

# SEN1

—*Software Analysis and Transformation*—  
(SWAT)

==

ATEAMS:

a joint CWI/INRIA research team

Paul Klint



ATEAMS is part of a strategic cooperation between CWI and INRIA



# Research Team

## SEN1 – Software Analysis and Transformation

- B. Basten (phd stud)
- P. de Bie (phd stud)
- J. v.d. Bos (phd stud)
- P. Griffioen (phd stud)
- M. Hills (postdoc)
- A. Izmaylova (phd stud)
- P. Klint (prof)
- A. Lankamp (prog)
- B. Lisser (prog)
- A. v.d. Ploeg (phd stud)
- T. v.d. Storm (perm)
- J. Vinju (perm)
- V. Zaytsev (postdoc)
- J. van Eijck (prof)
- F. Sietsma (phd stud)
- Sunil Simon (postdoc)



# Research Team

SEN1 – Software Analysis and Transformation

- B. Basten (phd stud)
- P. de Bie (phd stud)
- J. v.d. Bos (phd stud)
- P. Griffioen (phd stud)
- M. Hills (postdoc)
- A. Izmaylova (phd stud)
- P. Klint (prof)
- A. Lankamp (prog)
- B. Lisser (prog)
- A. v.d. Ploeg (phd stud)
- T. v.d. Storm (perm)
- J. Vinju (perm)
- V. Zaytsev (postdoc)
- J. van Eijck (prof)
- F. Sietsma (phd stud)
- Sunil Simon (postdoc)



# Research Team

SEN1 – Software Analysis and Transformation

Visitors:

- A. Bagge
- F. Nasab

Students:

- Davy Landman
- Jouke Stoel
- Jan de Mooy
- Christian Koppe

2009 merged with SEN2

2011 merged with INS3:

- R. van Liere (prof)
- F. Smit (postdoc)
- L. Liu
- C. Kruszynski (postdoc)



# Research Team

SEN1 – Software Analysis and Transformation

## Contributions to academia:

- M. v.d. Brand (TU/e)
- A. v. Deursen (TUD)
- W. Fokkink (VU)

## Contributions to industry:

- Y. Usenko (KPMG)

## Retired:

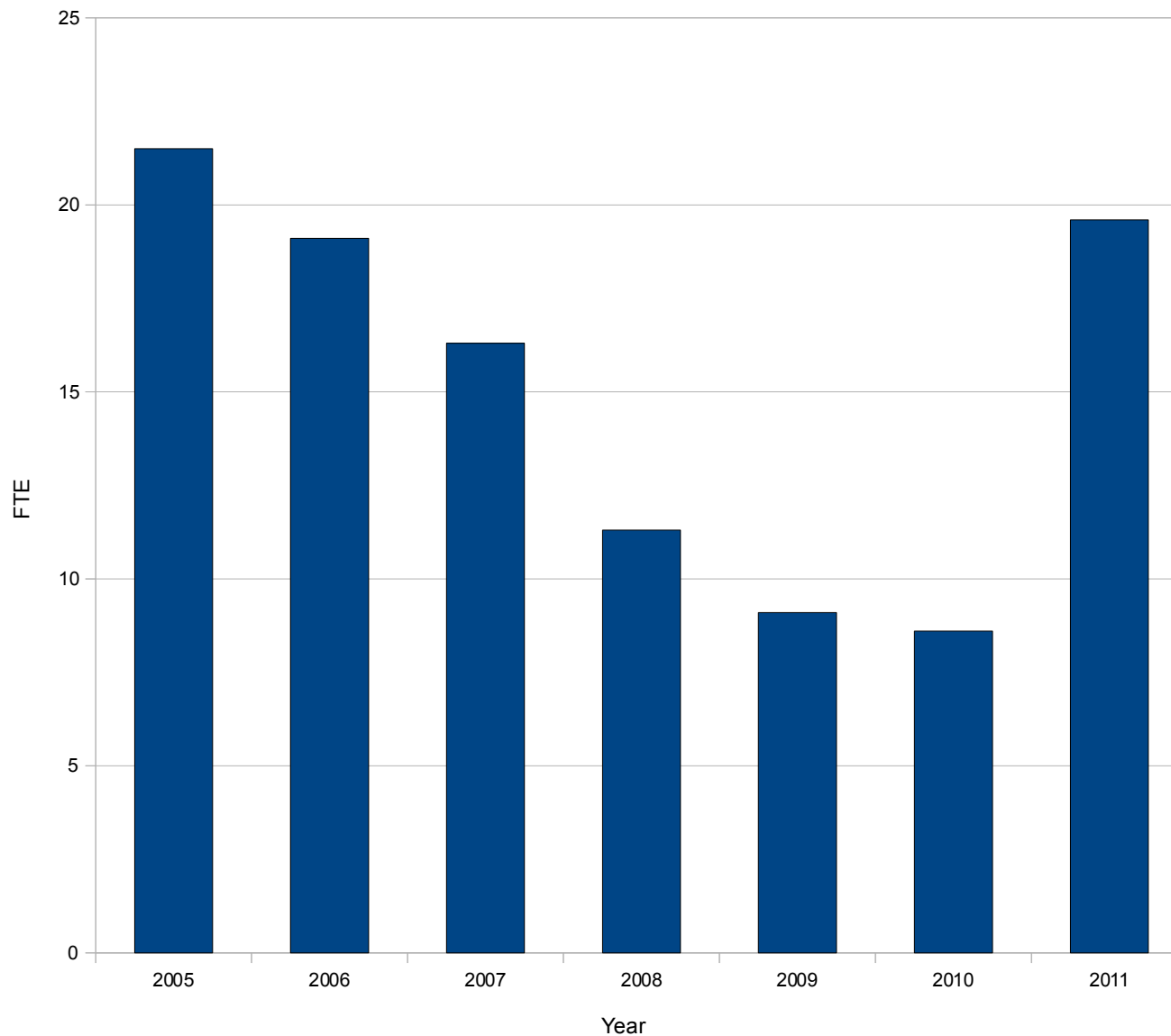
- J. Heering

A renewed,  
well-funded,  
young,  
talented  
team

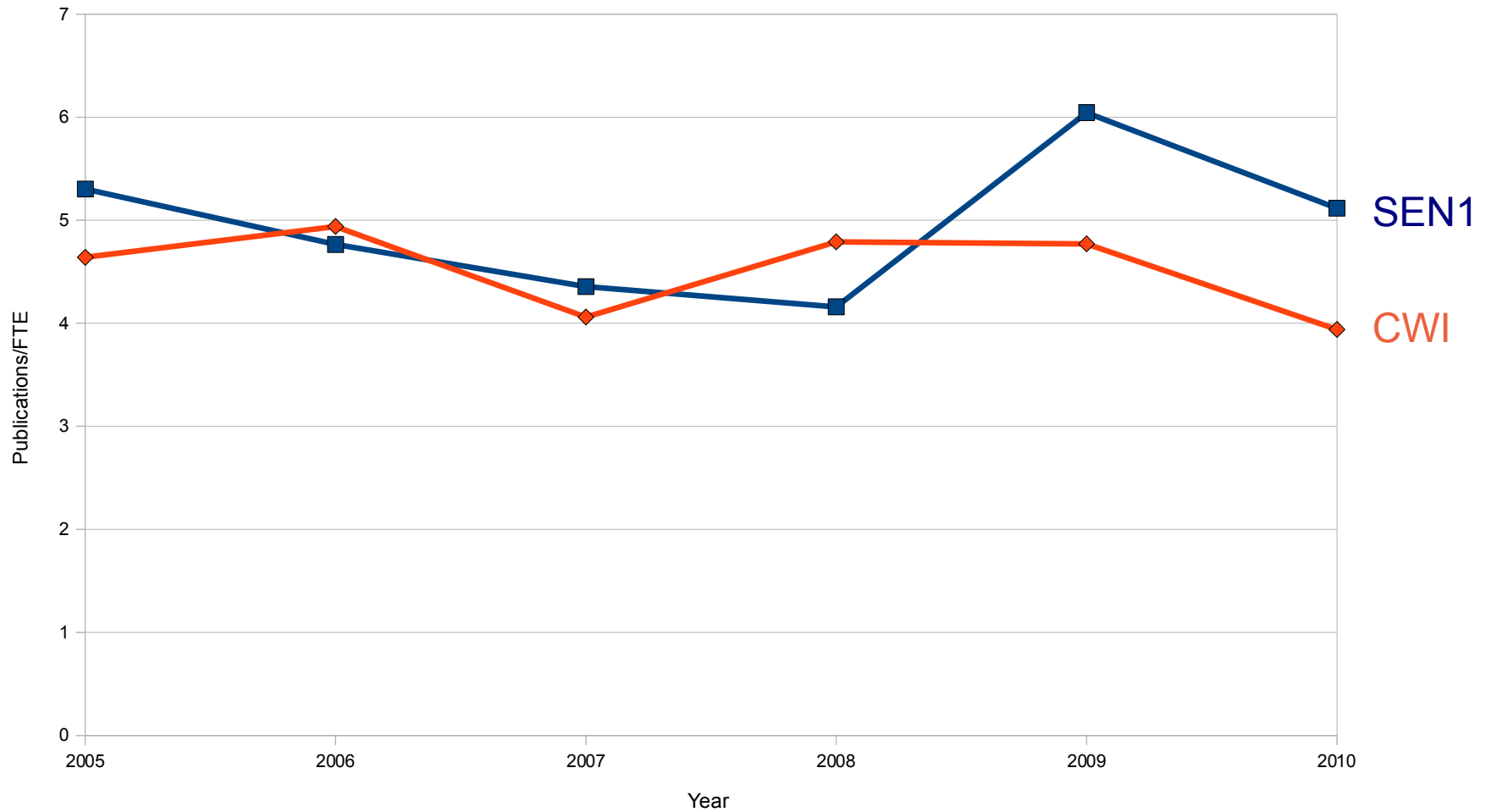
Jan 1, 2012,  
J. Vinju will succeed  
P. Klint as  
SEN1 team leader

# Personnel SEN1

## *A rejuvenated team*



# Productivity SEN1(4.9) vs CWI (4.4)





# Recently Acquired External Projects

- *Digital Forensics* (Dutch National Forensics Institute, 1 Phd)
- *Foundations for Grammar Laboratory* (NWO, 1 PD)
- *Next Generation Auditing* (NWO, 2 Phd)
- *End-user Scripting for Visual Software Analytics* (NWO, 2 Phd)
- *Domain-specific Languages: A Big Future for Small Programs* (NWO TOP, 3 phd, 1 pd): **competition across all disciplines, the only computer science project awarded**

# Strategy for Main Research Topics

Specific DSLs

Methods  
for DSL design

Methods for  
software maintenance

Methods for software  
improvement

## Applications

Parsing

Matching

Rewriting

Traversing

Constraint  
solving

Pretty  
printing

IDE  
support

## Rascal

## Technology

Grammar theory  
and  
Engineering

Language  
semantics

Compilation  
techniques

Software  
Engineering

## Foundations

# Current Focal Points

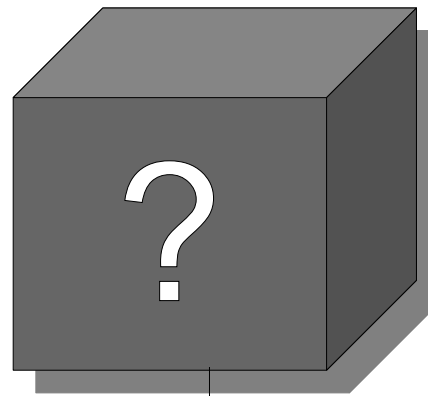
- Software Analysis and Transformation
- Design and implementation of Rascal language
- Applications
  - Domain-specific languages
  - Software Refactoring
  - Software maintenance
- Applied logic:
  - Voting systems/social protocols
  - Computational Linguistics

# Some Problems We Address

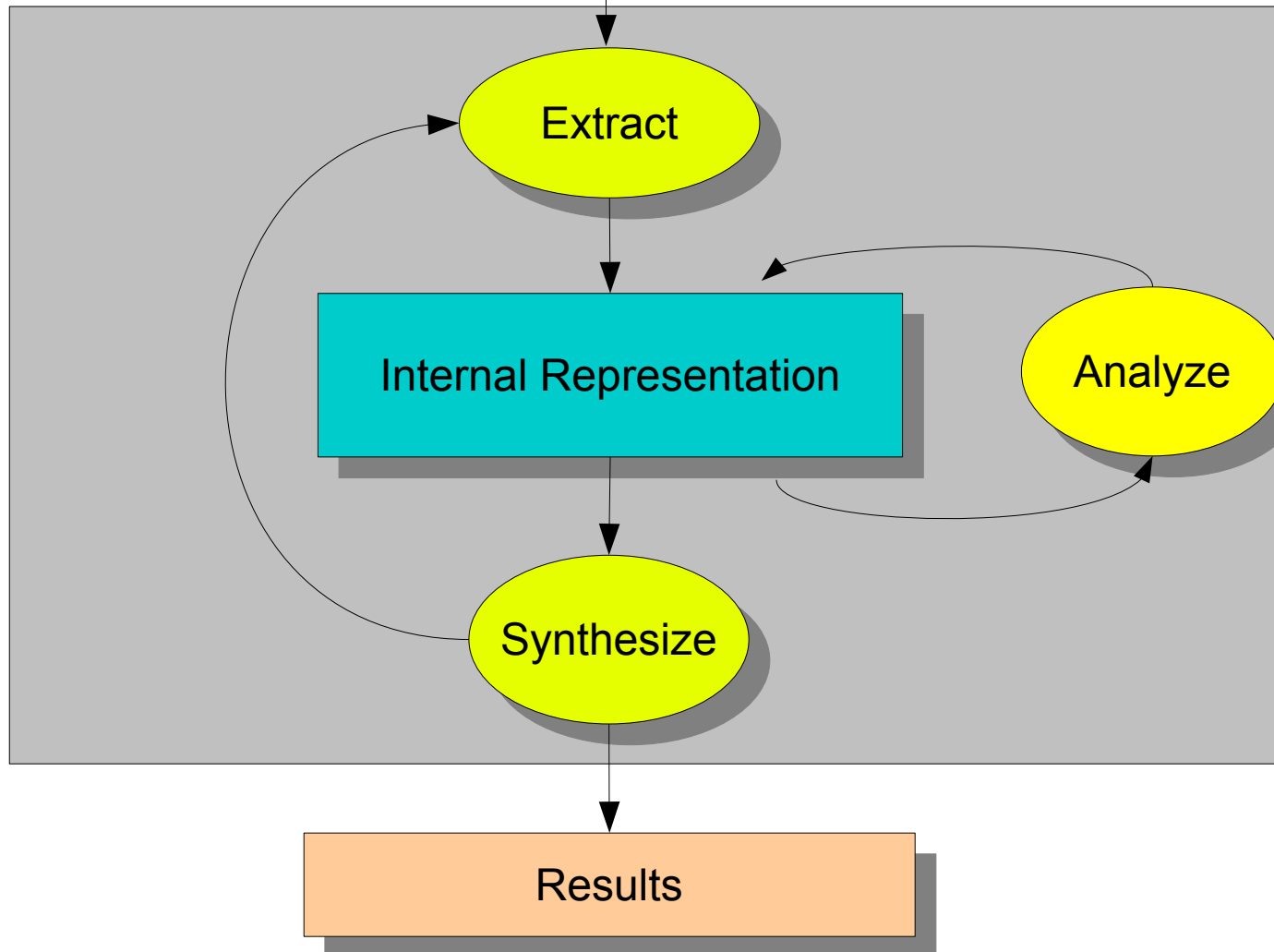
- How to parse source code/data files/models
- How to extract facts from them
- How to perform computations on these facts
- How to generate new source code (trafo, refactor, compile)
- How to synthesize other information

**EASY: Extract-Analyze-SYnthesize Paradigm**

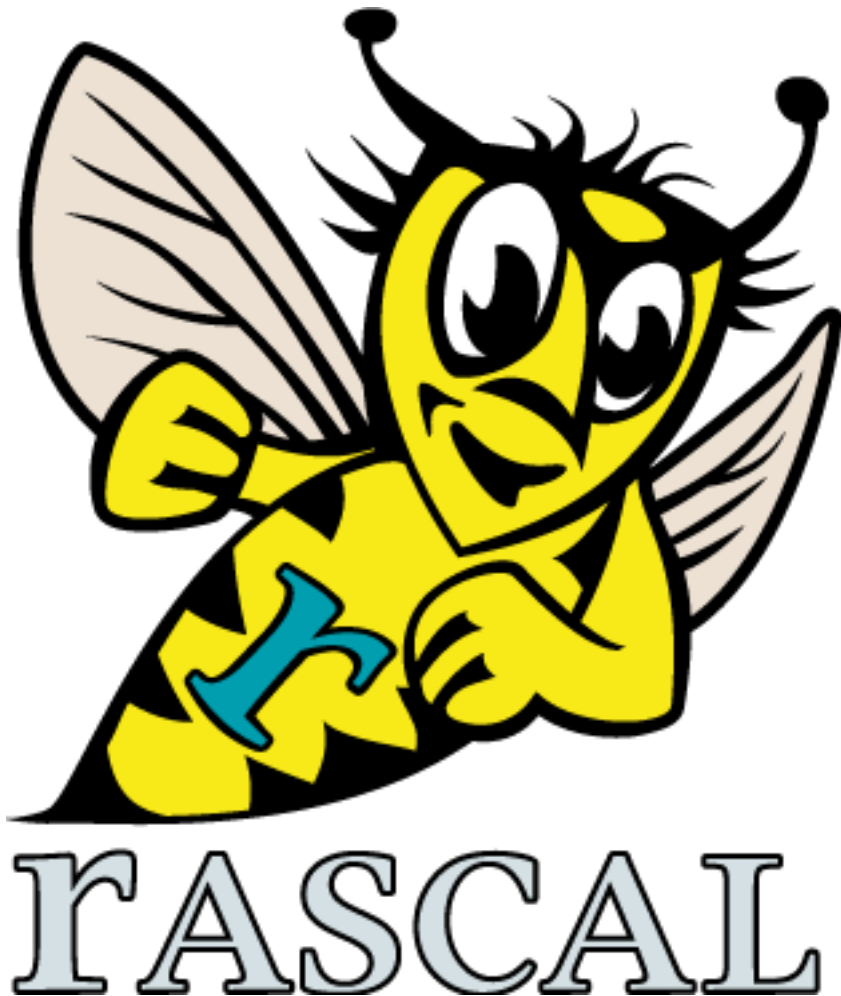
System  
Under  
Investigation  
(SUI)



# EASY Paradigm



# Here comes Rascal to the Rescue



- “One-stop shop”
- Lab infrastructure
- Test bed
- Social infrastructure
- Transfer medium
  - Academia
  - Industry (IBM, Eclipse)

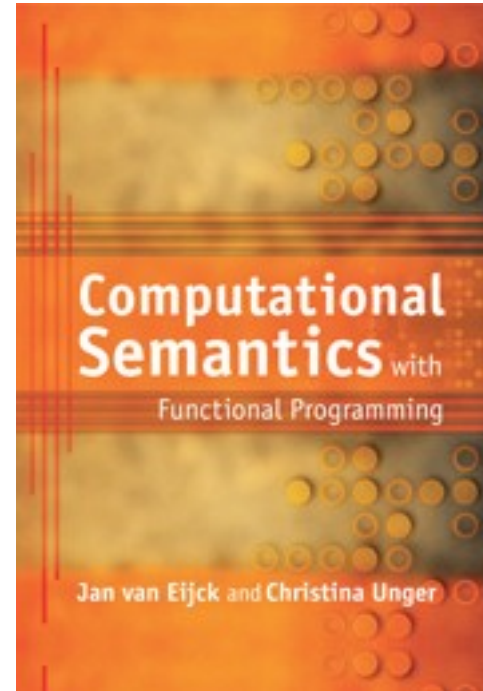
# Rascal Highlights

## a DSL for Meta-Programming

- Sophisticated built-in data types (immutable)
- Static safety
- Local type inference
- Pattern Matching
- Pattern-directed invocation
- Syntax definitions and parsing
- Concrete syntax
- Visiting/traversal
- Comprehensions
- Higher-order
- Familiar syntax
- Java and Eclipse integration
- Read-Eval-Print (REPL)

# Output

- 223 reviewed papers
- 3 Books
- 27 Book chapters
- 12 PhD theses
- 5 Univ. professors
- Many Software releases of
  - Meta-Environment
  - RScript
  - Rascal





# New/Future Activities

- Software Visualization
  - Declarative graphics for SW visualization, with INS3
- Next Generation Auditing (PWC, Tax Office)
  - Extract facts from accounting records
  - DSL to model a company's “value cycle”
- File Carving (National Forensics Institute)
  - Reconstruct damaged forensics data
  - DSL for file format specification + carver generator
- DSL concept mining

# Cooperations

- Univ. Bergen Norway: DSL for computational science (Haveraen, Bagge visits for a year)
- London & Swansea: modular semantics
- London, Eindhoven, Delft: Generalized Parsing
- Univ. of Koblenz (R. Laemmel)
- Univ. of Texas (W. Cook)
- Univ. of Waterloo: M. Godfrey will visit for a year
- PwC, KPMG, Dutch Tax Office, NFI, ...
- CWI: SEN3, INS2, MAC4  
Paul Klint SEN1/SWAT/ATEAMS

# Technology Transfer


- **Software Improvement Group** is a spinoff company of our team
- 45 employees and hiring
- Activities in Netherlands, Belgium, Germany, Switzerland and Scandinavia
- Several joint projects with ATEAMS



# Planned Activities of SEN1

- Further development of Rascal infrastructure
- Software visualization
- Specific DSLs (Forensics, Auditing, Cell Biology)
- Mining/Reverse engineering of domain concepts
- Social Protocols, Computational Linguistics, ...

# Strong/Weak/Opportunities/Threats

- S: integrated view on analysis & transformation of software (“**formal methods inside, usable outside**”)
- S: infrastructure and tools ▶  eclipse
- S: cooperations&applications: industry/international
- W: weak integration of applied logic research
- O: turn large investment in tools into publications
- O: integrate INS3 research (software visualization)
- T: (Dutch) funding landscape

# Further Background

- [www.cwi.nl/sen1](http://www.cwi.nl/sen1)
- [en.inria.fr/domaines-epi/algorithmics-programming-software-and-architecture/programs-verification-and-proofs/ateams](http://en.inria.fr/domaines-epi/algorithmics-programming-software-and-architecture/programs-verification-and-proofs/ateams)
- [www.rascal-mpl.org](http://www.rascal-mpl.org)
- [www.meta-environment.org](http://www.meta-environment.org)

