

RoelTyper

Typing the Image in 1,5 minutes

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ESUG'05, Brussels, 16/08/05

Ever Wondered...

- What the type was of the variable mapEntry in ProgramNode ?

The screenshot shows the Smalltalk IDE interface for the class `ProgramNode`. The `Source+Types` tab is selected, showing the class definition and a list of types used in the code. The variable `mapEntry` is highlighted in the list of types.

```
Smalltalk.Kernel defineClass: #ProgramNode
  superclass: #(Core.Object)
  indexedType: #none
  private: false
  instanceVariableNames: 'sourcePosition comment compilerHints
  blockIndex mapEntry returnMapEntry '
  classInstanceVariableNames: "
  imports: "
  category: 'System-Compiler-Program Objects'
```

The list of types used in the code includes:

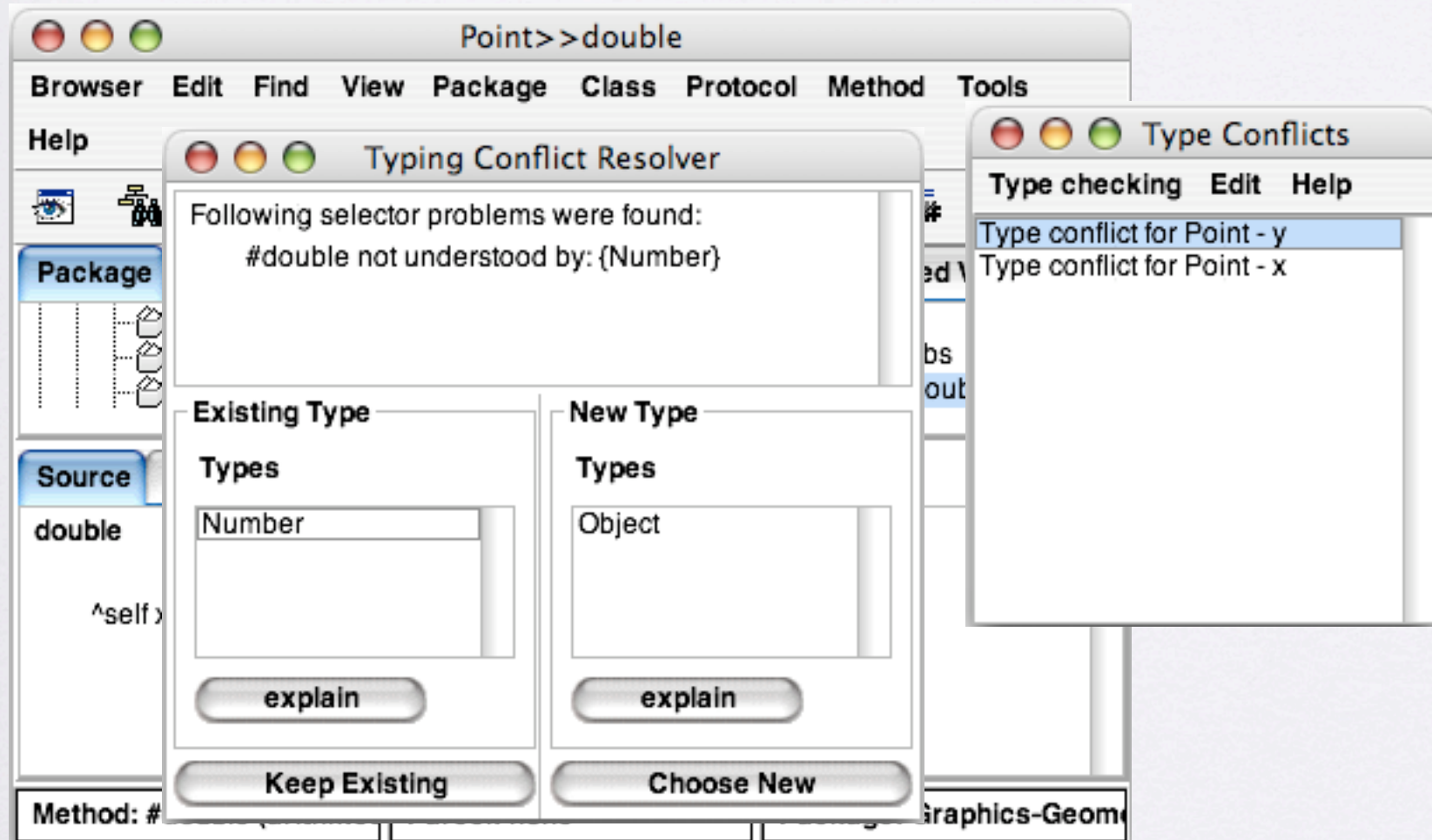
- comment
- ExceptionSet
- GenericException class
- SequenceableCollection
- Signal
- sourcePosition
- SequenceableCollection
- mapEntry
- SourceMapEntry

The status bar at the bottom shows:

- Class: Kernel.ProgramNode
- Parcel: none
- Package: System-Compiler-Progr

Ever wanted...

- Some type feedback after accepting a method ?



Meet RoelTyper!

- Heuristics-based Type Reconstruction for VisualWorks and Squeak
 - Fast
 - To give feedback on types of instance variables
 - Not 100% exact
 - Heuristics-based so that it can be very fast
 - Works for about 80% of instance variables

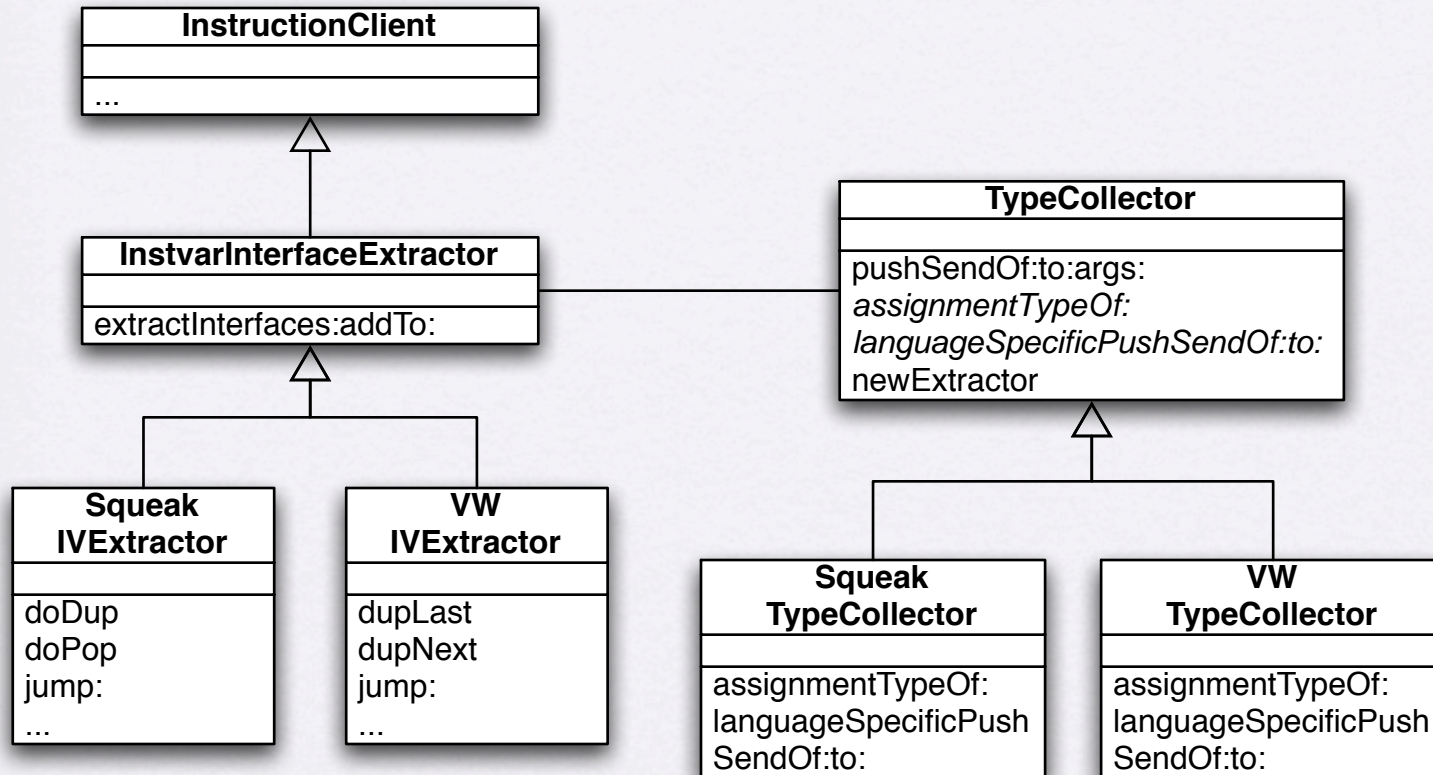
Core Idea

- Quite simple:
 1. Use the messages being sent
 - find out the interface used by an instance variable
 - find out all classes that understand this interface
 - weed out any superfluous results
 2. use the assignments to an instance variable
 - support certain right-hand side expressions
- Already existed in SOUL, but now directly in Smalltalk

Finding interface&assignments

- Byte-code interpreter:
 - messages being sent to instance variables
 - assignments
 - sends and assignments through accessor methods

Core Classes



Types from Interfaces

- Problem: Given a set of selectors, what are all the classes in the image that understand this set of selectors ?
 - Take first selector
 - Start from Object, do a depth-first search to find the subclasses that implement that selector
 - Take next selector
 - Start from these subclasses, find the ones that implement this selector to obtain a new set of classes
 - Repeat until all selectors are processed

Let's Try This...

- Interface for #x in Points: -, <, <=, >=, >, *, +, =, @, isZero, abs, asLimitedPrecisionReal, abs, literalArrayEncoding, printOn:, min:, max:, roundTo:, negated, floor, truncated, rounded, hash, ceiling, between:and:
- Take -, start at Object
 - does not implement -, 3 classes do: ArithmeticValue, CPointer, Set
 - Take <
 - Do these three classes implement - ?
 - No! Only ArithmeticValue
 - Take <=
 - Does ArithmeticValue implement <= ? Yes!
 - repeat until the complete interface is checked.

Assignments

- Regarding assignments, we support
 - Literals and LiteralArray's
 - Class
 - Class selector, where selector is in protocol 'instance creation'
- For example:

`x := 3`

-> SmallInteger

`u := Point`

-> Point class

`v := RefactoringBrowser new`

-> RefactoringBrowser

Applying RoelTyper

- Built utilities that use RoelTyper:
 - The Source&Types Tab in the RB
 - An editor to edit types for instance variables
 - A tool to explain the types found
 - So you can see all which is being sent or assigned
 - A Logging tool that logs Type Errors
 - Checks a class every time a method is accepted

VW versus Squeak

- 2 classes are different (as shown before)
- Rest of the (non-GUI!) code is the same
 - Especially the unit tests
- Not that much difference between the byte codes

Helping Out

- Where is the code?
 - Main Code is in VisualWorks (published in the Cincom Store)
 - Using FileOut30, Squeak versions are generated
- If you want to help:
 - VW: Use the Cincom Store
 - Squeak:
 - Only touch Squeak classes in Squeak
 - If you change 'common' classes: check in VW and Squeak!
 - Results need to be published in Store eventually!

<http://decomp.ulb.ac.be/roelwuyts/smalltalk/roeltyper/>