Migrating code with SmaCC

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Migration Strategy

- Define Parser
- Create transformation program

SmaCC

- Compatibility layer

✓Normal development continues

-Keeps same design — garbage in garbage out

Parser Definition

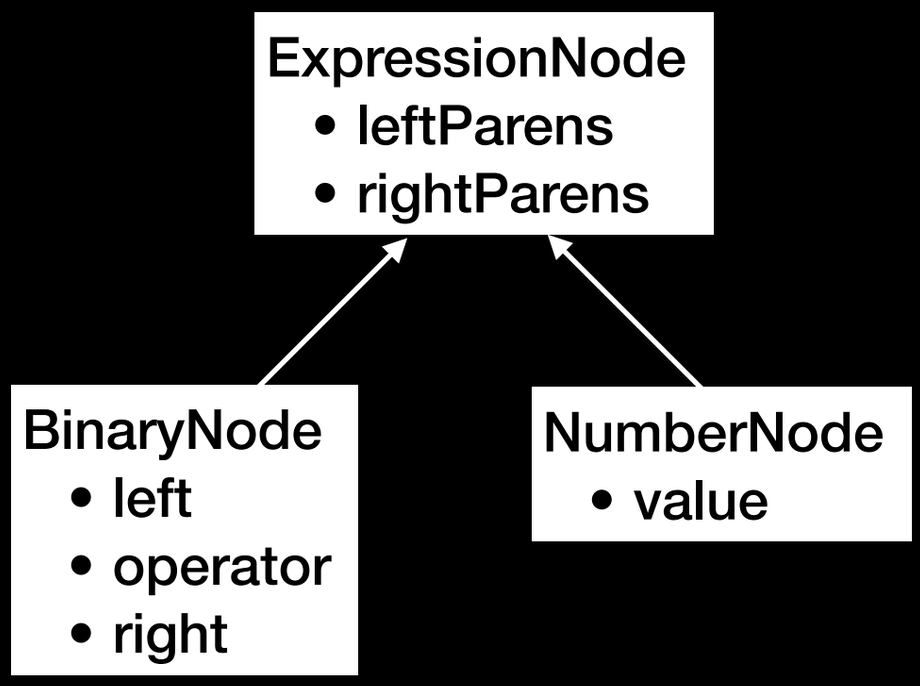
- LALR(1)/LR(1) parsers
- GLR
- AST generation
- Pattern matching

AST Definition

```
<number> : \d+ (\. \d*)? ;
<whitespace> : \s+;

%left "+";
%root Expression;
%suffix Node;

Expression
    : Expression 'left' "+" 'operator' Expression 'right' {{Binary}}
    | "(" 'leftParen' Expression ")" 'rightParen' {{Expression}}
    | <number> 'value' {{Number}}
    ;
```



Transformation Program

- Ordered list of transformation rules + methods and properties
- Declarative Pattern Rules
  - Quick to write
  - One-off expressions
- Imperative Code Rules
  - General syntax
  - Control flow

Pattern Rules

- Search expression pattern-based AST
- Replace expression is pattern-based string

Pattern Matching

```
<number> : \d+ (\. \d*) ? ;
<whitespace> : \s+;
<patternToken> : `[^`]+`;

%glr;
%left "+";
%root Expression;
%suffix Node;

Expression
    : Expression 'left' "+" 'operator' Expression 'right' {{Binary}}
    | "(" 'leftParen' Expression ")" 'rightParen' {{Expression}}
    | <number> 'value' {{Number}}
    ;
```

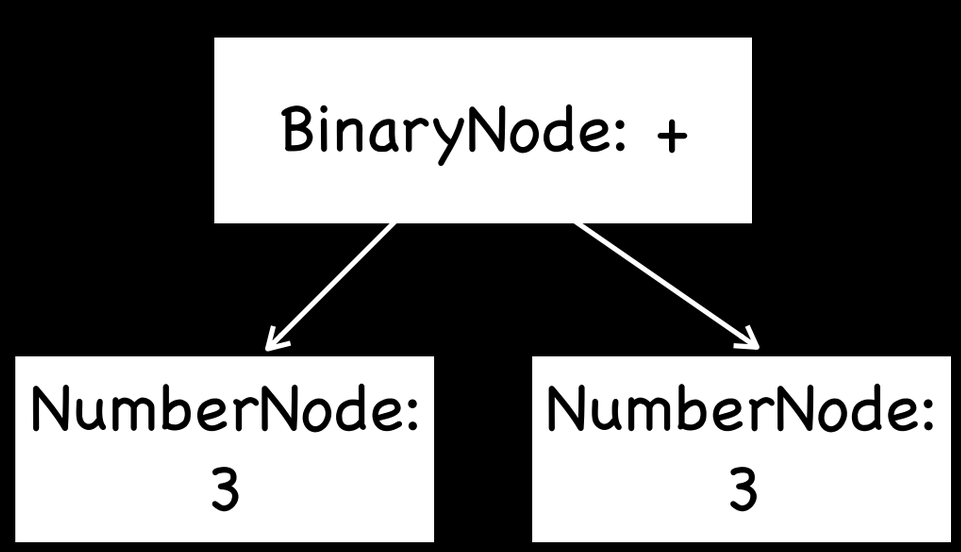
`a` + `a` ⇒ `a` * 2

Patterns can match any AST node

Pattern Example

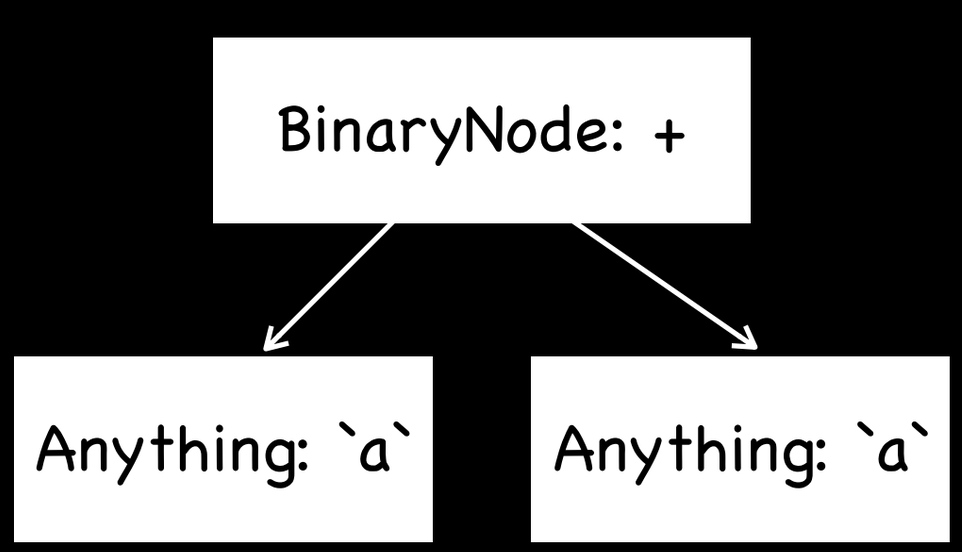
Source:

`3 + 3`



Search Pattern:

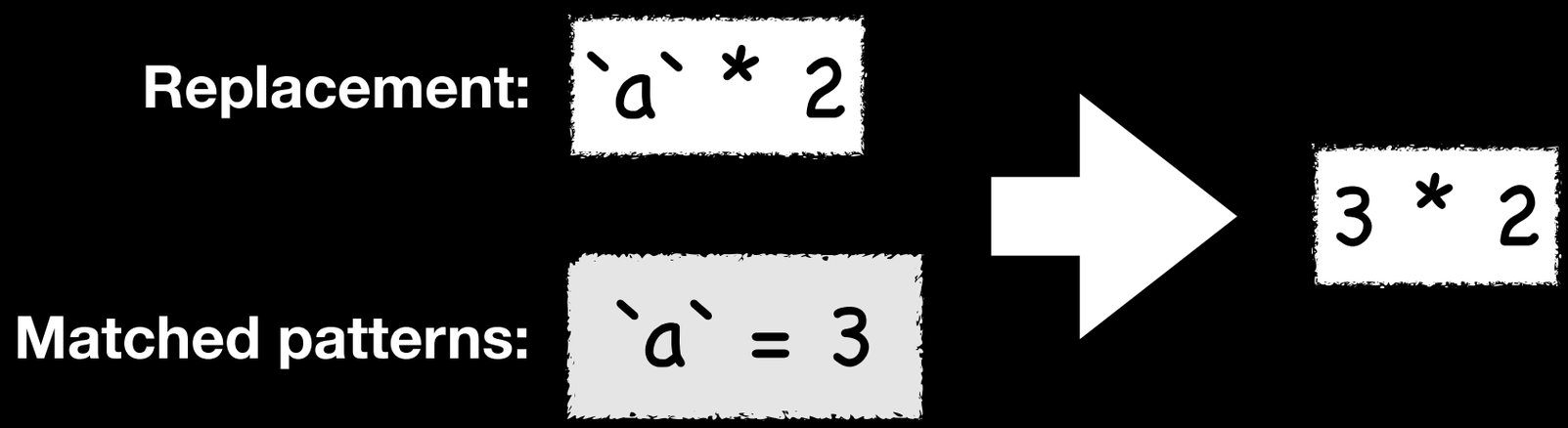
`` `a` + `a` ``



`` `a` = 3 ``

Replace Expressions

- Replacement pattern is string macro
- Original source replaced with expanded macro
- Matched pattern nodes rewritten before replacement string is generated



Pattern Examples

```
for `a` := `b` to `c` - 1 do `d` ⇒
    for (`a` = `b`; `a` < `c`; `a`++) `\d\`

`a/Forms.TCustomForm`.Constraints.MinHeight := `b` ⇒
    `a`.MinimumSize = new Size(`a`.MinimumSize.Width, `b`)
```

Code Rules

- Smalltalk expressions
- Search expressions based on AST node and code
- Replace expressions
  - Edit expressions
  - Control flow
  - General Smalltalk code

Edit Expressions

- Custom framework messages for editing source
- Replacing
  #replace:with: #replaceAll:with: …
- Moving
  #move:before: #move:after …
- Inserting
  #insert:before: #insert:afterAll: …
- Deleting
  #delete: #deleteWithWhitespaceAfter: …

Control Flow

- Normal traversal is depth first

- Change the order that nodes are traversed
  #processChild: #processChildren #continue

Code Examples

```
"{ }"
For: DelphiStatementBlockNode
When:
    true
Do:
    self replace: match beginToken with: '{'.
    self replace: match endToken with: '}'.
    self continue

"function objects"
For: PBTypeDeclarationNode
When:
    match from source sameAs: 'function_object'
Do:
    self isStatic: true.
    self classStart: match startPosition.
    self
        replace: match
        with: 'public partial class ' , self functionsClassName , ' {'
```

Parser Debugger

debug it

Bytecode GT

Parser Stack | Through Action | Into Reduce | Next Token | Possible Actions | GLR

Symbol	Value
Lookahead:	
<identifier>;<identifierName>	{url(122,124,#(97 98))}
","	{,(119,119,#(27))}
VariableDeclarationList	an Array(an OrderedCollection(a JSVariableDeclarationNode) an Or
"var"	{var(93,95,#(91 97 98))}
ModuleItemList	an OrderedCollection(a JSVariableStatementNode a JSVariableStat

Symbol	Action
"["	Shift
"{"	Shift
<identifier>	Shift
BindingPattern	Shift
Identifier	Shift
VariableDeclaration	Shift
ObjectBindingPattern	Shift
ArrayBindingPattern	Shift

1

Input | Step to Cursor | Scanner | Step Next Character

```
var sqlite = require('sqlite3');
var db = new sqlite.Database('/var/lib/weewx/weewx.sdb');

var http = require('http'),
    url = require('url'),
    path = require('path'),
    fs = require('fs');
const PORT = 8080;
const staticDirectory = path.join(process.cwd(), 'files');

function convertToDate(value) {
    return new Date(value * 1000);
}

function convertToTs(date) {
```

Name	Value
Scope	default

Stack | Proceed | Restart | Into | Over | Through | Source | Where is? | Browse

JSParser(SmaCCGLRParser)	getNextToken	
JSParser(SmaCCGLRParser)	performParsingLoop	
JSParser(SmaCCParser)	parse	
JSParser class(SmaCCParser class)	parseStream:startingAt:	
JSParser class(SmaCCParser class)	parseFile:encoding:	[:stream | stream
FileReference(AbstractFileReference)	readStreamDo:	[aBlock value: stre
BlockClosure	ensure:	

```
getNextToken
    currentToken isNil
        ifFalse: [ ^ self ].
    lastState = currentState scannerState
        ifTrue: [ currentToken := lastToken.
            scanner restoreState: nextScannerState.
            currentState scannerState: nextScannerState ]
```

Previewing

SmaCC Transformation Toolkit

Configuration | Transformations | Preview

w_eventhandling.srw

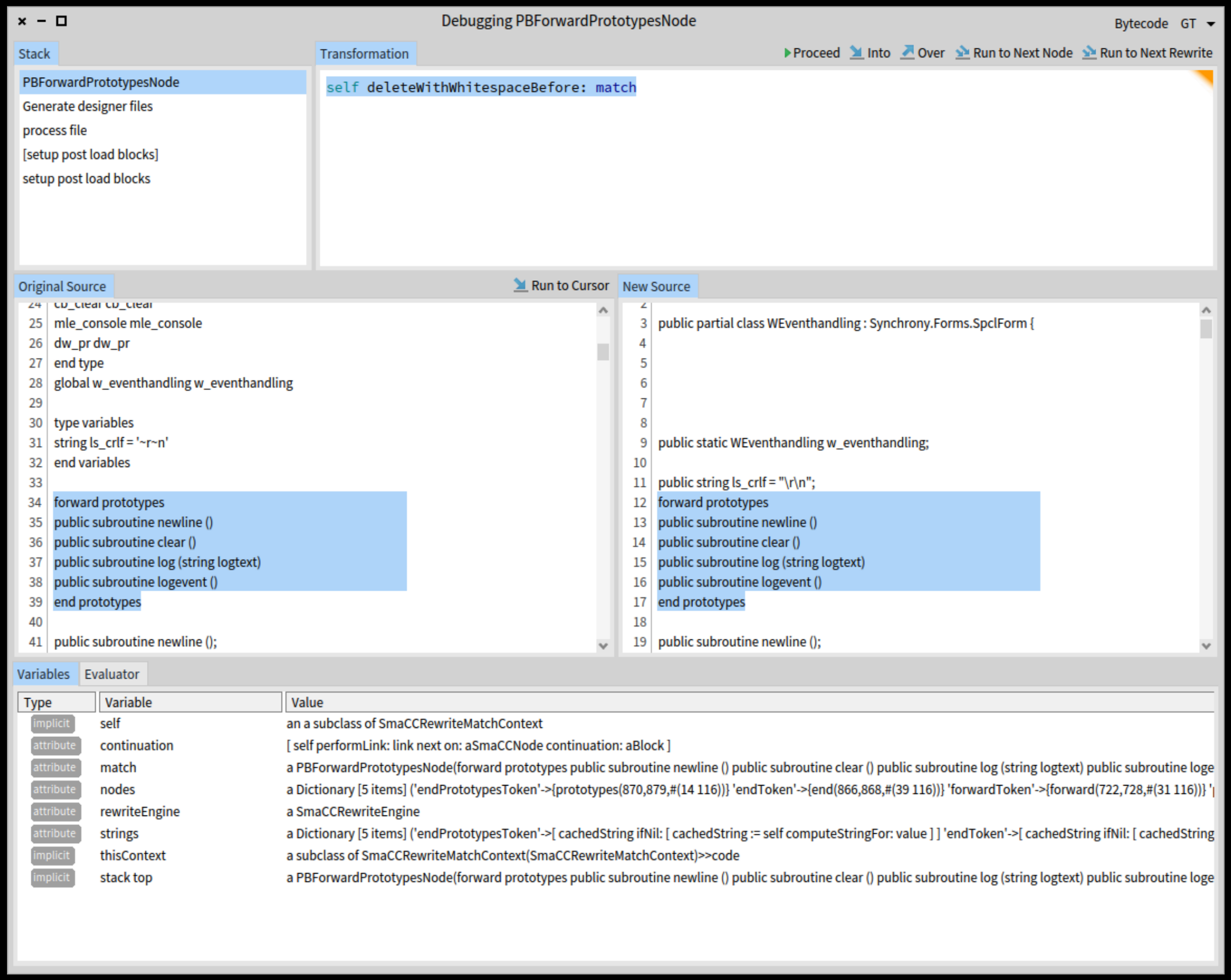
```
87  fontpitch fontpitch = variable!
88  fontfamily fontfamily = swiss!
89  string facename = "Tahoma"
90  string text = "clear"
91  end type
92
93  event clicked;
94  clear()
95  end event
96
97  type mle_console from multilineedit within w_eventhandling
98  integer x = 242
99  integer y = 1448
100 integer width = 2235
101 integer height = 1324
102 integer taborder = 20
103 integer textsize = -10
104 integer weight = 400
```

w_eventhandling.cs | w_eventhandling.Desi... | w_eventhandling.resx

```
31
32  public virtual void Logevent () {
33  }
34
35  public virtual void this_Open(object sender, EventArgs e) {;
36  dw_pr.SetTransObject(SpclTransaction.Default);
37  dw_pr.Retrieve();
38  }
39
40  public virtual void cb_clear_Clicked(object sender, EventArgs e) {;
41  Clear();
42  }
43
44  public virtual void dw_pr_Itemchanged(object sender, DataWindowItemCh
45  string messageText;;
46
47  messageText = "itemchanged: ";
48  messageText += "( row: " + Runtime.String(e.Row);
```

Rewrite	Node	Location
PBEventDeclarationNode	PBEventDeclarationNode	(1874 to: 1905)

Rule Debugger



Questions?

http://www.refactoryworkers.com/SmaCC/

Download for Pharo:

```
Gofer new
    smalltalkhubUser: 'JohnBrant'
        project: 'SmaCC';
    configurationOf: 'SmaCC';
    loadBleedingEdge
```