

# 80/20 Optimierung von Test-Suites

## Konzepte & Erfahrungen aus Forschung & Praxis

Dr. Elmar Juergens  
Raphael Noemmer

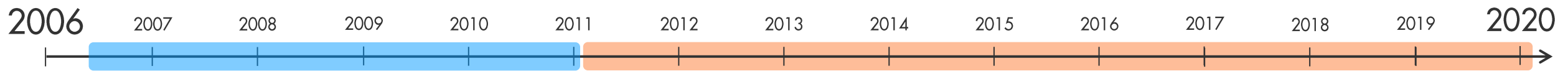




TUM



CQSE





com.teamscale.test.ui.architecture.ArchitecturePerspectiveTest - testViewingArchitectureElements

Runs: 1/227

 Errors: 0

 Failures: 0

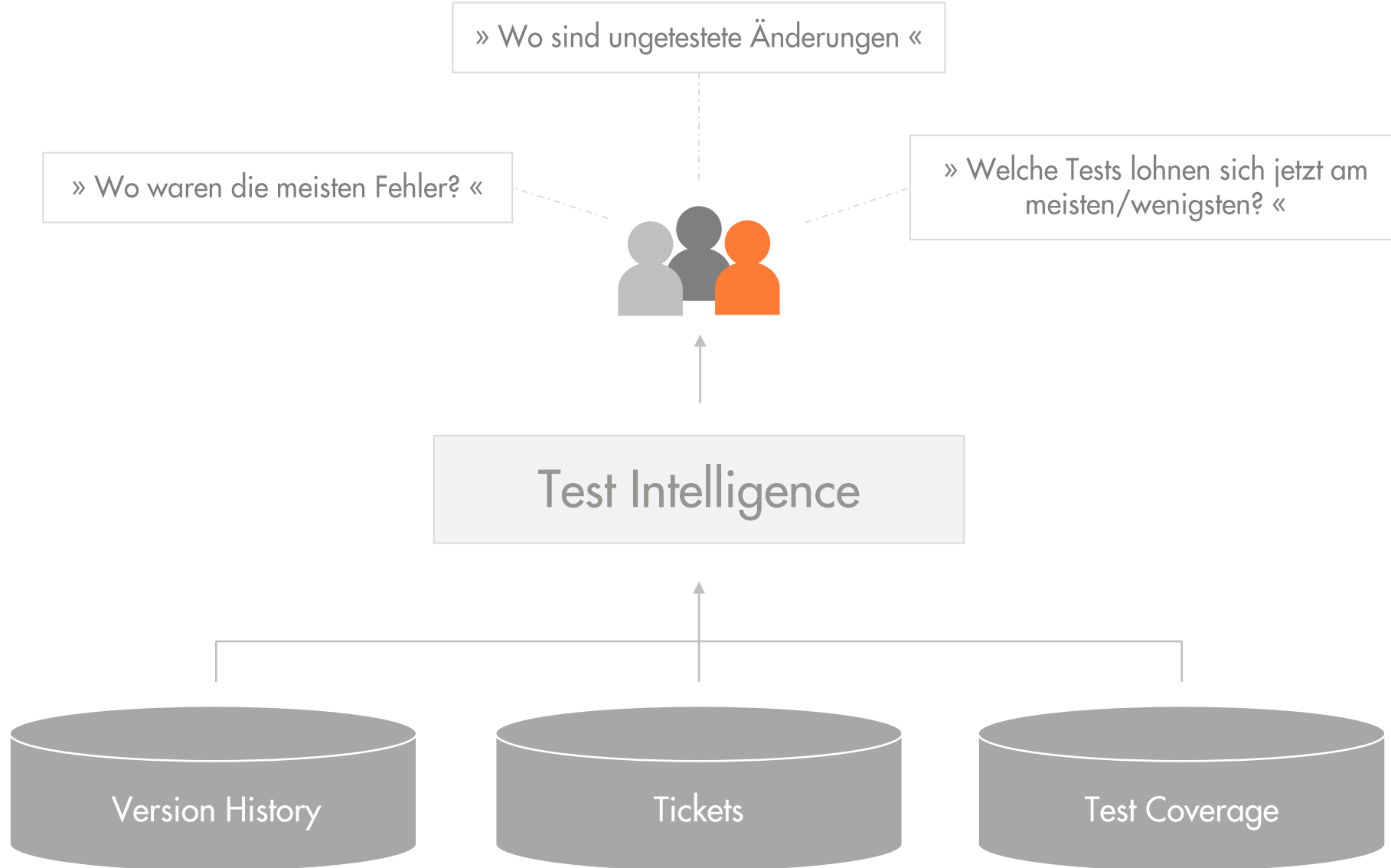
- ▼   com.teamscale.test.ui.architecture.ArchitecturePerspectiveTest [Runner: JUnit 5]
  -  testViewingArchitectureElements
  -  createArchitectureTest
  -  testTimetravelMode
  -  testUndoRedo
  -  testArchitecturePolicyUpdate
  -  testOpenCodeOfOrphans

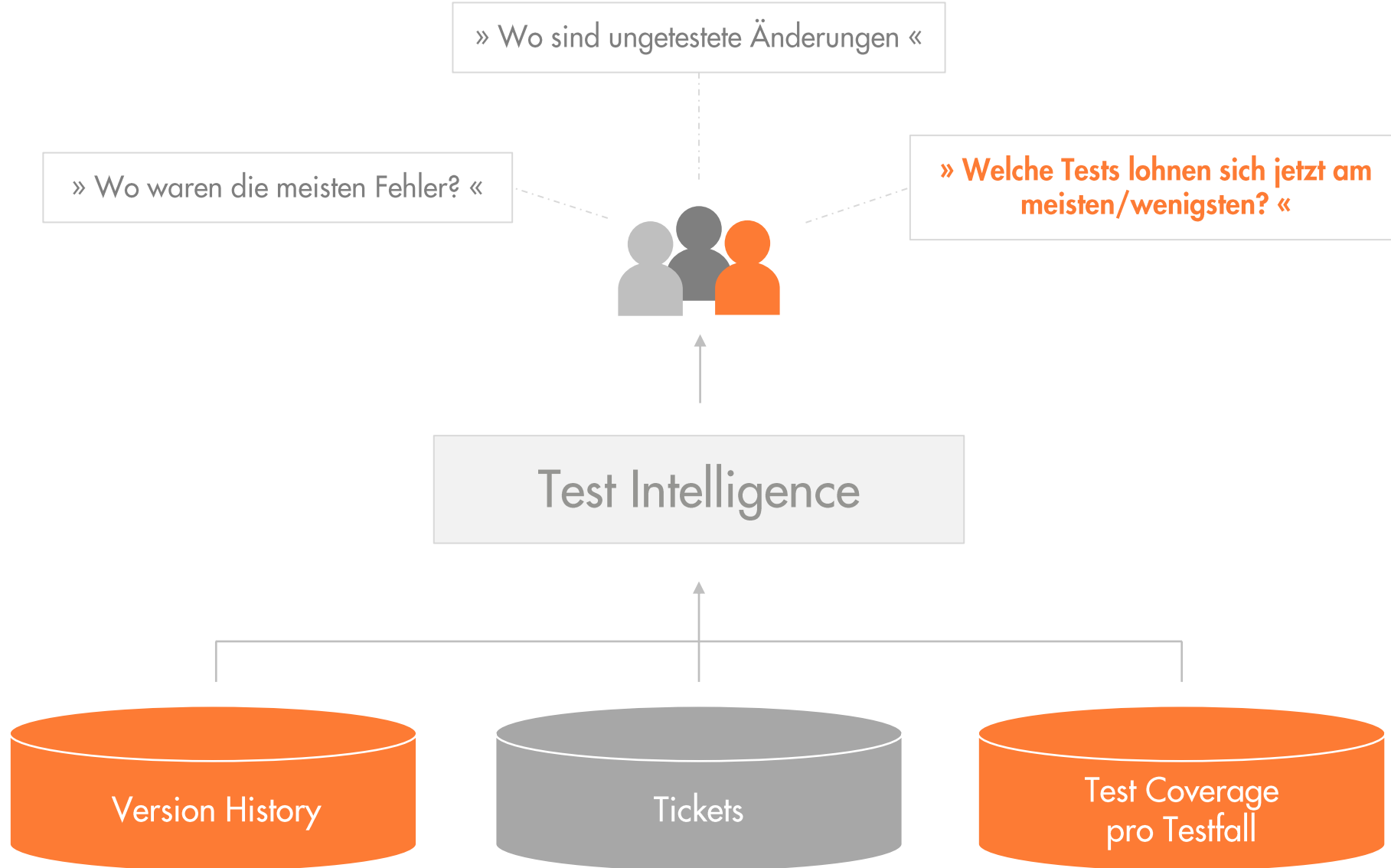
 Failure Trace

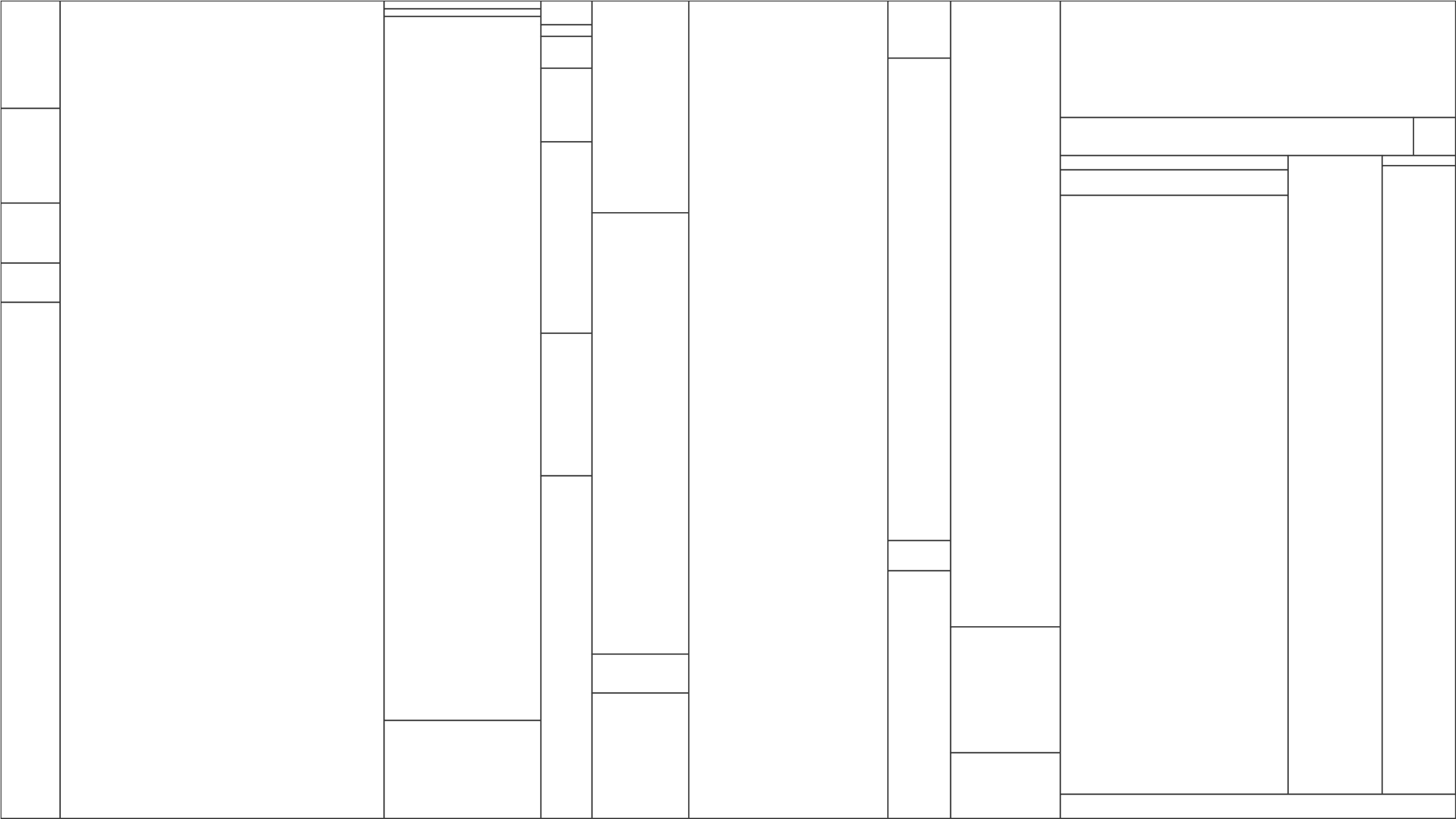




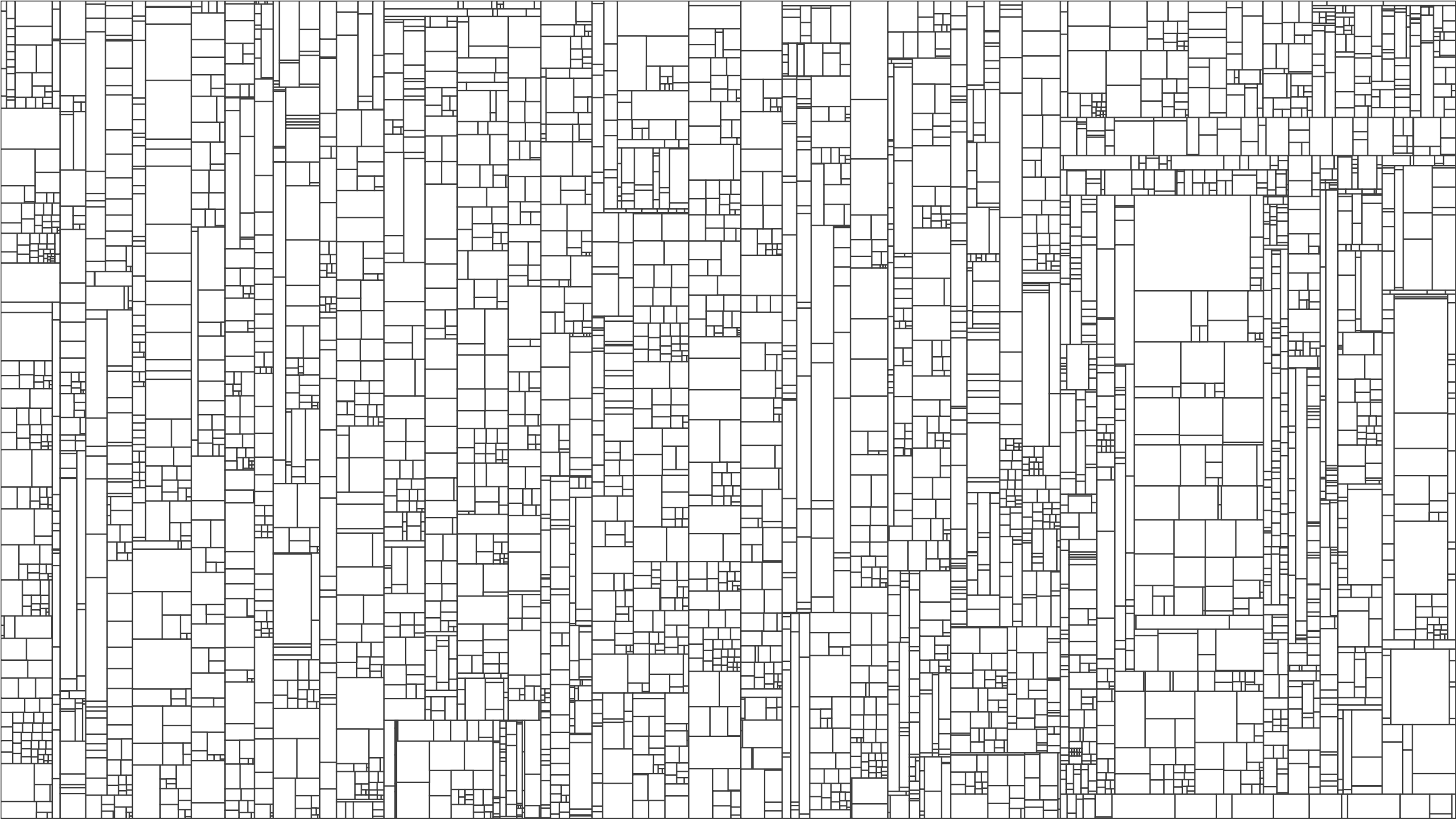


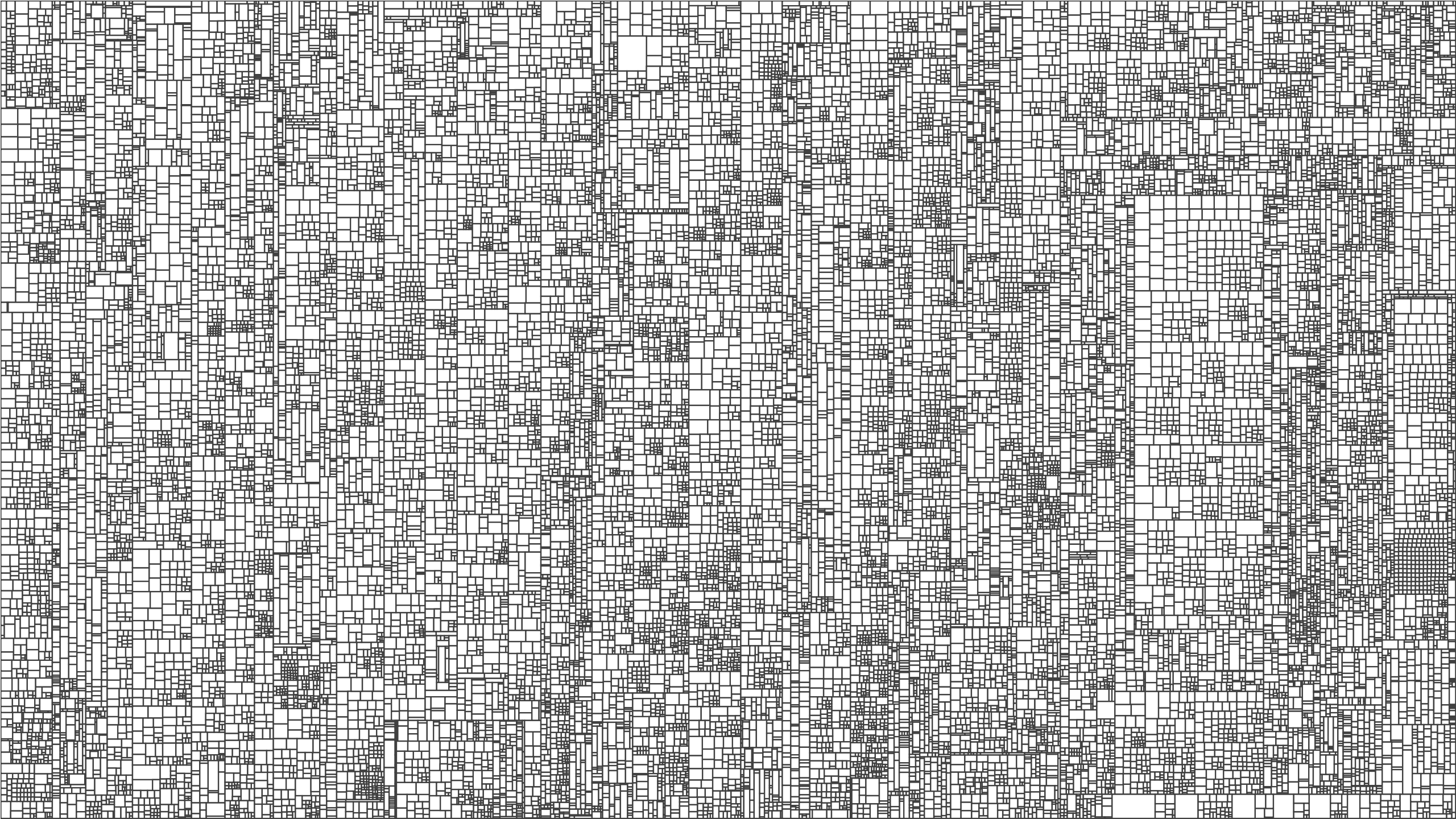














# Data Flow Analysis can not handle java lambdas (logs many errors currently)



- Edit
- Comment
- Assign
- More ▾
- Back to New



## Details

Type:	<span style="color: red;">■</span> Bug	Status:	<span style="background-color: green; color: white; padding: 2px;">DONE</span> (View Workflow)
Priority:	<span style="color: orange;">↑</span> High	Resolution:	Green
Component/s:	Backend	Fix Version/s:	Teamscale 4.3
Labels:	<span style="border: 1px solid #ccc; padding: 2px;">dataflow</span> <span style="border: 1px solid #ccc; padding: 2px;">java</span>		
Affected Version:	master		
Merge Request:	<a href="https://git.cqse.eu/cqse/teamscale/merge_requests/2734">https://git.cqse.eu/cqse/teamscale/merge_requests/2734</a>		
PDash Task:	#4886		

## People

Assignee:	 Andreas Sewe <a href="#">Assign to me</a>
Reporter:	 Rainer Niedermayr
QA-Contact:	Alexander von Rhein
Votes:	<span style="border: 1px solid #ccc; border-radius: 50%; padding: 2px;">2</span> Vote for this issue
Watchers:	<span style="border: 1px solid #ccc; border-radius: 50%; padding: 2px;">3</span> Start watching this issue

## Description

Analysis profile: Java  
 Repository: JabRef, start revision 9efd23b71871747fe5e18e915e637891d7e55b6d

```

ERROR : An error occurred while trying to construct a CFG for function 'null' in element src/main/java/net/sf/jabref/exporter/layout/format/DOI
[STATEMENT: lambda expression: null (lines 33-33)
]
Tokens: doi . getURL ( )
Occurred in src/main/java/net/sf/jabref/exporter/layout/format/DOICheck.java:32-32 (com.teamscale.index.dataflow.DataFlowFindingsSynchronizer.c
org.conqat.engine.core.core.ConQATException: Could not find any rule that applies to the following entity list:
[STATEMENT: lambda expression: null (lines 33-33)
]
Tokens: doi . getURL ( )
Occurred in src/main/java/net/sf/jabref/exporter/layout/format/DOICheck.java:32-32
    at org.conqat.engine.sourcecode.dataflow.heuristics.ControlFlowCreator.findApplicableRule(ControlFlowCreator.java:164)
    at org.conqat.engine.sourcecode.dataflow.heuristics.ControlFlowCreator.transformOneStep(ControlFlowCreator.java:139)
    at org.conqat.engine.sourcecode.dataflow.heuristics.ControlFlowCreator.transform(ControlFlowCreator.java:92)

[...]

ERROR : An error occurred while trying to construct a CFG for function 'null' in element src/main/java/net/sf/jabref/exporter/layout/format/DOI
[STATEMENT: lambda expression: null (lines 31-31)
]
Tokens: doi . getDOI ( )
Occurred in src/main/java/net/sf/jabref/exporter/layout/format/DOIStrip.java:30-30 (com.teamscale.index.dataflow.DataFlowFindingsSynchronizer.c
org.conqat.engine.core.core.ConQATException: Could not find any rule that applies to the following entity list:
  
```

## Dates

Created:	24/Nov/16 8:35 AM
Updated:	4 days ago
Resolved:	08/May/18 12:42 PM

## Time Tracking

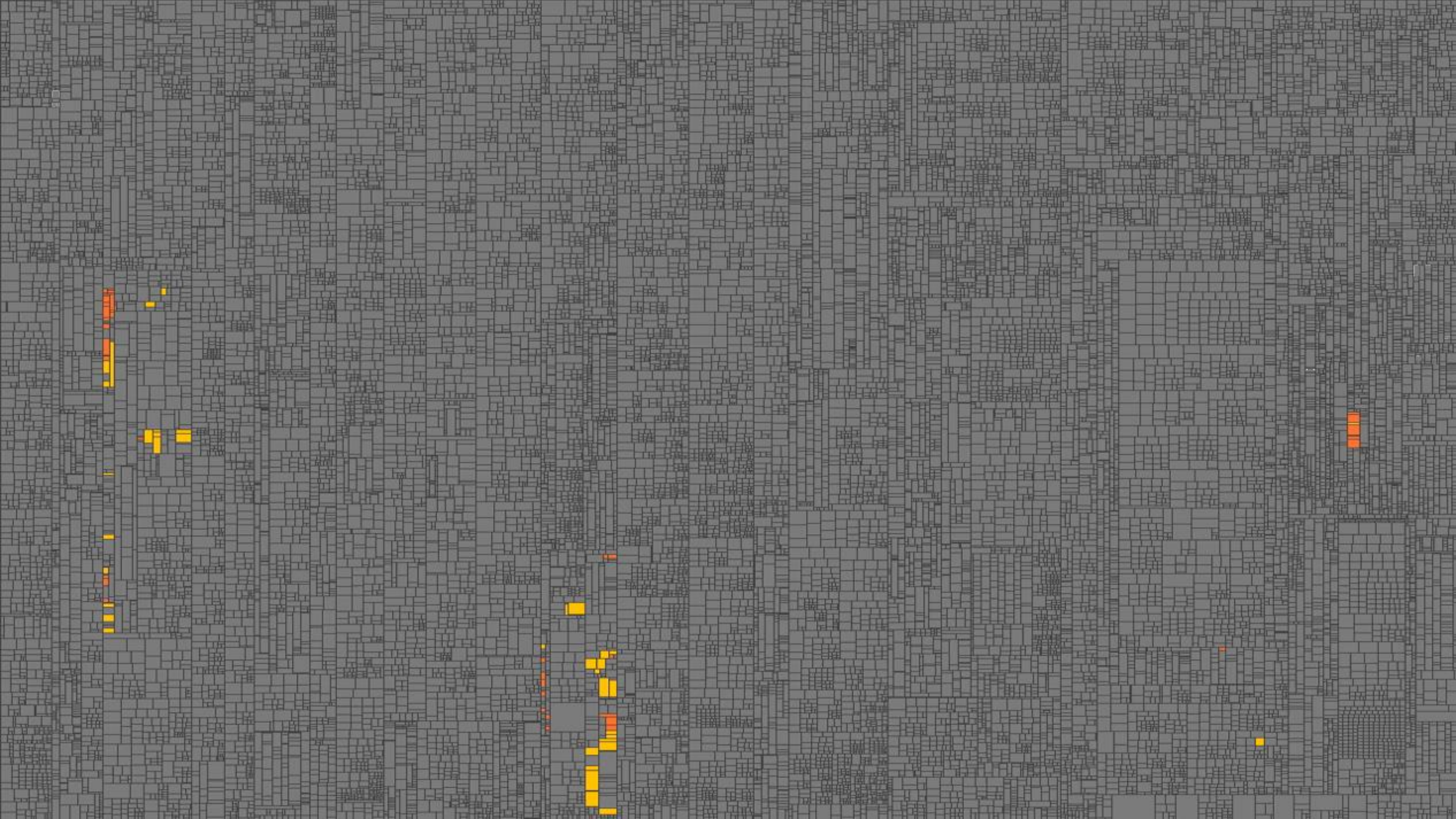
Estimated:	<div style="width: 100%; height: 10px; background-color: #ccc;"></div> Not Specified
Remaining:	<div style="width: 100%; height: 10px; background-color: #ccc;"></div> 0m
Logged:	<div style="width: 100%; height: 10px; background-color: #4CAF50;"></div> 4d 1h 57m

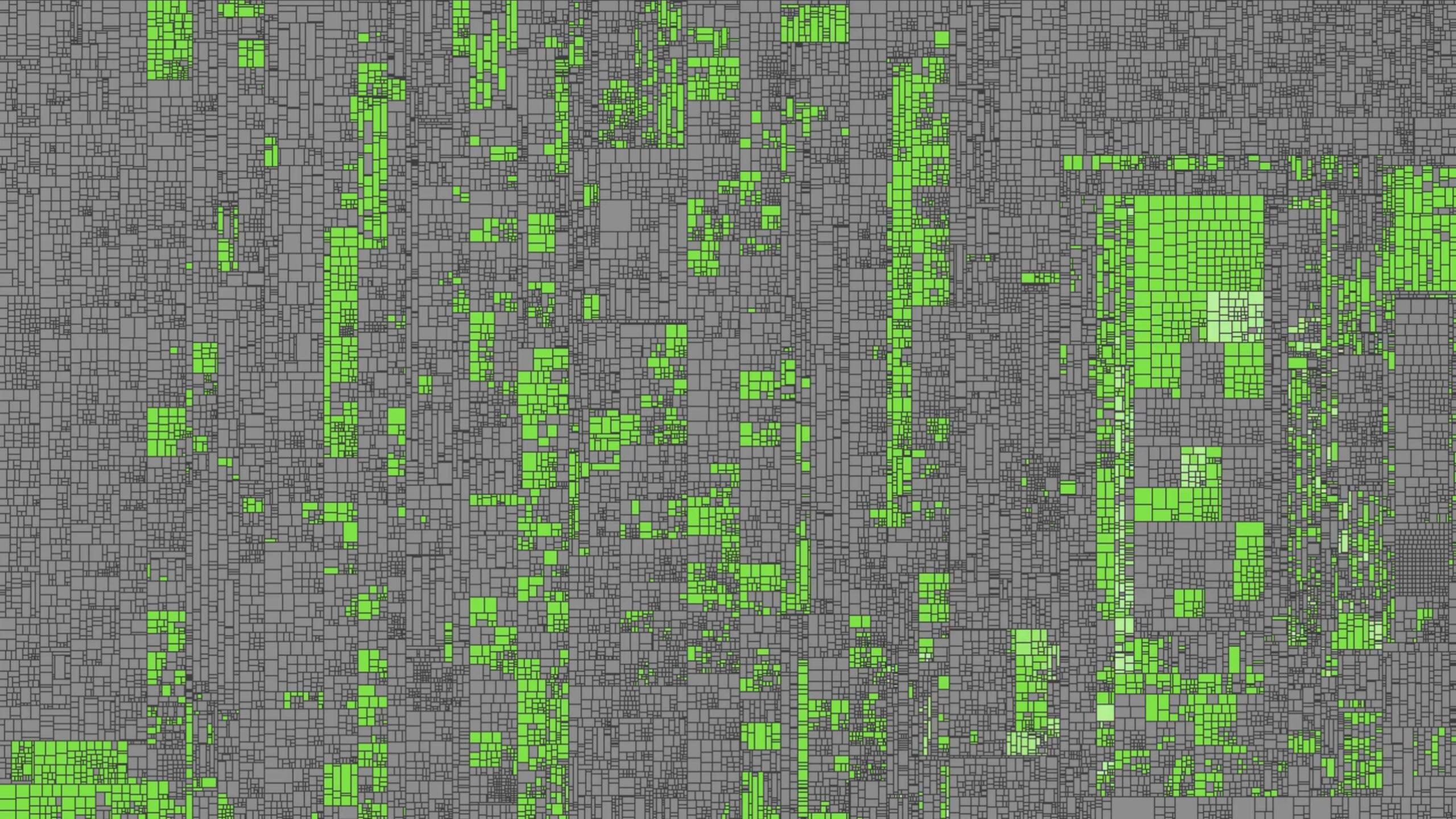
## Agile

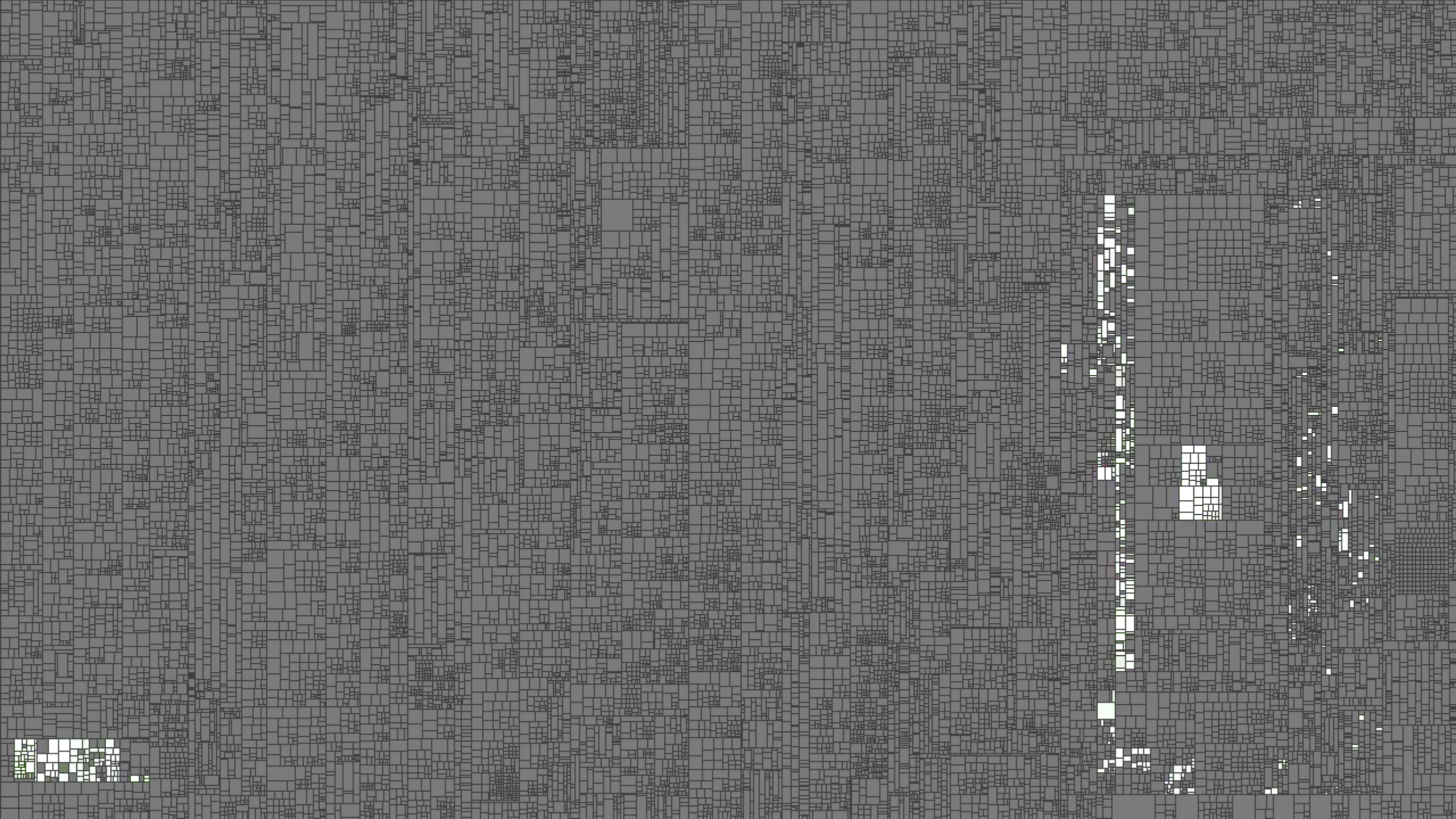
[View on Board](#)

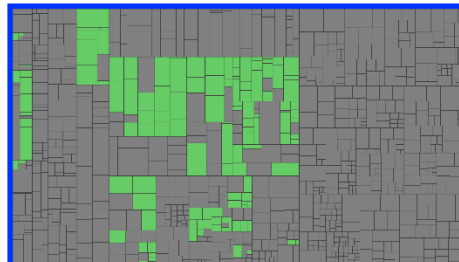
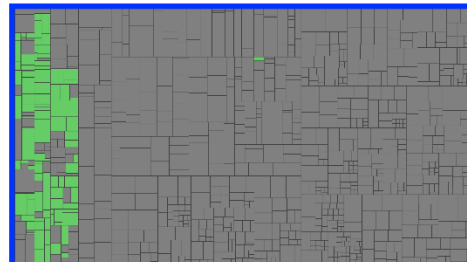
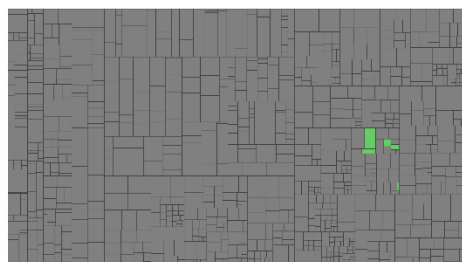
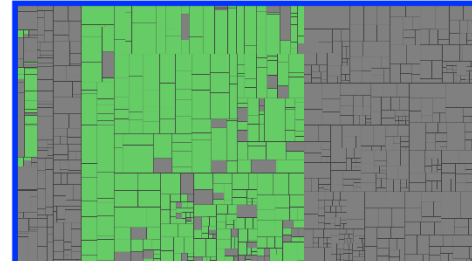
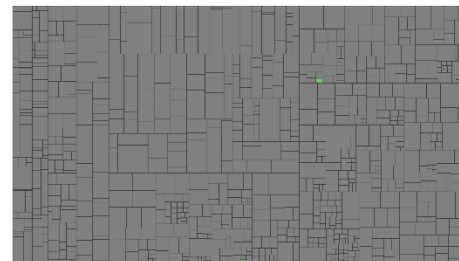
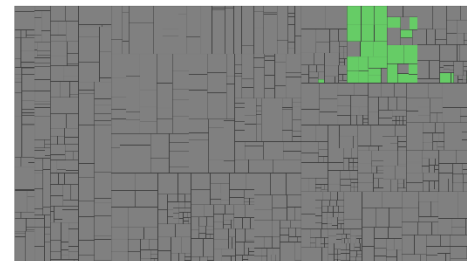
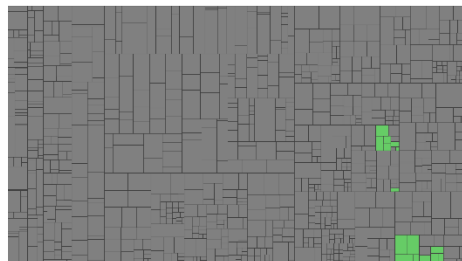
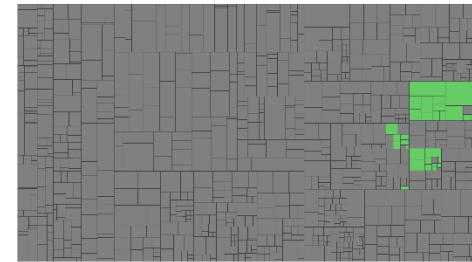
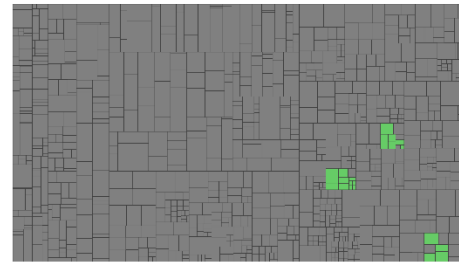
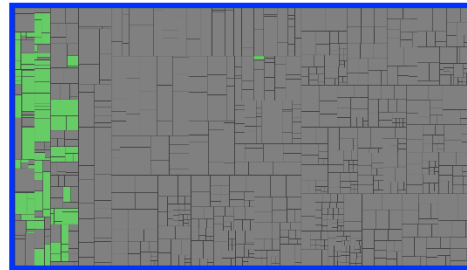
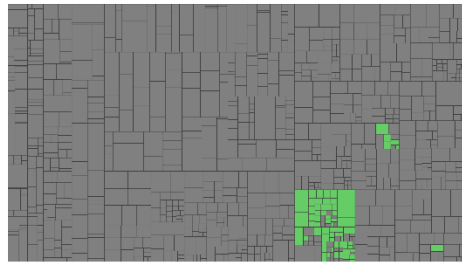
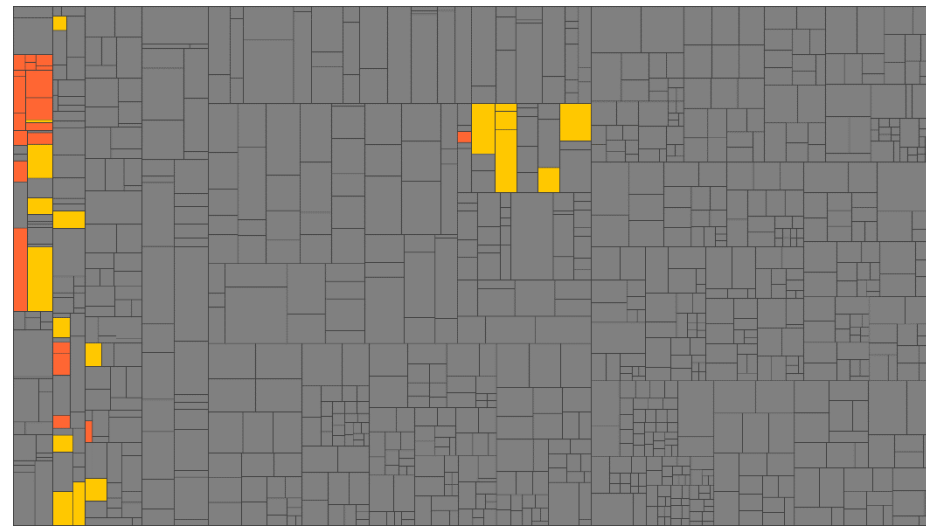
## Gitlab CI



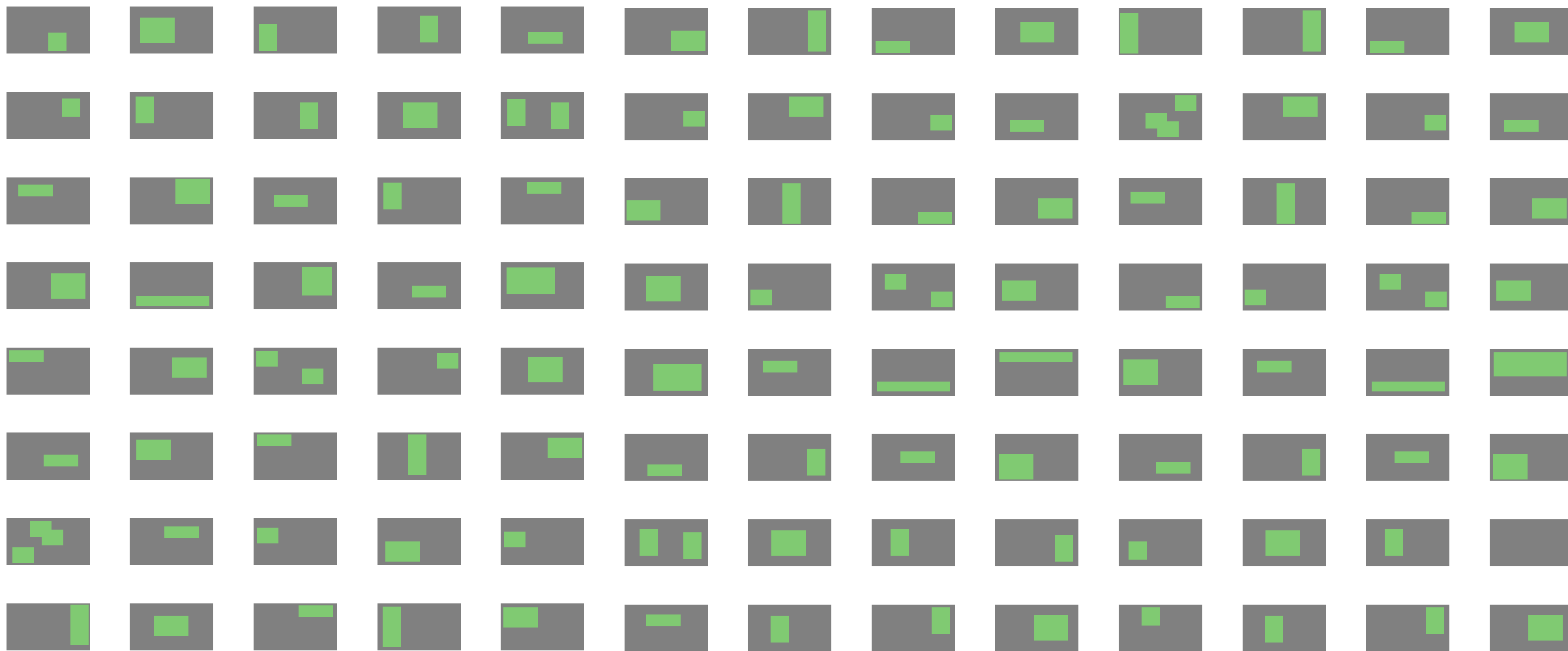








... 4000+ Testfälle  
ohne Überdeckung

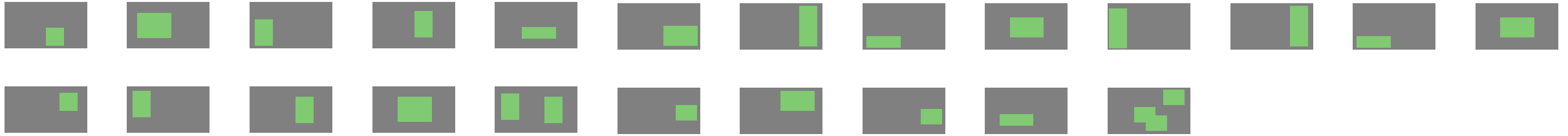




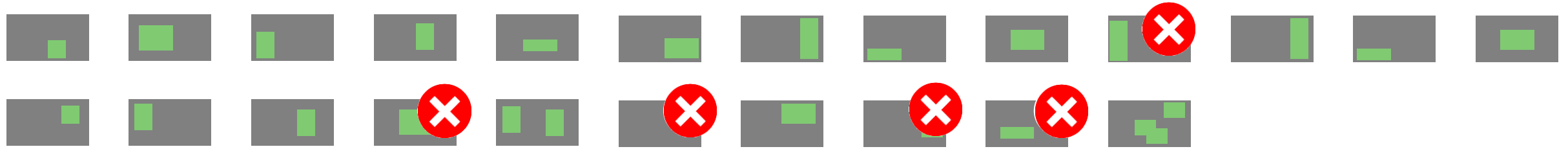
# Schritt 1: Selektion betroffener Testfälle



# Schritt 1: Selektion betroffener Testfälle



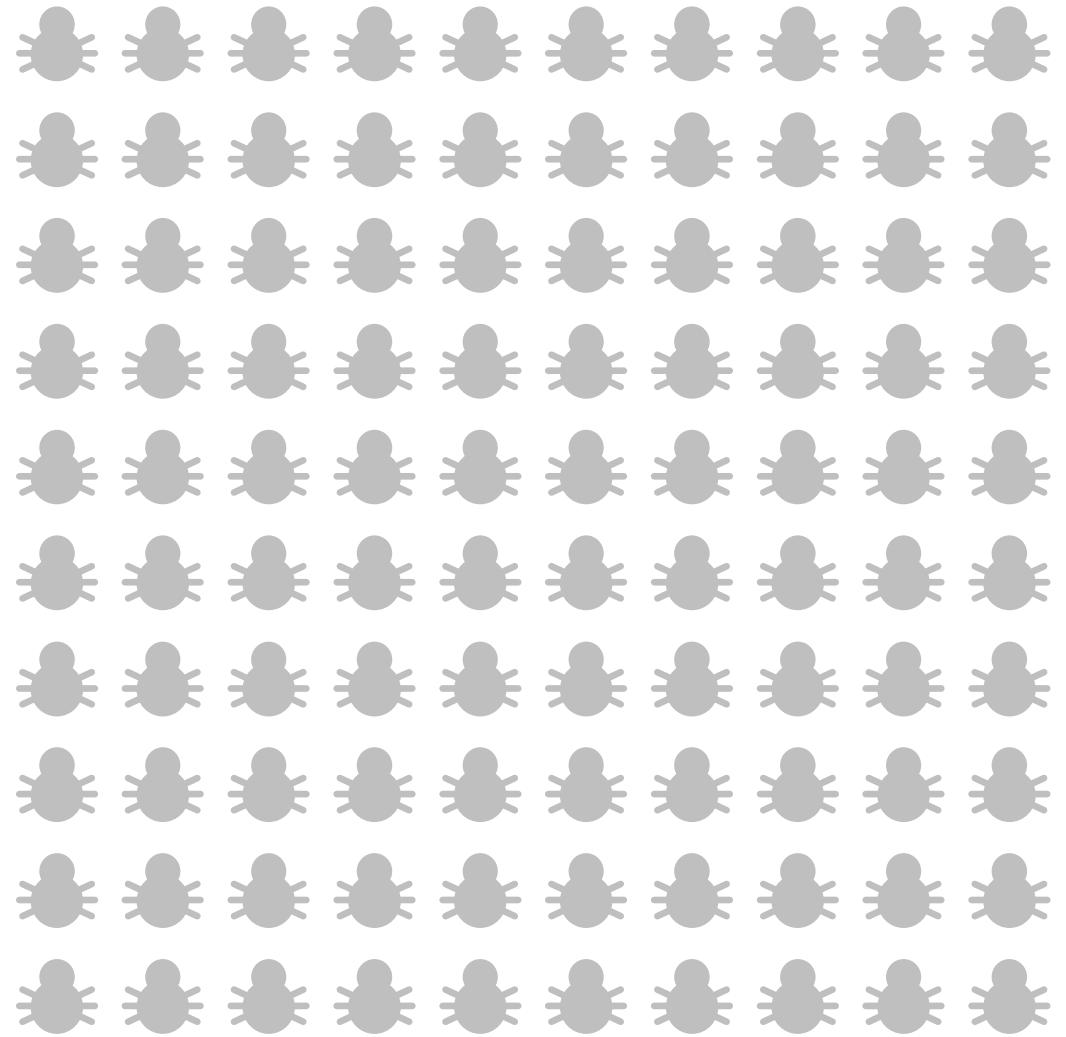
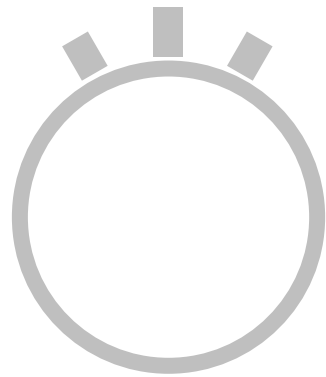
## Schritt 2: Priorisierung selektierter Testfälle





## Schritt 2: Priorisierung selektierter Testfälle







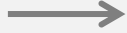




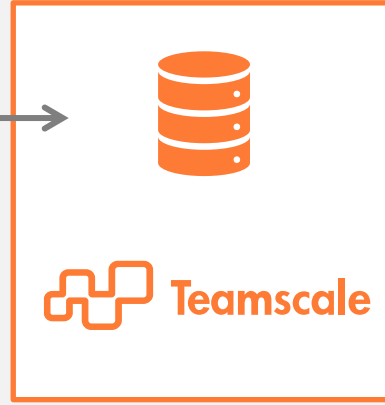
Initiale Aufzeichnung aller Tests



Ausführung  
aller Tests



Coverage & Laufzeit  
für alle Tests

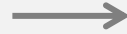


## Test-Impact-Analyse

Testausführung nach Änderungen

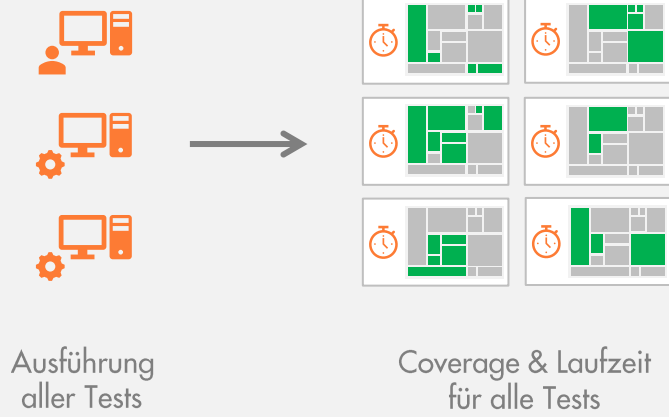


VCS



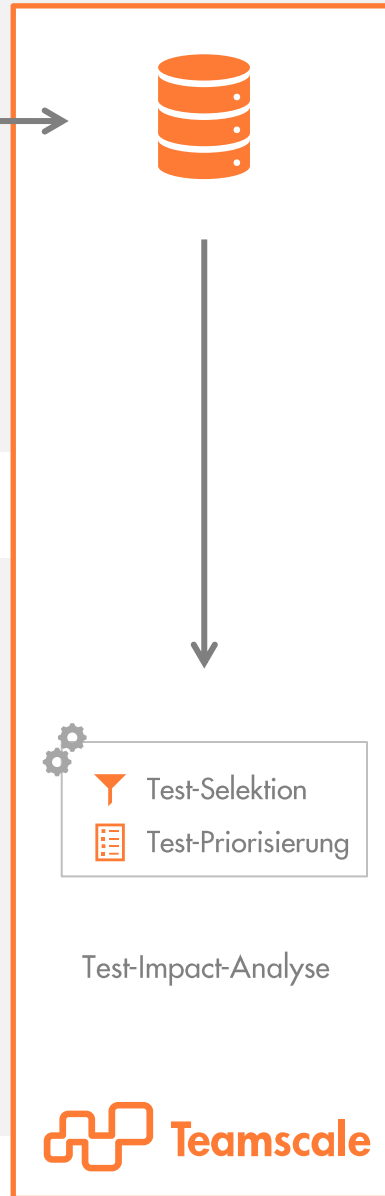
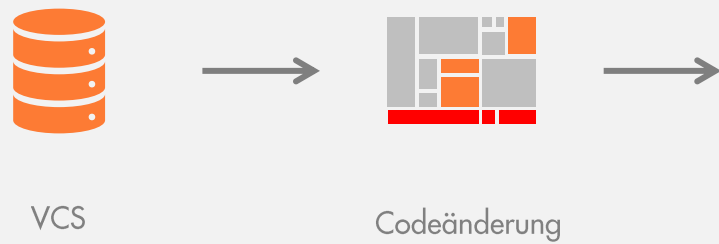
Codeänderung

Initiale Aufzeichnung aller Tests



## Test-Impact-Analyse

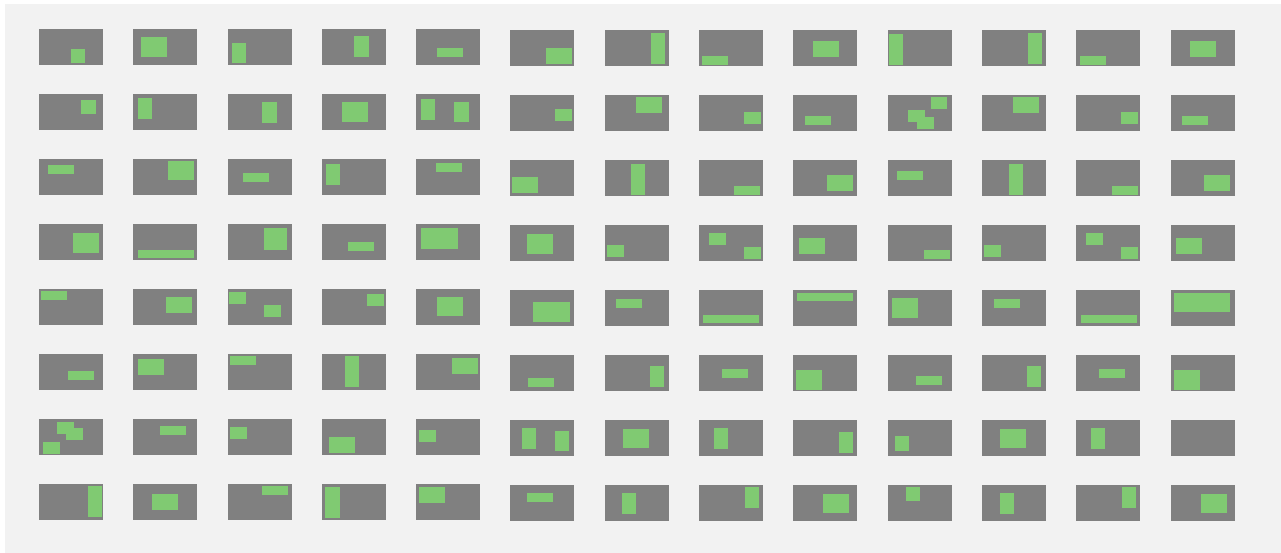
Testausführung nach Änderungen



Ziel: Tests in der **Continuous Integration** wirksam machen



Trotzdem: Regelmäßig **alle Tests** laufen lassen



Neue Tests immer ausführen



Geänderte Tests immer ausführen

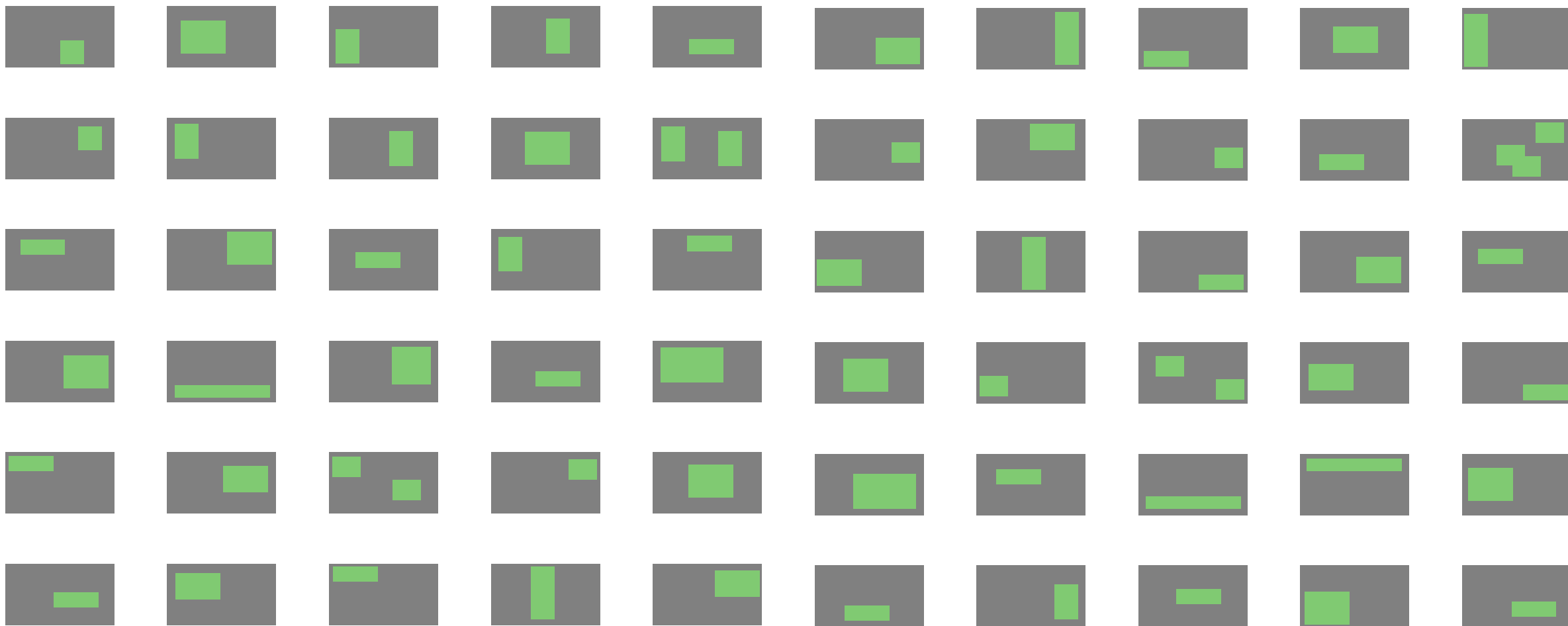


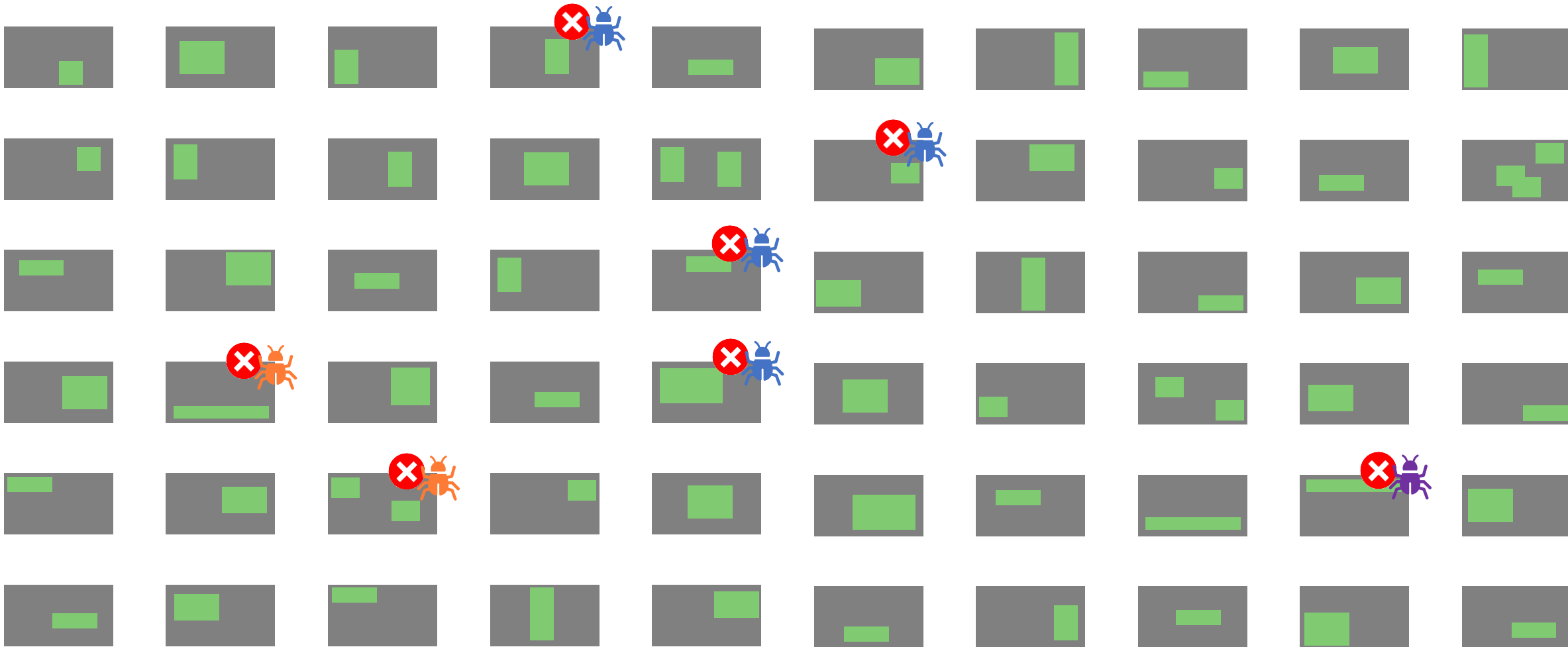
... wenn sich Daten ändern



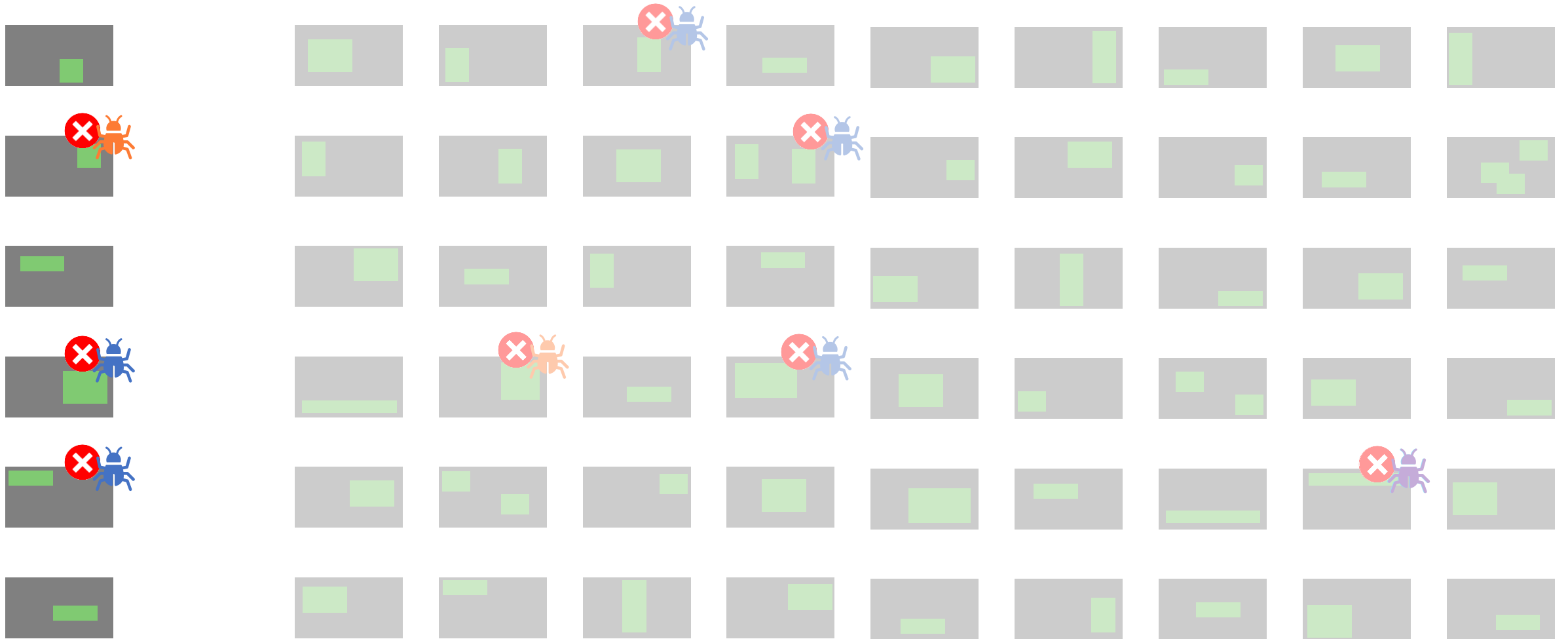
... wenn sich die Konfiguration ändert

**Geht das auch einfacher?**





# Pareto-Testing: 80/20 Optimierung



**Warum gibt es hier Optimierungspotential?**



Sample Only the Active Layer/Mask

Untitled1 x Picture1.png x

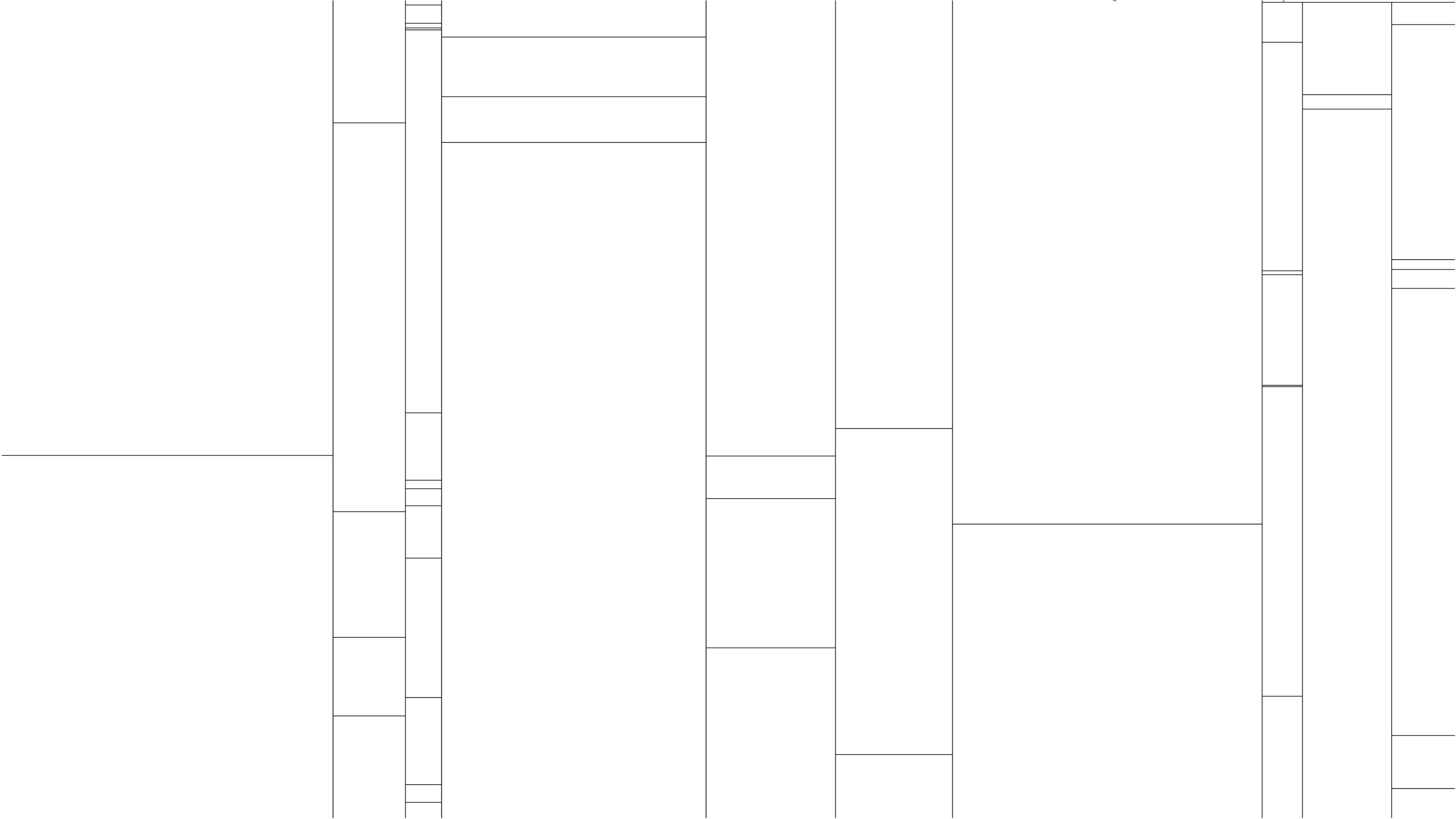


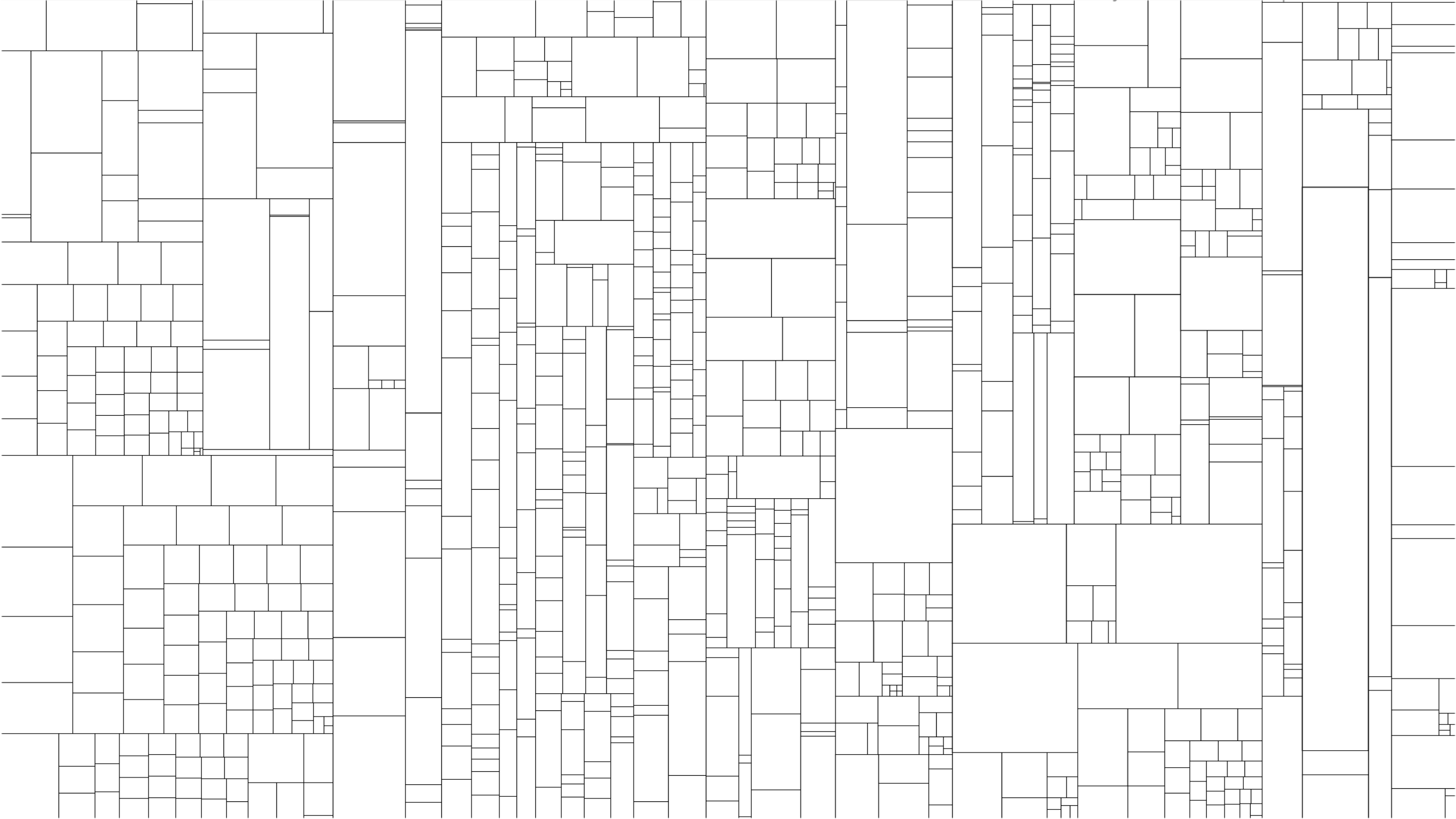
Layers

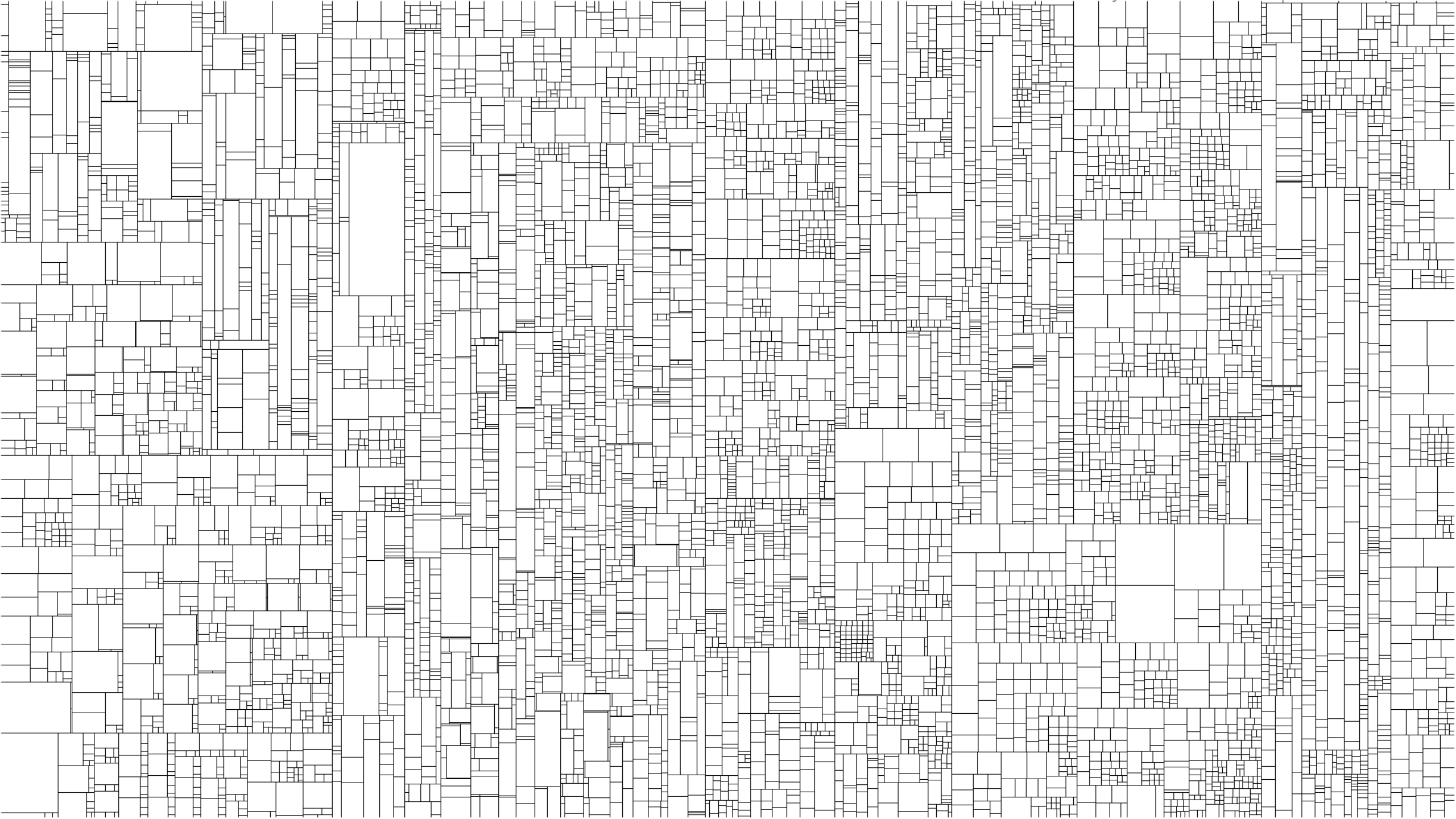
Opacity: 100 % Normal

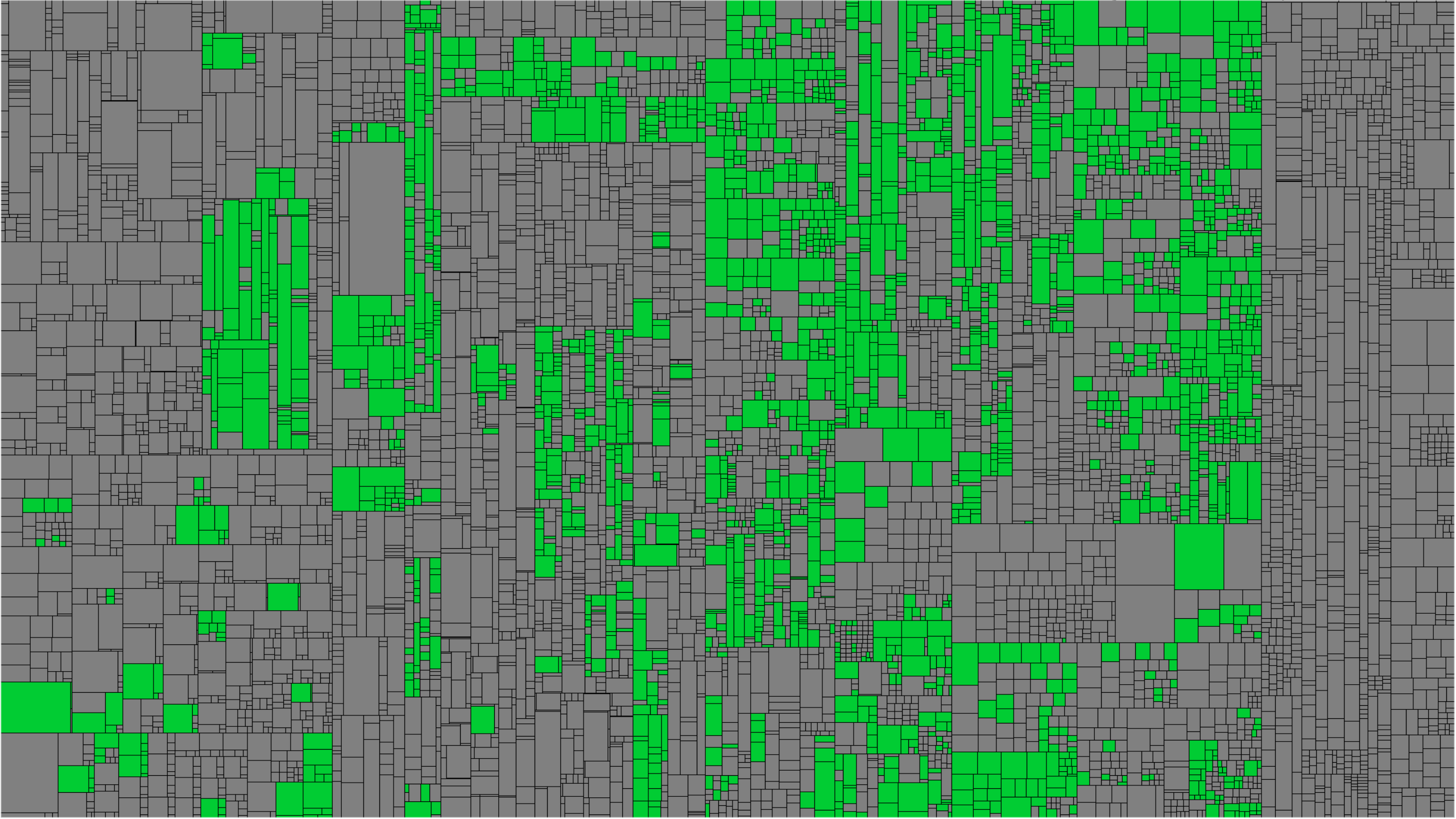
layer 1

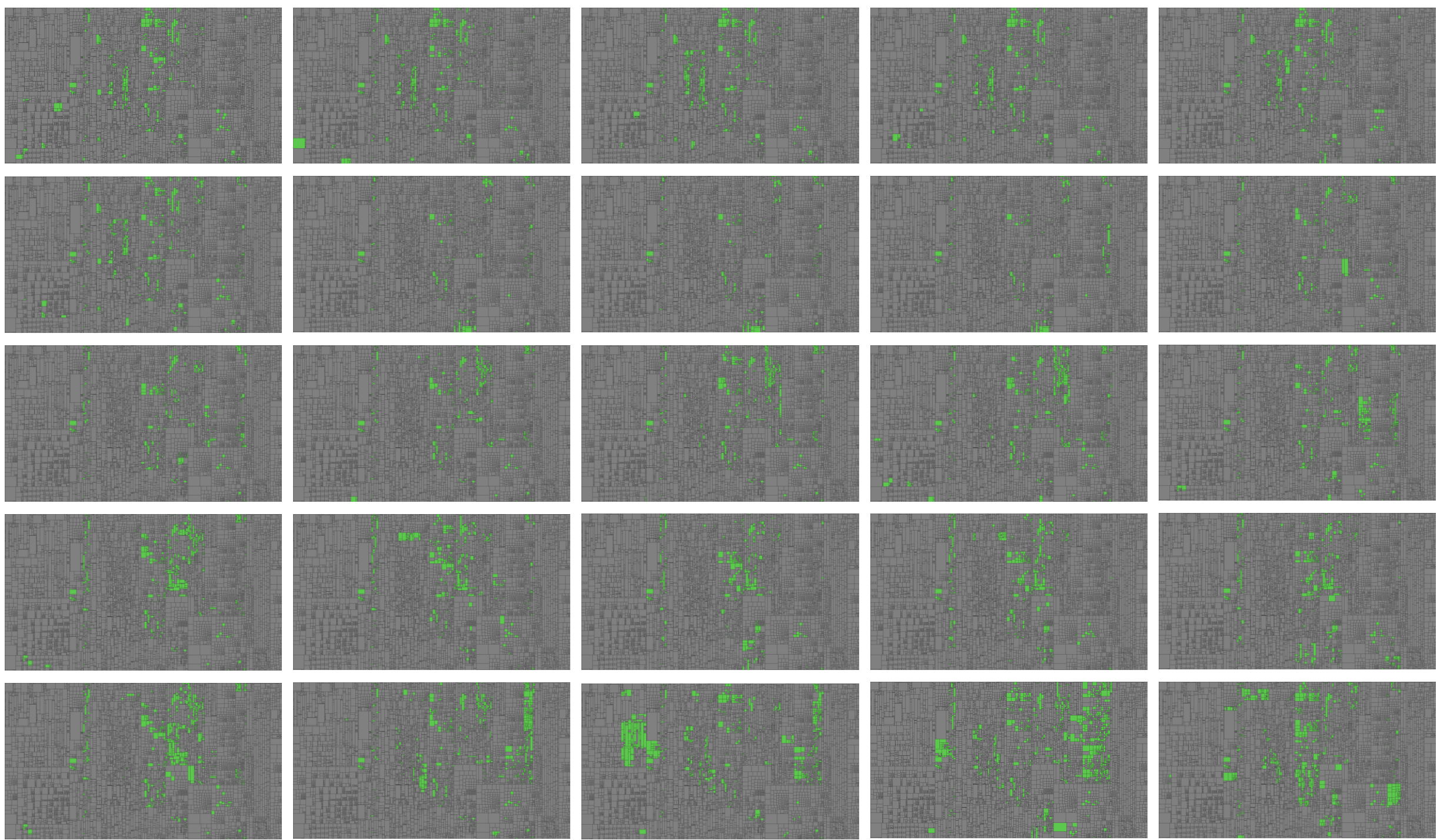




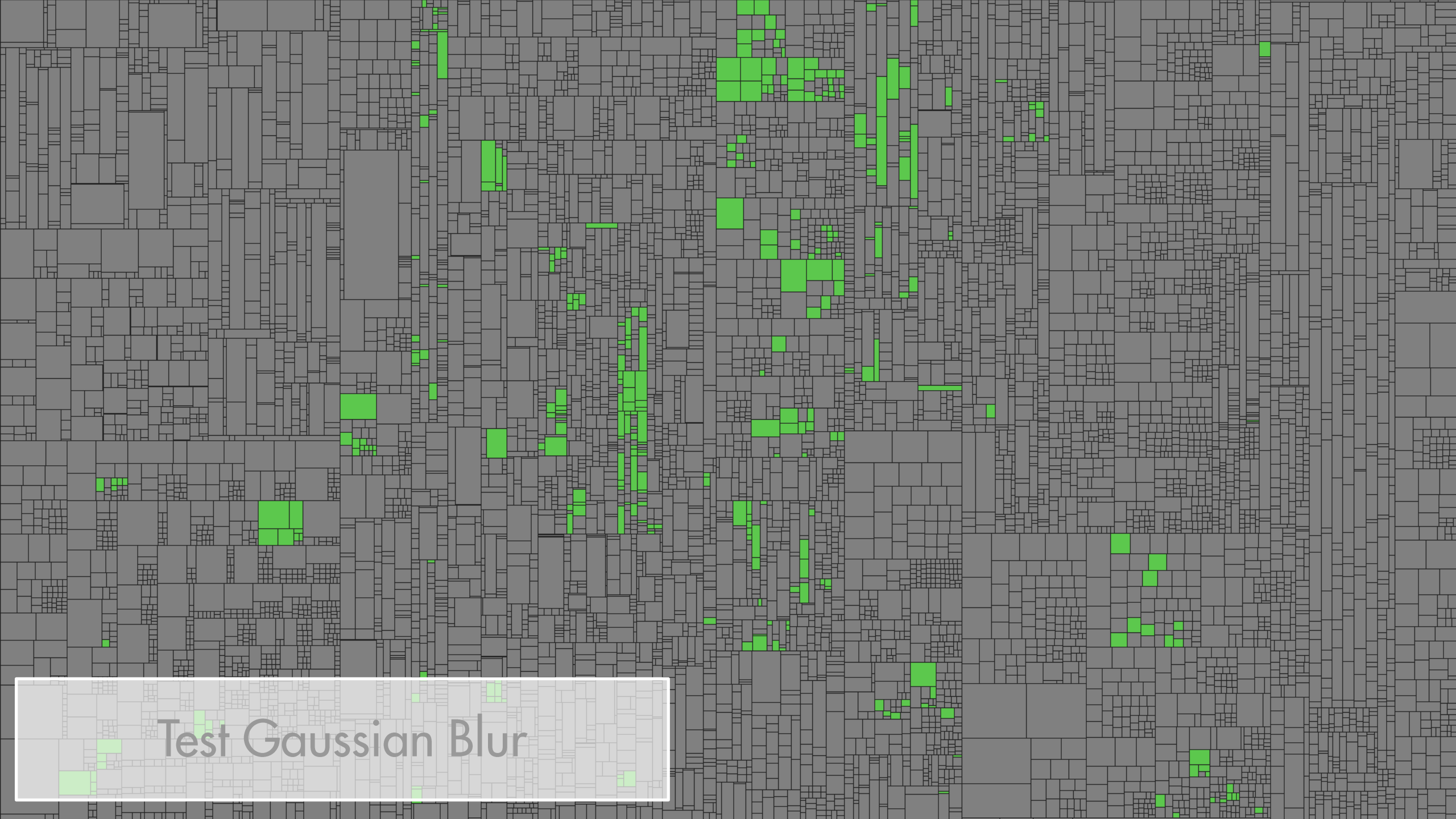








**Welchen Einfluss hat die Reihenfolge der  
Ausführung von Software Tests?**



Test Gaussian Blur



The image consists of a dense, overlapping grid of gray rectangles of various sizes and orientations. Scattered throughout this grid are several smaller rectangles in blue and green. The blue rectangles are more numerous and appear in various sizes and orientations, often forming vertical or horizontal lines. The green rectangles are fewer in number and are also scattered across the grid. In the bottom-left corner, there is a white rectangular box with a thin black border containing the text "Test Lens Blur".

Test Lens Blur

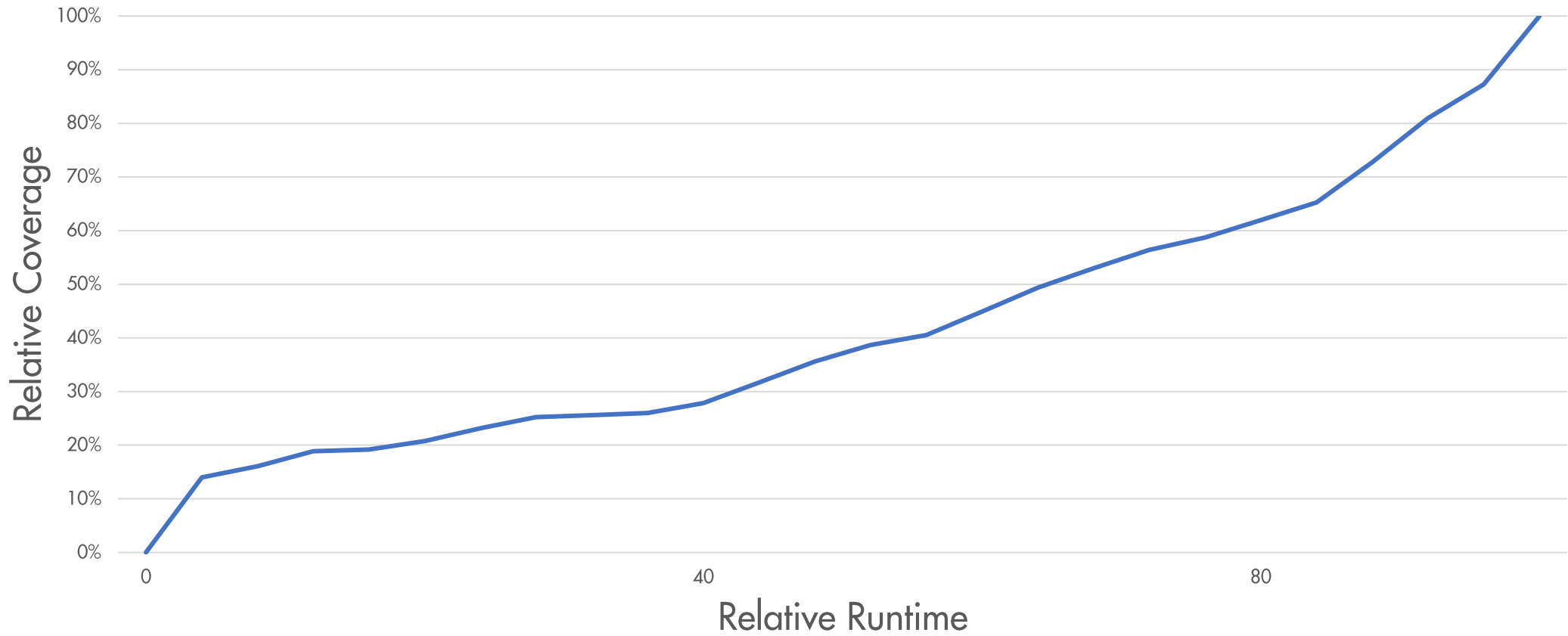


Test Motion Blur

The image consists of a dense, overlapping grid of gray rectangles of various sizes and orientations. Scattered throughout this grid are several smaller rectangles in blue and green. The blue rectangles are more numerous and appear in various sizes and orientations, often forming small clusters or lines. The green rectangles are fewer in number and are also scattered, with a few appearing in the lower-left quadrant. The overall effect is a complex, textured pattern of geometric shapes.

Test Smart Blur

# Time vs Code Coverage

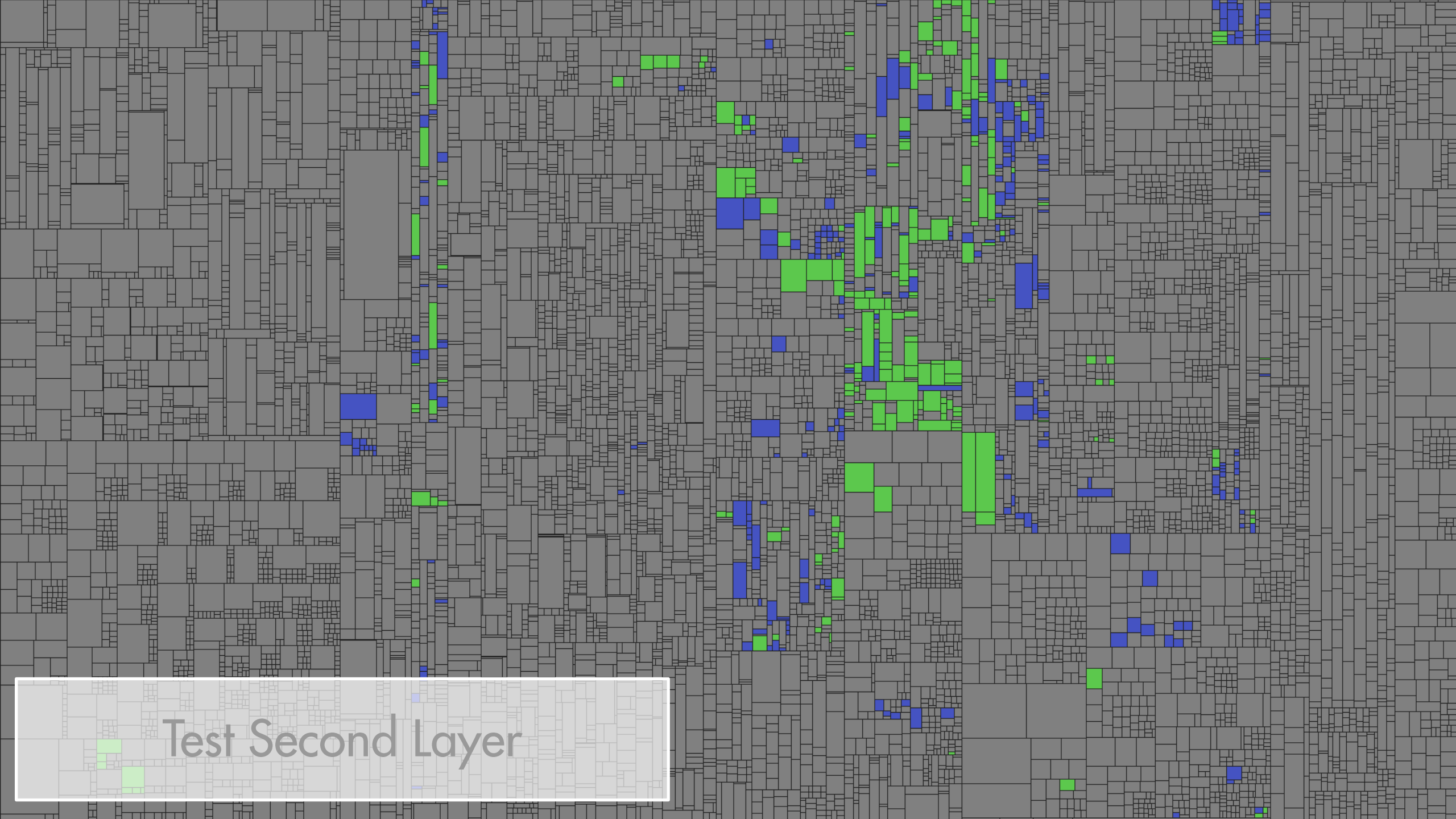




Test Create and Modify  
Selection



Test Change View Settings



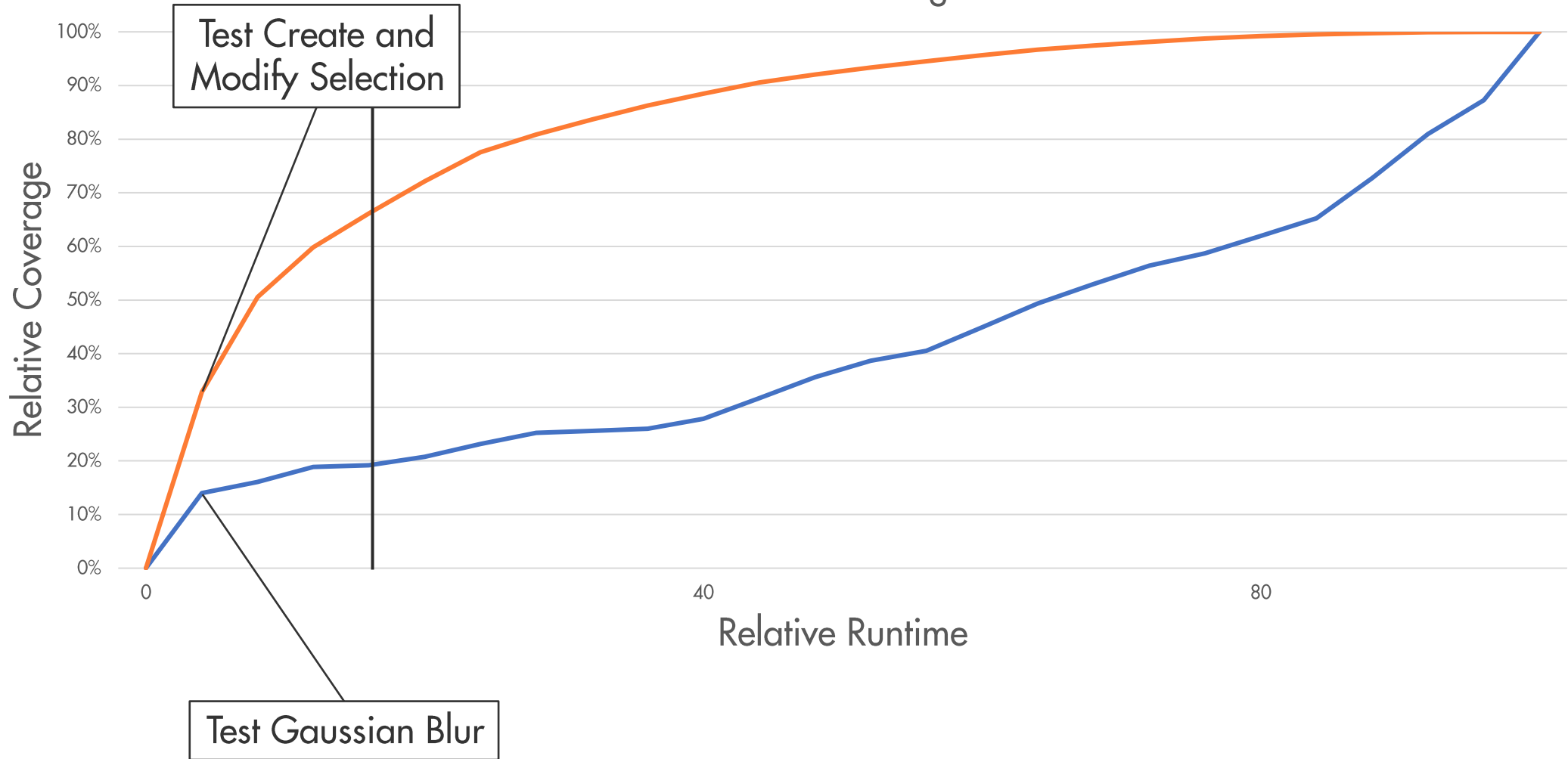
Test Second Layer

The image consists of a dense, overlapping grid of gray rectangles of various sizes. Scattered throughout this grid are several smaller rectangles in blue and green. The blue rectangles are more numerous and appear in various orientations and sizes. The green rectangles are fewer in number and often appear in small clusters or as single blocks. The overall effect is a complex, textured pattern of gray with occasional color accents.

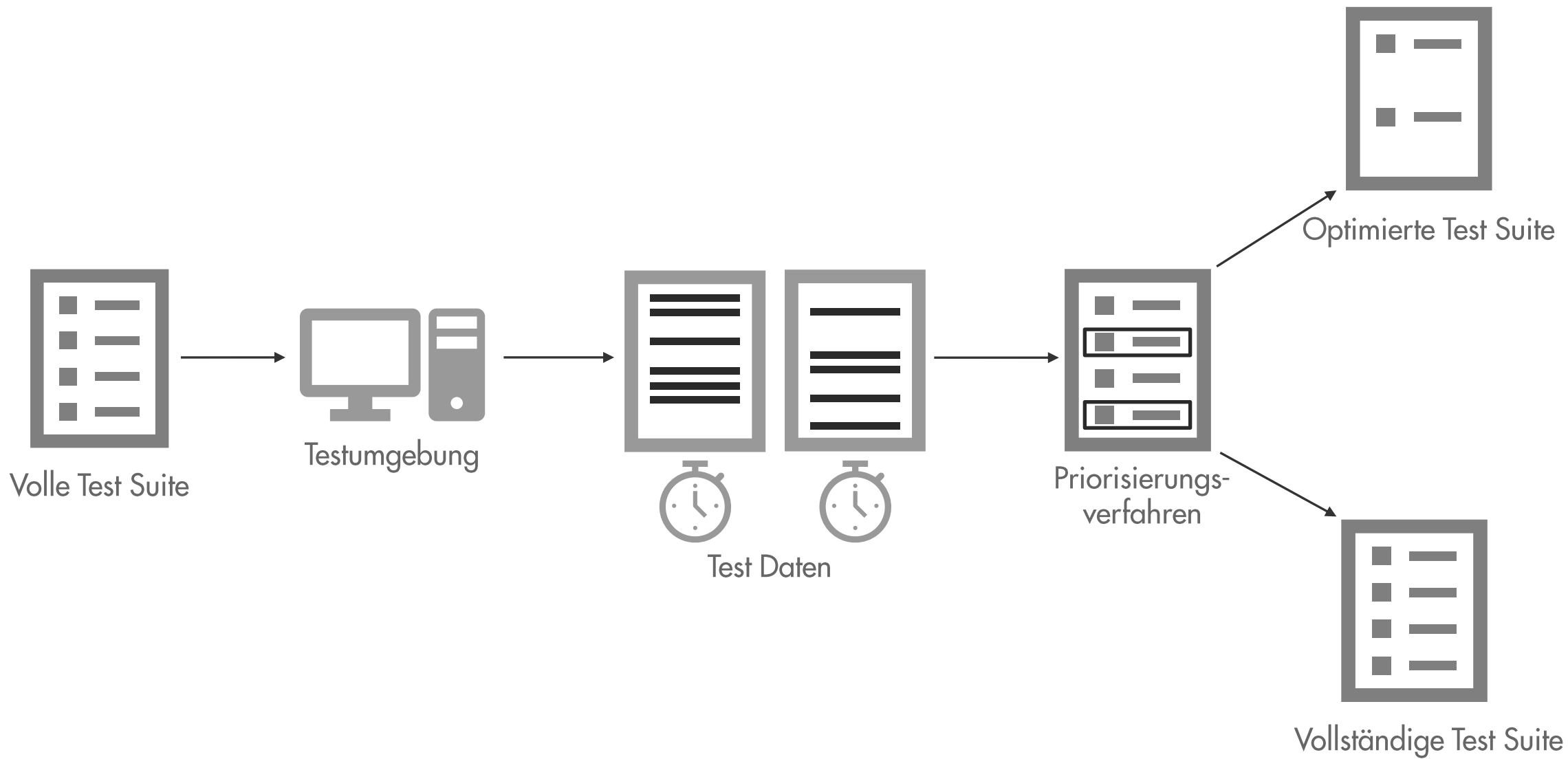
Test Save Image



Time vs Code Coverage



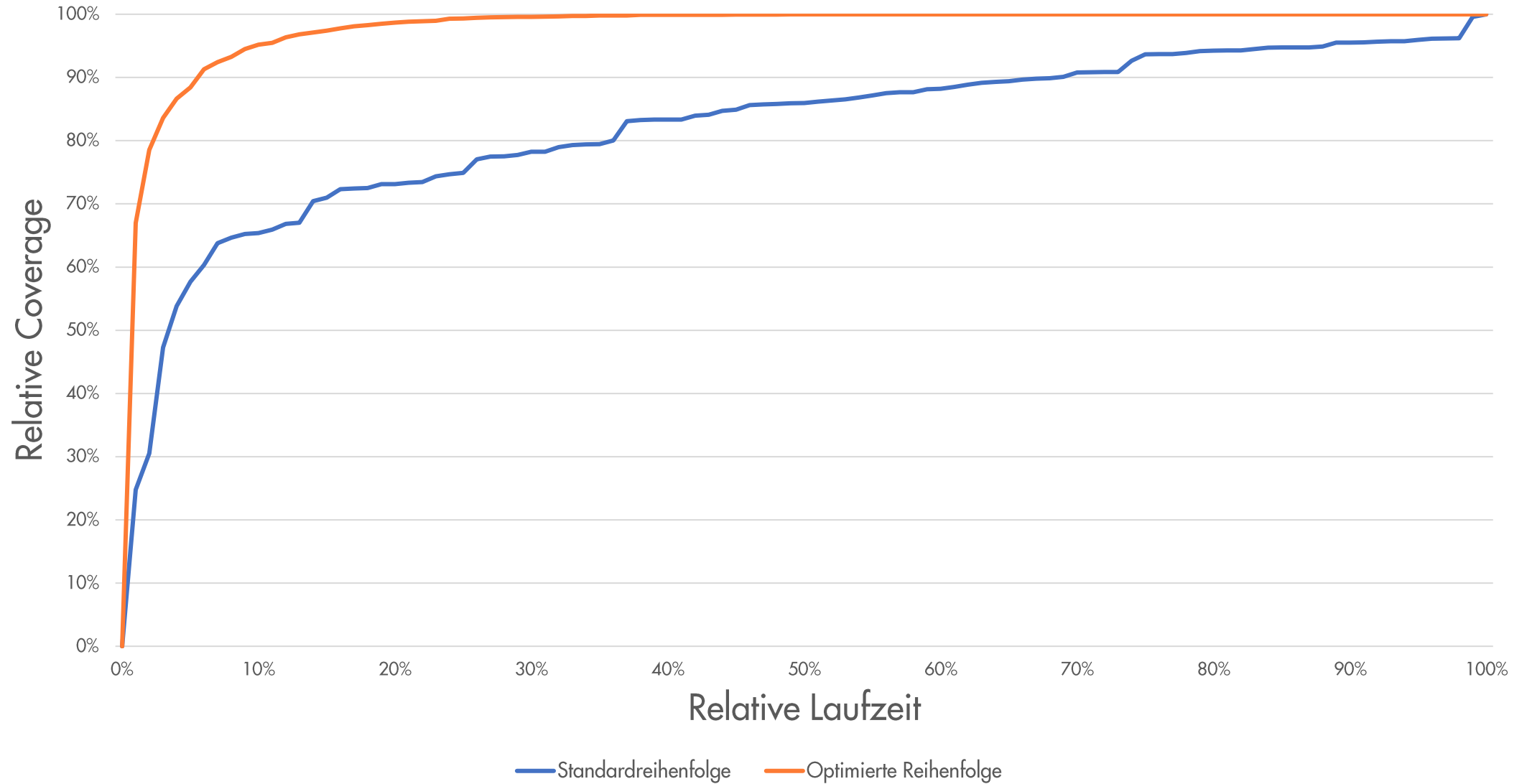
**Wie wählen wir die besten Tests aus?**



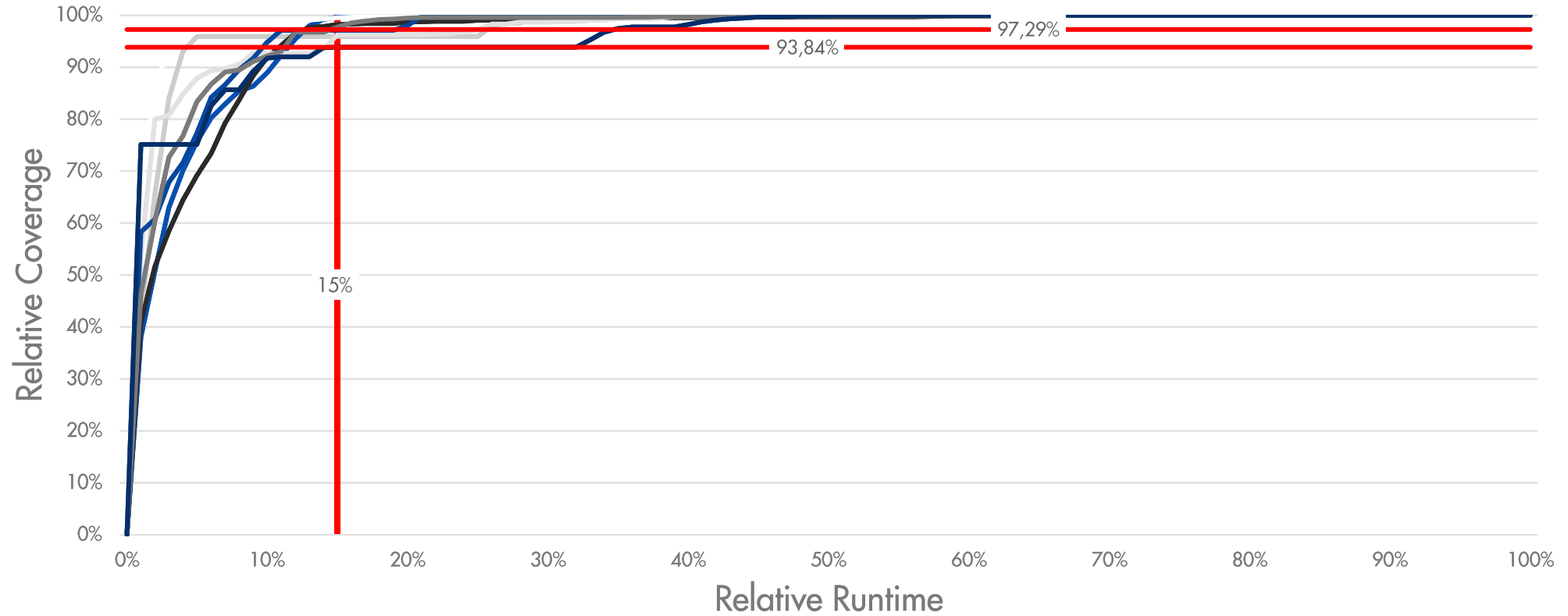
**Wie gut funktioniert das ganze für echte Test Suites?**

Open-Source Project	SLOC	# Tests	Code Coverage
AC Collections	62,934	15,183	86%
AC Lang	75,467	3,484	95%
AC Math	174,522	4,828	92%
AssertJ	161,306	14,685	91%
EBean	170,656	2,618	77%
JoptSimple	9,433	838	98%
Spoon	112,650	1,619	83%
Closed-Source Project			
Siemens	>>203,964	5,366	75%
CQSE	516,949	2,979	76%

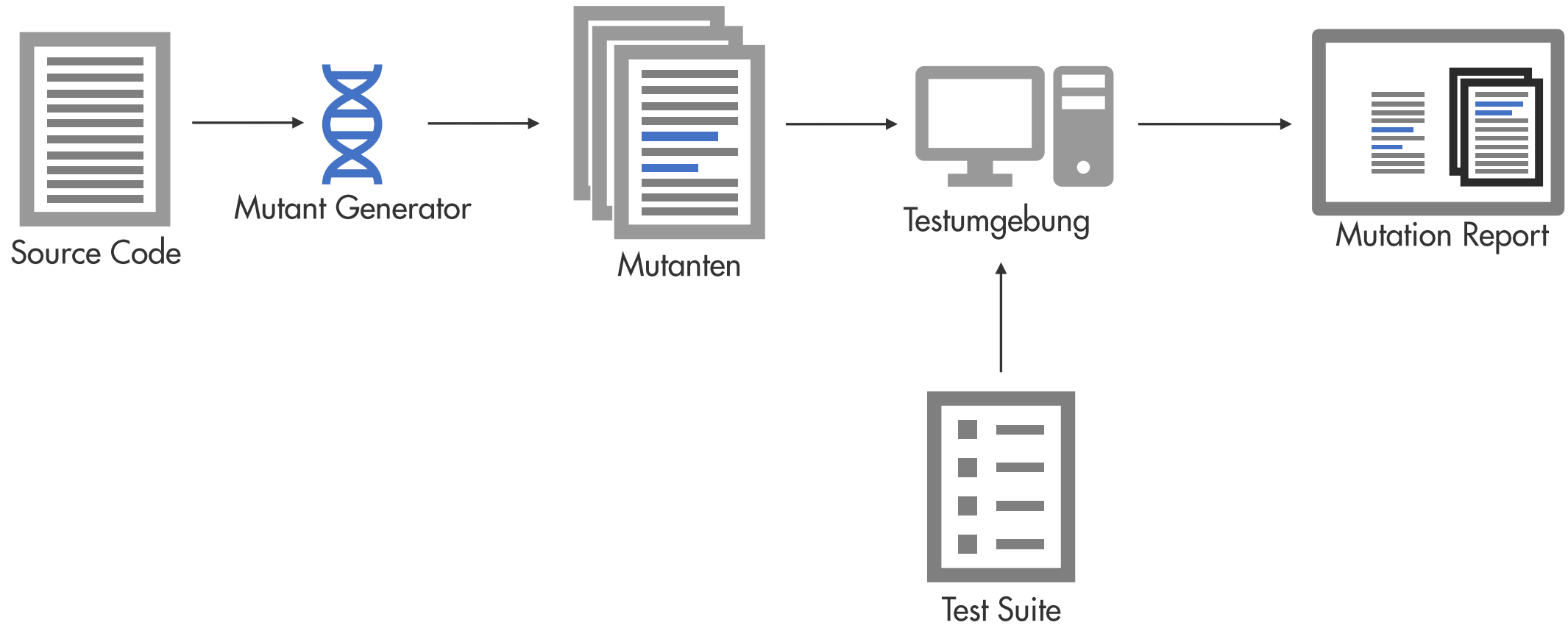
# Siemens Projekt



# Überblick

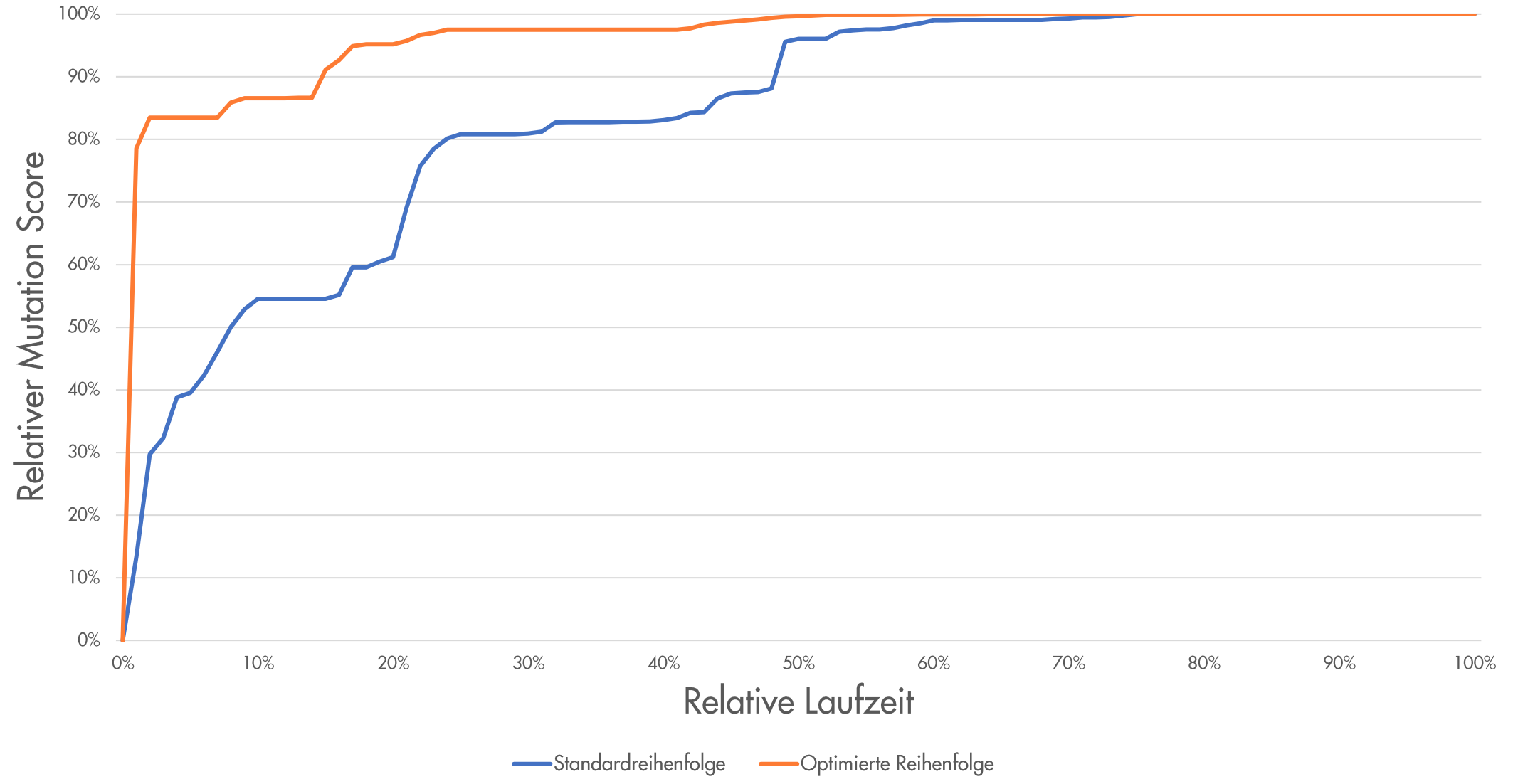


AC Coll AC Lang AC Math AssertJ Ebean Jopt-Simple Jsoup Spoon

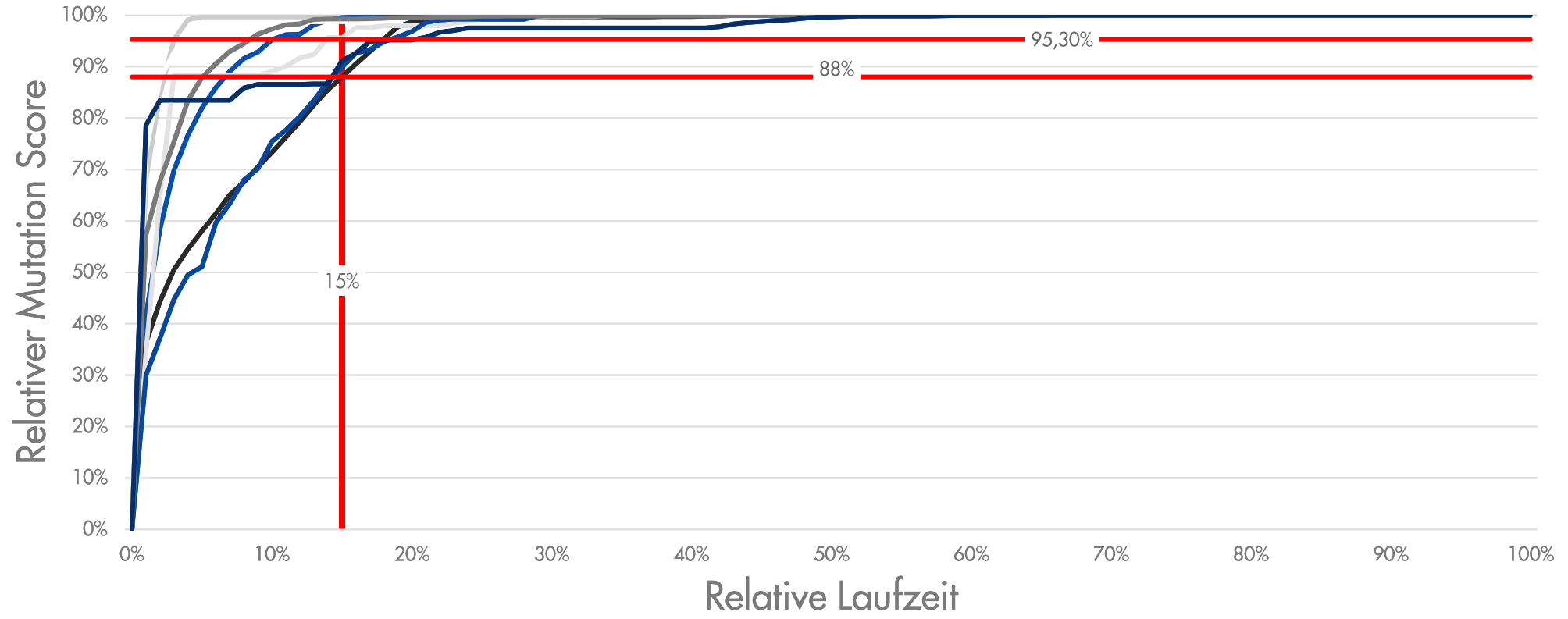




# Spoon



# Überblick



AC Coll AC Lang AC Math AssertJ Ebean Jopt-Simple Jsoup Spoon

# Fazit Pareto Testing

- Bei einigen Systemen  $>70\%$  der Coverage/Mutanten in 1% der Zeit
- Über 95% der Coverage und Mutanten in 15% der Zeit
- Je ineffektiver die Test-Suite, desto stärker ausgeprägt der Effekt
- Anwendbar auf automatisierte und auf manuelle Tests



# Pareto-Testing

Tests werden **unabhängig von Änderungen** ausgewählt.

95% der Mutanten in 15% der Zeit ermittelt

Einmalige Messung der Coverage reicht aus (ggf. quartärliehe Wiederholung)

**Weniger Aufwand & breiter Anwendbar**

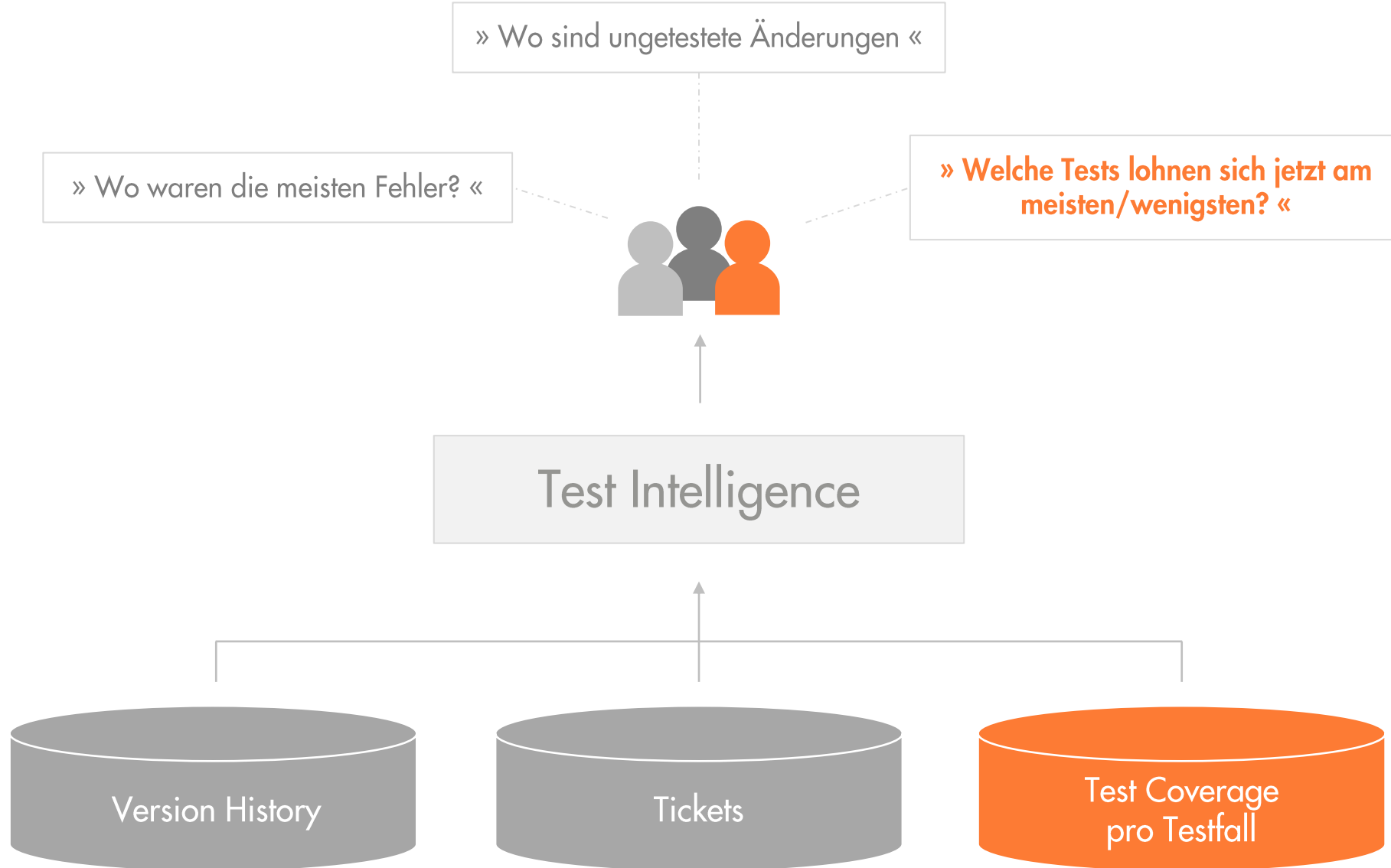
# Test-Impact-Analyse

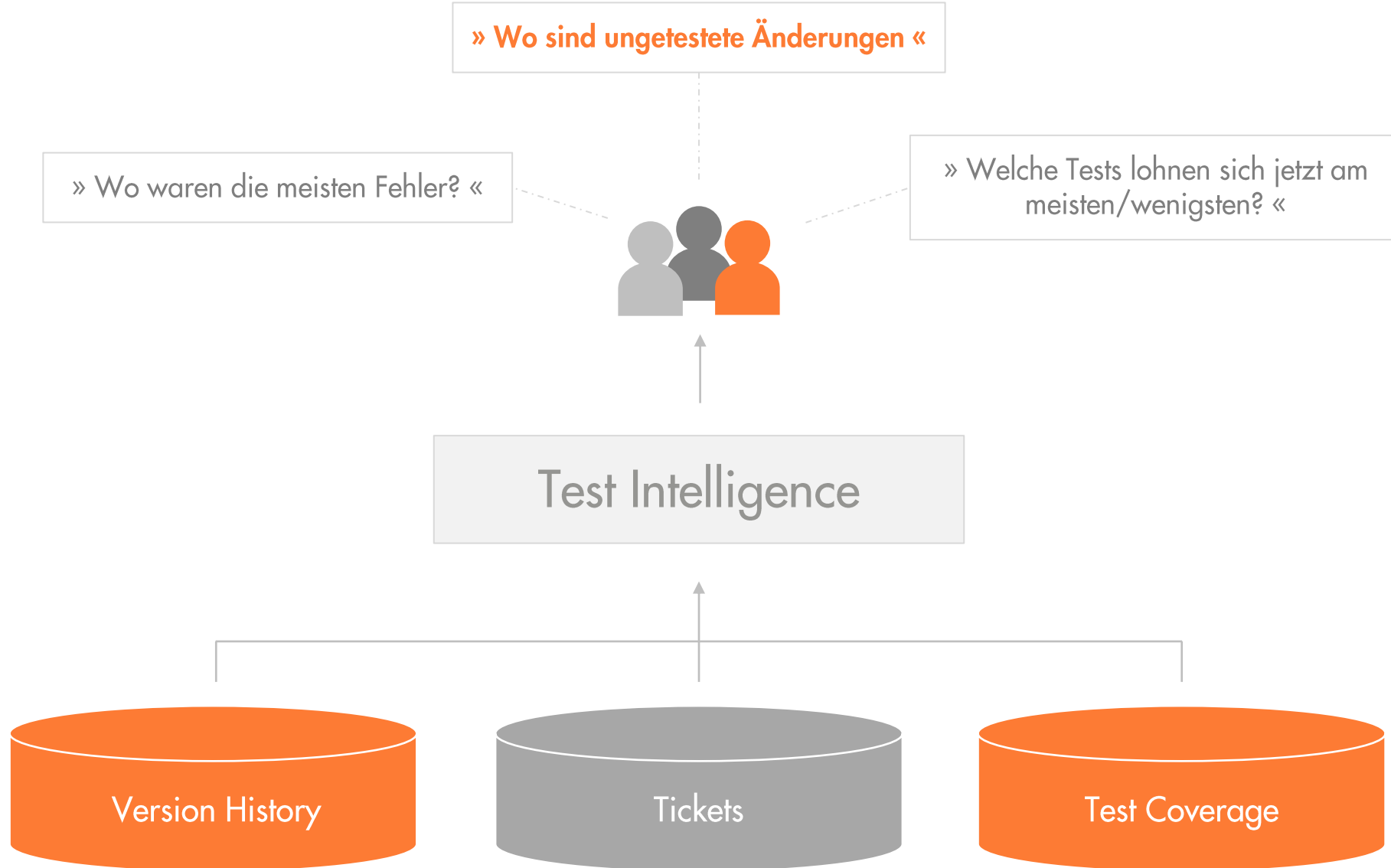
Tests werden für jeden Lauf **passend zu Änderungen** ausgewählt

90% der Mutanten in 2% der Zeit ermittelt

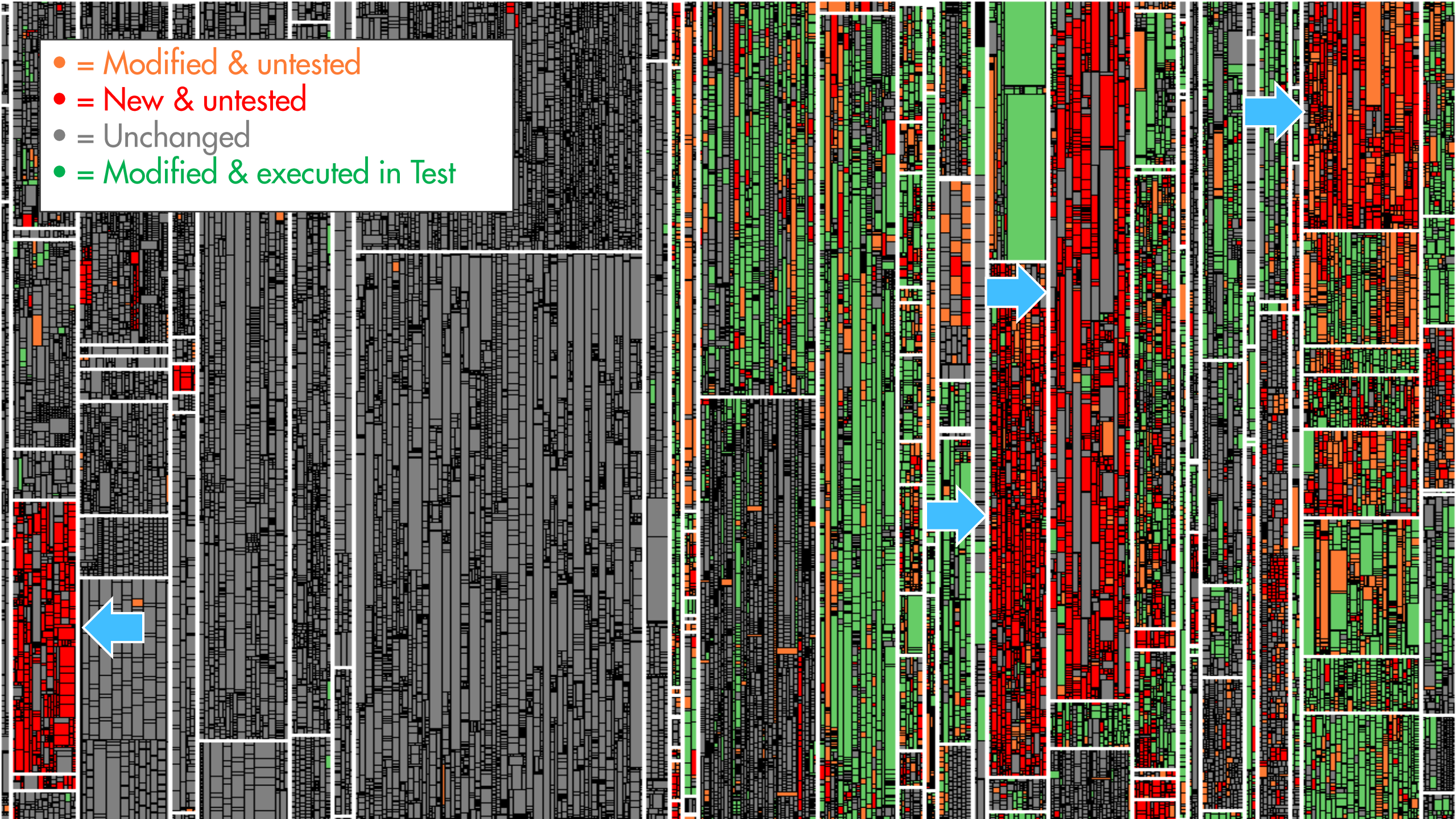
Erfordert kontinuierliche Messung der Coverage und Integration der Test-Auswahl in die CI / Testautomatisierung.

**Stärkere Beschleunigung des Feedbacks (bei höherem Aufwand)**

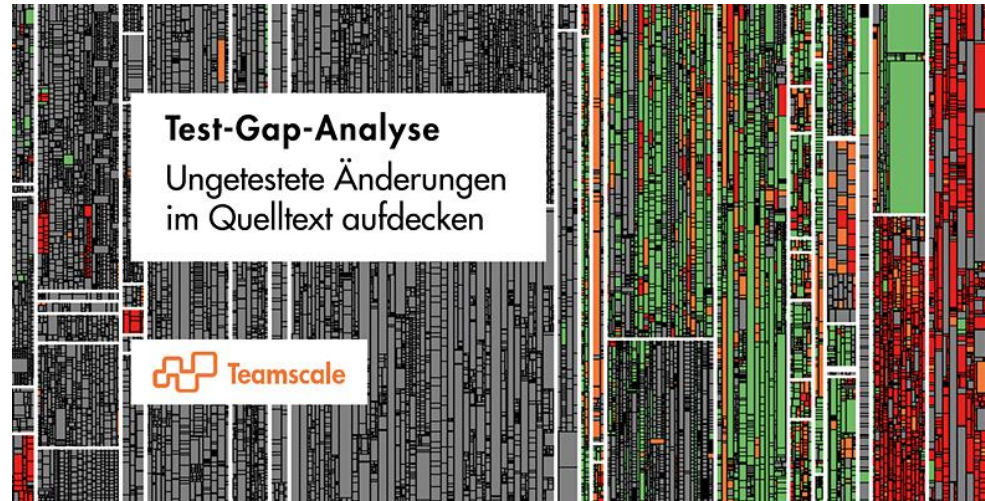




- = Modified & untested
- = New & untested
- = Unchanged
- = Modified & executed in Test



# Workshop



DE 16. Februar 2022, 10:30-12:00 Uhr CEST  
Registrierung: <http://cqse.eu/tga-workshop-de-2022-02-er>



us 09. März 2022, 17:00-18:30 Uhr CEST  
Registrierung: <http://cqse.eu/tga-workshop-en-2022-03-er>





# Feedback



<https://www.sigs-datacom.de/sd/conference-evaluation/oop2022/4285>

# Kontakt



Dr. Elmar Jürgens · [juergens@cqse.eu](mailto:juergens@cqse.eu) · +49 179 675 3863

Raphael Nömmer · [noemmer@cqse.eu](mailto:noemmer@cqse.eu) · +49 151 59861610

CQSE GmbH  
Centa-Hafenbrädl-Straße 59  
81249 München  
[www.cqse.eu](http://www.cqse.eu)

