

# Haben wir das Richtige getestet?

## Erfahrungen mit Test-Gap-Analyse in der Praxis

Dr. Elmar Juergens  
CQSE GmbH



Bugzilla - Bug List

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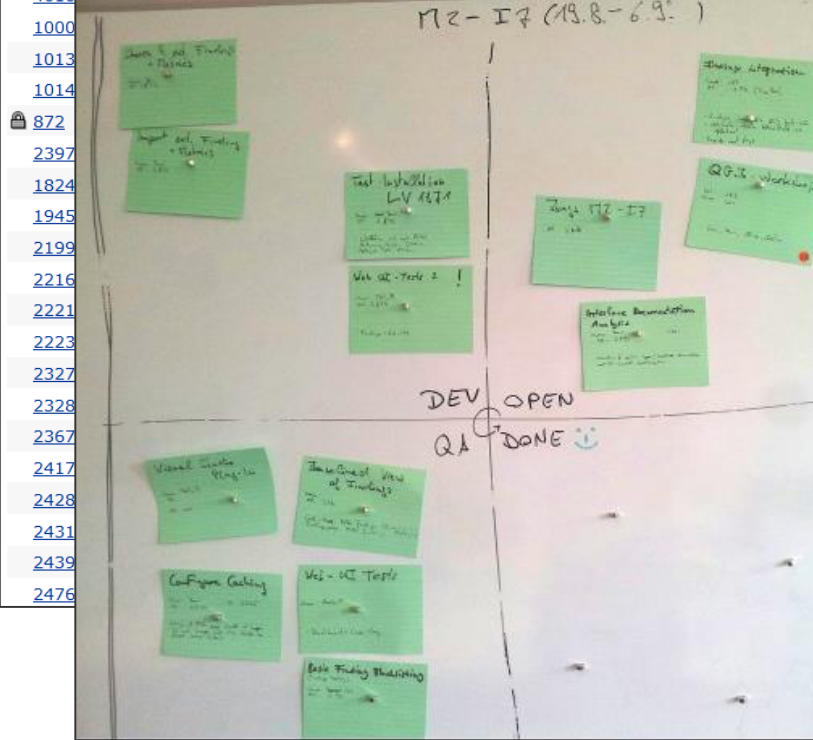
Wed Aug 28 2013 11:45:48 CEST  
[quip?](#)

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Status: UNCONFIRMED, NEW, ASSIGNED, REOPENED Product: clone Component: clone

83 bugs found.

- [ID ▲](#) [Summary](#)
- [3382](#) [Remove old filtering framework](#)
- [4608](#) [Improve progress monitoring for clone detection](#)
- [3613](#) [Make MetricOverview more flexible w.r.t. to database table names](#)
- [3811](#) [Incorrect offset reported by two-phased scanners](#)
- [4610](#) [Clone compare view does not open clone pair at correct position](#)



Übersicht
Aktivität
Roadmap
Tickets
Neues Ticket
Projektarchiv
Konfiguration

## Tickets

Filter

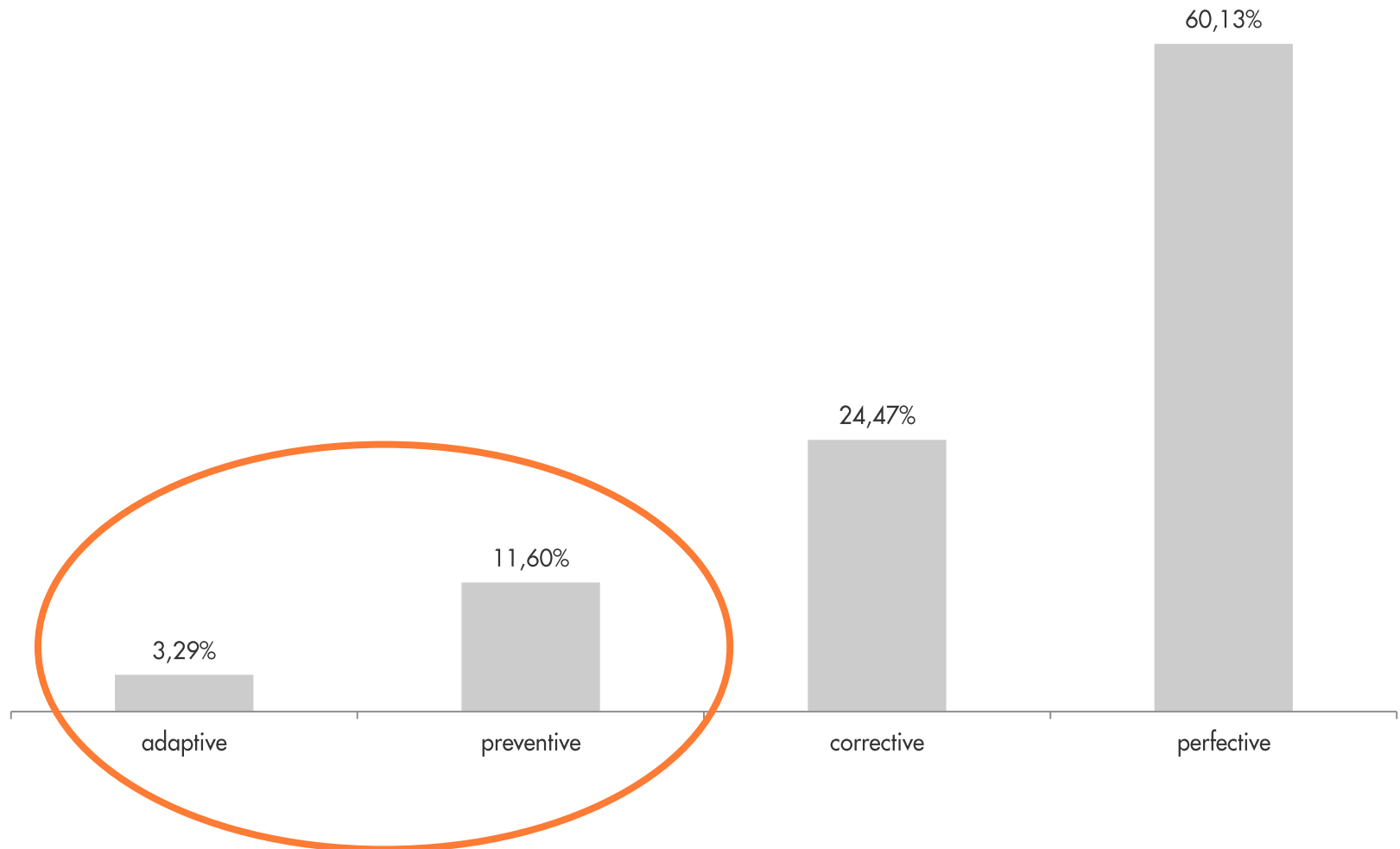
Status offen ▾

Optionen

Anwenden  Zurücksetzen  Speichern

#	Tracker	Status	Priorität	Them
<input type="checkbox"/> 5489	corrective	New	Normal	Cannot install ConQAT from update site on Kepler
<input type="checkbox"/> 5488	adaptive	New	Normal	Should be able to view "own" findings
<input type="checkbox"/> 5487	uncategorized	Assigned	Normal	Upload/Change of user image broken
<input type="checkbox"/> 5486	uncategorized	New	Normal	Allow for branded dists
<input type="checkbox"/> 5485	perfective	New	Normal	Enable hiding of individual findings in the IDE (e.g. after they are resolved)
<input type="checkbox"/> 5484	corrective	New	High	Visual Studio crashes after editing on findings
<input type="checkbox"/> 5483	uncategorized	Yellow	Normal	Cleanup com.teamscale.ide.prefs
<input type="checkbox"/> 5482	uncategorized	New	Normal	Filter structural clones
<input type="checkbox"/> 5481	adaptive	New	Normal	Integrate Sharepoint Analysis in MR Dashboard
<input type="checkbox"/> 5480	uncategorized	New	Normal	Teamscale connection preference page not working in Eclipse 4.3 on Mac
<input type="checkbox"/> 5479	preventive	Red	Normal	Benchmarking and selection of storage systems
<input type="checkbox"/> 5478	uncategorized	Yellow	Normal	Usability: "Open in Web Browser" should use the browser from preferences
<input type="checkbox"/> 5477	corrective	New	Normal	Fix refresh problem when setting a dashboard as default
<input type="checkbox"/> 5475	perfective	Assigned	Normal	Create UI test for "show history" in code perspective
<input type="checkbox"/> 5474	adaptive	Assigned	Normal	Enable mapping of baseline to head resources when packages are split
<input type="checkbox"/> 5473	perfective	Red	Urgent	Connection problems using svn+ssh
<input type="checkbox"/> 5472	perfective	Accepted	Normal	Display baselines in charts (as small vertical lines)
<input type="checkbox"/> 5471	perfective	Accepted	Normal	Support selection of explicit baseline for filtering
<input type="checkbox"/> 5470	perfective	Accepted	Normal	Service documentation shall also provide more detailed documentation on q
<input type="checkbox"/> 5469	perfective	Accepted	Normal	Adding/removing metrics to chart widget changes colors of other metrics
<input type="checkbox"/> 5468	perfective	Accepted	Normal	Simple metric widget shall support explicit baseline for delta value calculation
<input type="checkbox"/> 5467	corrective	Accepted	High	The delta not found in the store!
<input type="checkbox"/> 5466	corrective	Accepted	Normal	Problems when tracking TODOs which have changed line breaks

# CRs in ConQAT



Auf Basis von ca. 2000 CRs aus dem ConQAT Bugzilla

# Bugzilla - Bug List

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Wed Aug 28 2013 11:45:48 CEST

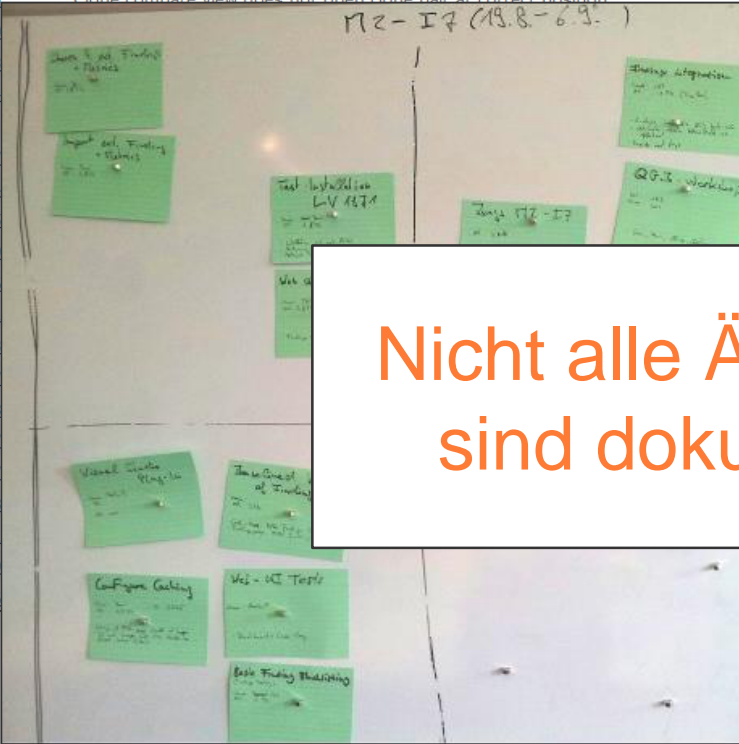
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4608	Improve progress monitoring for clone detection
3613	Make MetricOverview more flexible w.r.t. to database table names
3811	Incorrect offset reported by two-phased scanners
4610	Clone compare view does not open clone pair at correct position
1000	
1013	
1014	
872	
2397	
1824	
1945	
2199	
2216	
2221	
2223	
2327	
2328	
2367	
2417	
2428	
2431	
2439	
2476	



Nicht alle Änderungen sind dokumentiert!

## ConQAT

Übersicht Aktivität Roadmap **Tickets** Neues Ticket Projektarchiv Konfiguration

### Tickets

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Status

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				Enable hiding of individual findings in the IDE (e.g. after they are resolved)
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5473	perfective	Red	Urgent	Connection problems using svn+ssh
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# Wieviele Änderungen sind ungetestet?

Studie: C# System @ Munich Re

Release A: 5 Iterationen (2 Monate)

- 15% Methoden neu/geändert, 8% ungetestet

Release B: 10 Iterationen (4 Monate)

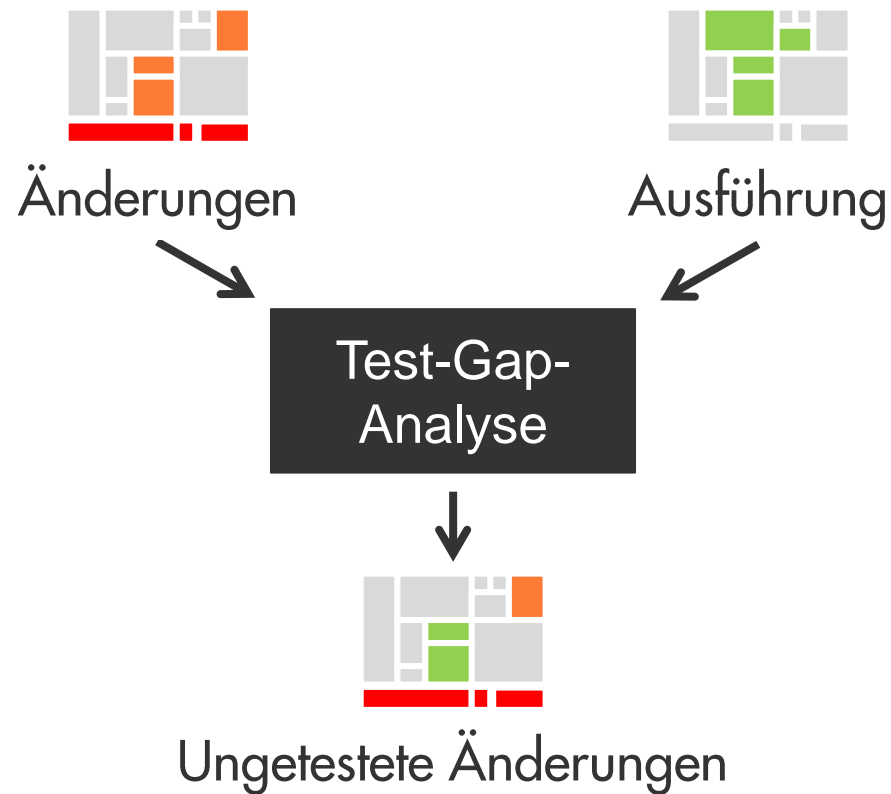
- 15% Methoden neu/geändert, 9% ungetestet

*Feldfehlerwahrscheinlichkeit 5x höher für unget. Änderungen*

# Agenda

1. Test-Gap-Analyse
2. Einsatz in verschiedenen Test-Szenarien
3. Ausblick

# Anatomie Test-Gap-Analyse





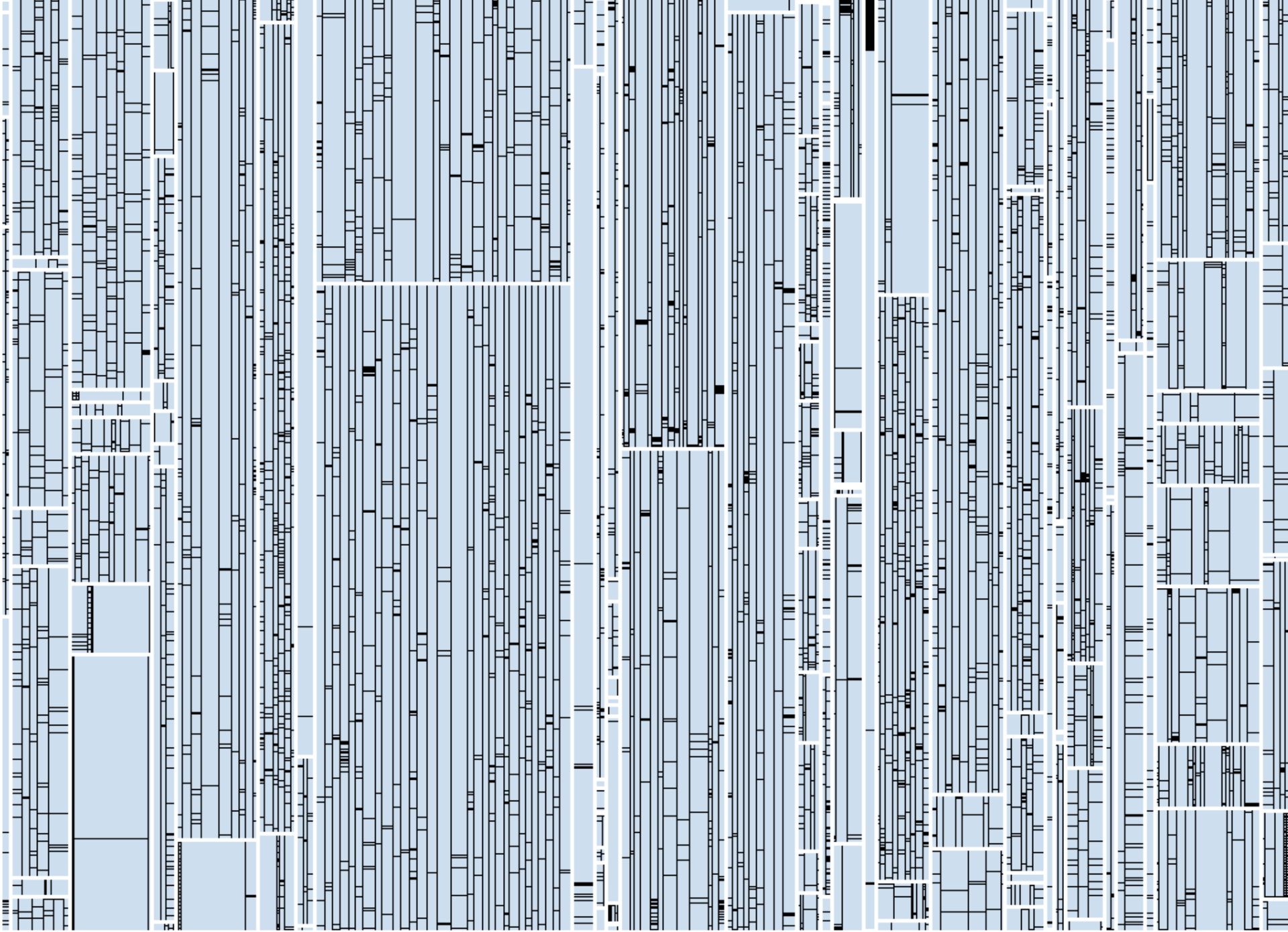
**GUI.Dialogs**

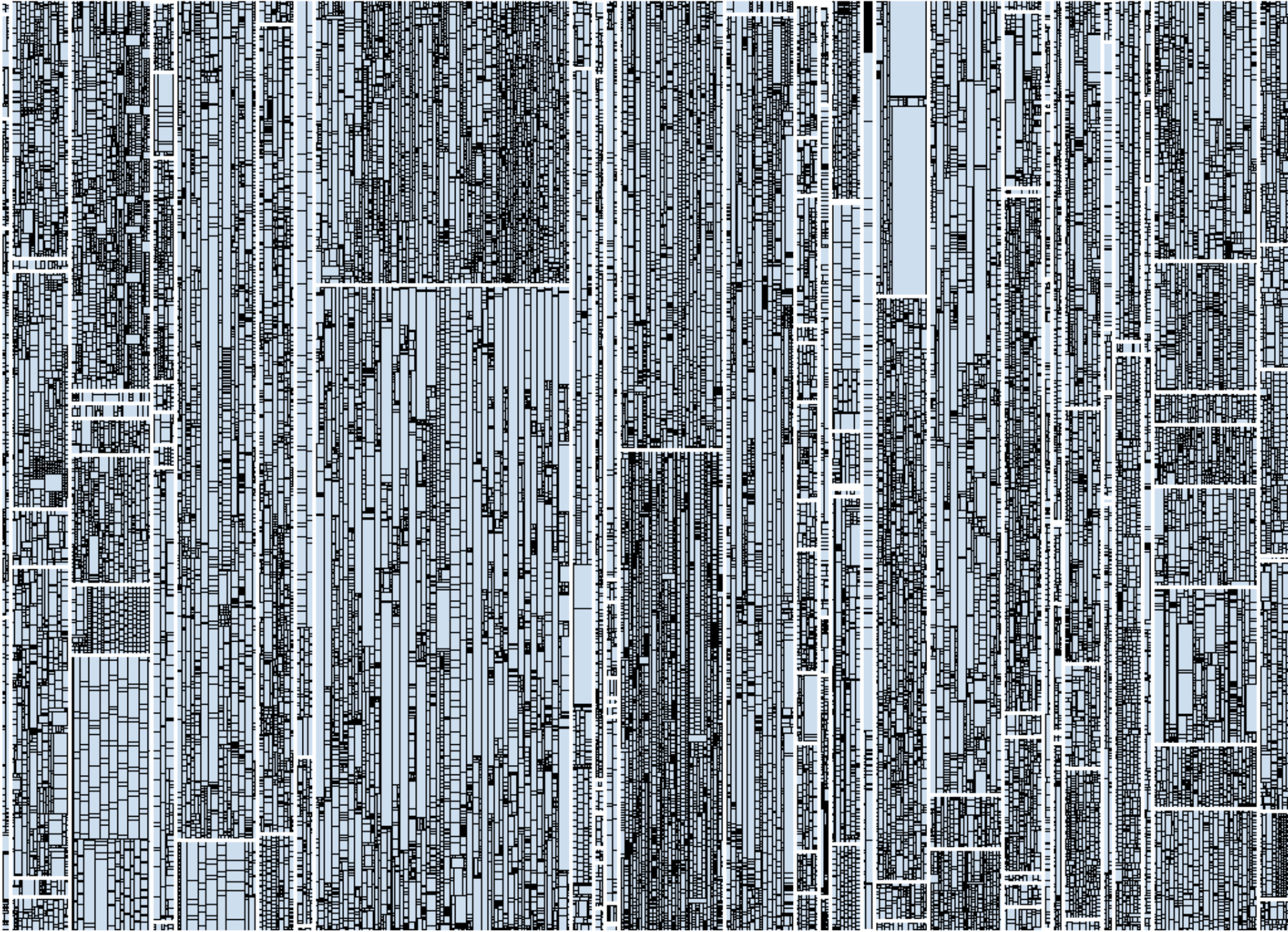
**Authentication**

**UI Controls**

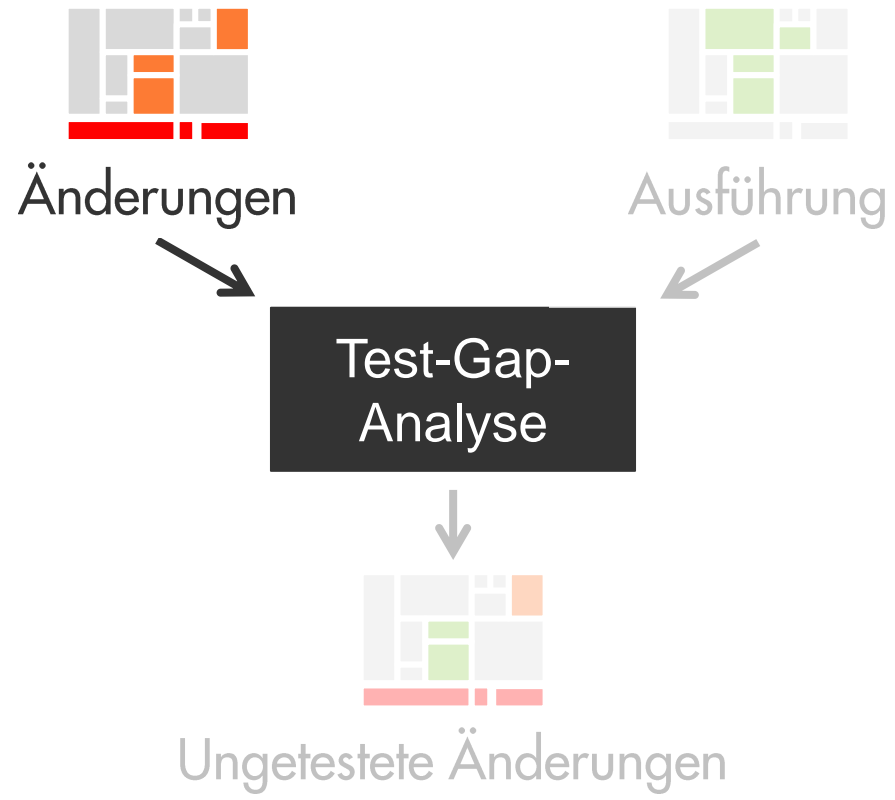
**GUI.Base**

**Data  
Validation**

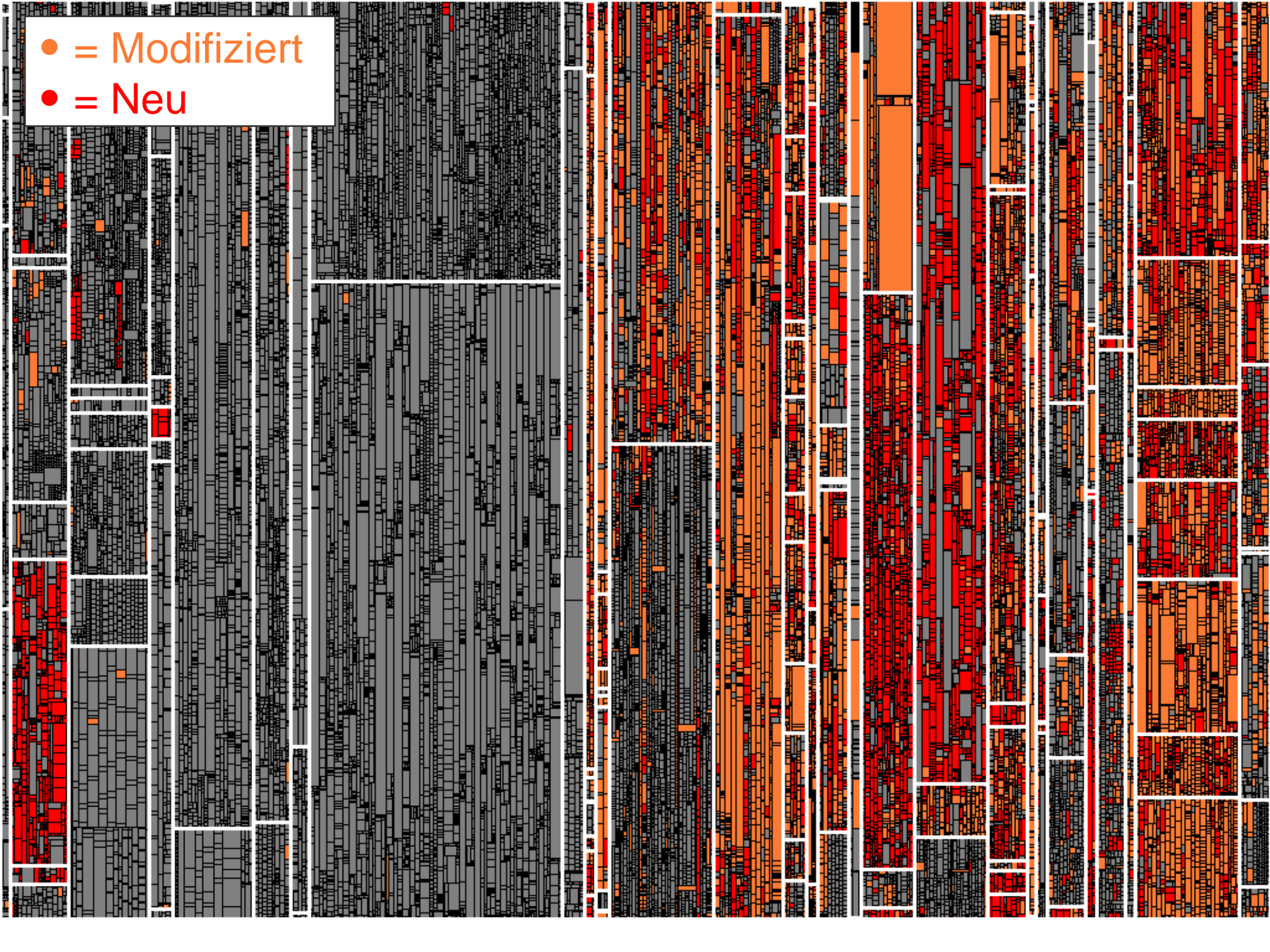


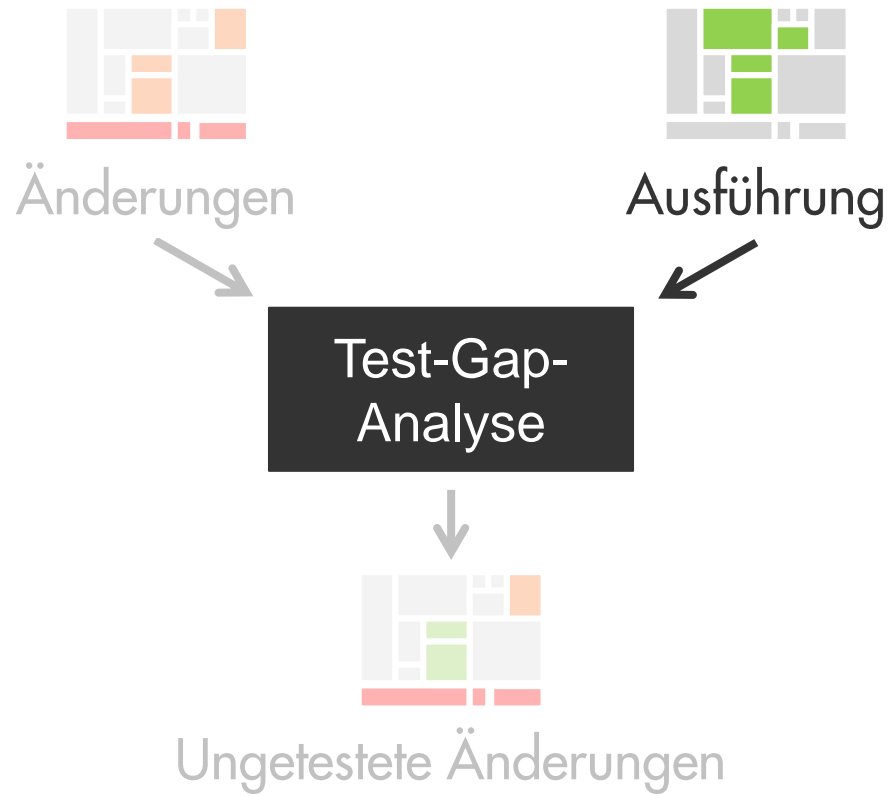




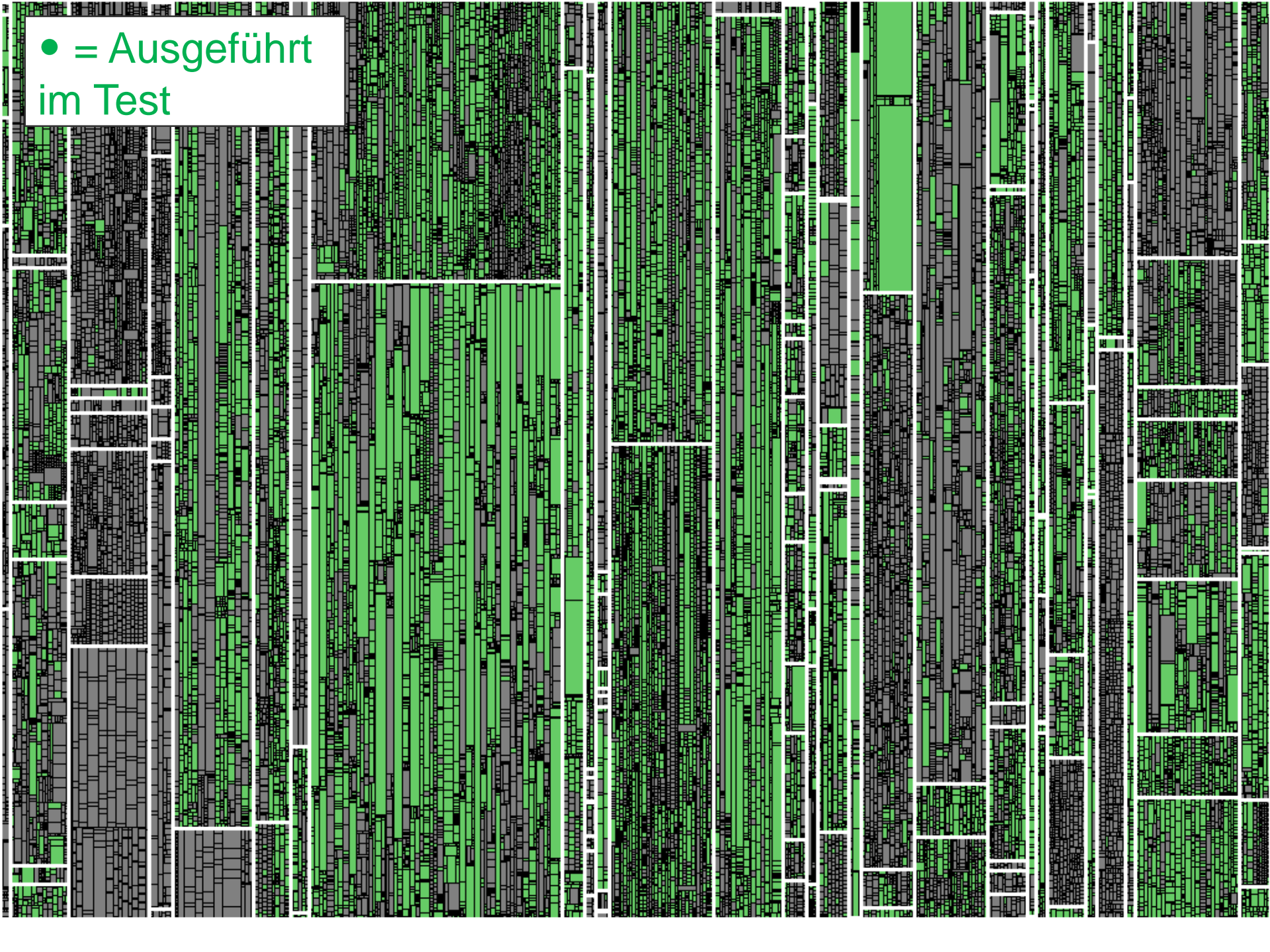


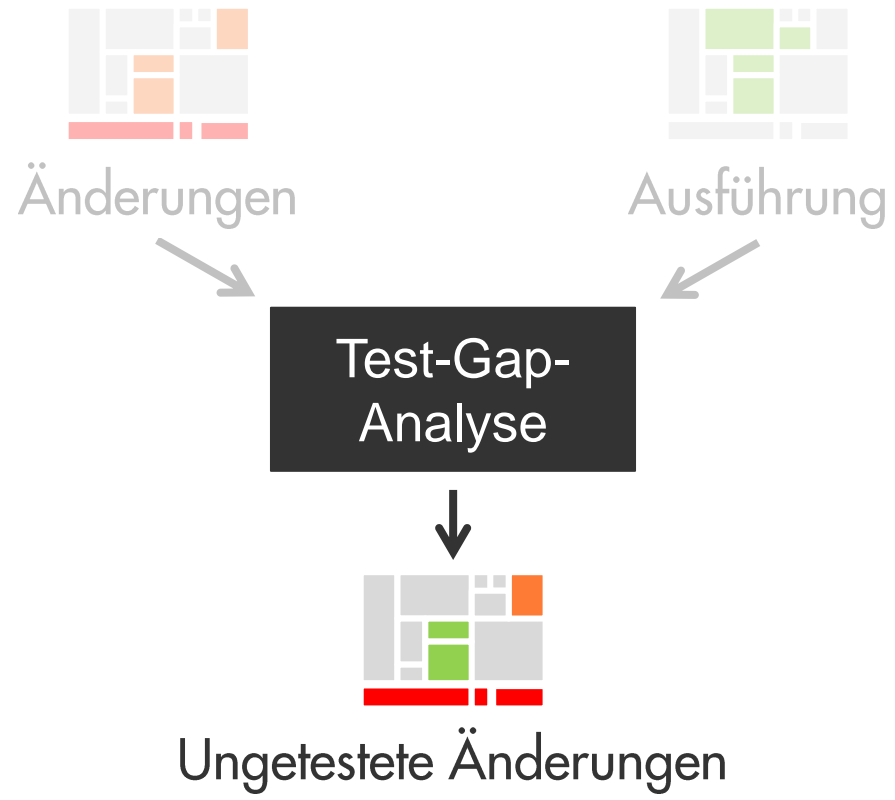
- = Modifiziert
- = Neu





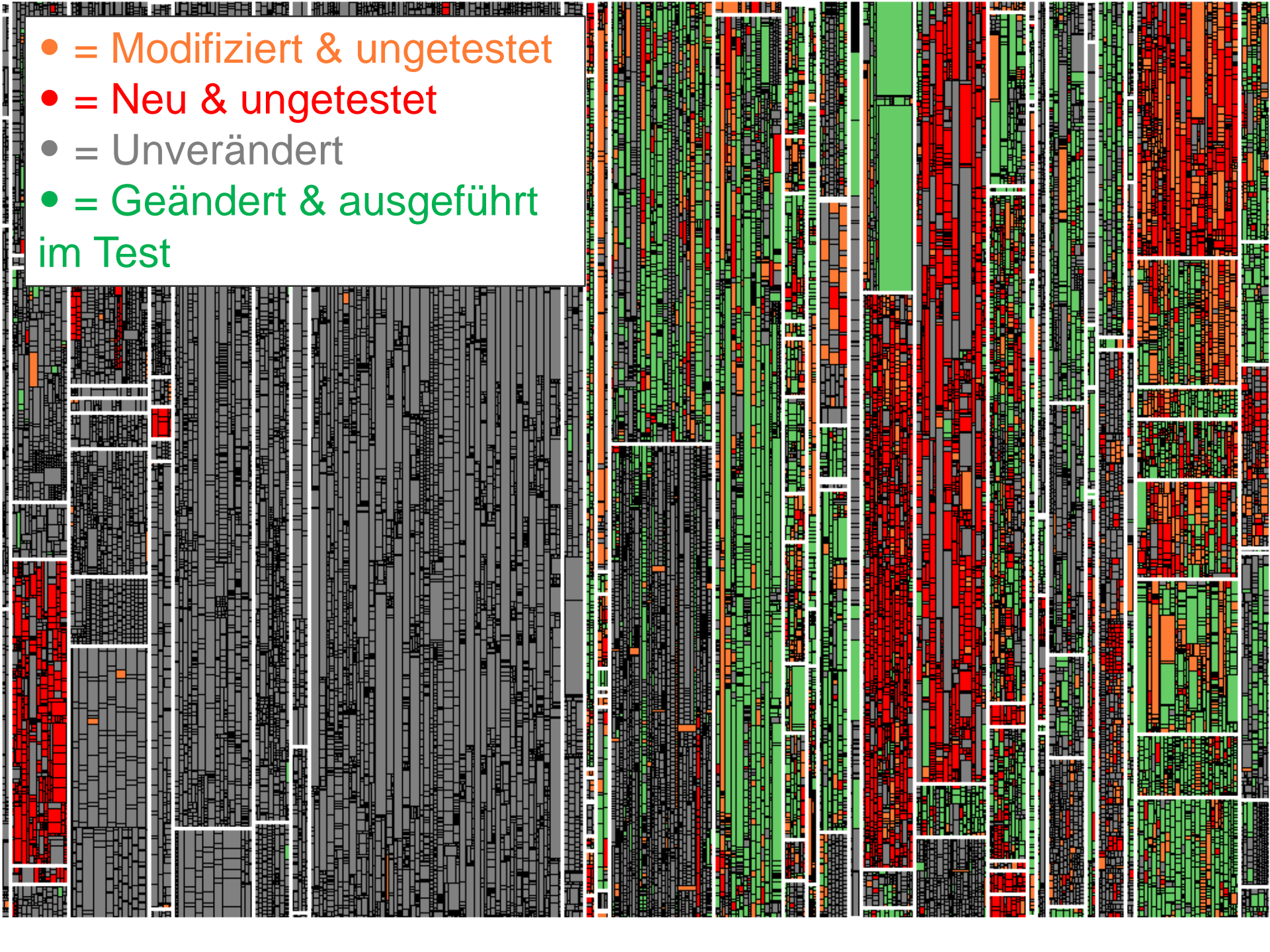
● = Ausgeführt  
im Test



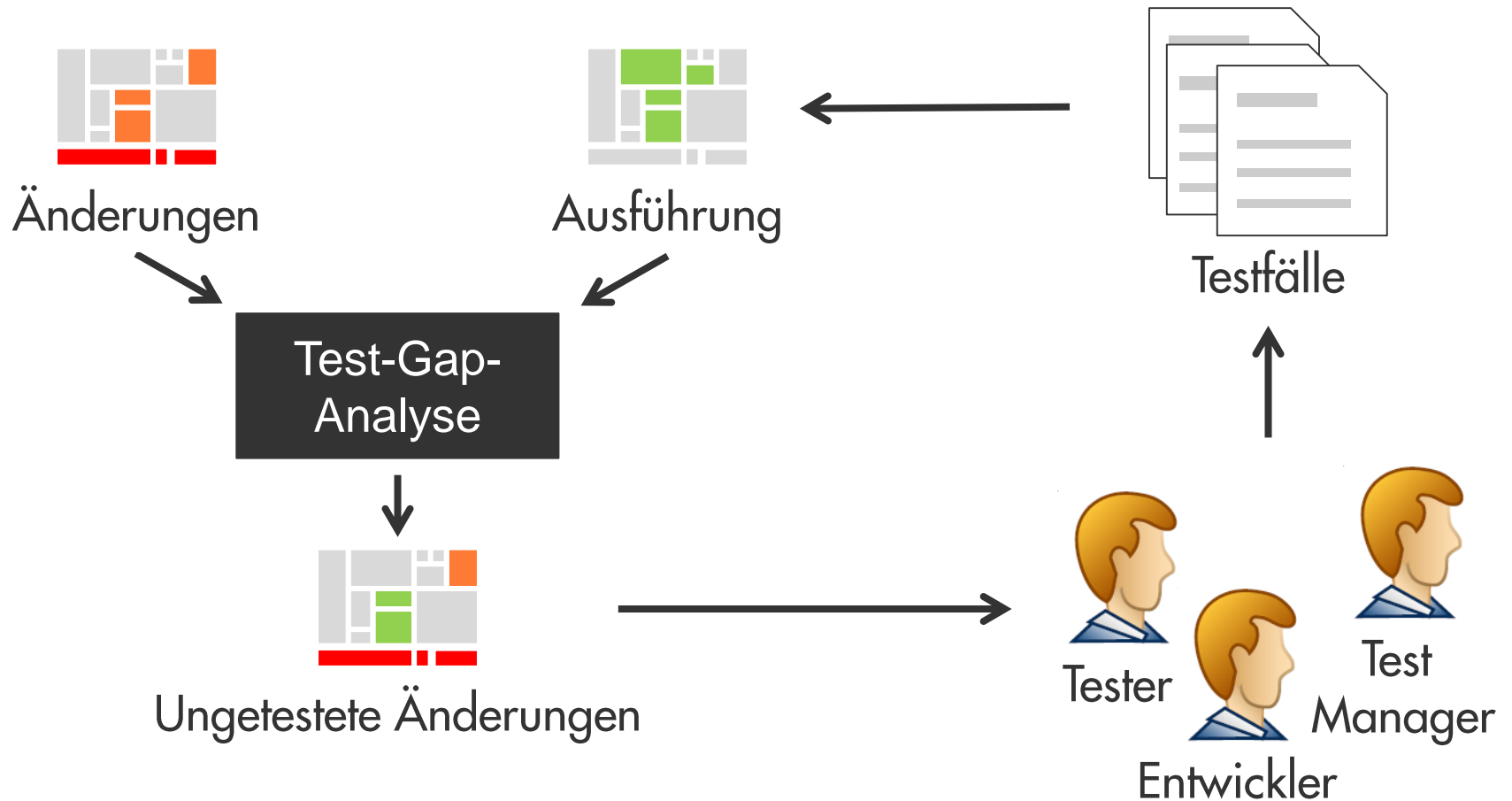




- = Modifiziert & ungetestet
- = Neu & ungetestet
- = Unverändert
- = Geändert & ausgeführt im Test



# Einsatz im Testprozess







100% Change Coverage



100% Change Coverage → 0 Fehler

conQAT

dotCover 2

Clover

NCOVER  
Measurable Quality

EMMA



Microsoft

Visual Studio  
Performance Tools

JACOCO  
Java Code Coverage

BULLSEYE  
TESTING TECHNOLOGY

Bullseye Coverage

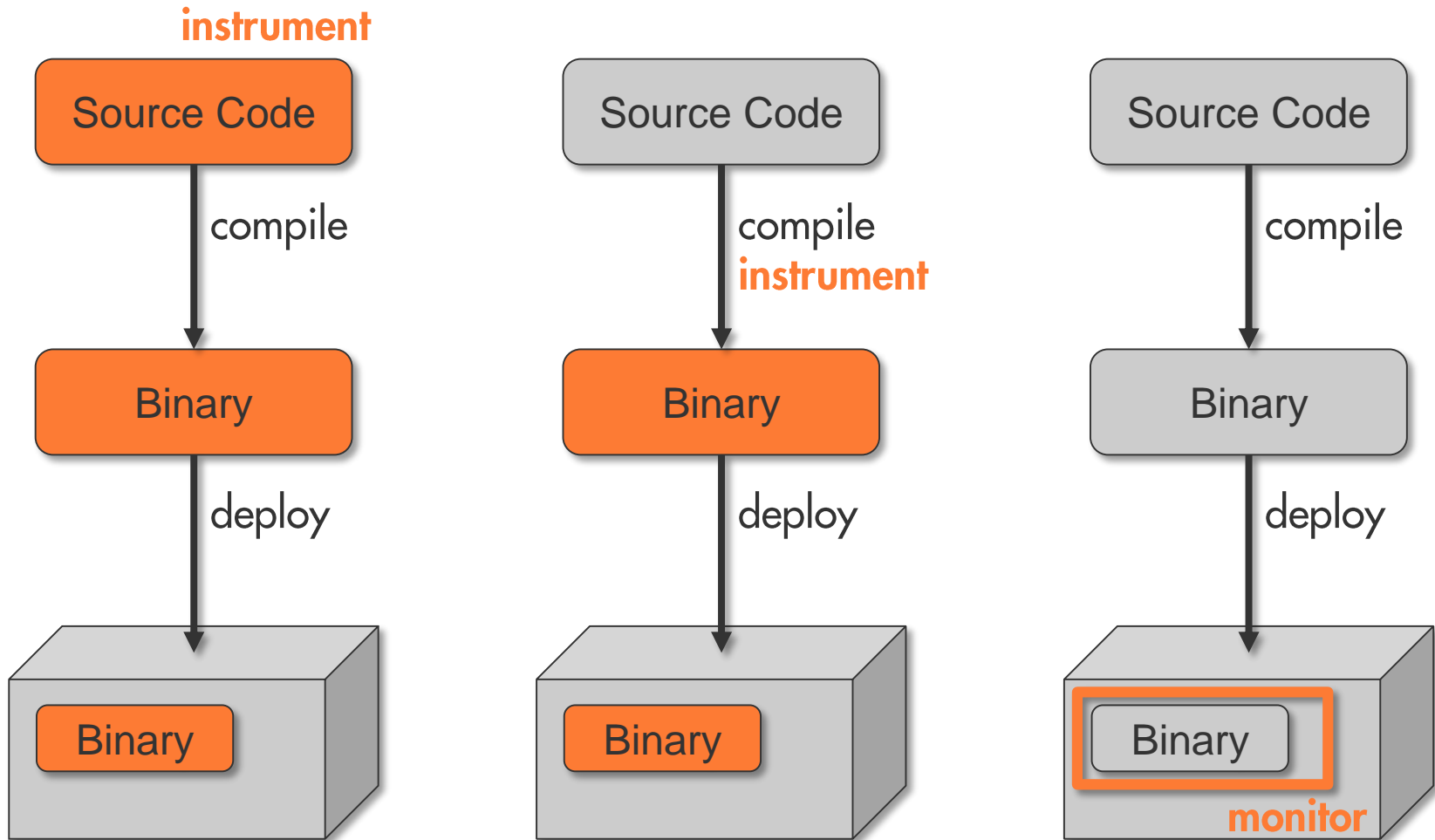
froglogic

Squish Coco

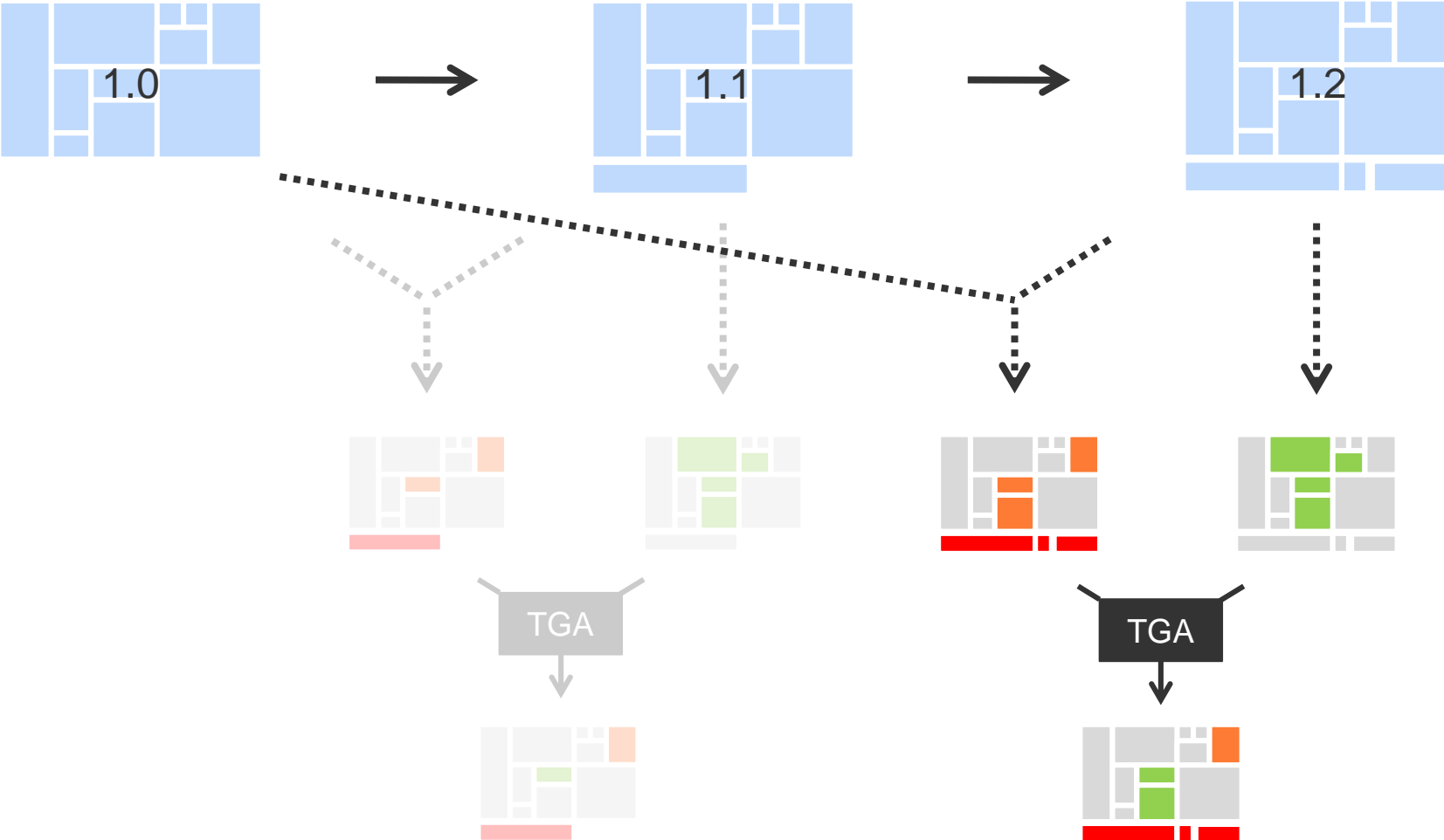
QA SYSTEMS  
The Software Quality Company  
Cantata

debug

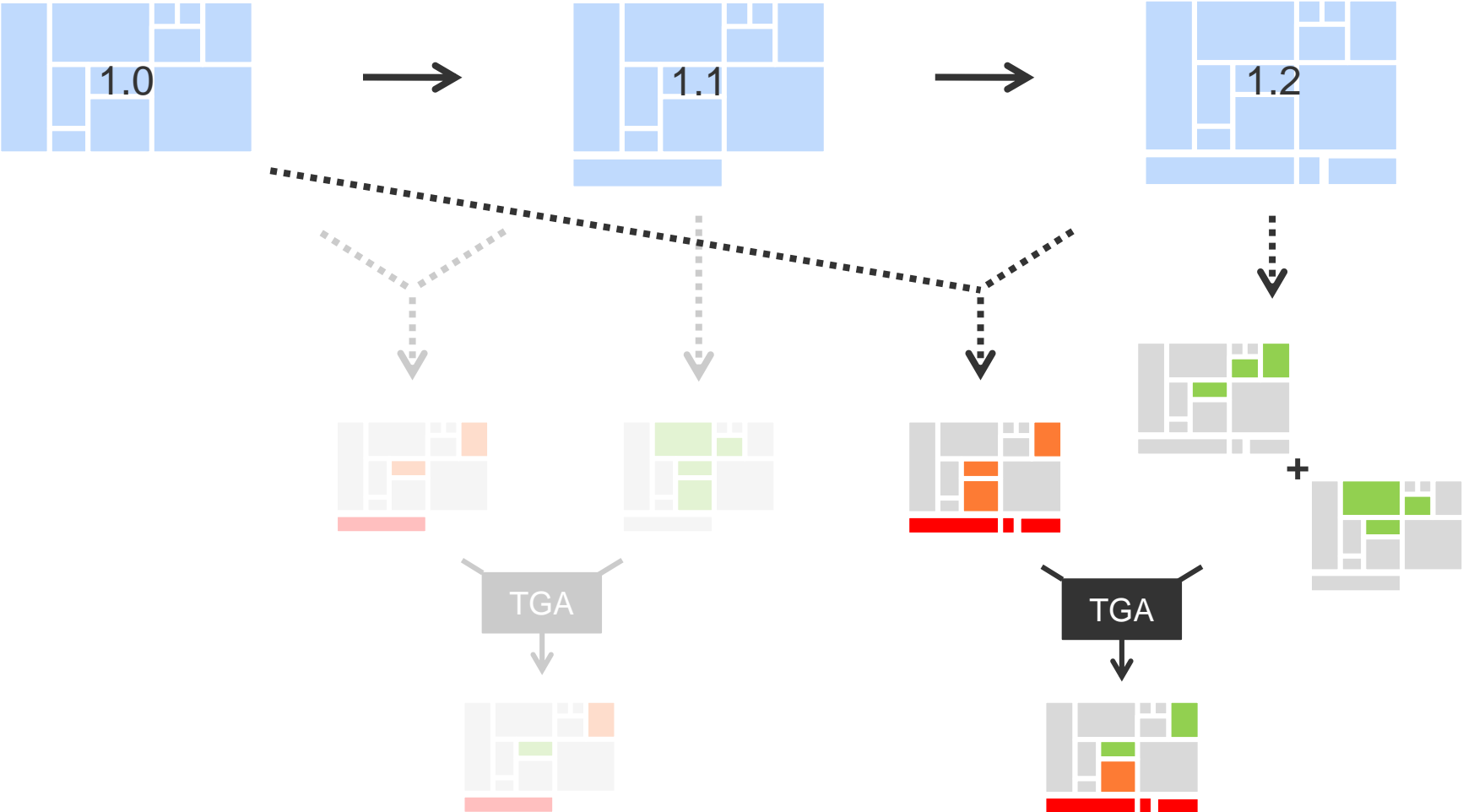
# Ansätze zur Instrumentierung



# Automatisierte Tests



# Manuelle Tests



NamespaceRenames.java 8737

```
23
24
25
26 /* package */class NamespaceRenames {
27
28     /** Maps from old name fragment to new name fragment */
29     public Set<ImmutablePair<String, String>> namespaceRenames = new HashSet<
30
31     /**
32      * Computes a rename rule from an old and a new namespace name based on a
33      * type name correspondence. <code>
34      * For name1 = a.oldnamespace.b.c.D and name2 = a.newnamespace.b.c.D, res
35      * </code>
36      * */
37     public static ImmutablePair<String, String> computeRenameRule(
38         String fqTypeName1, String fqTypeName2, String separator) {
39
40         if (fqTypeName1.equals(fqTypeName2)) {
41             return null;
42         }
43
44         String commonSuffix = StringUtils.longestCommonSuffix(fqTypeName1,
45             fqTypeName2);
46         if (StringUtils.isEmpty(commonSuffix)) {
47             return null;
48         }
49
50         int separatorPosition = commonSuffix.indexOf(separator);
51         if (separatorPosition != -1) {
52             commonSuffix = commonSuffix.substring(separatorPosition);
53         }
54
55         String from = StringUtils.stripSuffix(commonSuffix, fqTypeName1);
56         String to = StringUtils.stripSuffix(commonSuffix, fqTypeName2);
57
58         return new ImmutablePair<String, String>(from, to);
59     }
60
61
62
63
64
```

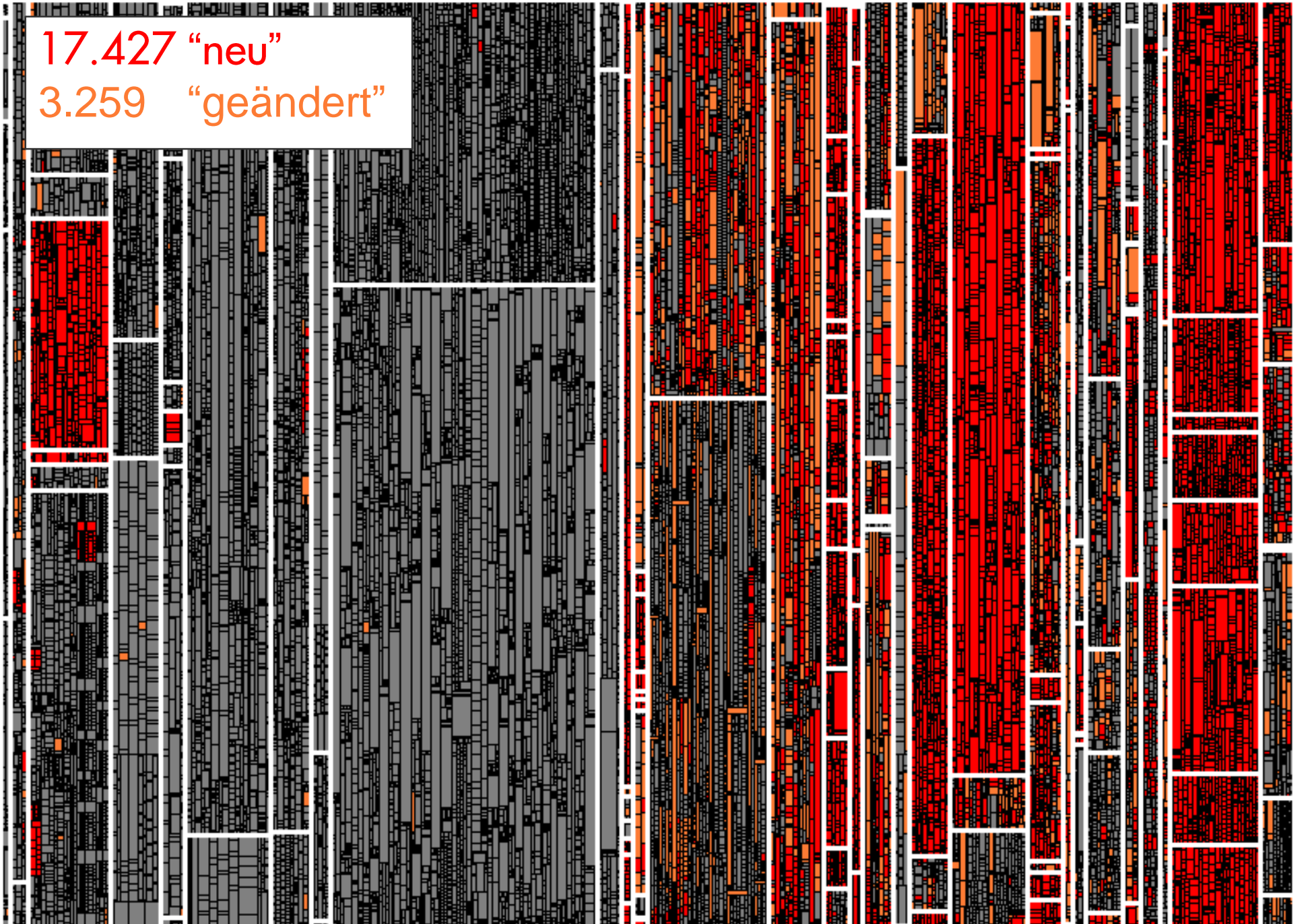
NamespaceRenames.java 8727

```
24
25
26 /* package */class NamespaceRenames {
27
28     /** Maps from old name fragment to new name fragment */
29     public Set<ImmutablePair<String, String>> namespaceRenames = new Has
30
31     // TODO (LH) Doc vs. method name : 'Compute' vs. 'find'
32     /**
33      * Computes a rename rule from an old and a new namespace name based
34      * type name correspondence. <code>
35      * For name1 = a.oldnamespace.b.c.D and name2 = a.newnamespace.b.c.D
36      * </code>
37      * */
38     // TODO (LH) Please reflect in identifier names that they refer to
39     // names
40     public static ImmutablePair<String, String> findRenameRule(String na
41         String name2, String separator) {
42
43         if (name1.equals(name2)) {
44             return null;
45         }
46
47         // TODO (LH) Looks like StringUtils is missing a 'longestCommonS
48         String commonSuffix = reverse(StringUtils.longestCommonPrefix(
49             reverse(name1), reverse(name2)));
50         if (StringUtils.isEmpty(commonSuffix)) {
51             return null;
52         }
53
54         int separatorPosition = commonSuffix.indexOf(separator);
55         if (separatorPosition != -1) {
56             commonSuffix = commonSuffix.substring(separatorPosition);
57         }
58
59         // TODO (LH) Please reflect in identifier names that these are
60         // namespaces
61         String from = StringUtils.stripSuffix(commonSuffix, name1);
62         String to = StringUtils.stripSuffix(commonSuffix, name2);
63
64         return new ImmutablePair<String, String>(from, to);
65
66
```

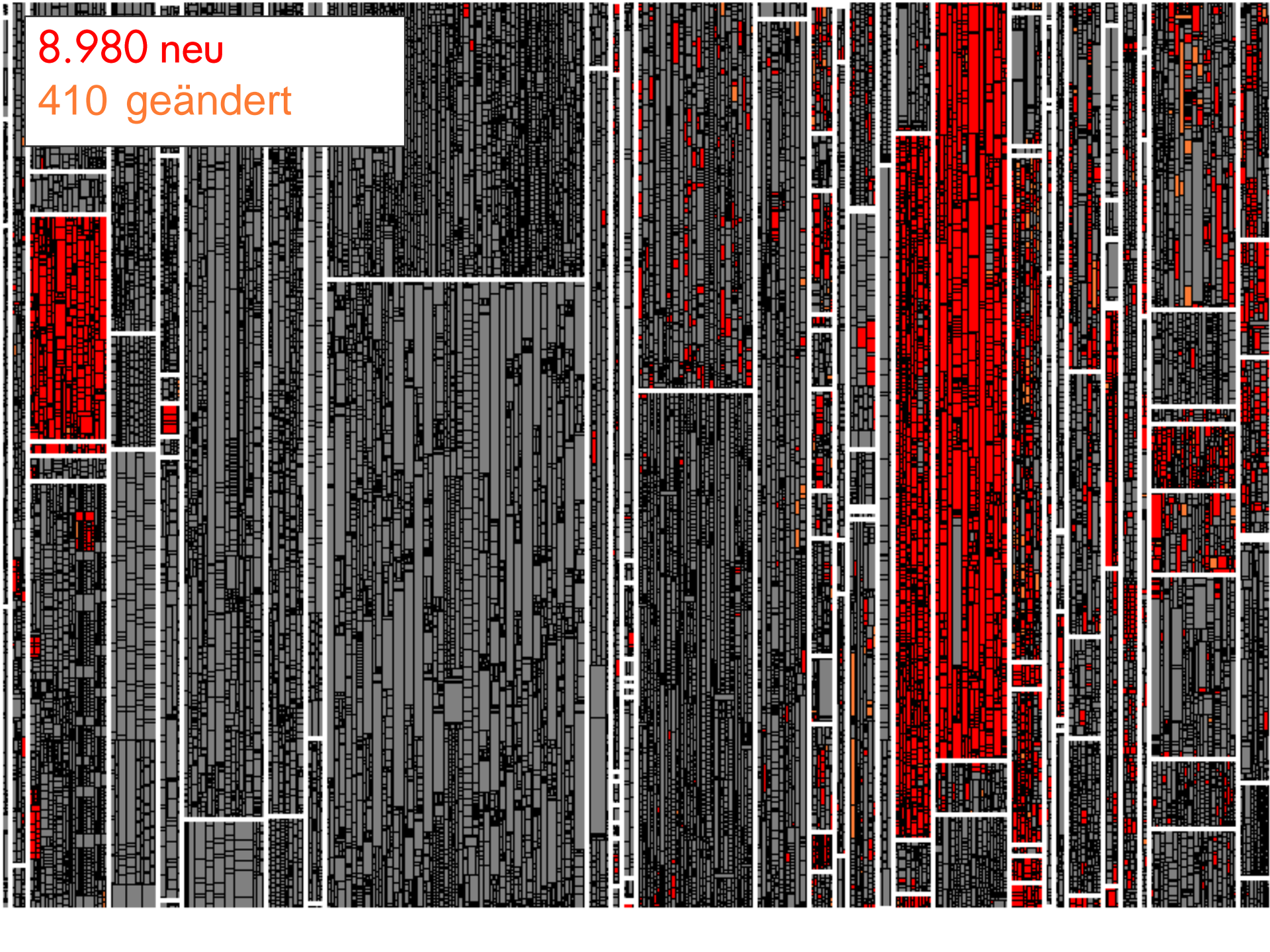


17.427 “neu”

3.259 “geändert”



8.980 neu  
410 geändert



# Verschiedene Umgebungen

conQAI  
Wed May 28 08:15:31

Overview  
Test Gap Analysis  
Changed Methods  
Executed Methods  
Test Gaps  
Details  
Debug  
Traces  
Snapshots  
Related Dashboards  
all  
Dev  
Test  
UAT  
KPIs  
Charts  
Execution  
Test State  
Info  
Log  
Config  
Execution Time  
Version

Test Gap Analysis

Changed Methods  
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Debug  
Traces  
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Related Dashboards  
all  
Dev  
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Execution  
Test State  
Info  
Log  
Config  
Execution Time  
Version

General Information

Environment: test  
System: test  
Reference Version: 20131113.1044.8.2.2.0  
Header Version: 20131113.1044.8.2.2.0.4  
Final Test Run: 20140520.0203.8.2.101.9

Machine Overview

Machine	# Execs	# Failed	# Executed Methods	Label	Execution
Host4811292	6	0	2014-05-28 11:06:44	20140518.1258.8.2.303.3	
Host4811292	6	0	2014-05-27 16:52:15	20140518.1258.8.2.303.3	

Version Overview

Version	# Execs	# Failed	# Executed Methods	Label	Execution
20131113.1044.8.2.2.0	6	0	2014-05-28 16:59:11		
20131026.0709.8.2.101.9	1	1	2013-12-08 11:05:54		
20131113.1044.8.2.101.4	1	2	2013-12-10 15:08:09		
20131113.1044.8.2.101.4	1	0	2013-12-10 15:08:09		
20131113.1044.8.2.101.5	1	0	2014-01-30 10:05:59		
20131026.0709.8.2.101.9	1	1	2013-12-08 11:05:54		
20140520.0203.8.2.101.7	1	1	2014-05-20 07:25:44		
20140518.1258.8.2.101.9	1	0	2014-05-18 07:51:09		
20140518.1258.8.2.101.9	1	1	2014-05-18 07:51:09		

Test

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Wed May 28 08:15:31

Overview  
Test Gap Analysis  
Changed Methods  
Executed Methods  
Test Gaps  
Details  
Debug  
Traces  
Snapshots  
Related Dashboards  
all  
Dev  
Test  
UAT  
KPIs  
Charts  
Execution  
Test State  
Info  
Log  
Config  
Execution Time  
Version

Test Gap Analysis

Changed Methods  
Executed Methods  
Test Gaps  
Details

Debug  
Traces  
Snapshots

Related Dashboards  
all  
Dev  
Test  
UAT  
KPIs  
Charts  
Execution  
Test State  
Info  
Log  
Config  
Execution Time  
Version

General Information

Environment: dev  
System: test  
Reference Version: 20131113.1044.8.2.2.0  
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Dev

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Wed May 28 08:15:31

Overview  
Test Gap Analysis  
Changed Methods  
Executed Methods  
Test Gaps  
Details  
Debug  
Traces  
Snapshots  
Related Dashboards  
all  
Dev  
Test  
UAT  
KPIs  
Charts  
Execution  
Test State  
Info  
Log  
Config  
Execution Time  
Version

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Changed Methods  
Executed Methods  
Test Gaps  
Details

Debug  
Traces  
Snapshots

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all  
Dev  
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Test State  
Info  
Log  
Config  
Execution Time  
Version

General Information

Environment: uat  
System: test  
Reference Version: 20131113.1044.8.2.2.0  
Header Version: 20131113.1044.8.2.2.0.4  
Final Test Run: 20140520.0203.8.2.101.9

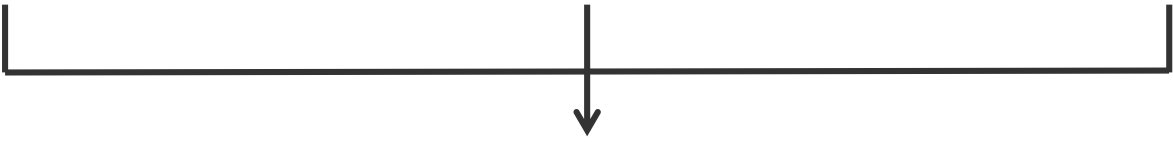
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UAT



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Test Gap Analysis  
Changed Methods  
Executed Methods  
Test Gaps  
Details  
Debug  
Traces  
Snapshots  
Related Dashboards  
all  
Dev  
Test  
UAT  
KPIs  
Charts  
Execution  
Test State  
Info  
Log  
Config  
Execution Time  
Version

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Changed Methods  
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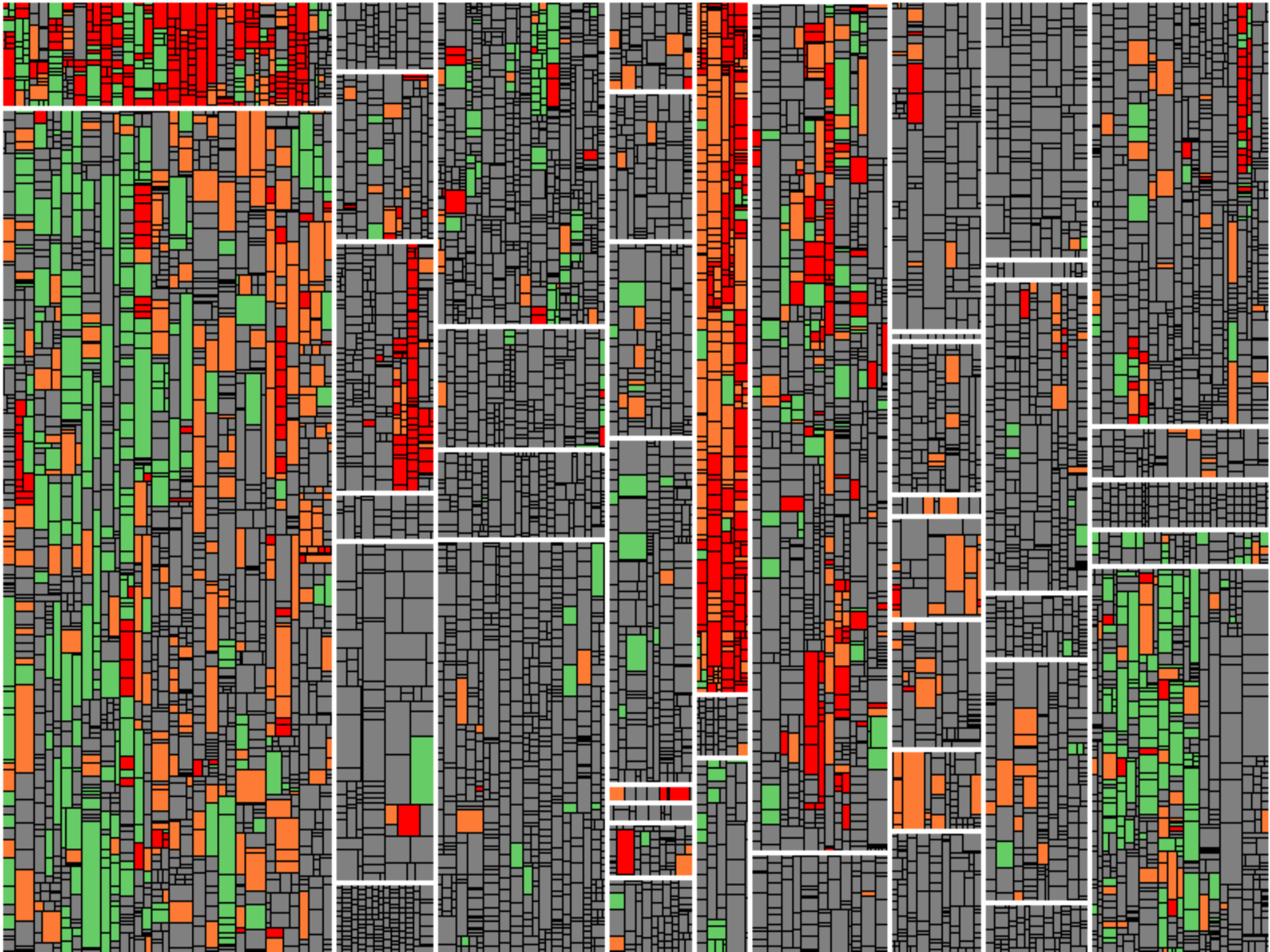
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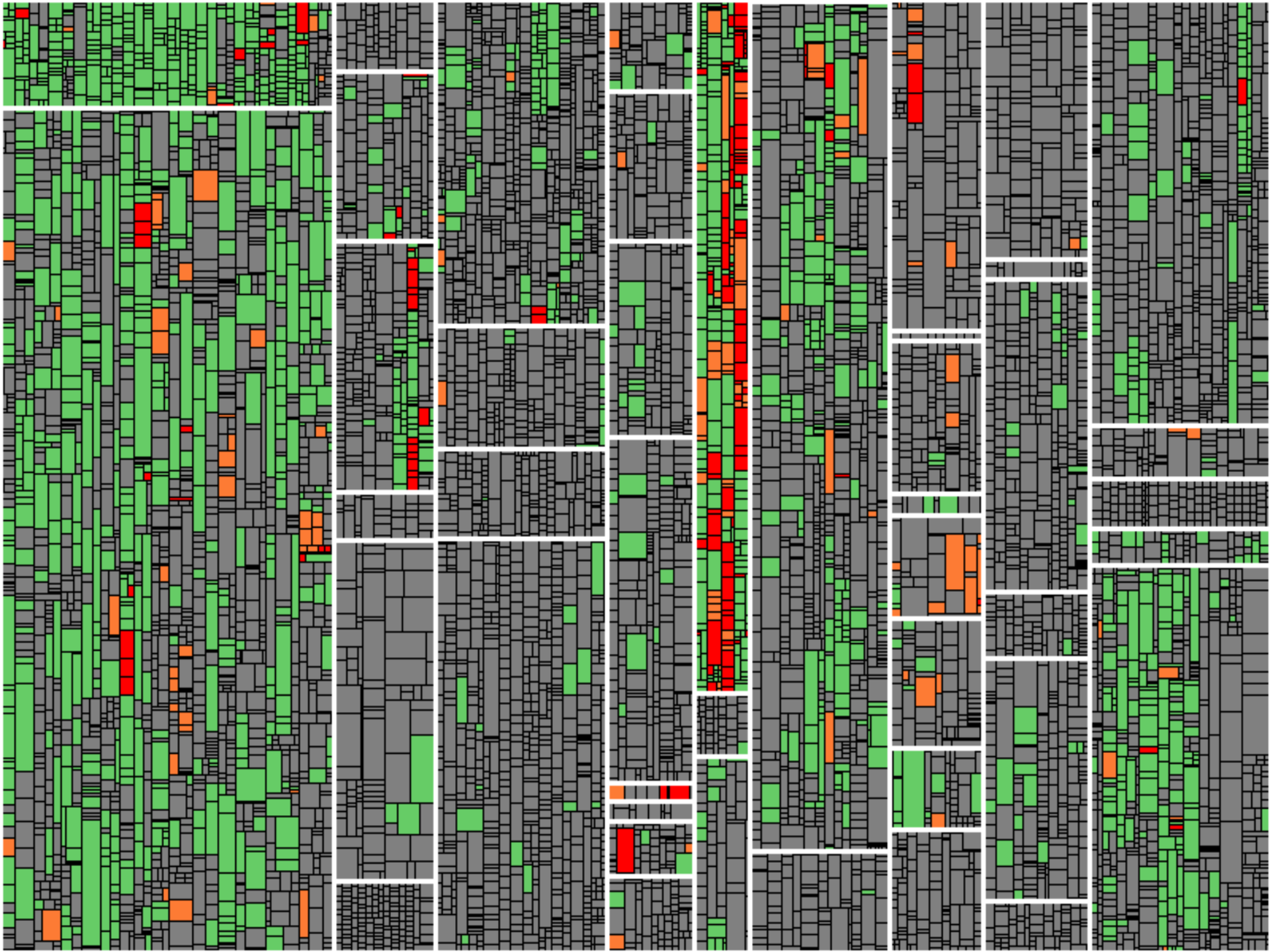
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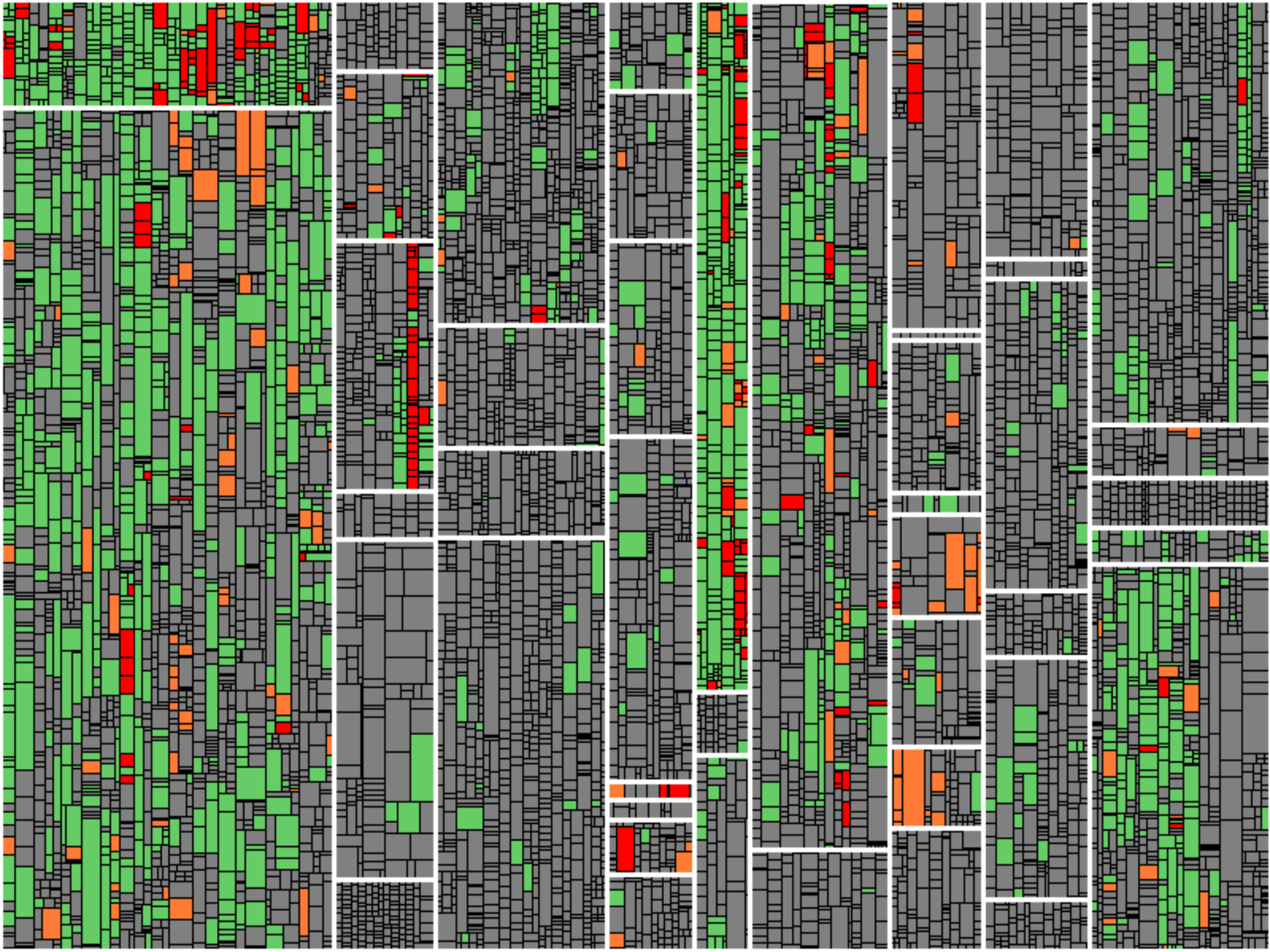
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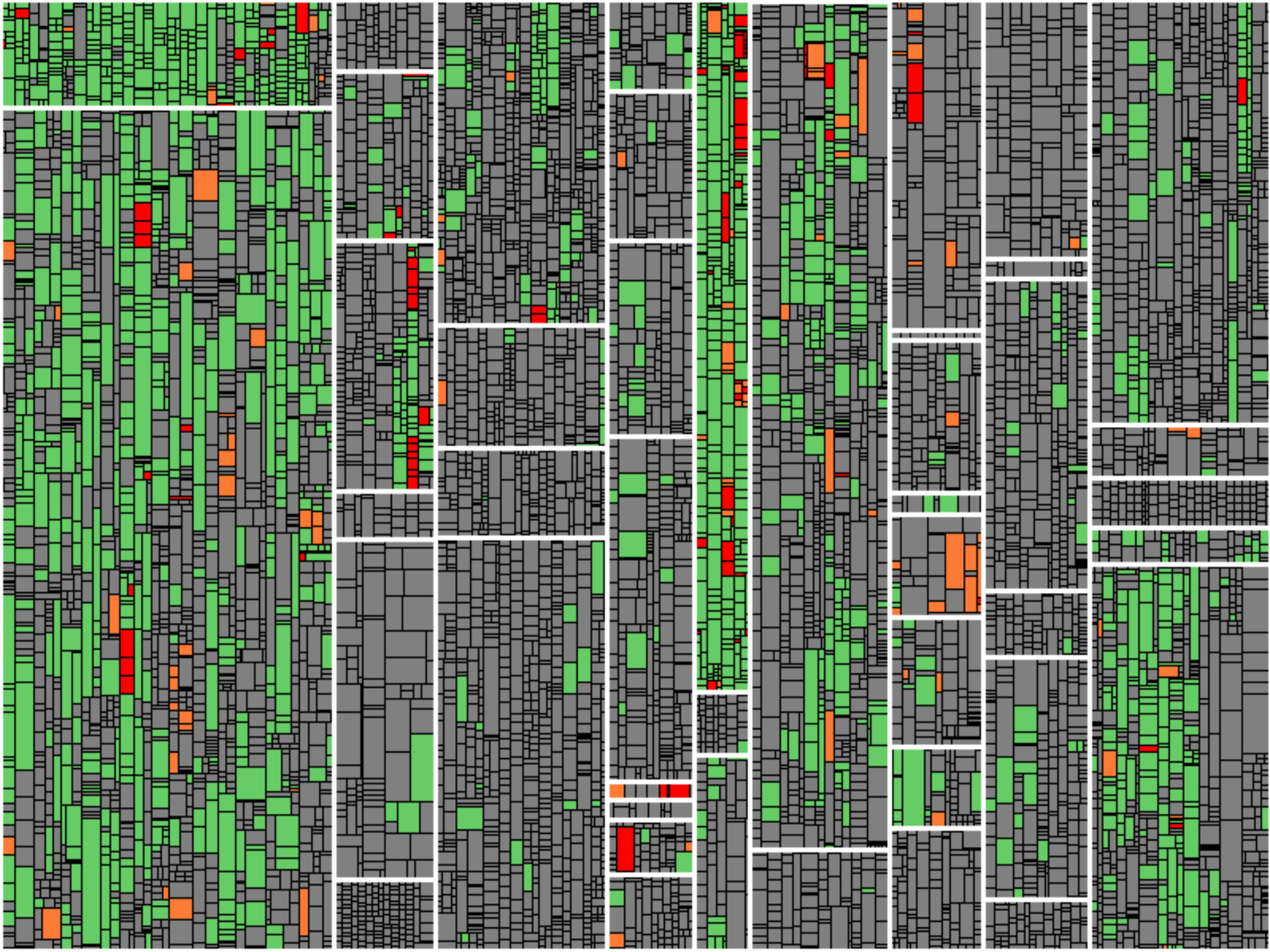
All













**TODO: Folie HS zu API-Steuerung?**

# Agenda

1. Test-Gap-Analyse
2. **Einsatz in verschiedenen Test-Szenarien**
3. Ausblick

# Test-Arten

## Hotfix-Test

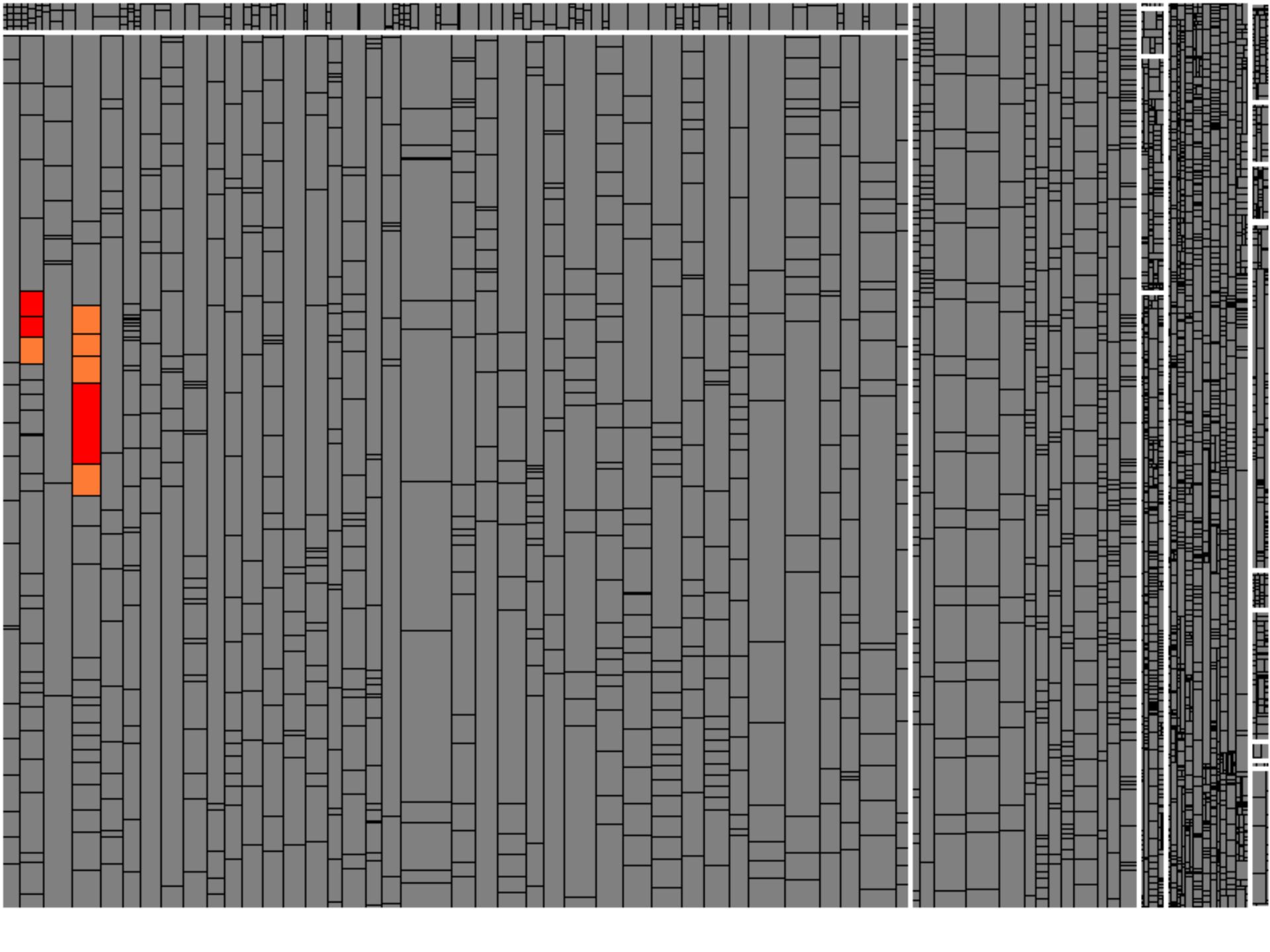
- On-Demand, wenig Zeit
- Getestet werden nur Änderungen des Hotfix

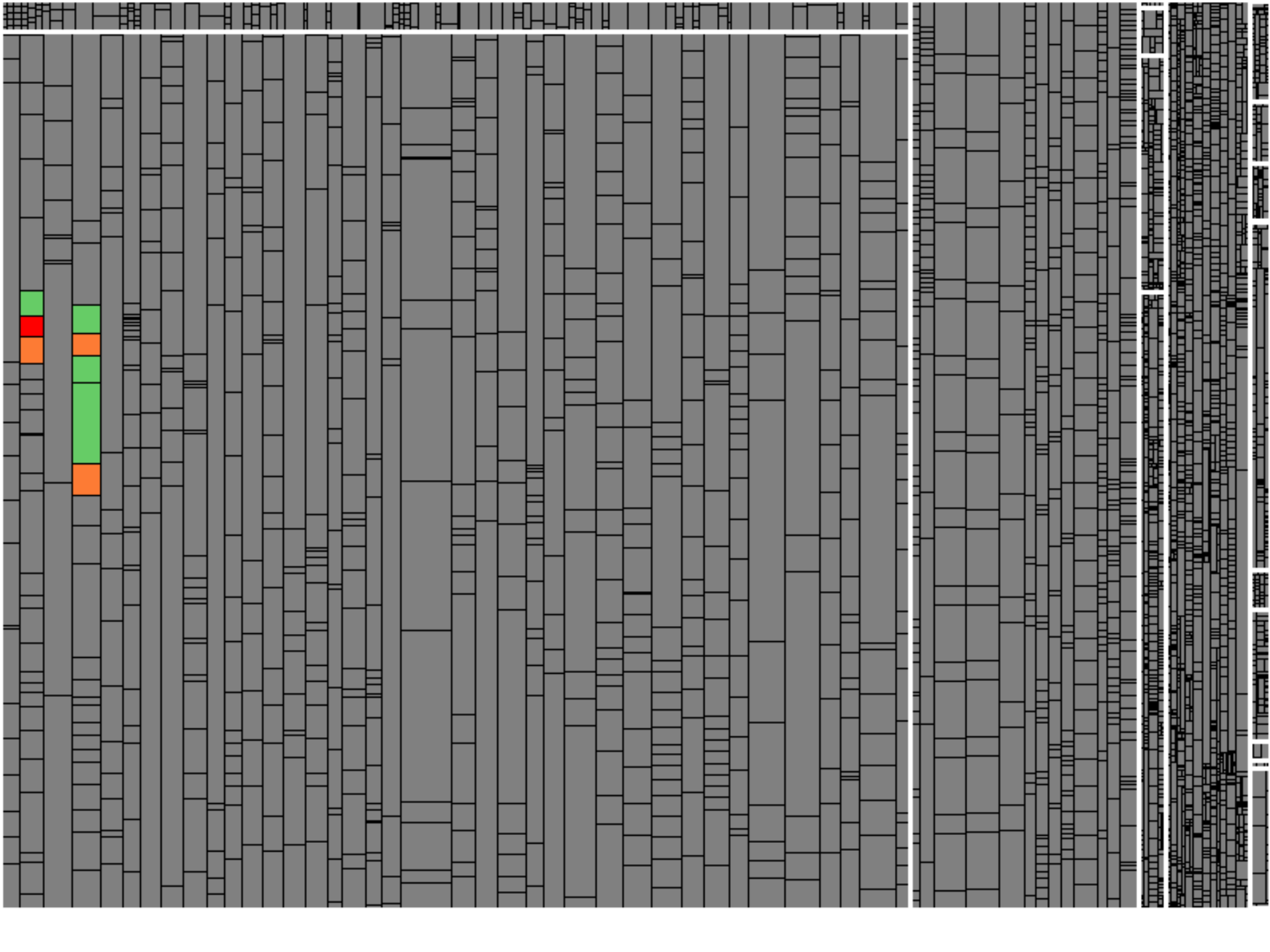
## Release-Test

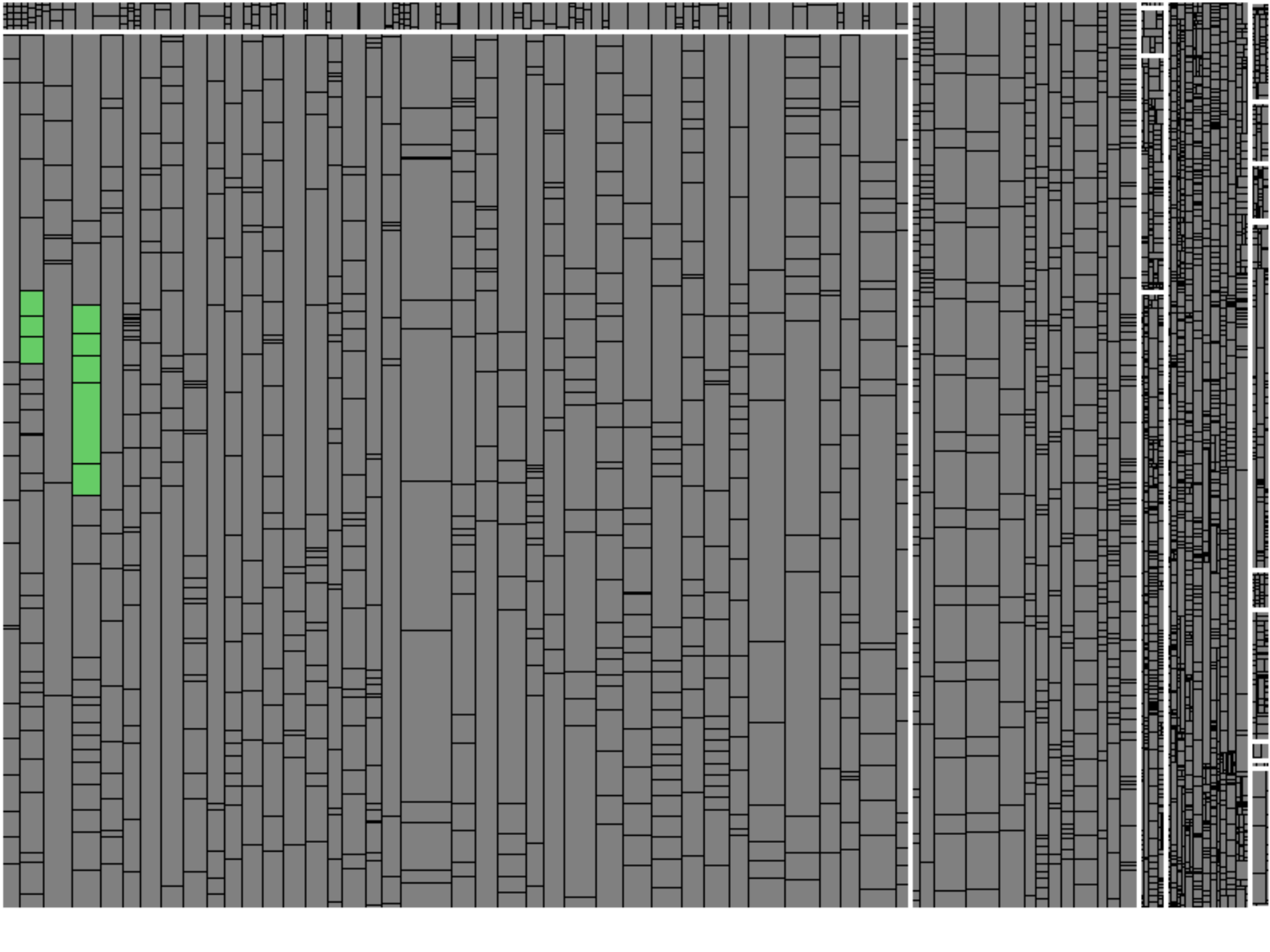
- Nur vor Release, Dauer mehrere Wochen
- Getestet werden alle Änderungen seit letztem Release
- 2-4 Mal pro Jahr (abh. Von Release-Zyklus der Anwendung)

## Iterations-Test

- Entwicklungsbegleitend, kontinuierlich, Iterationsdauer (2-4 Wochen)
- Getestet werden Änderungen aus der Iteration

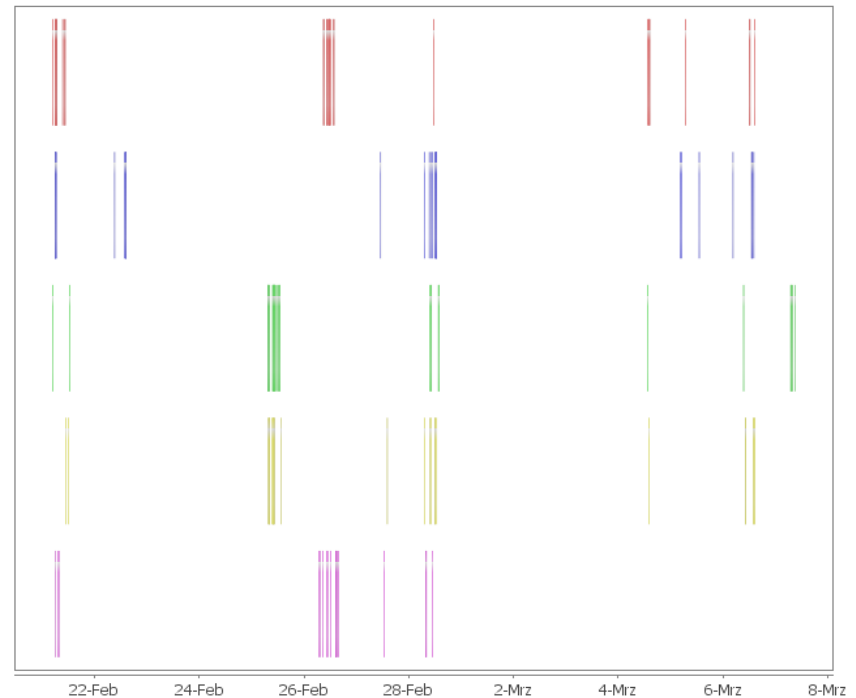




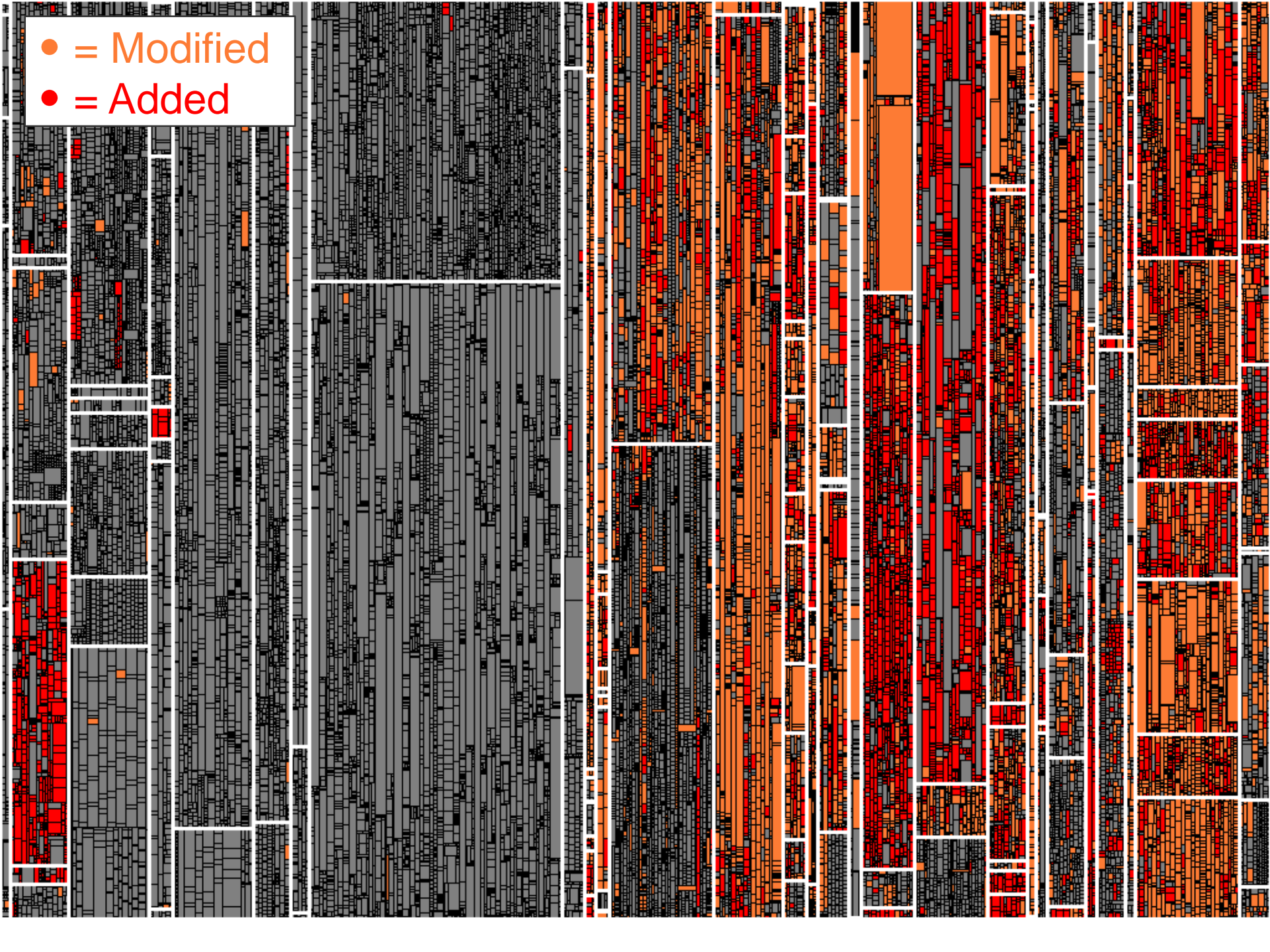


# Einsatz bei Test-Factory

- 5 Tester in Indien
- Zeitraum 2 Wochen
- 143 Test-Sessions
- 6 Versionen des Systems

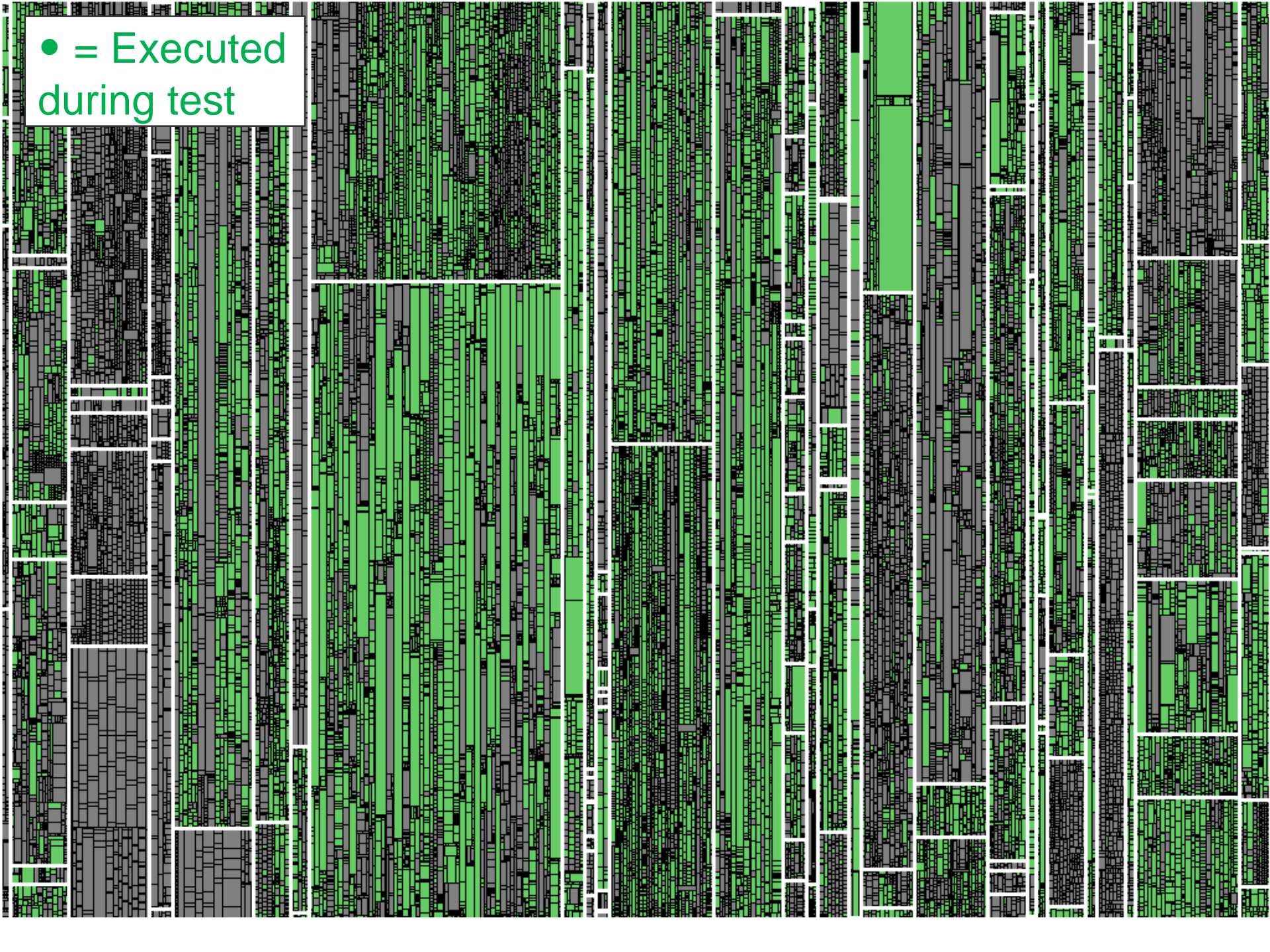


- = Modified
- = Added

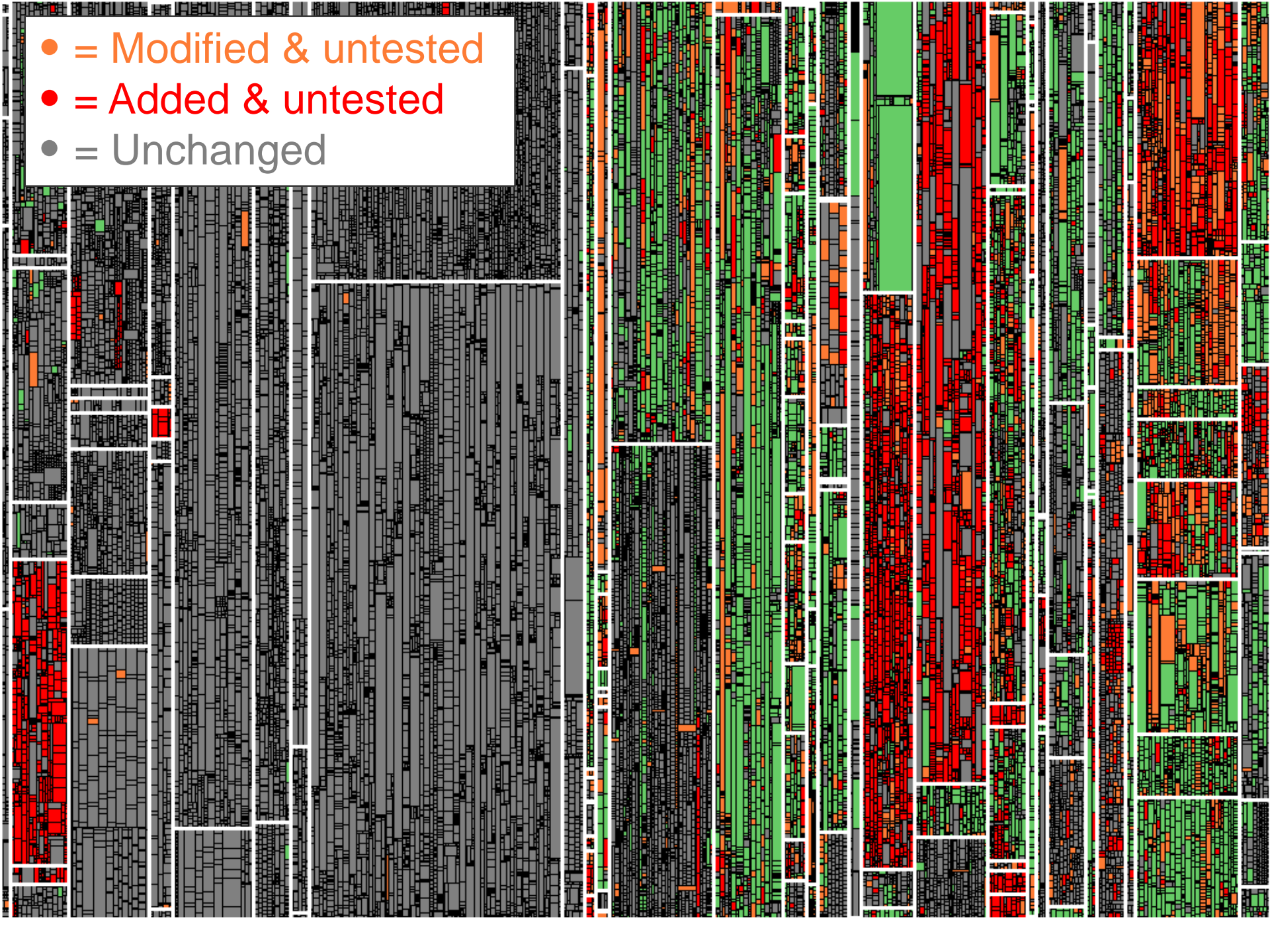




● = Executed during test

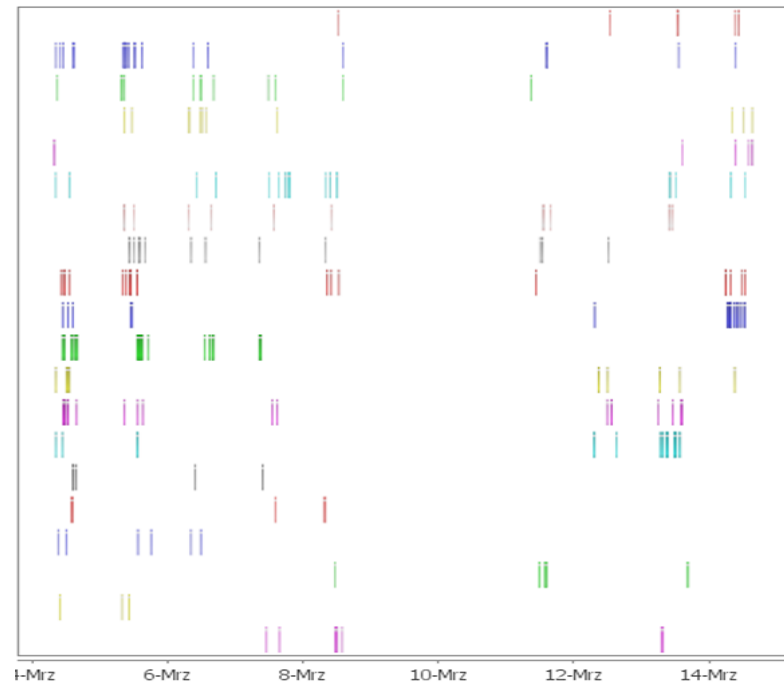


- = Modified & untested
- = Added & untested
- = Unchanged



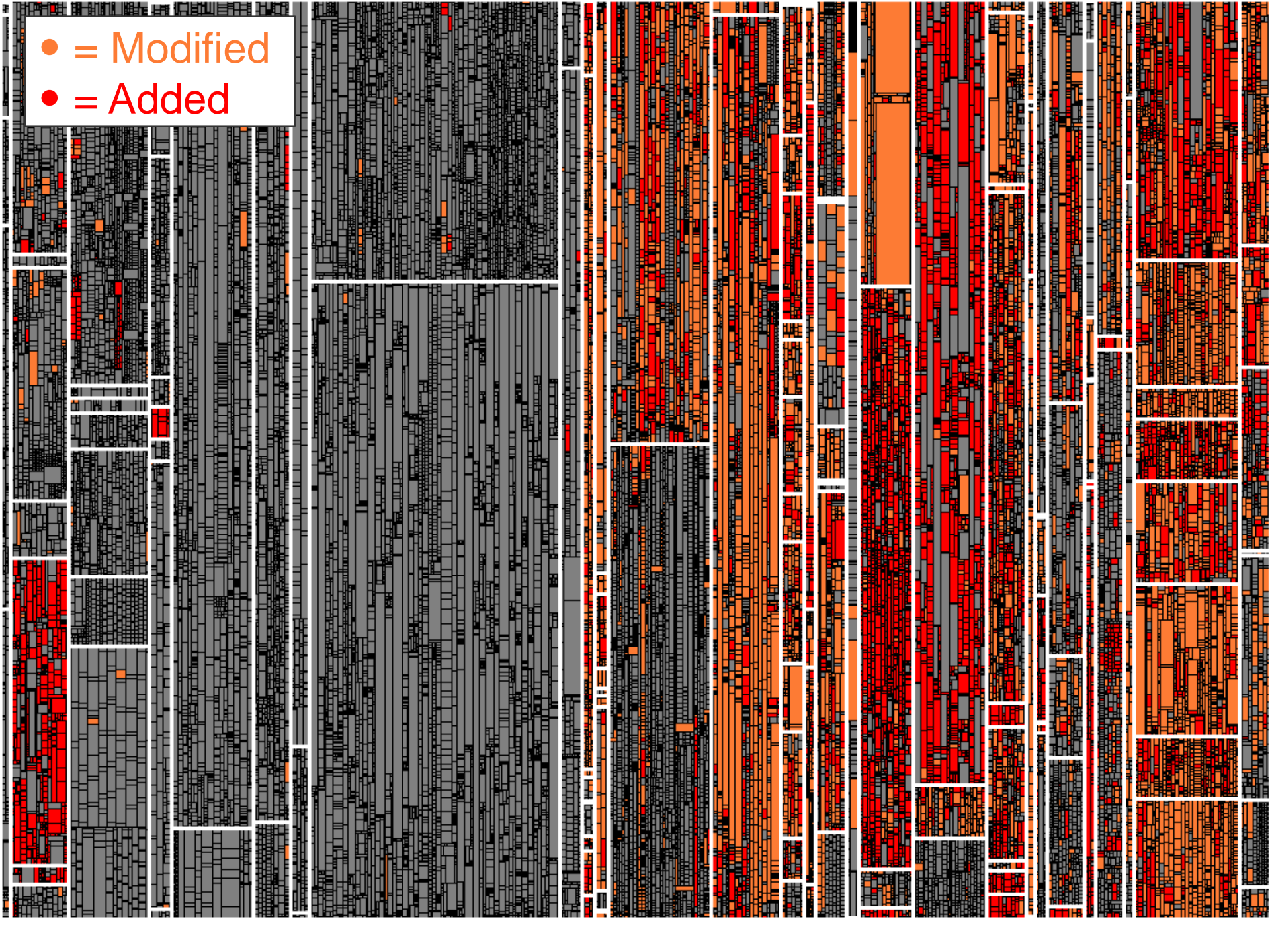
# Einsatz bei explorativem Test

- 23 Tester
  - Requirement Engineers
  - Fachbereich
  - Endanwender
- Zeitraum 2 Wochen
- 307 Test-Sessions
- 8 Versionen des Systems

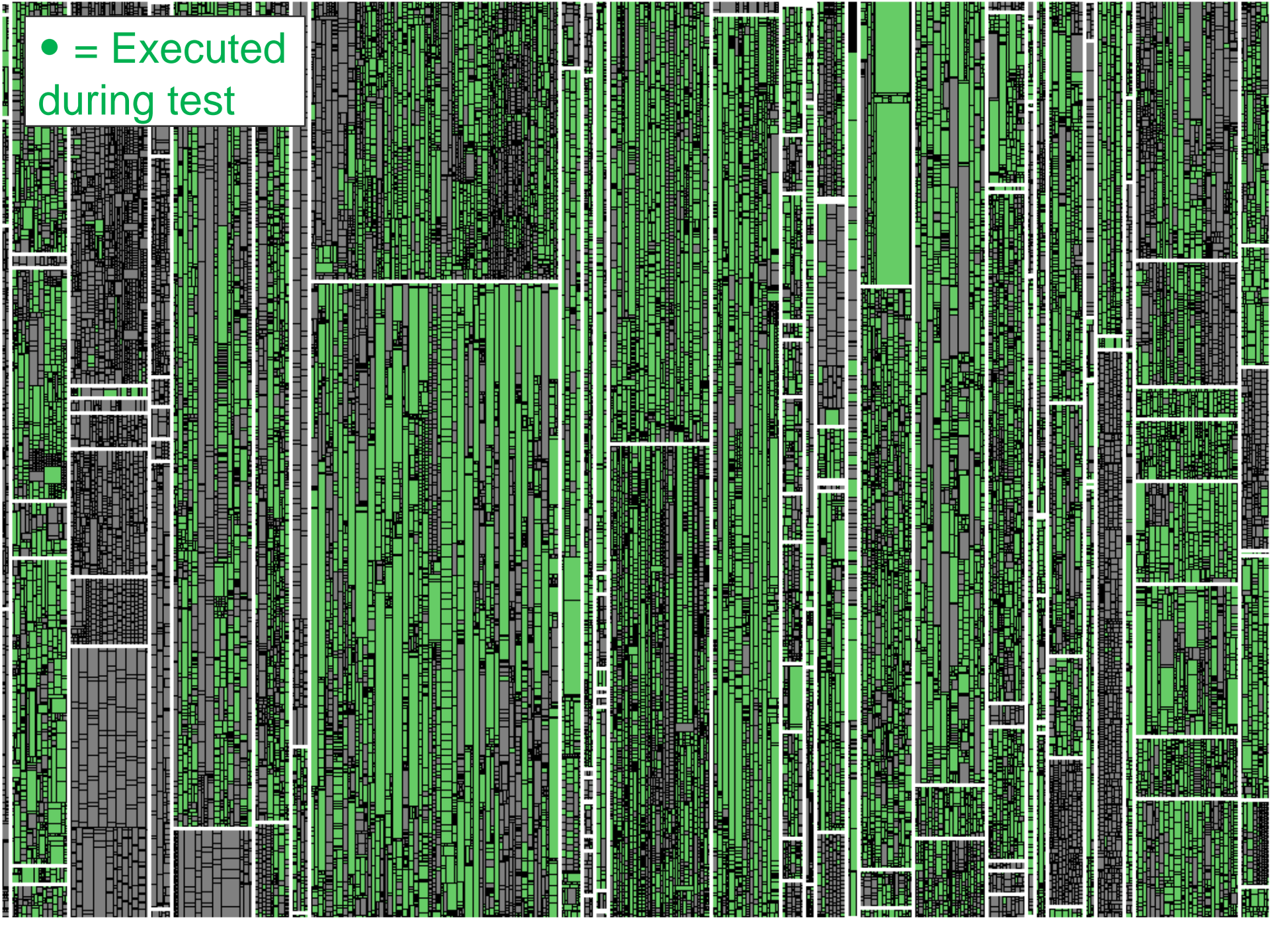




- = Modified
- = Added

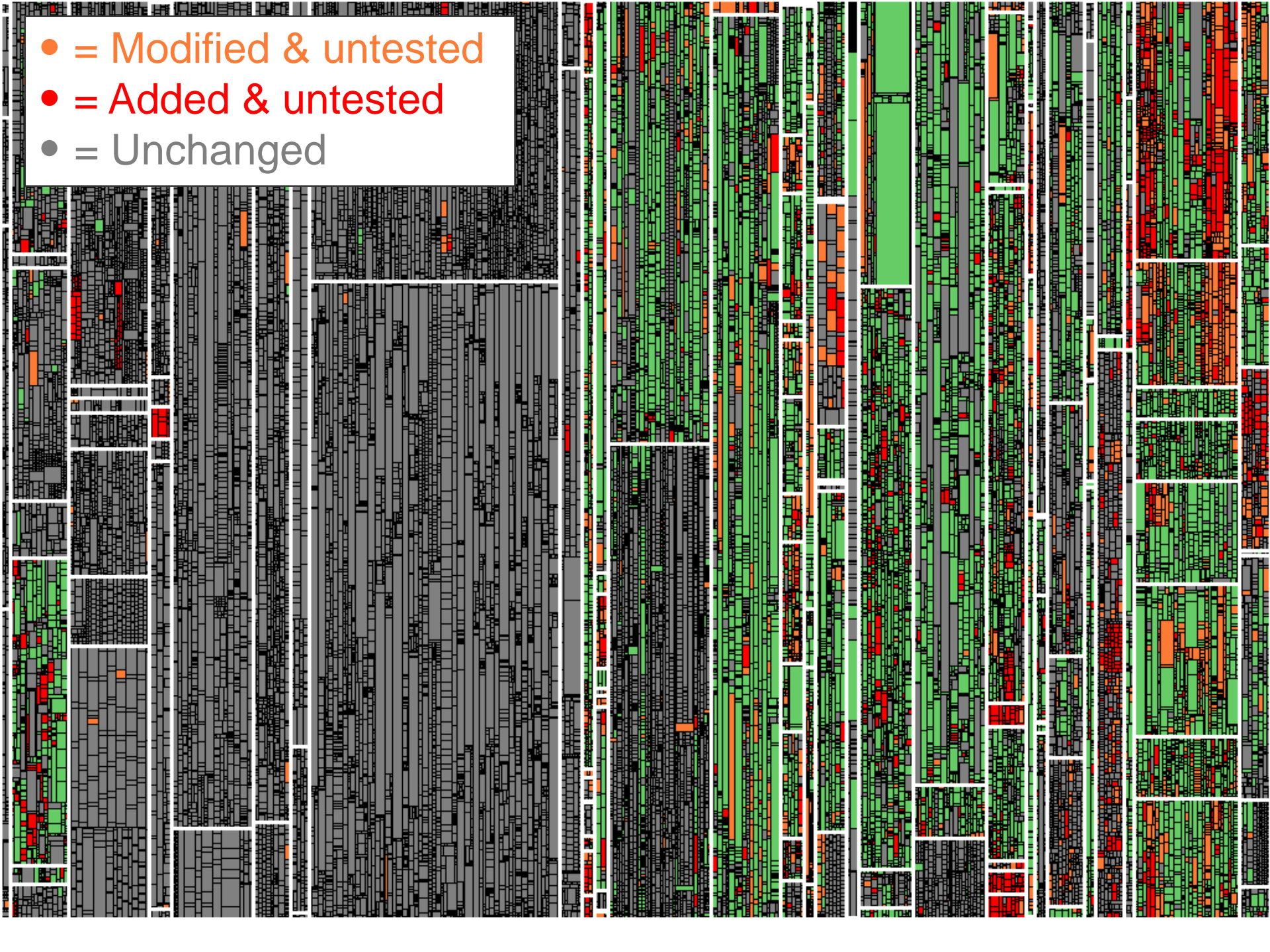


● = Executed during test

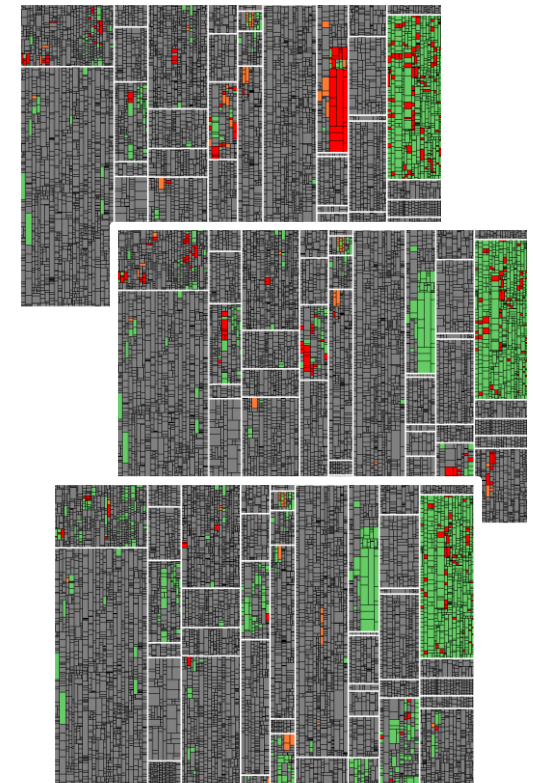
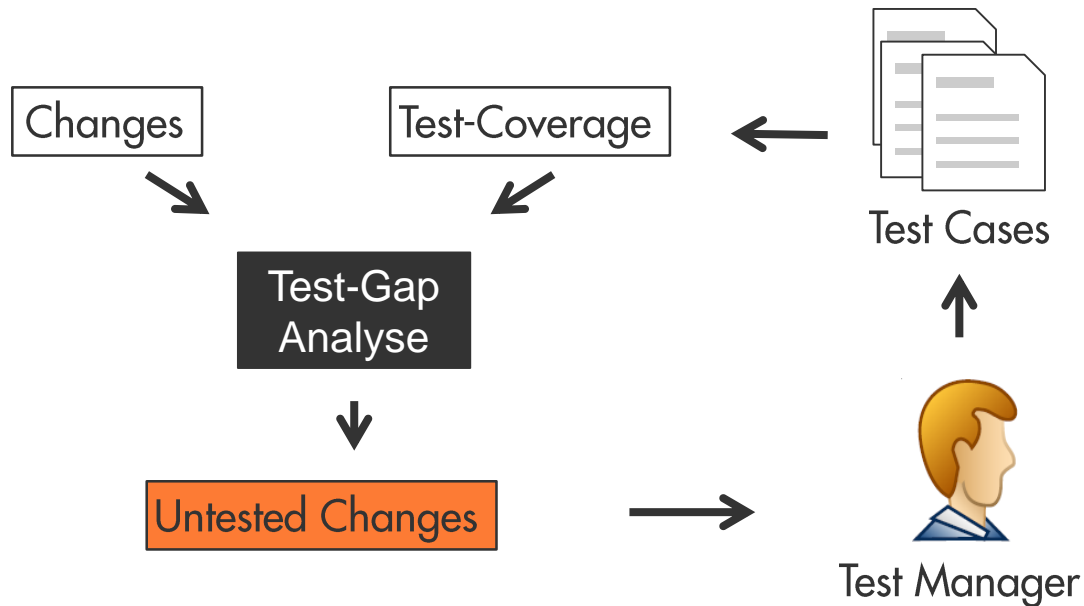




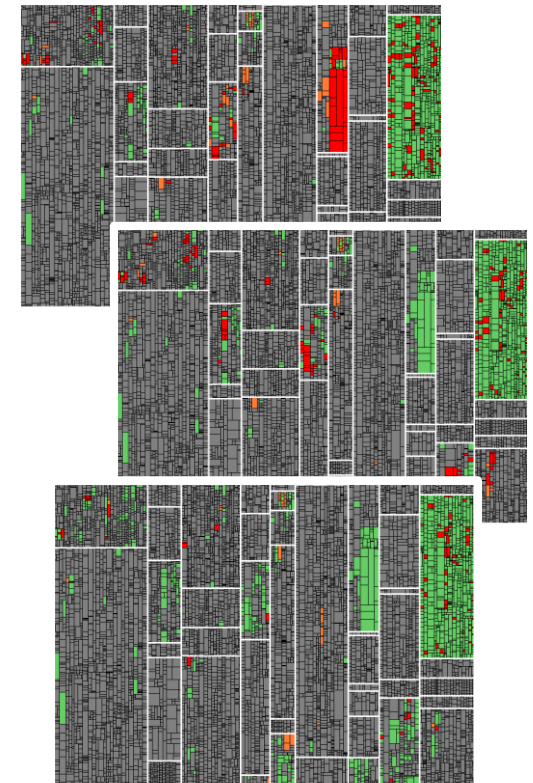
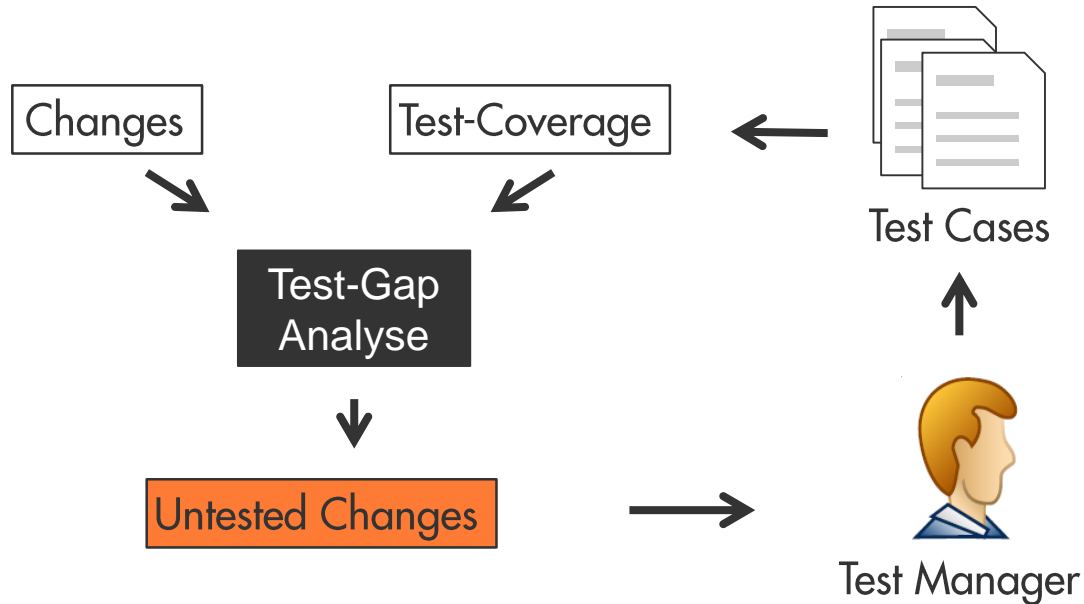
- = Modified & untested
- = Added & untested
- = Unchanged



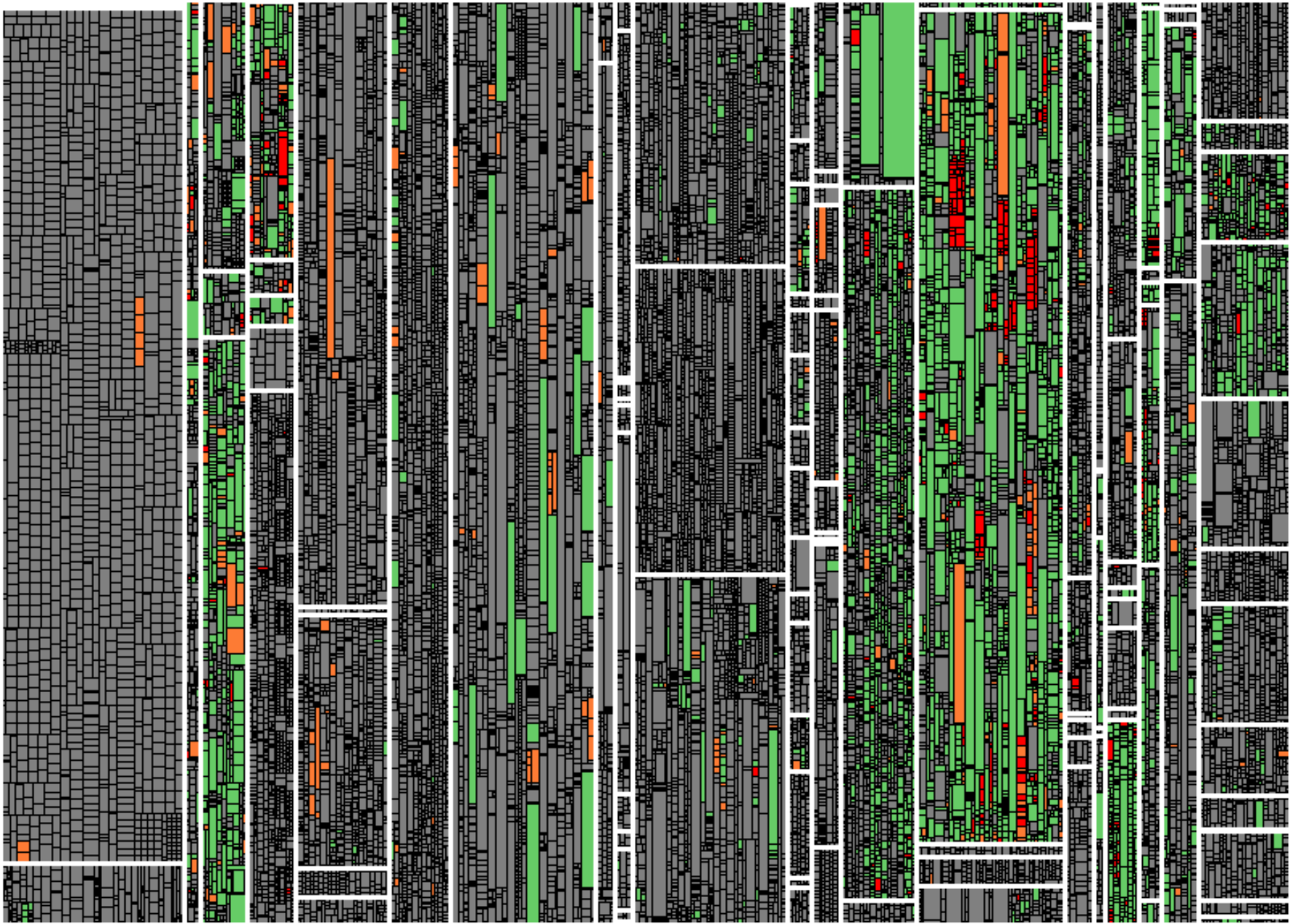
# Einsatz im Testprozess: Beispiel (2)

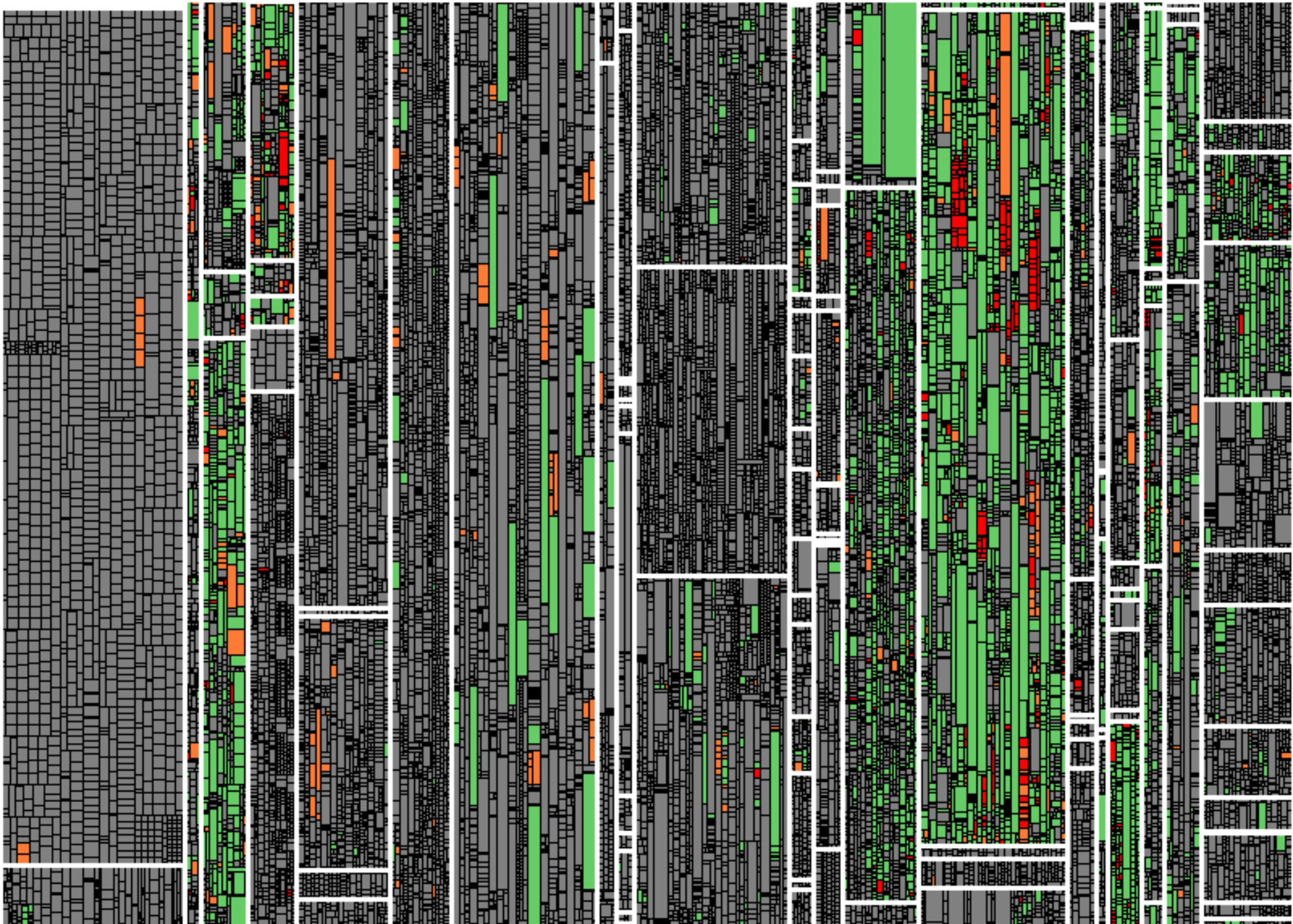


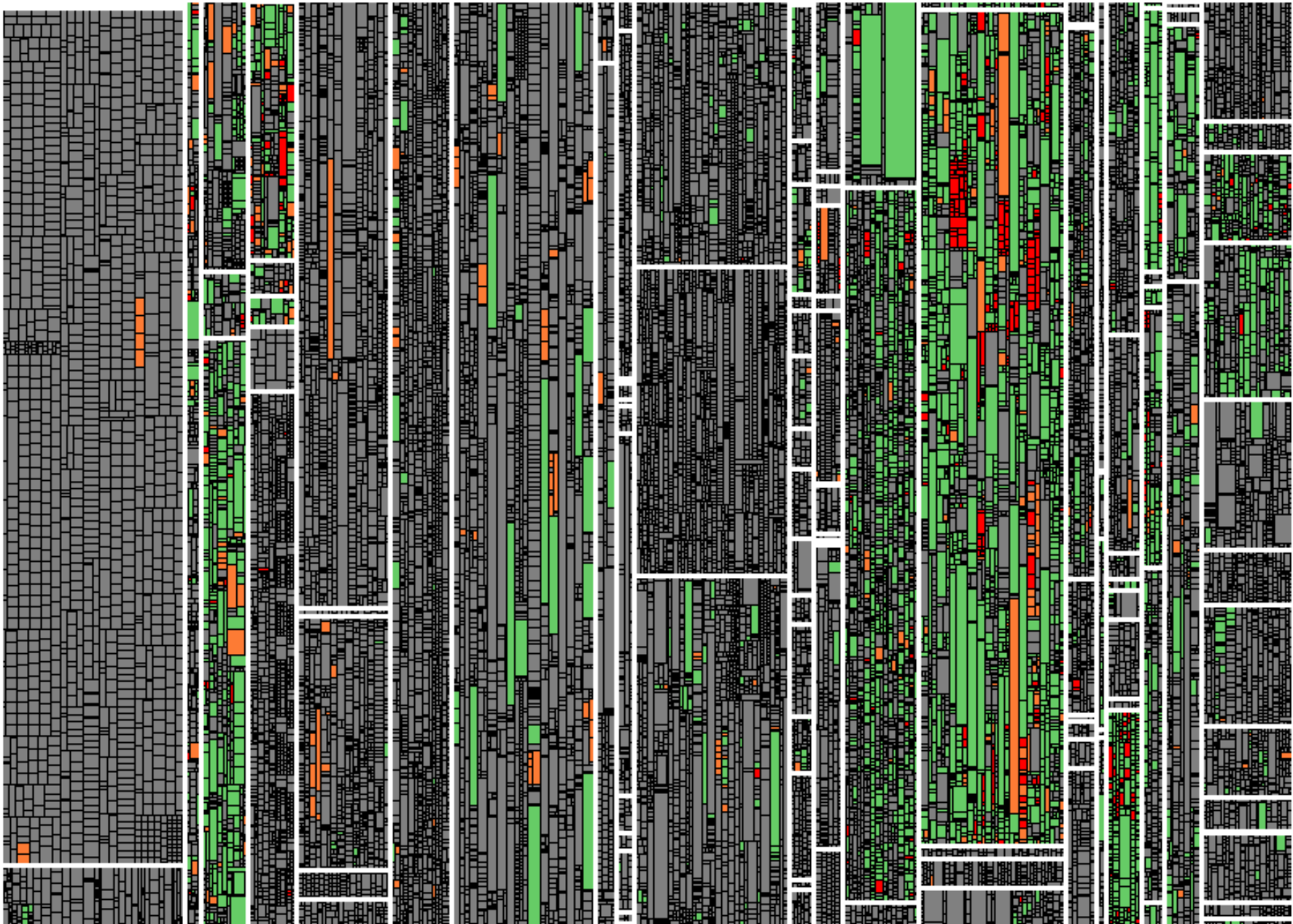
# Einsatz im Release-Test: Beispiel (3)



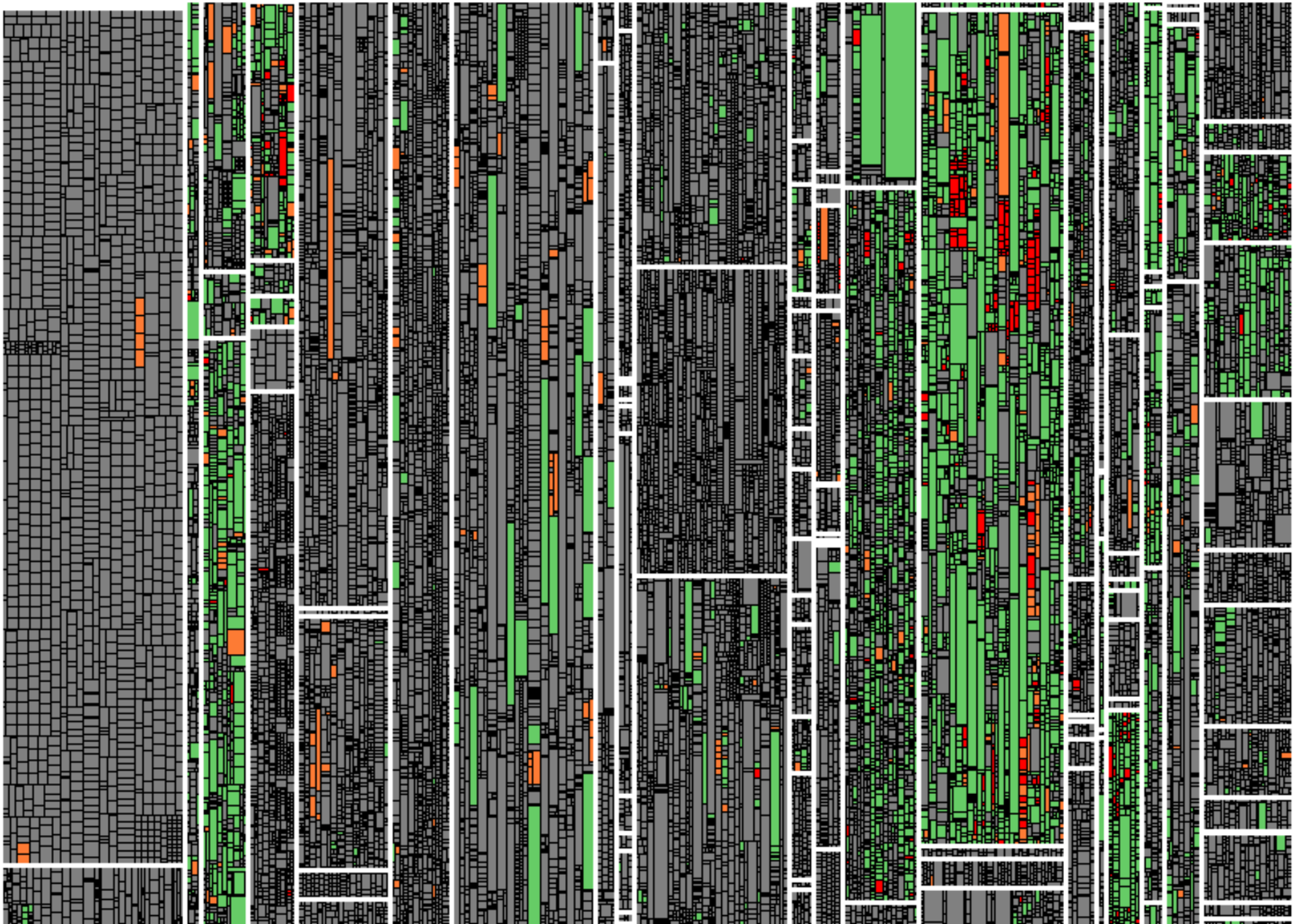


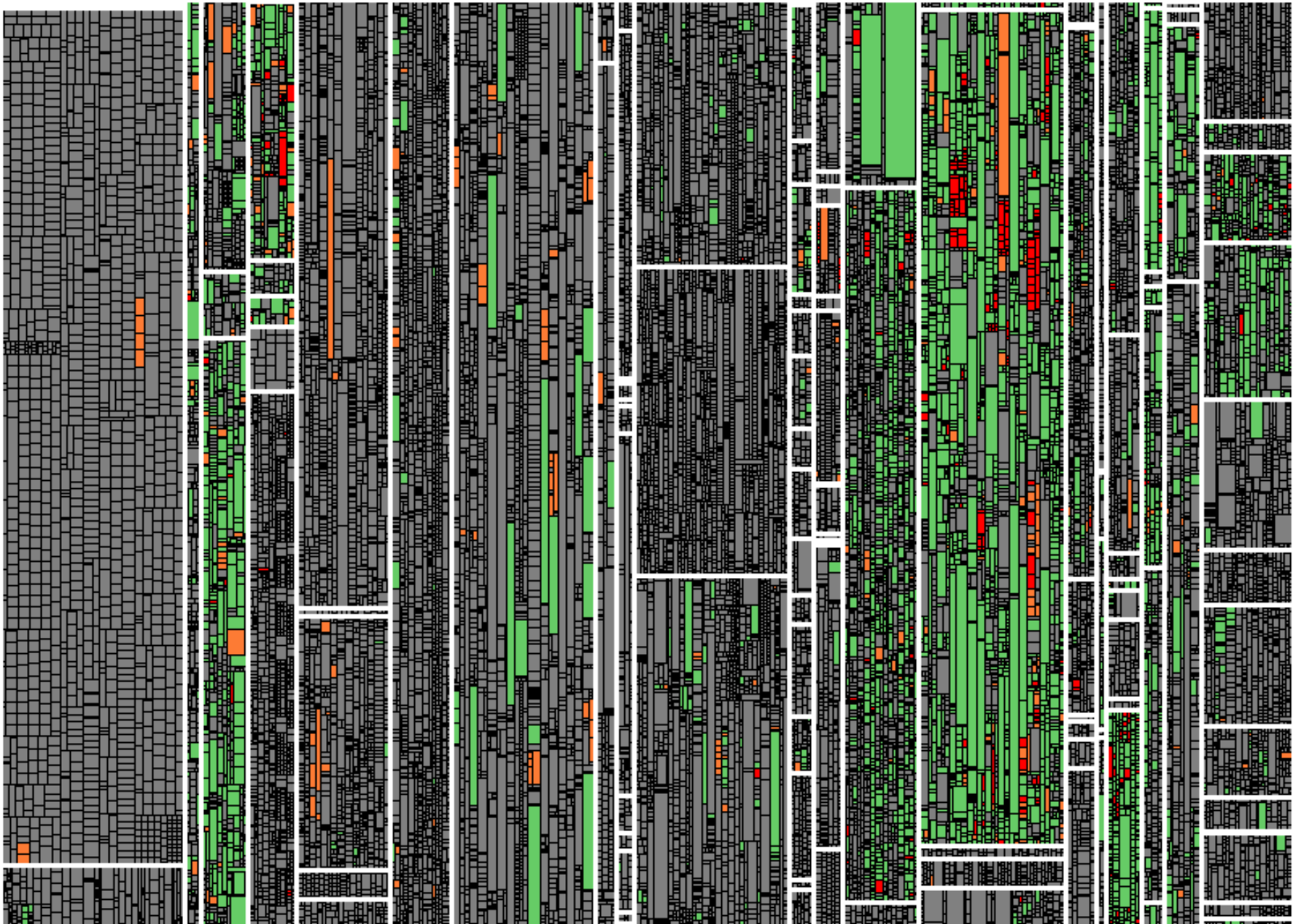












# Interaktive Dashboards mit Teamscale

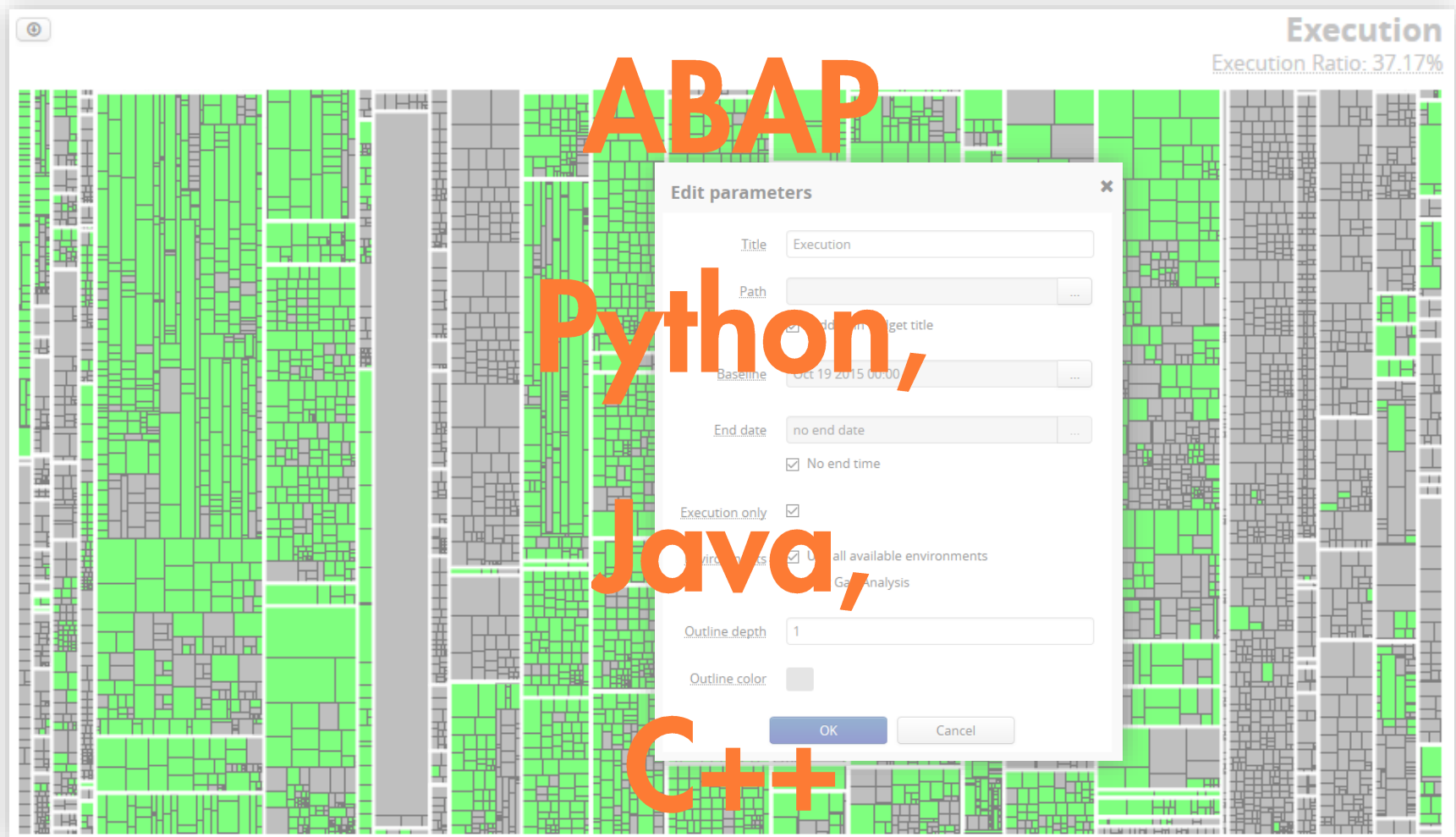
C#

ABAP

Python

Java

C++



thek  
...aber ist frühe  
matischer Analyse  
ach? (Vortrag)  
Heiner  
land Informatik  
GmbH

Garden Court  
Code-Metriken lügen!?  
Praxisbeispiele und  
Gegenmaßnahmen (Vortrag)  
Johannes Dienst  
MULTA MEDIO  
Informationssysteme AG

Burggrafensaal  
Haben wir das Richtige getestet?  
Erfahrungen mit Test-Gap-Analyse  
in der Praxis (Vortrag)  
Dr. Elmar Jürgens  
CQSE GmbH

Orangerie  
Wie helfen Testarchitekten bei der  
Definition und Umsetzung des  
"richtigen Testens" (Vortrag)  
Dr. Erhardt Wunderlich  
Bombardier Transportation GmbH

Erem  
M-TDD - Mode  
Driven Develop  
Scale Mechatr  
Sieme  
Ivan Tr  
Sieme

Pause/Raumwechsel

nts & Architecture

Track 2 Testautomation

Track 3 Testdesign

Track 4 Testmanagement

Track 5 Sp

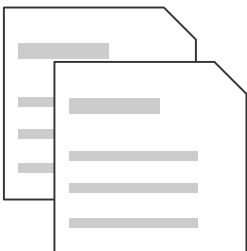
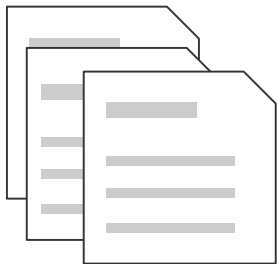
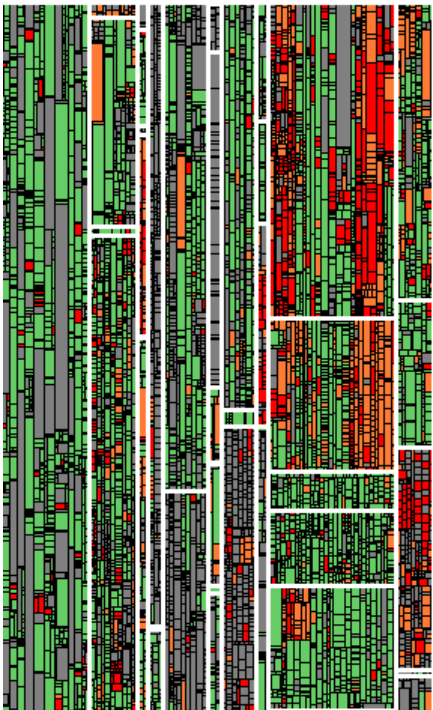
3:10 Uhr  
Court  
Quality Service  
Workshop)  
Faßbender  
Main GmbH  
Glunz  
s AG

12:25 - 13:10 Uhr  
Eremitage  
Key Features of a Modern Test  
Data Management Tool (Solution-  
Workshop)  
Martin Kralj  
Ekobit d.o.o.

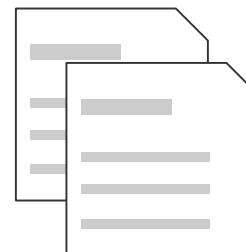
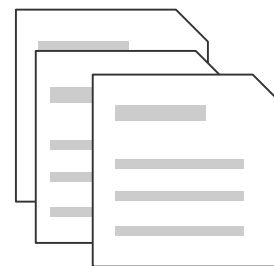
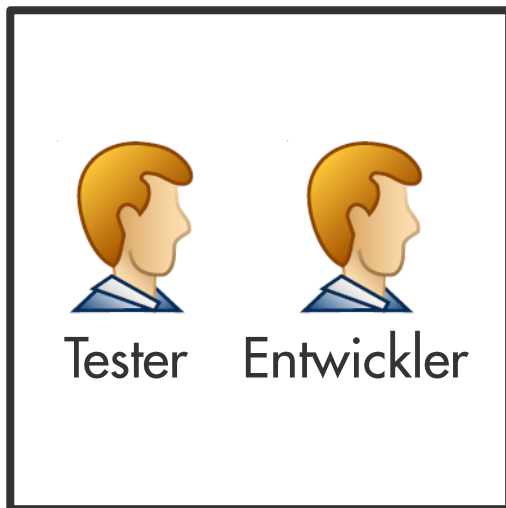
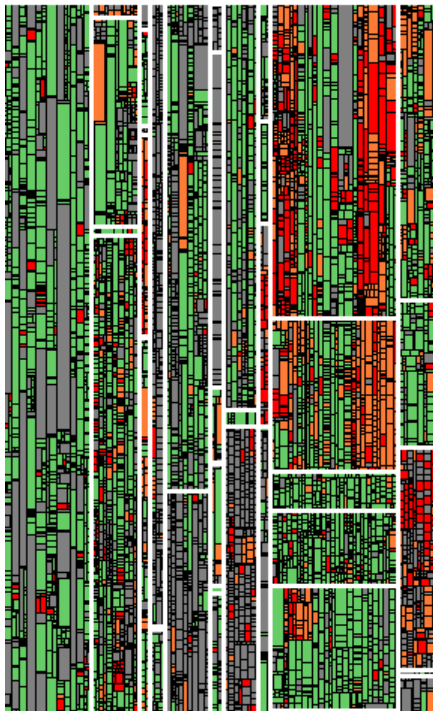
12:25 - 13:10 Uhr  
Burggrafensaal  
Oh nein, morgen ist Release! Test-  
Gap-Analyse Live am Beispiel  
(Solution-Workshop)  
Dr. Dennis Pagano  
CQSE GmbH

12:25 - 13:10 Uhr  
Orangerie  
Agiles Vorgehen und zentrale  
Testverantwortung? (Solution-  
Workshop)  
Stephan Brehovsky  
Bundesagentur für Arbeit  
Michael Heller  
imbus AG

12:25 - 13:10 Uhr  
Biblio  
RapidRep - Bar  
schnell und effi  
Works  
Werner  
FINARIS Financial  
Gm





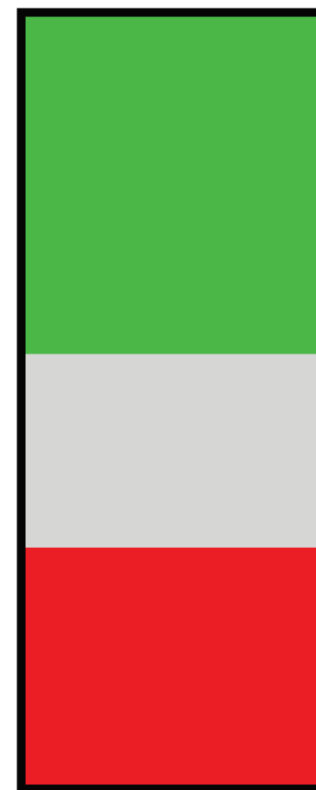
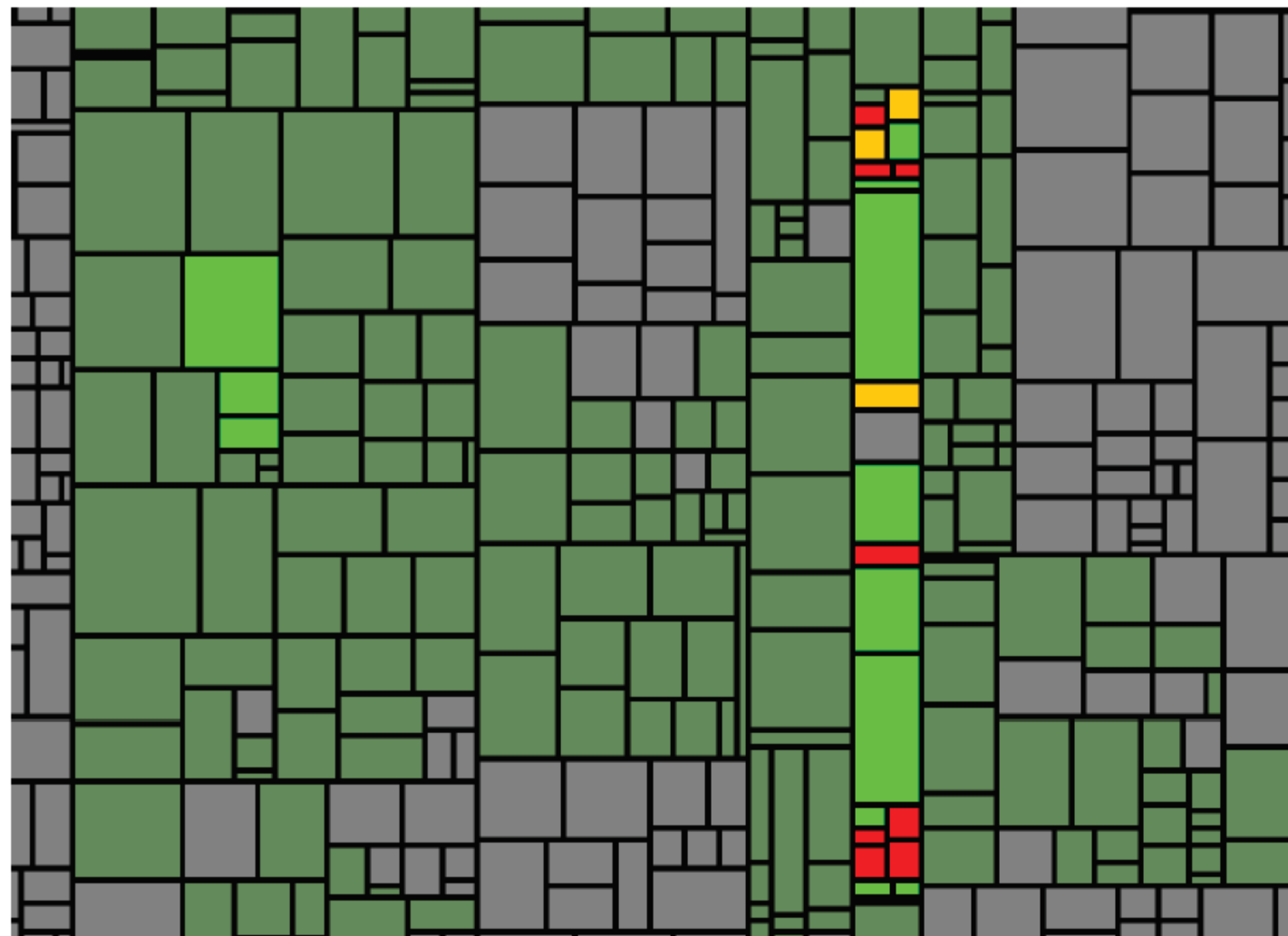


# Agenda

1. Test-Gap-Analyse
2. Einsatz in verschiedenen Test-Szenarien
3. **Ausblick**

# Change Request Coverage

Revision	Acti...	Author	Date	Message
24178		veihelm...	Montag, 25. April 2016 13:55:07	CR#7707: GREEN-RATING Closure compiler warning fixes
24177		veihelm...	Montag, 25. April 2016 13:42:41	CR#7707: GREEN-RATING Closure comment fix
24176		kinnen	Montag, 25. April 2016 13:30:14	CR#9702: GREEN
24175		kinnen	Montag, 25. April 2016 13:28:40	CR#9593: GREEN
24170		streitel	Montag, 25. April 2016 13:02:55	CR#9684: YELLOW fixing compiler warning
24169		streitel	Montag, 25. April 2016 11:43:53	CR#9684: YELLOW
24168		streitel	Montag, 25. April 2016 11:37:10	CR#9684: GREEN with Andi
24167		pawelka	Montag, 25. April 2016 11:28:47	CR#7707: fixing checkType warnings
24166		kinnen	Montag, 25. April 2016 09:15:58	Merged 2.0.x -> trunk
24165		haas	Freitag, 22. April 2016 18:27:50	CR#9697: YELLOW: Fix UI test (by using a new test case). Fix issue with Assume nodes in GFCs (they have no tok...
24163		baumeis...	Freitag, 22. April 2016 17:32:30	CR#9399: RED, incorporated review comment.
24162		goeb	Freitag, 22. April 2016 17:21:26	CR#9622: adjust handling of commit timestamps
24159		baumeis...	Freitag, 22. April 2016 17:08:18	CR#9399: GREEN, incorporated review comment.
24158		pawelka	Freitag, 22. April 2016 17:06:18	CR#0: Fixing architecture assessing if [ENTF] is clicked even if no element was deleted.
24157		pawelka	Freitag, 22. April 2016 17:05:01	CR#7707: fixing type check warning
24152		chasapis	Freitag, 22. April 2016 16:35:39	CR#9731: set minimum value for number input 0, because number of days cannot be negative.
24149		baumeis...	Freitag, 22. April 2016 15:49:19	CR#8487: YELLOW, incorporated review comments.
24148		haas	Freitag, 22. April 2016 15:40:30	CR#9697: RED: Temporarily disable refactoring suggestions in UI tests
24147		haas	Freitag, 22. April 2016 14:29:05	CR#9697: YELLOW: Improve data flow analysis for refactoring suggestions: * FOR, FOR EACH and WHILE loops (...)
24146		haas	Freitag, 22. April 2016 14:22:48	CR#9697: YELLOW: Only consider candidates that have statements (i.e. not only META shallow entities, which occ...
24144		ashutoshb	Freitag, 22. April 2016 12:51:47	CR#9090: fixed the GUI-test.
24143		chasapis	Freitag, 22. April 2016 12:01:28	CR#8022: fixed nesting depth issue
24142		baumeis...	Freitag, 22. April 2016 11:57:54	CR#8487: YELLOW, incorporated review comments.
24141		baumeis...	Freitag, 22. April 2016 11:53:47	CR#8487: YELLOW, incorporated review comments.
24140		chasapis	Freitag, 22. April 2016 11:44:35	CR#8022: added functionality to all widgets that use a SingleMetricParameter, so that when the user edits the par...
24138		baumeis...	Freitag, 22. April 2016 11:37:24	CR#8487: YELLOW, renamed metric rules editor.
24137		baumeis...	Freitag, 22. April 2016 11:36:31	CR#8609: YELLOW, fix build.
24136		baumeis...	Freitag, 22. April 2016 11:18:17	CR#8609: YELLOW, added new notification utils method.
24135		gibtner	Freitag, 22. April 2016 11:03:51	CR#9364: changed status of files to YELLOW
24134		gibtner	Freitag, 22. April 2016 10:49:59	CR#9364: CommitTrackingService: - corrected comment - refactored: extracted methods
24133		baumeis...	Freitag, 22. April 2016 09:55:00	CR#8609: YELLOW, renamed template parameters.

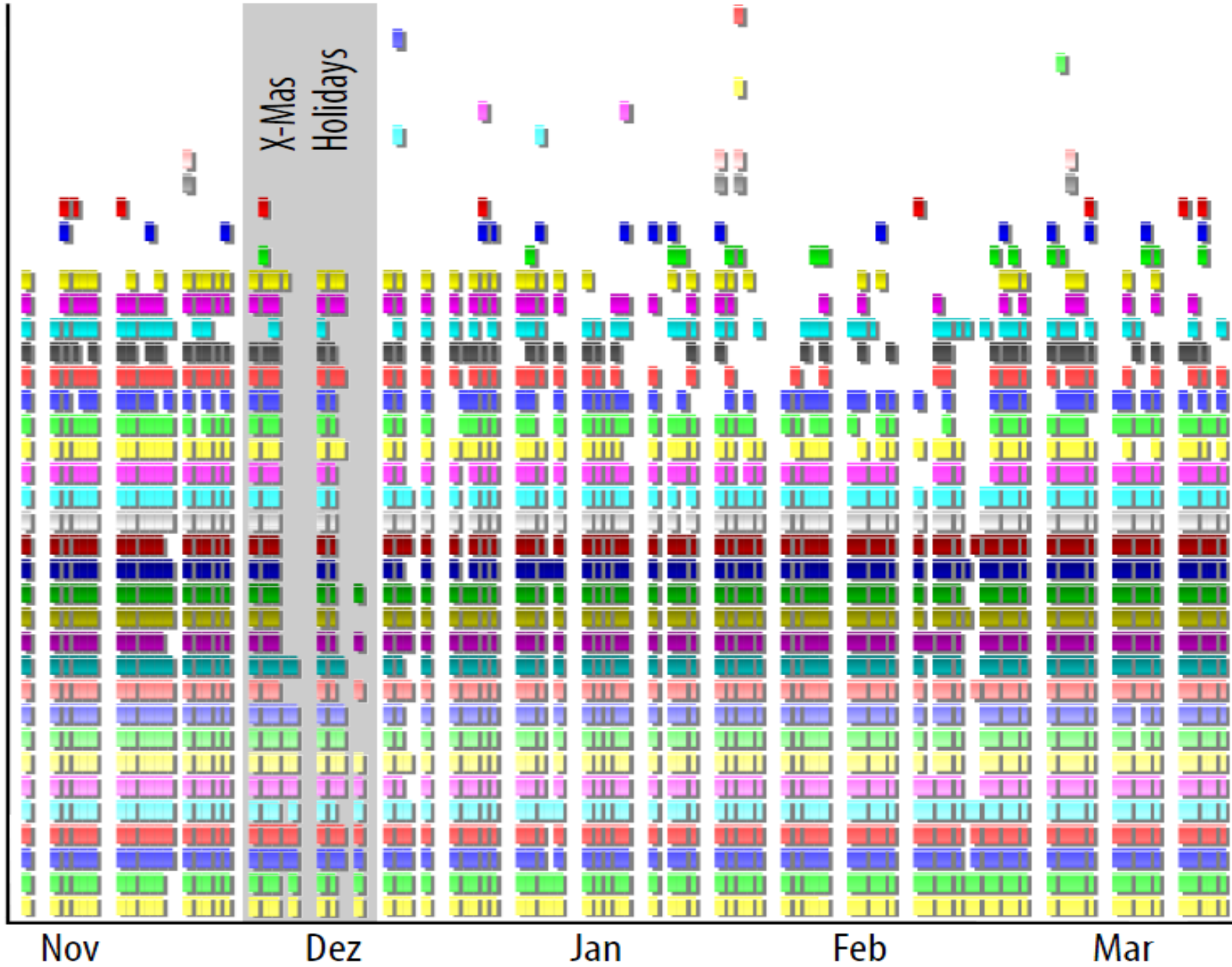


**CR#7409**

#c/a methods	16 [100%]
#not tested	5 [31,25%]
#exec in base	4 [25,00%]
#exec in test	7 [43,75%]

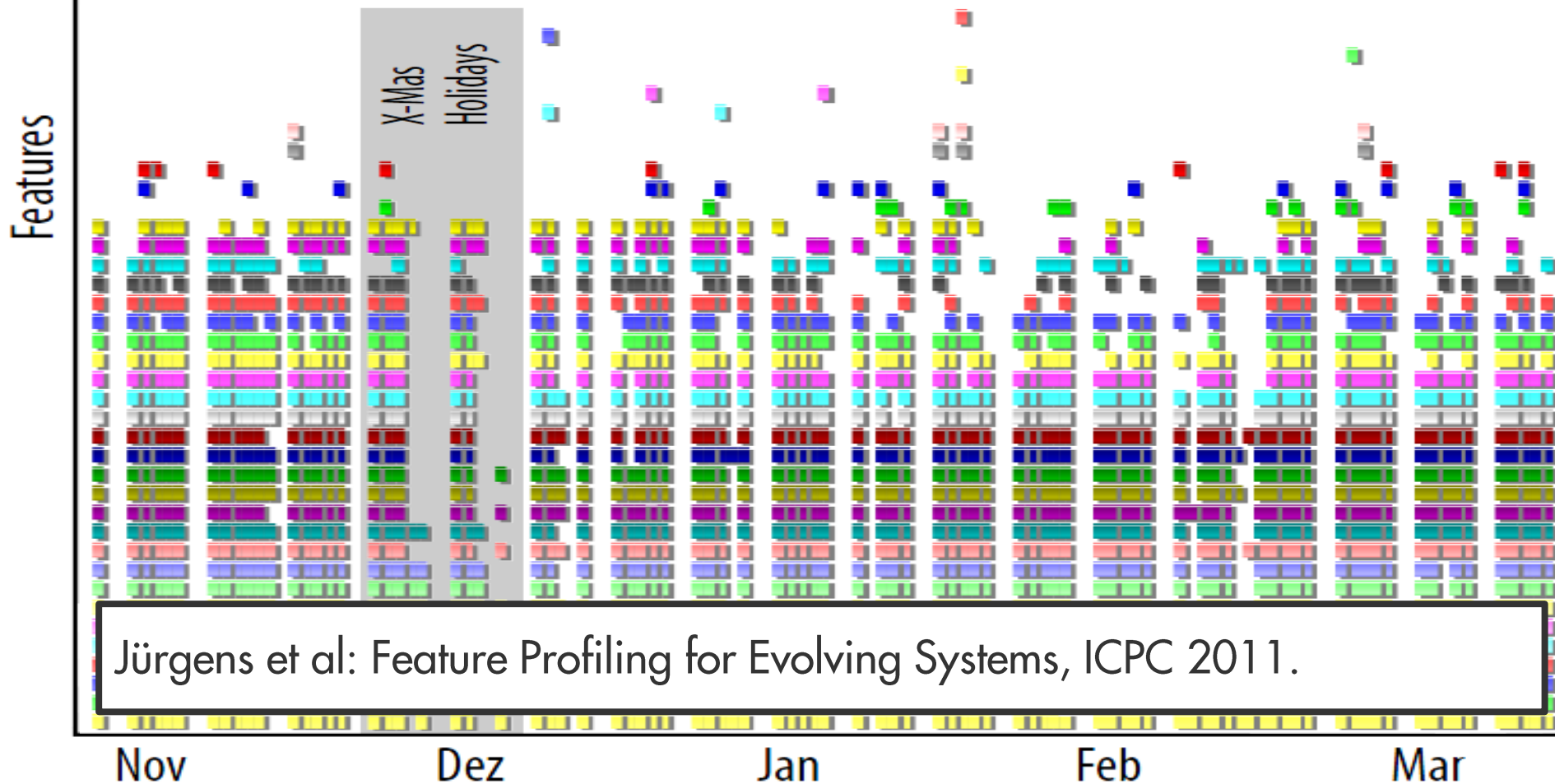


Features



## 28% features unused (15/53)

- 5 unexpected by all,
- further 6 unexpected for at least 1 stakeholder







# Software Intelligence

Welche Überraschungen lauern in Ihrer Software?

**CQSE**

**Wo sind Probleme in Ihrem Quelltext?**



Gibt es Bereiche, die niemand im Team beherrscht?  
Wird Ihr Code mit der Zeit immer schlechter?

**Welche Schwächen hat Ihre Architektur?**



Sind die zugrunde liegenden Technologien zukunftssicher?  
Haben Architekturprobleme ihre Ursache auf Teamebene?

**Welche Änderungen sind ungetestet?**







# <https://www.cqse.eu/en/blog>

## Bridge your Test Gaps with Teamscale

Posted on 04/27/2016 by Dr. Dennis Pagano

Many companies employ sophisticated testing processes, but still bugs find their way into production. Often they hide among the subset of changes that were not tested. Actually, we found that untested changes are five times more error prone than the rest of the system.



Teamscale Dashboard

Test Gaps for pinta  
Test Gap: 77.78%

Editing Test Gaps Pinta

- Label
- Numeric Metric Value
- Assessment Pie Chart
- Metrics Table
- Metrics Bar Chart
- Metric Distribution Table
- Metric Distribution Pie Chart
- Metrics Hotspot Table
- Metrics Change Table
- Findings Summary Table
- Findings Summary Bar Chart
- Findings Churn
- Metrics Trend Chart
- Assessment Trend Chart
- Treemap
- Test Gap Treemap
- Test Gap Trend Chart
- Code City
- Metric File Distribution

Save Save as Cancel

ge regularly.

verage can be found here.

ges made on the way have been  
want to show you how to find

## Testing Changes in SAP BW Applications

Posted on 04/29/2015 by Dr. Andreas Göb

As my colleague Fabian explained a few weeks ago, a combination of change detection and execution logging can substantially increase transparency regarding which recent changes of a software system have actually been covered by the testing process. I will not repeat all the details of the Test Gap Analysis approach here, but instead just summarize the core idea: Untested new or changed (informative) information. Therefore it makes sense to use only those changed but untested areas.

Several times  
In the main  
from Python  
containing  
may provide  
Analysis in

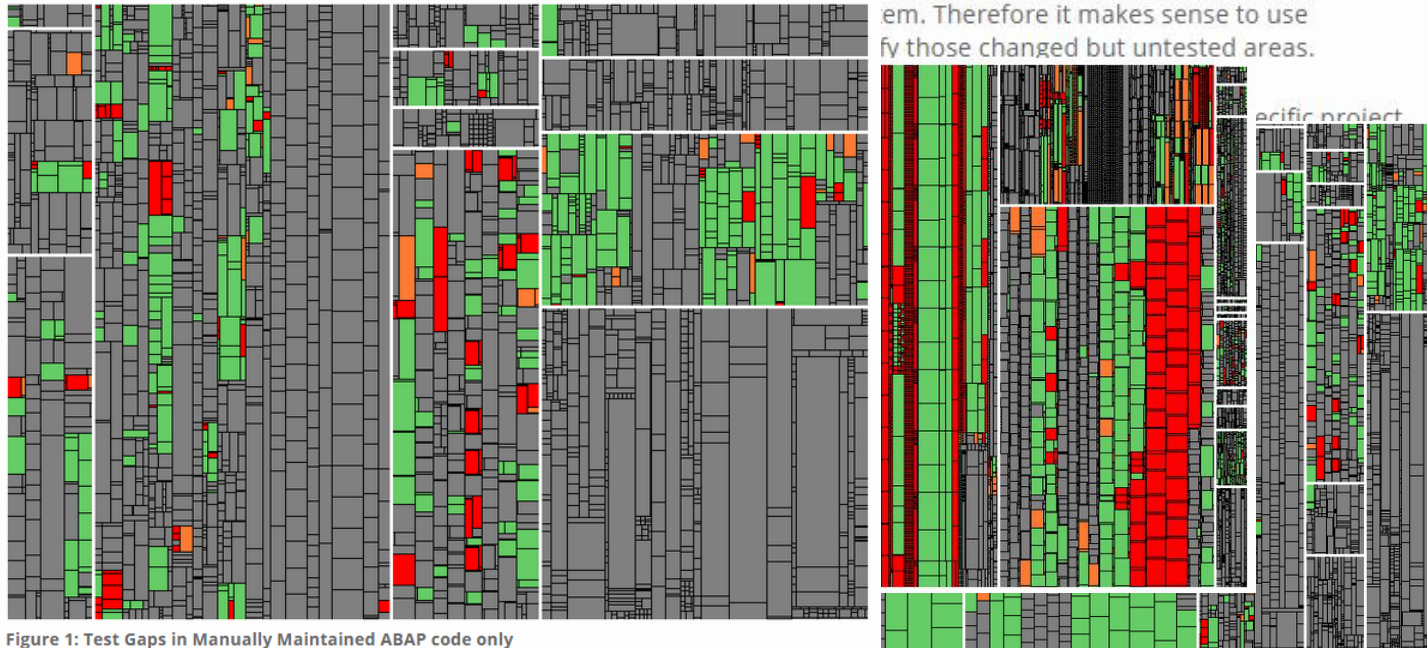


Figure 1: Test Gaps in Manually Maintained ABAP code only



# Fazit

Änderungen am Code sind guter Fehlerprädiktor.

Test-Gap-Analyse macht Änderungen und Testaktivitäten transparenter und ermöglicht es *ungewollt* ungetestete Änderungen zu vermeiden.

Wir unterstützen gerne bei der Evaluierung und Einführung.