



Visually Supporting Source Code Changes Integration: the Torch Dashboard

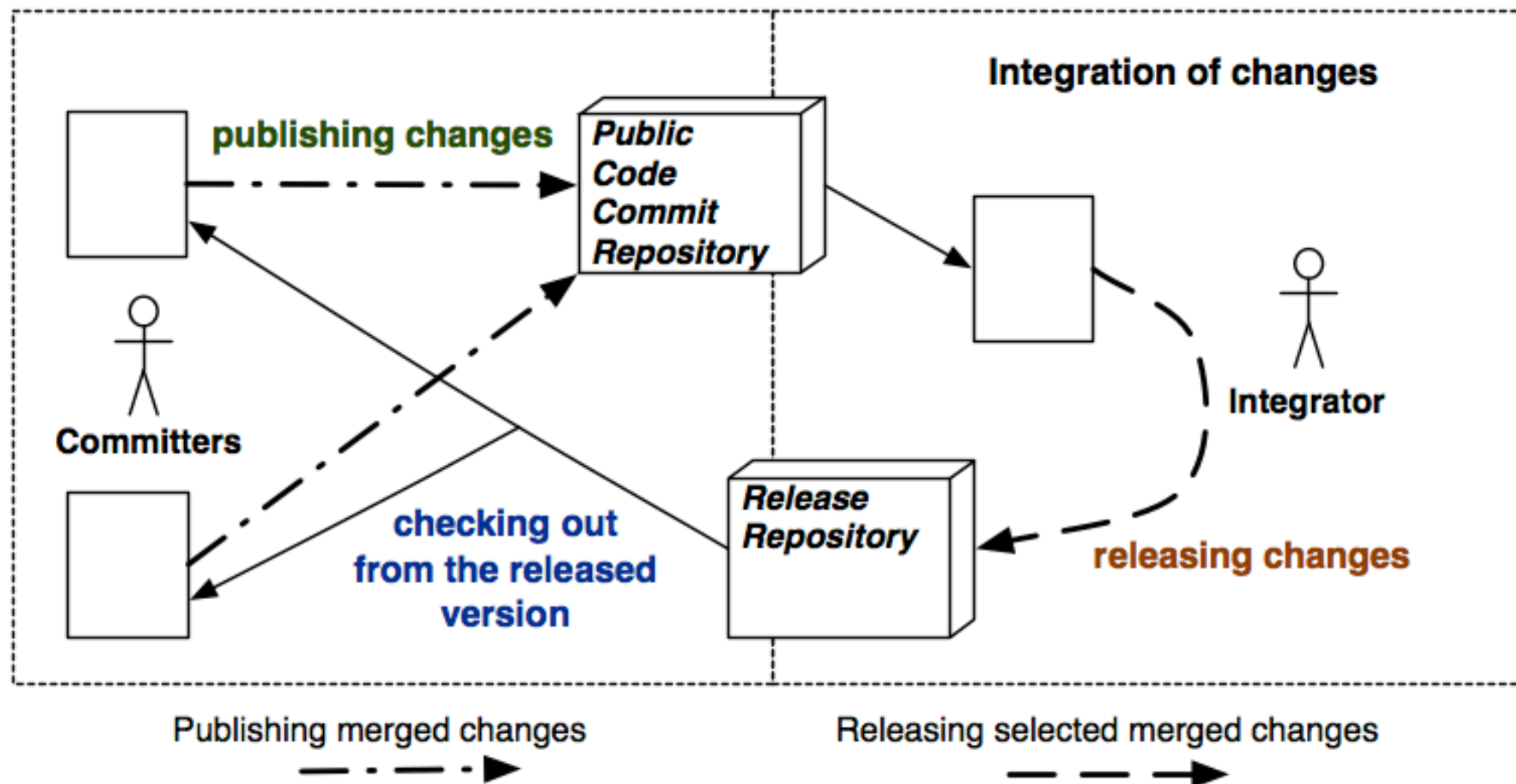
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Stéphane Ducasse
Theo D'Hondt



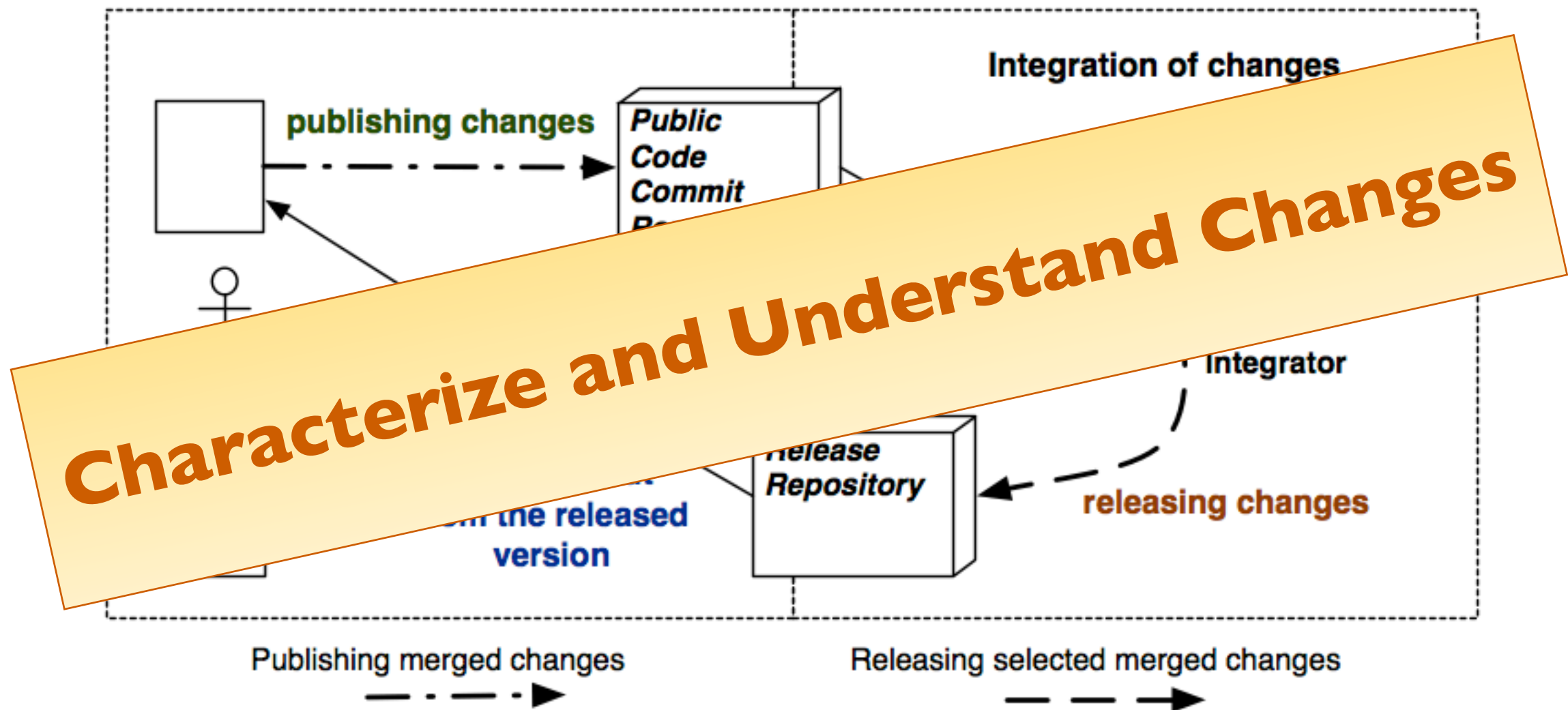
WCRE 2010

17th Working Conference on Reverse Engineering
October 13-16, 2010 - Beverly, USA

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
- ▶ Limited support for integrators



We aim at supporting...

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



The Torch Dashboard

- ▶ Visualization tool
 - ✓ provides an overview of changes
 - ✓ characterizes changes (size, structure, kind of actions, scope, vocabulary)
- ▶ Written in Smalltalk - Pharo
- ▶ Integrated with Monticello I

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

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 Source Code Protocol/Author

buildDisplayPatch

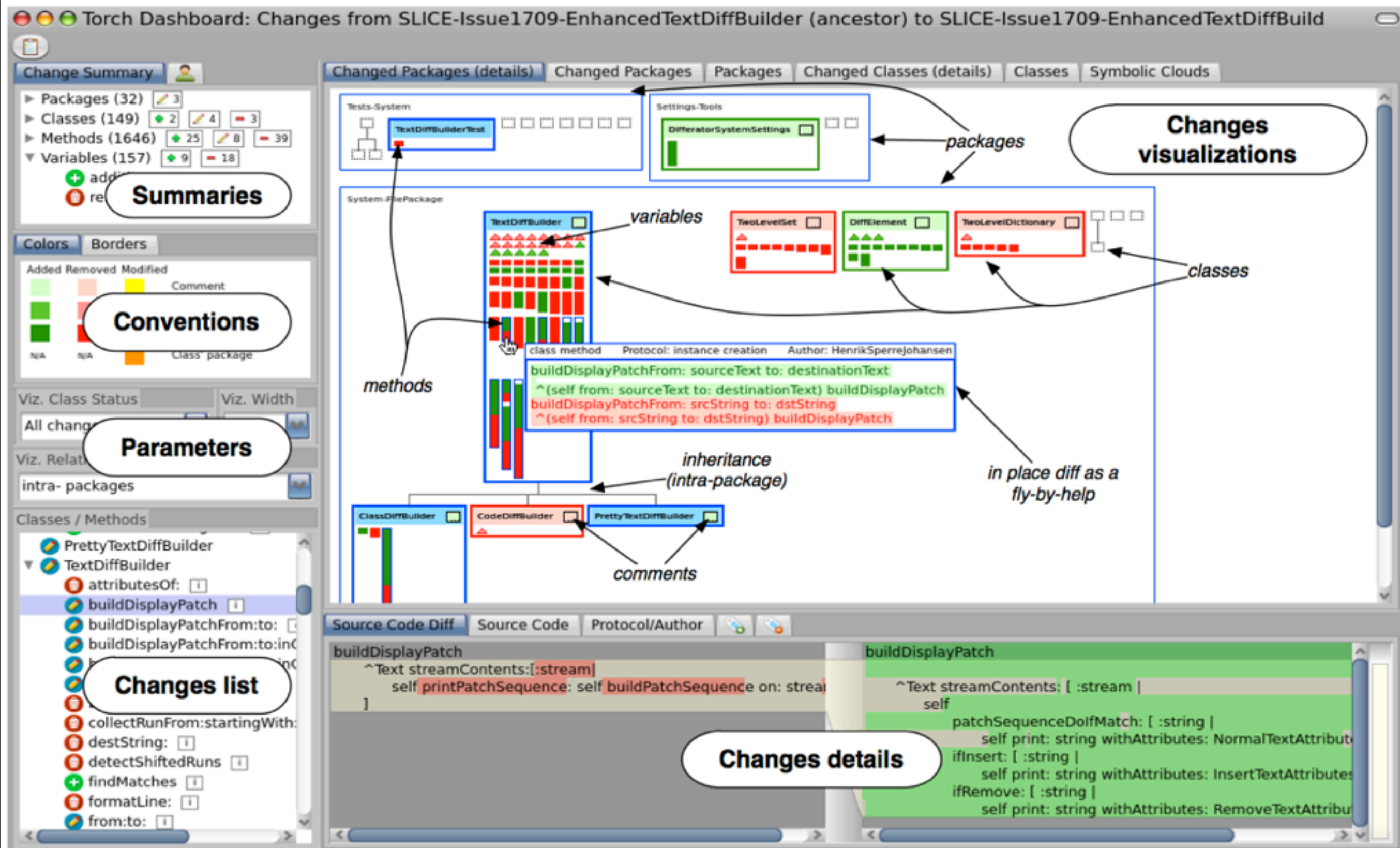
```

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

buildDisplayPatch

```

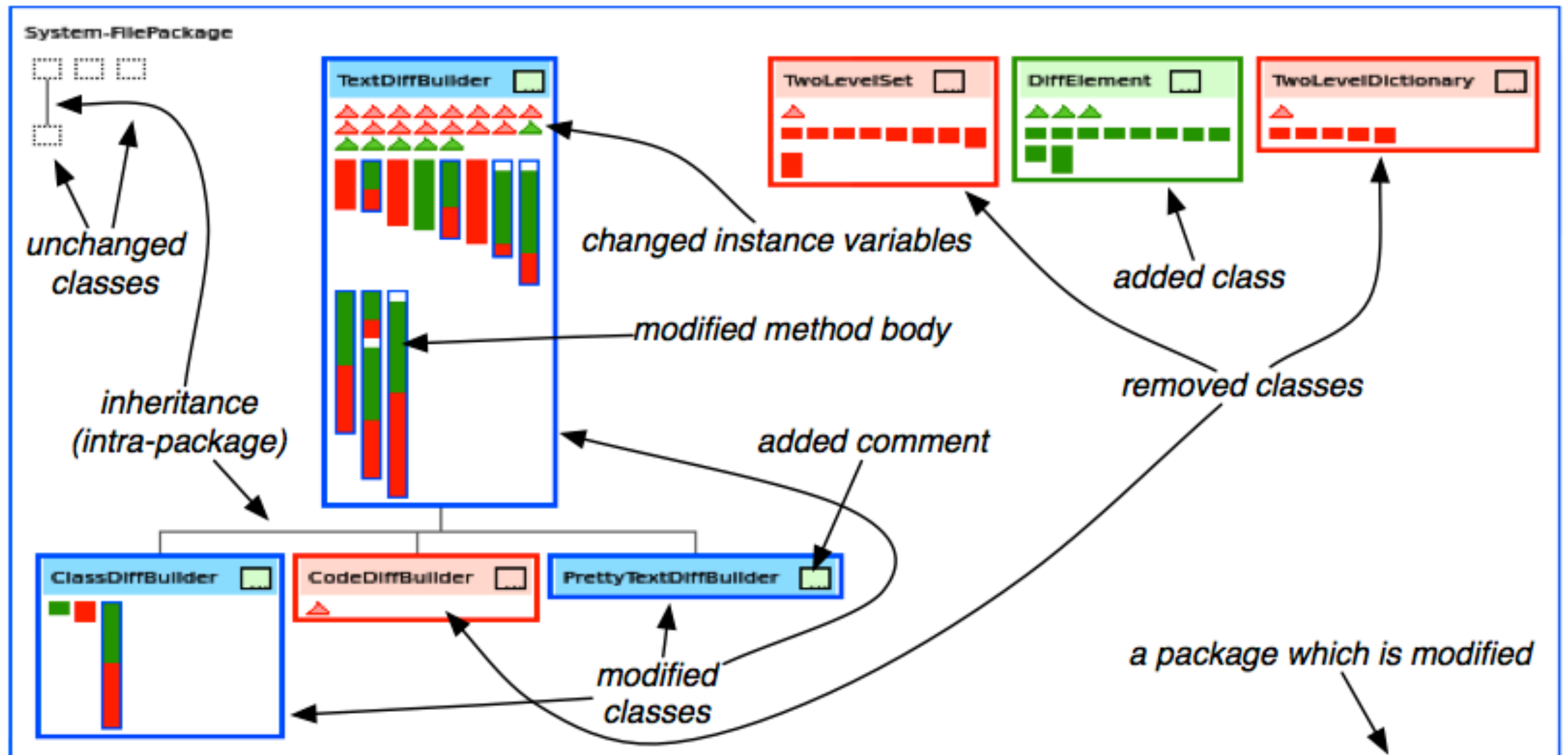
^Text streamContents: [ :stream |
  self
    patchSequenceDofMatch: [ :string |
      self print: string withAttributes: NormalTextAttributes
    ]
    ifinsert: [ :string |
      self print: string withAttributes: InsertTextAttributes
    ]
    ifremove: [ :string |
      self print: string withAttributes: RemoveTextAttributes
    ]
  ]
  
```



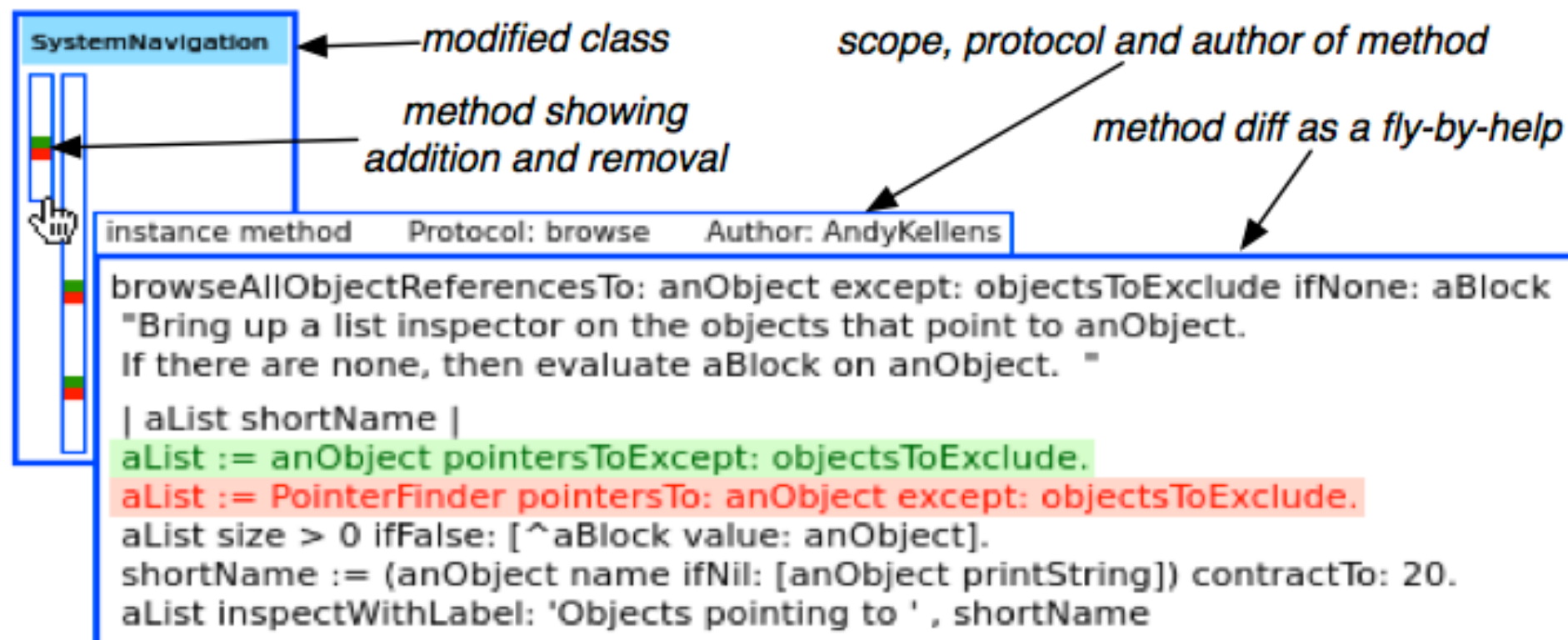
Component: Change visualizations

- ▶ Package-centric
- ▶ Class-centric
- ▶ Symbolic clouds

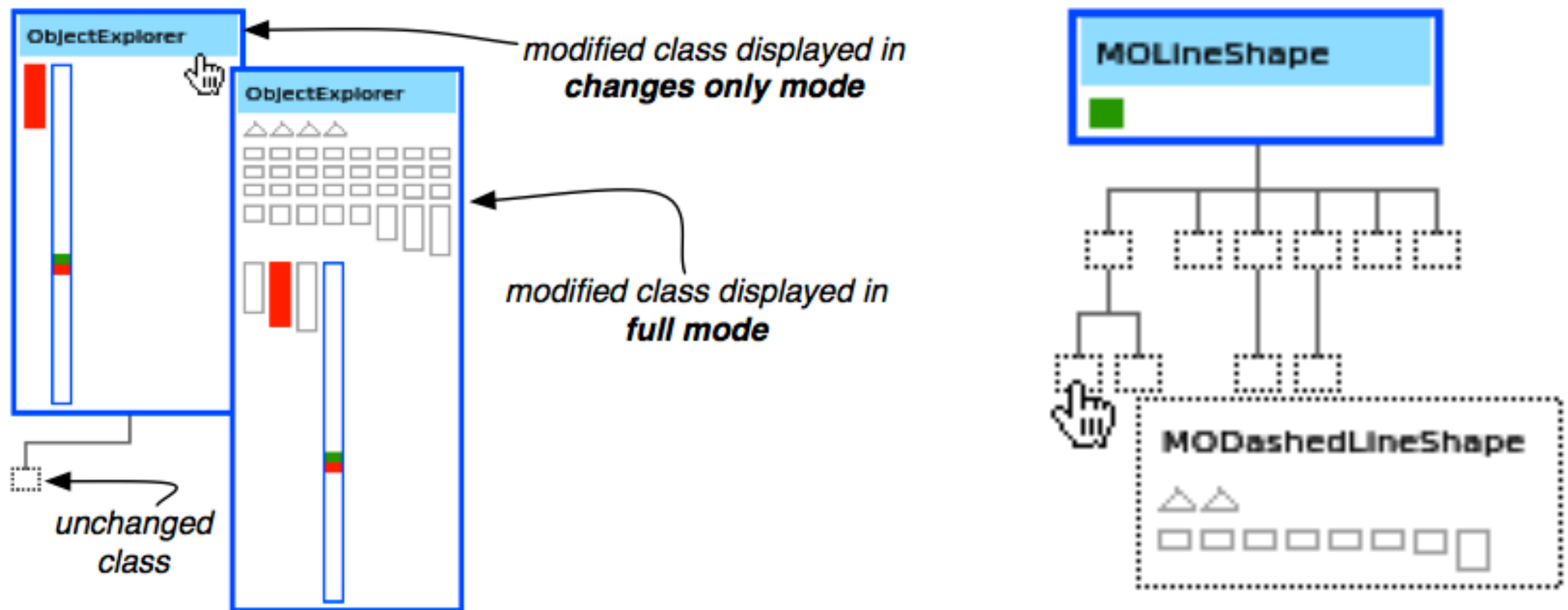
Package Structure



Omnipresent source code

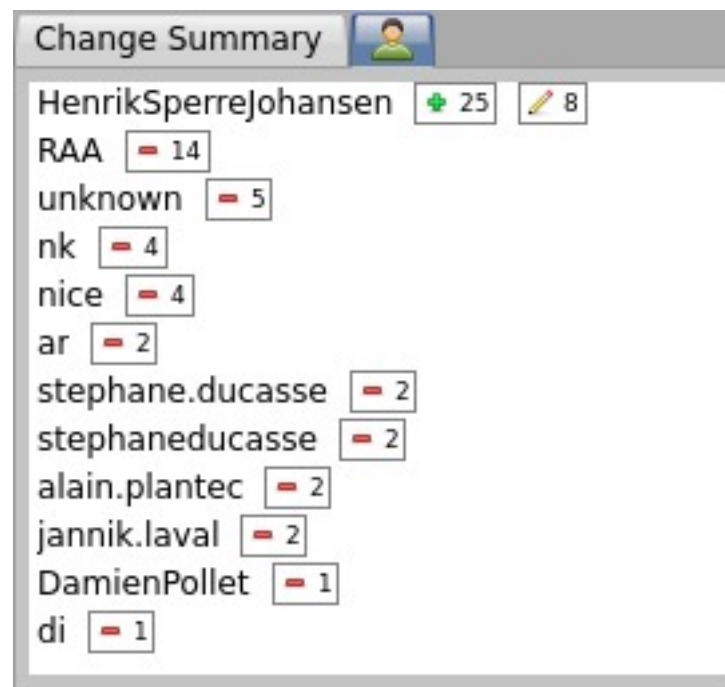
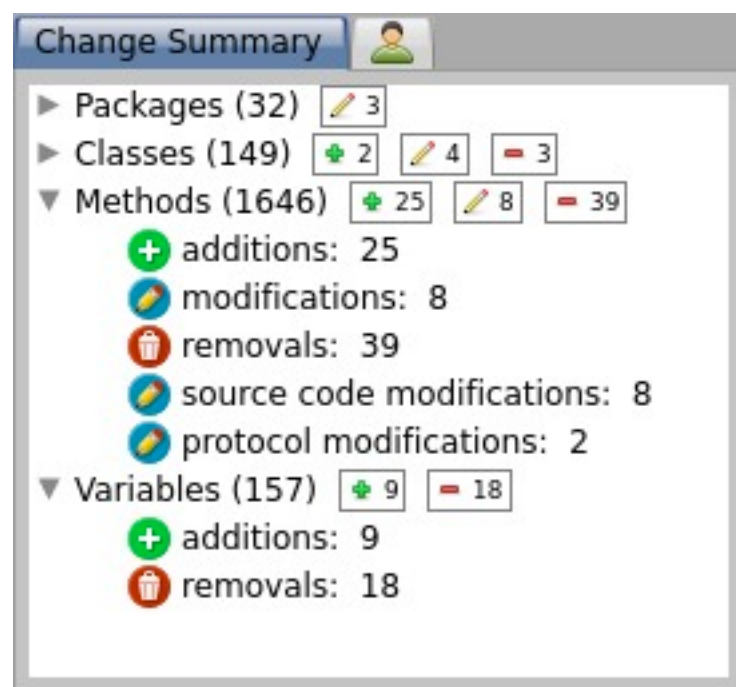


Omnipresent class structure



Component: Summaries

- ▶ Metrics with overview of changes
 - ✓ Entities x Kind of actions
 - ✓ Users x Kind of actions
- ▶ Allow to list changes per metric



Change list / Change details

The image shows a screenshot of an IDE interface. On the left, a 'Classes / Methods' sidebar displays a tree view of classes and methods. The 'ClassDiffBuilder' class is expanded, showing methods like `print:withAttributes:on:`, `printPatchSequence:on:`, and `split:`. Below it, other classes like `CodeDiffBuilder`, `DiffElement`, `DifferatorSystemSettings`, `PrettyTextDiffBuilder`, `TextDiffBuilder`, `TextDiffBuilderTest`, `TwoLevelDictionary`, and `TwoLevelSet` are listed. On the right, a 'Source Code Diff' window is open, showing a comparison between two versions of the `buildDisplayPatchFrom:` method. The left pane shows the original code with `srcString` and `dstString` parameters. The right pane shows the modified code with `sourceText` and `destinationText` parameters. The changes are highlighted in green in the right pane.

Classes / Methods

- ClassDiffBuilder
 - + print:withAttributes:on: ⓘ
 - printPatchSequence:on: ⓘ
 - split: ⓘ
- CodeDiffBuilder
- DiffElement
- + DifferatorSystemSettings
 - + differatorSettingsOn: ⓘ
- PrettyTextDiffBuilder
- TextDiffBuilder
- TextDiffBuilderTest
- TwoLevelDictionary
 - at: ⓘ
 - at:put: ⓘ
 - initialize ⓘ
 - keysDo: ⓘ
 - twoLevelKeys ⓘ
- TwoLevelSet

Source Code Diff | Source Code | Protocol/Author

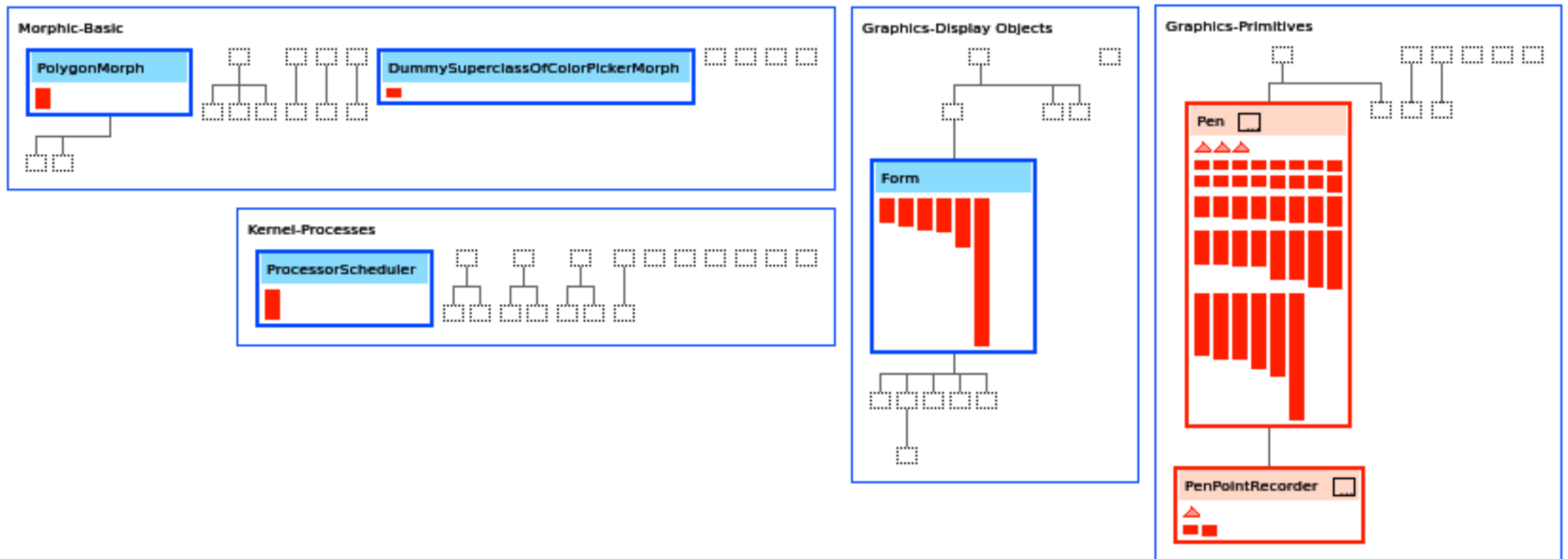
buildDisplayPatchFrom: srcString to: dstString
^(self from: srcString to: dstString) buildDisplayPatch

buildDisplayPatchFrom: sourceText to: destinationText
^(self from: sourceText to: destinationText) buildDisplayPatch

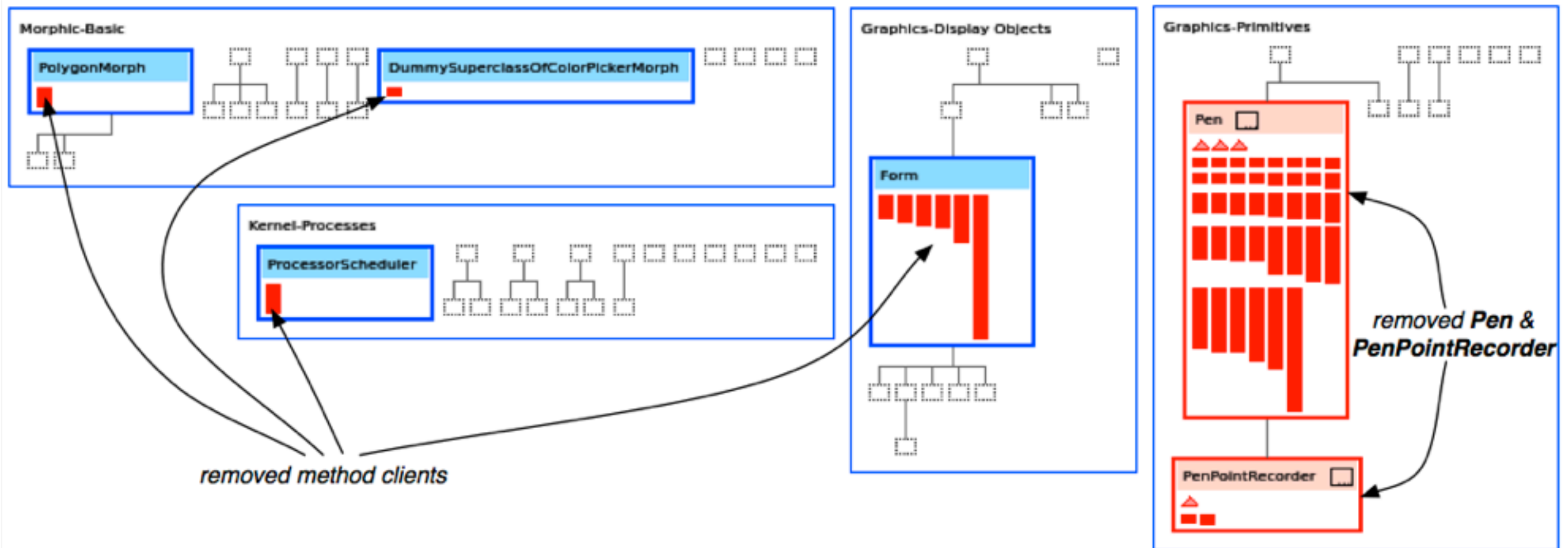
Detecting Change Patterns

- ▶ Removing a feature
- ▶ Pushing up/Introducing methods in a class hierarchy
- ▶ Editing comments
- ▶ Replacing method calls

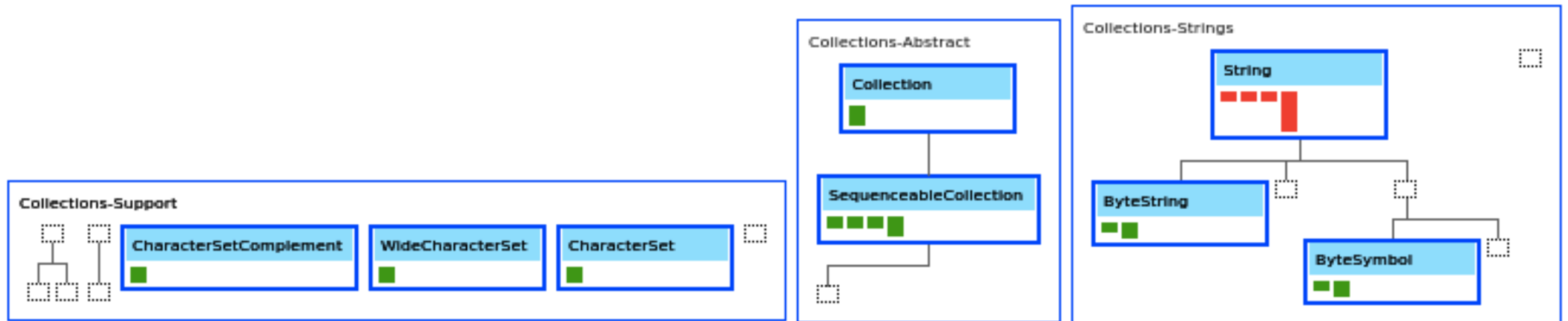
Removing a feature (I)



Removing a feature (II)

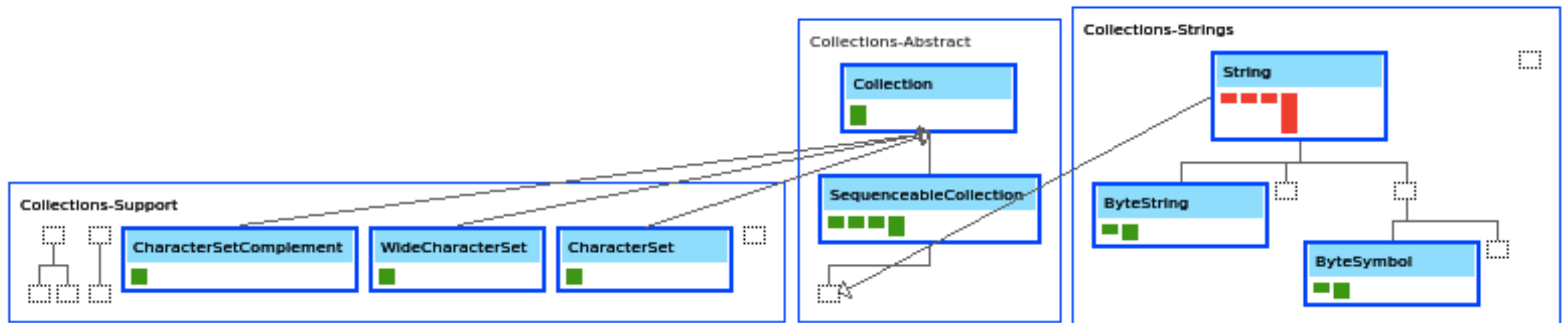


Changing Hierarchies (I)



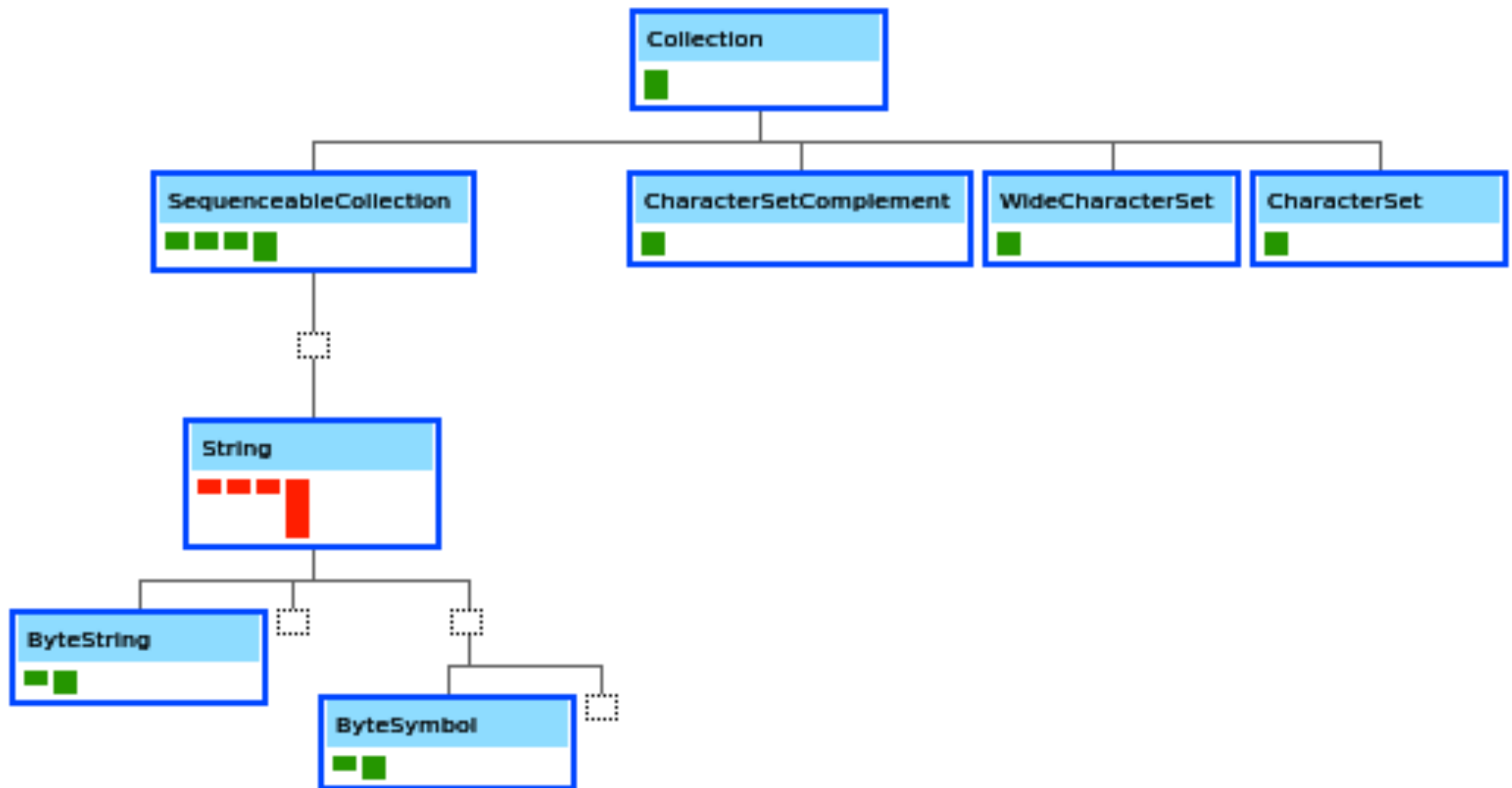
- Hierarchies may be distributed in different packages

Changing Hierarchies (I)

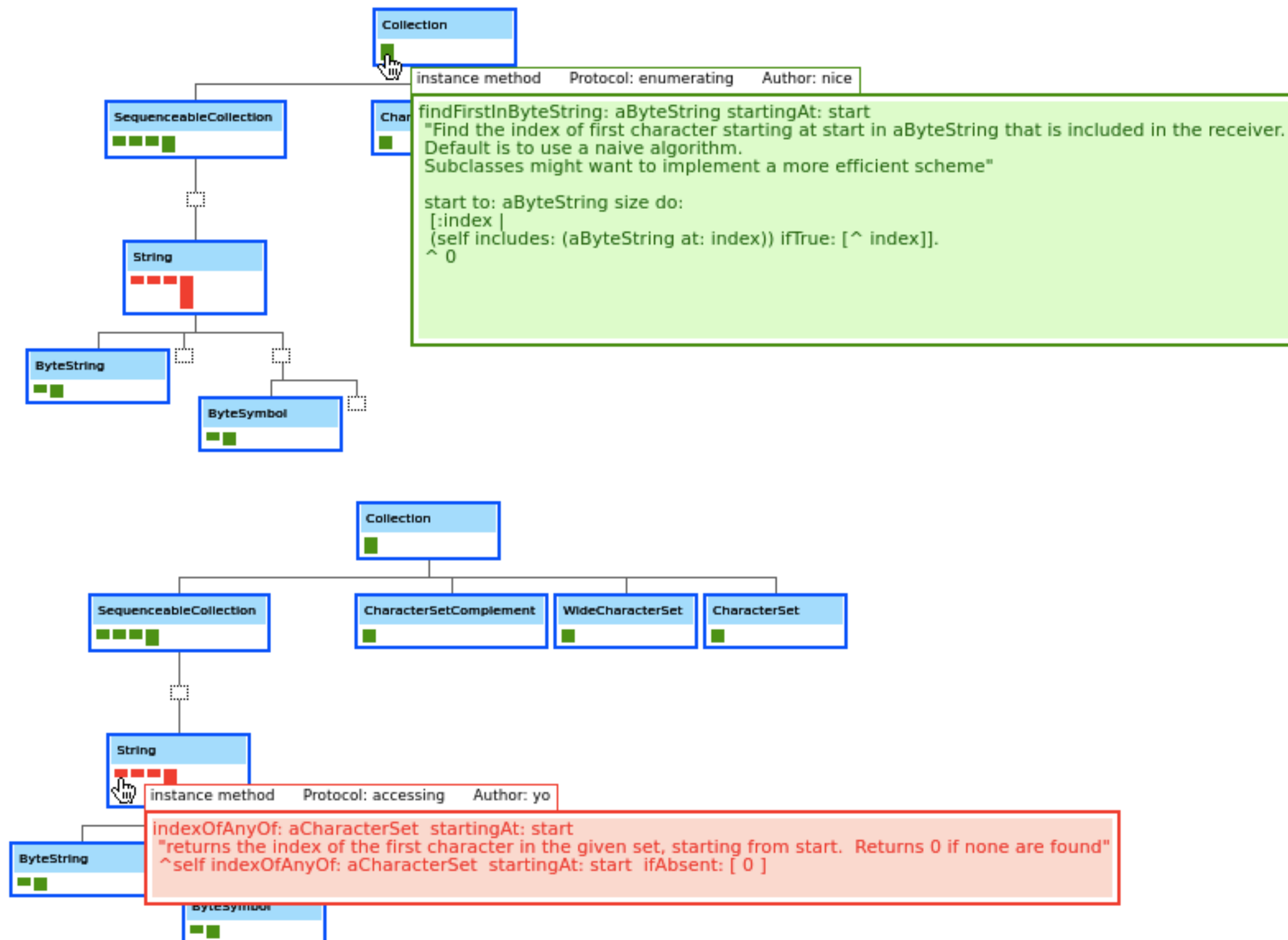


- ▶ Hierarchies may be distributed in different packages
- ▶ Showing inter-package relationship is needed

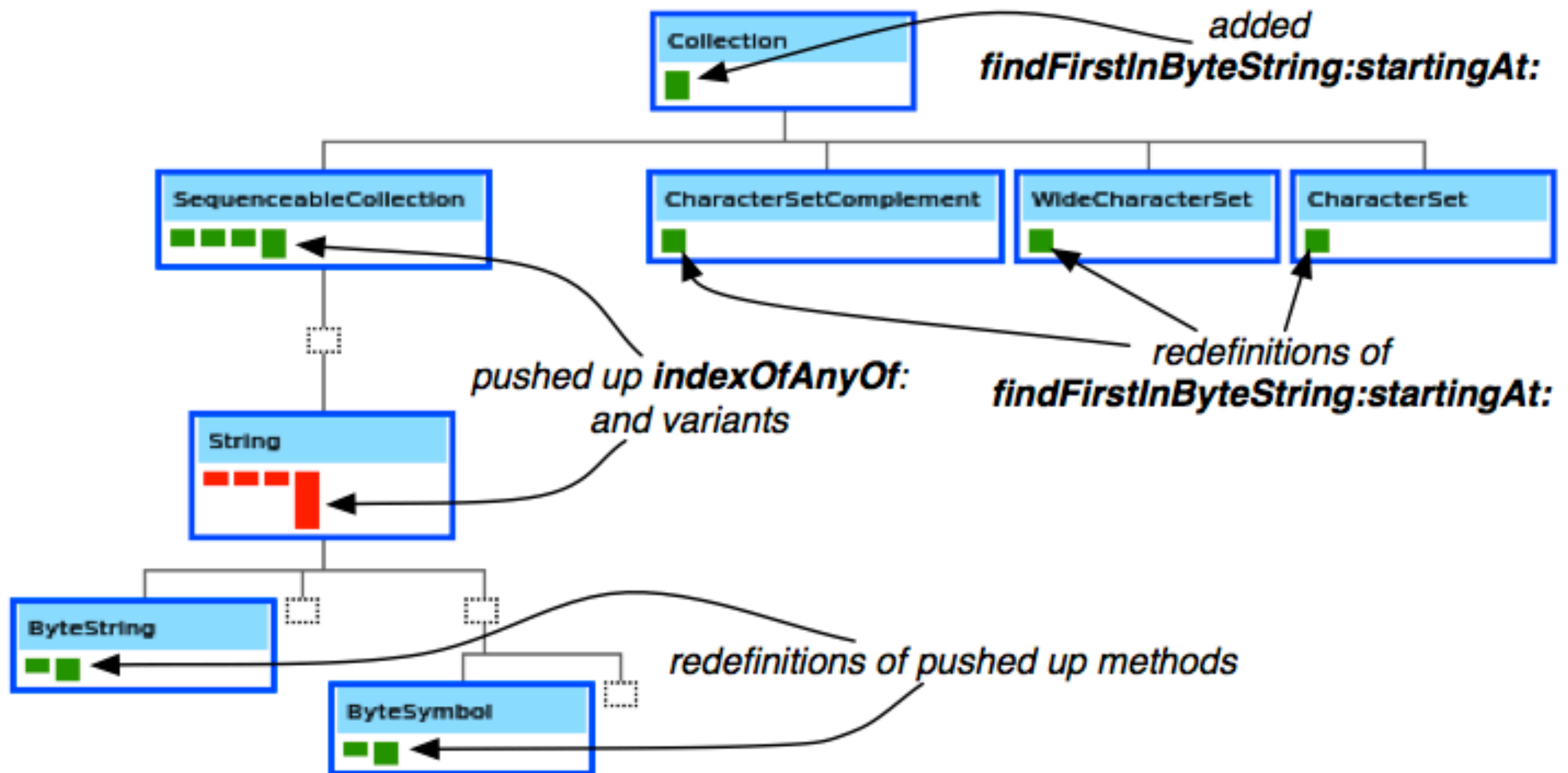
Changing Hierarchies (II)







Changing Hierarchies (III)



Changing Hierarchies (IV)

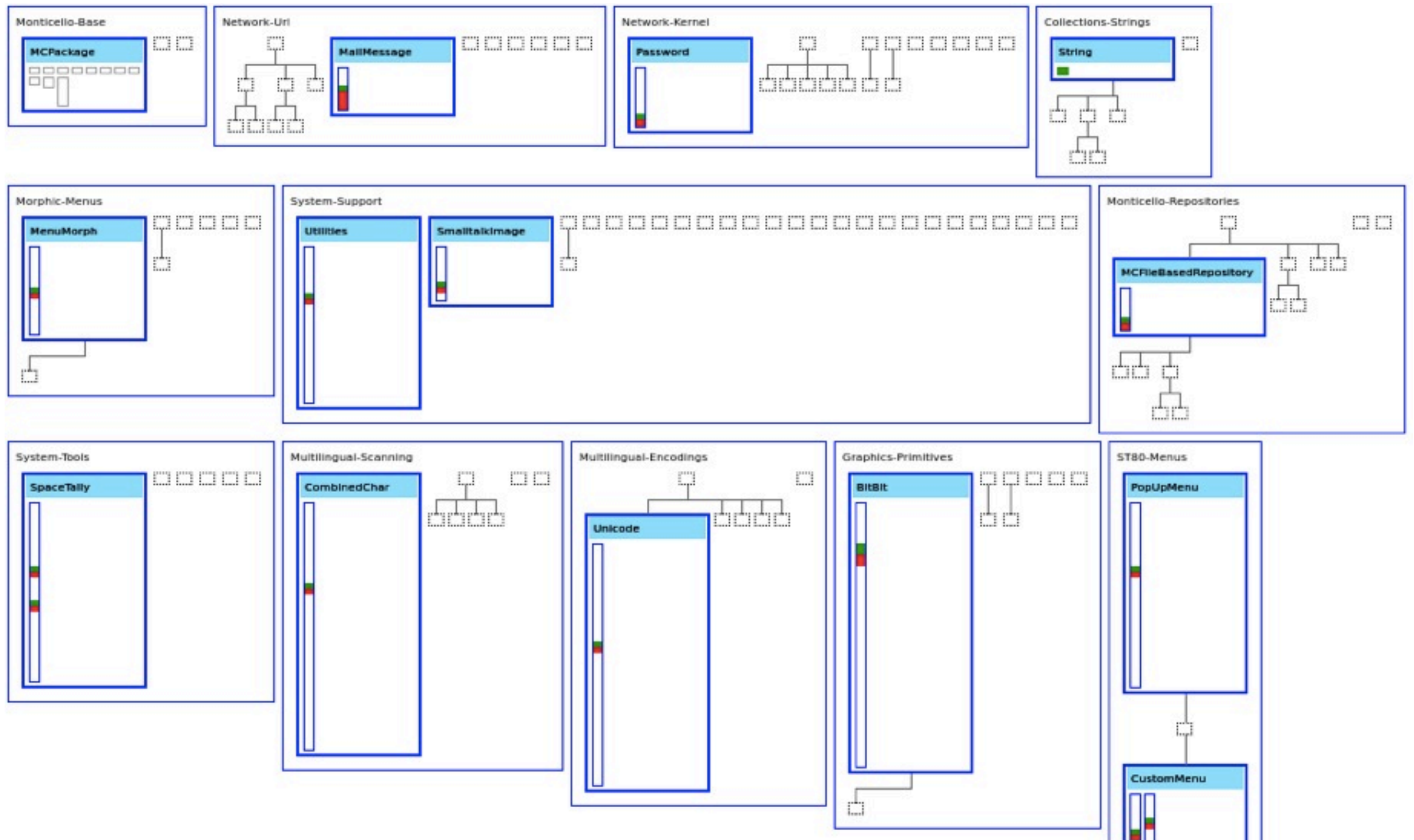


Editing comments

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



Replacing method calls (I)



Replacing method calls (II)

The screenshot shows a Smalltalk IDE window titled "System-Support". On the left, there are two panes: "Utilities" and "SmalltalkImage". The "SmalltalkImage" pane has a vertical toolbar with a button that has a green and red bar. A mouse cursor is clicking this button. To the right of the panes is a large area containing a sequence of small squares, with a line connecting one square to a smaller one below it. Below the panes, a pop-up window displays the following information:

instance method Protocol: vm statistics Author: HenrikSperreJohansen

vmStatisticsShortString
"Convenience item for access to recent statistics only"
"StringHolderView open: (StringHolder new contents: SmalltalkImage current vmStatisticsShortString)
label: 'VM Recent Statistics'"
^ self vmStatisticsReportString readStream
upToAll: 'Since';
nextLine;
upTo: Character cr;
upToEnd

Replacing method calls (III)

- ▶ 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:

Future Work

- ▶ Detect and display other changes
 - ✓ refactorings
 - ✓ co-related changes
 - ✓ semantical changes
 - ▶ Integrate Torch with the merging process
 - ▶ Perform a large experiment
 - ✓ integrators & developers
-

Summary

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

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Changed Packages (details)

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Settings-Tools

- DifferatorSystemSettings

System-FilePackage

- TextDiffBuilder
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 - ^(self from: sourceText to: destinationText) buildDisplayPatch
 - buildDisplayPatchFrom: srcString to: dstString
 - ^(self from: srcString to: dstString) buildDisplayPatch
- TwoLevelSet
- DiffElement
- TwoLevelDictionary

ClassDiffBuilder

- CodeDiffBuilder
- PrettyTextDiffBuilder

Source Code Diff

Source Code

```

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

Protocol/Author

```

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
      ]
  ]
  
```