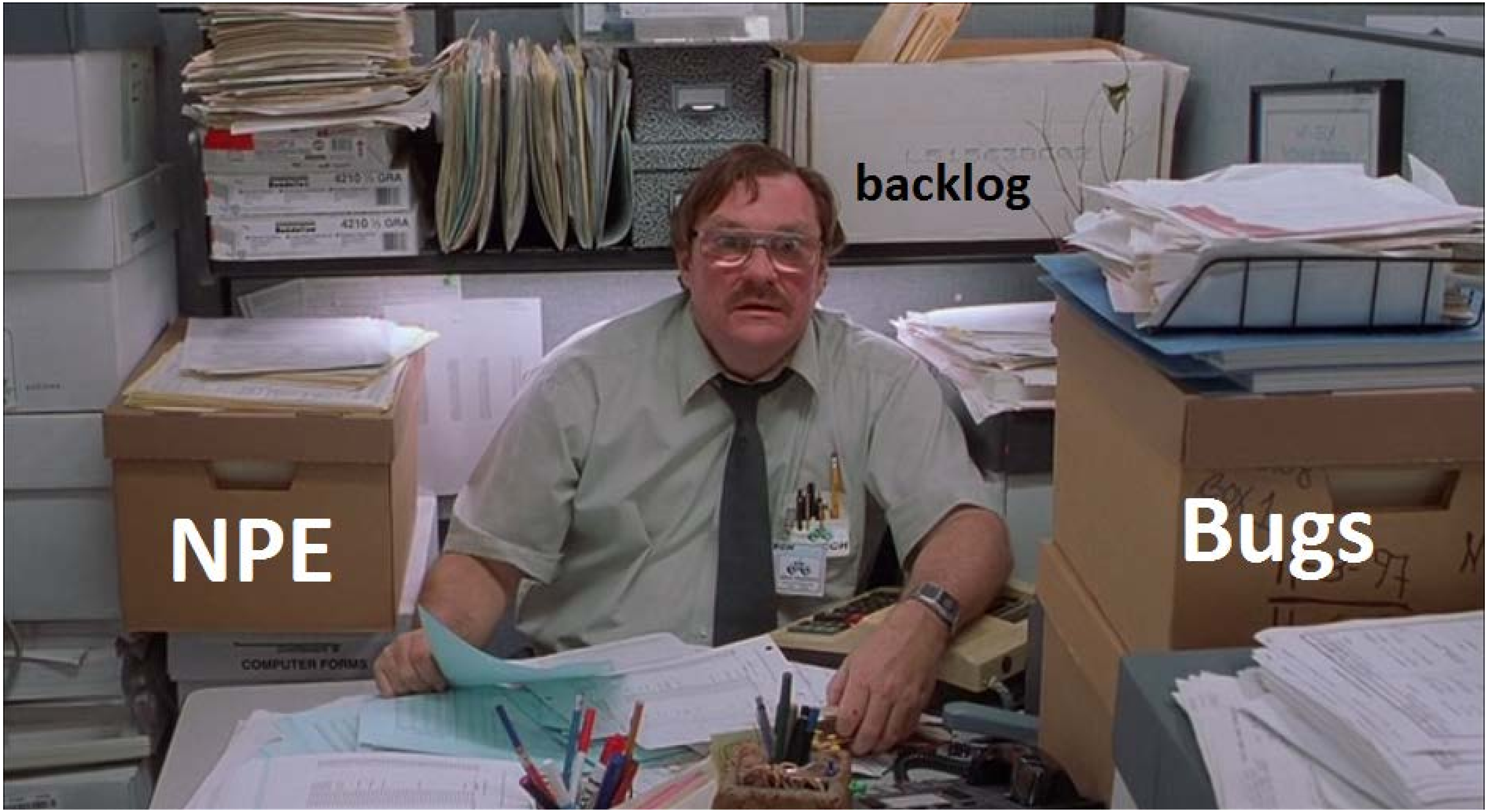
# Computer Science is dead.

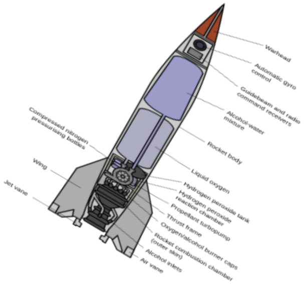


Highlighters update
on text reparse.

VS

Обновление подсветочных
текстовыделителей при
повторном истолковывании
надписей.

# Problem.


Warhead
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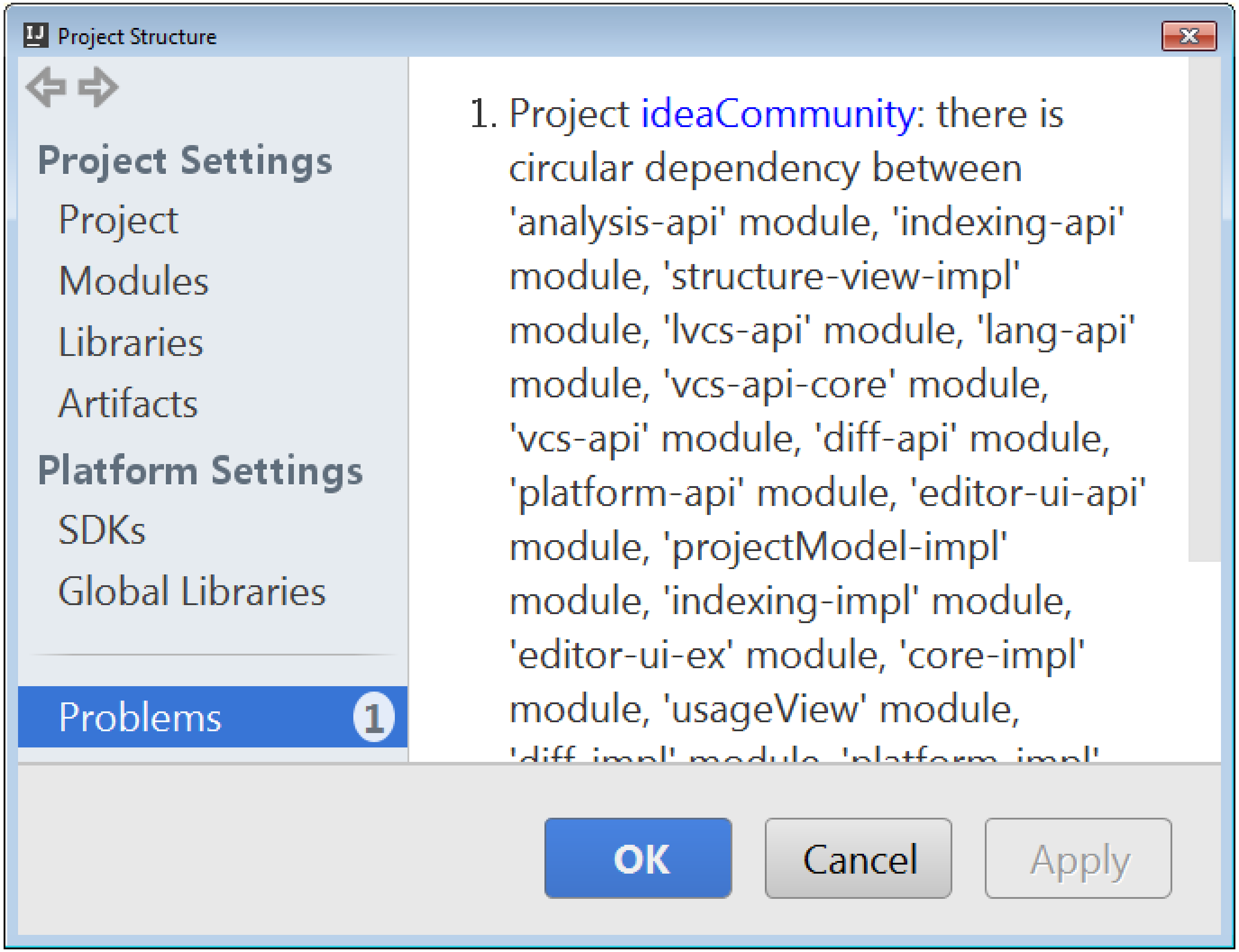
Guidebeam and radio command receivers
Alcohol-water mixture
Rocket body
Liquid oxygen
Hydrogen peroxide tank
Hydrogen peroxide reaction chamber
Propellant turbopump
Thrust frame
Oxygen/alcohol burner caps
Rocket combustion chamber (outer skin)
Alcohol inlets
Air vane
Compressed nitrogen pressurising bottles
Wing
Jet vane

# Computer Science Name.

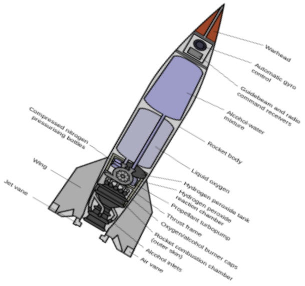
# Algorithm.

# Cyclic dependencies.



1. Project ideaCommunity: there is circular dependency between 'analysis-api' module, 'indexing-api' module, 'structure-view-impl' module, 'lvcs-api' module, 'lang-api' module, 'vcs-api-core' module, 'vcs-api' module, 'diff-api' module, 'platform-api' module, 'editor-ui-api' module, 'projectModel-impl' module, 'indexing-impl' module, 'editor-ui-ex' module, 'core-impl' module, 'usageView' module, 'diff-impl' module, 'platform-impl'

# Cyclic dependencies.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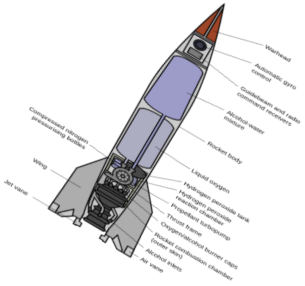
Graph Cycle Detection.

# Cyclic dependencies.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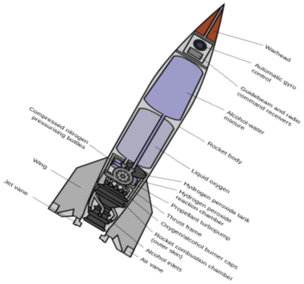
## Graph Cycle Detection.

# Cyclic dependencies.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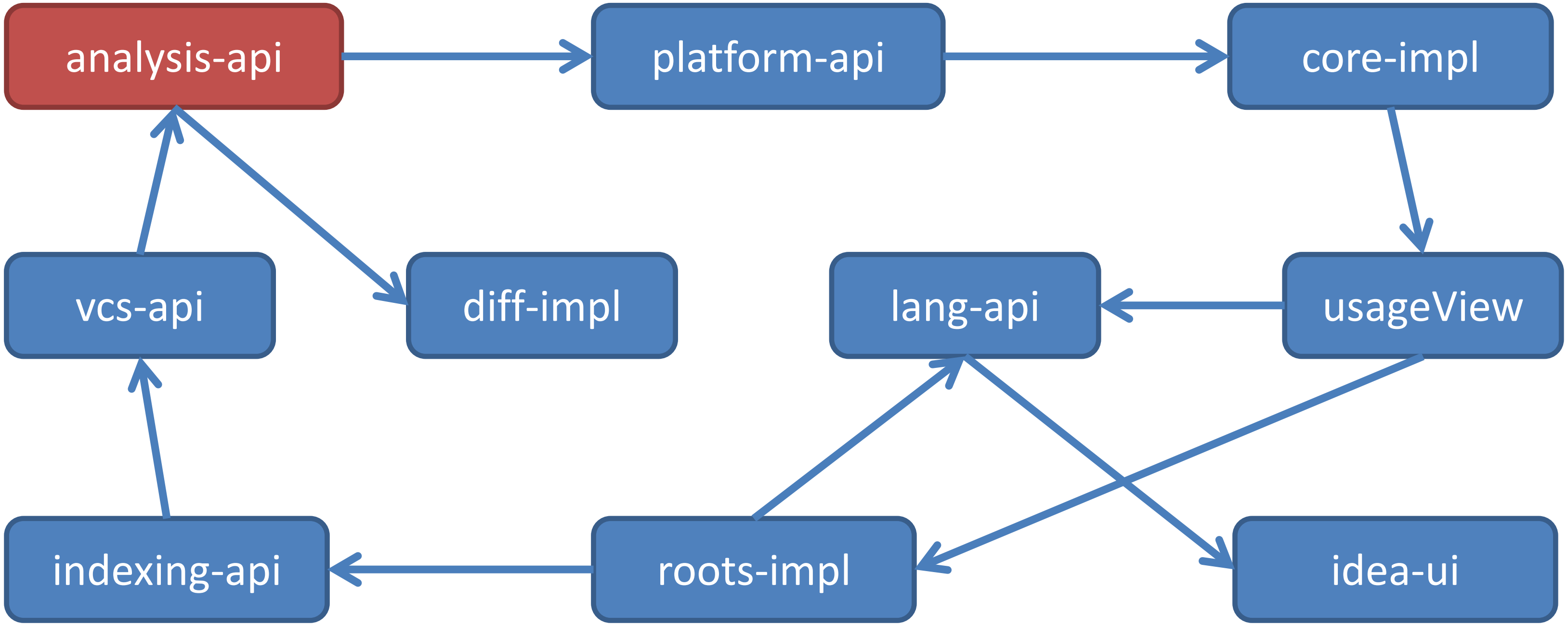
Graph Cycle Detection.

Depth-first search.

# Cyclic dependencies.

## Depth-first search



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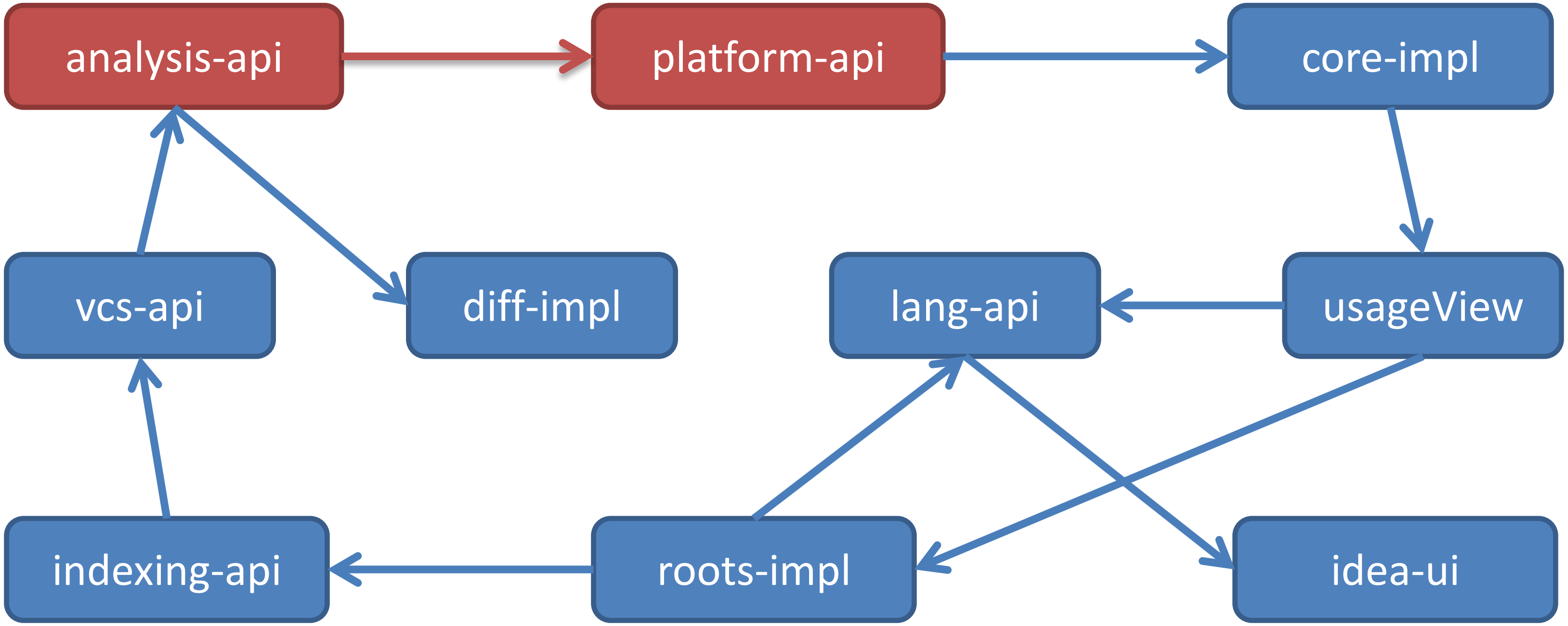

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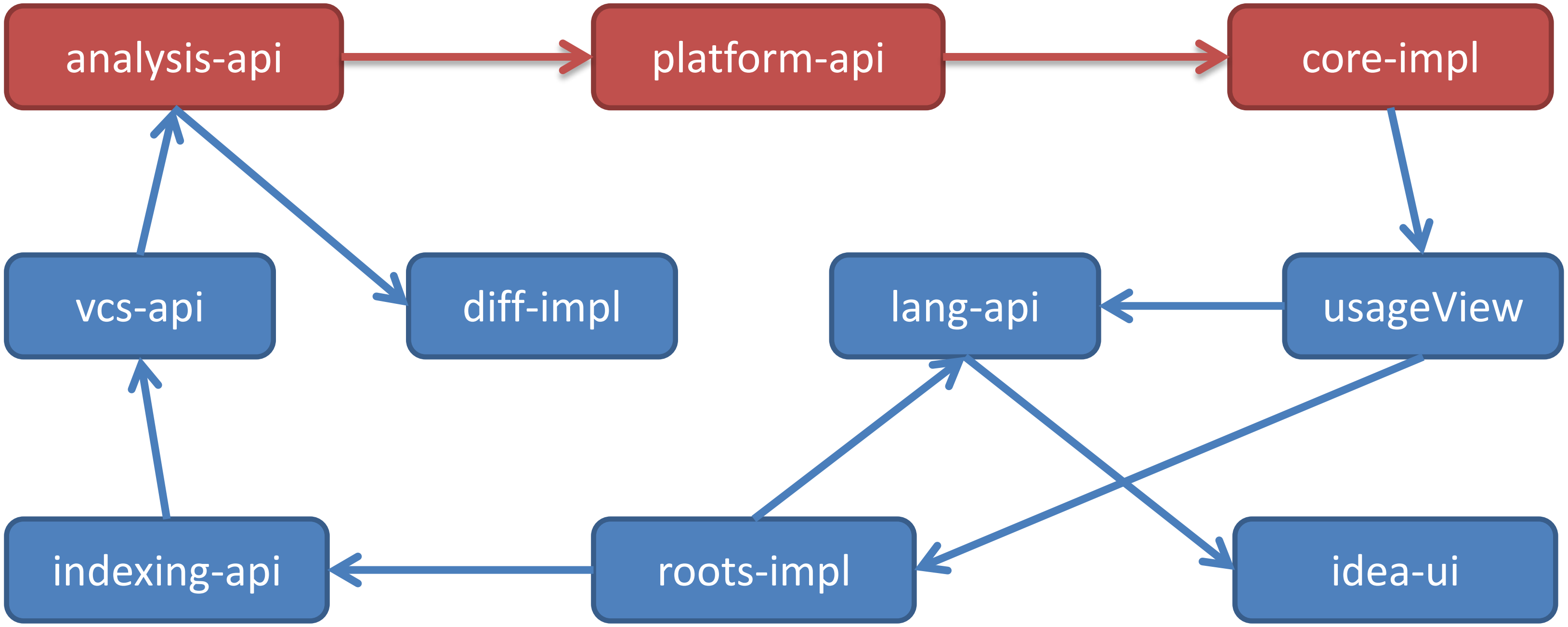

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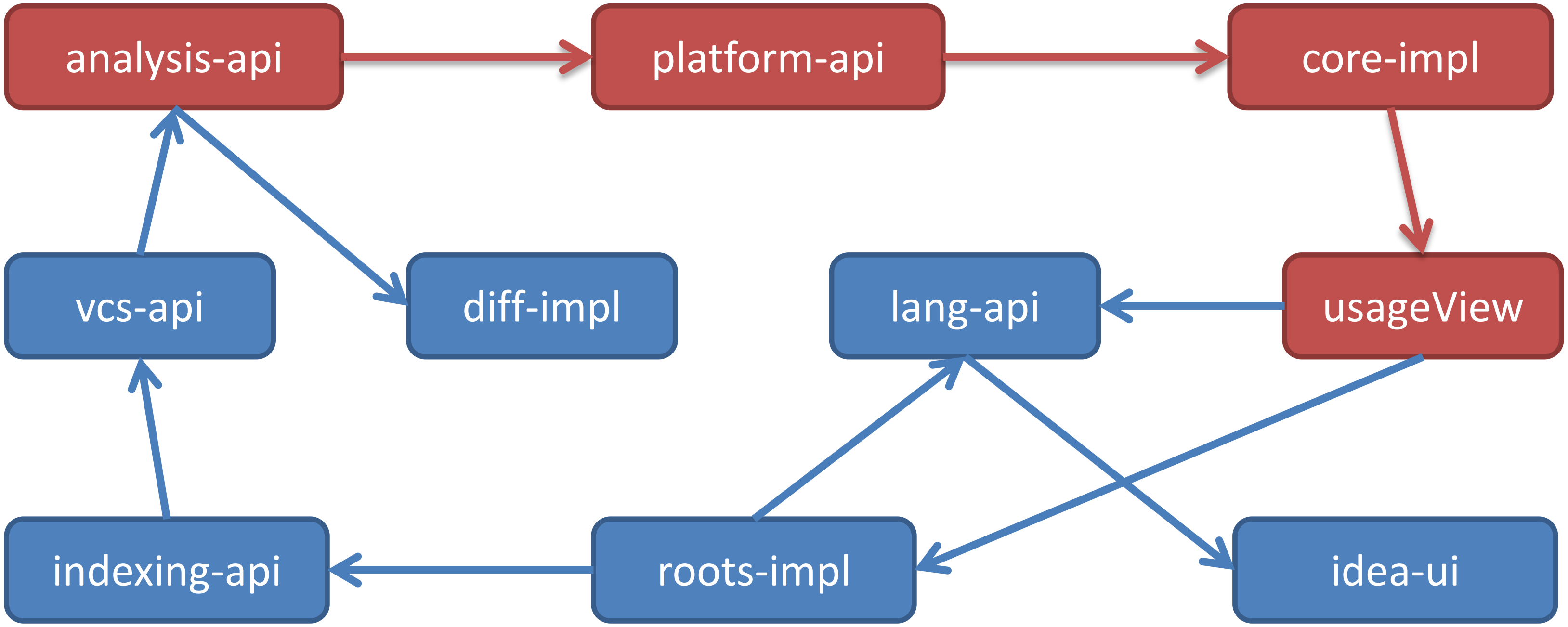

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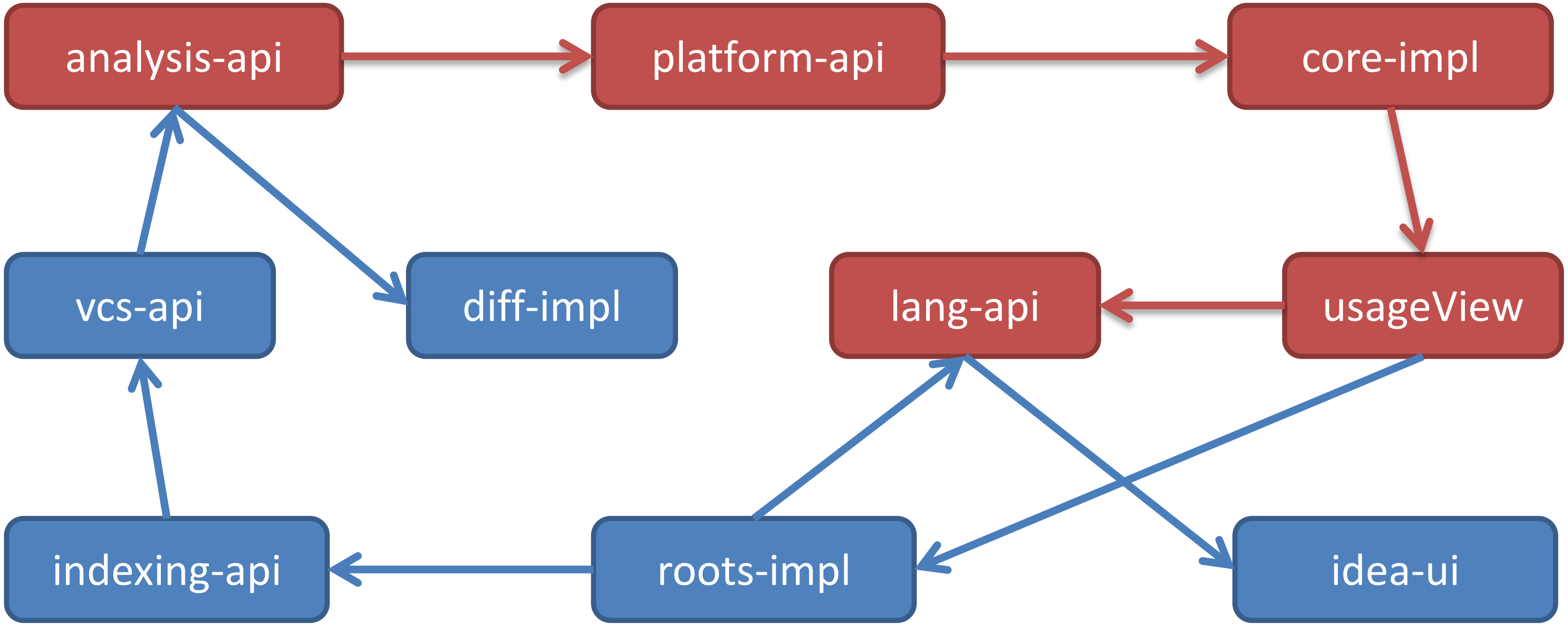

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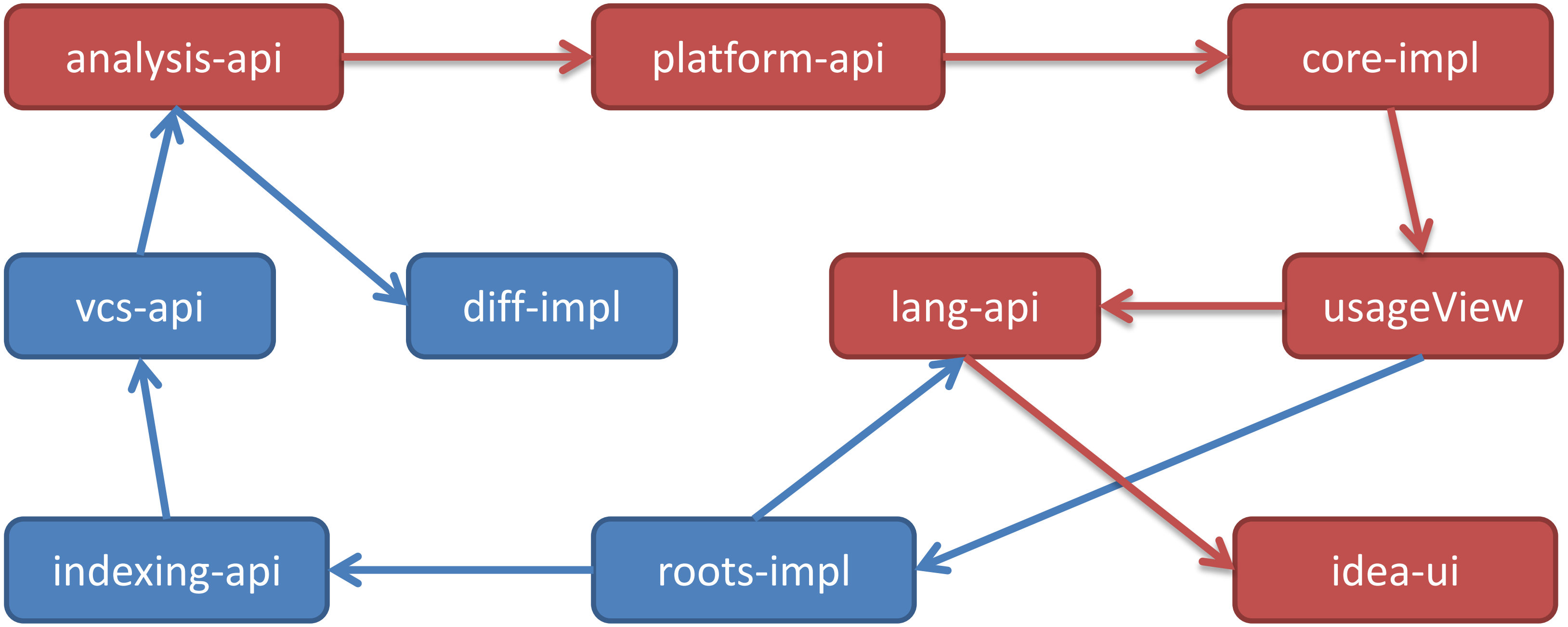

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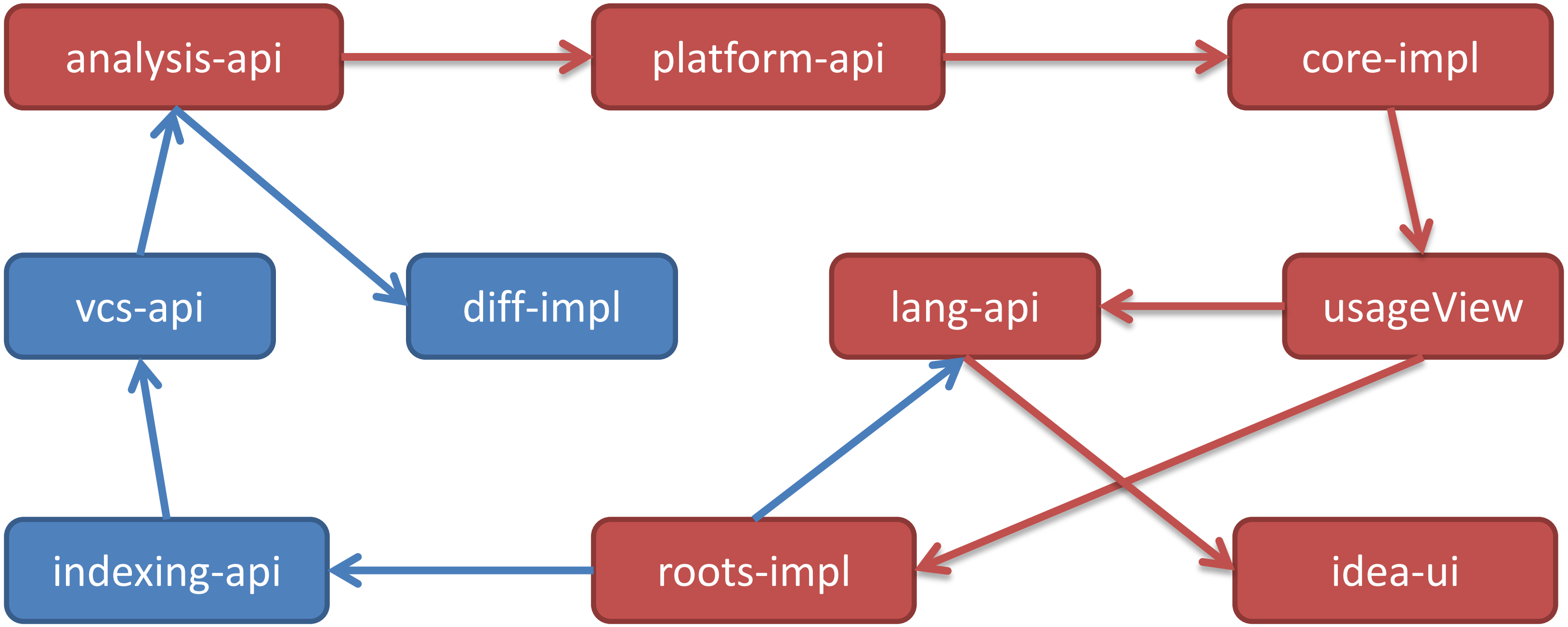

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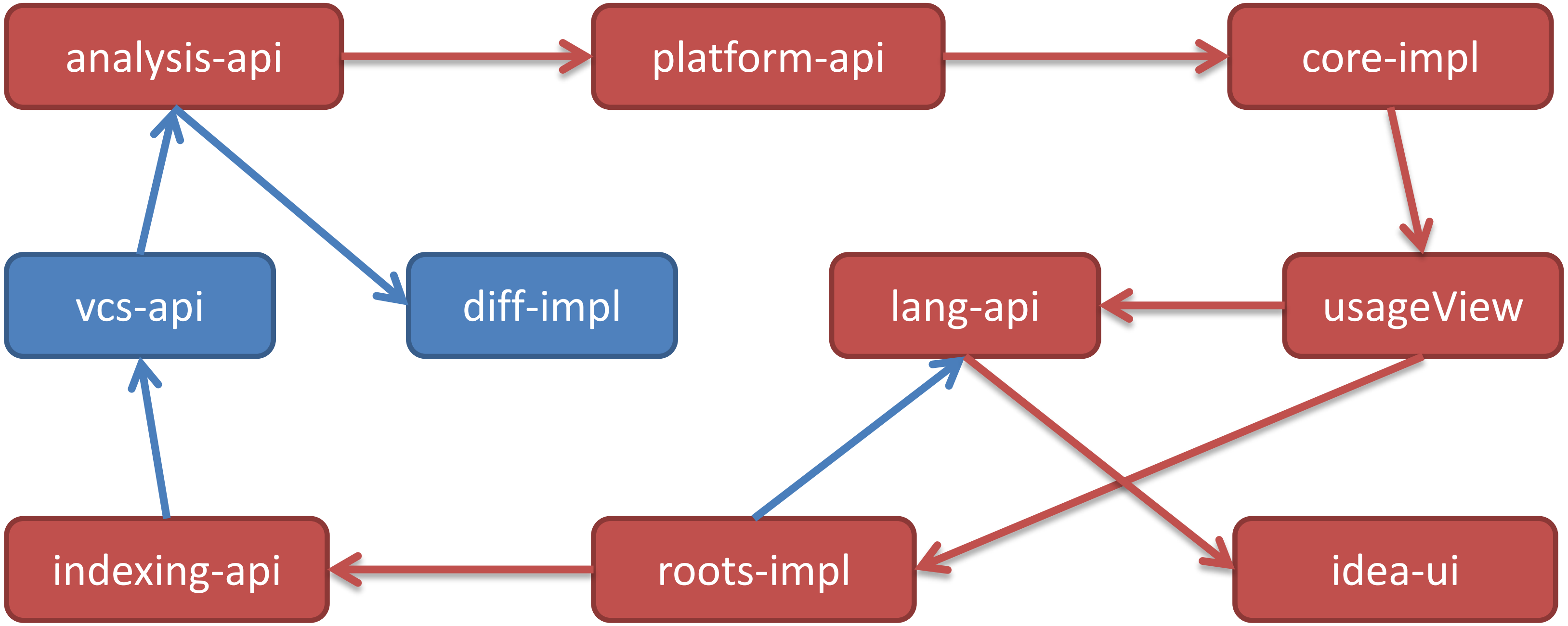

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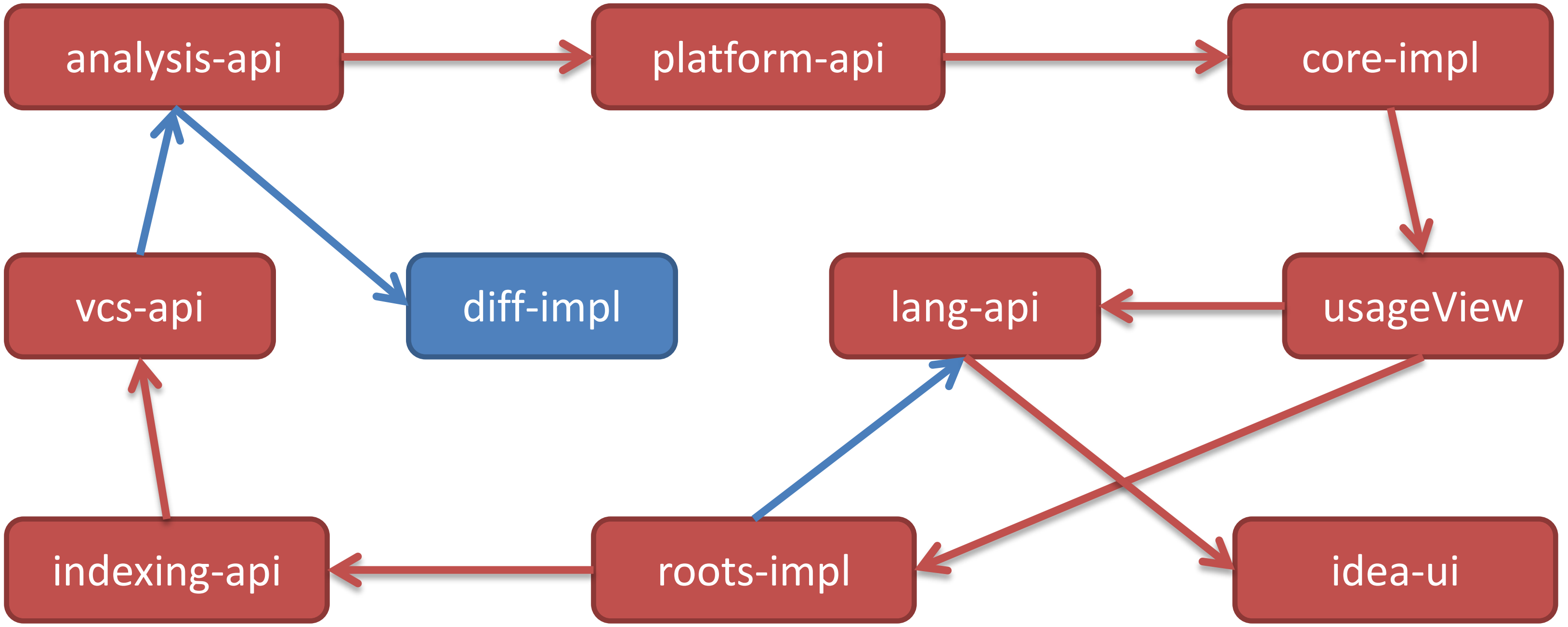

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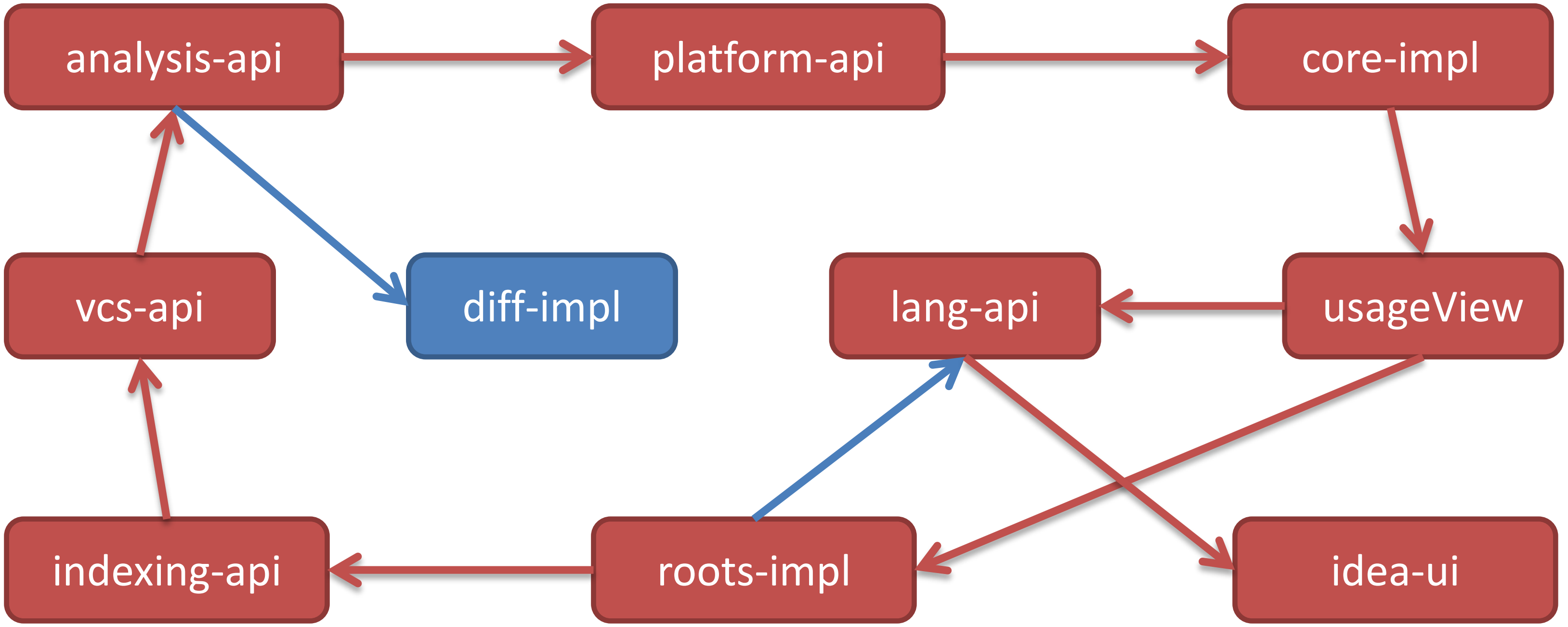

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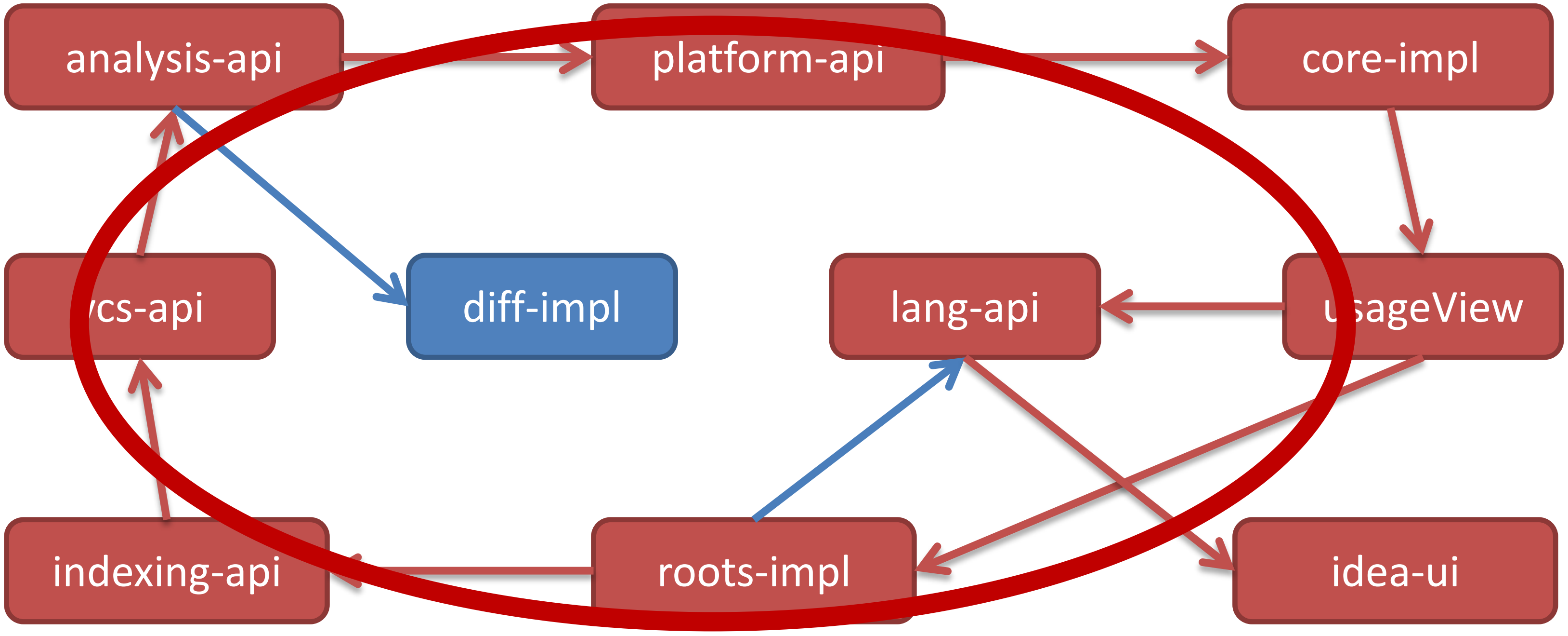
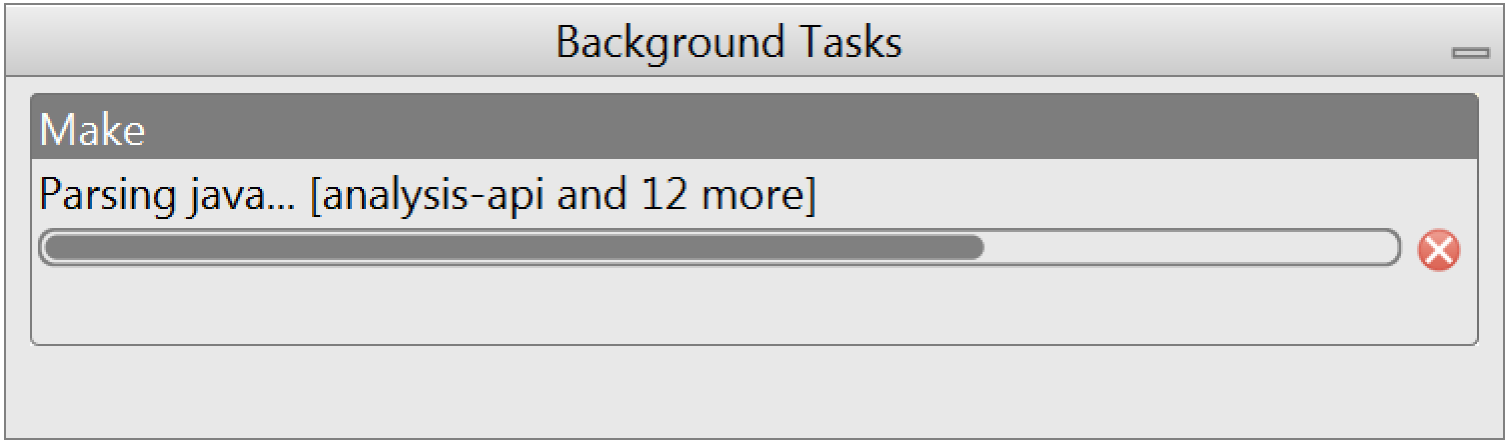


Q.E.D.

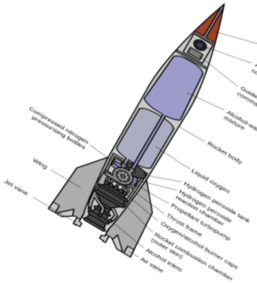
# Dependencies compilation



Make

Parsing java... [analysis-api and 12 more]

# Dependencies compilation.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Strongly Connected Components.

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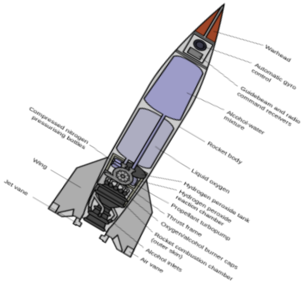
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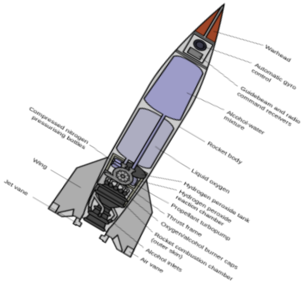
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Strongly Connected Components.

Tarjan's algorithm.

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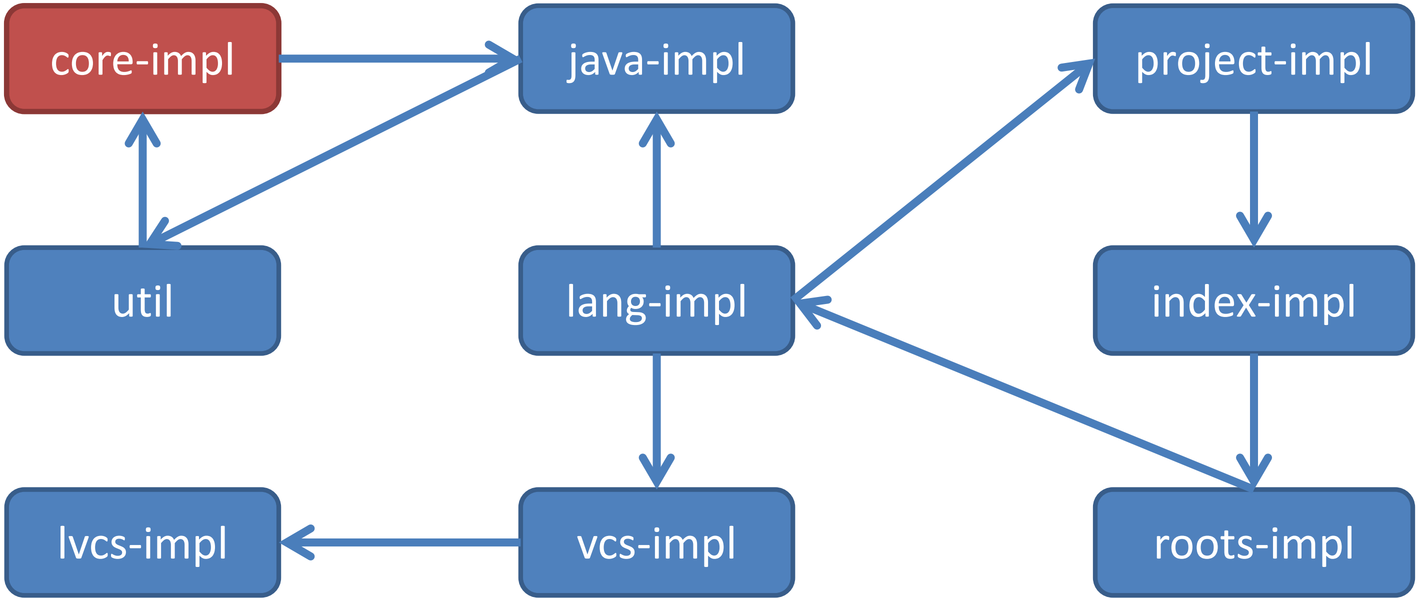
## Tarjan’s algorithm



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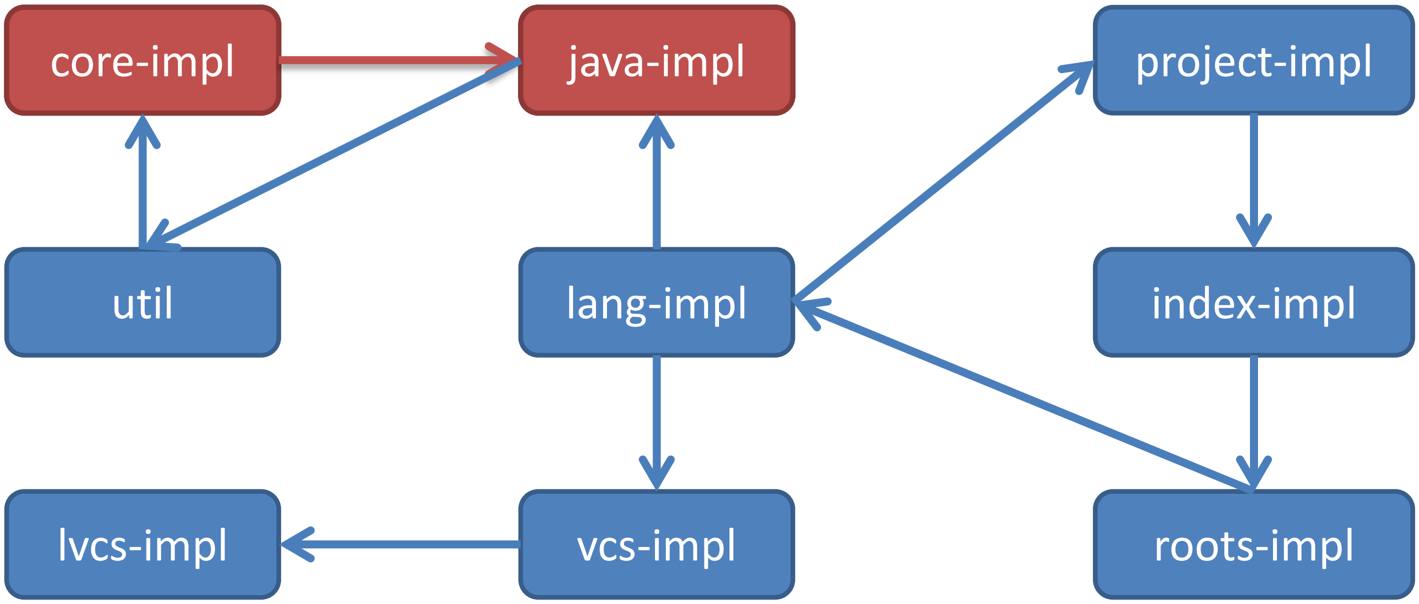

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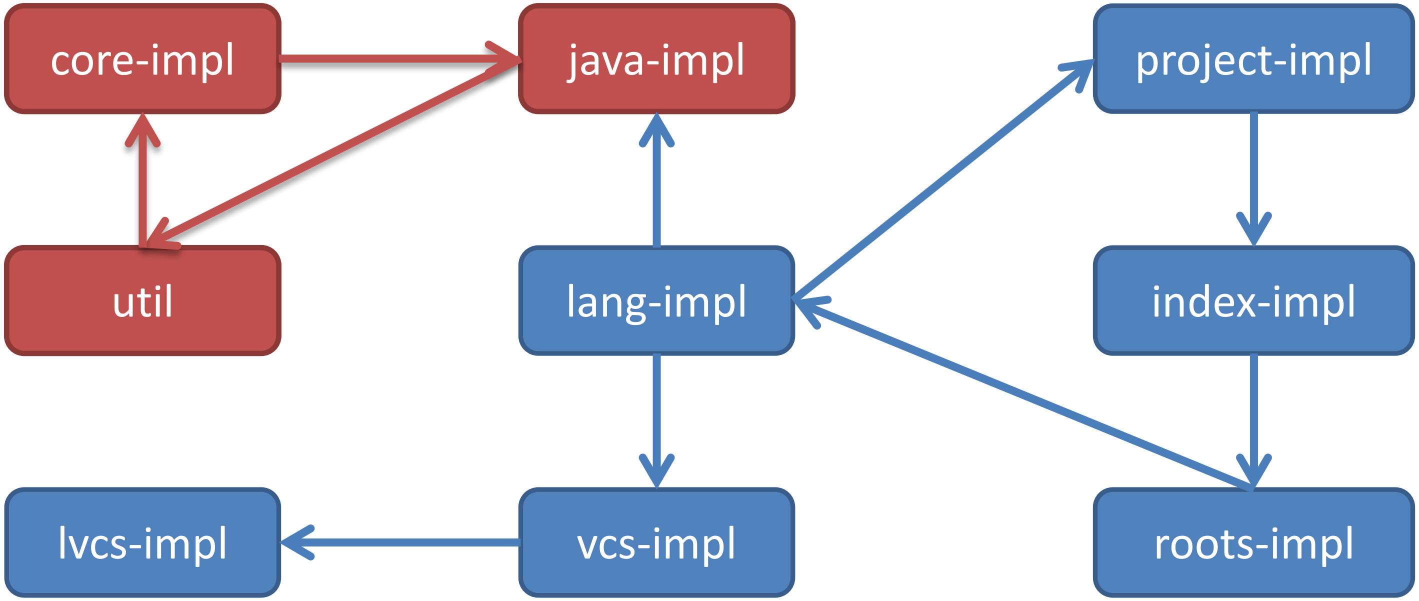

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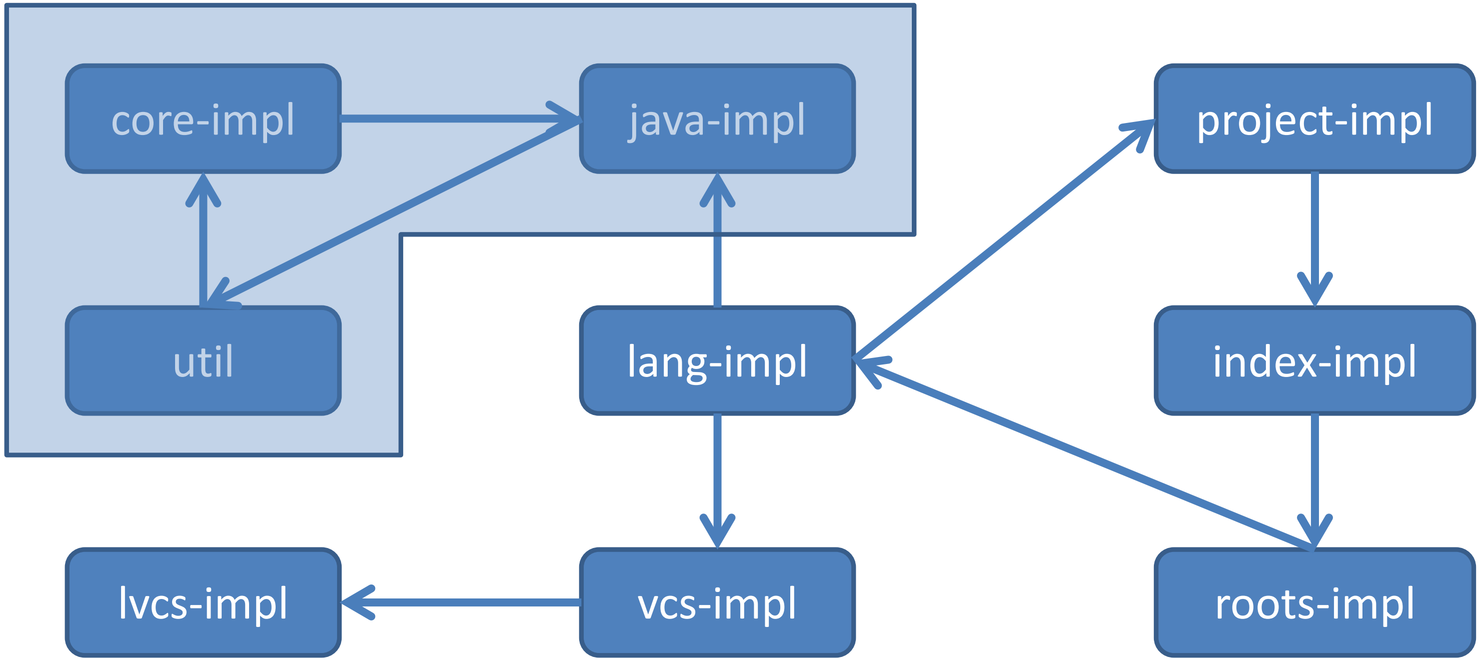

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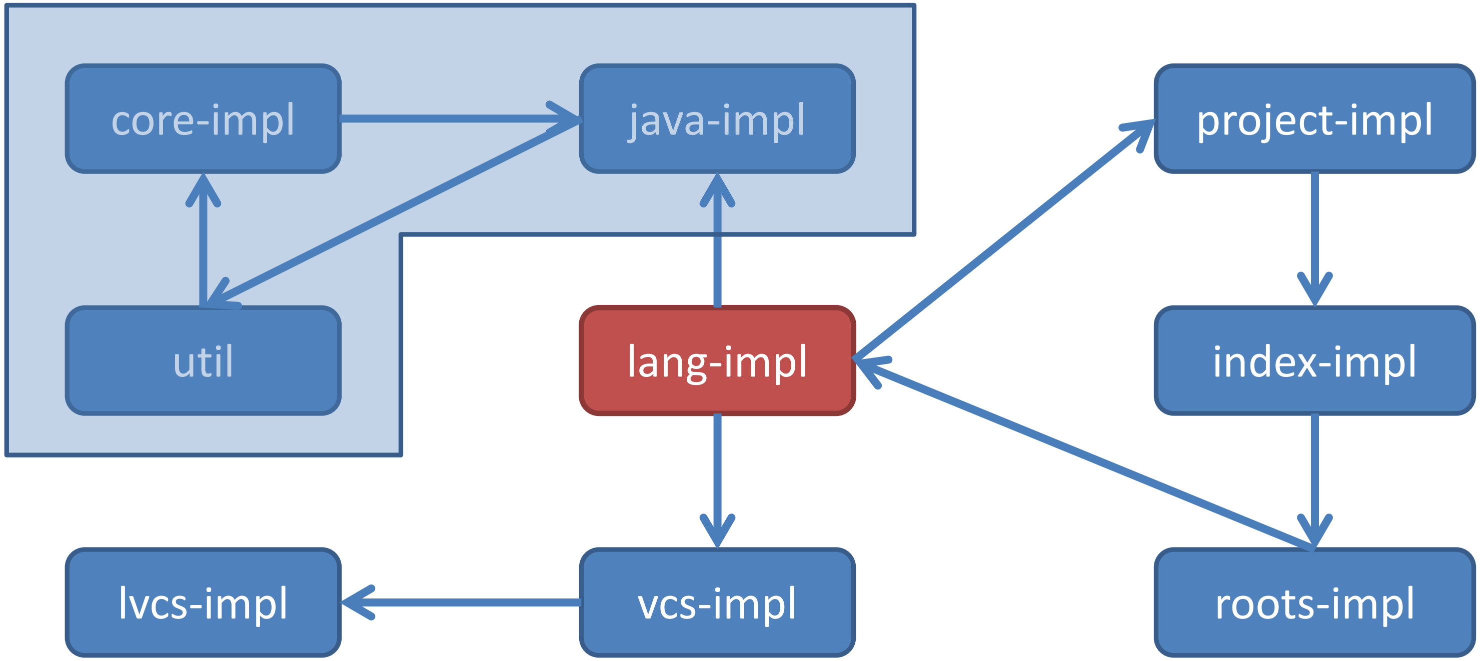

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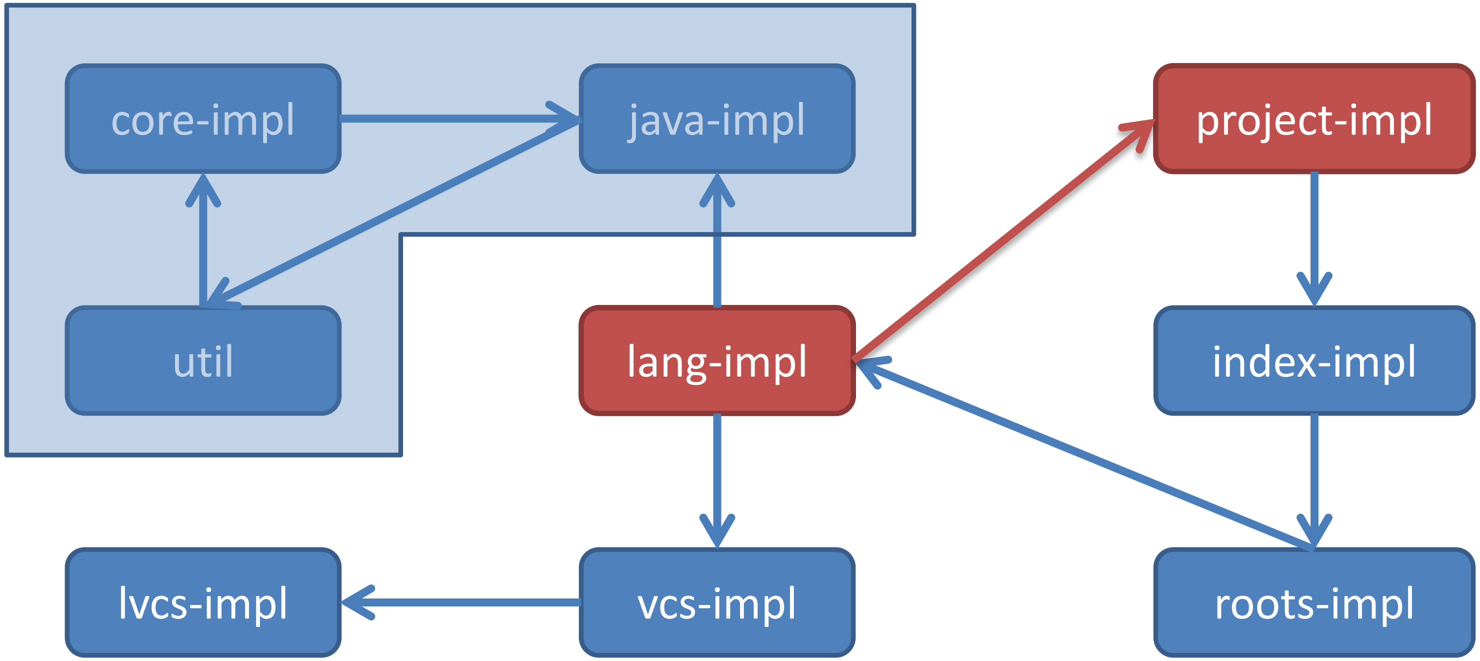

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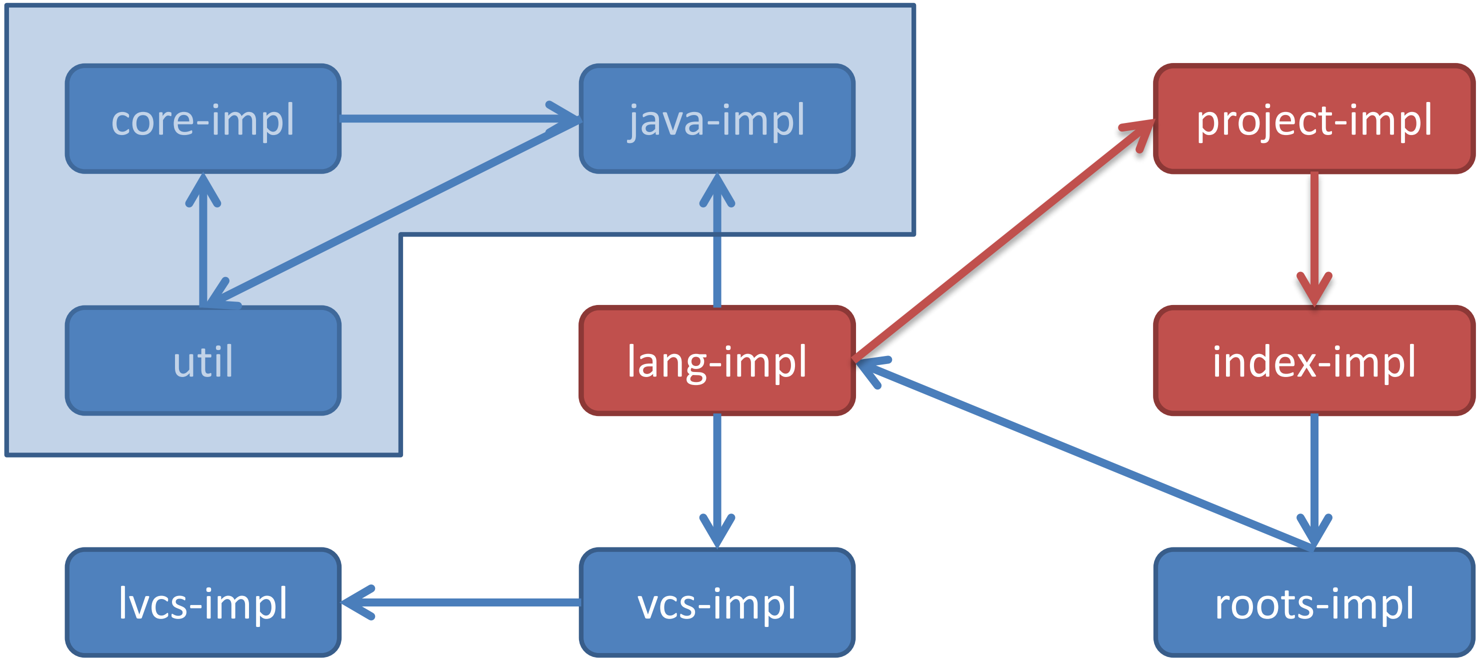

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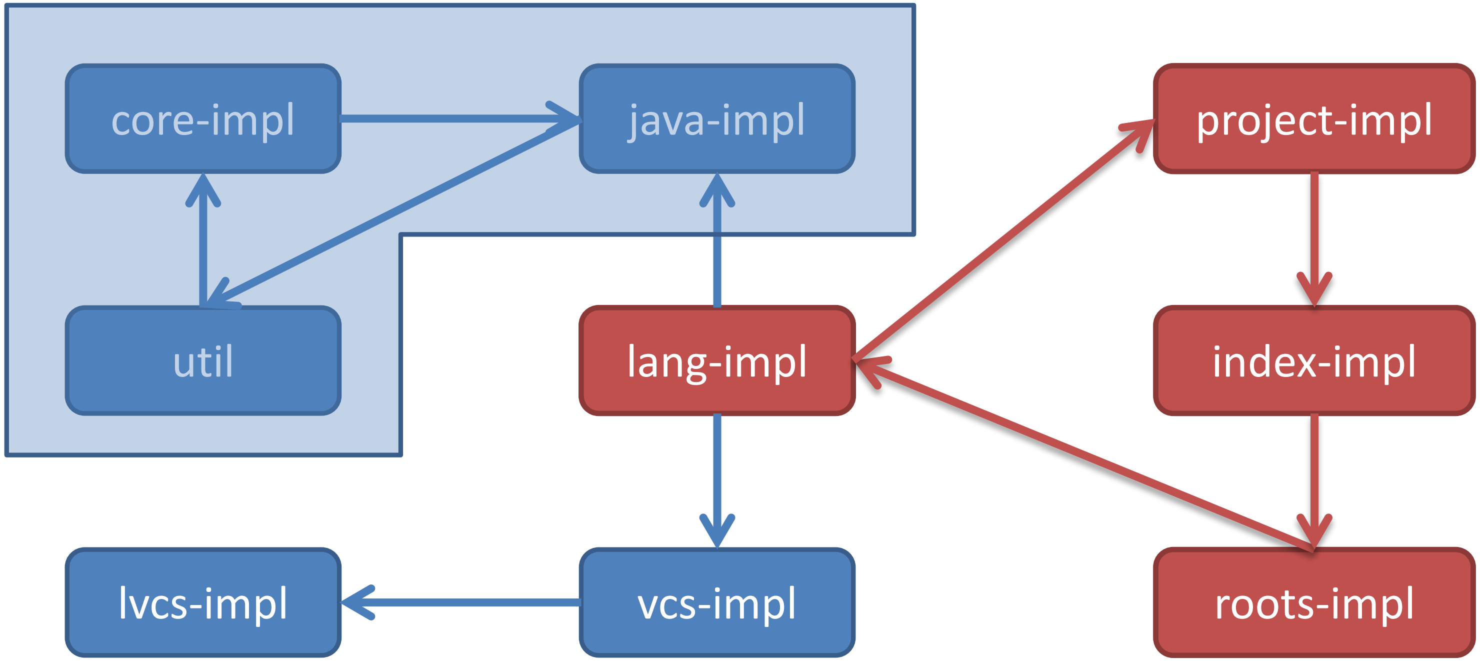

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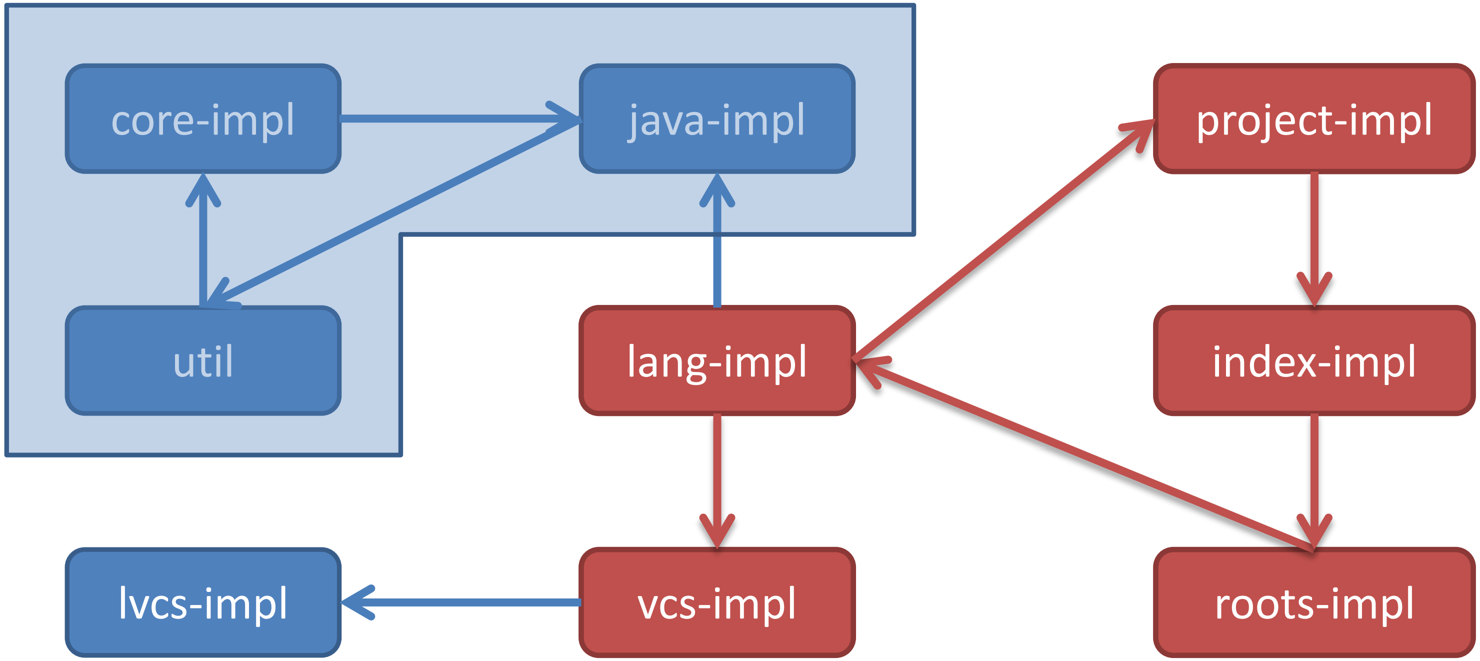

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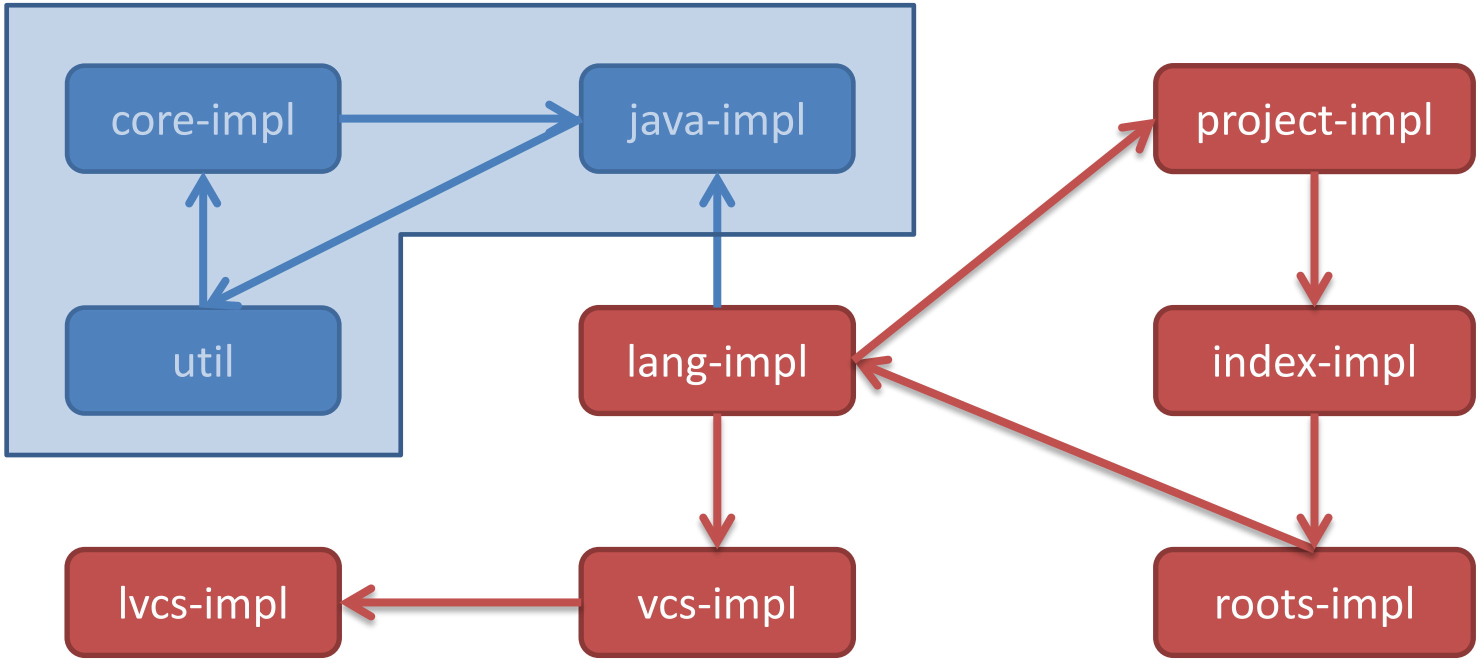

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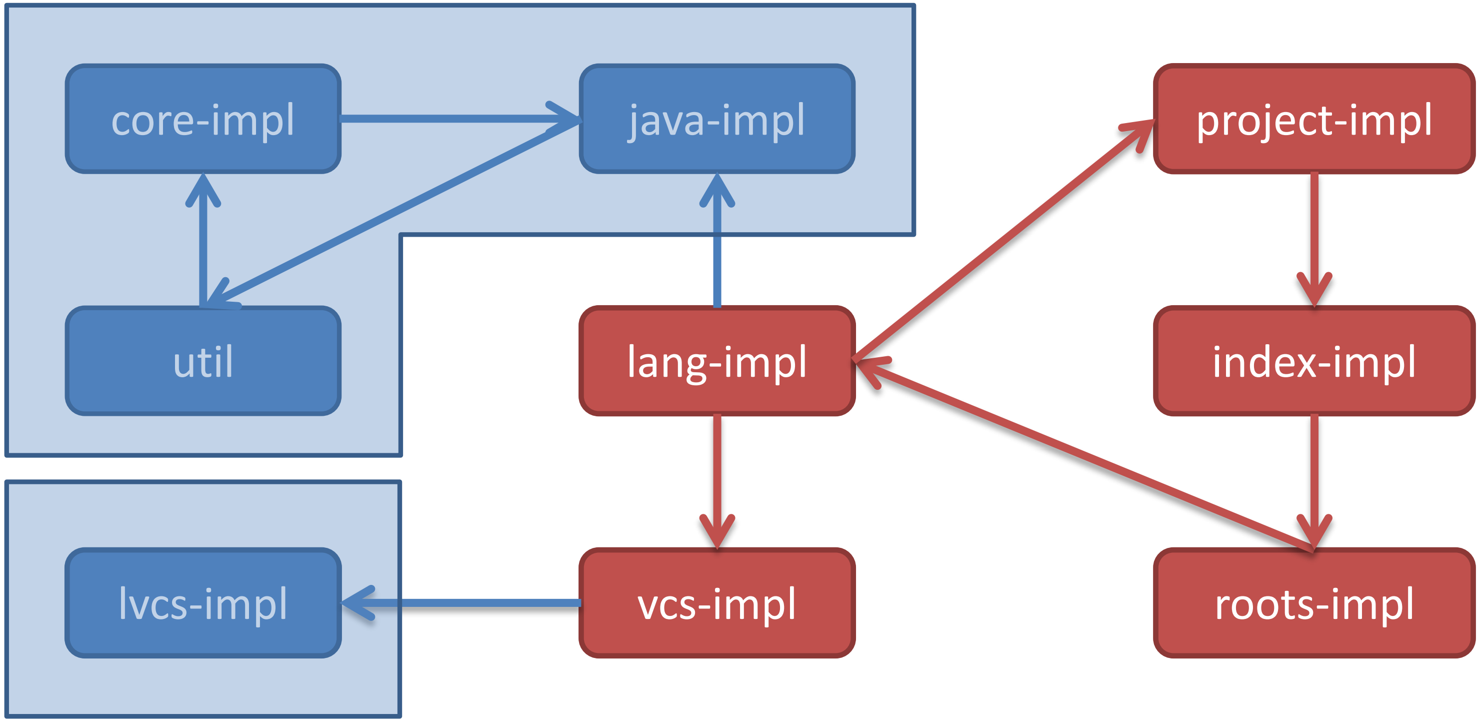

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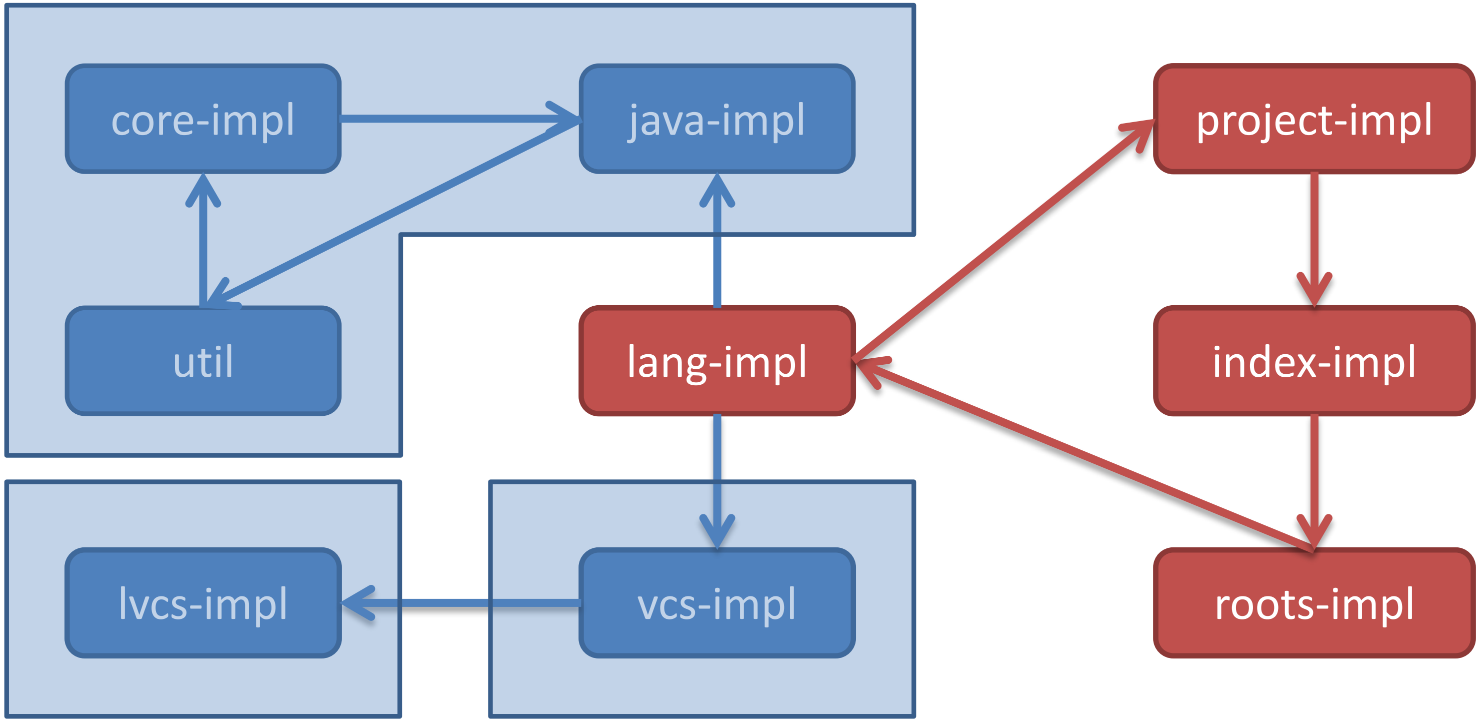

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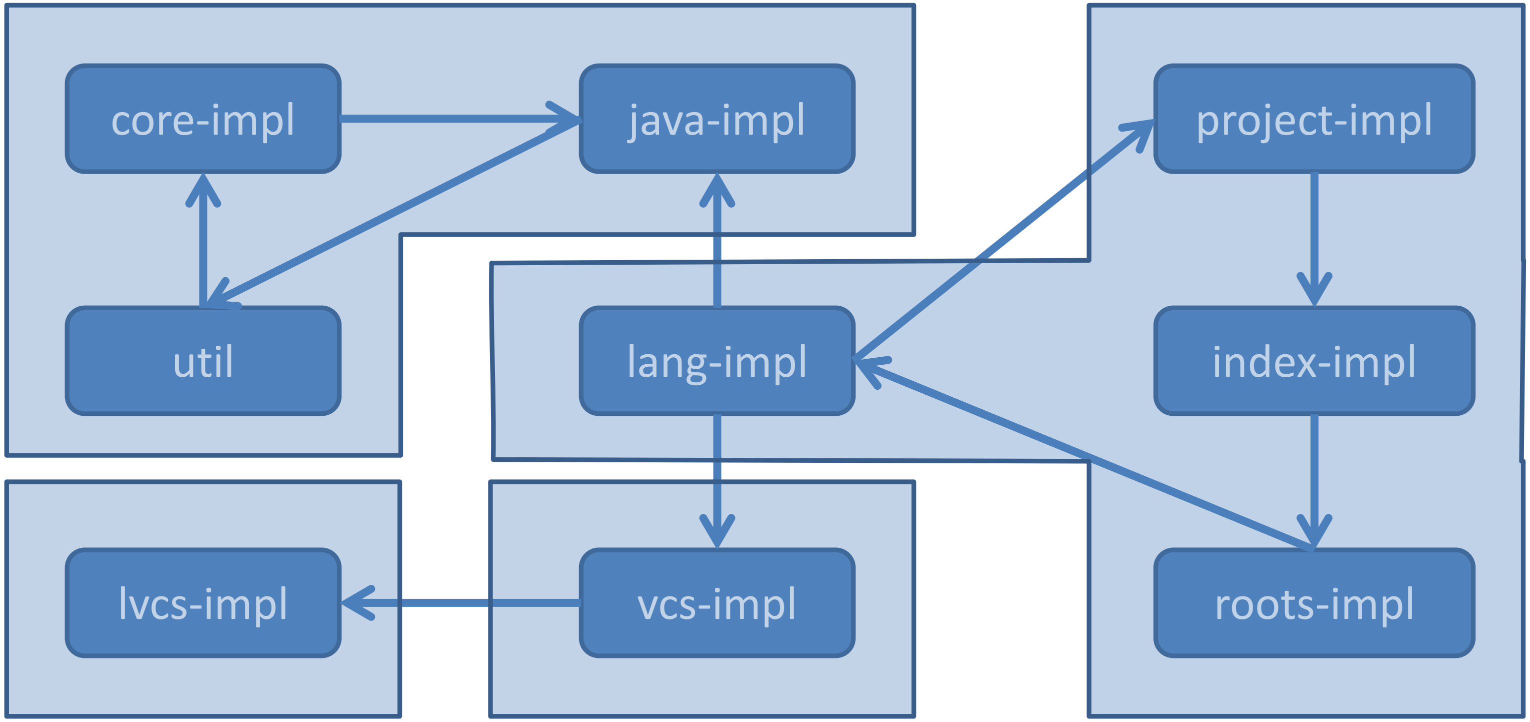


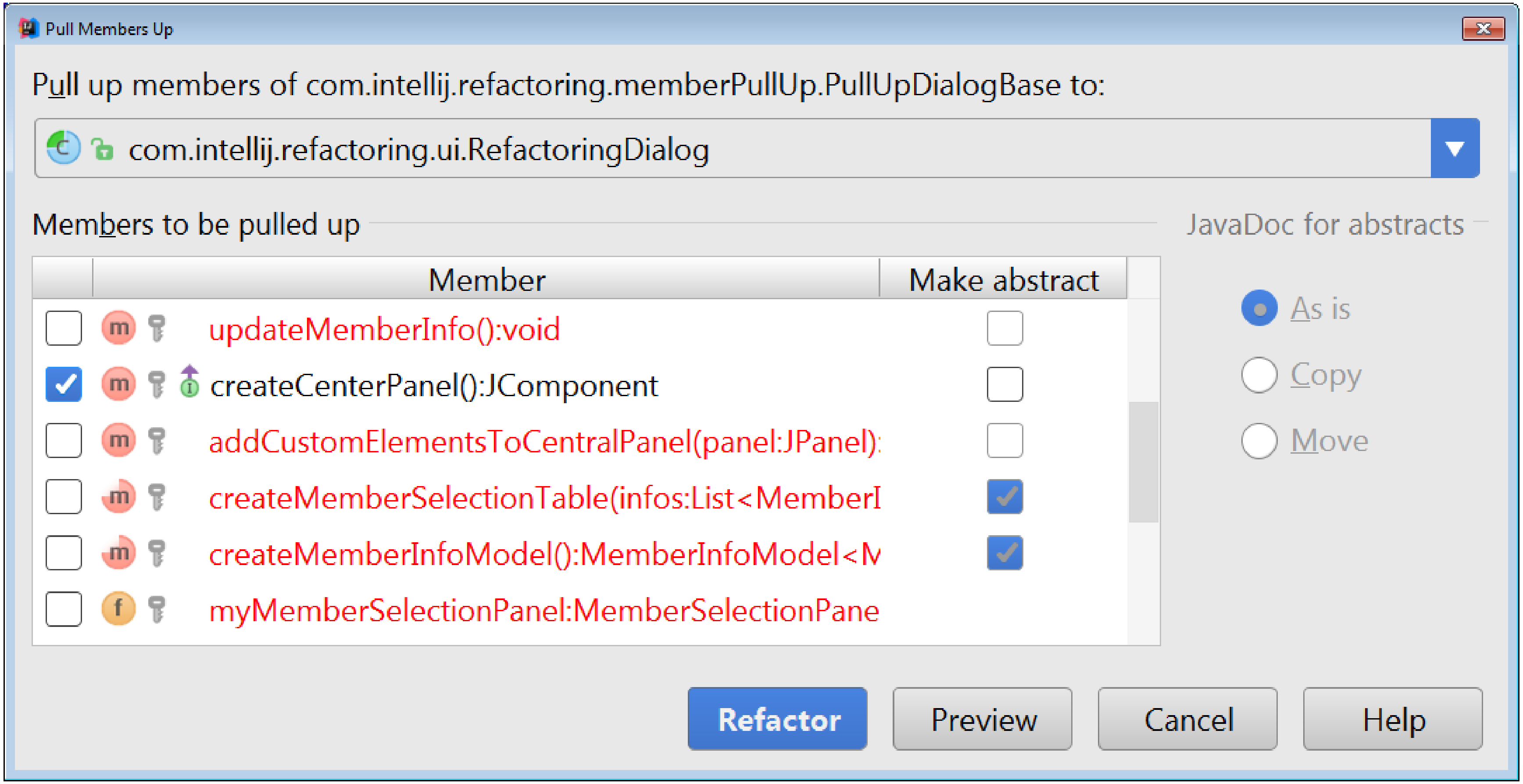
# Dependencies compilation

Tarjan's algorithm

(+non-recursive mods).

- Extensions/plugins loading order,
- type migration,
- data flow loop analyzer, etc

# Suggest members



Pull Members Up

Pull up members of com.intellij.refactoring.memberPullUp.PullUpDialogBase to:

com.intellij.refactoring.ui.RefactoringDialog

Members to be pulled up

|   | Member | Make abstract |
|---|---|---|
| □ | updateMemberInfo():void | □ |
| ☑ | createCenterPanel():JComponent | □ |
| □ | addCustomElementsToCentralPanel(panel:JPanel): | □ |
| □ | createMemberSelectionTable(infos:List<MemberI | ☑ |
| □ | createMemberInfoModel():MemberInfoModel<M | ☑ |
| □ | myMemberSelectionPanel:MemberSelectionPane |   |

JavaDoc for abstracts

● As is

○ Copy

○ Move

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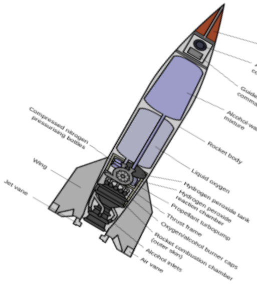
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Transitive closure.

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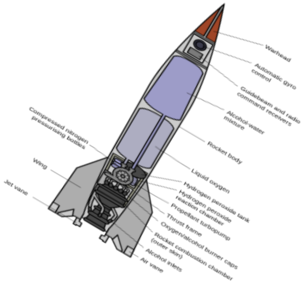
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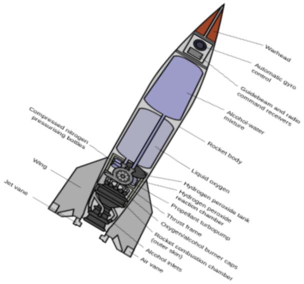
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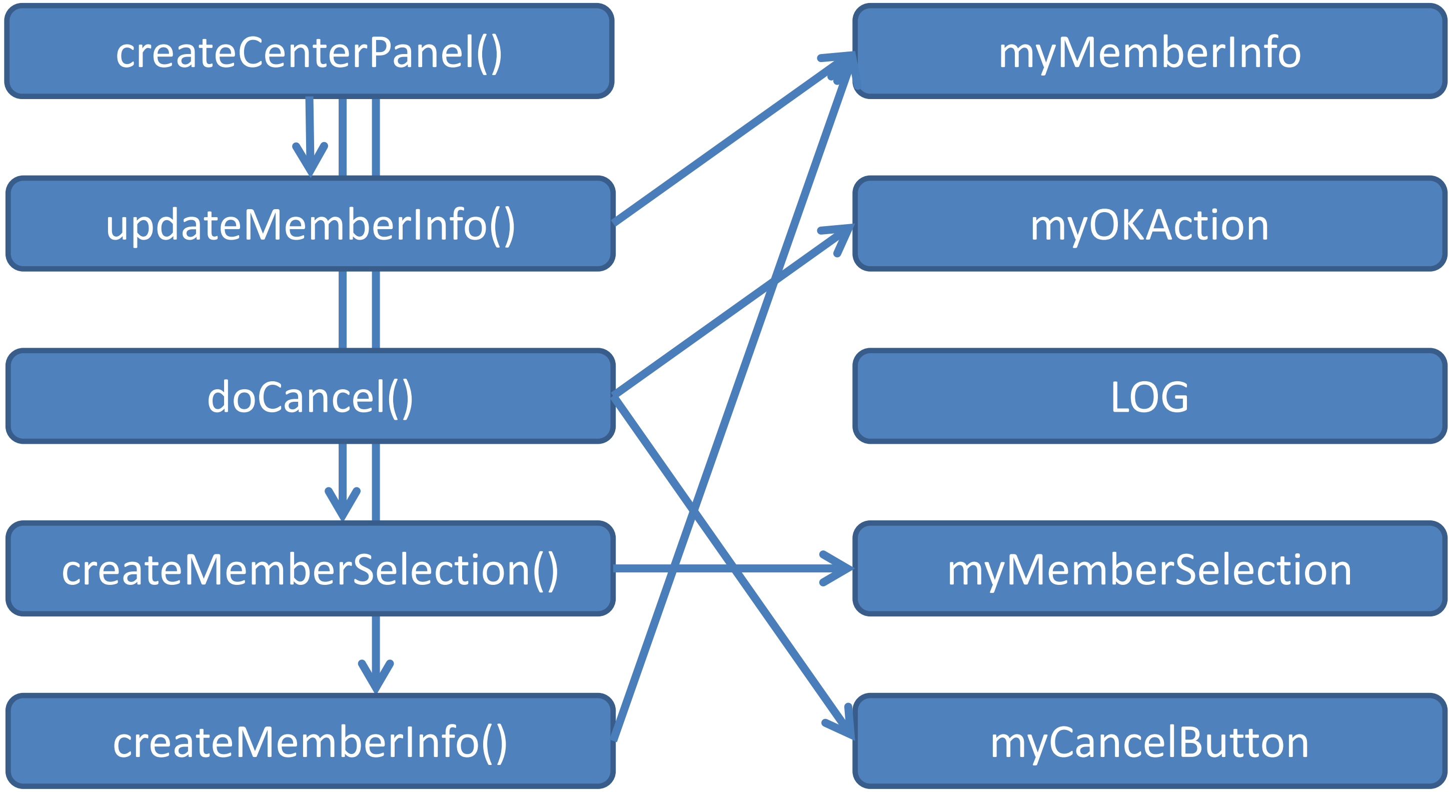
Transitive closure.

Depth-first search.

# Suggest members

## Transitive closure: Depth-first search



# Suggest members

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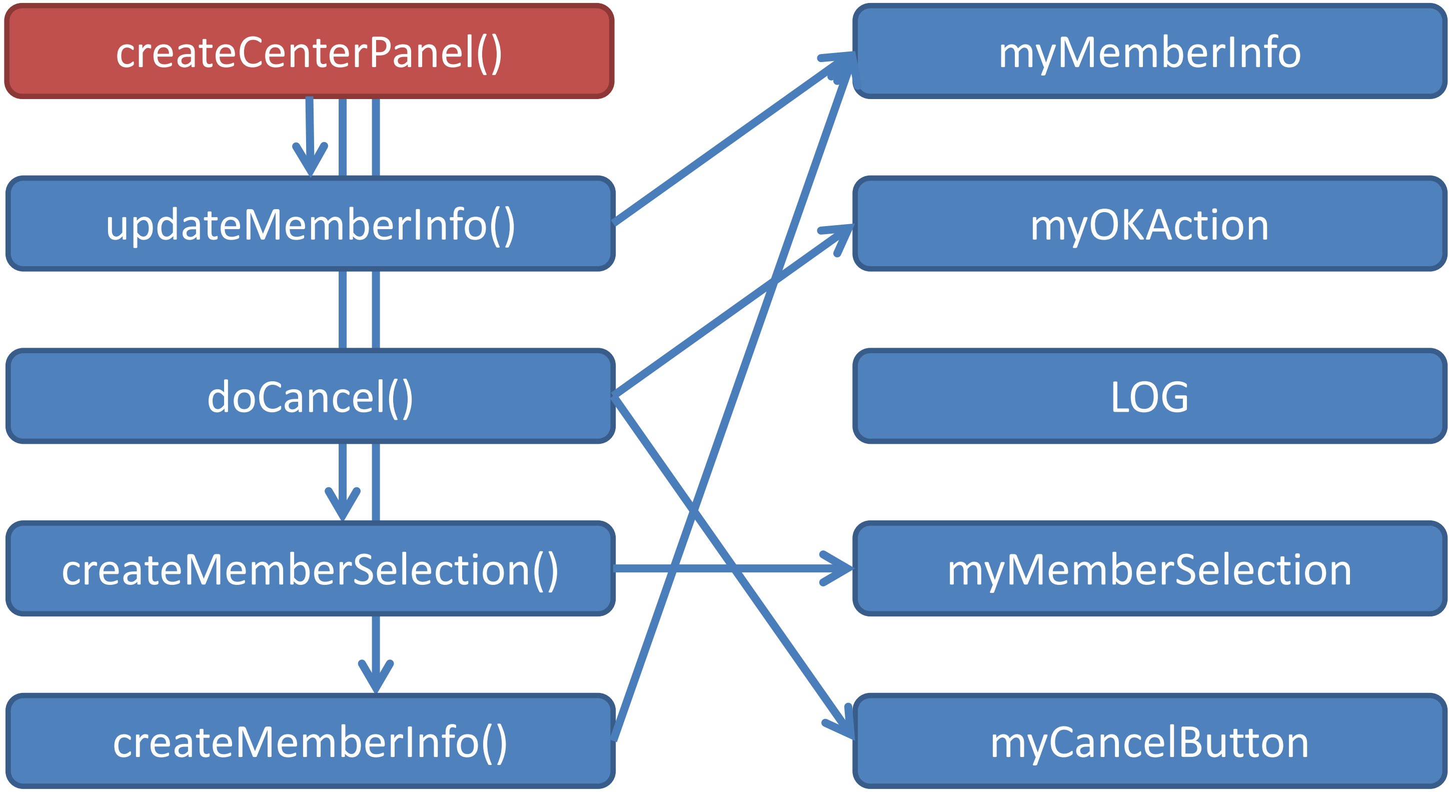

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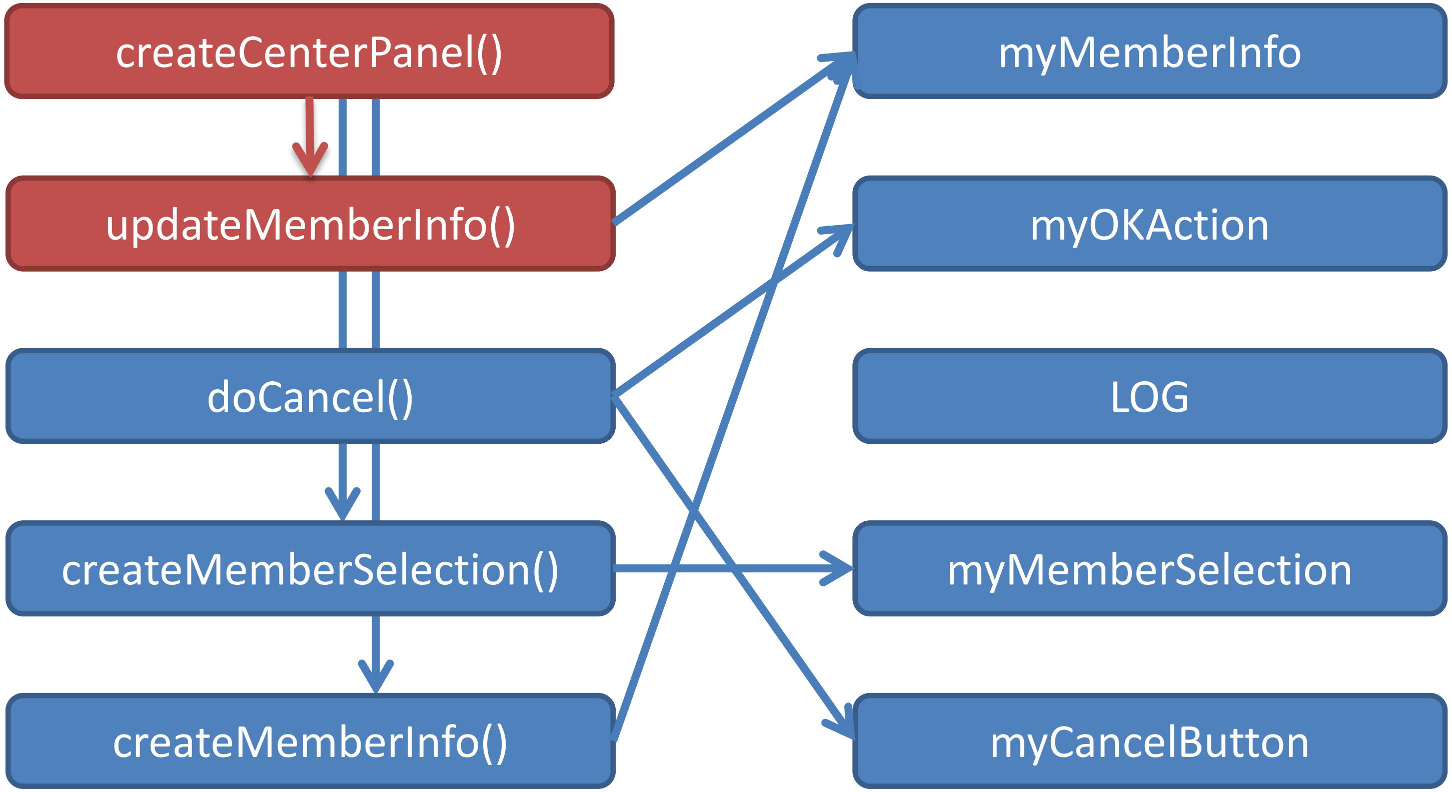

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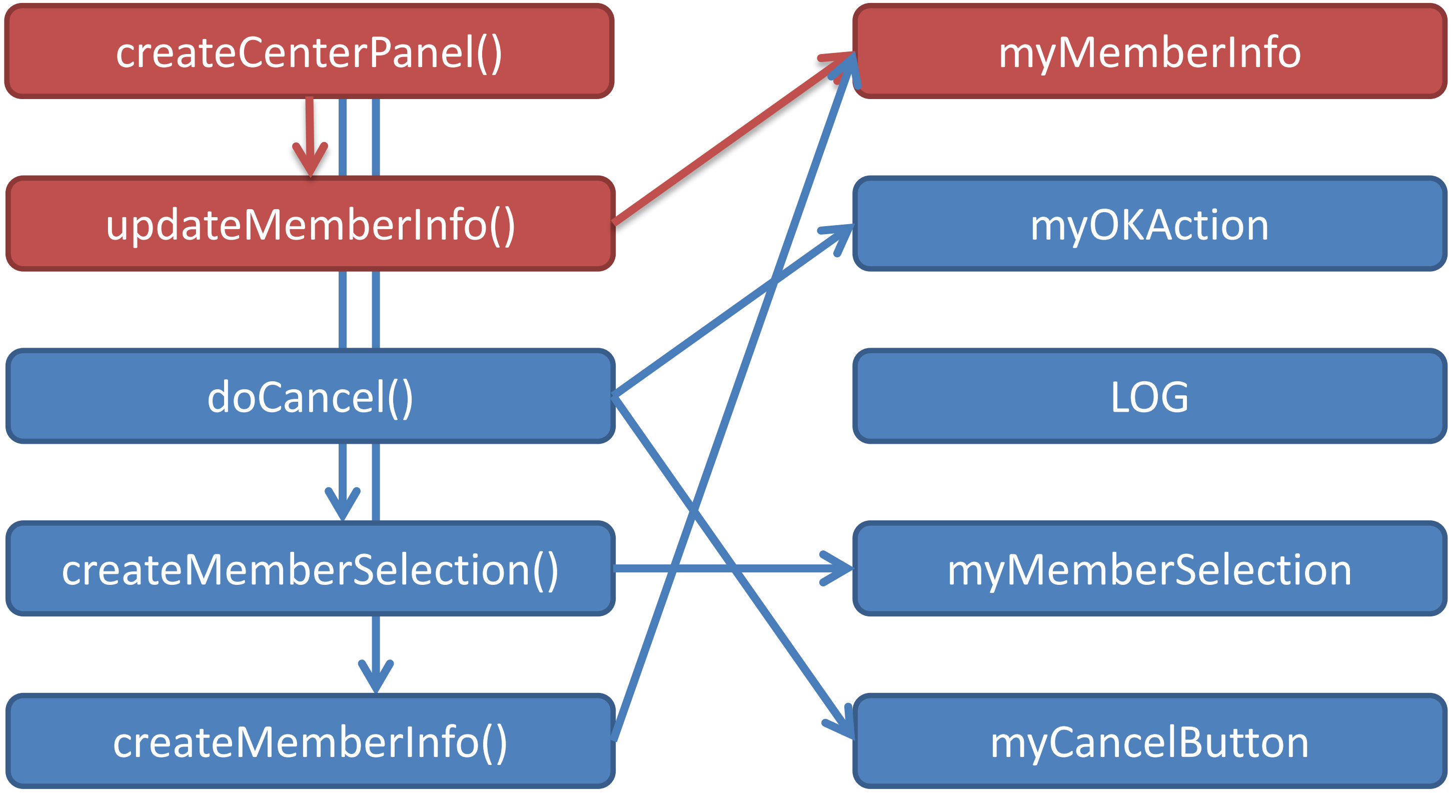

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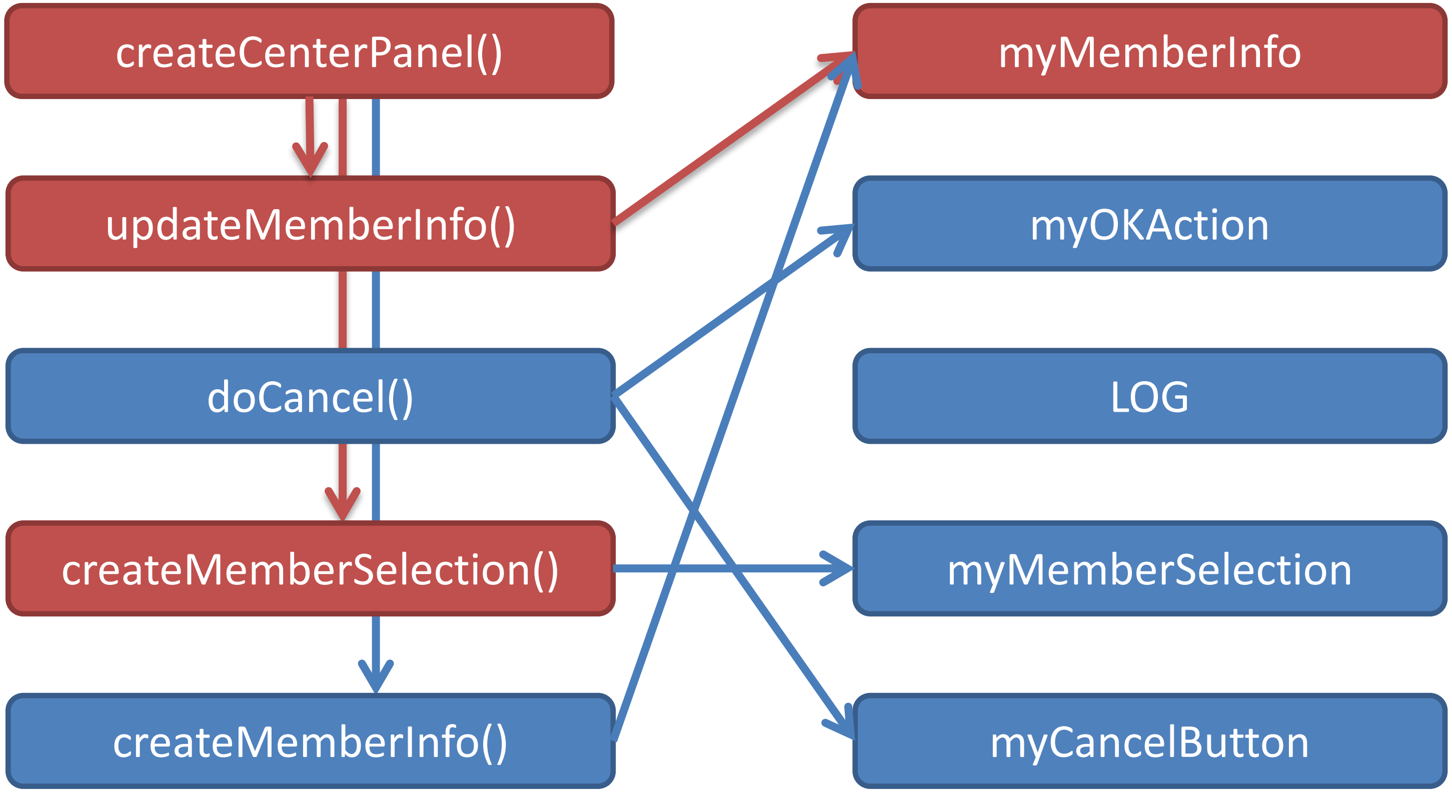

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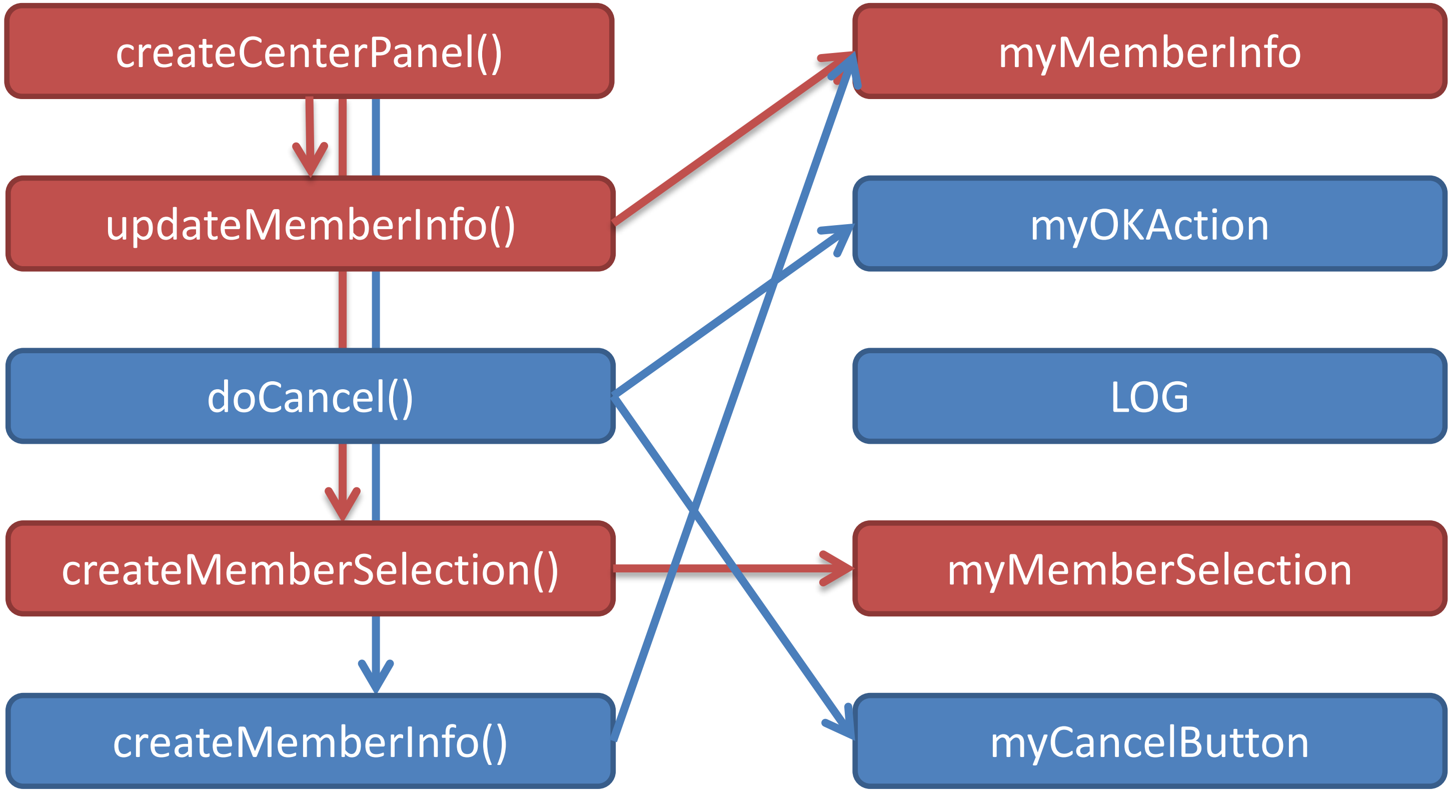

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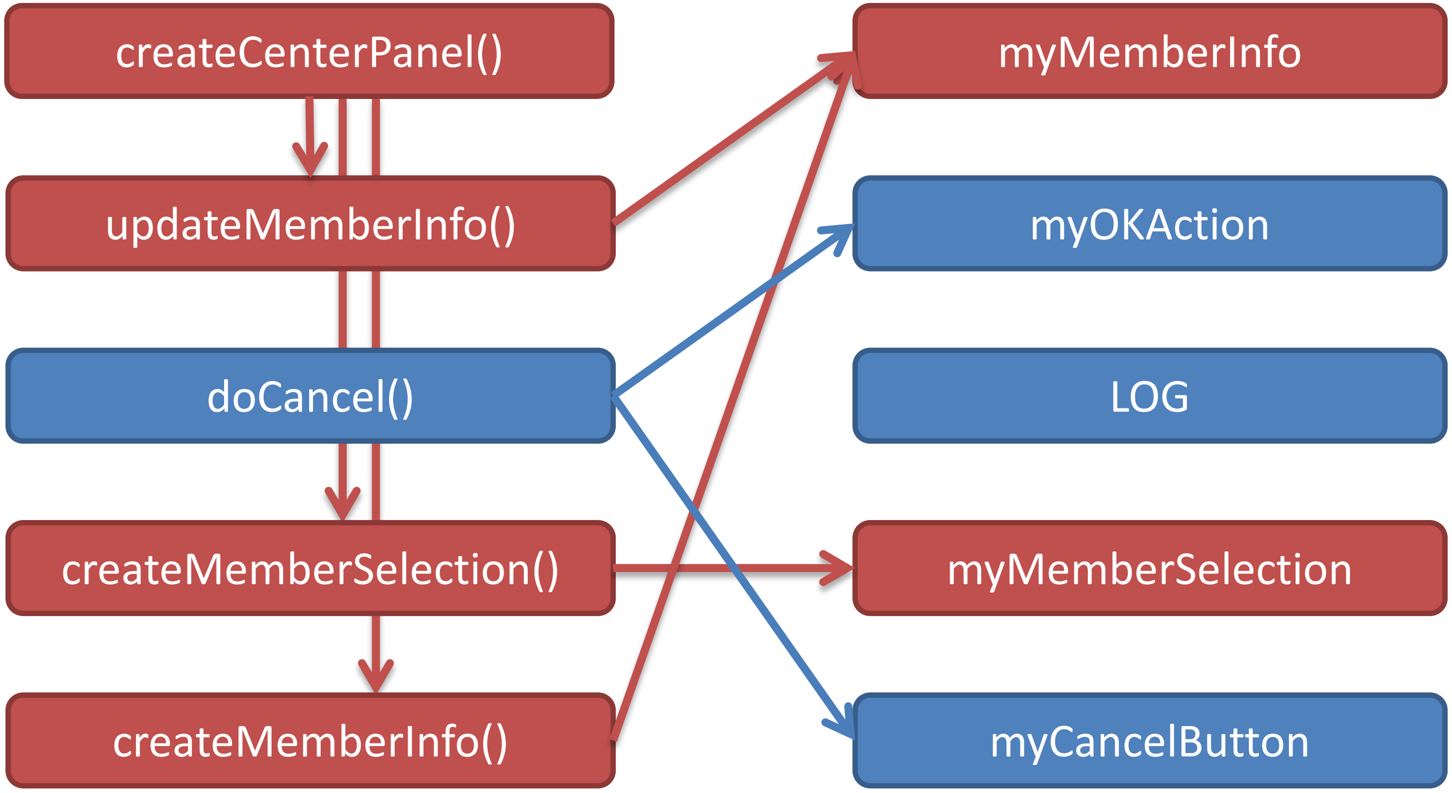

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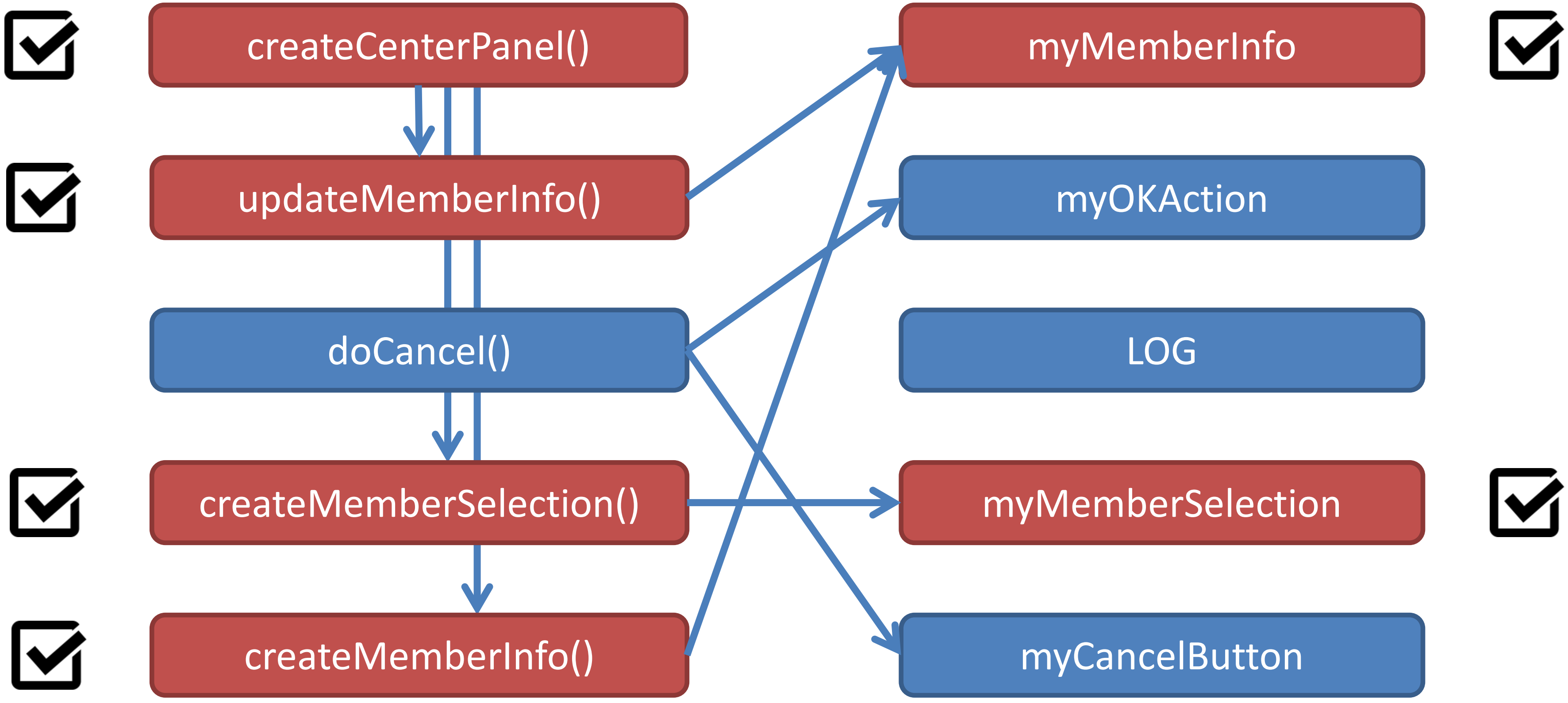
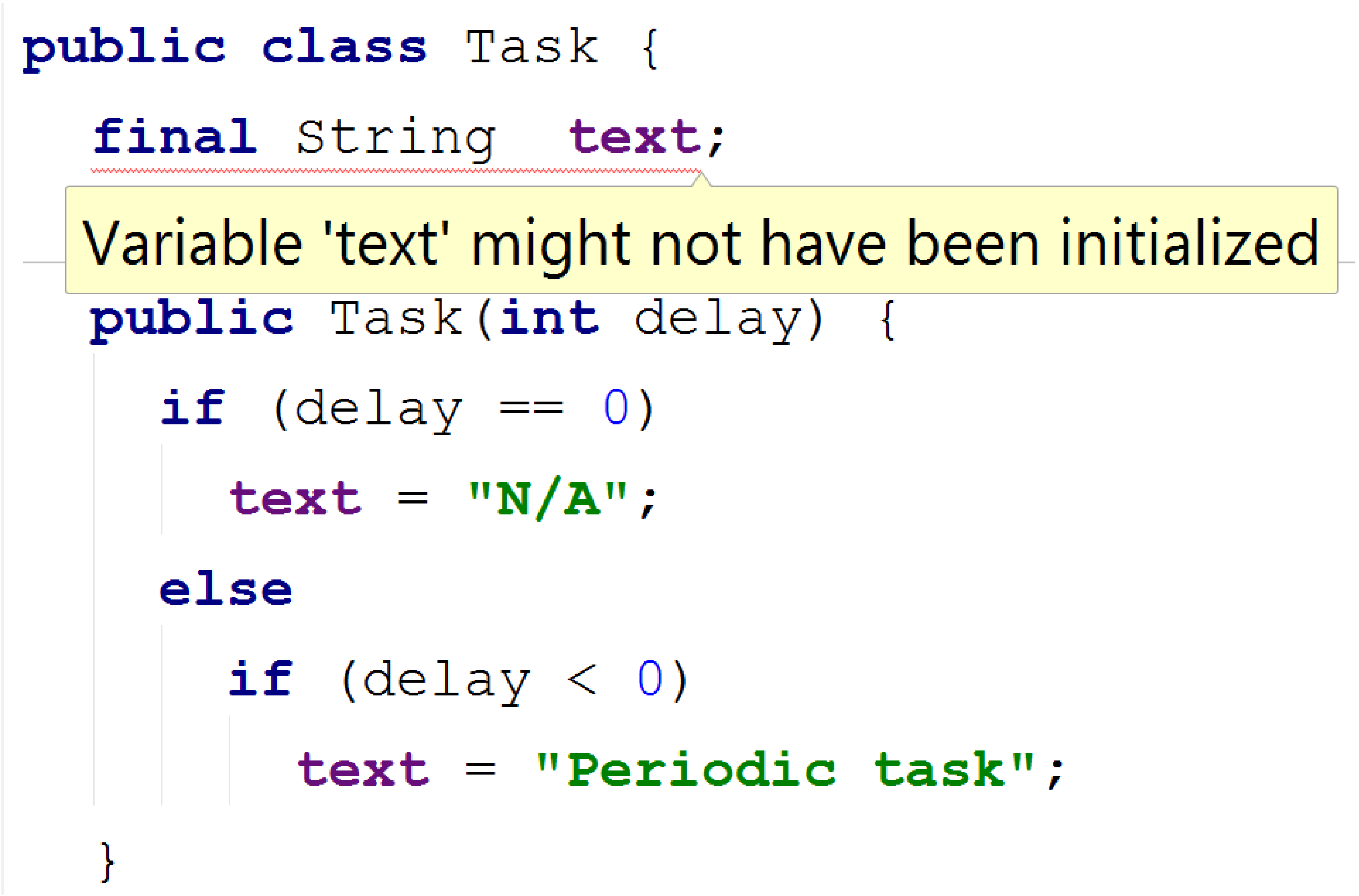


Q.E.D.

# Control flow

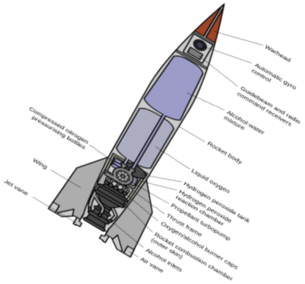


```java
public class Task {
  final String  text;

  public Task(int delay) {
    if (delay == 0)
      text = "N/A";
    else
      if (delay < 0)
        text = "Periodic task";
  }
```

Variable 'text' might not have been initialized

# Control flow.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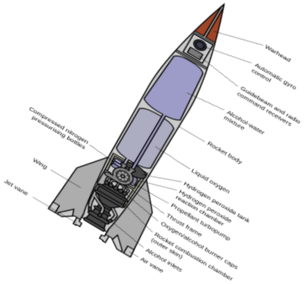
Graph connectivity problems.

# Control flow.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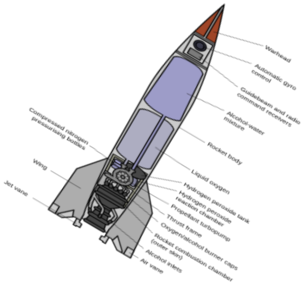
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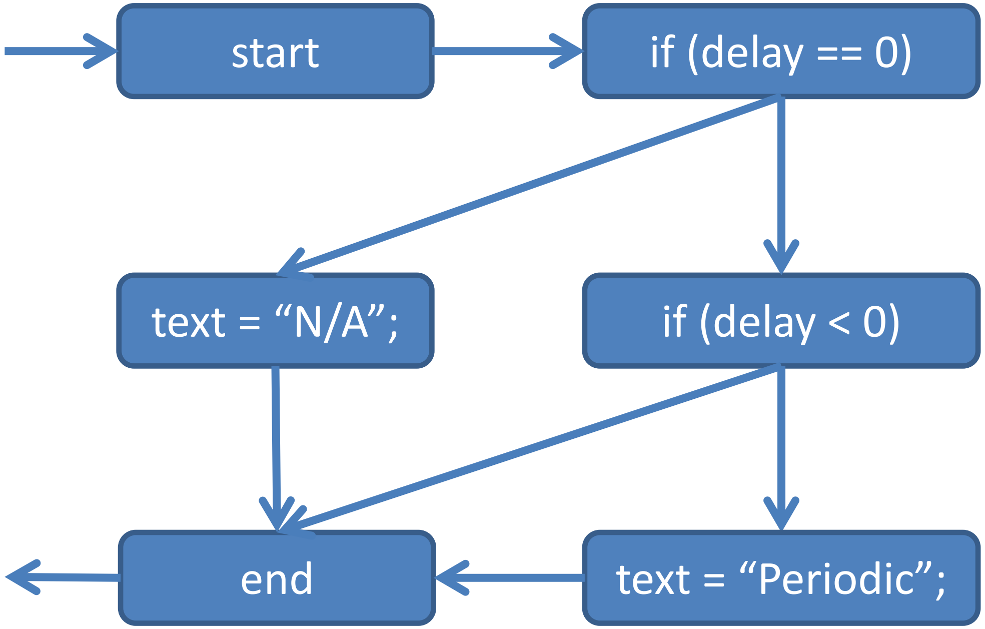
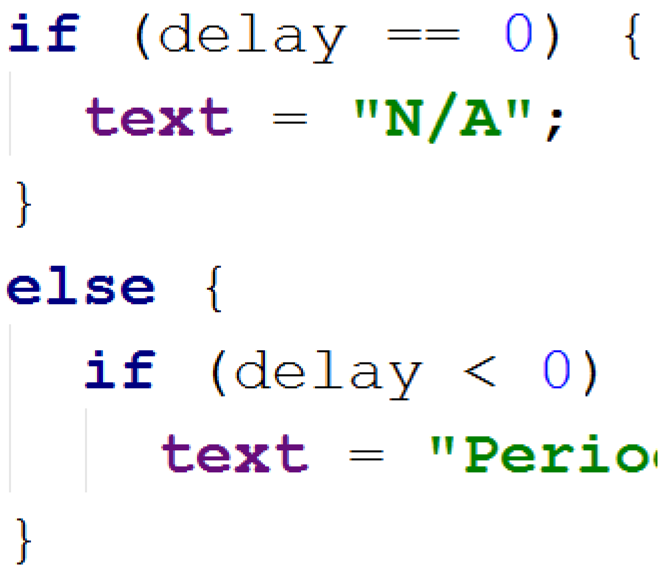
Graph connectivity problems.

Depth-first search.

# Control flow

## Graph connectivity: Definite assignment.

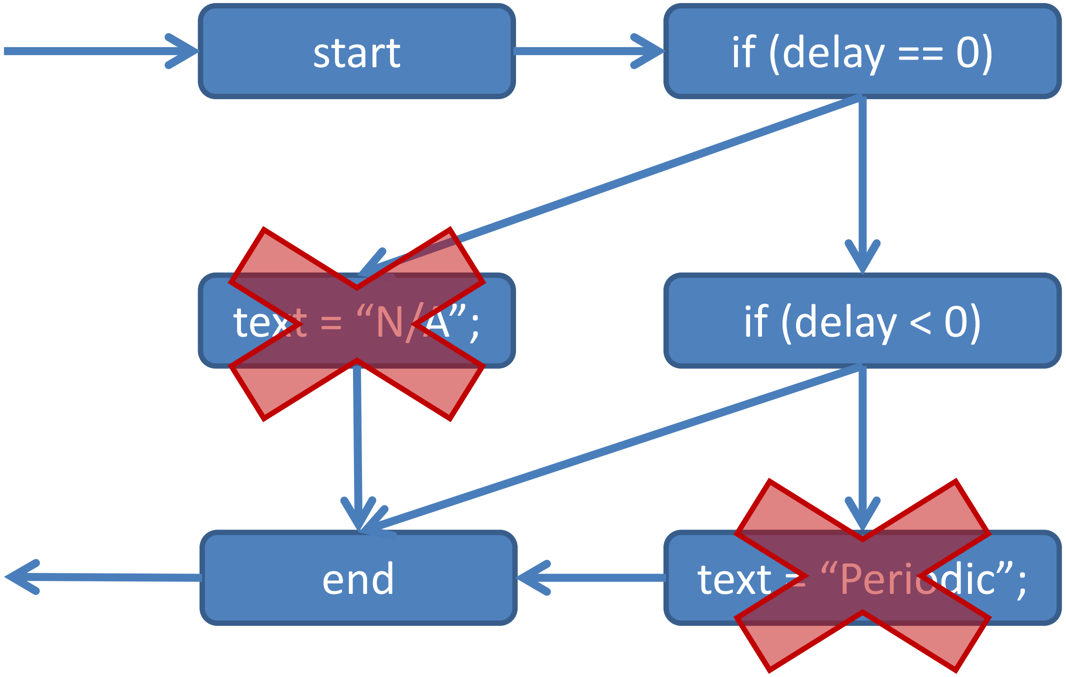




```
if (delay == 0) {
  text = "N/A";
}
else {
  if (delay < 0)
    text = "Perio
}
```

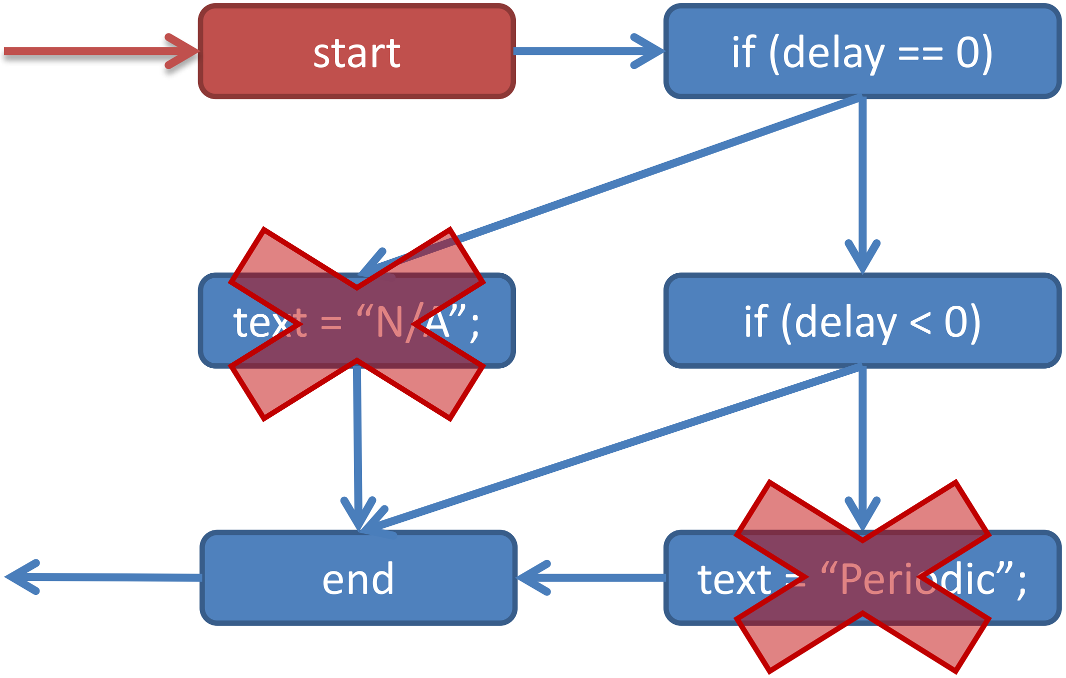
# Control flow

## Graph connectivity: Definite assignment.



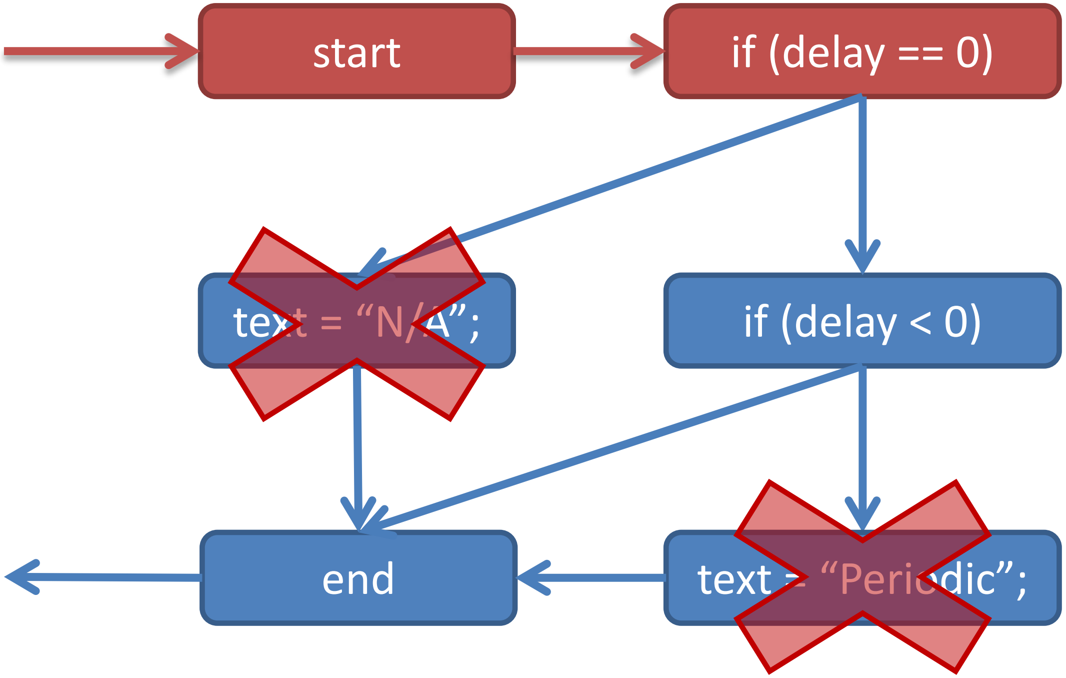
# Control flow

## Graph connectivity: Definite assignment.



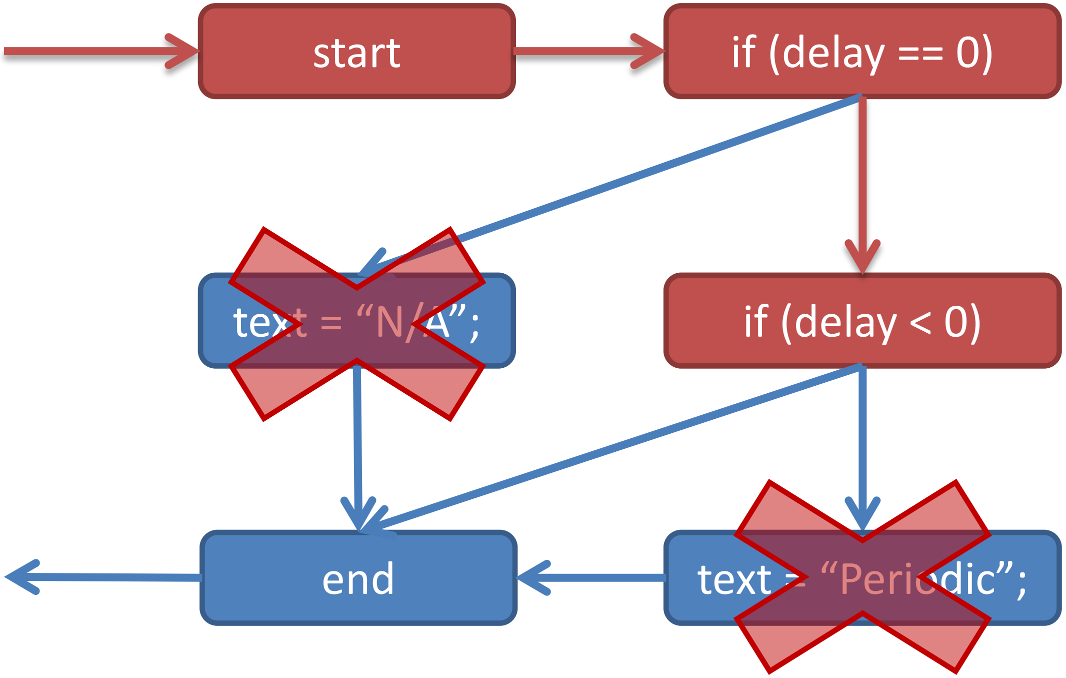
# Control flow

## Graph connectivity: Definite assignment.



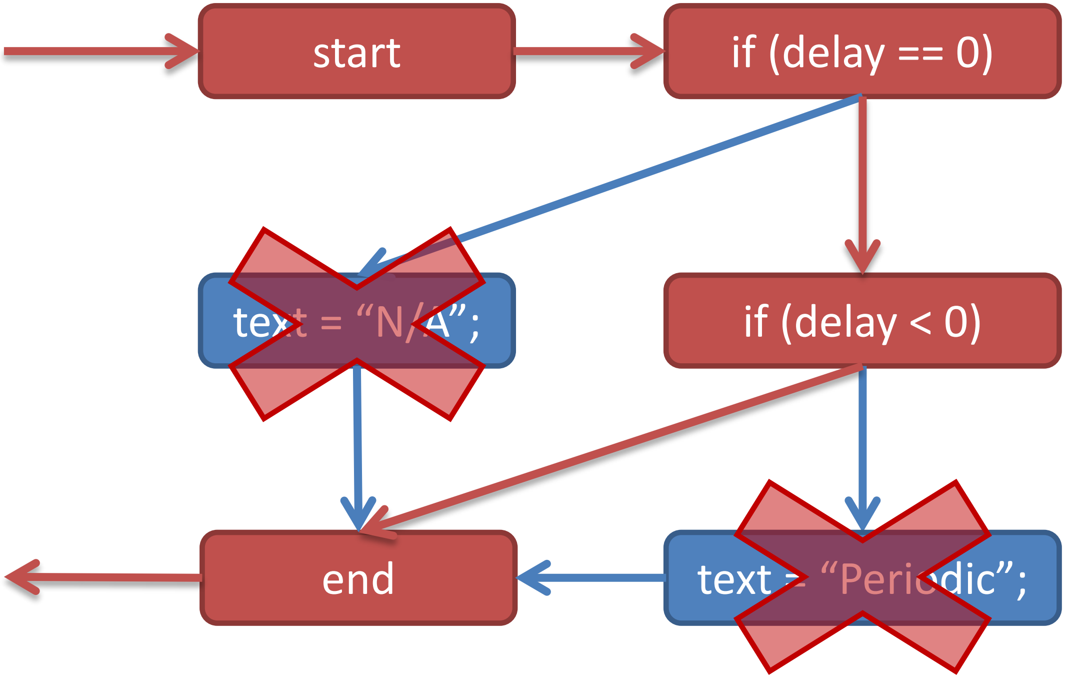
# Control flow

## Graph connectivity: Definite assignment.



# Control flow

## Graph connectivity: Definite assignment.



# Control flow

- Block can complete normally.
- Variable initialized twice.
- Variable is read before write.
- Statement is reachable.
- Variable is assigned in loop:
- Variable is definitely assigned.
- Variable is definitely not assigned.

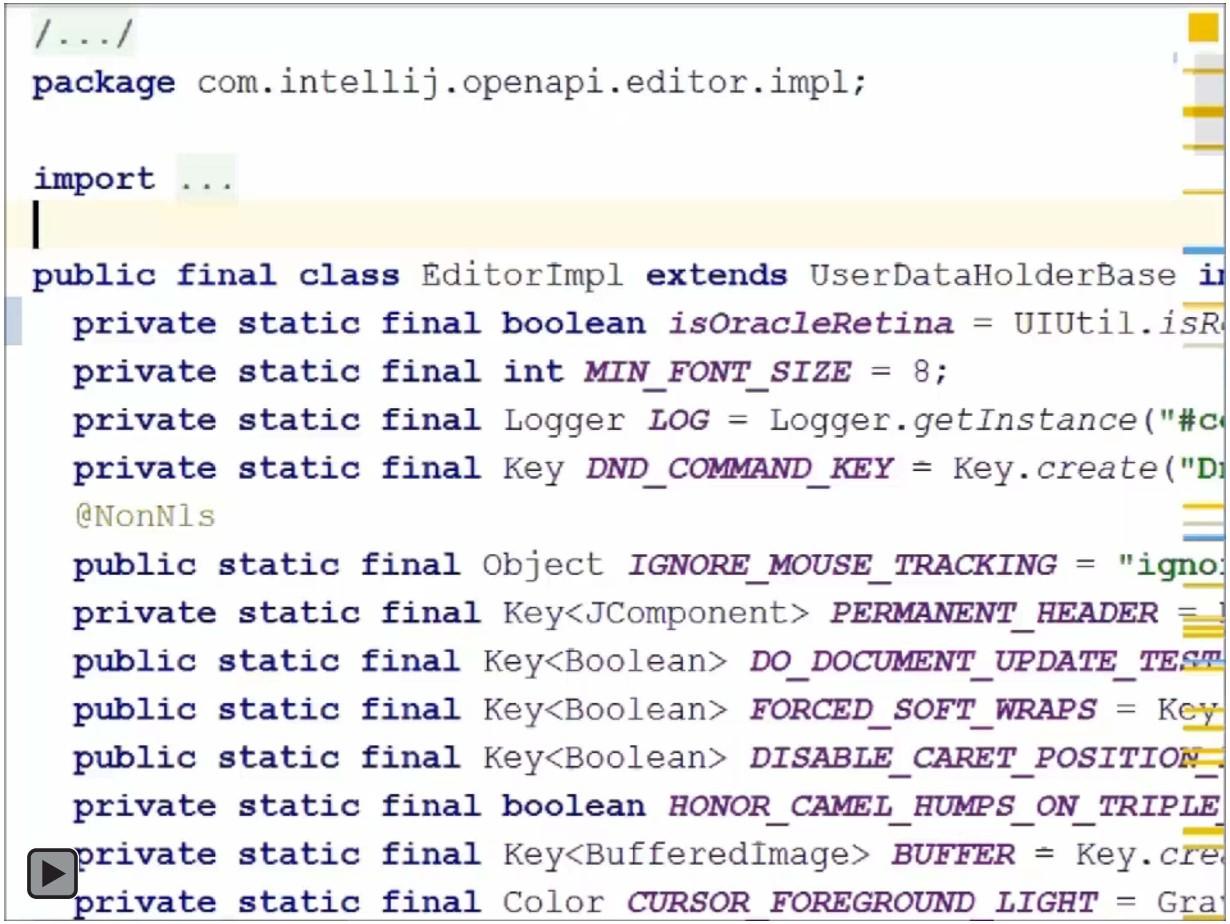
# Control flow

- Block can complete normally.
- Variable initialized twice.
- Variable is read before write.
- Statement is reachable.
- Variable is assigned in loop:
- Variable is definitely assigned.
- Variable is definitely not assigned.

# Control flow

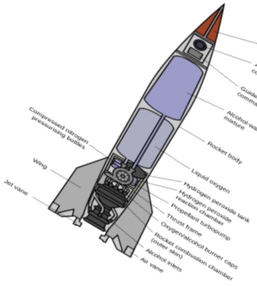
- Block can complete normally.
- Variable initialized twice.
- Variable is read before write.
- Statement is reachable.
- Variable is assigned in loop:
  - Write in cycle.
- Variable is definitely assigned.
- Variable is definitely not assigned.

# Reparse text



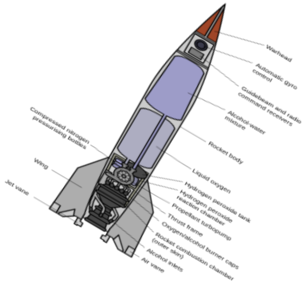
```
/.../
package com.intellij.openapi.editor.impl;

import ...

public final class EditorImpl extends UserDataHolderBase i
  private static final boolean isOracleRetina = UIUtil.isR
  private static final int MIN_FONT_SIZE = 8;
  private static final Logger LOG = Logger.getInstance("#c
  private static final Key DND_COMMAND_KEY = Key.create("D
  @NonNls
  public static final Object IGNORE_MOUSE_TRACKING = "igno
  private static final Key<JComponent> PERMANENT_HEADER = 
  public static final Key<Boolean> DO_DOCUMENT_UPDATE_TEST
  public static final Key<Boolean> FORCED_SOFT_WRAPS = Key
  public static final Key<Boolean> DISABLE_CARET_POSITION
  private static final boolean HONOR_CAMEL_HUMPS_ON_TRIPLE
  private static final Key<BufferedImage> BUFFER = Key.cre
  private static final Color CURSOR_FOREGROUND_LIGHT = Gra
```

# Reparse text


Warhead
Automatic gyro control
Guidebeam and radio command receivers
Alcohol-water mixture
Rocket body
Liquid oxygen
Hydrogen peroxide tank
Hydrogen peroxide reaction chamber
Propellant turbopump
Thrust frame
Oxygen/alcohol burner caps
Rocket combustion chamber (outer skin)
Alcohol inlets
Air vane
Compressed nitrogen pressurising bottles
Wing
Jet vane

Tree edit distance.

# Reparse text


Warhead
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Air vane
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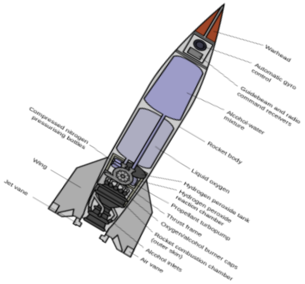
Tree edit distance.

# Reparse text


Warhead
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Hydrogen peroxide reaction chamber
Propellant turbopump
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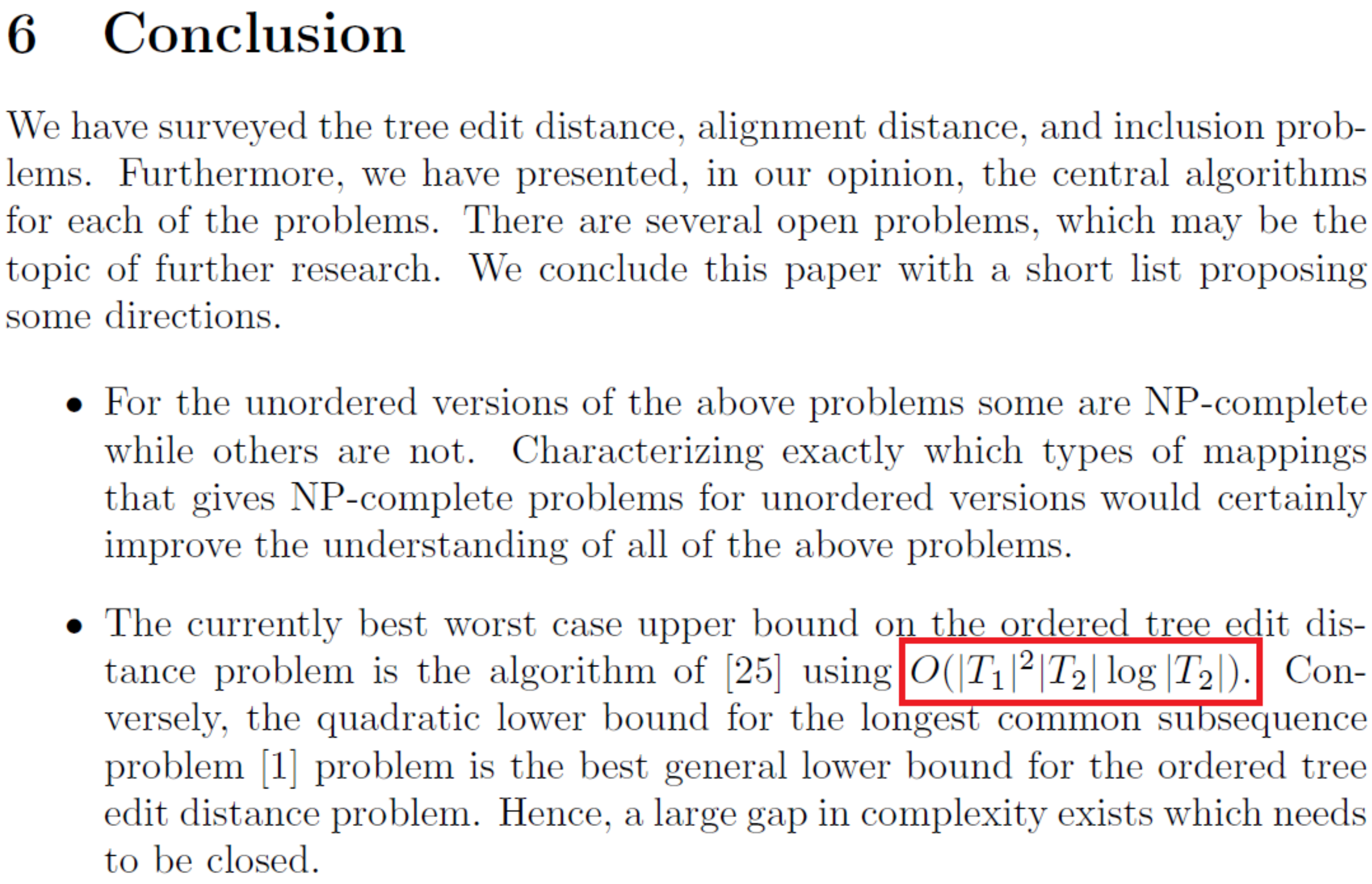
Wing
Jet vane

Tree edit distance.

Almost none. Various heuristics.

# Reparse text



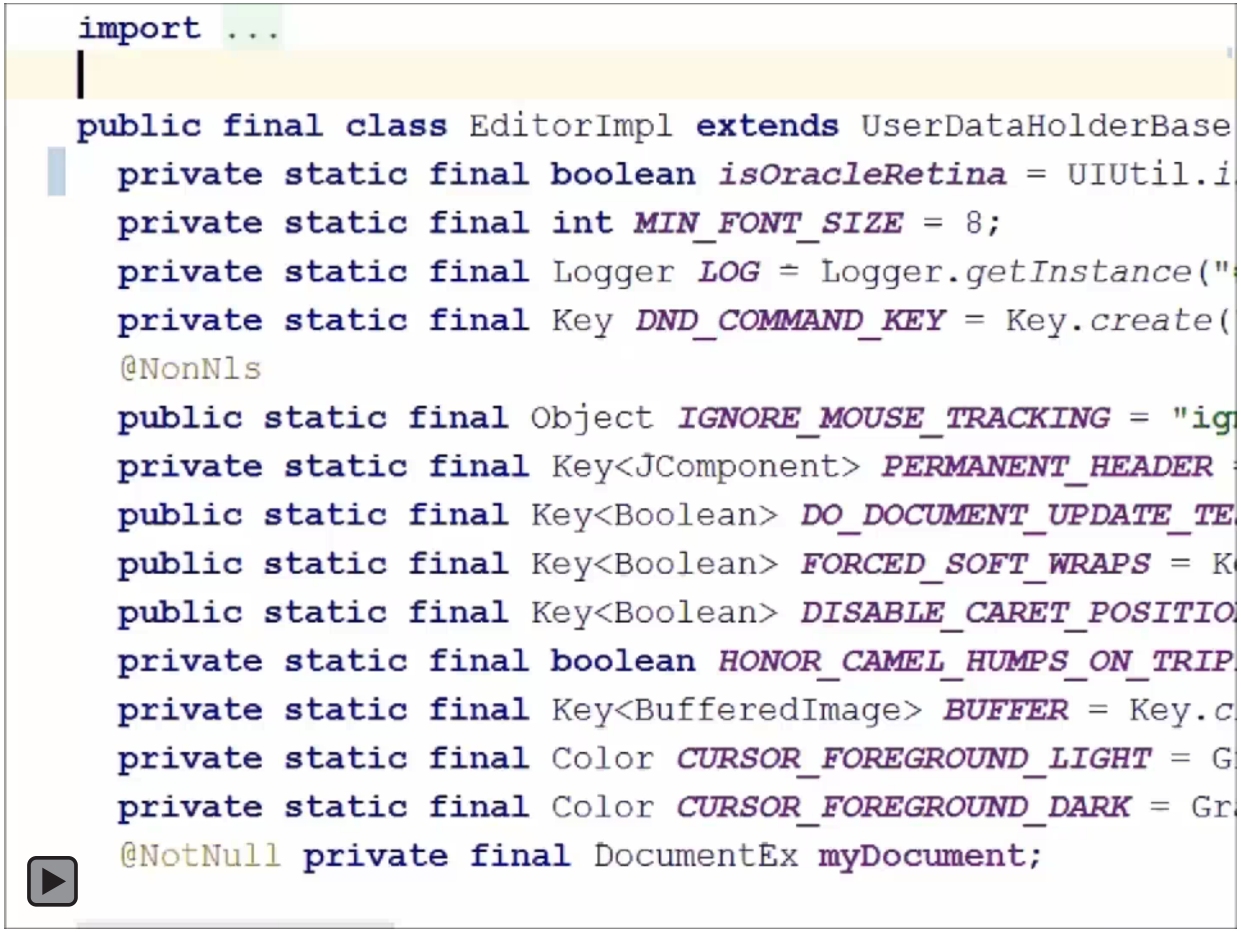
## 6 Conclusion

We have surveyed the tree edit distance, alignment distance, and inclusion problems. Furthermore, we have presented, in our opinion, the central algorithms for each of the problems. There are several open problems, which may be the topic of further research. We conclude this paper with a short list proposing some directions.

- For the unordered versions of the above problems some are NP-complete while others are not. Characterizing exactly which types of mappings that gives NP-complete problems for unordered versions would certainly improve the understanding of all of the above problems.

- The currently best worst case upper bound on the ordered tree edit distance problem is the algorithm of [25] using $\boxed{O(|T_1|^2|T_2| \log |T_2|).}$ Conversely, the quadratic lower bound for the longest common subsequence problem [1] problem is the best general lower bound for the ordered tree edit distance problem. Hence, a large gap in complexity exists which needs to be closed.

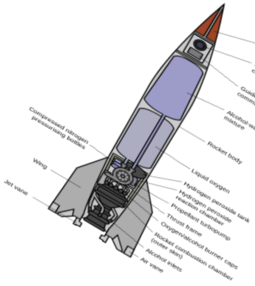
# Highlighters update



```
import ...

public final class EditorImpl extends UserDataHolderBase
  private static final boolean isOracleRetina = UIUtil.i
  private static final int MIN_FONT_SIZE = 8;
  private static final Logger LOG = Logger.getInstance("
  private static final Key DND_COMMAND_KEY = Key.create(
  @NonNls
  public static final Object IGNORE_MOUSE_TRACKING = "ig
  private static final Key<JComponent> PERMANENT_HEADER =
  public static final Key<Boolean> DO_DOCUMENT_UPDATE_TE
  public static final Key<Boolean> FORCED_SOFT_WRAPS = K
  public static final Key<Boolean> DISABLE_CARET_POSITIO
  private static final boolean HONOR_CAMEL_HUMPS_ON_TRIP
  private static final Key<BufferedImage> BUFFER = Key.c
  private static final Color CURSOR_FOREGROUND_LIGHT = G
  private static final Color CURSOR_FOREGROUND_DARK = Gr
  @NotNull private final DocumentEx myDocument;
```

# Highlighters update


Warhead
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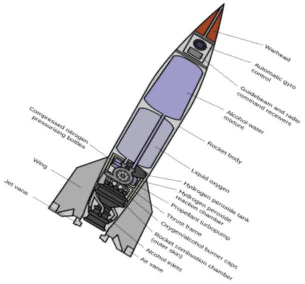
Rocket body
Compressed nitrogen pressurising bottles
Wing
Jet vane
Liquid oxygen
Hydrogen peroxide tank
Hydrogen peroxide reaction chamber
Propellant turbopump
Thrust frame
Oxygen/alcohol burner caps
Rocket combustion chamber (outer skin)
Alcohol inlets
Air vane

Intervals stabbing queries/update.

# Highlighters update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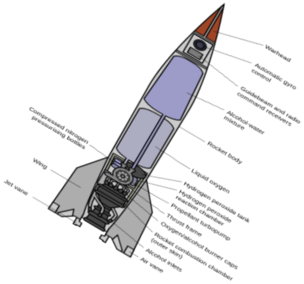
Intervals stabbing queries/update.

# Highlighters update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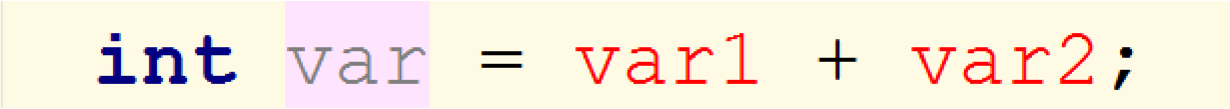
Compressed nitrogen pressurising bottles
Wing
Jet vane

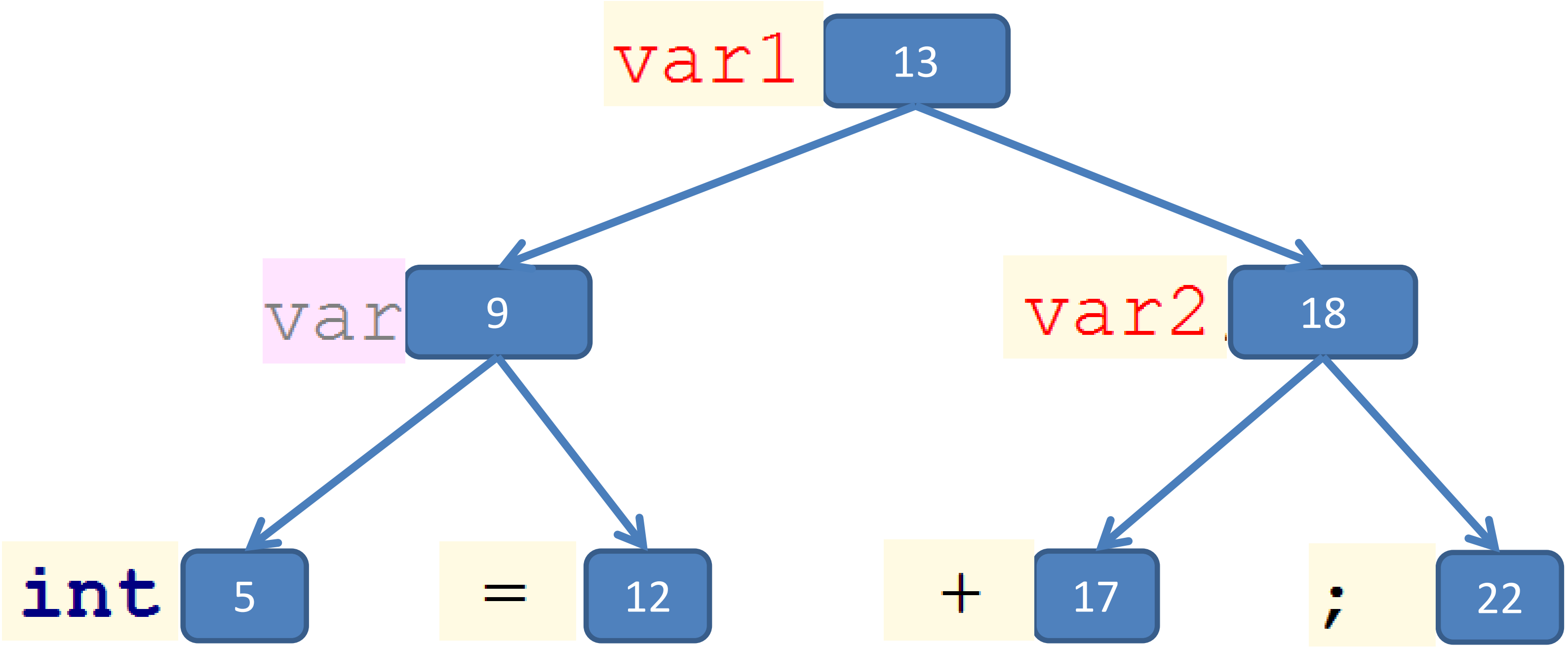
Intervals stabbing queries/update.

Augmented interval tree.

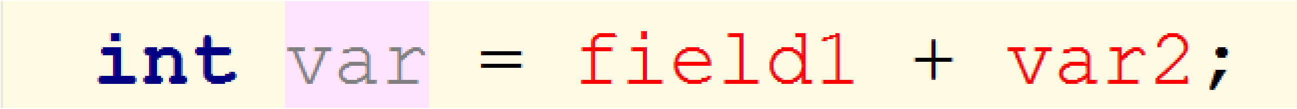
# Highlighters update
# Augmented interval tree



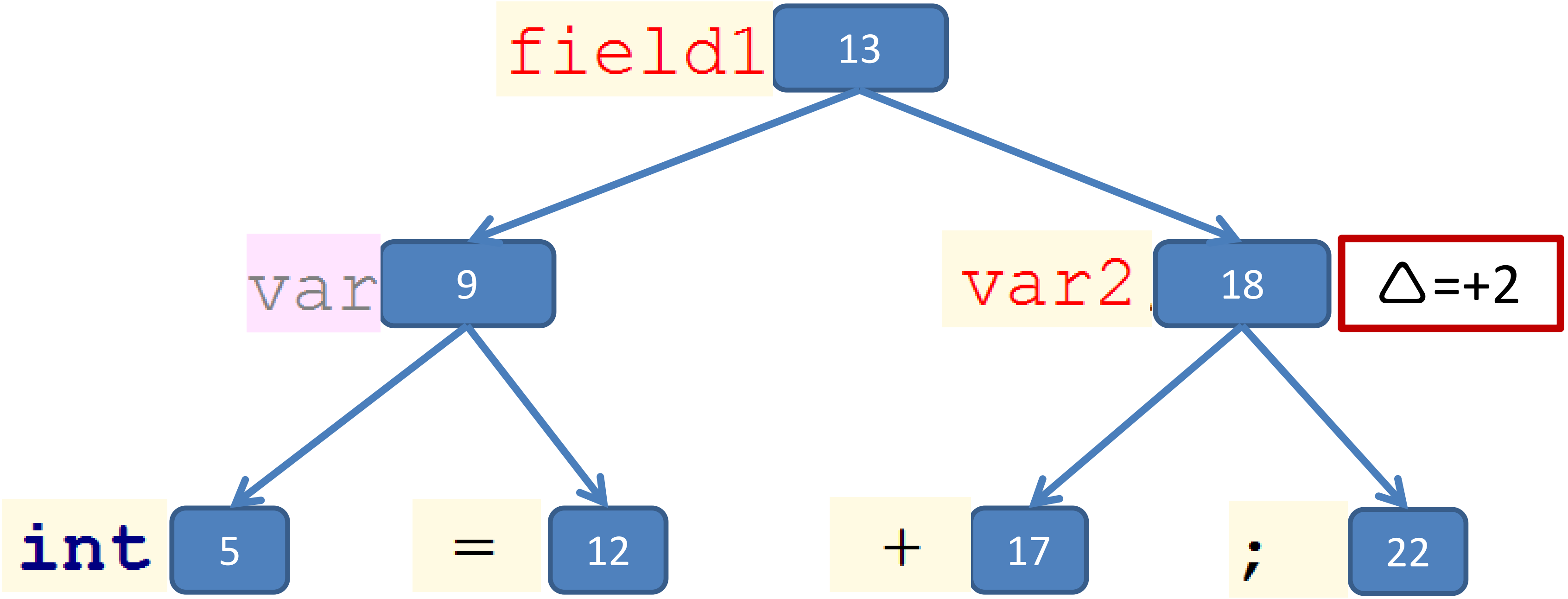
```
int var = var1 + var2;
```



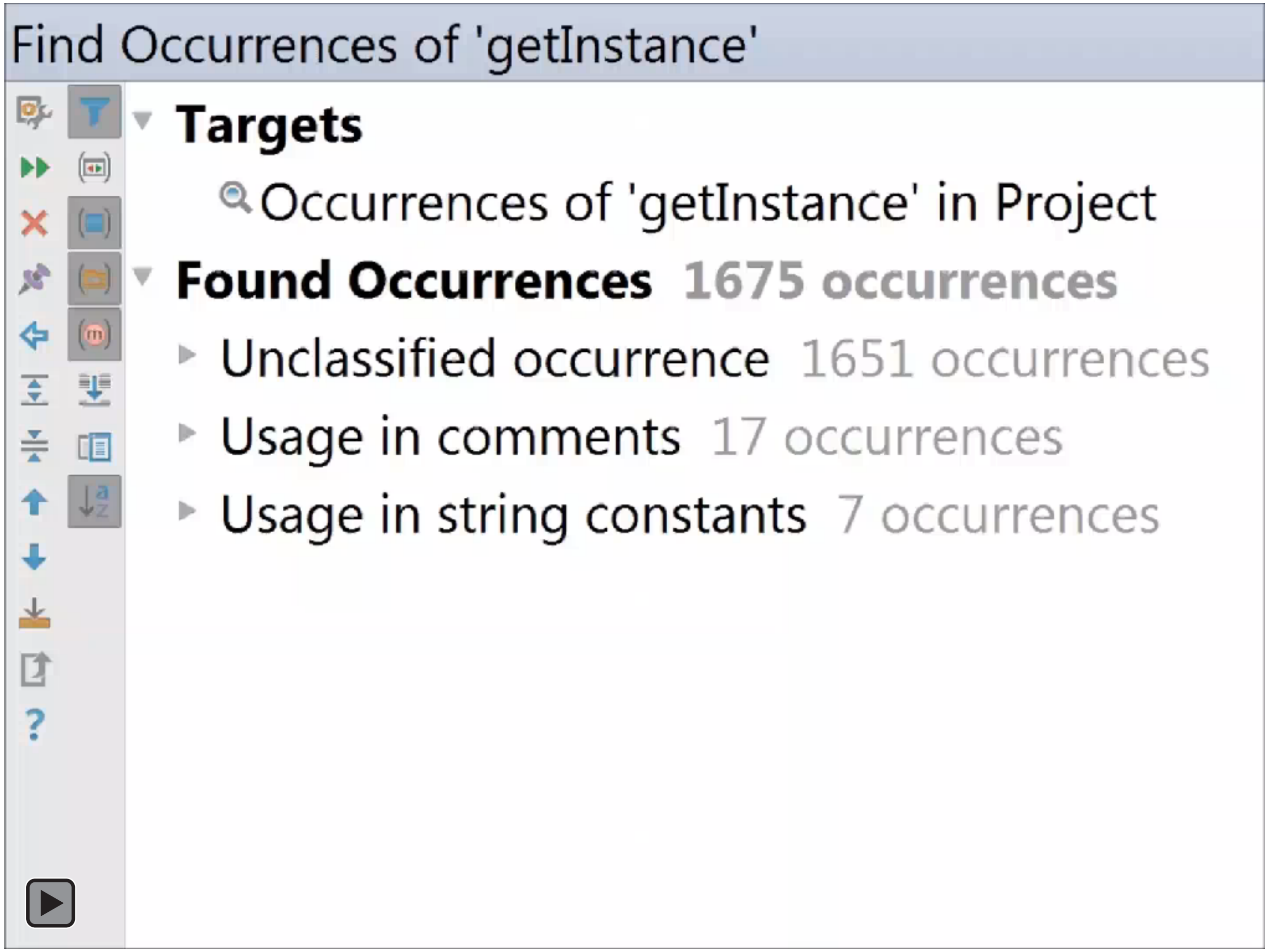
# Highlighters update
# Augmented interval tree



```
int var = field1 + var2;
```



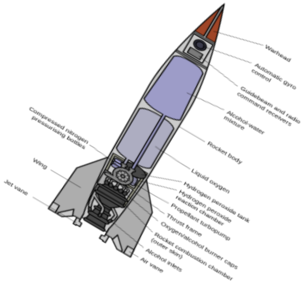
# Find In Path



Find Occurrences of 'getInstance'

- Targets
  - Occurrences of 'getInstance' in Project
- Found Occurrences 1675 occurrences
  - Unclassified occurrence 1651 occurrences
  - Usage in comments 17 occurrences
  - Usage in string constants 7 occurrences

# Find In Path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Hydrogen peroxide reaction chamber
Propellant turbopump
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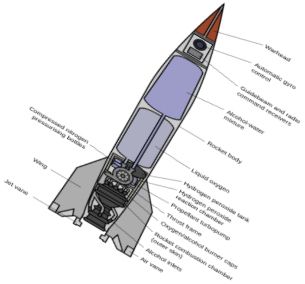
Wing
Jet vane

Fast substring search.

# Find In Path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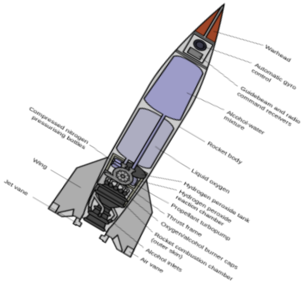
Fast substring search.

# Find In Path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Hydrogen peroxide reaction chamber
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Rocket combustion chamber (outer skin)
Alcohol inlets
Air vane

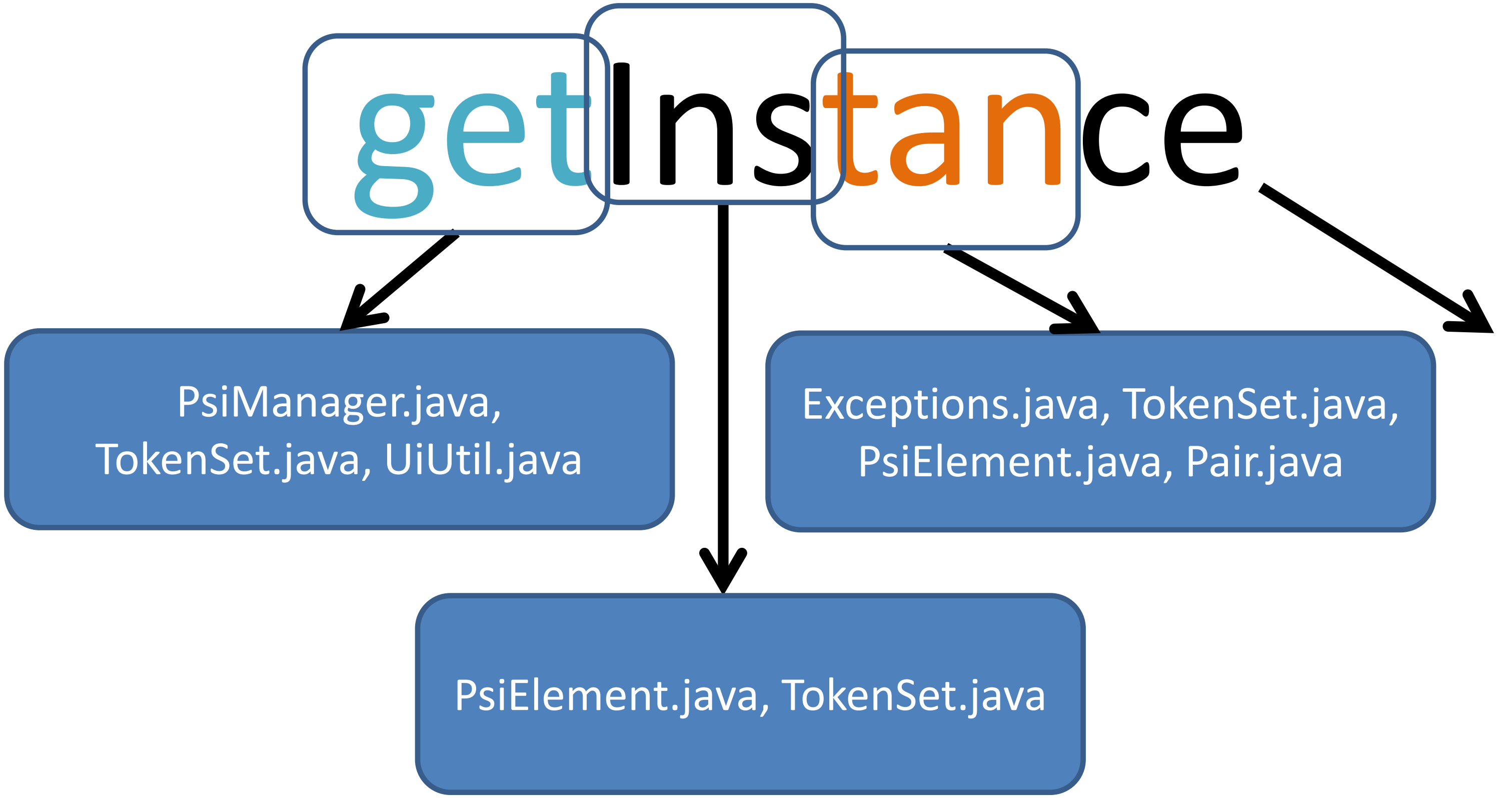
Fast substring search.

Trigram index +

Boyer–Moore.

# Find In Path

## Trigram index:



getInstance

PsiManager.java, TokenSet.java, UiUtil.java

Exceptions.java, TokenSet.java, PsiElement.java, Pair.java

PsiElement.java, TokenSet.java

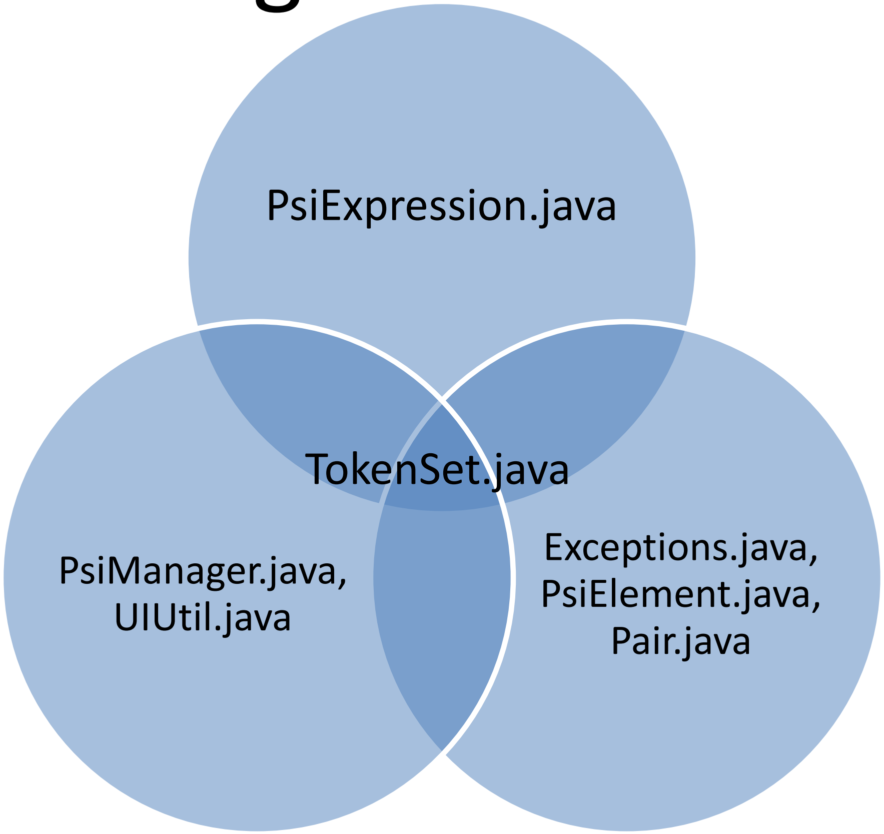
# Find In Path
# Trigram index:

PsiManager.java, TokenSet.java, UiUtil.java

Exceptions.java, TokenSet.java, PsiElement.java, Pair.java

PsiElement.java, TokenSet.java

# Find In Path
# Trigram index:



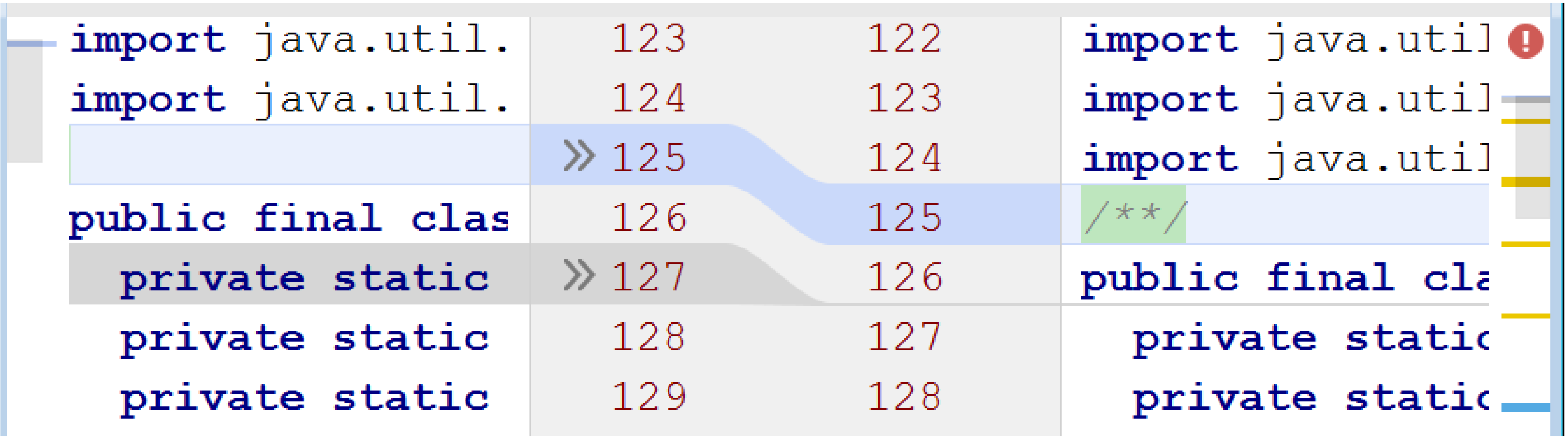
PsiExpression.java

TokenSet.java

PsiManager.java,
UIUtil.java

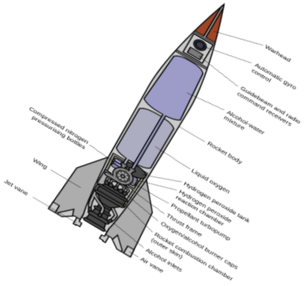
Exceptions.java,
PsiElement.java,
Pair.java

# Diff



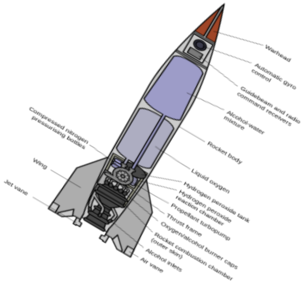
```
import java.util.      123   122   import java.util
import java.util.      124   123   import java.util
                    »  125   124   import java.util
public final clas      126   125   /**/
  private static    »  127   126   public final cla
  private static       128   127     private static
  private static       129   128     private static
```

# Diff



Longest common subsequence.

# Diff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Hydrogen peroxide reaction chamber
Propellant turbopump
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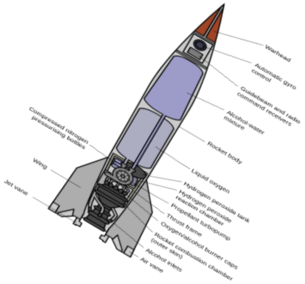
Rocket combustion chamber (outer skin)
Alcohol inlets
Air vane
Compressed nitrogen pressurising bottles
Wing
Jet vane

Longest common subsequence.

# Diff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Propellant turbopump
Thrust frame
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Air vane

Longest common subsequence.

Dynamic programming +

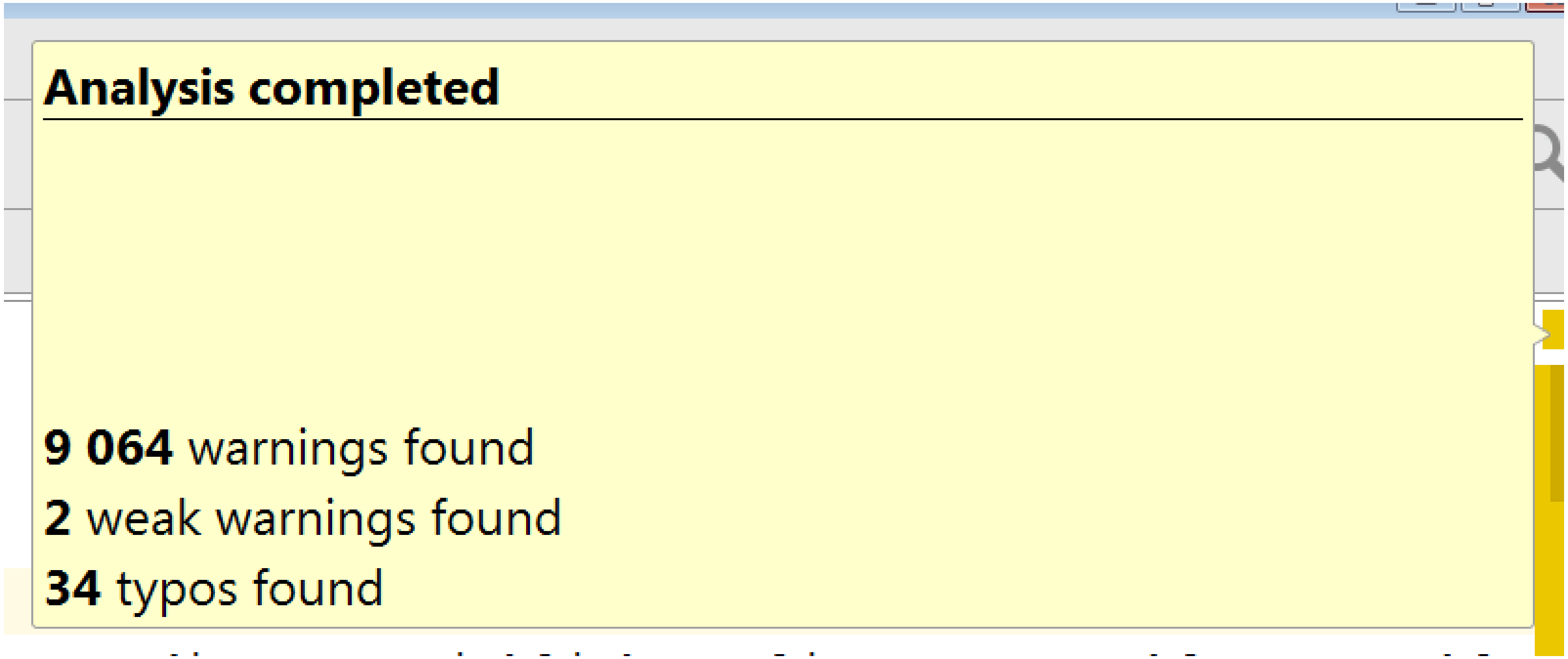
Patience Diff.

# Diff

## LCS via dynamic programming

$$LCS(X_i, Y_j) = \begin{cases} LCS(X_{i-1}, Y_{j-1}) \cup \ x_i : x_i = y_i \\ \max LCS(X_i, Y_{j-1}), LCS(X_{i-1}, Y_j): \ x_i \neq y_i \end{cases}$$

# Allocating tokens



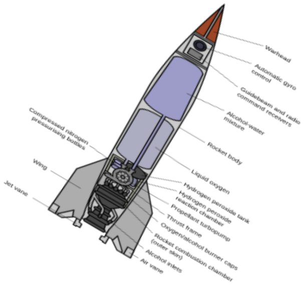
**Analysis completed**

**9 064** warnings found

**2** weak warnings found

**34** typos found

# Allocating tokens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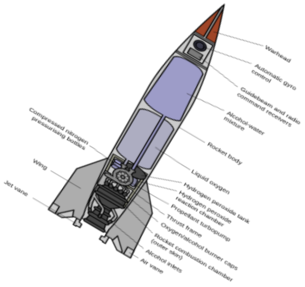
Object pooling.

# Allocating tokens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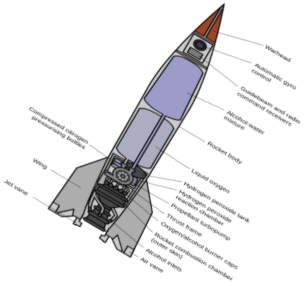
Object pooling.

# Allocating tokens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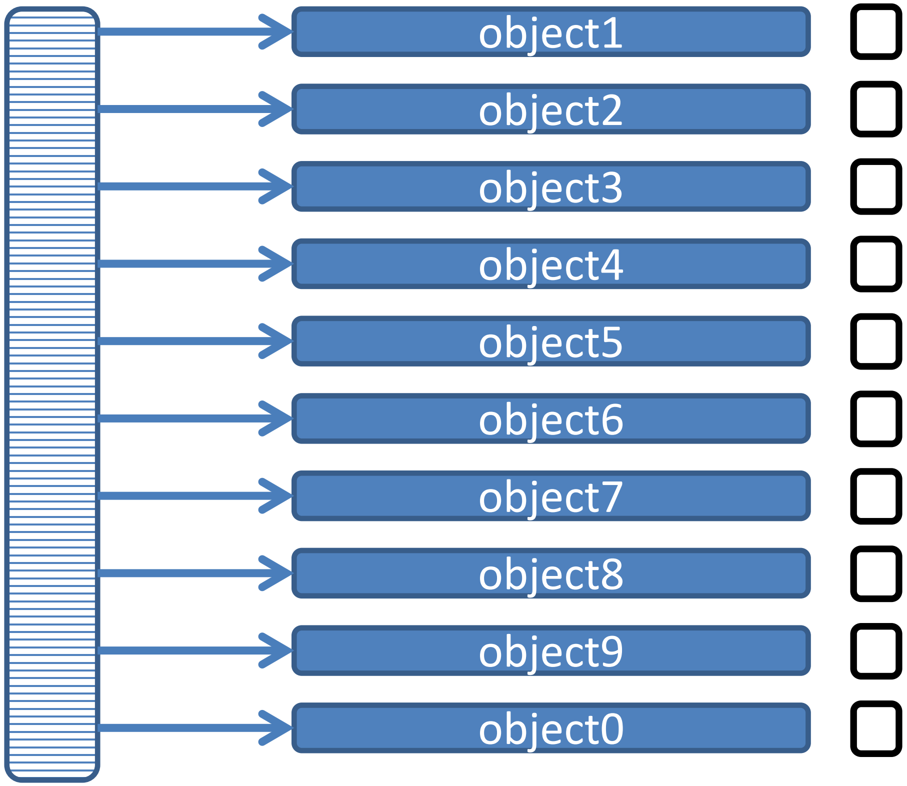
Object pooling.

Lock-free fixed-size object pool.

# Allocating tokens

## Lock-free fixed-size object pool



object1 □

object2 □

object3 □

object4 □

object5 □

object6 □

object7 □

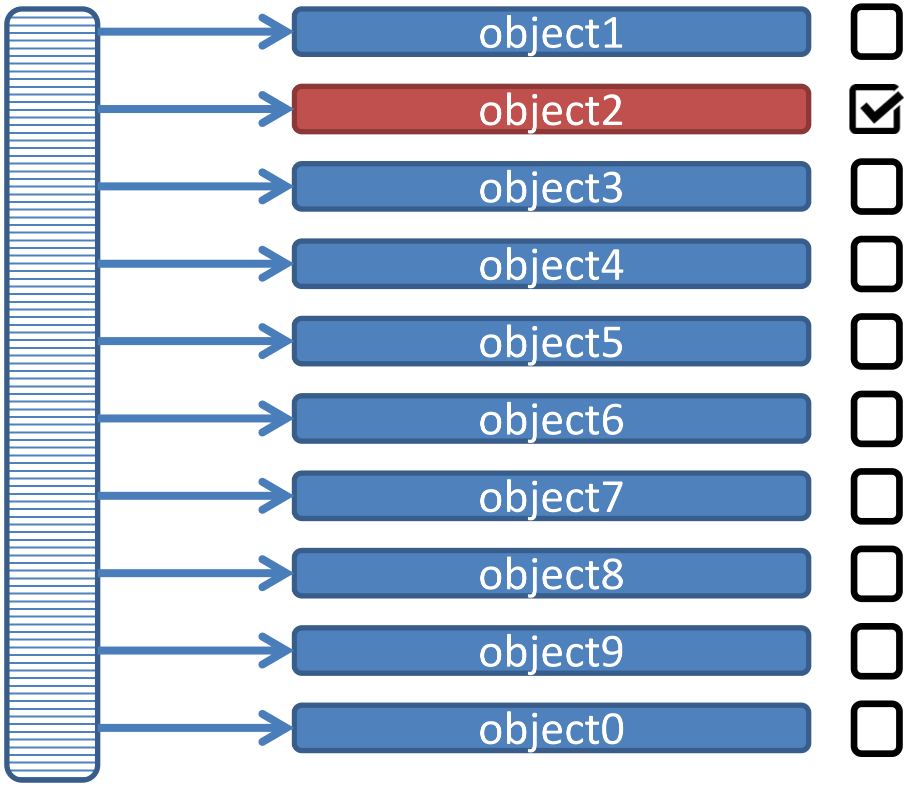
object8 □

object9 □

object0 □

# Allocating tokens

## Lock-free fixed-size object pool



object1 □

object2 ☑

object3 □

object4 □

object5 □

object6 □

object7 □

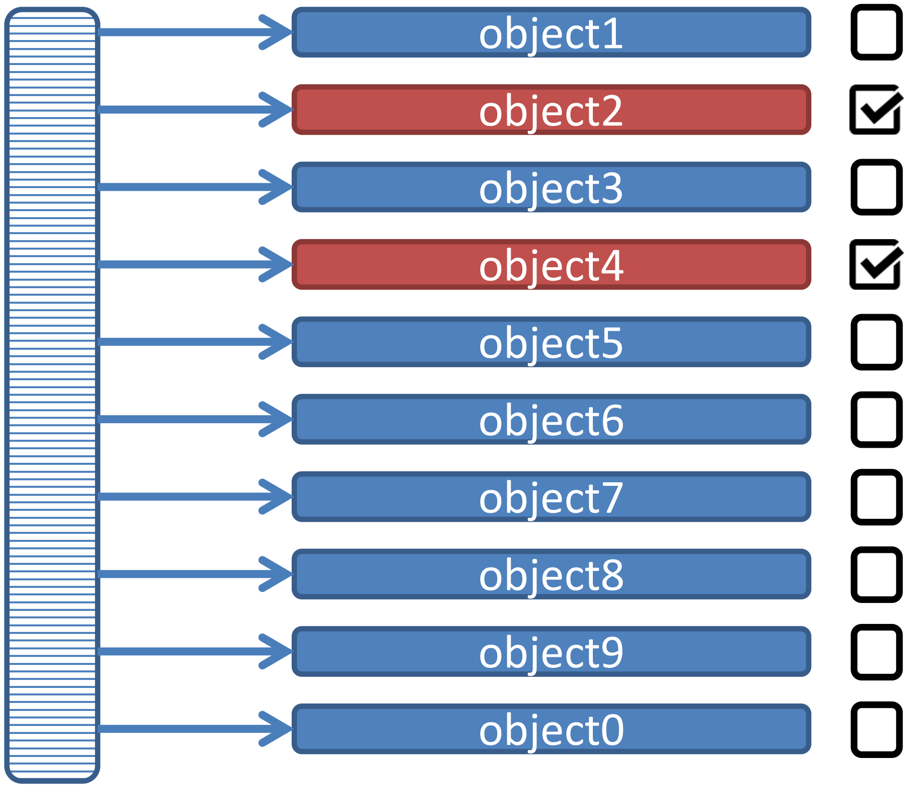
object8 □

object9 □

object0 □

# Allocating tokens

## Lock-free fixed-size object pool



object1 □

object2 ☑

object3 □

object4 ☑

object5 □

object6 □

object7 □

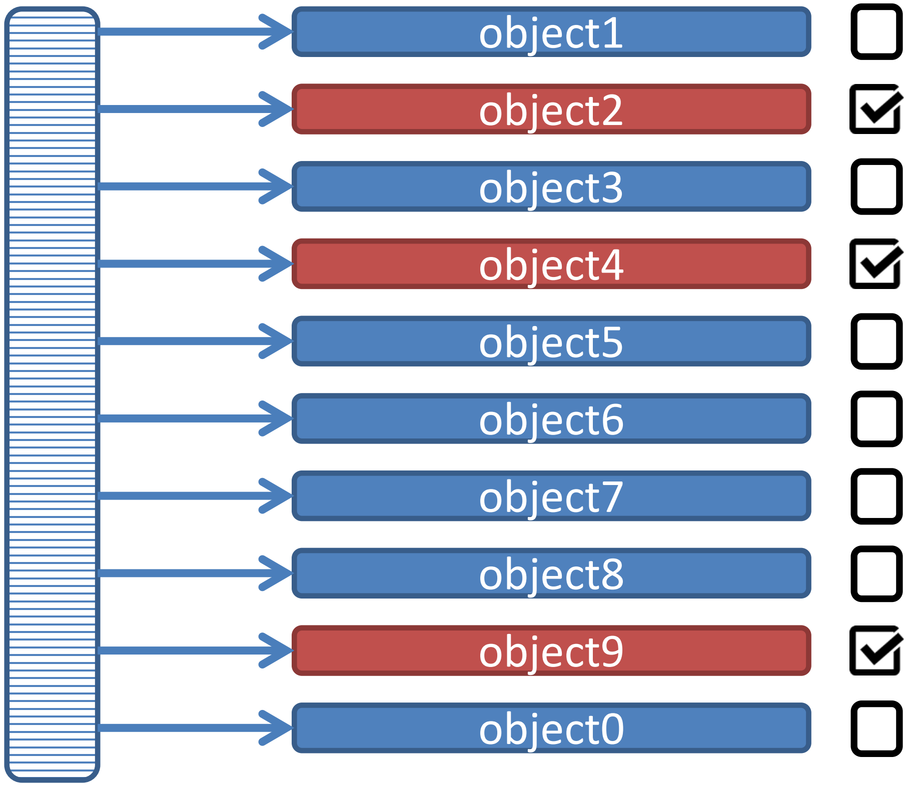
object8 □

object9 □

object0 □

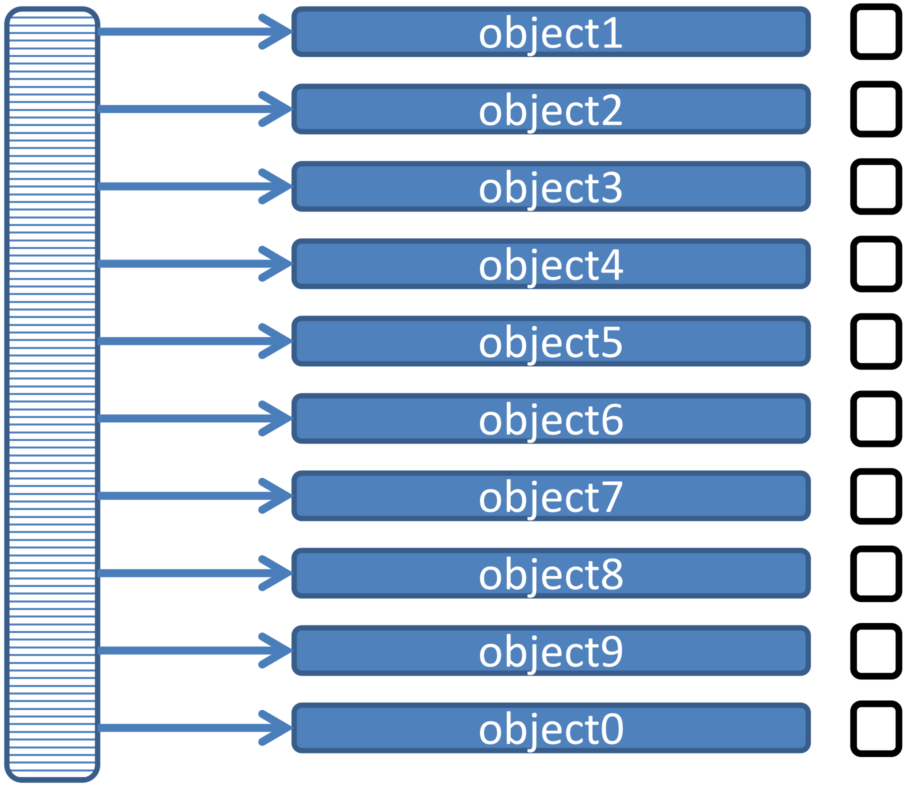
# Allocating tokens

## Lock-free fixed-size object pool

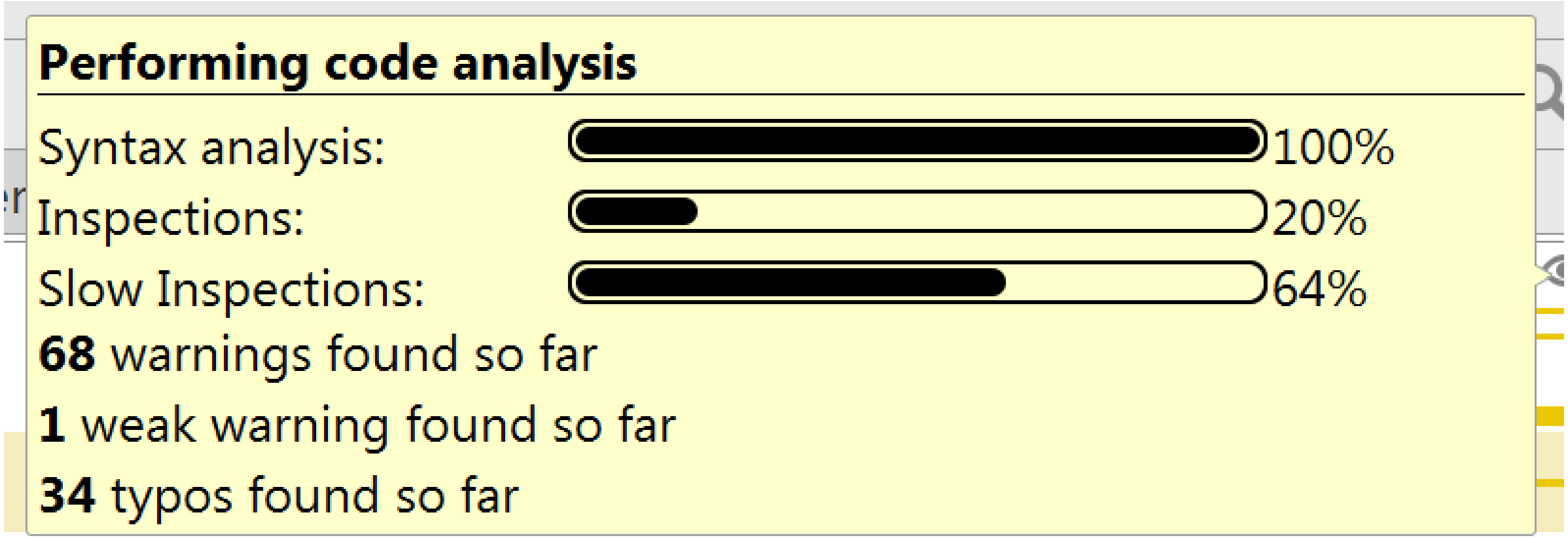


# Allocating tokens

## Lock-free fixed-size object pool



# Multi-threaded inspections



**Performing code analysis**

Syntax analysis: 100%

Inspections: 20%

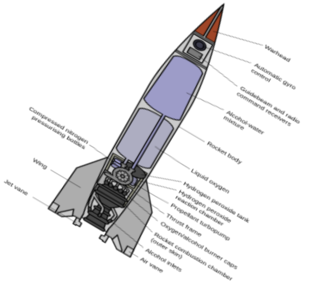
Slow Inspections: 64%

**68** warnings found so far

**1** weak warning found so far

**34** typos found so far

# Multi-threaded inspections


Warhead
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Rocket body
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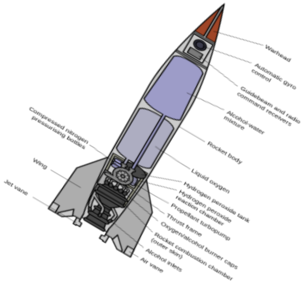
Thrust frame
Oxygen/alcohol burner caps
Rocket combustion chamber (outer skin)
Alcohol inlets
Air vane
Compressed nitrogen pressurising bottles
Wing
Jet vane

Scalable read-write lock.

# Multi-threaded inspections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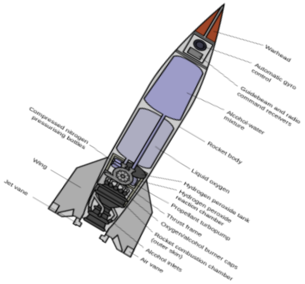
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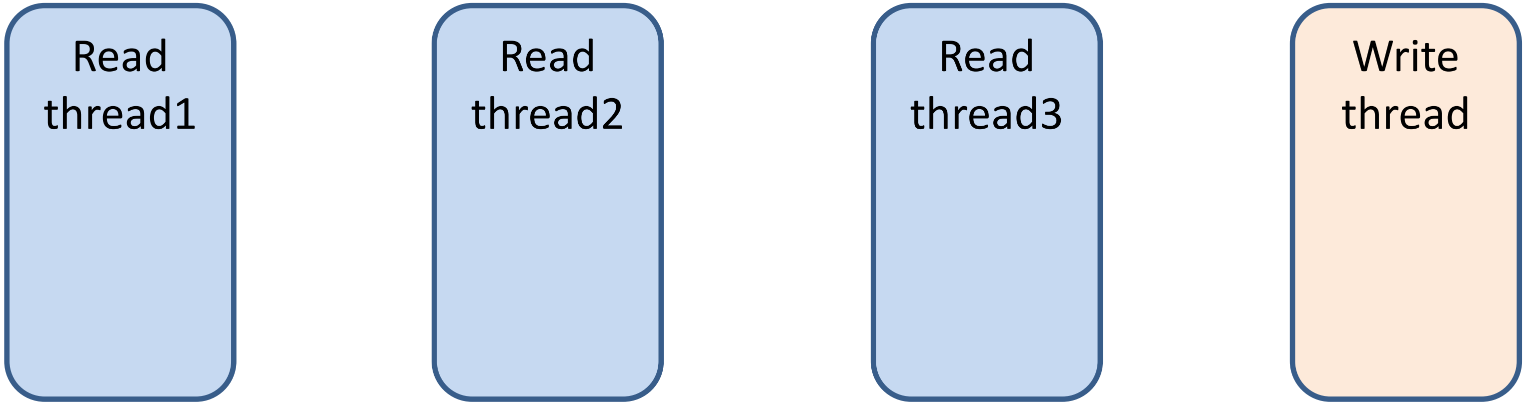
Scalable read-write lock.

Thread-local-based storage +

volatile flags.

# Multi-threaded inspections

## Thread-locals + volatile flags



Read thread1

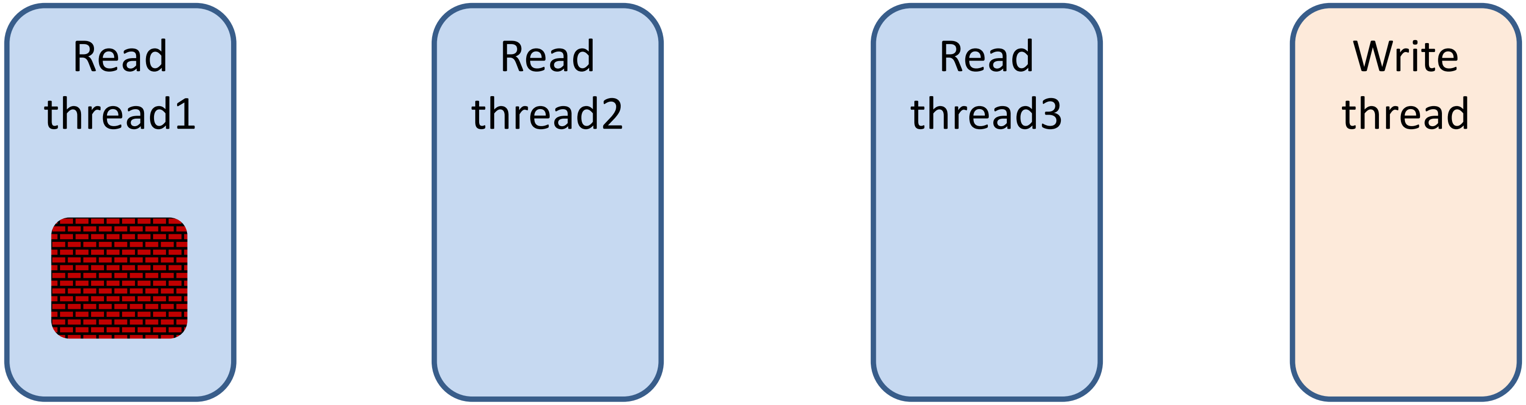
Read thread2

Read thread3

Write thread

# Multi-threaded inspections

## Thread-locals + volatile flags



Read thread1

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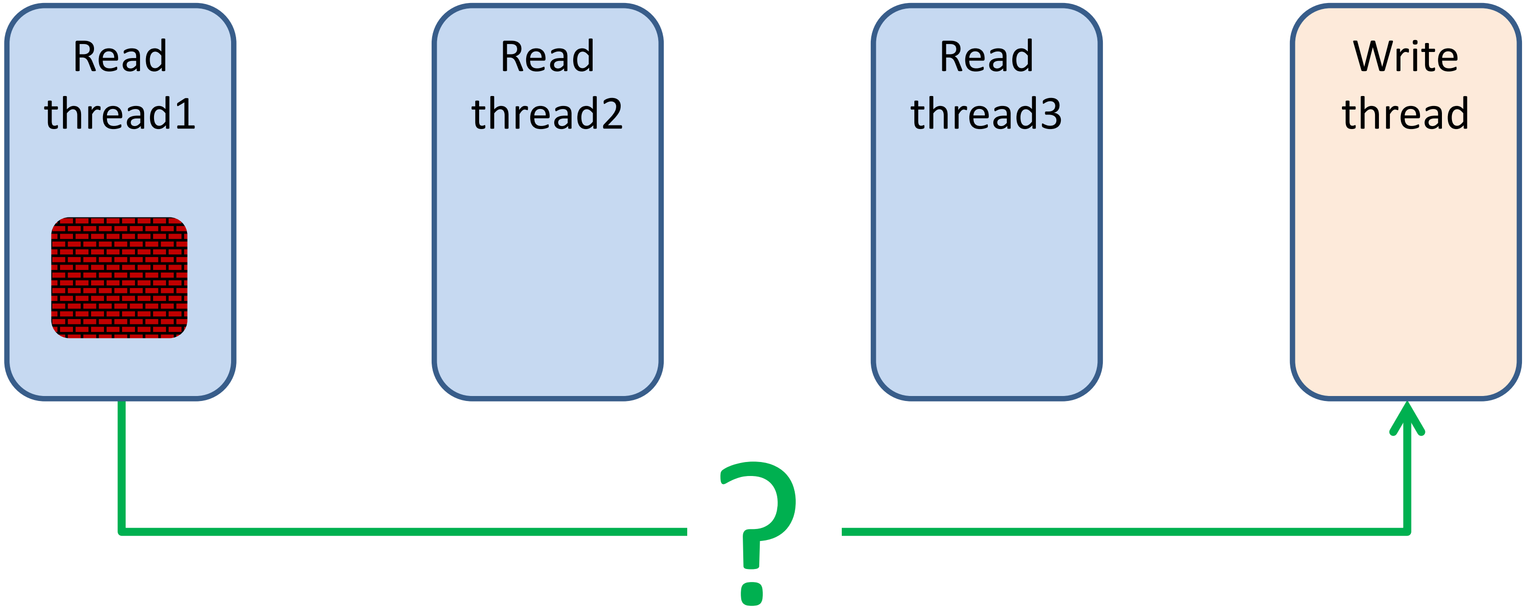
Write thread

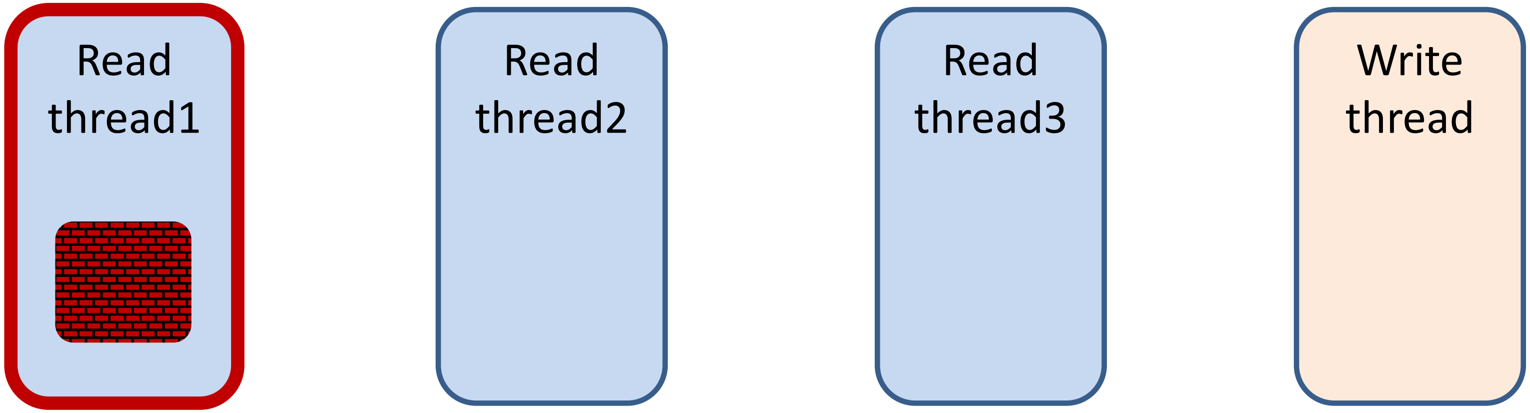
# Multi-threaded inspections

## Thread-locals + volatile flags



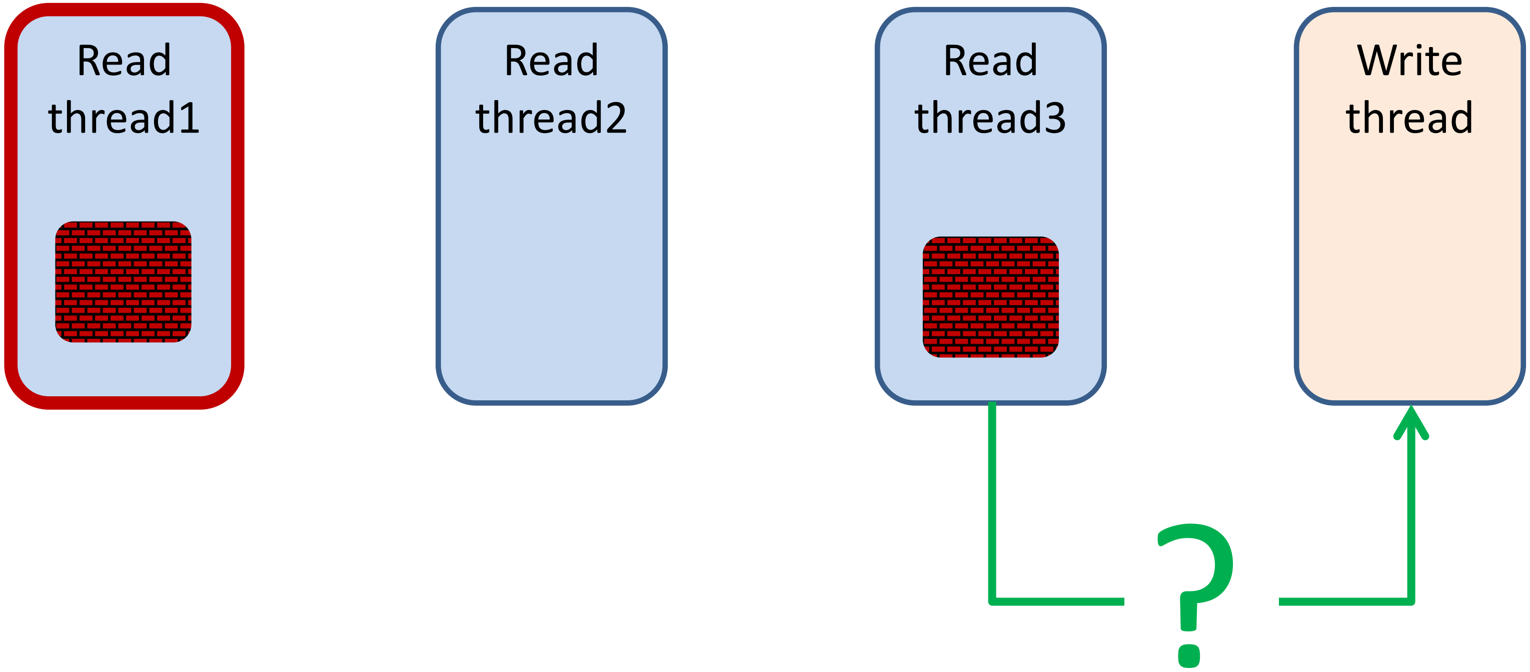
# Multi-threaded inspections

## Thread-locals + volatile flags



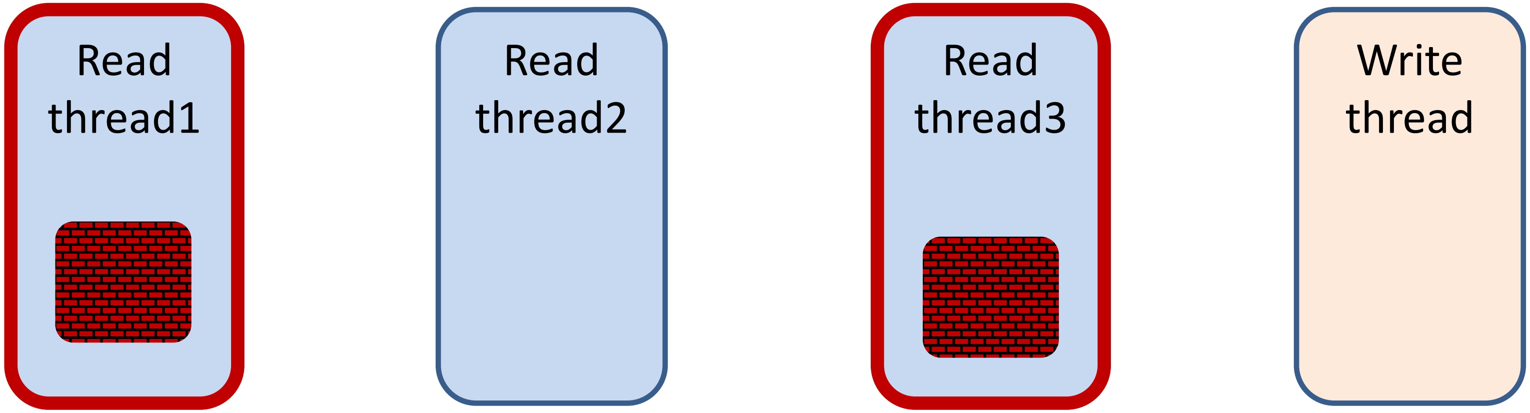
# Multi-threaded inspections

## Thread-locals + volatile flags



# Multi-threaded inspections

## Thread-locals + volatile flags



Read thread1

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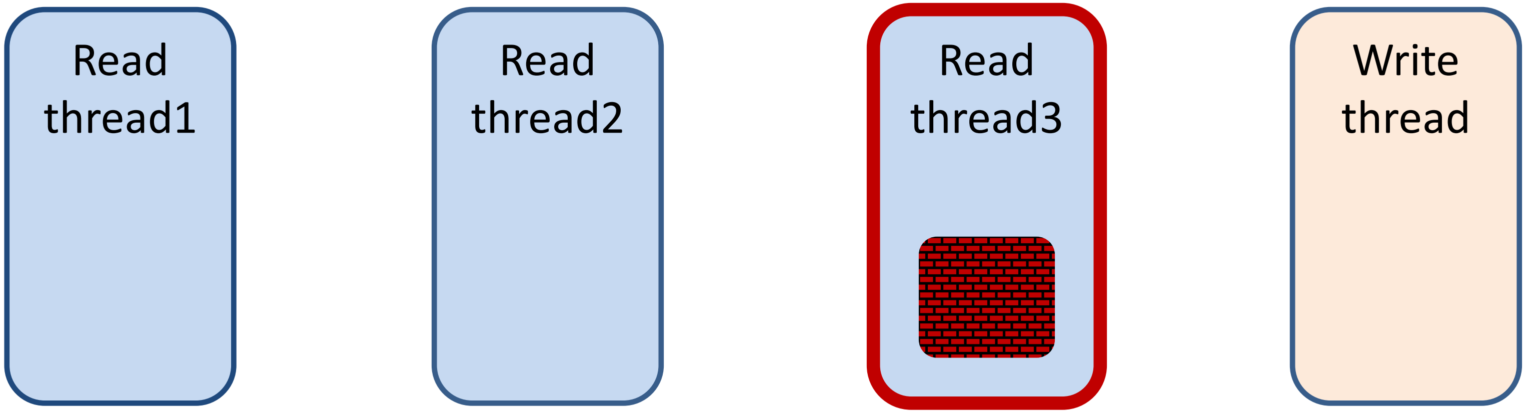
# Multi-threaded inspections

## Thread-locals + volatile flags



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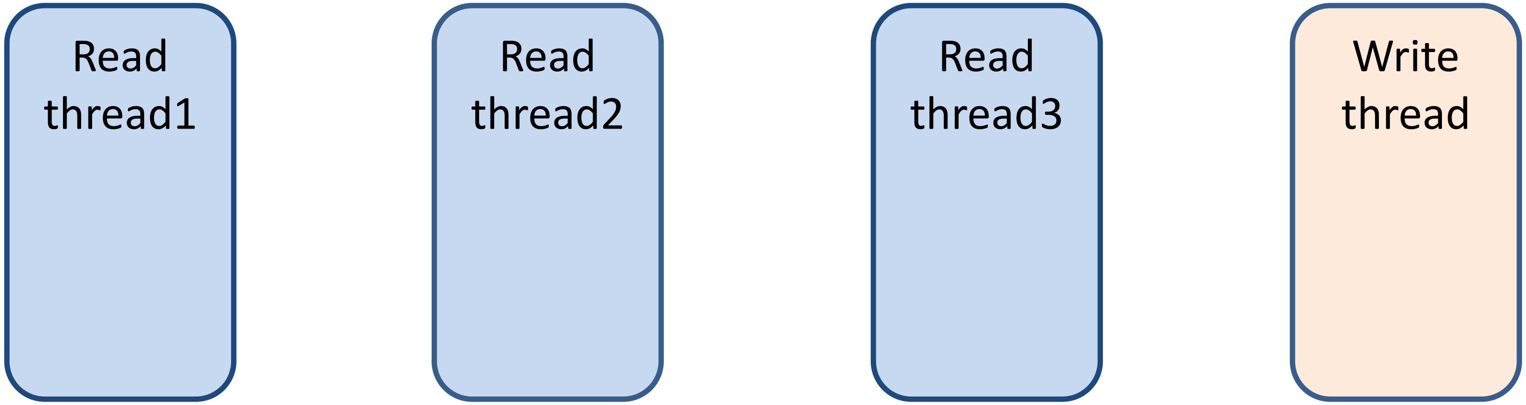
# Multi-threaded inspections

## Thread-locals + volatile flags



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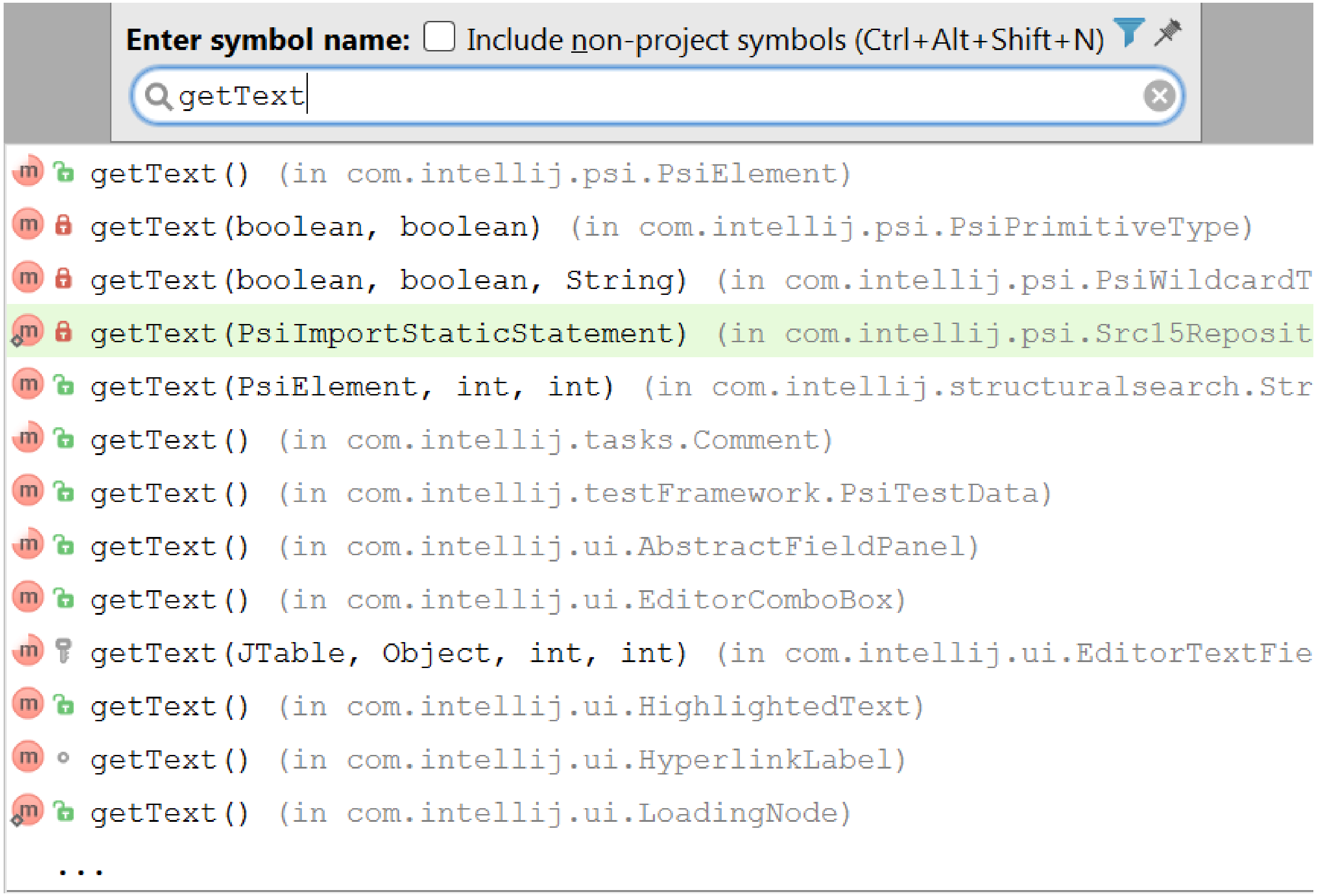
# Document Text.



**Enter symbol name:** □ Include non-project symbols (Ctrl+Alt+Shift+N)

getText

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getText(boolean, boolean) (in com.intellij.psi.PsiPrimitiveType)
getText(boolean, boolean, String) (in com.intellij.psi.PsiWildcardT
getText(PsiImportStaticStatement) (in com.intellij.psi.Src15Reposit
getText(PsiElement, int, int) (in com.intellij.structuralsearch.Str
getText() (in com.intellij.tasks.Comment)
getText() (in com.intellij.testFramework.PsiTestData)
getText() (in com.intellij.ui.AbstractFieldPanel)
getText() (in com.intellij.ui.EditorComboBox)
getText(JTable, Object, int, int) (in com.intellij.ui.EditorTextFie
getText() (in com.intellij.ui.HighlightedText)
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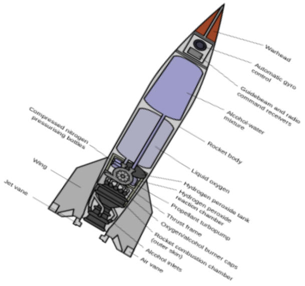
# Document Text.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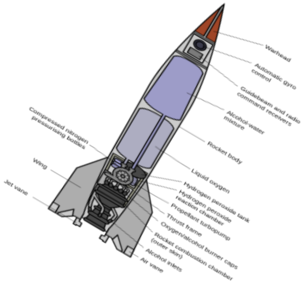
## Persistent Data Structures.

# Document Text.



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Persistent Data Structures.

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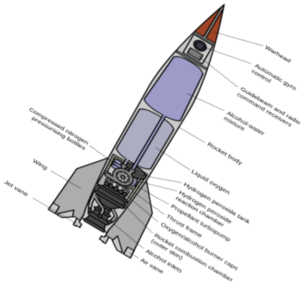
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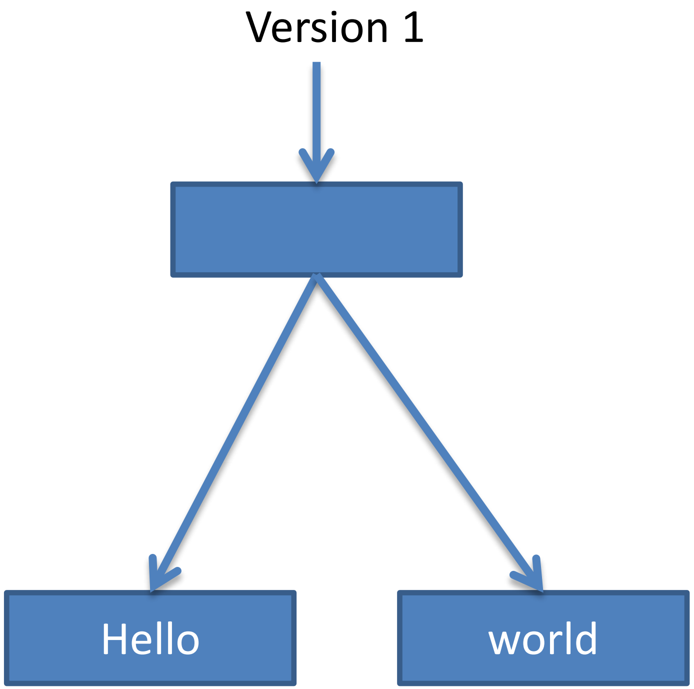
Persistent Data Structures.

Persistent string.

# Document Text.



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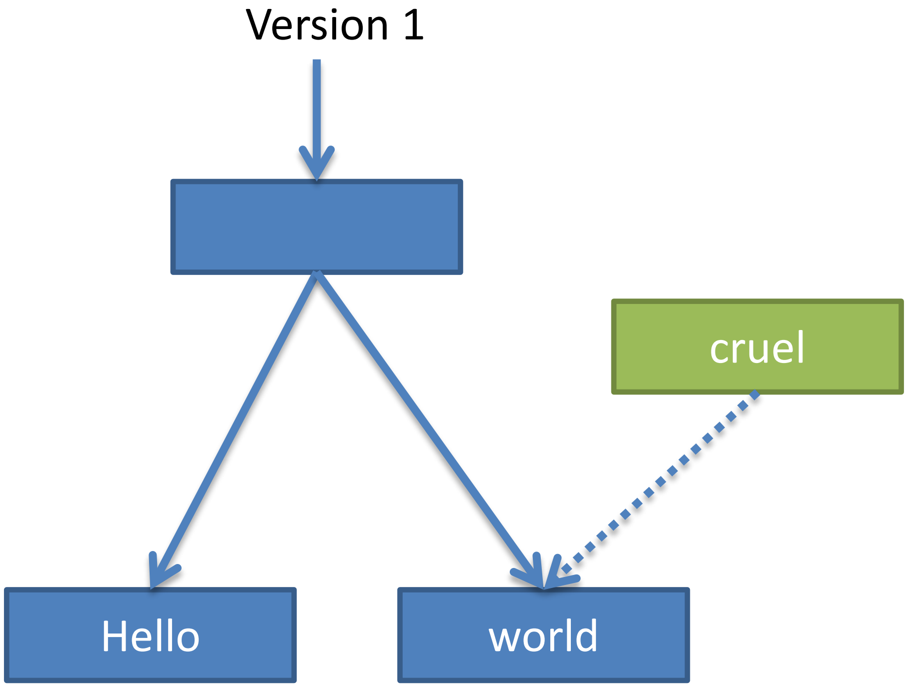

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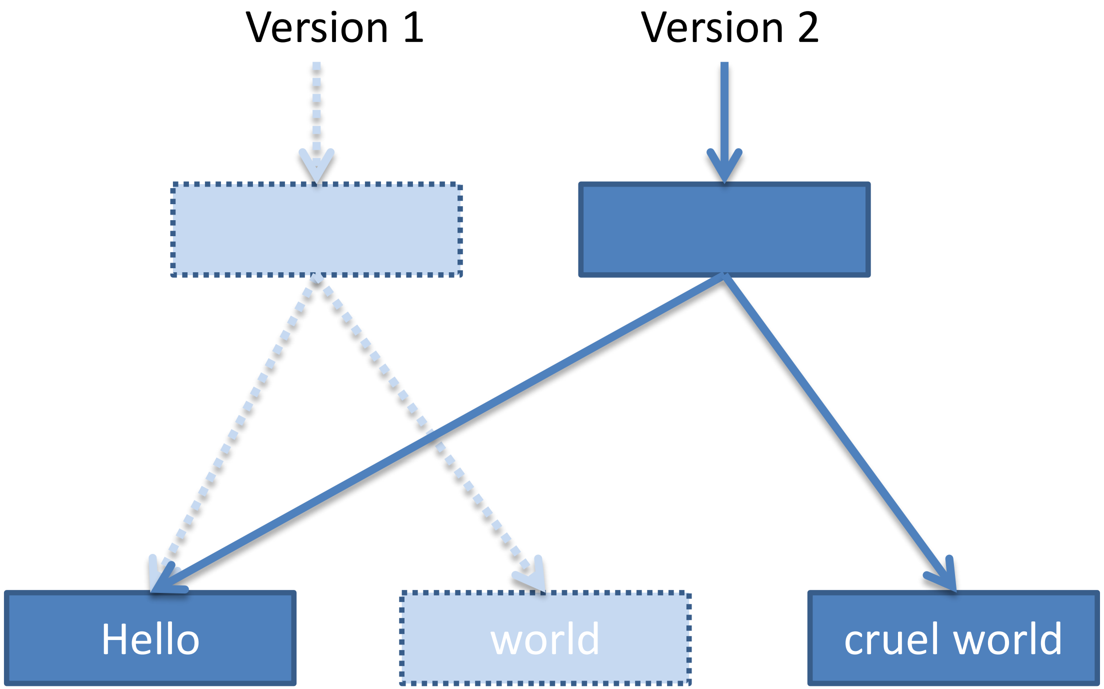

Q.E.D.

# Lies, damned lies and presentations

1. Dependencies compilation: Tarjan.
2. Suggest members in Refactoring: DFS.
3. Control flow: DFS.
4. Highlighters update: Augmented int-tree.
5. Find In Path: Trigrams + Boyer-Moore.
6. Allocating tokens: Lock-free fixed pool.
7. Multi-threaded inspections: Scalable RW-lock
8. Document Text: Persistent Strings.

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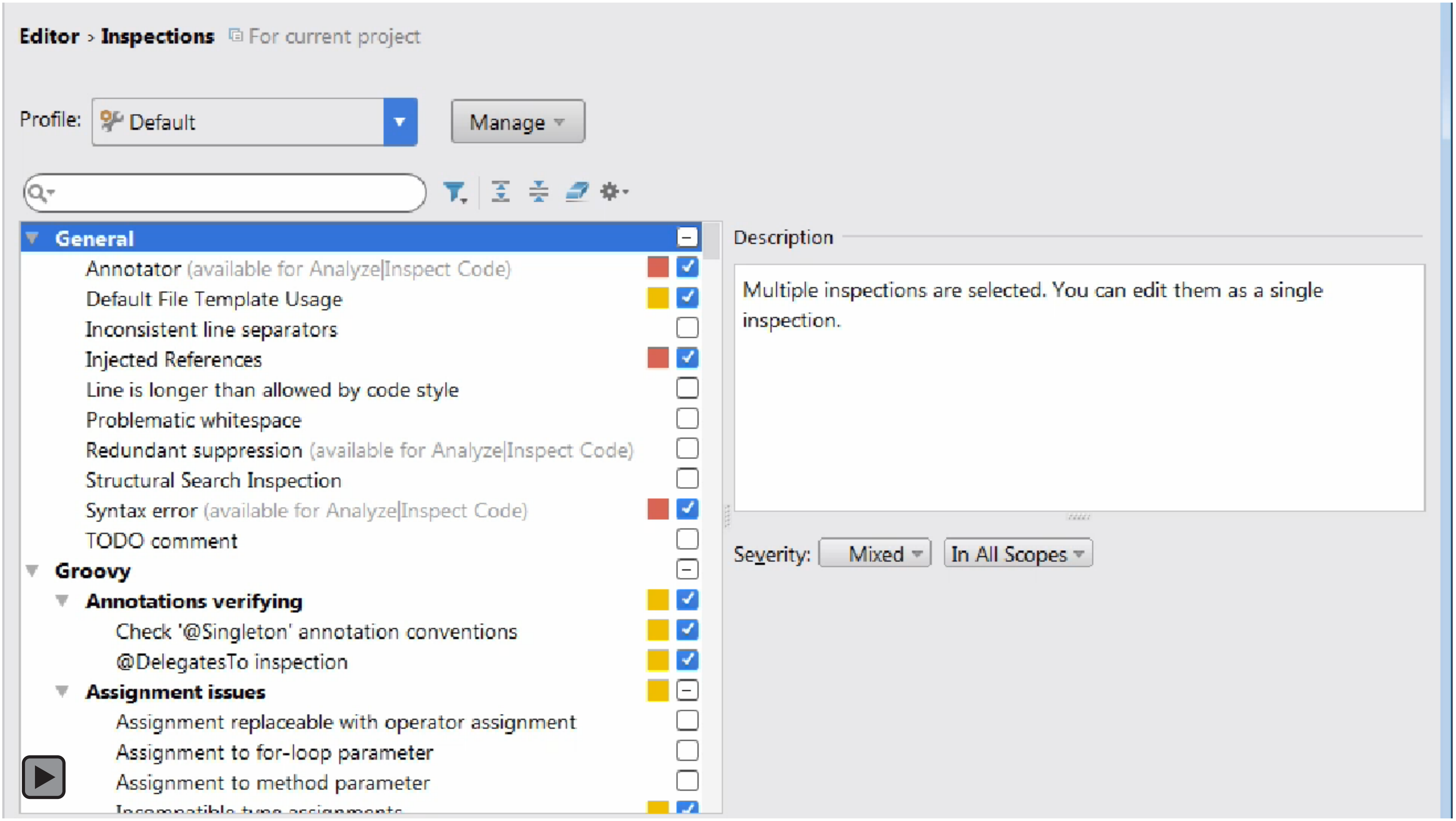
Q.E.D.

# Too Many Algorithms.



**Editor** › **Inspections** For current project

Profile: Default ▾ Manage ▾

- ▾ **General** ⊟
  - Annotator (available for Analyze|Inspect Code) 🟥 ☑
  - Default File Template Usage 🟨 ☑
  - Inconsistent line separators ☐
  - Injected References 🟥 ☑
  - Line is longer than allowed by code style ☐
  - Problematic whitespace ☐
  - Redundant suppression (available for Analyze|Inspect Code) ☐
  - Structural Search Inspection ☐
  - Syntax error (available for Analyze|Inspect Code) 🟥 ☑
  - TODO comment ☐
- ▾ **Groovy** ⊟
  - ▾ **Annotations verifying** 🟨 ☑
    - Check '@Singleton' annotation conventions 🟨 ☑
    - @DelegatesTo inspection 🟨 ☑
  - ▾ **Assignment issues** 🟨 ⊟
    - Assignment replaceable with operator assignment ☐
    - Assignment to for-loop parameter ☐
    - Assignment to method parameter ☐
    - Incompatible type assignments 🟨 ☑

Description

Multiple inspections are selected. You can edit them as a single inspection.

Severity: Mixed ▾ In All Scopes ▾

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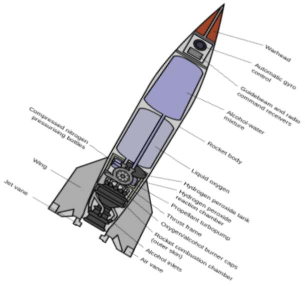
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$O()$

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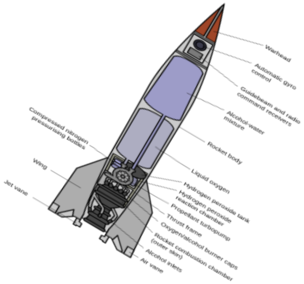
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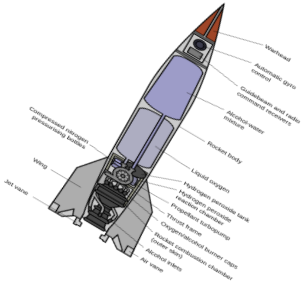
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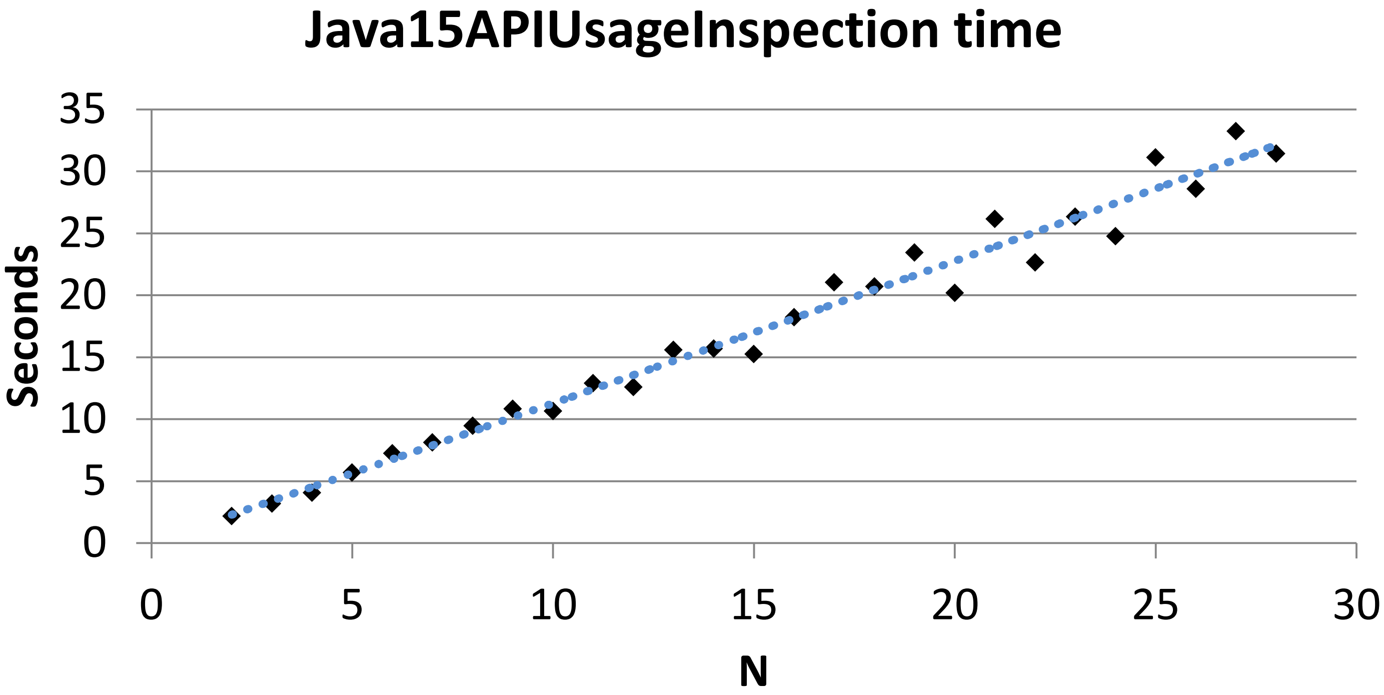
O()

The method of least squares.

# Too Many Algorithms.



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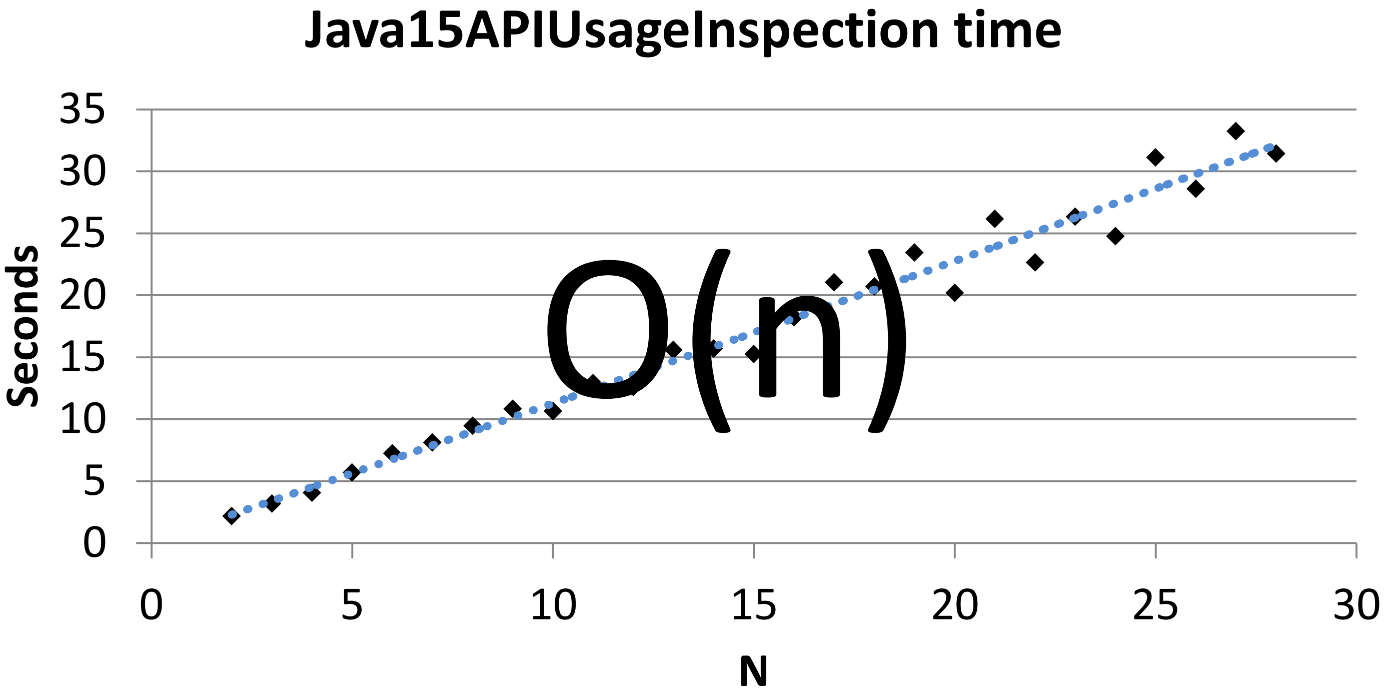

O(n)

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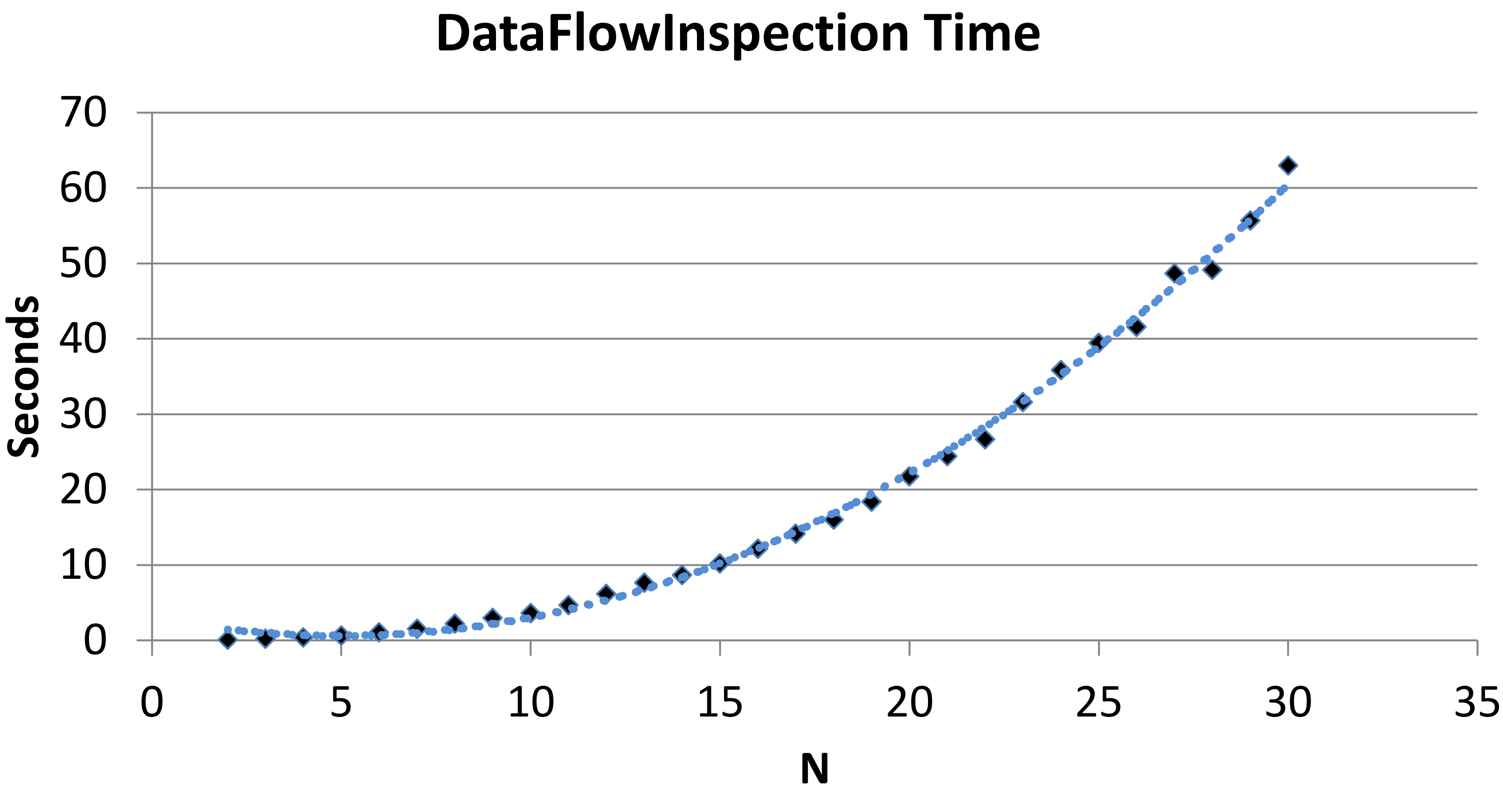

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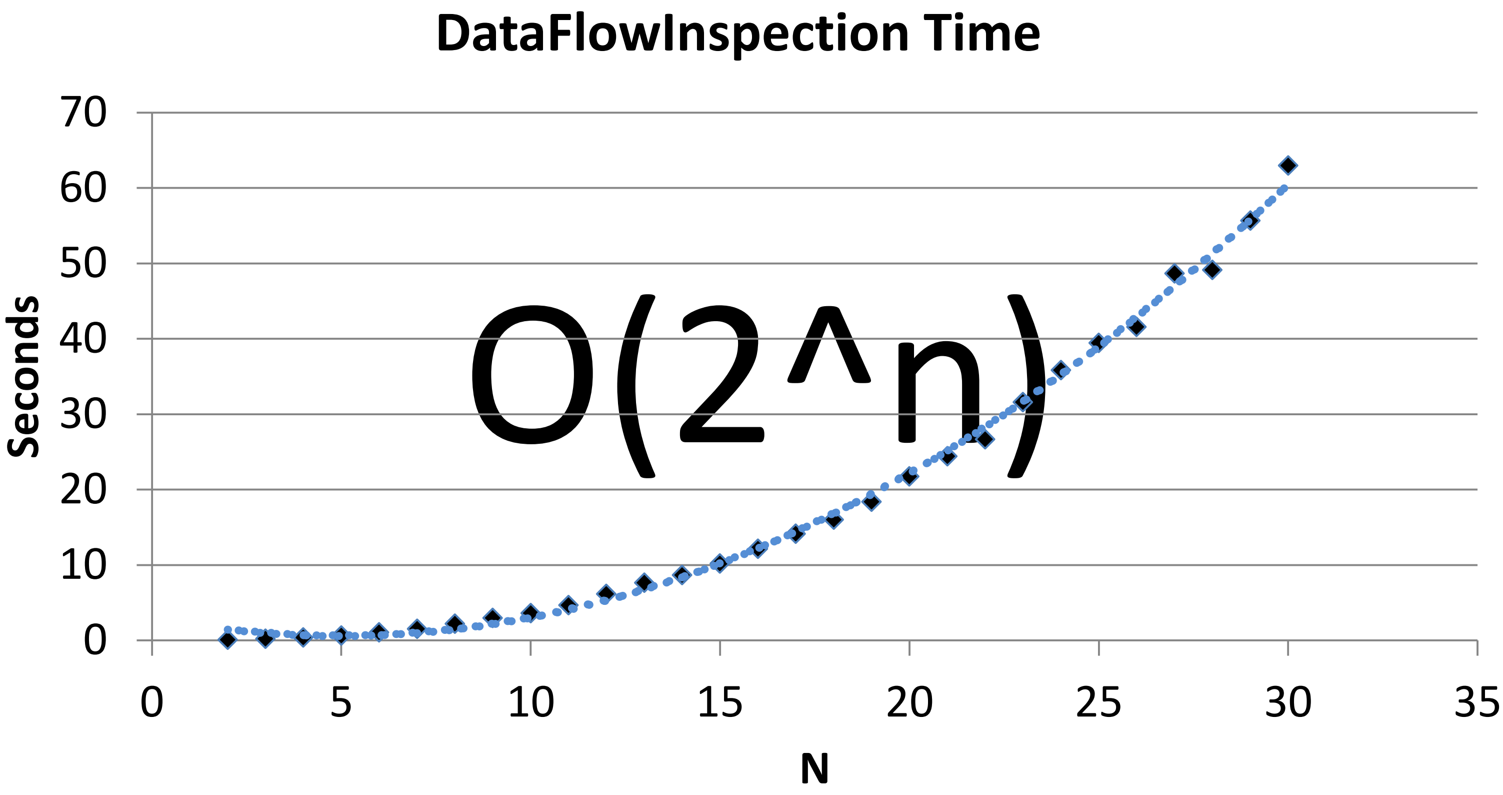

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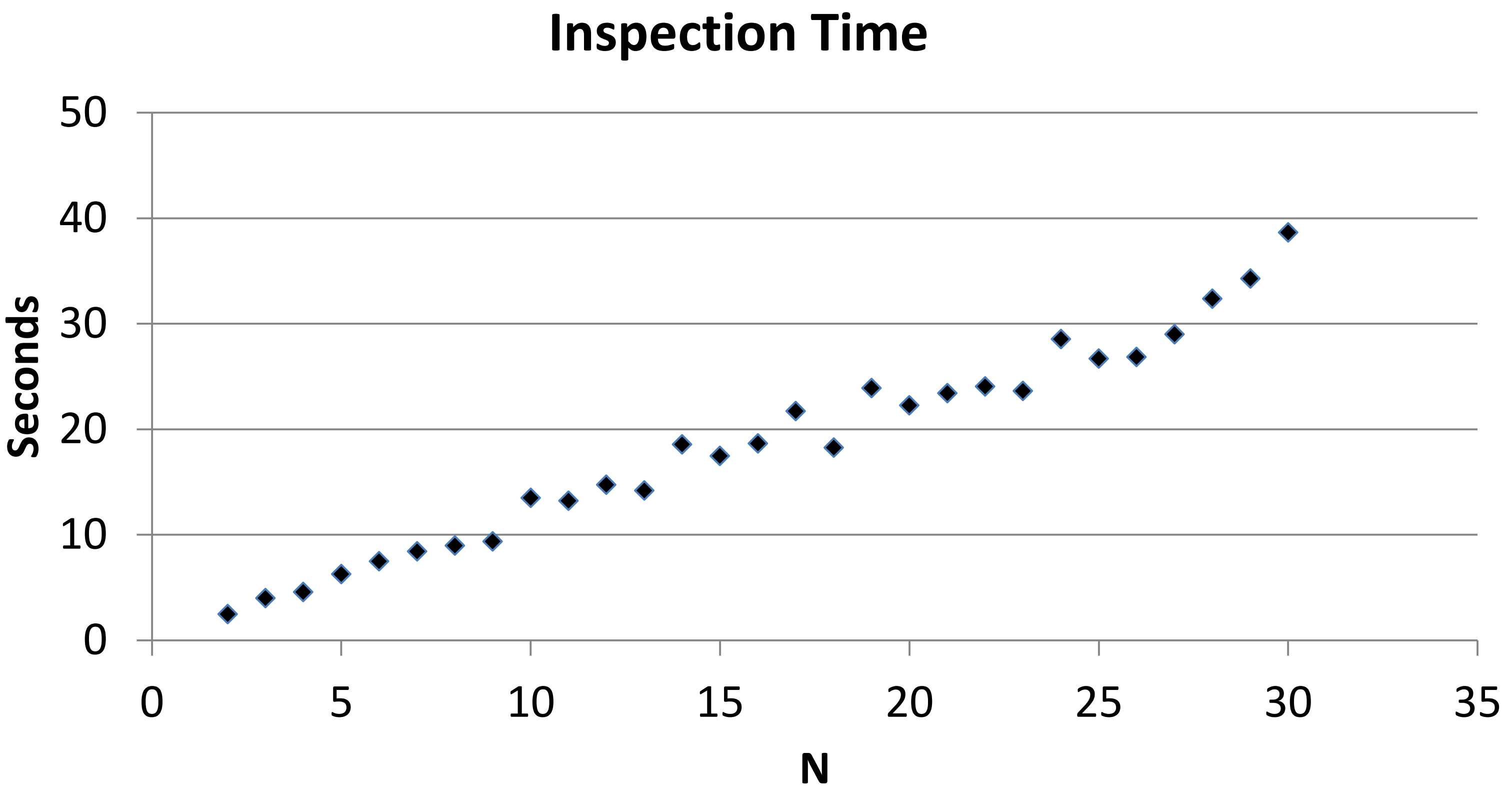

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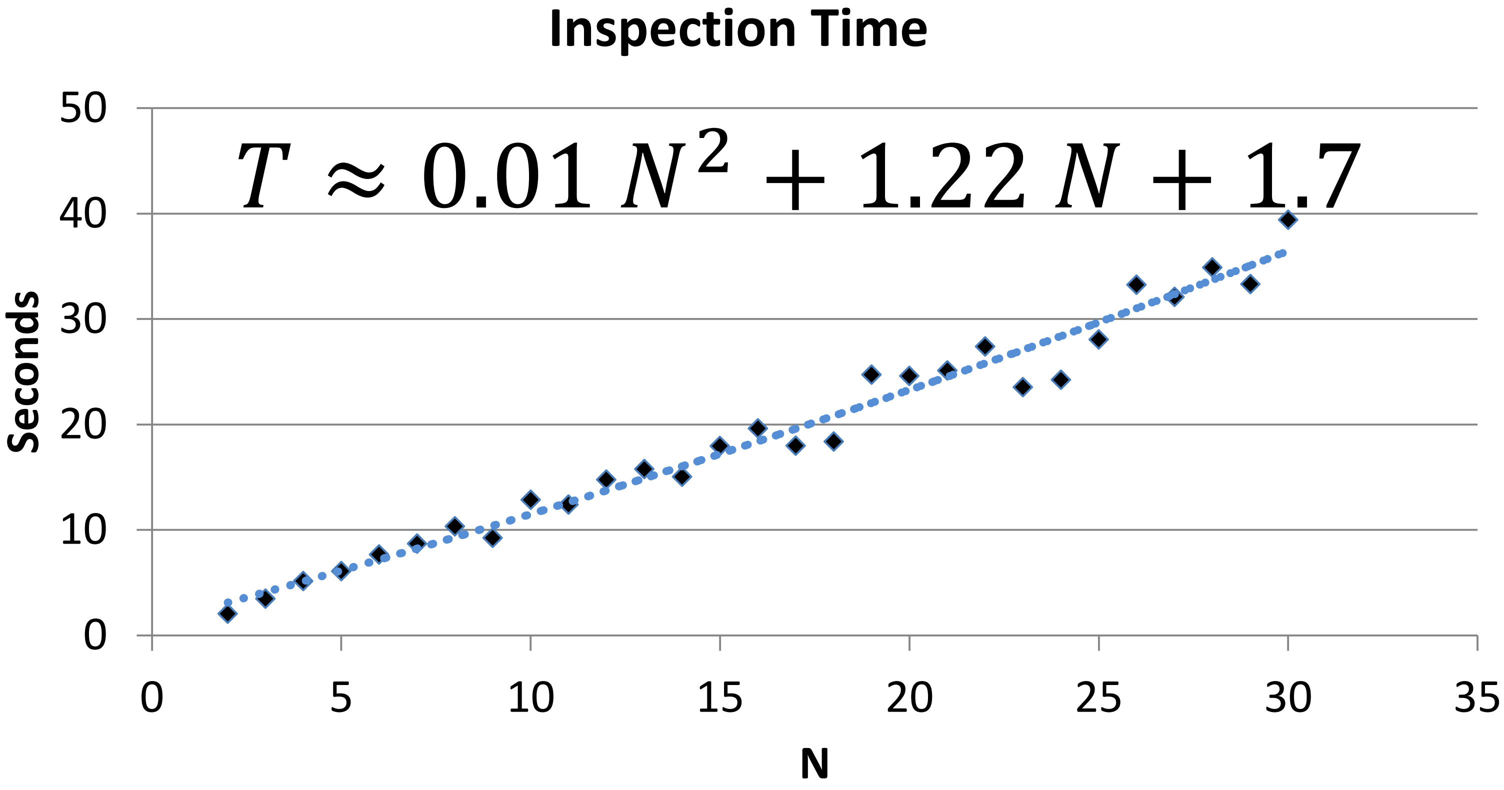

$$T \approx 0.01\,N^2 + 1.22\,N + 1.7$$

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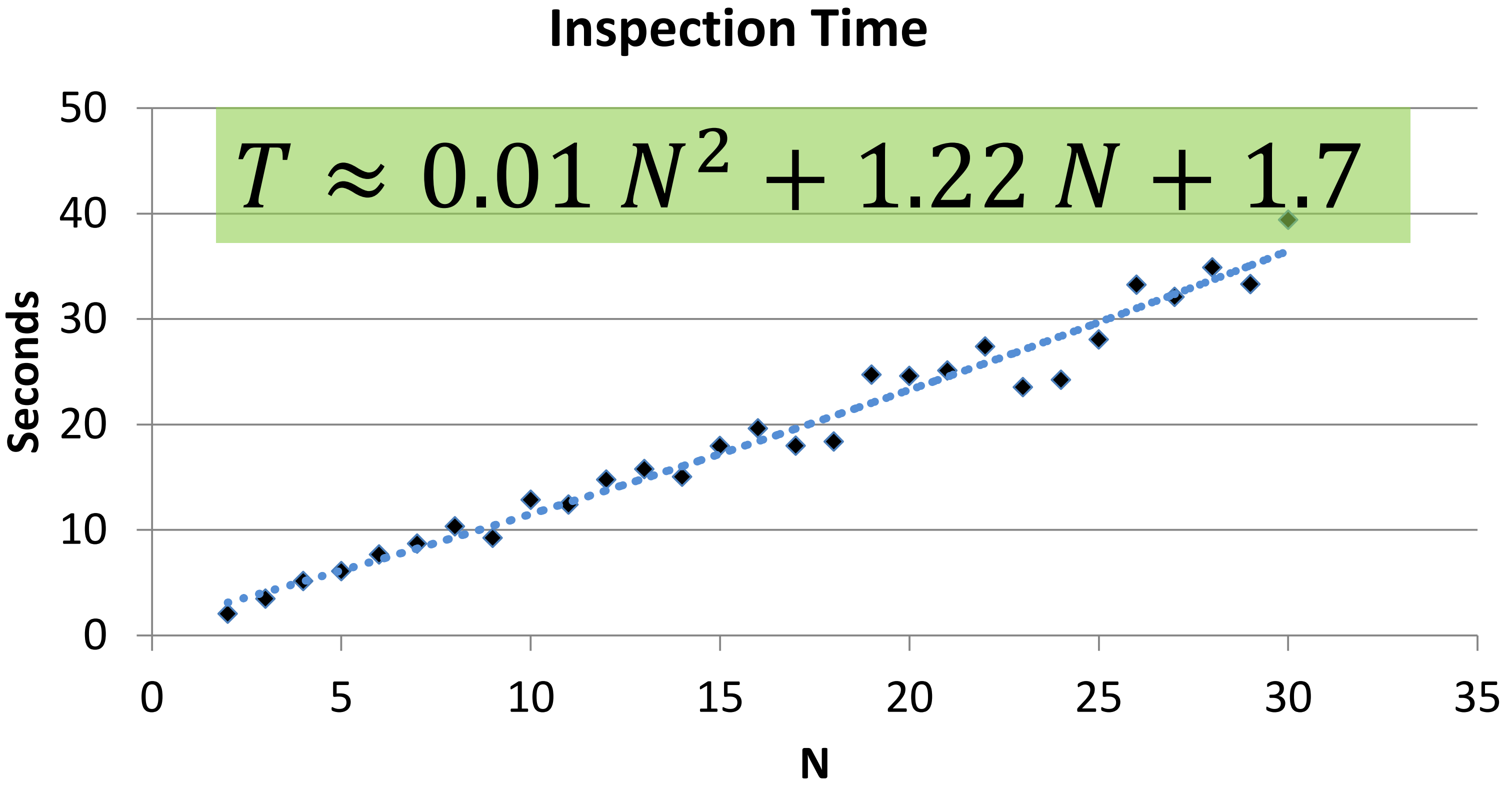

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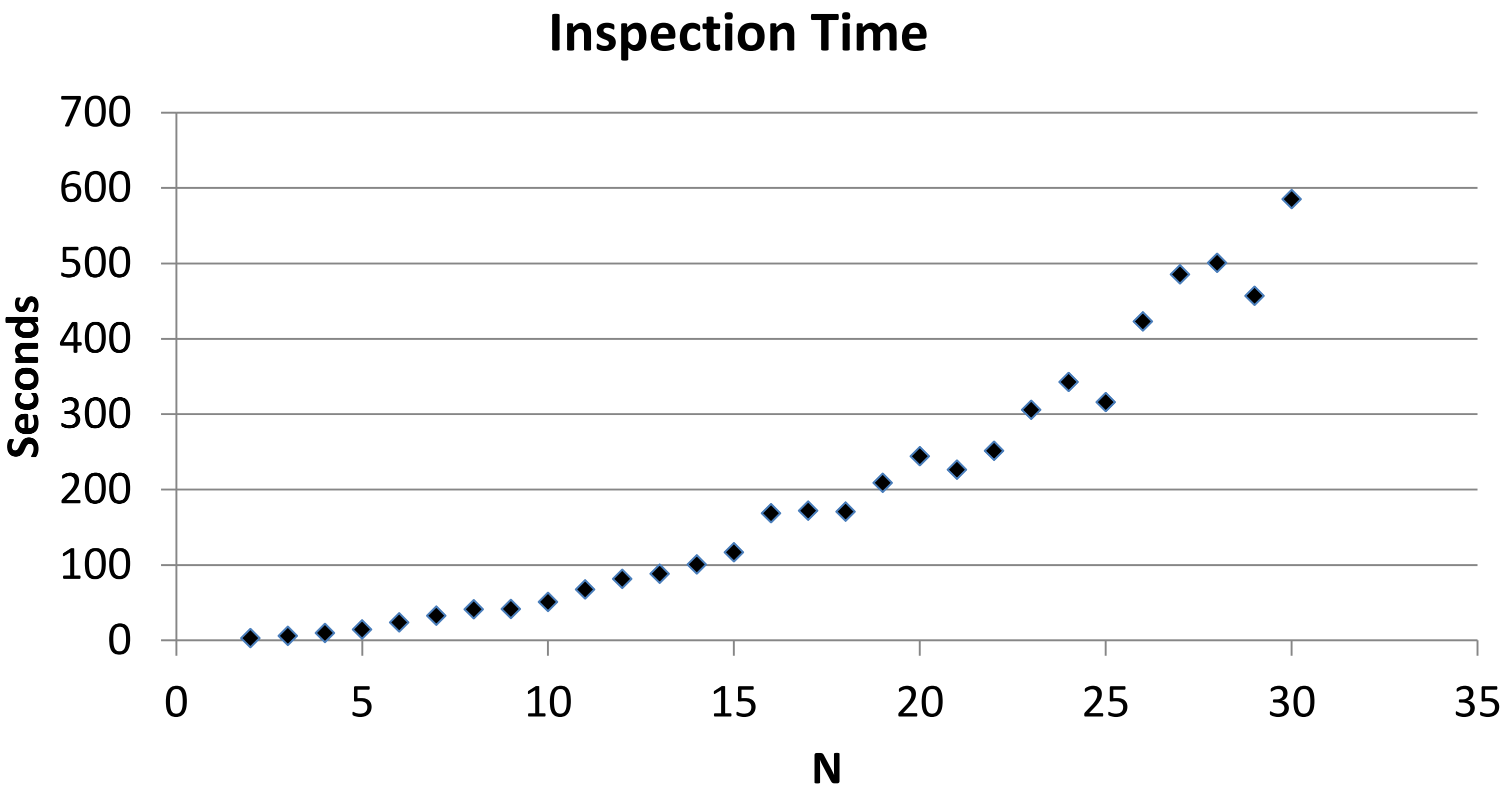

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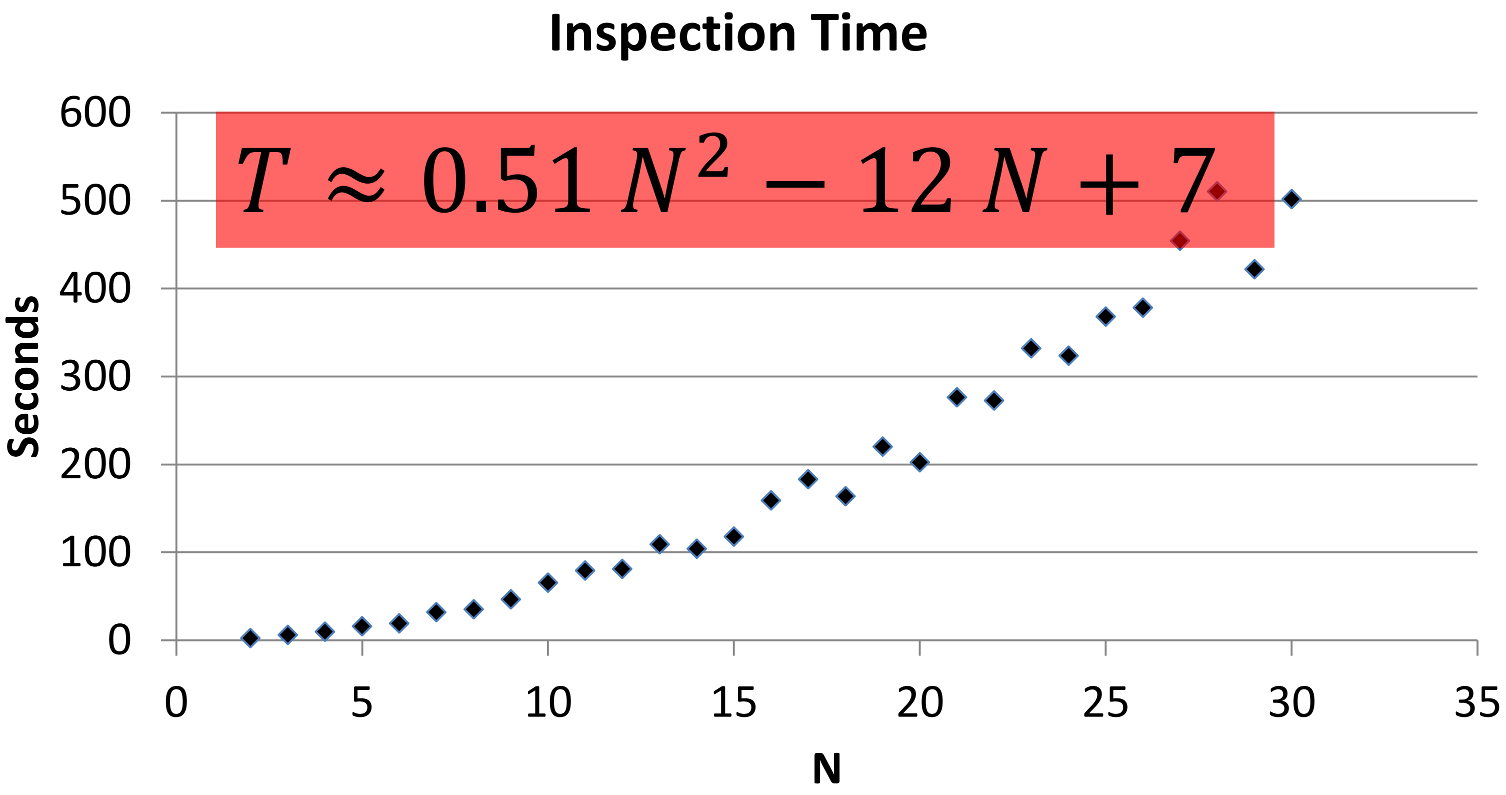

$$T \approx 0.51\,N^2 - 12\,N + 7$$

# Outro

# Outro

# Outro

Intellij IDEA:
github.com/JetBrains/intellij-community

Algorithms:

www.wikipedia.org

Me:

Alexey.Kudravtsev@jetbrains.com