



Understanding changes with Torch

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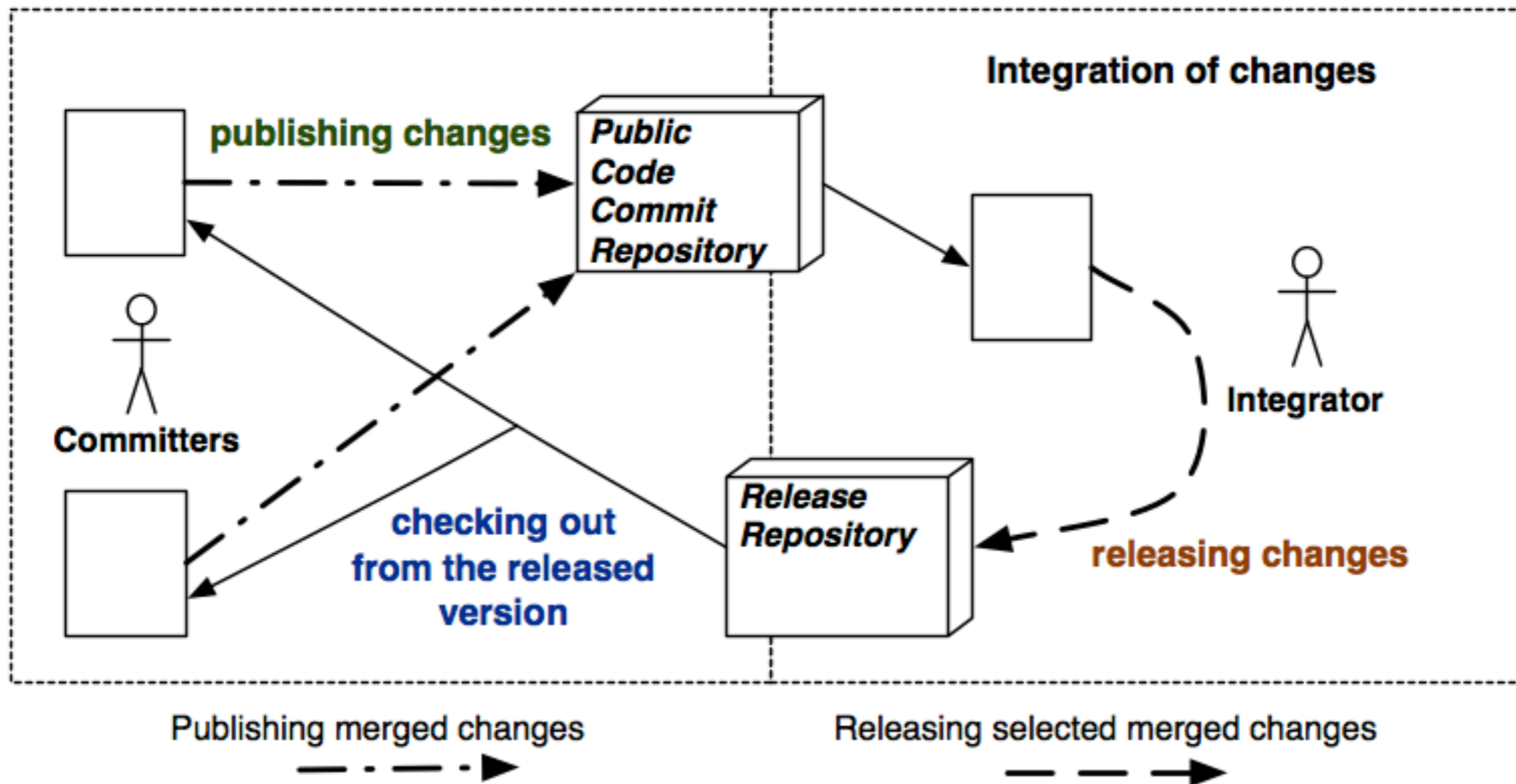


About me

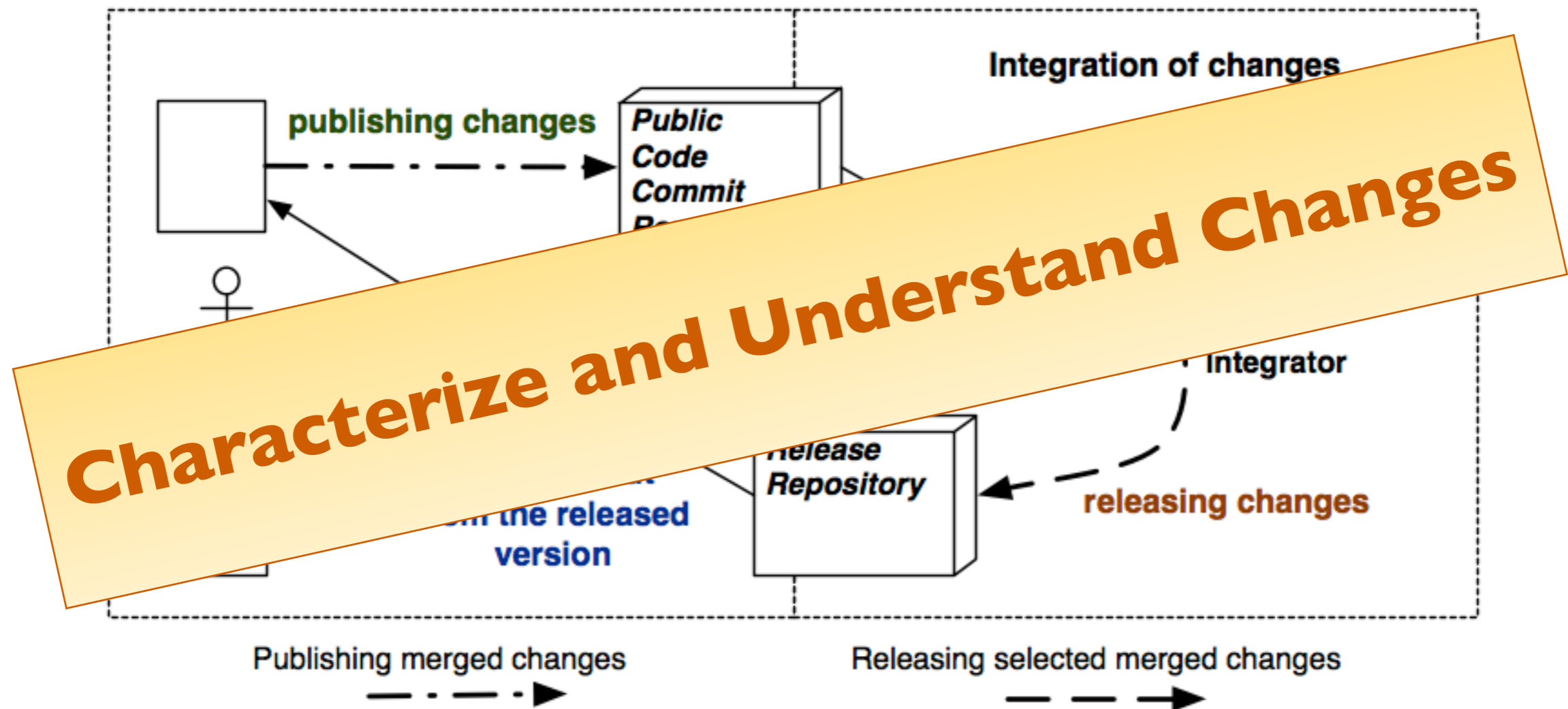


- ▶ VisualAge for Smalltalk developer (1998 - 2002)
- ▶ PhD candidate (interuniversity program)
 - ✓ Vrije Universiteit Brussel, Belgium 
 - Software Language Lab / prof. dr. Theo D'Hondt
 - ✓ Université Lille I, France 
 - RMoD Team / prof. dr. Stéphane Ducasse

Conceptual process of change integration*



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Integration is difficult



Integration is difficult

- ▶ Requires expertise on the system



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- ▶ Requires expertise on the system
- ▶ May demand a lot of time



Integration is difficult

- ▶ Requires expertise on the system
- ▶ May demand a lot of time
- ▶ Not enough support for integrators*



Integration is difficult

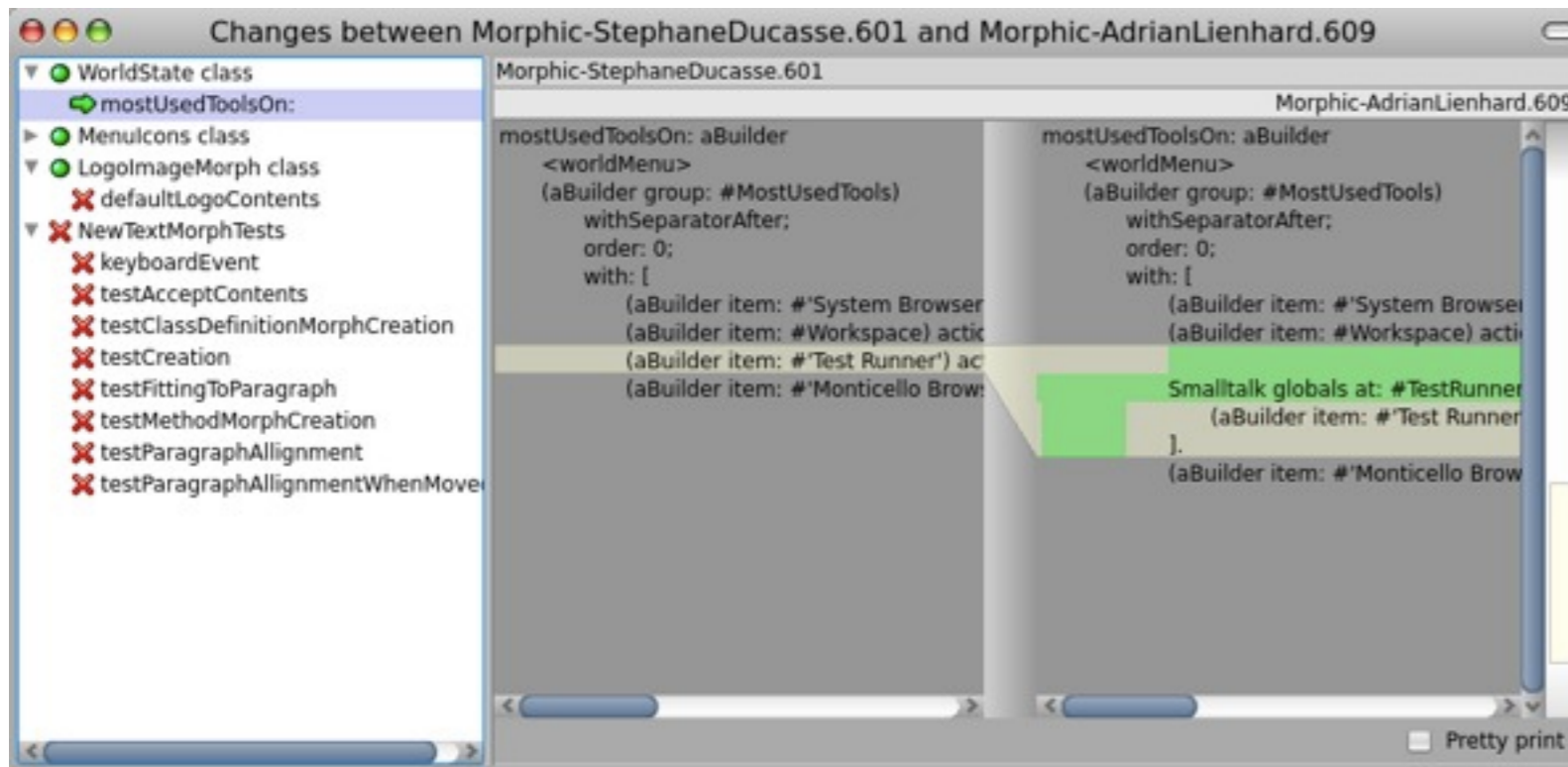
- ▶ Requires expertise on the system
- ▶ May demand a lot of time
- ▶ Not enough support for integrators*



Integrators are using ...



Integrators are using ...



Changes between Morphic-StephaneDucasse.601 and Morphic-AdrianLienhard.609

Morphic-StephaneDucasse.601

```
mostUsedToolsOn: aBuilder
  <worldMenu>
  (aBuilder group: #MostUsedTools)
  withSeparatorAfter;
  order: 0;
  with: [
    (aBuilder item: #'System Browser')
    (aBuilder item: #'Workspace') acti
    (aBuilder item: #'Test Runner') ac
    (aBuilder item: #'Monticello Brow
```

Morphic-AdrianLienhard.609

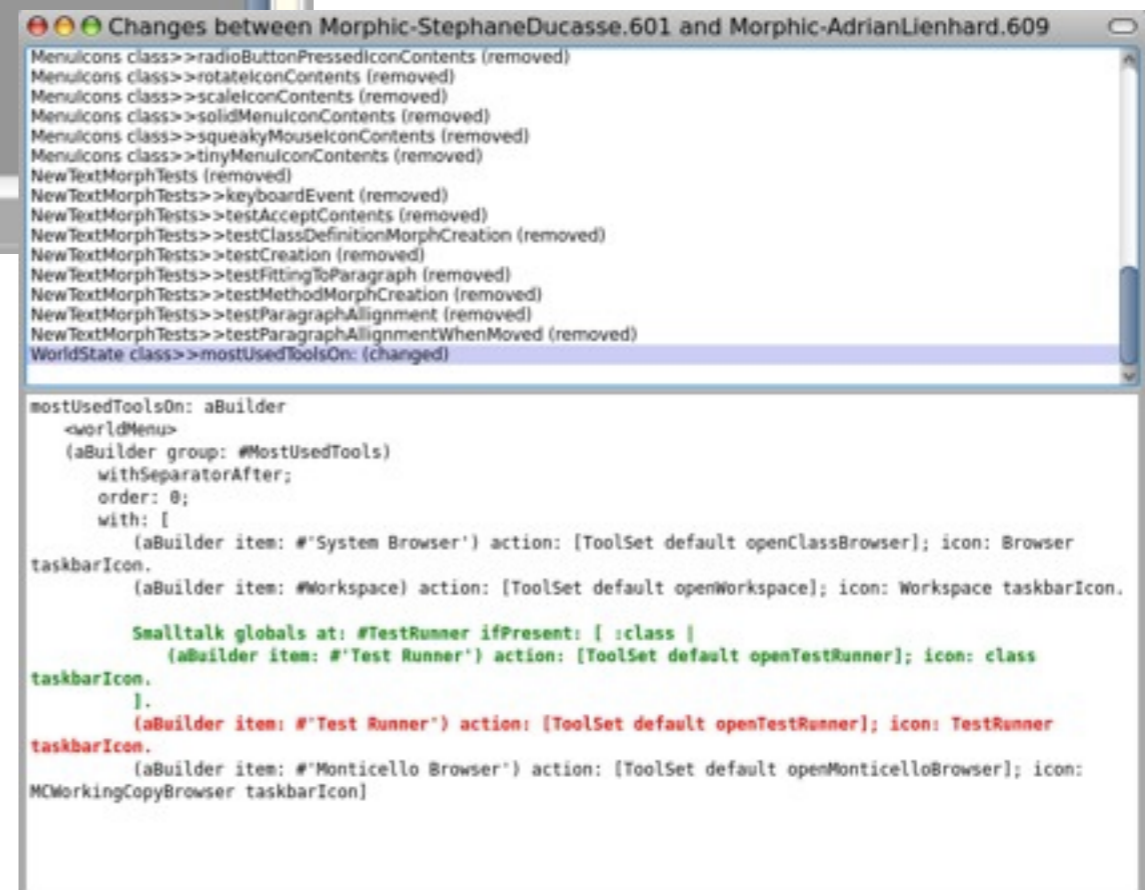
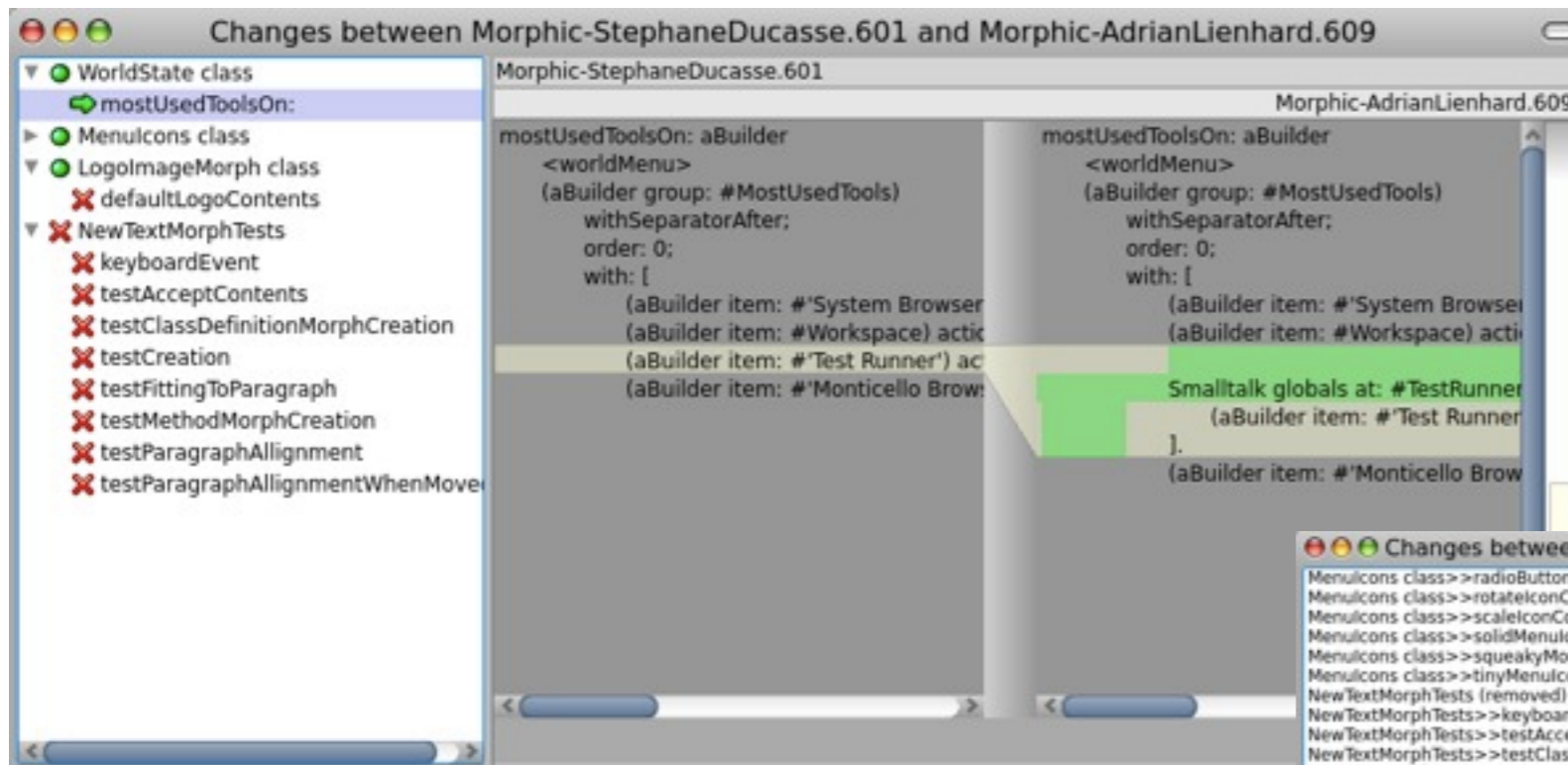
```
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  <worldMenu>
  (aBuilder group: #MostUsedTools)
  withSeparatorAfter;
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    (aBuilder item: #'System Browse
    (aBuilder item: #'Workspace) acti
    (aBuilder item: #'Test Runner
    Smalltalk globals at: #TestRunner
      (aBuilder item: #'Test Runner
    ].
    (aBuilder item: #'Monticello Brow
```

WorldState class
mostUsedToolsOn:
MenuIcons class
LogoImageMorph class
defaultLogoContents
NewTextMorphTests
keyboardEvent
testAcceptContents
testClassDefinitionMorphCreation
testCreation
testFittingToParagraph
testMethodMorphCreation
testParagraphAlignment
testParagraphAlignmentWhenMove

Pretty print



Integrators are using ...



We want to support...

We want to support...

- ▶ Integrators 

We want to support...


- ▶ Integrators 
 - ✓ aiding in understanding changes

We want to support...

- ▶ Integrators ★
 - ✓ aiding in understanding changes
 - ✓ taking decisions about the integration process




We want to support...

- ▶ Integrators 
 - ✓ aiding in understanding changes
 - ✓ taking decisions about the integration process
- ▶ Developers



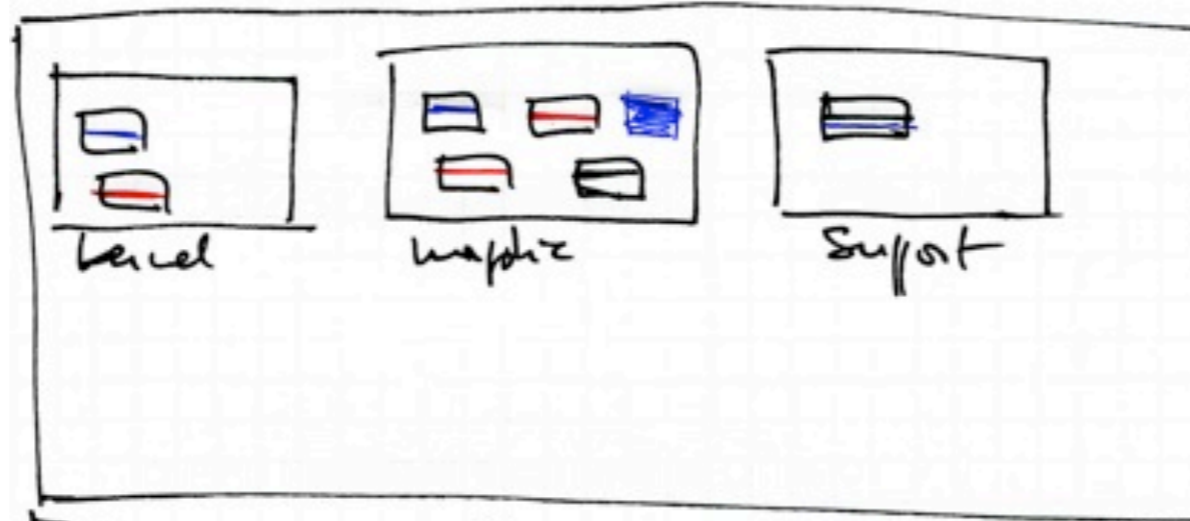
We want to support...

- ▶ Integrators 
 - ✓ aiding in understanding changes
 - ✓ taking decisions about the integration process
- ▶ Developers
 - ✓ controlling their changes before publishing



DASHBOARD

NAME: Text Editor.



Package: 3 / 7 clones

New clone: 1

Methods changed: 3

Methods new: 15

Author: Juan Vuletich.

New Symbol.



CHANGED

ADDED: text EDITOR

REMOVED: PARAGRAPH
.....

Torch Dashboard: Changes from SLICE-Issue1709-EnhancedTextDiffBuilder (ancestor) to SLICE-Issue1709-EnhancedTextDiffBuild

Change Summary

- Packages (32) 3
- Classes (149) 2 4 3
- Methods (1646) 25 8 39
- Variables (157) 9 18
 - additions: 9
 - removals: 18

Colors Borders

Added	Removed	Modified	Comment
			Comment
		N/A	Variable
			Method source
N/A	N/A		Class' package

Viz. Class Status: All changed

Viz. Width: 900

Viz. Relationships: intra- packages

Classes / Methods

- PrettyTextDiffBuilder
- TextDiffBuilder
 - attributesOf: i
 - buildDisplayPatch i
 - buildDisplayPatchFrom:to: i
 - buildDisplayPatchFrom:to:inC i
 - buildDisplayPatchFrom:to:inC i
 - buildPatchSequence i
 - buildReferenceMap i
 - collectRunFrom:startingWith: i
 - destString: i
 - detectShiftedRuns i
 - findMatches i
 - formatLine: i
 - from:to: i

Changed Packages (details)

- Tests-System: TextDiffBuilderTest
- Settings-Tools: DifferatorSystemSettings
- System-FilePackage:
 - TextDiffBuilder
 - TwoLevelSet
 - DiffElement
 - TwoLevelDictionary
 - ClassDiffBuilder
 - CodeDiffBuilder
 - PrettyTextDiffBuilder

class method Protocol: instance creation Author: HenrikSperreJohansen

```

buildDisplayPatchFrom: sourceText to: destinationText
^(self from: sourceText to: destinationText) buildDisplayPatch
buildDisplayPatchFrom: srcString to: dstString
^(self from: srcString to: dstString) buildDisplayPatch
  
```

Source Code Diff

```

buildDisplayPatch
  ^Text streamContents:[ :stream]
  self printPatchSequence: self buildPatchSequence on: stream
  ]

buildDisplayPatch
  ^Text streamContents: [ :stream |
    self
      patchSequenceDofMatch: [ :string |
        self print: string withAttributes: NormalTextAttributes
      ]
      ifInsert: [ :string |
        self print: string withAttributes: InsertTextAttributes
      ]
      ifRemove: [ :string |
        self print: string withAttributes: RemoveTextAttributes
      ]
  ]
  
```

Torch

Torch

- ▶ Visualization tool

Torch

- ▶ Visualization tool
 - ✓ provides an overview of changes

Torch

- ▶ Visualization tool
 - ✓ provides an overview of changes
 - ✓ uses structural & symbolic information

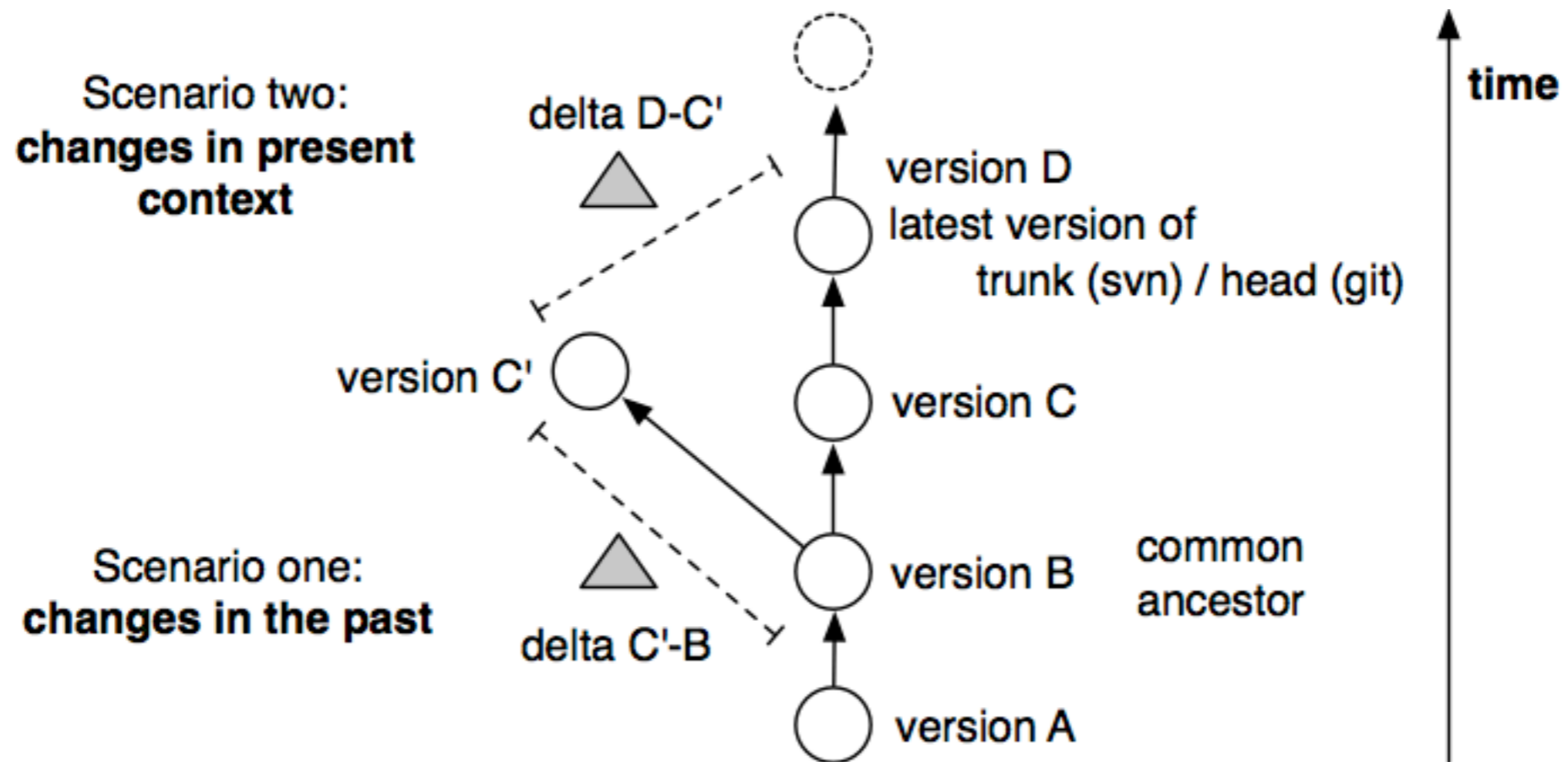
Torch

- ▶ Visualization tool
 - ✓ provides an overview of changes
 - ✓ uses structural & symbolic information
- ▶ Written in Smalltalk - Pharo

Torch

- ▶ Visualization tool
 - ✓ provides an overview of changes
 - ✓ uses structural & symbolic information
- ▶ Written in Smalltalk - Pharo
- ▶ Integrated with Monticello I

Extracting Changes



The dashboard shows ...

- ▶ Packages
 - ✓ Classes | Traits
 - Methods
 - Variables
 - ✓ Protocols*
 - ✓ Authors
 - ✓ Relationships

Change Operations

- ▶ Additions
- ▶ Modifications
- ▶ Removals
- ▶ Movements (classes)



Torch Dashboard: Changes from SLICE-Issue1709-EnhancedTextDiffBuilder (ancestor) to SLICE-Issue1709-EnhancedTextDiffBuild

Change Summary

- Packages (32) 3
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- Methods (1646) 25 8 39
- Variables (157) 9 18

Summaries

Colors Borders

Added Removed Modified Comment

Conventions

Viz. Class Status Viz. Width

Parameters

Classes / Methods

- PrettyTextDiffBuilder
- TextDiffBuilder
 - attributesOf: []
 - buildDisplayPatch []
 - buildDisplayPatchFrom:to: []
 - buildDisplayPatchFrom:to:inC []
 - collectRunFrom:startingWith: []
 - destString: []
 - detectShiftedRuns []
 - findMatches []
 - formatLine: []
 - from:to: []

Changes list

Changed Packages (details) Changed Packages Packages Changed Classes (details) Classes Symbolic Clouds

packages

classes

variables

methods

inheritance (intra-package)

comments

in place diff as a fly-by-help

Changes visualizations

Source Code Diff Source Code Protocol/Author

```

buildDisplayPatch
  ^Text streamContents:[ :stream ]
  self printPatchSequence: self buildPatchSequence on: stream
]

buildDisplayPatch
  ^Text streamContents: [ :stream |
  self
    patchSequenceDolfMatch: [ :string |
      self print: string withAttributes: NormalTextAttributes
    ]
    ifInsert: [ :string |
      self print: string withAttributes: InsertTextAttributes
    ]
    ifRemove: [ :string |
      self print: string withAttributes: RemoveTextAttributes
    ]
  ]

```

Changes details

The Torch Dashboard main components

Visual Representation

- ▶ Rectangles

- ✓ packages, classes, traits, methods

- ▶ Triangles

- ✓ variables

- ▶ Edges

- ✓ class-inherits-class



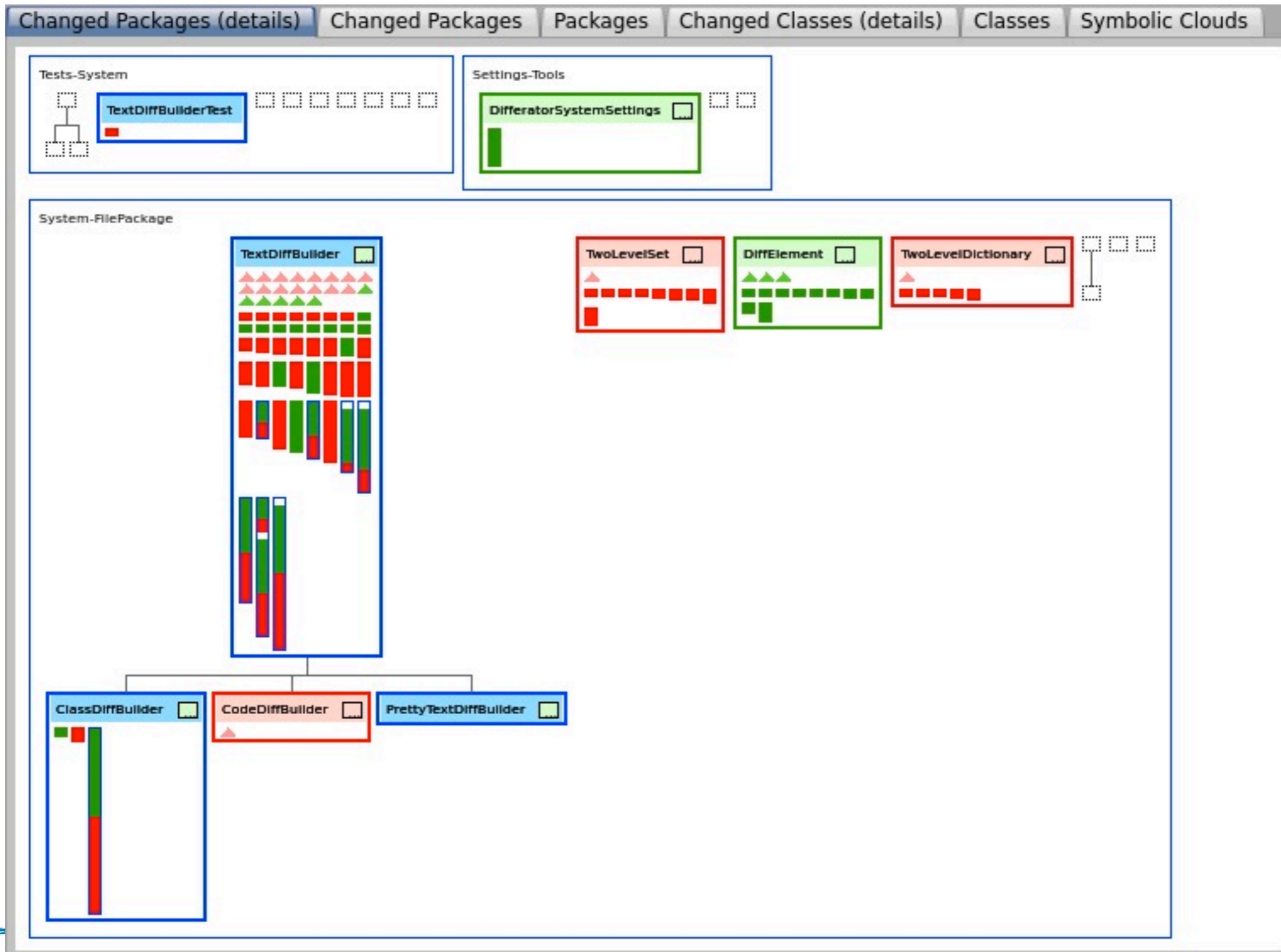
- ✓ class-uses-trait



- ✓ class-is-extended-in-package



Component: Change visualizations



Component: Change visualizations

Package-centric		Class-centric	
<i>Packages</i>	<i>class visual representation</i>	<i>Classes</i>	<i>class visual representation</i>
changed			

Component: Change visualizations

Package-centric		Class-centric	
<i>Packages</i>	<i>class visual representation</i>	<i>Classes</i>	<i>class visual representation</i>
changed	structural		

Component: Change visualizations

Package-centric		Class-centric	
<i>Packages</i>	<i>class visual representation</i>	<i>Classes</i>	<i>class visual representation</i>
changed	structural	changed and dependents	structural

Component: Change visualizations

Package-centric		Class-centric	
<i>Packages</i>	<i>class visual representation</i>	<i>Classes</i>	<i>class visual representation</i>
changed	structural	changed and dependents	structural
changed and unchanged	condensed		

Component: Change visualizations

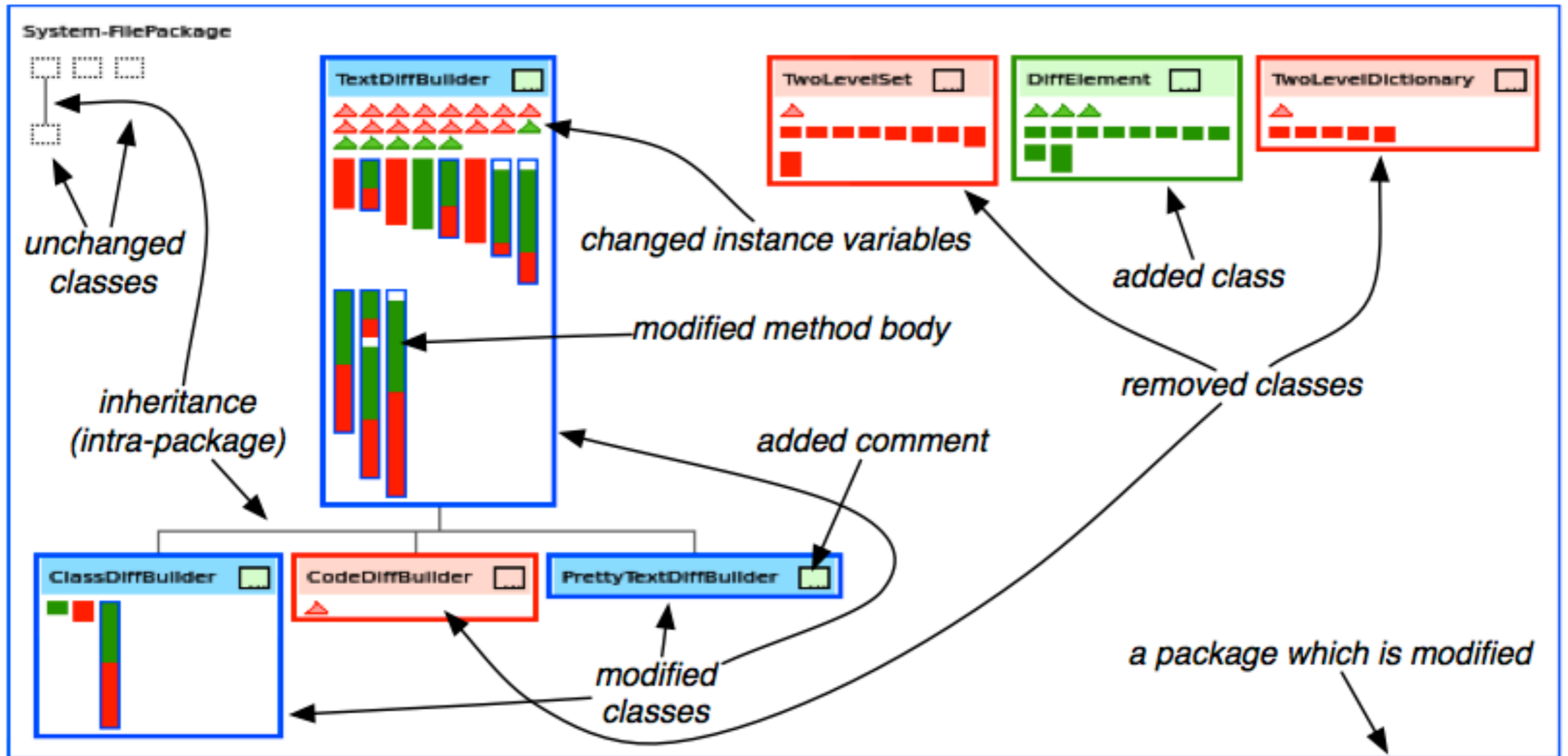
Package-centric		Class-centric	
<i>Packages</i>	<i>class visual representation</i>	<i>Classes</i>	<i>class visual representation</i>
changed	structural	changed and dependents	structural
changed and unchanged	condensed		
		changed and unchanged	condensed

Component: Change visualizations

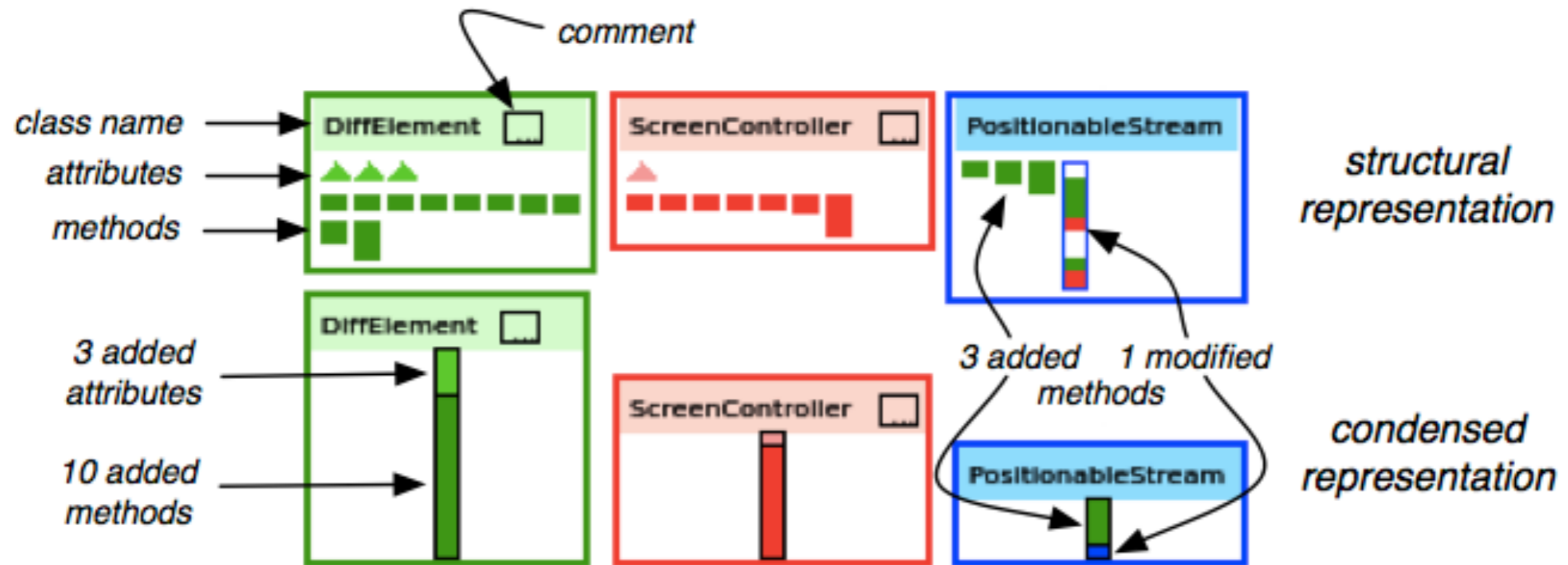
Package-centric		Class-centric	
Packages	<i>class visual representation</i>	Classes	<i>class visual representation</i>
changed	structural	changed and dependents	structural
changed and unchanged	condensed		
		changed and unchanged	condensed

+ Symbolic Clouds

Package Structure



Class Representation

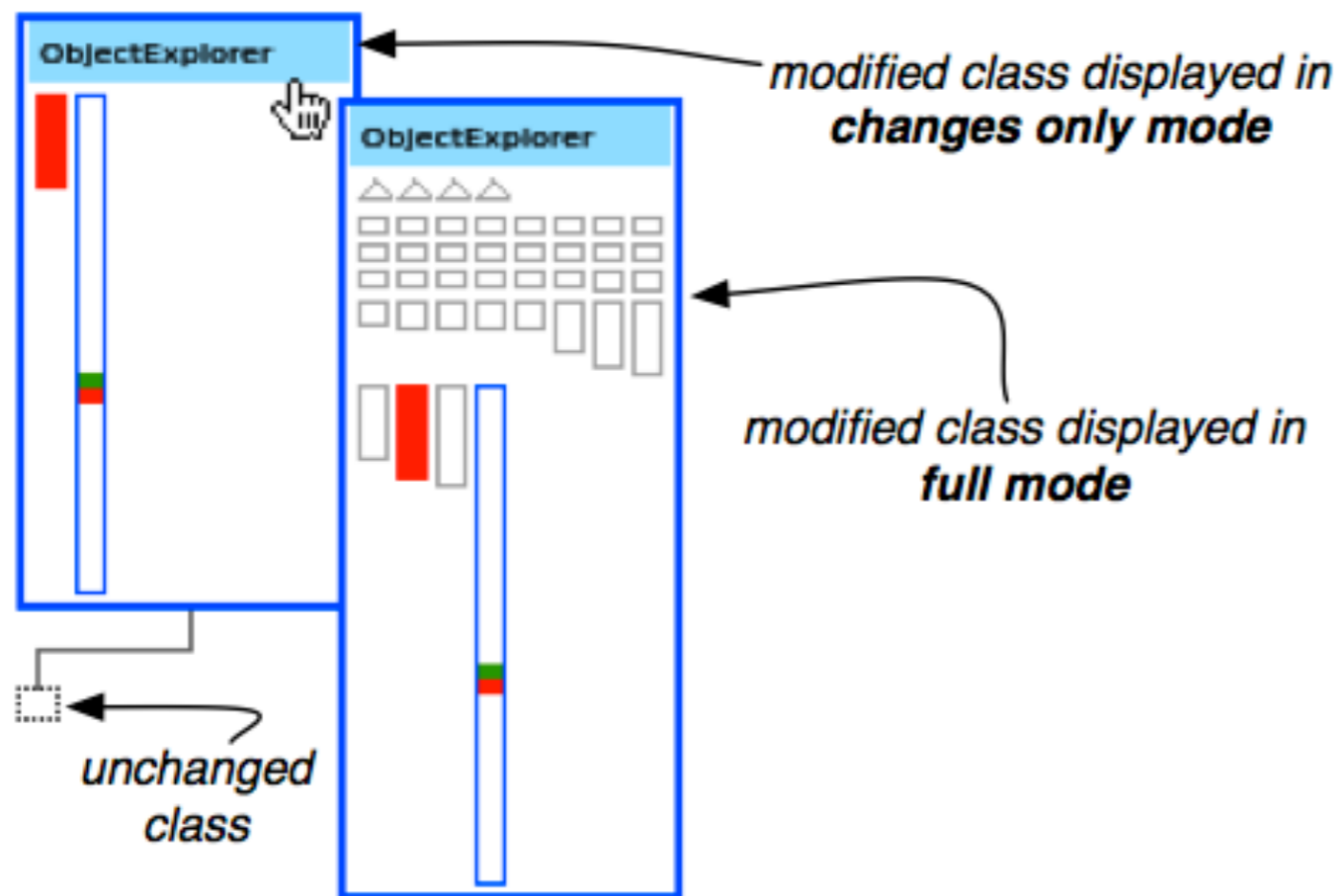


Omnipresent source code

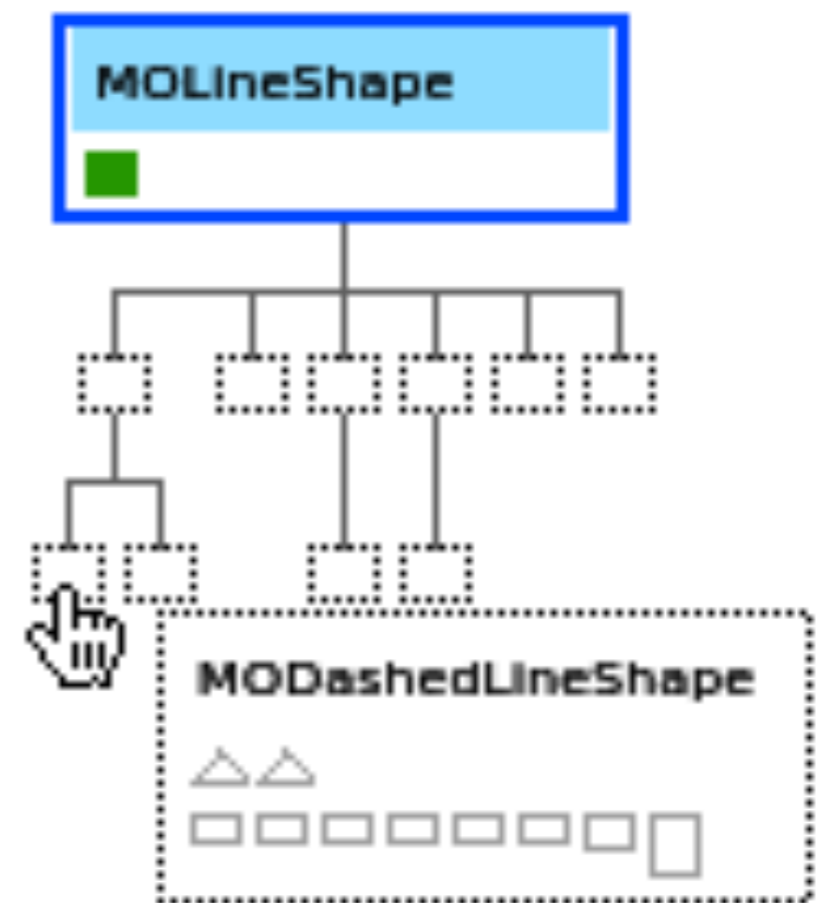
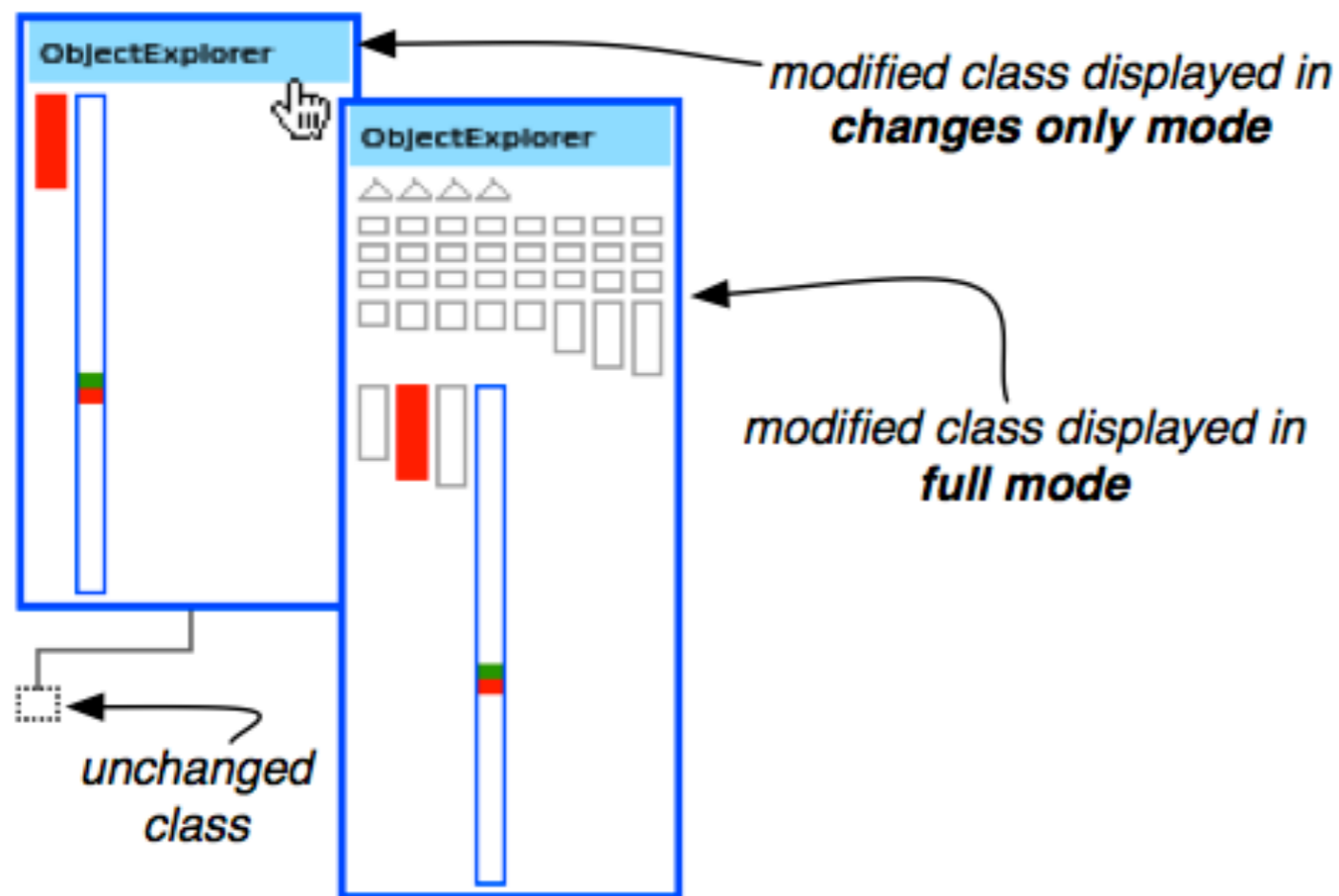
The screenshot shows a class browser for `SystemNavigation`. A method `browseAllObjectReferencesTo:` is selected, and its source code is displayed in a fly-by-help window. Annotations explain the visual cues: a blue box around the class name indicates a "modified class"; a red and green bar in the method list indicates "method showing addition and removal"; the header of the fly-by-help window shows "scope, protocol and author of method" as "instance method Protocol: browse Author: AndyKellens"; and the source code itself is a "method diff as a fly-by-help" with green and red highlights.

```
instance method Protocol: browse Author: AndyKellens  
browseAllObjectReferencesTo: anObject except: objectsToExclude ifNone: aBlock  
"Bring up a list inspector on the objects that point to anObject.  
If there are none, then evaluate aBlock on anObject. "  
| aList shortName |  
aList := anObject pointersToExcept: objectsToExclude.  
aList := PointerFinder pointersTo: anObject except: objectsToExclude.  
aList size > 0 ifFalse: [^aBlock value: anObject].  
shortName := (anObject name ifNil: [anObject printString]) contractTo: 20.  
aList inspectWithLabel: 'Objects pointing to ' , shortName
```

Omnipresent class structure

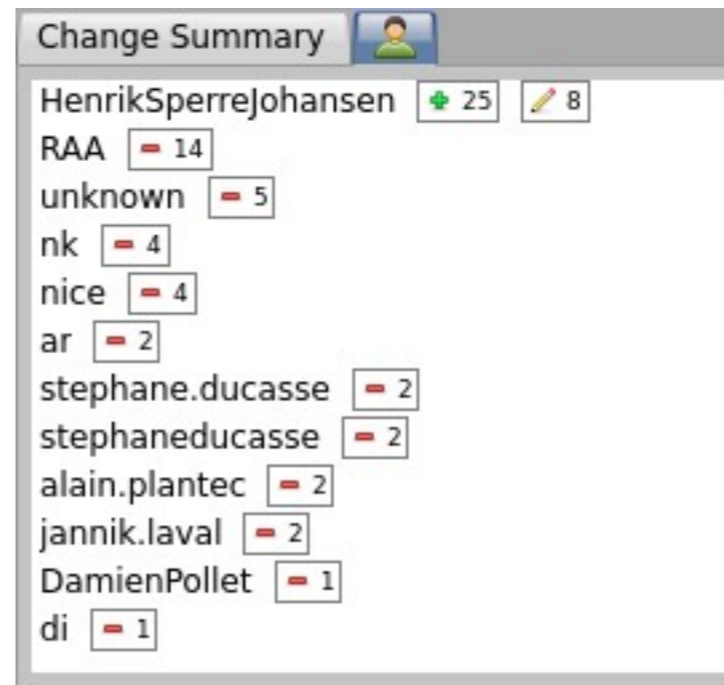
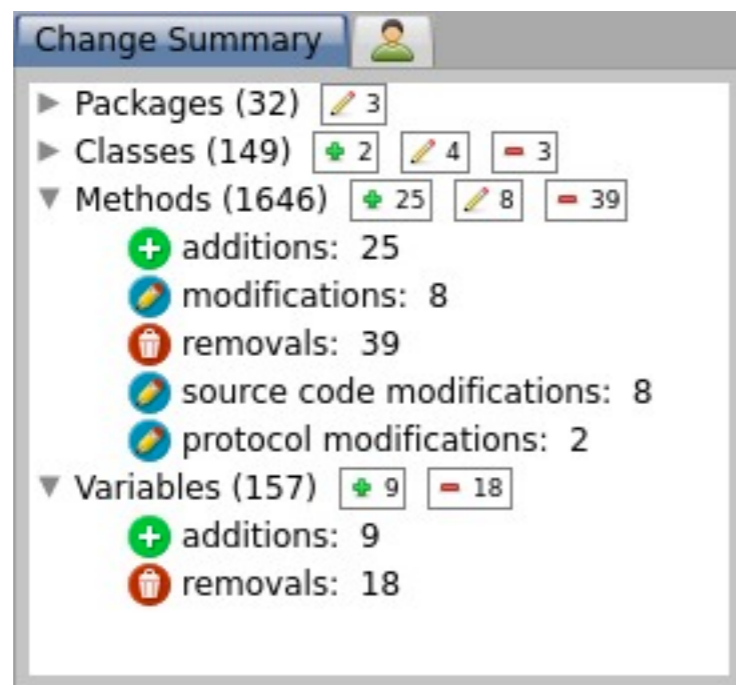


Omnipresent class structure



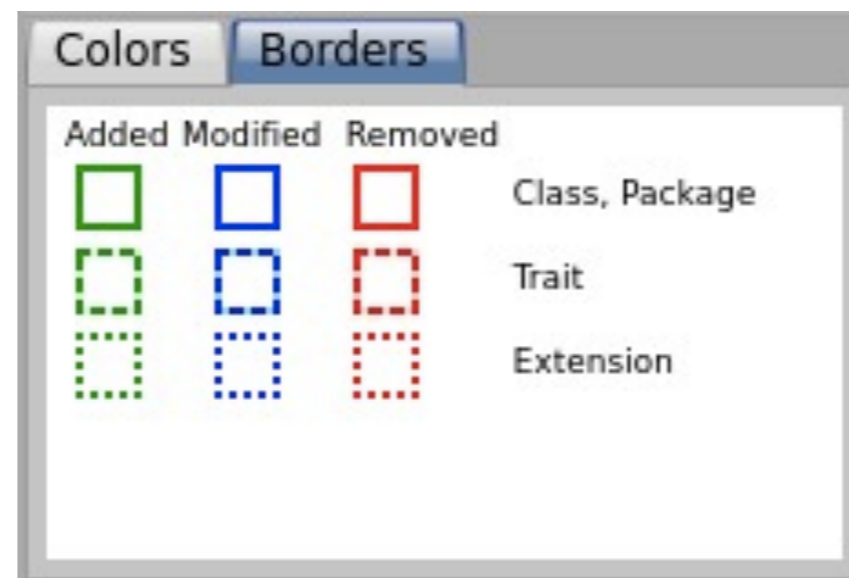
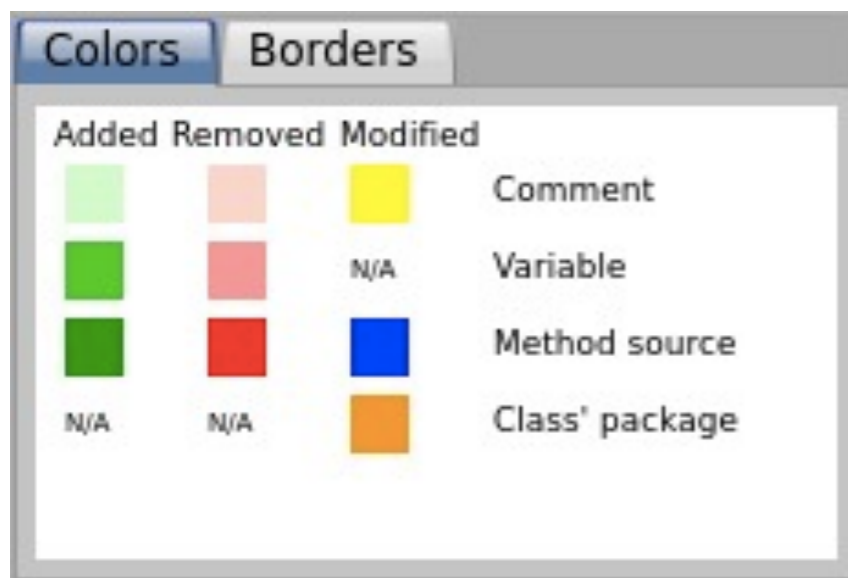
Component: Summaries

- ▶ Metrics with overview of changes
 - ✓ Entities x Operations
 - ✓ Users x Operations
- ▶ Filter the changes



Component: Conventions

- ▶ Colors represent change operations on entities
- ▶ Borders distinguish some entities
- ▶ Icons emphasize changes

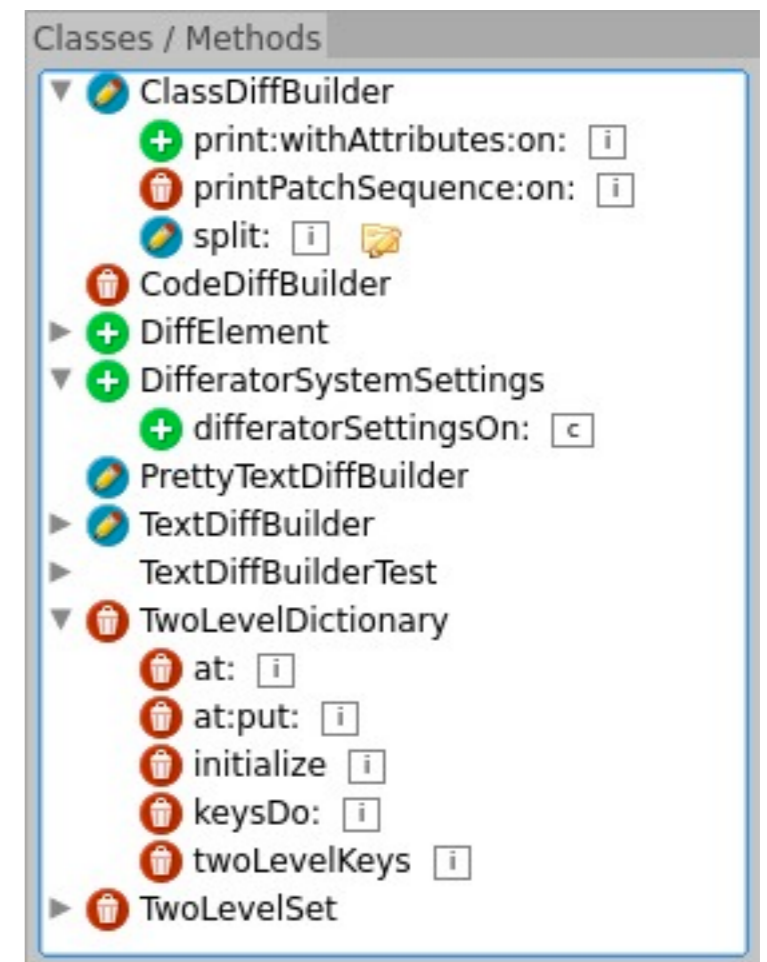


Component: Parameters

- ▶ Affect the changes visualizations component
 - ✓ Class status: added, modified, removed, unchanged, **changed***
 - ✓ Relationships: inter- or intra- packages

Component: Change list

- ▶ Shows selected changes
- ▶ Resembles the Monticello change list, but ...
 - ✓ class + metaclass = one class
 - ✓ adds extra information
 - ✓ sorted

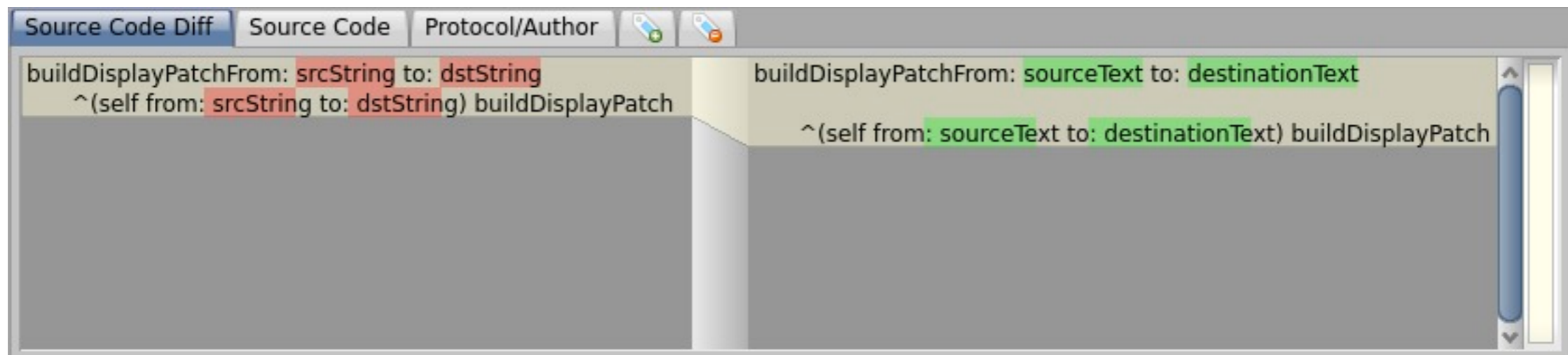


Component: Change details

- ▶ Offer textual information of changes

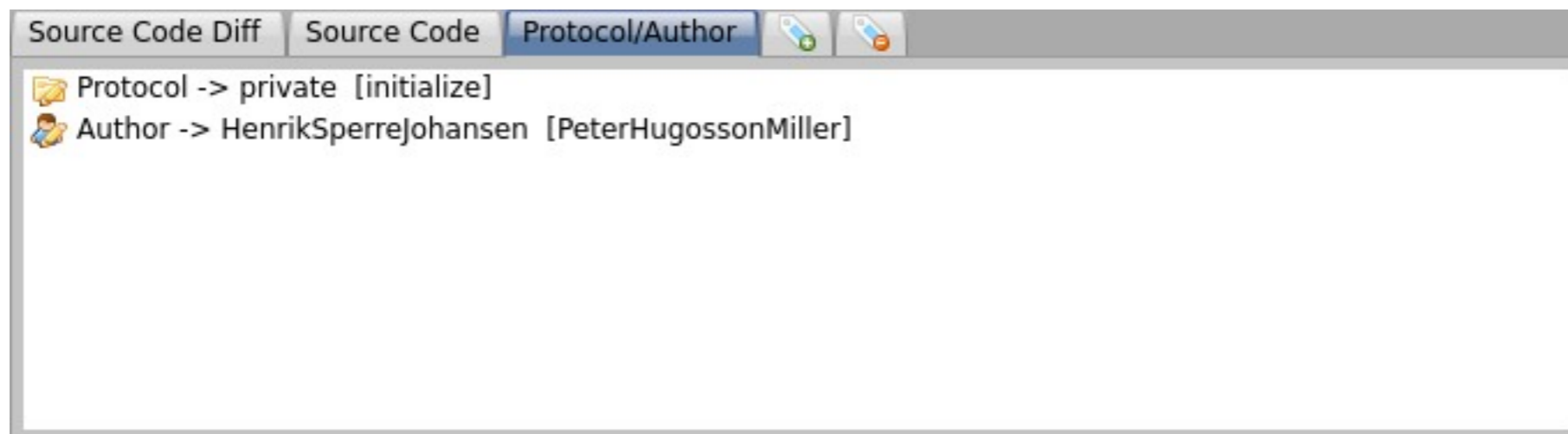
Component: Change details

- ▶ Offer textual information of changes



Component: Change details

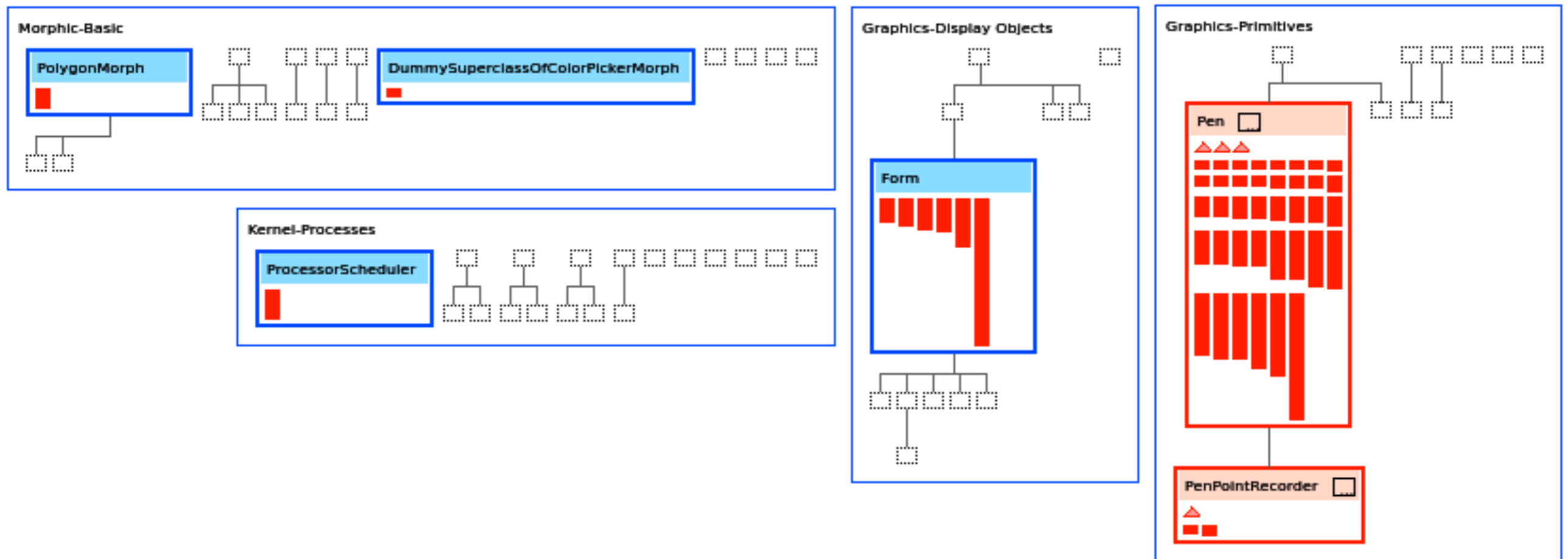
- ▶ Offer textual information of changes



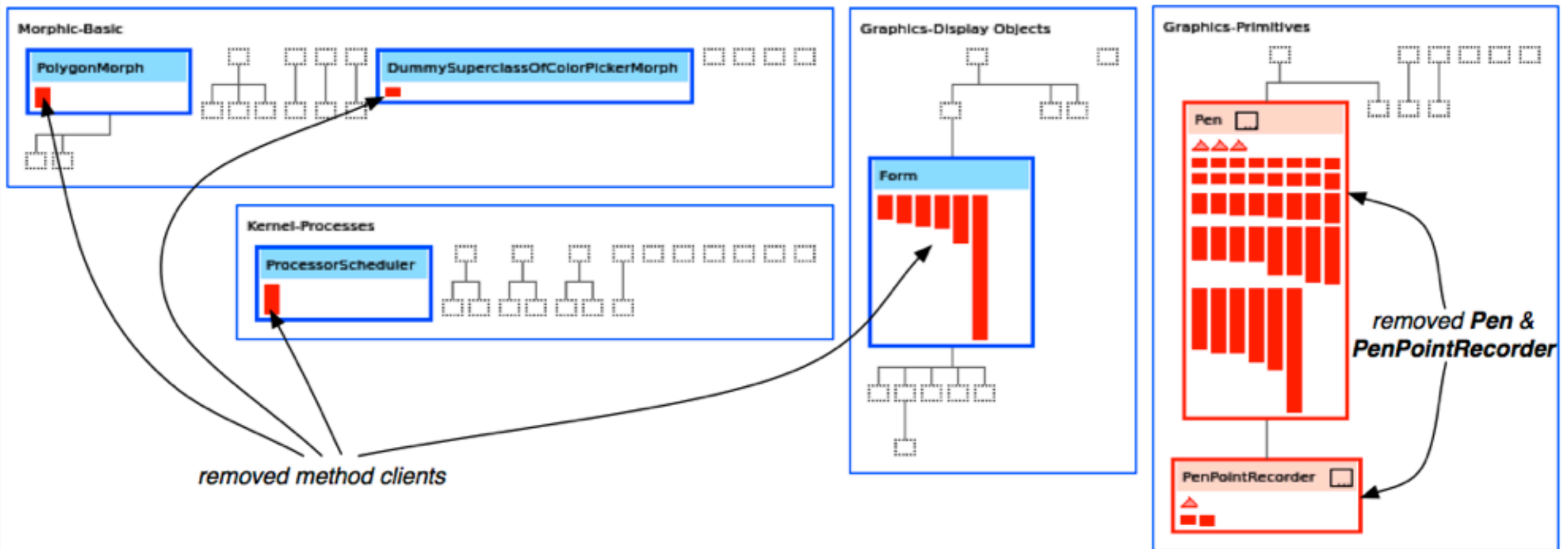
Torch in action

Package slices: PharolInbox and PharoTreatedInbox
repositories

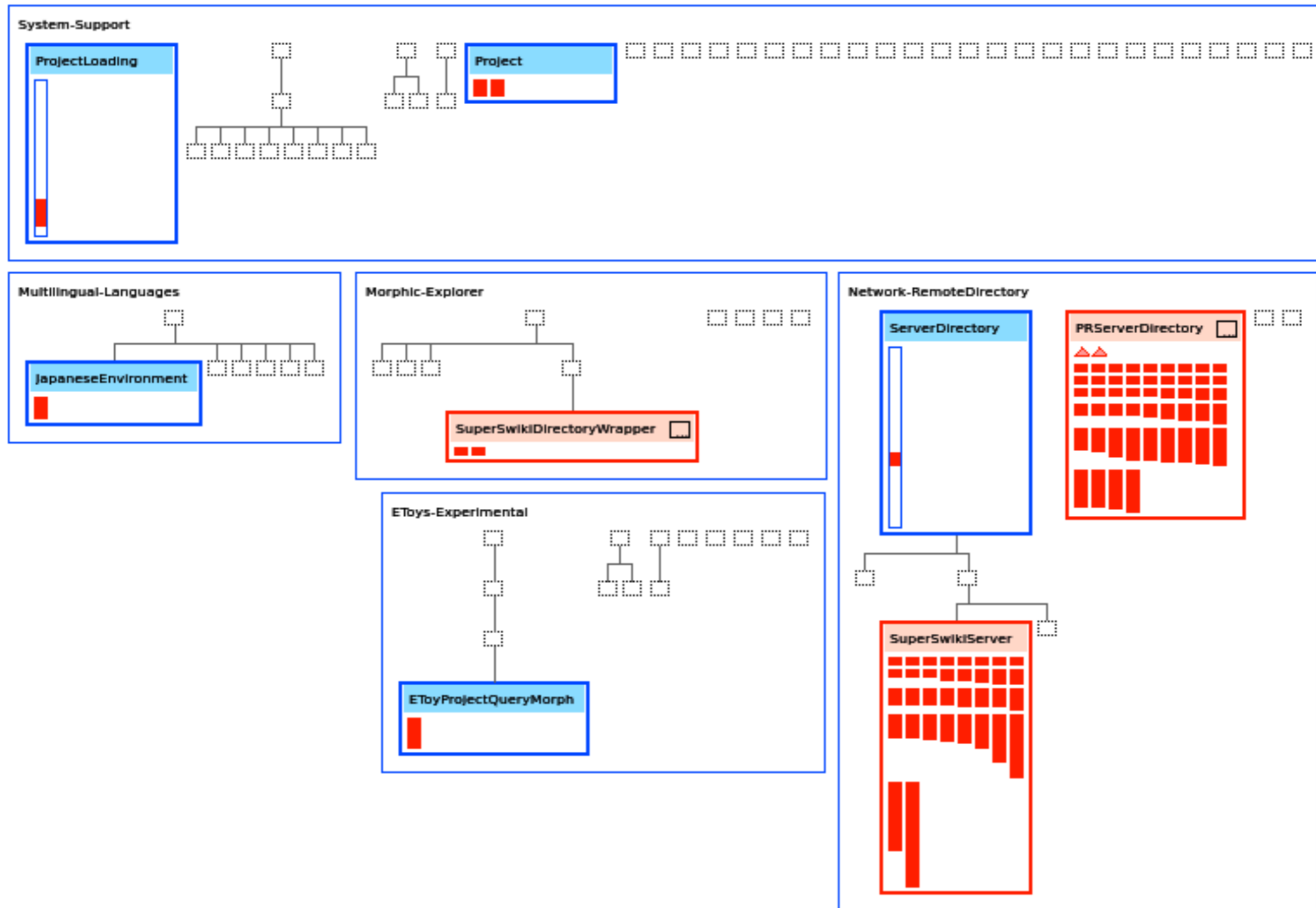
What do you think it happened?



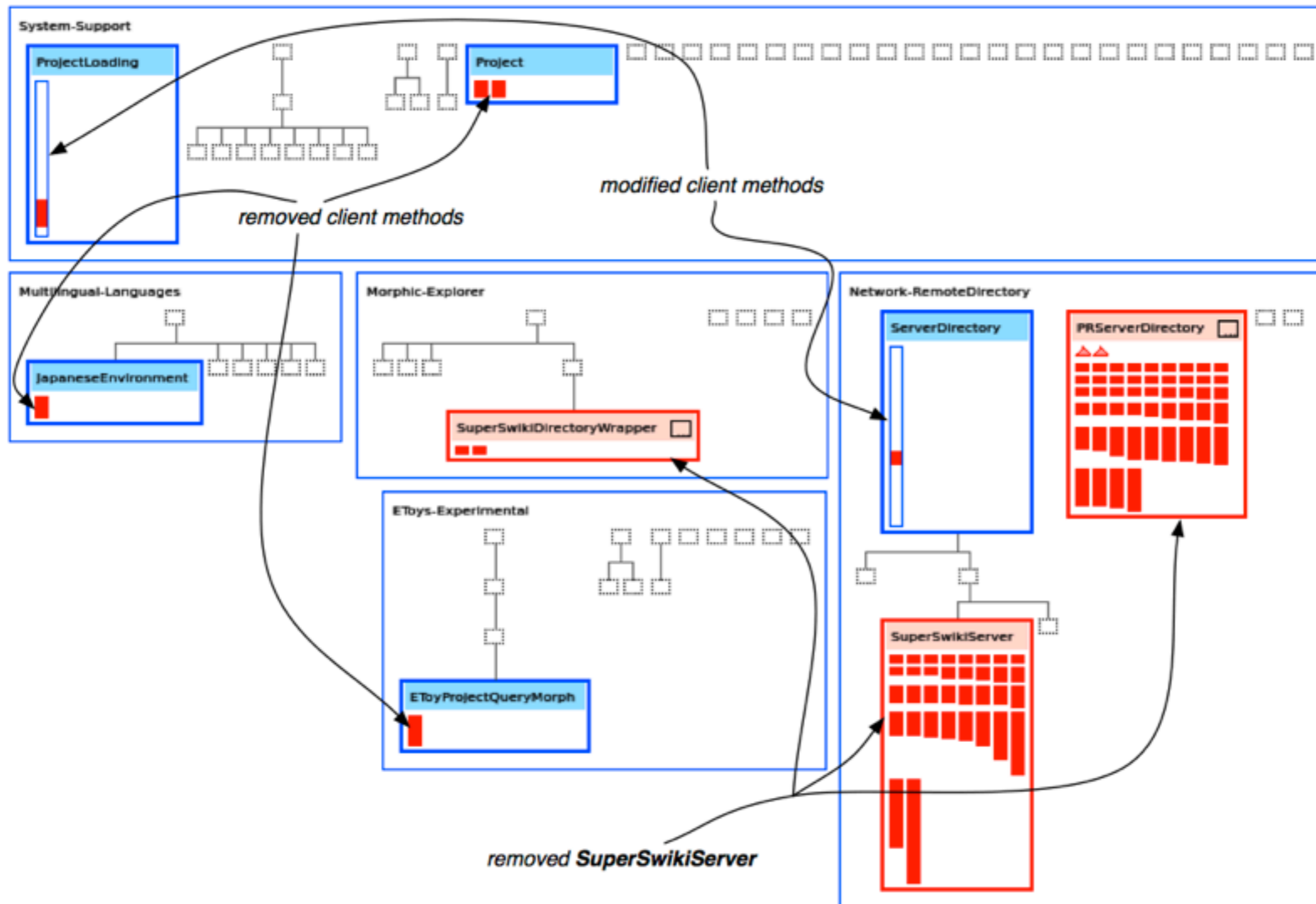
Removing a feature (I)



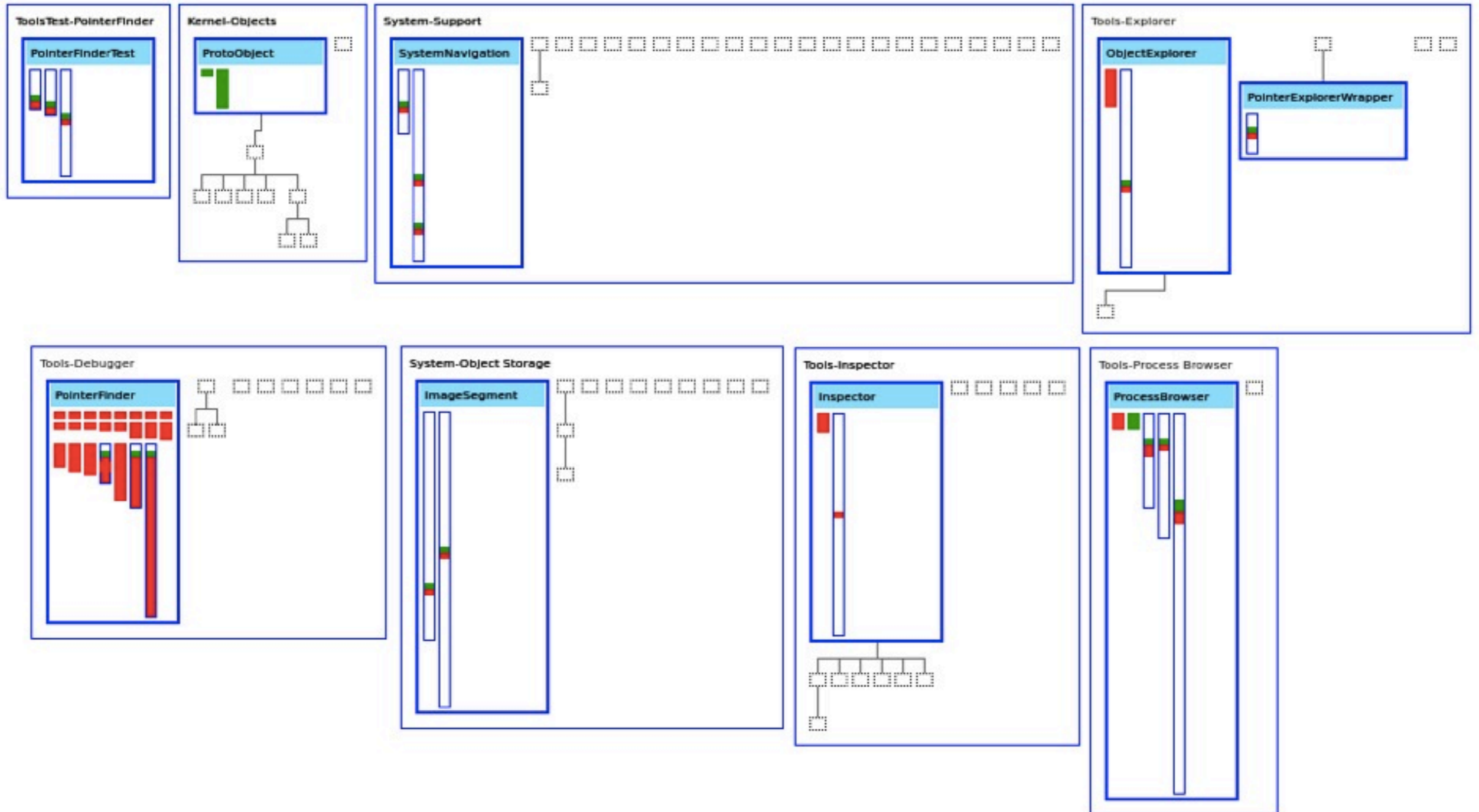
Removing a feature (II)



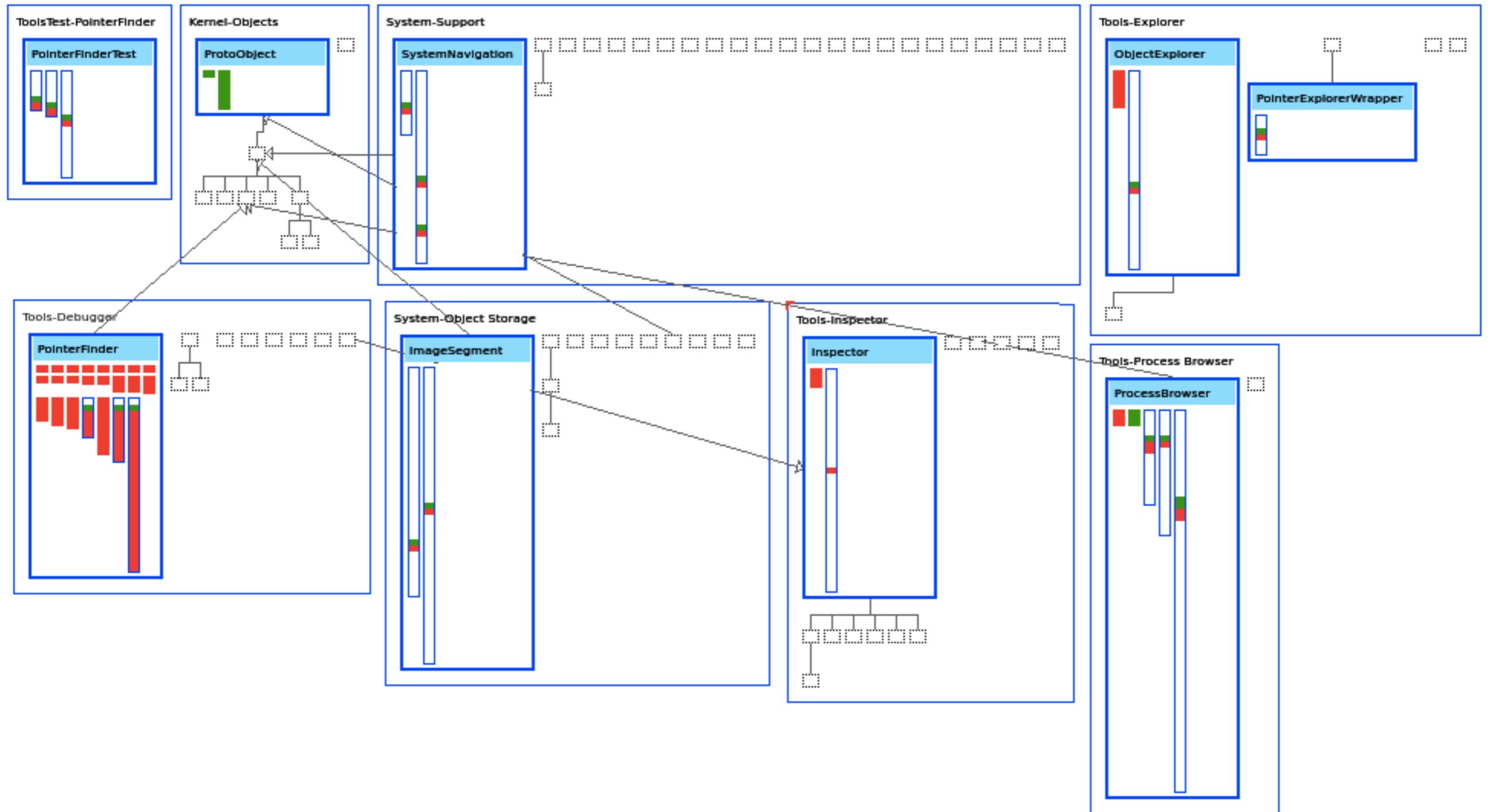
Removing a feature (II)



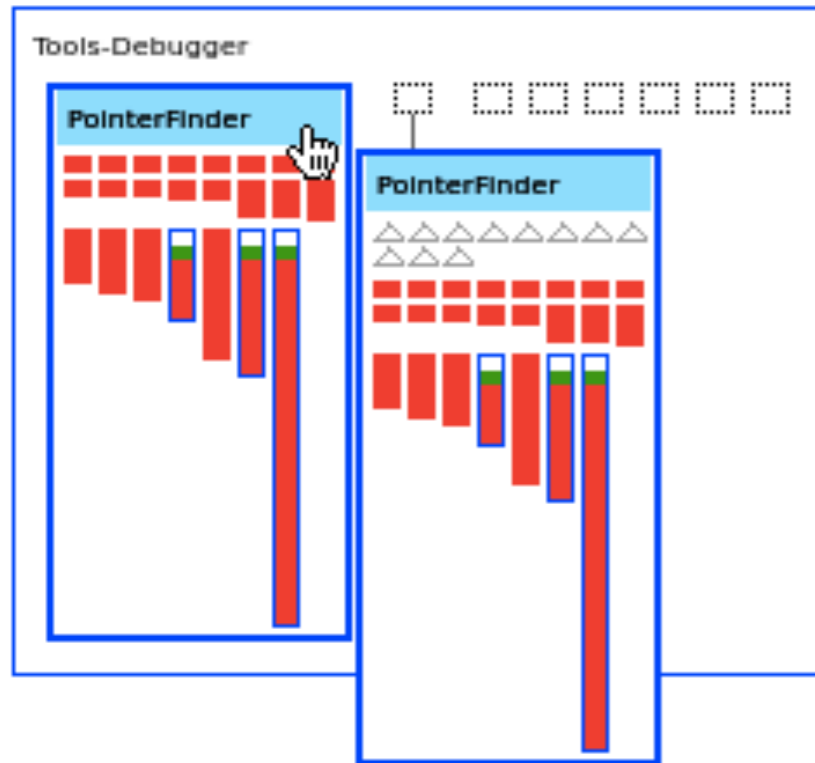
??



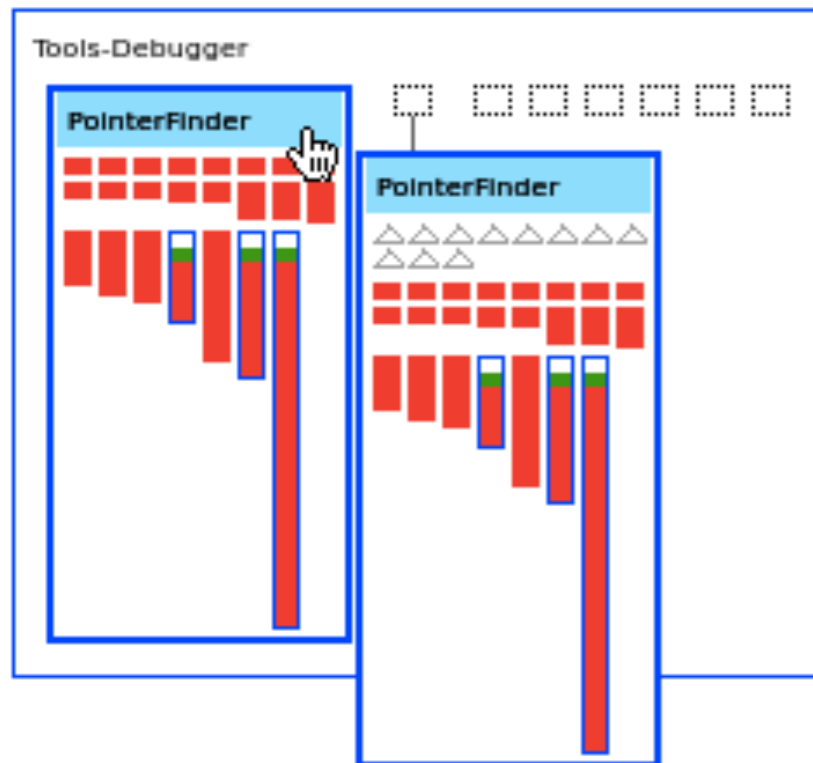
??



??



??

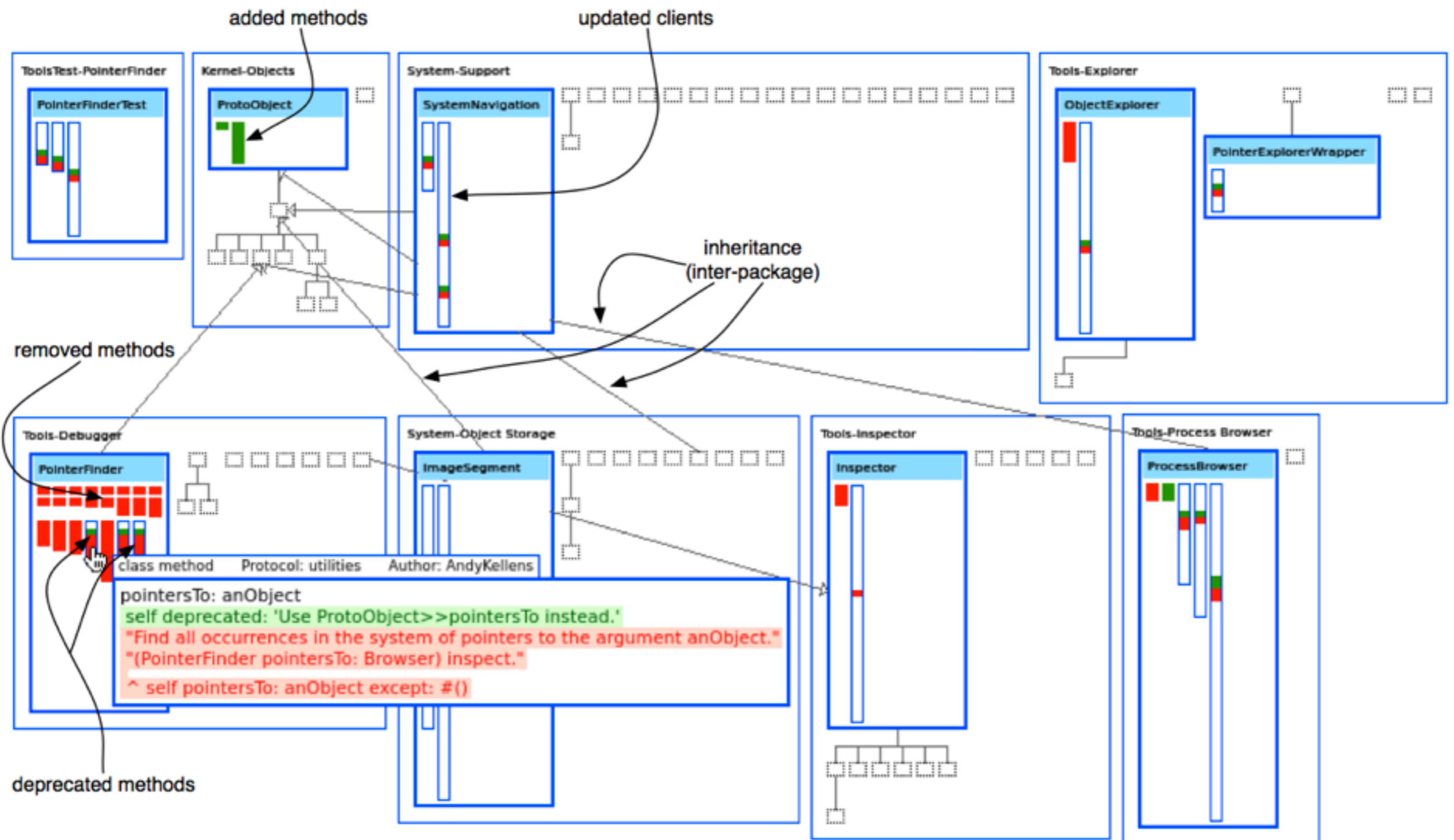


The screenshot shows the 'Tools-Debugger' window with the 'PointerFinder' class selected. A tooltip is displayed over the class name, showing the following information:

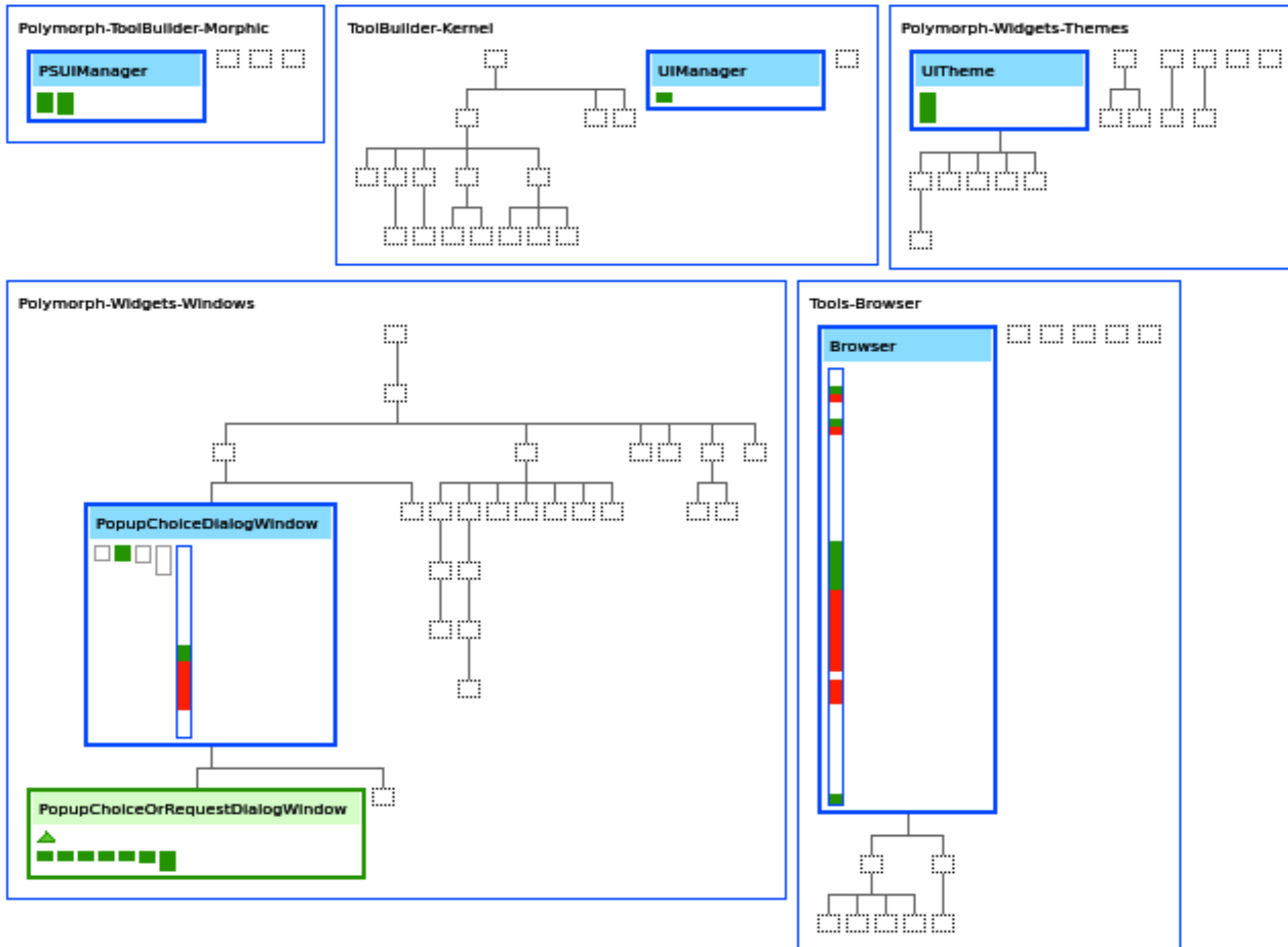
class method Protocol: utilities Author: AndyKellens

pointersTo: anObject
self deprecated: 'Use ProtoObject>>pointersTo instead.'
"Find all occurrences in the system of pointers to the argument anObject."
"(PointerFinder pointersTo: Browser) inspect."
^ self pointersTo: anObject except: #()

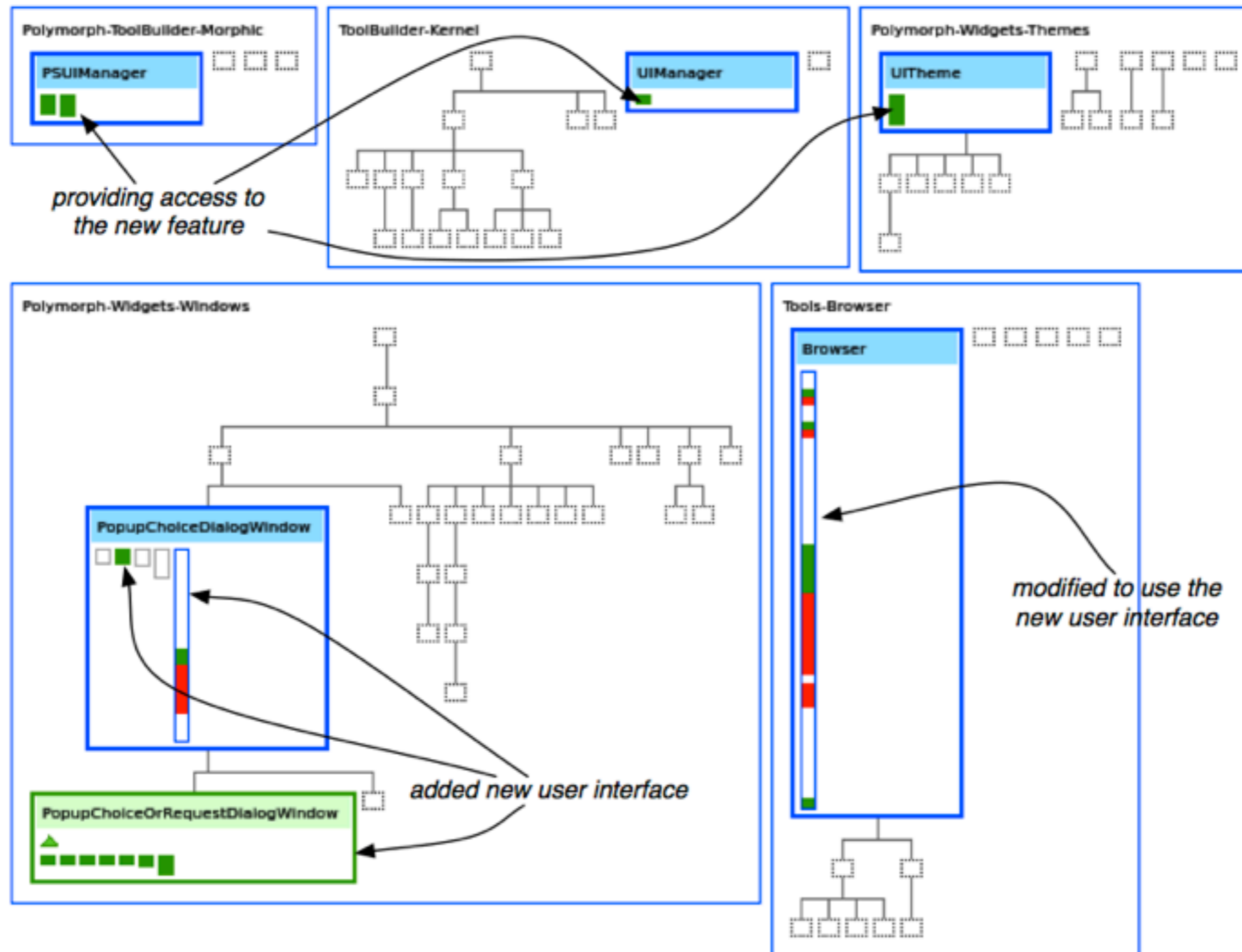
Removing a feature (III)



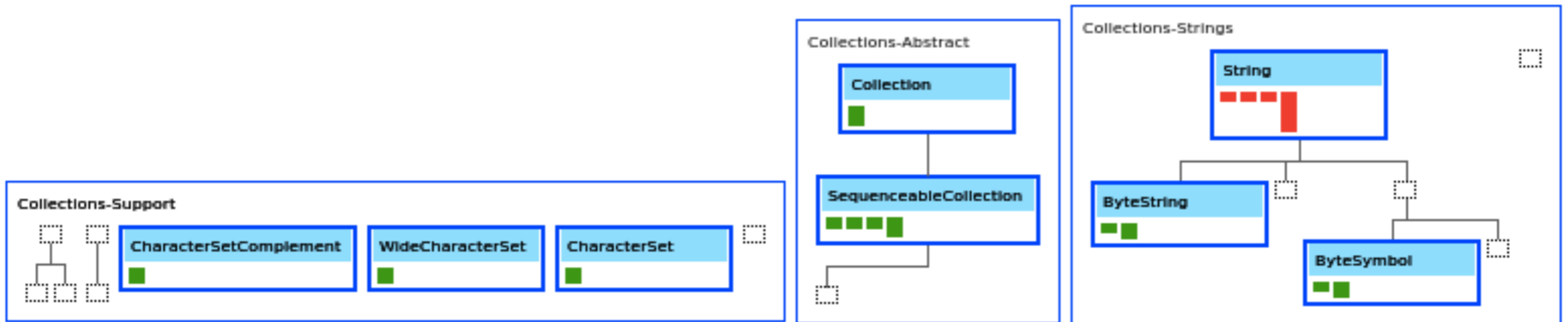
Introducing a feature



Introducing a feature

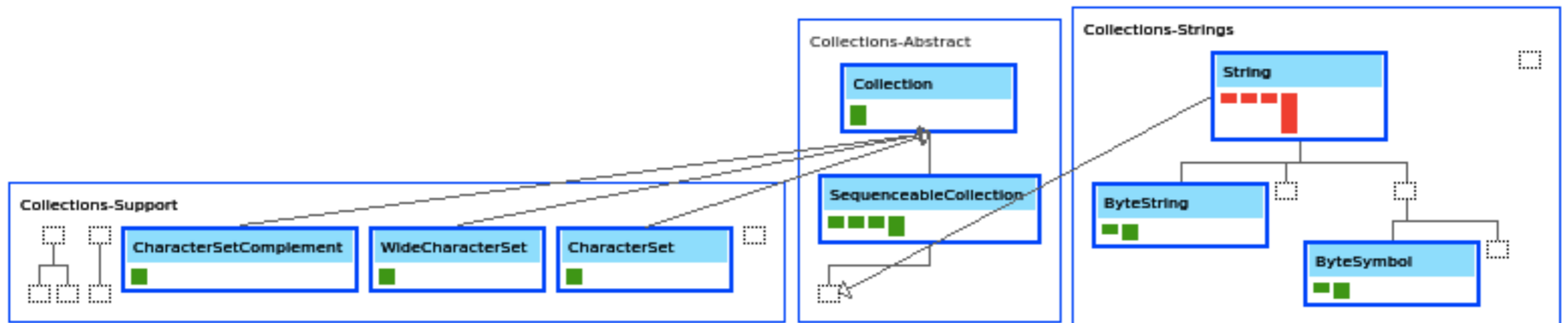


Changing Hierarchies



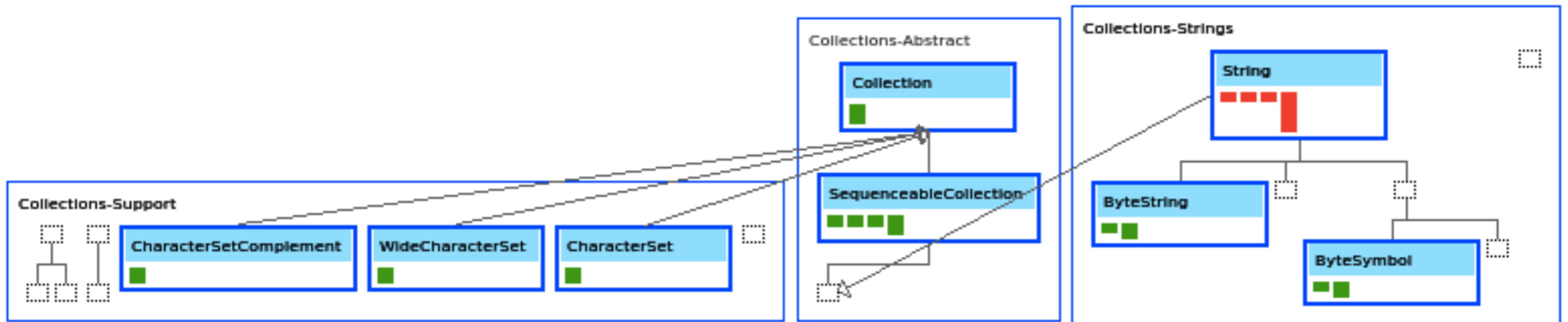
- ▶ Hierarchies may be distributed in different packages
- ▶ Showing inter-package relationship is needed
- ▶ Still... We can show it better!!!

Changing Hierarchies



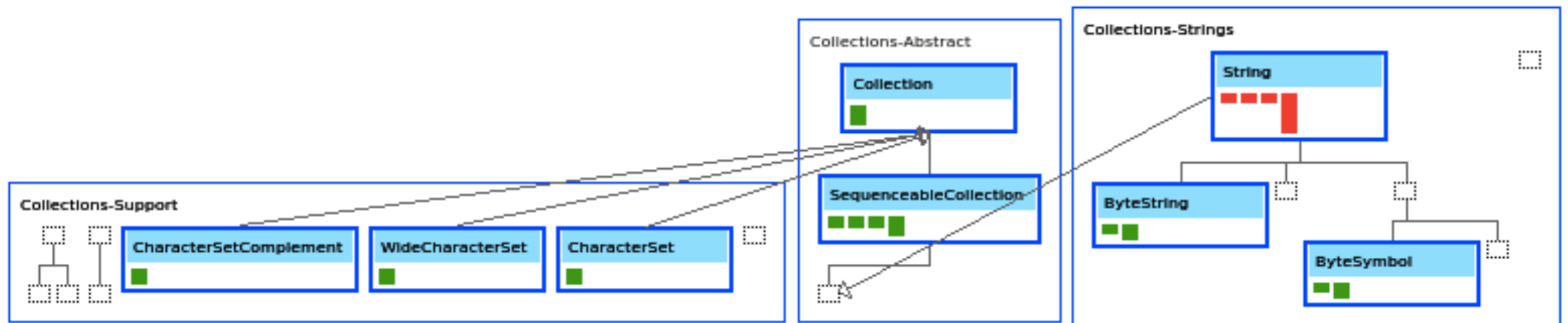
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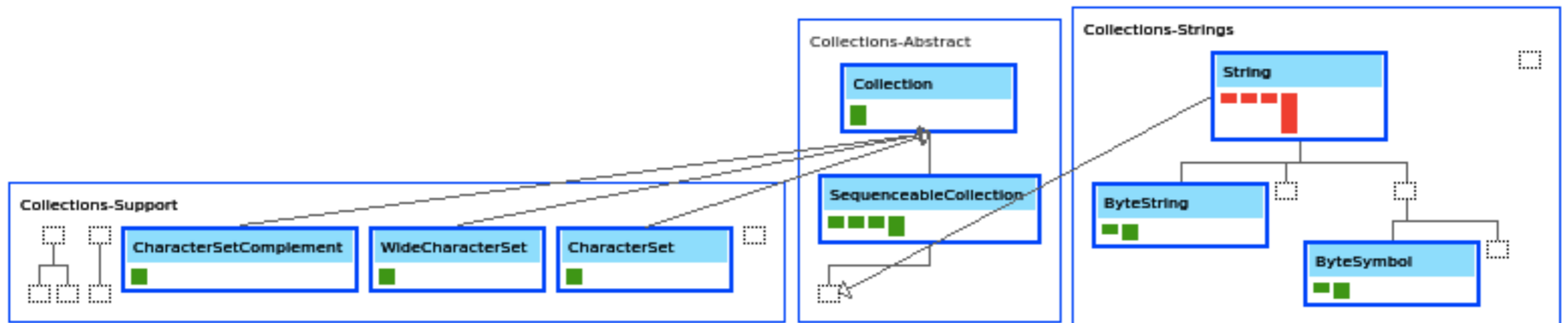
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Changing Hierarchies



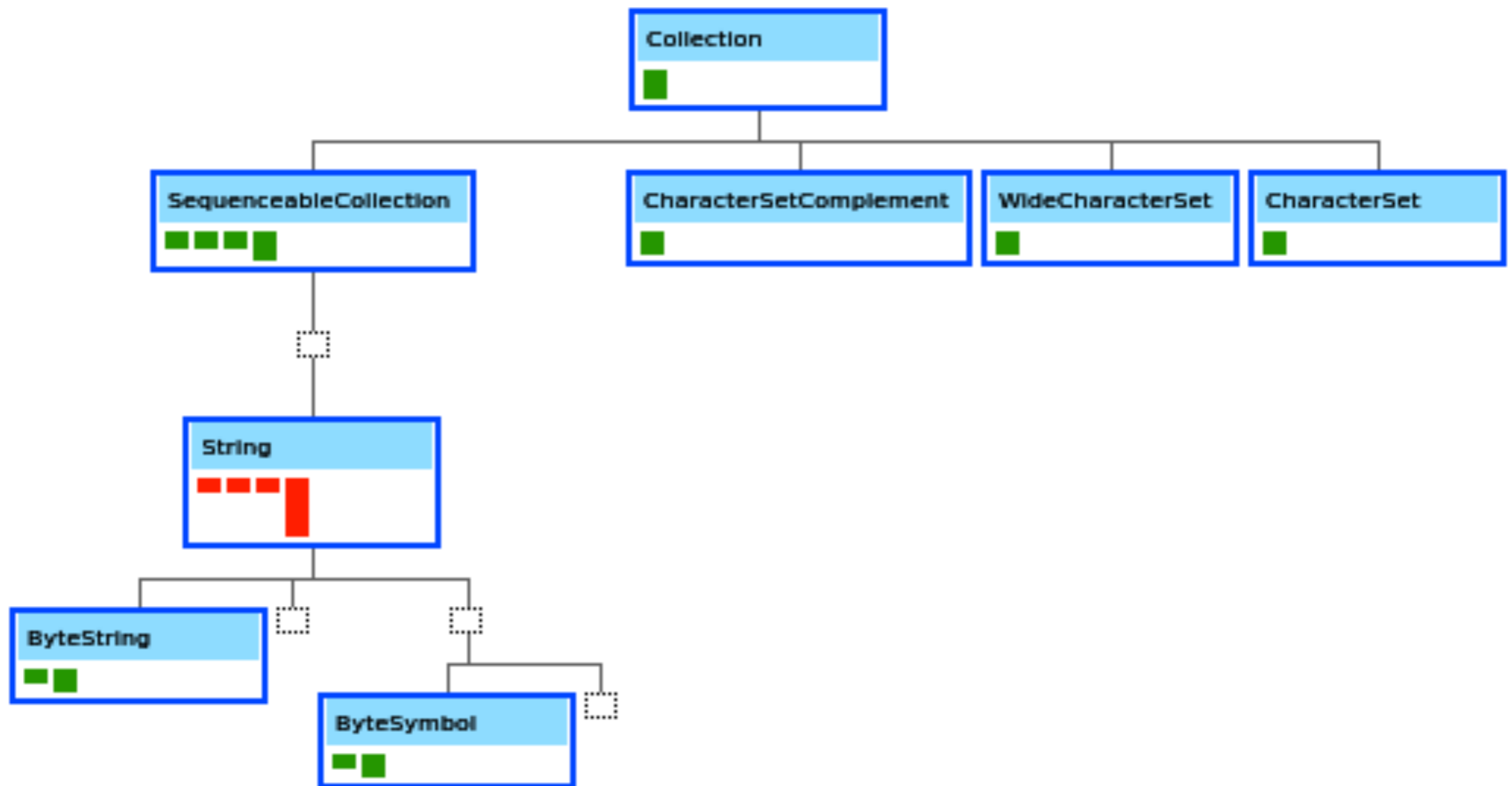
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Changing Hierarchies



- ▶ Hierarchies may be distributed in different packages
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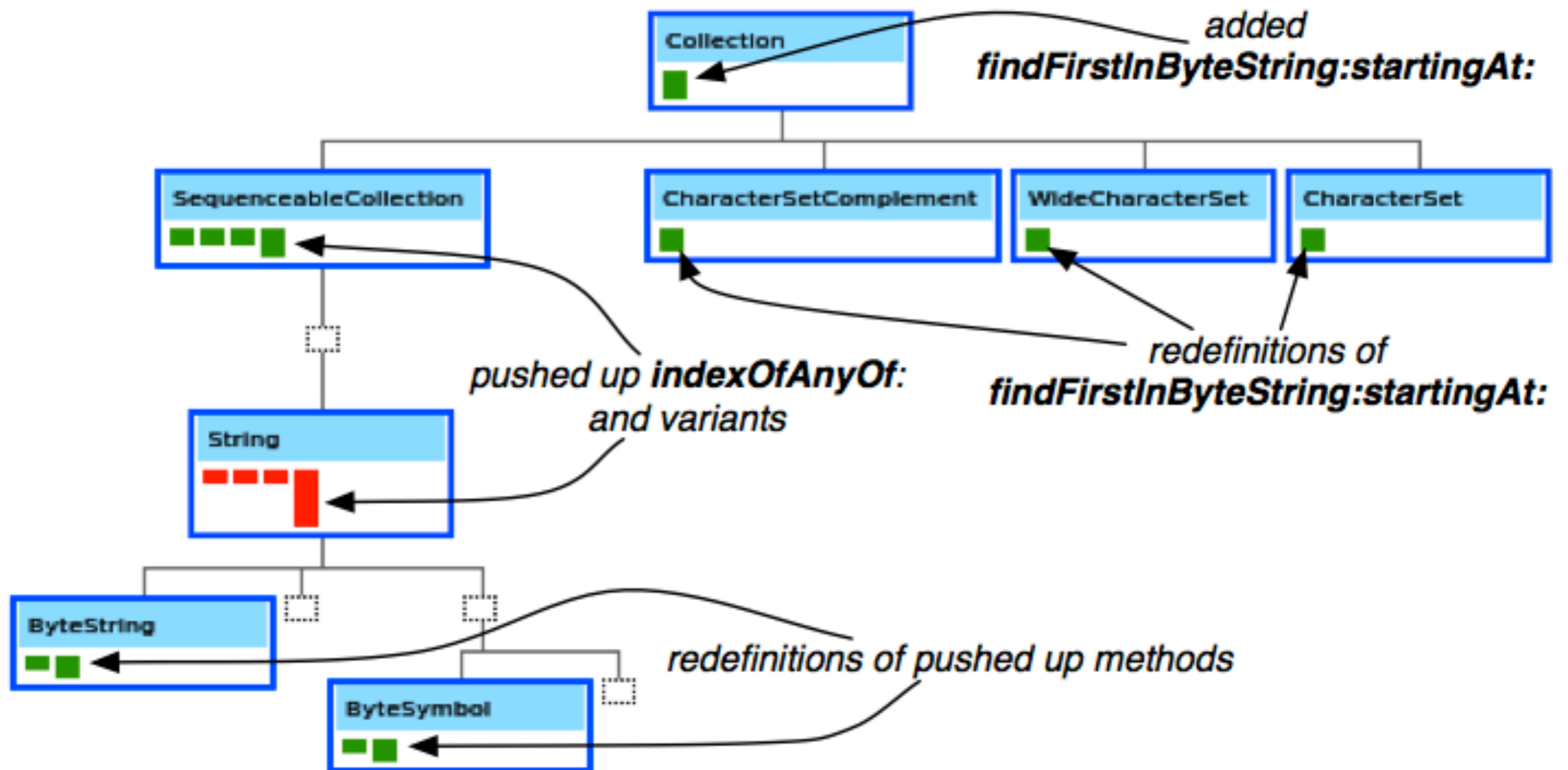
Changing Hierarchies







Changing Hierarchies

Changing Hierarchies





Changing Hierarchies



- ▶ Packages (138)  41
- ▶ Classes (1031)  64
- ▶ Methods (23434)  2  54
- ▶ Variables (2886)

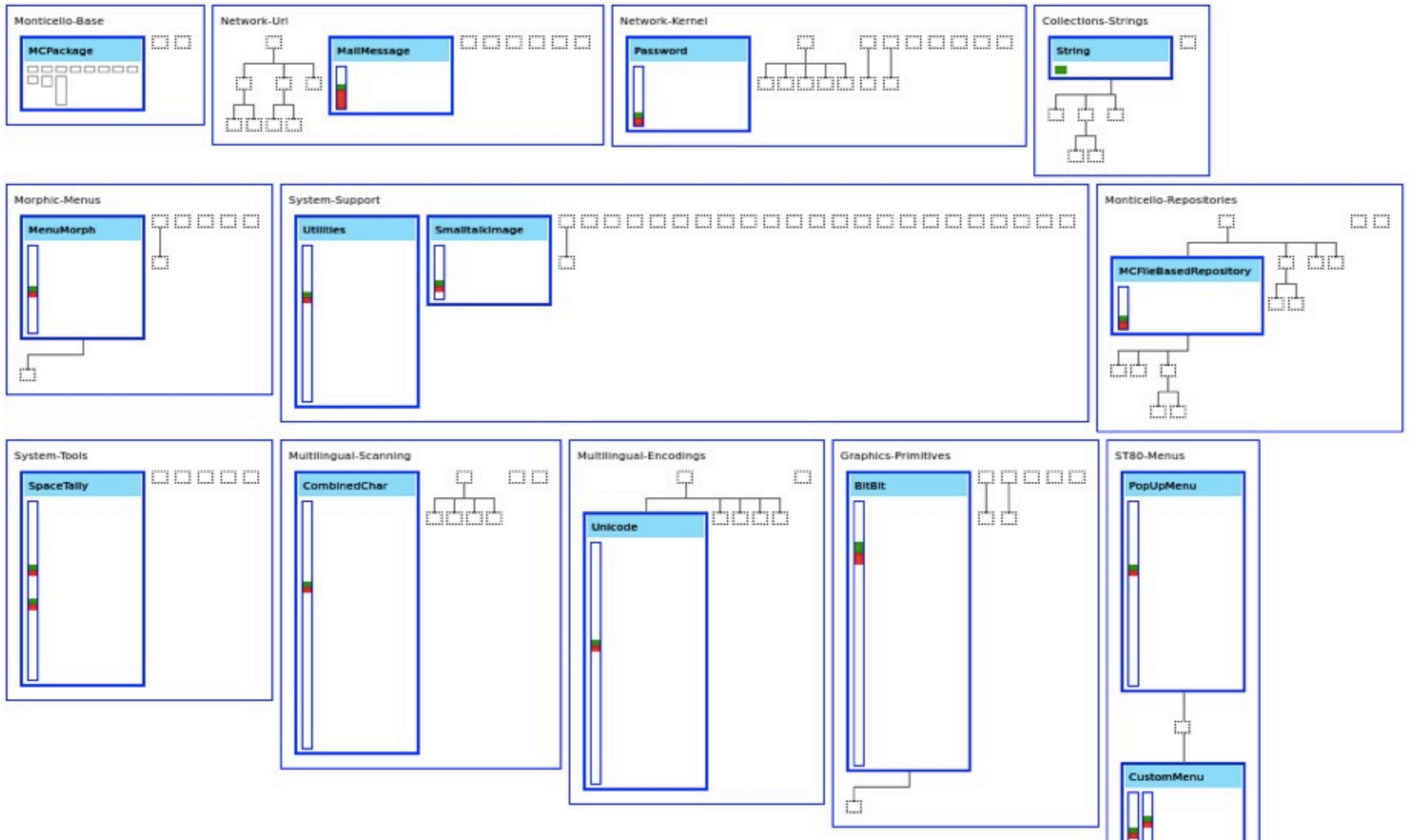


Editing comments

- ▶ Packages (138)  41
- ▶ Classes (1031)  64
- ▶ Methods (23434)  2  54
- ▶ Variables (2886)



Can you see a change pattern?

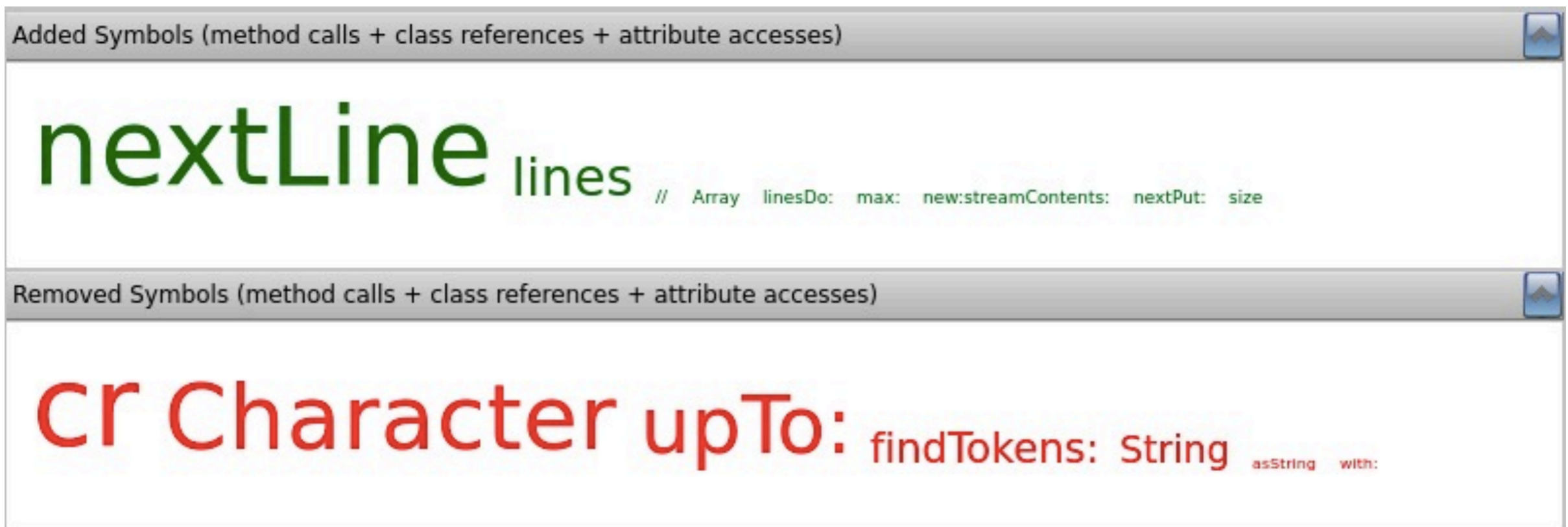


Symbolic Clouds

- ▶ Provide
 - ✓ Vocabulary involved in changes
 - ✓ Hints towards the developers' intentions*
- ▶ Methods' source code → vocabulary
- ▶ Three symbolic clouds

Replacing method calls

- ▶ Packages (56)  13
- ▶ Classes (531)  16
- ▶ Methods (12265)  1  27
- ▶ Variables (1907)



Added Symbols (method calls + class references + attribute accesses)

nextLine lines // Array linesDo: max: new:streamContents: nextPut: size

Removed Symbols (method calls + class references + attribute accesses)

Cr Character upTo: findTokens: String asString with:

Symbolic Clouds (II)

Symbolic Clouds (II)

Mixed Symbols (added + removed)

Parameters **at:ifAbsent:** **at:ifAbsentPut:**
at:put: false method methodChanges queueDict references soleInstance superclasses true

Symbolic Clouds (II)

Mixed Symbols (added + removed)

Parameters **at:ifAbsent:** **at:ifAbsentPut:**
at:put: false method methodChanges queueDict references soleInstance superclasses true

Added Symbols (method calls + class references + attribute accesses)

isNil assert: nil - anyOne at: keyAtIdentityValue:ifAbsent: keyAtValue:ifAbsent: nonEmpty valueNotIn values

Removed Symbols (method calls + class references + attribute accesses)

= nil destX + **indexOf** line true characterPoint lastCharacter @ destY ifTrue: text textStyle x justified alignment at: characterIndex lastCharacterExtent leftMargin spaceCount - and: font ifFalse: ifTrue:ifFalse: justifiedTabDeltaFor: last lastCharacterExtentSetX: leadingTab max: nextTabXFrom:leftMargin:rightMargin: not pendingKernX rightMargin tabWidth // <= == > >= Space false ifNil: justifiedPadFor:font: kern lineHeight

Summary

- ▶ Torch v1 - <http://soft.vub.ac.be/torch>
 - ✓ change characterization
 - ✓ change overview
 - ✓ omnipresent contextual diff

Summary

▶ Torch v1 - <http://soft.vub.ac.be/torch>

✓ change characteri

understanding changes

present contextual diff

Torch Dashboard: Changes from SLICE-Issue1709-EnhancedTextDiffBuilder (ancestor) to SLICE-Issue1709-EnhancedTextDiffBuild

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Colors Borders

Added	Removed	Modified	Comment
			Comment
		N/A	Variable
			Method source
N/A	N/A		Class' package

Viz. Class Status: All changed

Viz. Width: 900

Viz. Relationships: intra- packages

Classes / Methods

- PrettyTextDiffBuilder
- TextDiffBuilder
 - attributesOf: i
 - buildDisplayPatch i
 - buildDisplayPatchFrom:to: i
 - buildDisplayPatchFrom:to:inC i
 - buildDisplayPatchFrom:to:inC i
 - buildPatchSequence i
 - buildReferenceMap i
 - collectRunFrom:startingWith: i
 - destString: i
 - detectShiftedRuns i
 - findMatches i
 - formatLine: i
 - from:to: i

Changed Packages (details)

- Tests-System: TextDiffBuilderTest
- Settings-Tools: DifferatorSystemSettings
- System-FilePackage:
 - TextDiffBuilder
 - TwoLevelSet
 - DiffElement
 - TwoLevelDictionary
 - ClassDiffBuilder
 - CodeDiffBuilder
 - PrettyTextDiffBuilder

class method Protocol: instance creation Author: HenrikSperreJohansen

```

buildDisplayPatchFrom: sourceText to: destinationText
^(self from: sourceText to: destinationText) buildDisplayPatch
buildDisplayPatchFrom: srcString to: dstString
^(self from: srcString to: dstString) buildDisplayPatch
  
```

Source Code Diff

```

buildDisplayPatch
^Text streamContents:[ :stream]
self printPatchSequence: self buildPatchSequence on: stream
]
  
```

```

buildDisplayPatch
^Text streamContents: [ :stream |
self
patchSequenceDolfMatch: [ :string |
self print: string withAttributes: NormalTextAttributes
ifinsert: [ :string |
self print: string withAttributes: InsertTextAttributes
ifRemove: [ :string |
self print: string withAttributes: RemoveTextAttributes
  
```