EMF/ePNK/ECNO Tool)
  - Practical application of (some of the) concepts and techniques for small examples
- Project:
  - A simple tool for some aspect of software development (which requires to use a combination of some concepts of this course)
  - In groups of 2-**4** students
  - There are different predefined topics from which the groups may chose (see other presentation);

II. Domain Specific Languages

- Domain Specific Language (DSL)
- Domain Specific Languages (DSLs)

What do they mean?
What is their “spirit”?

DSL / DSLs

The terms DSL and DSLs are uses since the the mid 90ties; ”Domain Specific Automatic Programming” even dates back to the mid 80ties.

Still, there is not is not a uniform or universal understanding of what a DSL or what DSLs are; it depends a bit on the background which characterisitics of DSLs are considered to but important or relevant.

This lecture gives an overview – but with a model-based software engineering bias!

- DSL (singular):
  A single domain specific language,
  designed and realised according to some principles
  and for a specific purpose or a specific domain

- DSLs (plural):
  - Disipline and principles for designing and realising a DSL
  - A technology or set of technolgies for designing and realising a DSL
  - A way of ”thinking” software design

1. Examples

- COBOL
- Lisp
- PROLOG

Some examples named by some proponents of DSLs; if there, not all would agree!

- SQL (Structured Query Language → DB)
- BNF (Backus Naur Form → syntax definition)
- regex (regular expressions)
- lex, yacc (compiler construction)

- Shell scripting languages
- OCL

Some DSL existed even before the term DSL was invented!

- BPEL (Business process execution language)
  BPML (Business process modeling language)

- Petri nets
- ECNO
- OCL

- Trading strategy language (see next slide)

- PDF / PostScript
- HTML / CSS

Tool for testing FX strategies

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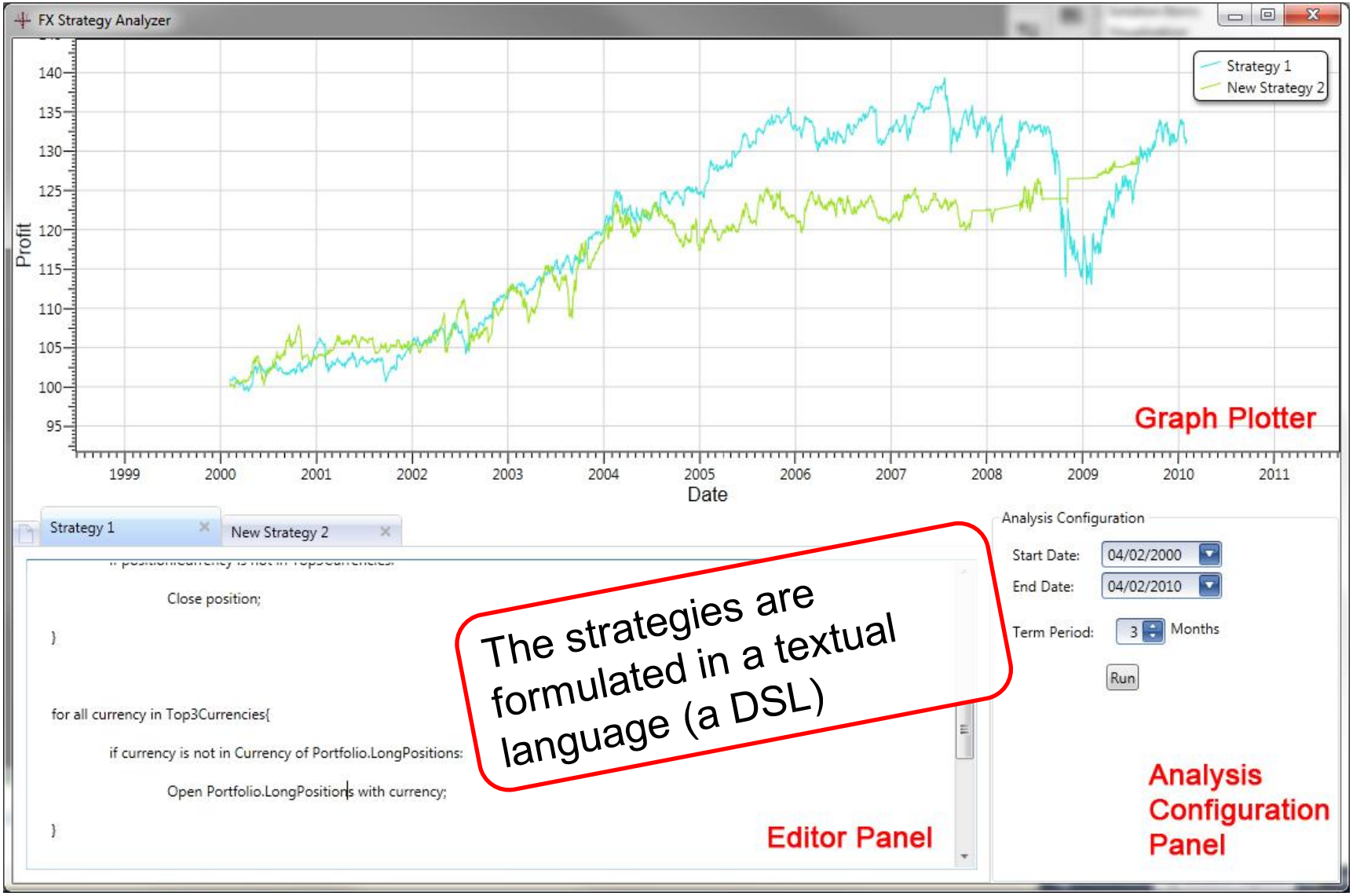

Counter-examples

- C
- C++
- C#
- Java
- Ruby
- ...

- UML
- ...

2. Characteristics

Traditional distinction of ”programming languages”:

- General Purpose Languages (GPL):
  - universal
  - same thing can be achieved in many differnent ways
  - Turing complete
  - huge
- Special Purpose Language (SPL):
  - made for a specific purpose
    (adequate for this specific purpose)
  - succinct and highly expressive (for given purpose)
  - typically, not Turing complete
  - small

SPL and DSL?

- Is any SPL a DSL?
- Is every DSL a SPL?

DSL characteristics

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- Textual (language) vs graphical (notation)
- Programming vs. modelling
- Domain of application vs separation of concerns
- Way of thinking design vs
  use of specific”DSL technology”
- Abstraction vs technical
- User focus vs technical focus
- Language vs framework
- Idiom oriented vs. programming oriented

Classification

- **Embedded DSL**:
  Embedded to an existing programming language by adding some framework for some purpose (often some functional languages with syntactic sugaring features)

  - Typically textual languages!
  - Often programmed (with ”DSL thinking” in mind)

- **External DSL**:
  Standalone language (graphical/textual) which is then compiled or interpreted. Often realized by DSL development tech

  - Often: Focus on adequate concrete syntax!
  - Typically realized by using ”DSL technologies”

3. Parts of a DSL definition

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- **Abstract syntax** (see L01):
  language concepts and their relation
  (*API / domain model / framework)*

- **Concrete syntax** (see L01):
  syntactical representation of concepts
  (graphical or textual)

Actually, there could be different concrete syntax for the same abstract syntax.

- **Semantics** (what it does):
  Code generation or interpretation, which enacts what an instance of the DSL says

DSL Technolgies typically support the first two steps; and might help a bit with the last!

4. Philosophy

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- A DSLs should help decrease redundancy and unnecessary work
- A DSL should help separating the variable or generic parts of a software product from parts which do not change
- A DSL should improve reuse
- A DSL should support abstraction form irrelevant technical details
- A DSL should emphasize the domains idioms