Software Evolution: a Maintenance Perspective

S. Ducasse

http://rmod.lille.inria.fr

Merge Trace Language Validation Semantic
Reflection
Layers Traits Architecture
Object analysis Analyses
Bootstrap Serialization Aspects Teaching Engineering
Evolution
Information Reflective Pharo Visual
Repositories Code Tools Dependency
Understanding Identification Moose Encapsulation
IDE Software Quality Reengineering
Comprehension Models
Class Scripting
Programming History Dynamic
Development Maps Meta Modules
Interexchange Proxy
Duplicated Remodularisation formats Checking Reverse
Visualization Mining Web Metrics Array Extraction
Extensions Rules
Patterns Feature Cycles Design

- http://stephane.ducasse.free.fr
- Co-creator of Moose
- Co-founder of http://www.synectique.eu
- Core http://www.pharo-project.org developer
- Coder and designer

RMOD Challenges

How can we build evolvable software?

- systems that runs 24h 7/7
- in my system some objects were born in 1980 and migrated since then, how can we make this the default?

How can we build dynamic but safer?

- Need for reflective and dynamic systems
- Can we make them safer?

Two faces of the same coin

How to help maintaining large systems?

we design meta analyses & tools (to invent new tools and analyses ;))

What is the language runtime infrastructure to support evolution?

we are rethinking dynamic language fundamentals

Mixing OSes and languages

Axis 2- Past: Dynamic Language Infrastructure

La perfection est atteinte, non pas lorsqu'il n'y a plus rien à ajouter, mais lorsqu'il n'y a plus rien à retirer. St-Exupery

Some Topics

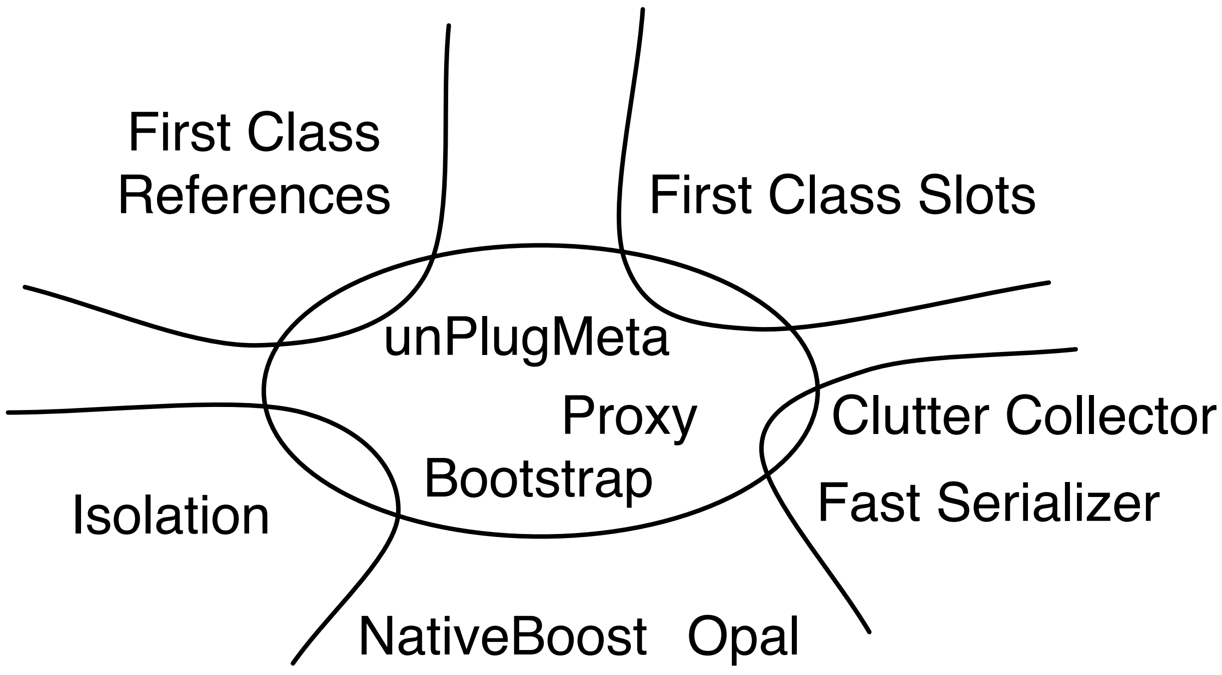
- Classboxes: Modules for open-classes [OOPSLA'05]
- OOPAL: OOP + APL Generalizing message passing [OOPSLA'03]
- Encapsulation for dynamic languages [ECOOP '04, OOPSLA'04]
- Reusable behavior: Traits [ECOOP'03, OOPSLA'03, Toplas, ..., OOPSLA'07]

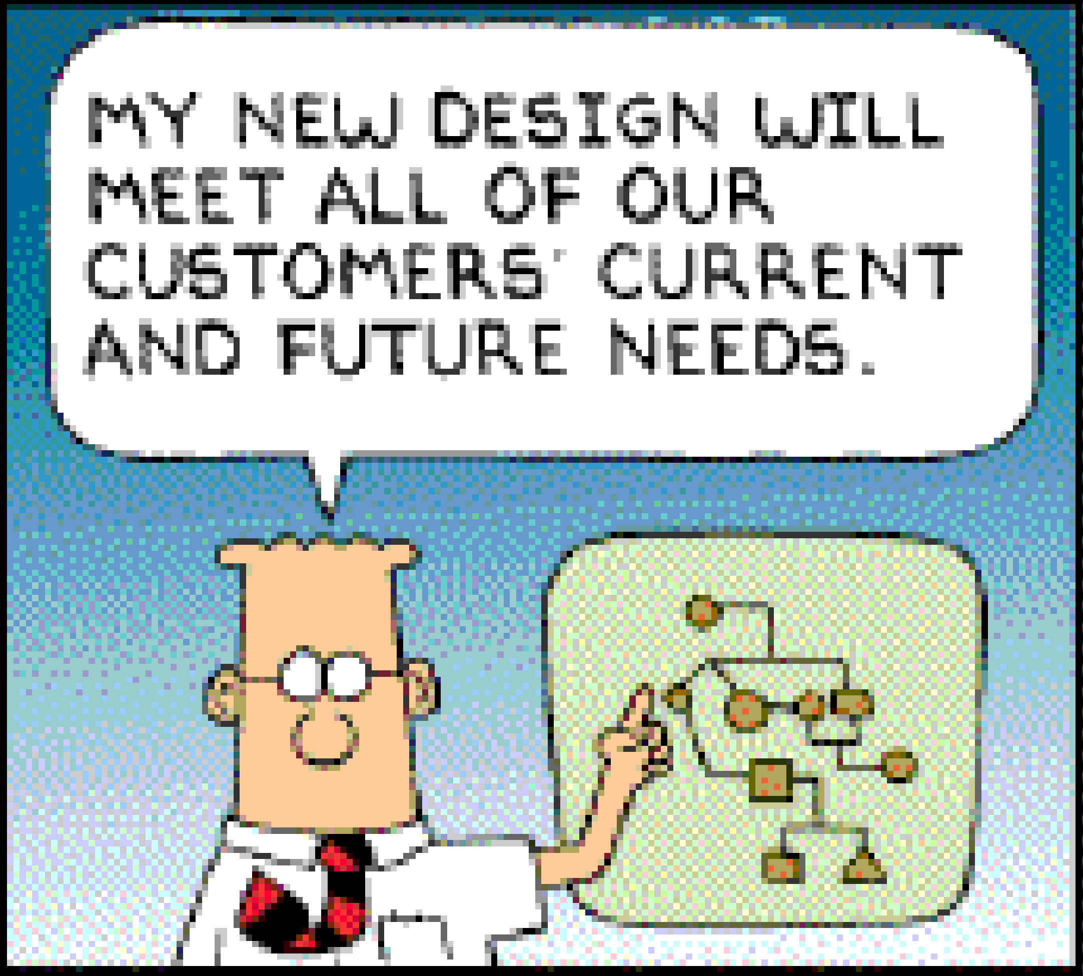
Impacts

- *Traits used by*
  - Perl-6, PHP 5.4, Squeak/Pharo, Dr-Scheme
  - variant Fortress (SUN Microsystems), Scala (EPFL), Multiple type systems (Drossopoulos, Reppy, Liquori, Bono...)

Infrastructure for Safer Reflective Systems

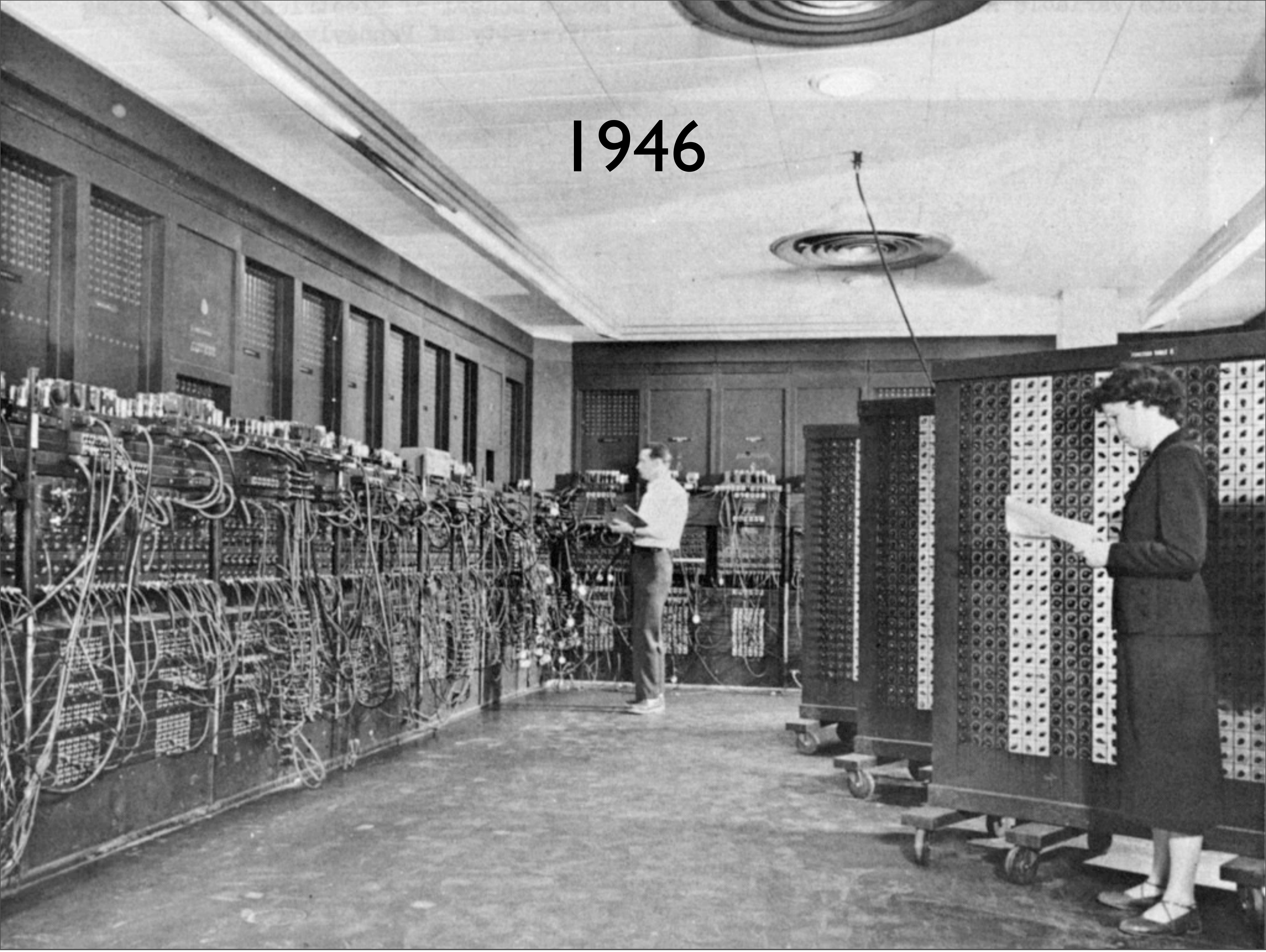
- Unpluggable reflection
- Isolation
- Fast serializers
- First class references
- Clutter collector (memory)




MY NEW DESIGN WILL MEET ALL OF OUR CUSTOMERS' CURRENT AND FUTURE NEEDS.

Software is

Complex



1946

1’000’000 lines of code

* 2s = 2’000’000 seconds
/ 3600 = 560 hours
/ 8 = 70 days
/ 20 = 3 months

Facts

- Cobol > 60% world software
- 70% of business applications
- Applications cobol handle 85%
- Cobol grows of 5 billions lines of code per year [eWeeks, 2001]

Counting a bit

- 1 sheet ~ 60 lines of code
- Two sides ~ 120 loc

Windows NT 3.1 (1993)

- 4 à 5 MLOC

3.75m

3.2m

Encyclopedia Britanica
(15 ed., 32 volumes)

Windows server 2003
50 MLOC

41.m

46 m

Business Relevance

- 1990 → 120 billions LOC in maintenance (Ulrich, 1990)   100 km height :)
- 2000 → 250 billions LOC in maintenance (Sommerville, 2000)
- Maintained code double every 7 years (Müller et al., 1994)

What? It still exist?

- Advanced languages (OO, AOP)
- Modern Processes (RUP, Agiles)
- Quality (CMMi)
- New Development (MDE, SOA)

One upon a time

- Un marchand de moules construit un magasin à Dunkerque ...

Il était une fois ...

- Les affaires marchent bien

Il était une fois ...

- Vraiment bien

Il était une fois ...

- Les employés veulent un restaurant

Il était une fois ...

- Les directeurs, une terrasse

Il était une fois ...

- La loi impose une sortie de secours

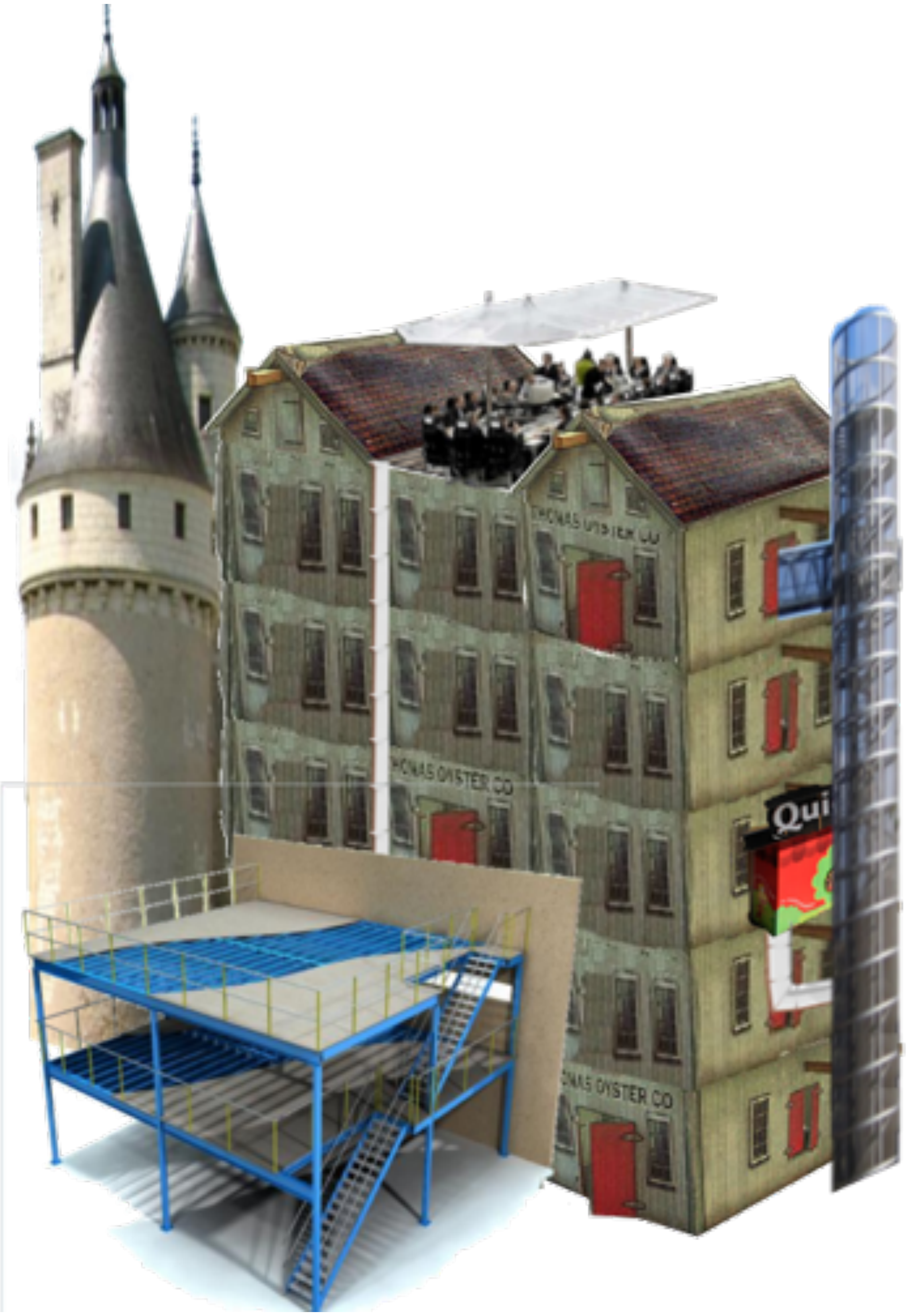
THOMAS OYSTER CO
THOMAS OYSTER CO
THOMAS OYSTER CO
THOMAS OYSTER CO
Qui

Il était une fois ...

- La concurrence offre des *goodies* aux clients, l'entreprise … une piscine !

Il était une fois ...

- etc ...



Laws of software evolution

- **Continuing change**
  - A program that is used in a real-world environment must change, or become progressively less useful in that environment.
- **Increasing complexity**
  - As a program evolves, it becomes more complex, and extra resources are needed to preserve and simplify its structure.

Software is a living entity...

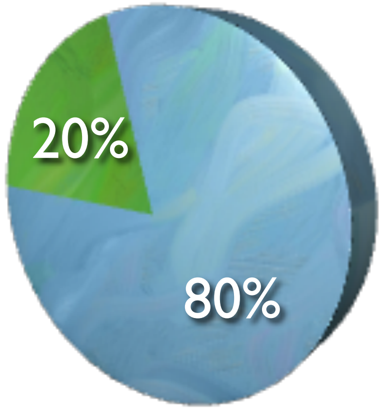
- Early decisions were certainly good at that time
- But the context changes
- Customers change
- Technology changes
- People change

Maintenance = Success!!

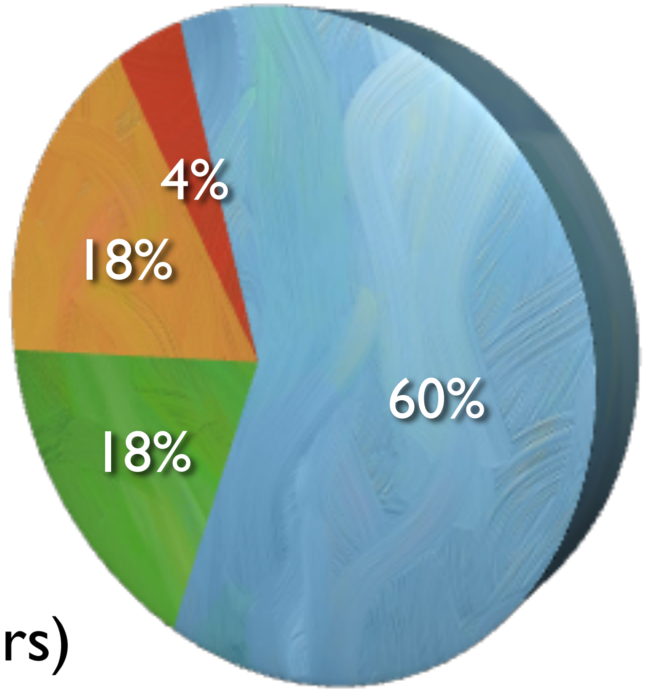
We only maintain useful successful software

Maintenance is controlled by external factors (Success, laws, people...) and not driven by software

Maintenance is *continuous* Development



Between **50%** and **80%** of ***global*** effort is spent on "maintenance" !



4% Other

18% Adaptive
(new platforms or OS)

18% Corrective
(fixing reported errors)

60% Perfective
(new functionality)

"Maintenance"

RMOD

RMoD: code analysis, metamodeling, software metrics, program understanding, program visualization, evolution analysis, refactorings, legacy code, quality, ...

Current focus

Remodularization analyses

Quality models (PSA-Airfrance)

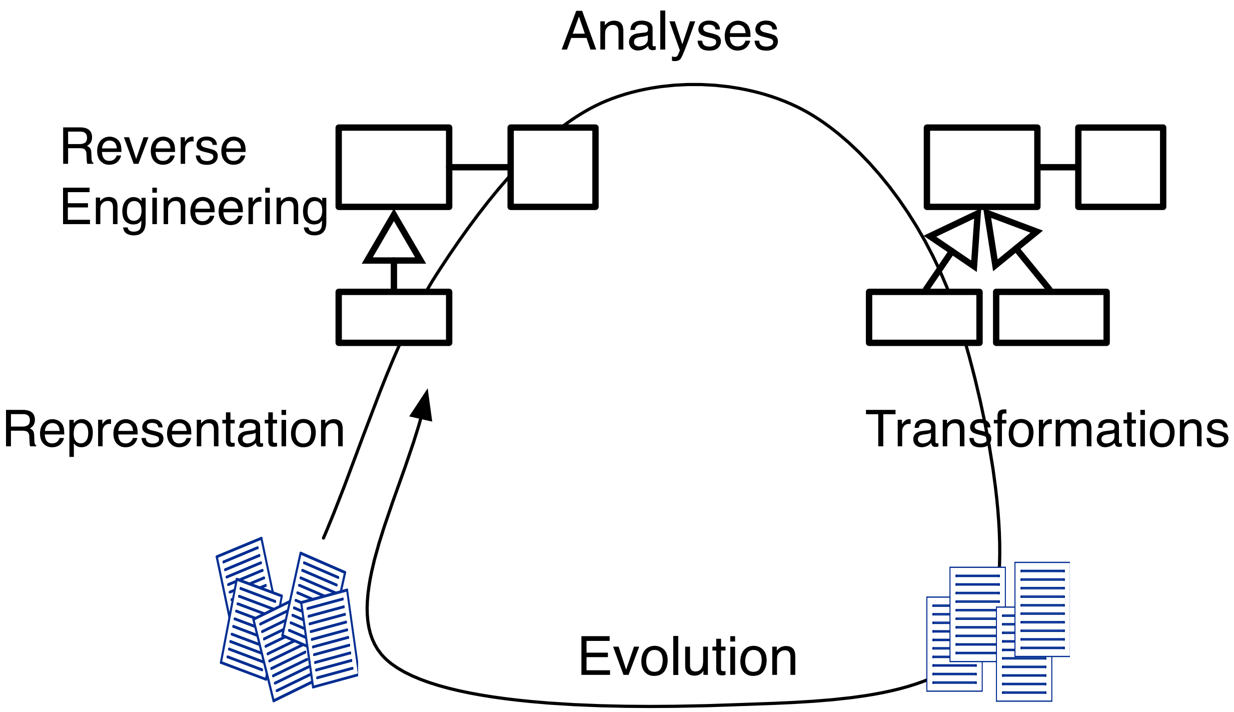
Towards semantic merge

Rule and bug assessment

Collaborations

Soft-VUB (Belgium), Pleiad (Chile)

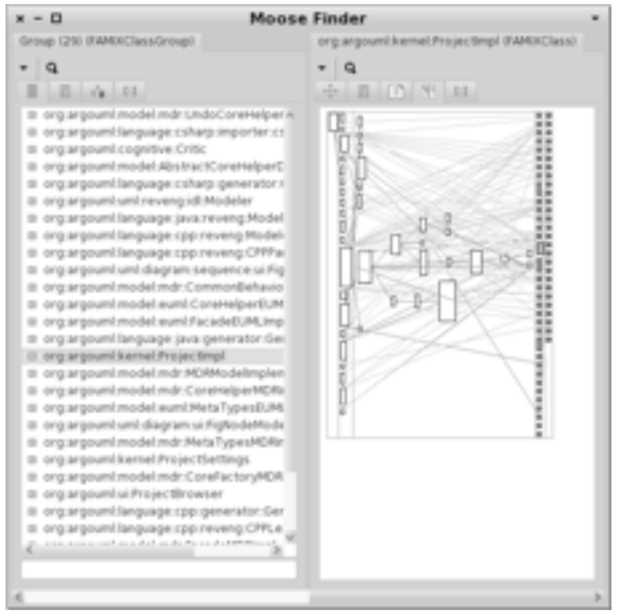
UFMG (Brazil), SCG (Swiss), LIRMM



classes select: #isGod

McCabe = 21

LOC = 753,000



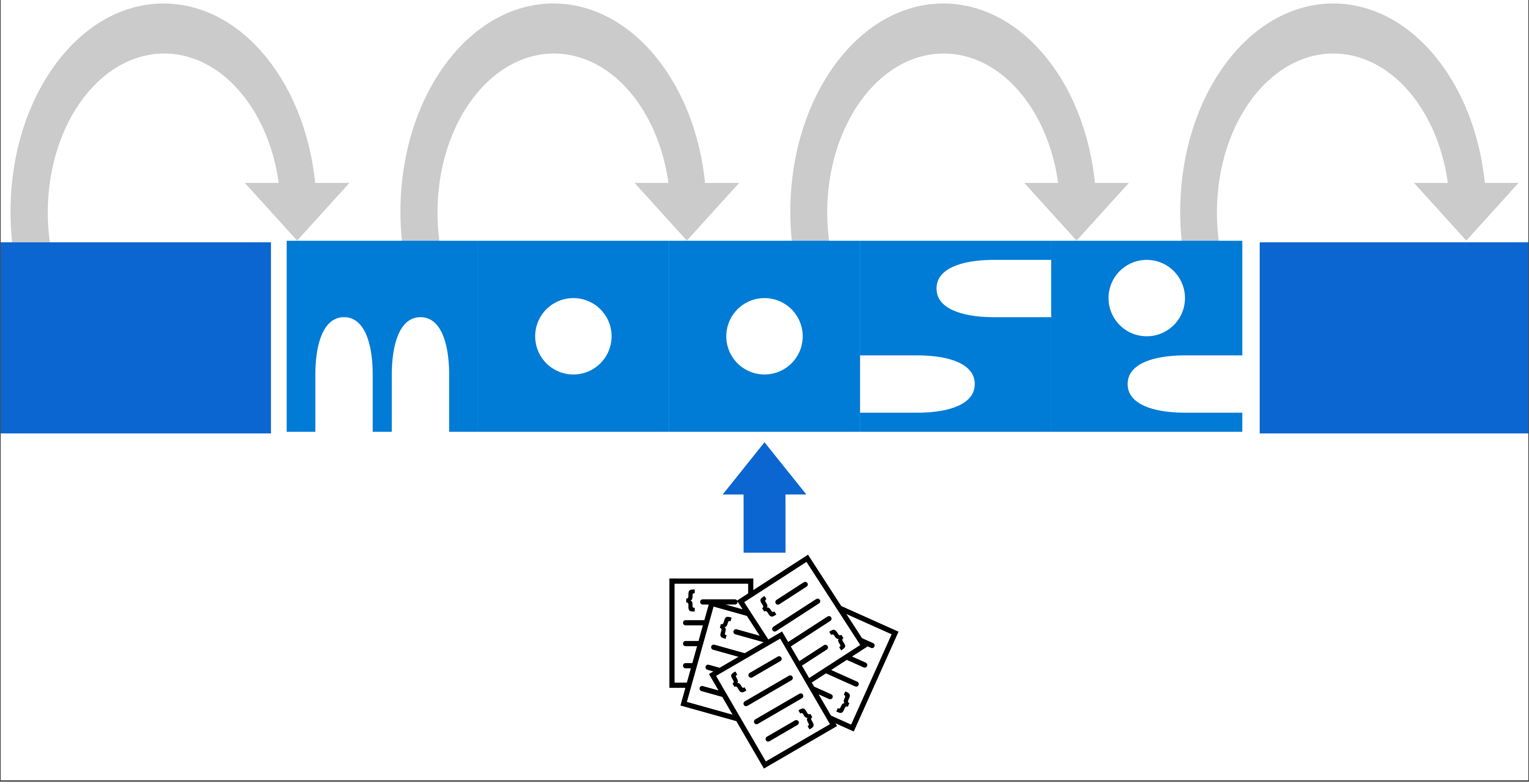
Moose Finder

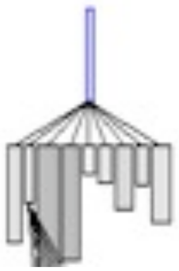
Group (29) (FAMIXClassGroup)

org.argouml.kernel.ProjectImpl (FAMIXClass)

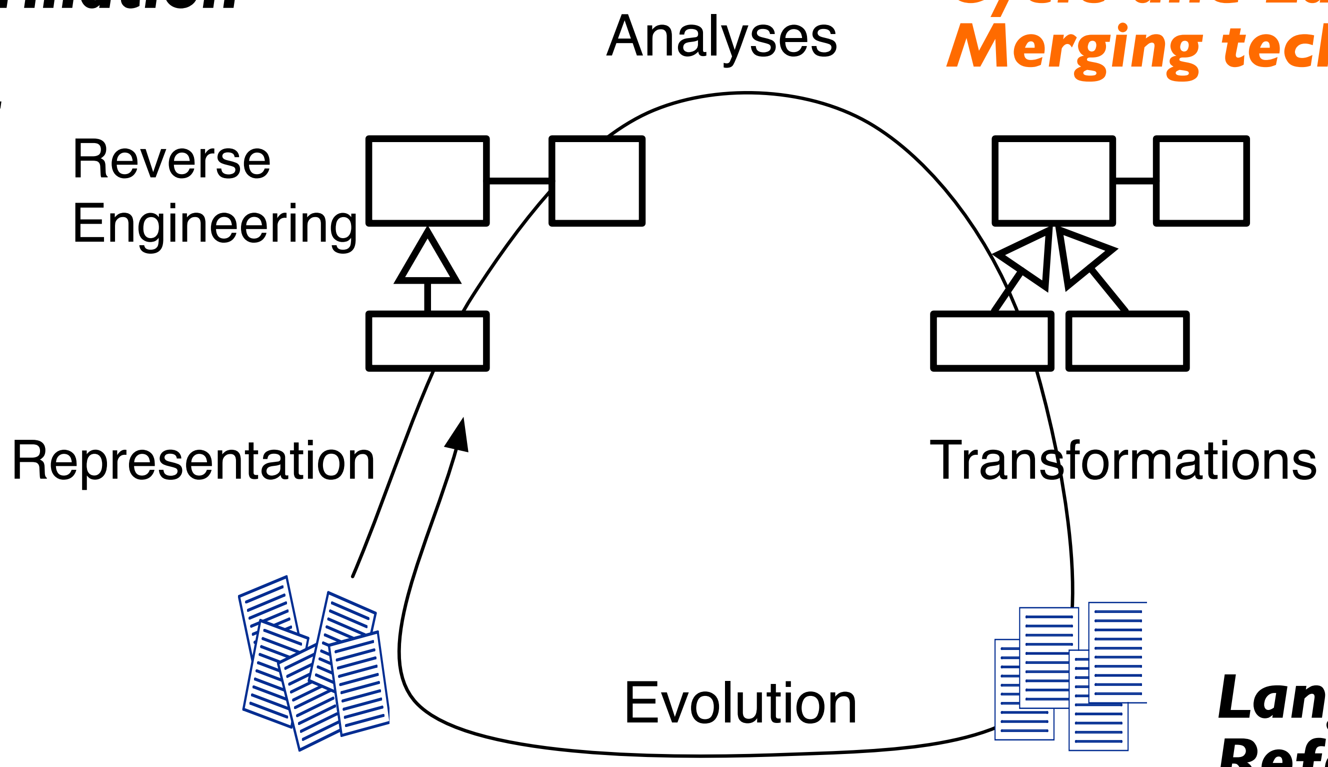
- org.argouml.model.mdr.UndoCoreHelperA
- org.argouml.language.csharp.importer.cs
- org.argouml.cognitive.Critic
- org.argouml.model.AbstractCoreHelperD
- org.argouml.language.csharp.generator.
- org.argouml.uml.reveng.idl.Modeler
- org.argouml.language.java.reveng.Model
- org.argouml.language.cpp.reveng.Model
- org.argouml.language.cpp.reveng.CPPFa
- org.argouml.uml.diagram.sequence.ui.Fig
- org.argouml.model.mdr.CommonBehavio
- org.argouml.model.euml.CoreHelperEUM
- org.argouml.model.euml.FacadeEUMLImp
- org.argouml.language.java.generator.Ge
- org.argouml.kernel.ProjectImpl
- org.argouml.model.mdr.MDRModelImplen
- org.argouml.model.mdr.CoreHelperMDRI
- org.argouml.model.euml.MetaTypesEUML
- org.argouml.uml.diagram.ui.FigNodeMode
- org.argouml.model.mdr.MetaTypesMDRIr
- org.argouml.kernel.ProjectSettings
- org.argouml.model.mdr.CoreFactoryMDR
- org.argouml.ui.ProjectBrowser
- org.argouml.language.cpp.generator.Ger
- org.argouml.language.cpp.reveng.CPPLe

...

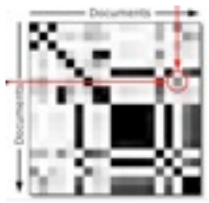




Understanding Large Systems
Static/Dynamic Information
Feature Analysis
Class Understanding
Package Blueprints
Distribution Maps



Software Metrics
Quality Models
Duplicated Code Identification
Test Generation
Code Pattern Identification
Cycle and Layer Identification
Merging technics



Language Independent Refactorings

Language Independent Meta Model (FAMIX)
An Extensible Reengineering Environment

Reengineering Patterns
Version Analyses
HISMO metamodel

S.Ducasse

RMod

One picture is worth one thousand words

Which one?

How could it be that simple?

Program visualization is difficult

Limited number of colors: 12

Blur and color emergence

Limited screen size

Limited context, edges crossing

Limited short-term memory (three to nine)

Difficult to remember too many symbols/semantics

Culture, Colorblind

How many 5?

3332123466509000096766689877835367
7866760910919818971746433039821768
34467865860880221167687687789762

How many 5?

3332123466509000096766689877835367
7866760910919818971746433039821768
34467865860880221167687687789762

Preattentive attributes

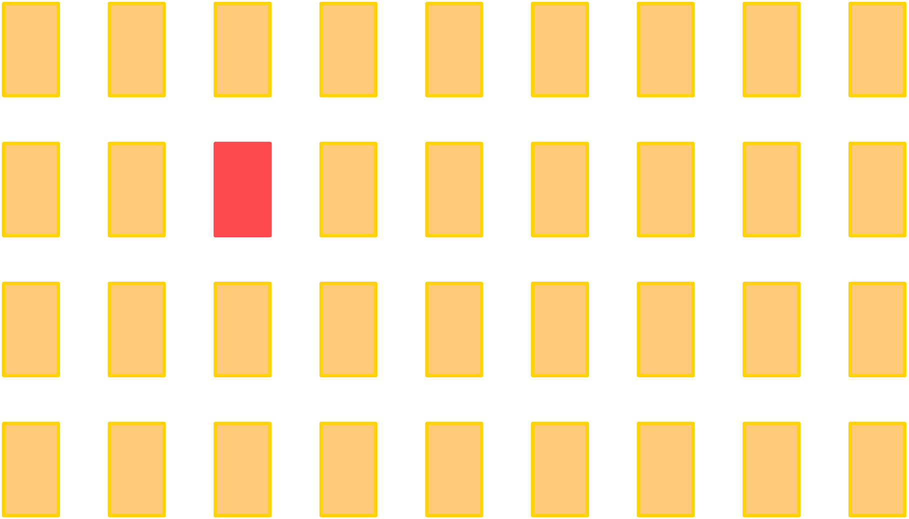
Color intensity

Form: orientation, line length, line width, size, shape, added marks, enclosure

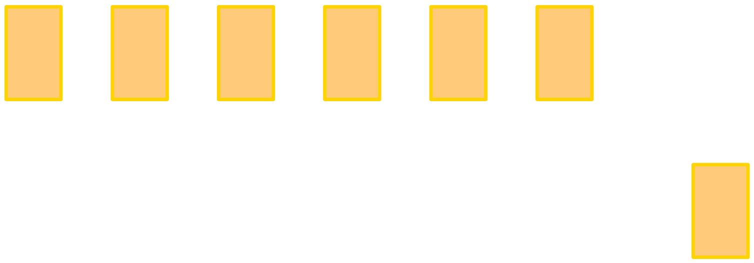
Spatial position (2D location)

Motion (flicker)

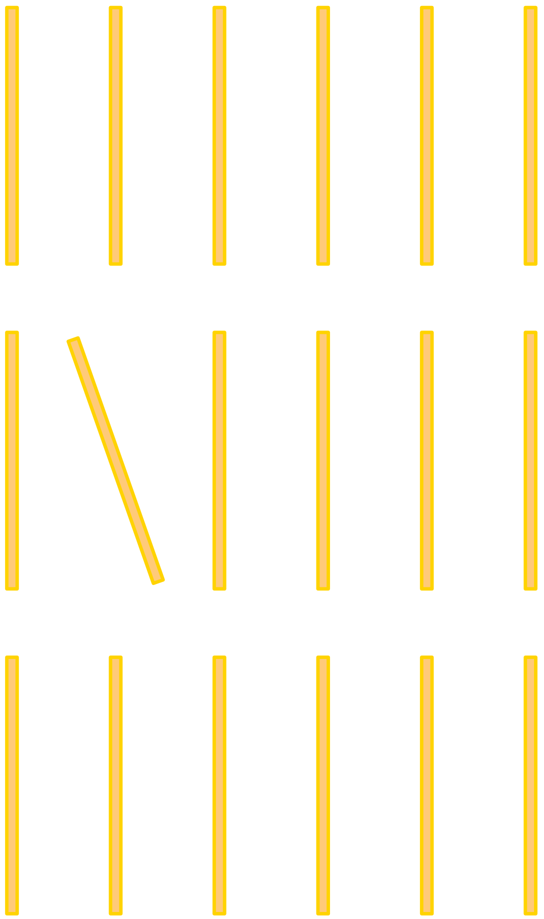
Color / intensity



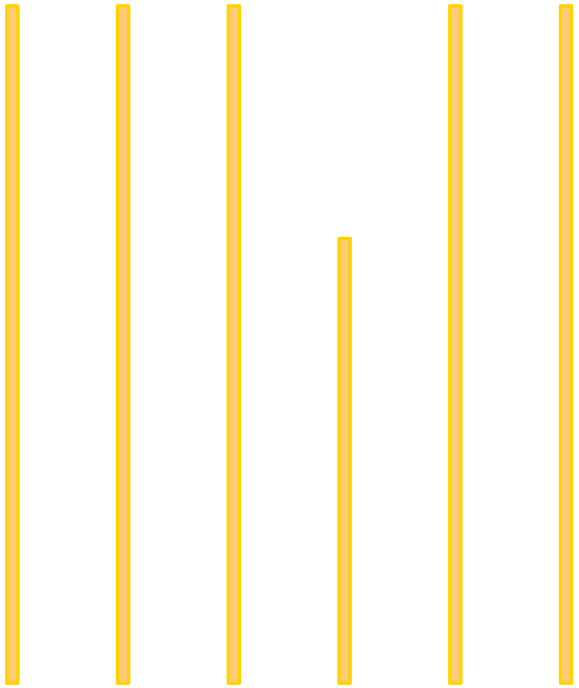
Position



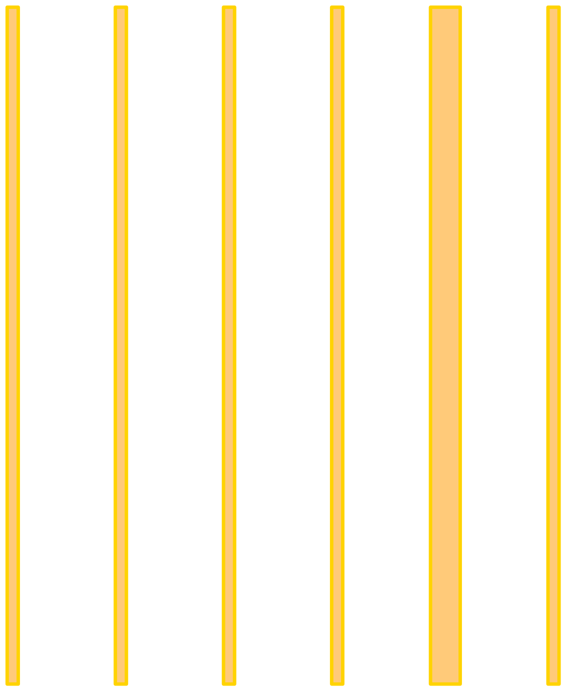
Form / Orientation



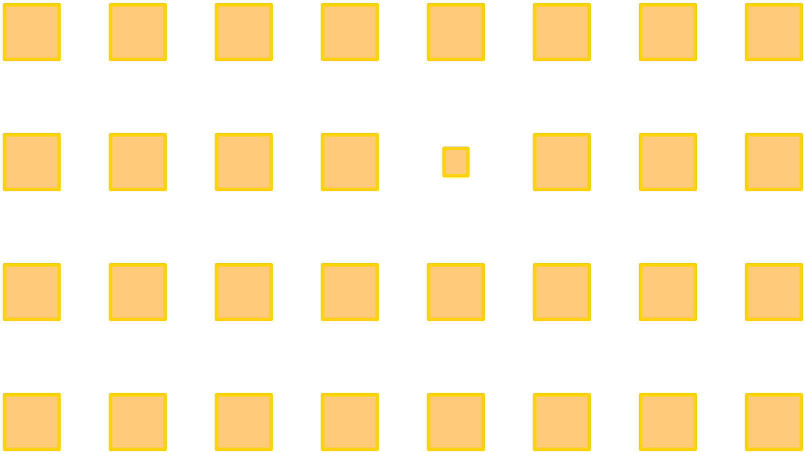
Form / Line length



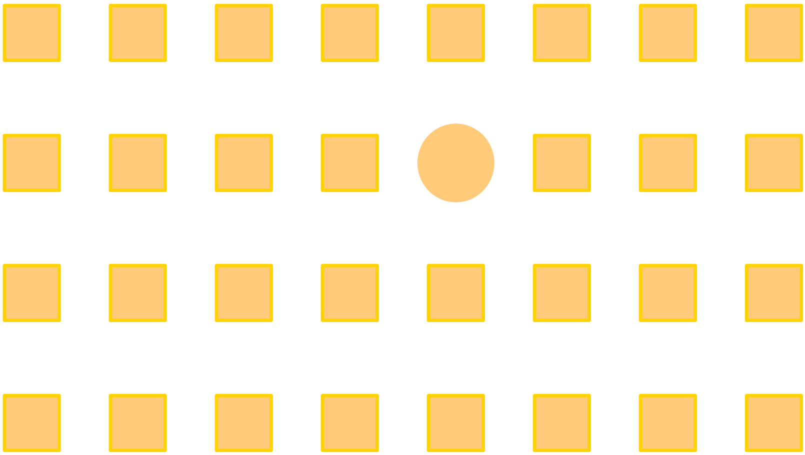
Form / Line width



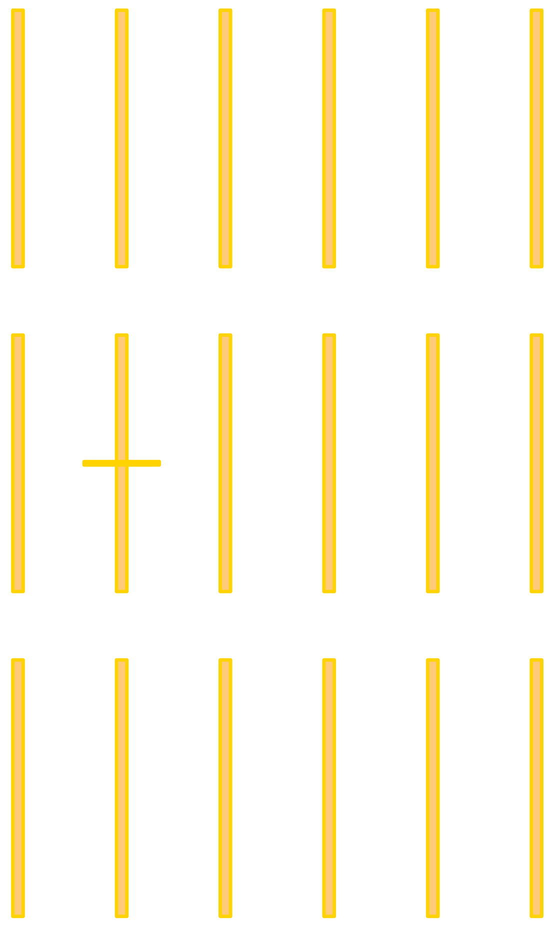
Form / Size



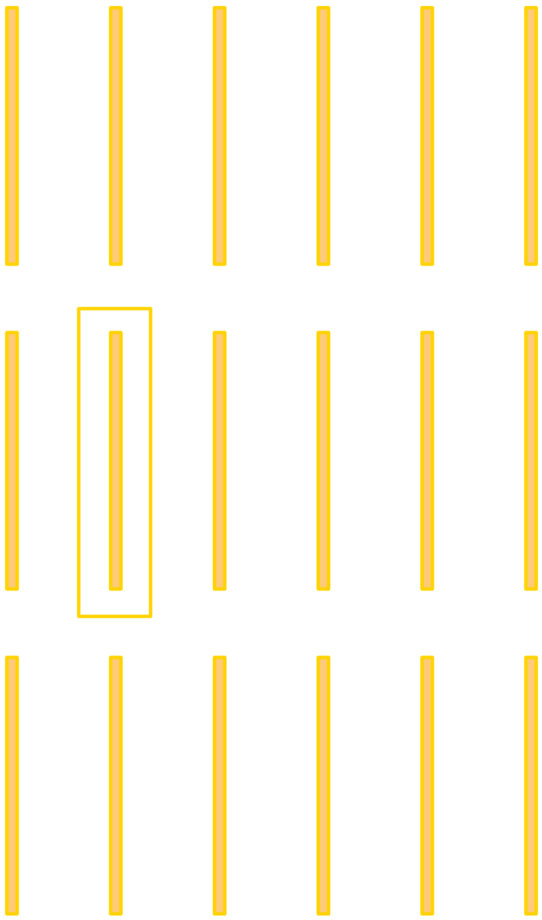
Form / Shapes



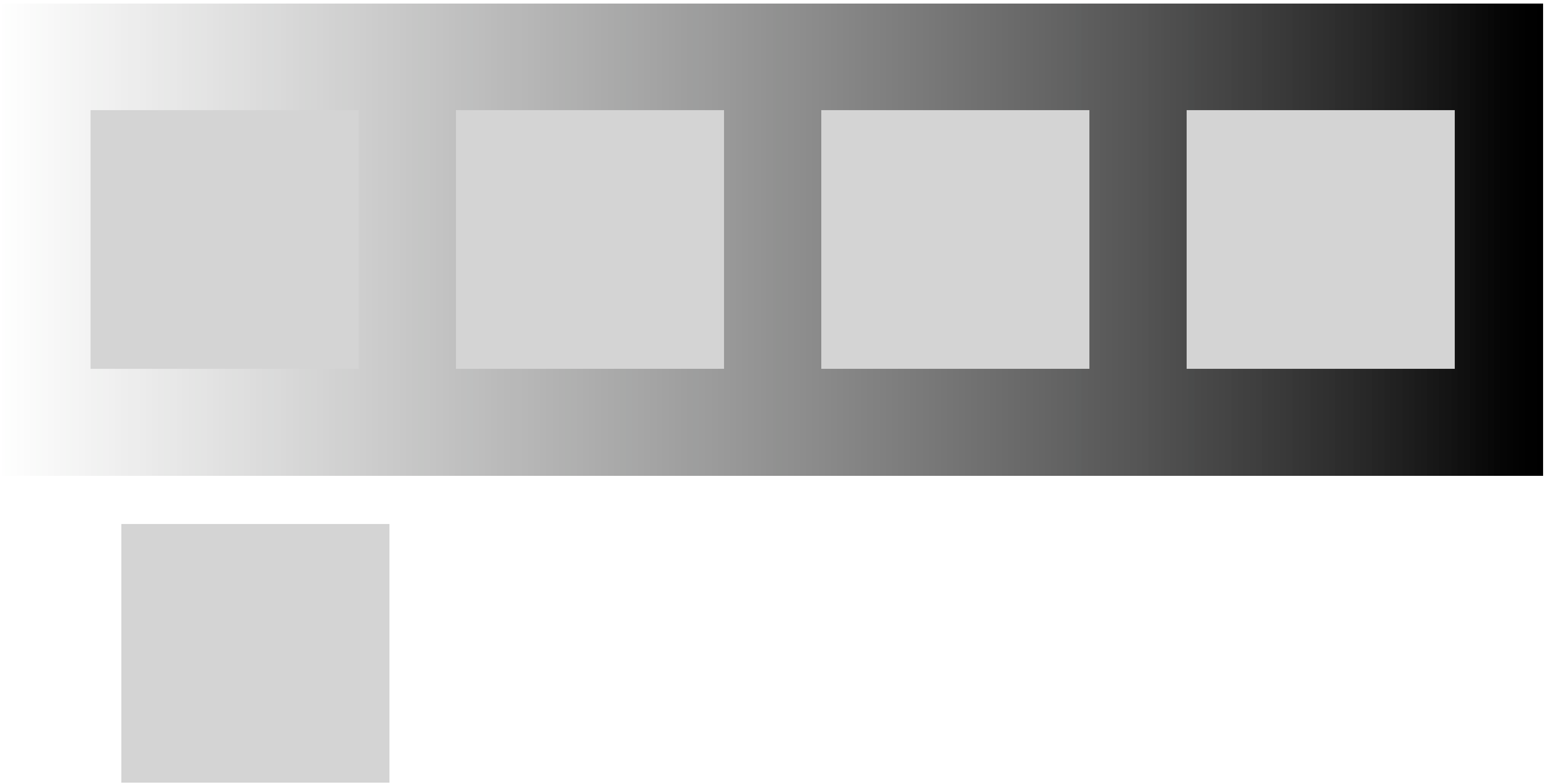
Form / Added marks



Form / Enclosure



Context



Gestalt Principles of Visual Perception

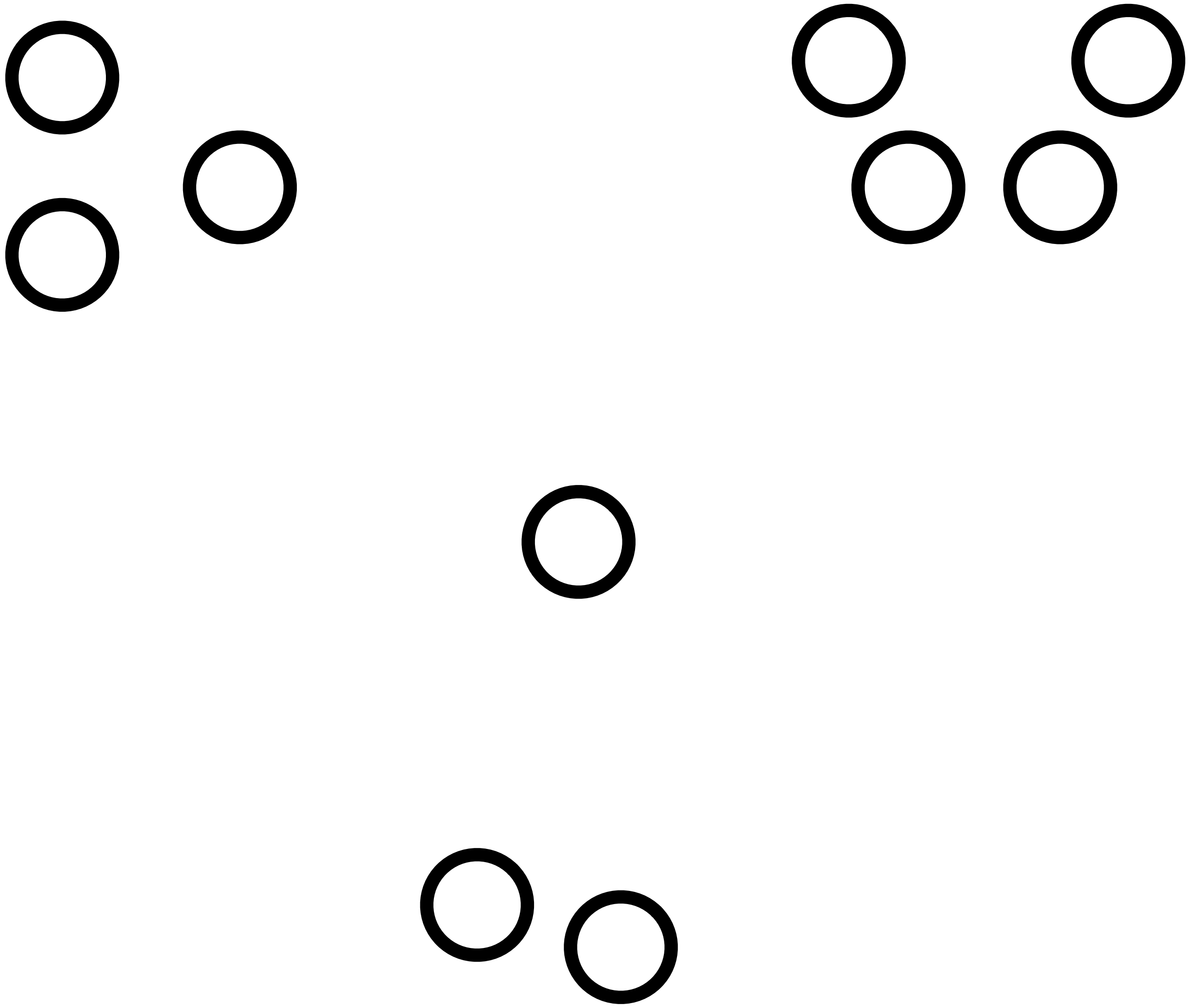
Back in 1912, from the Gestalt School of psychology

Still stand today

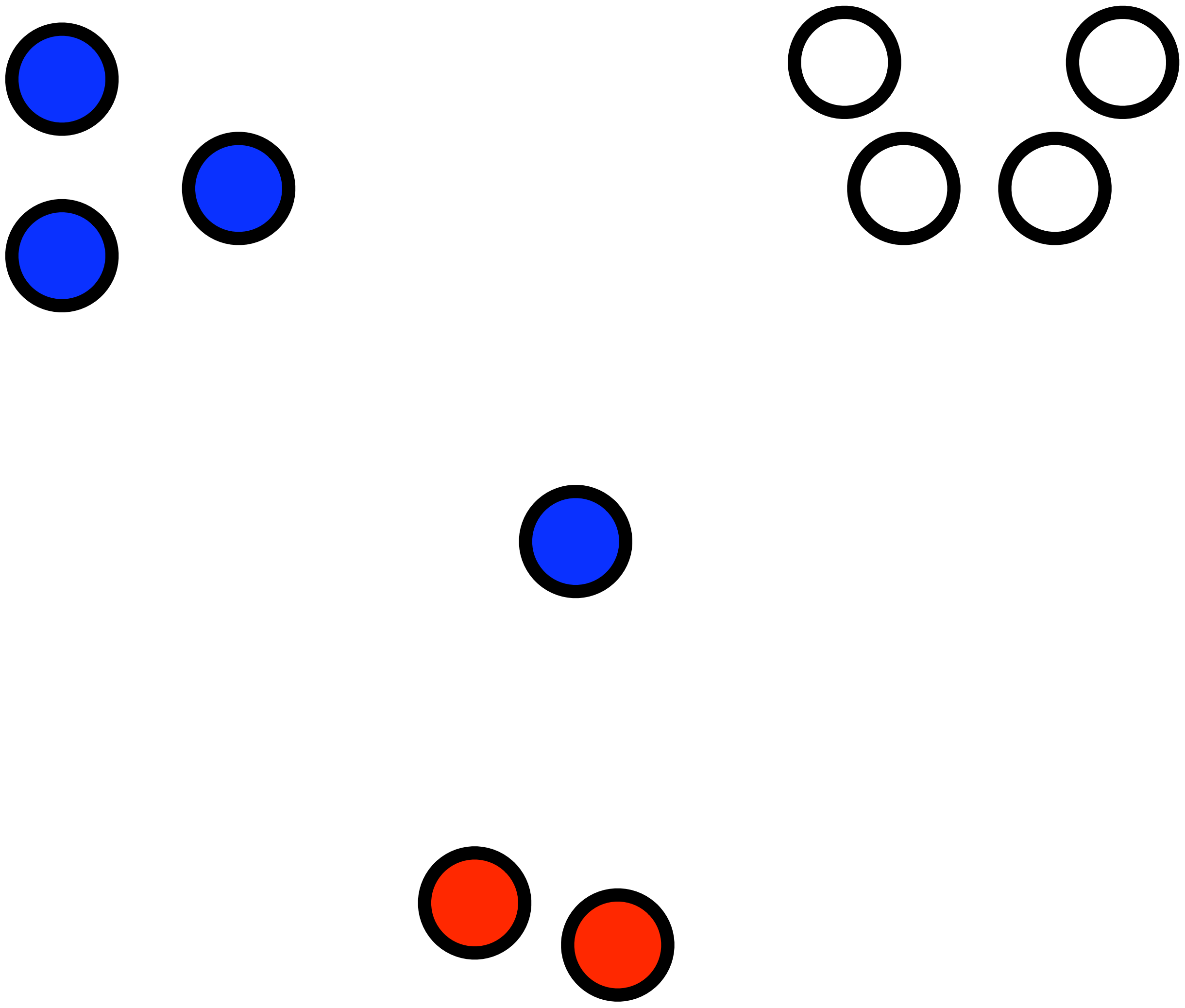
Gestalt means patterns

How do we perceive pattern, form, and organization?

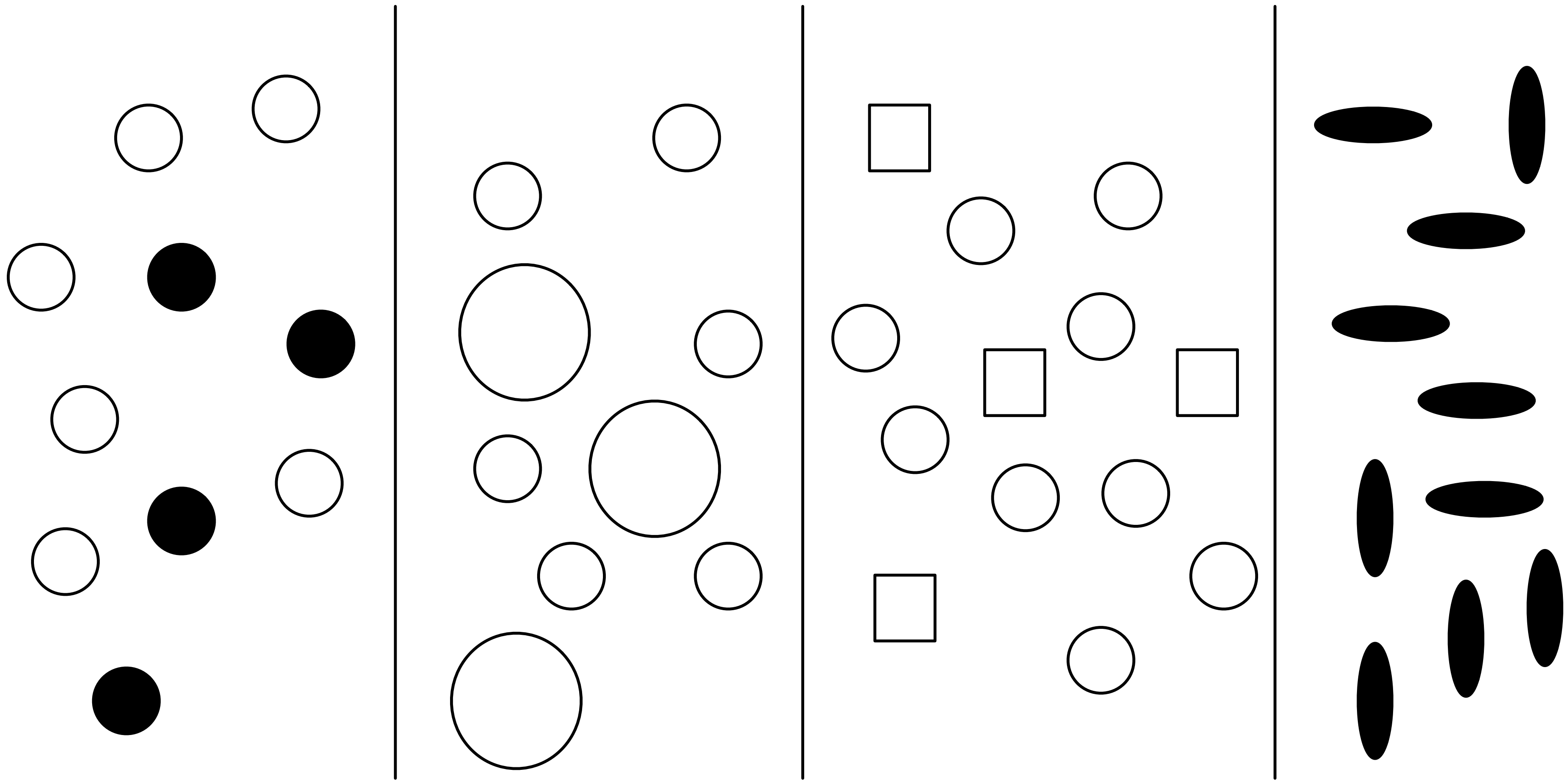
Principle of Proximity



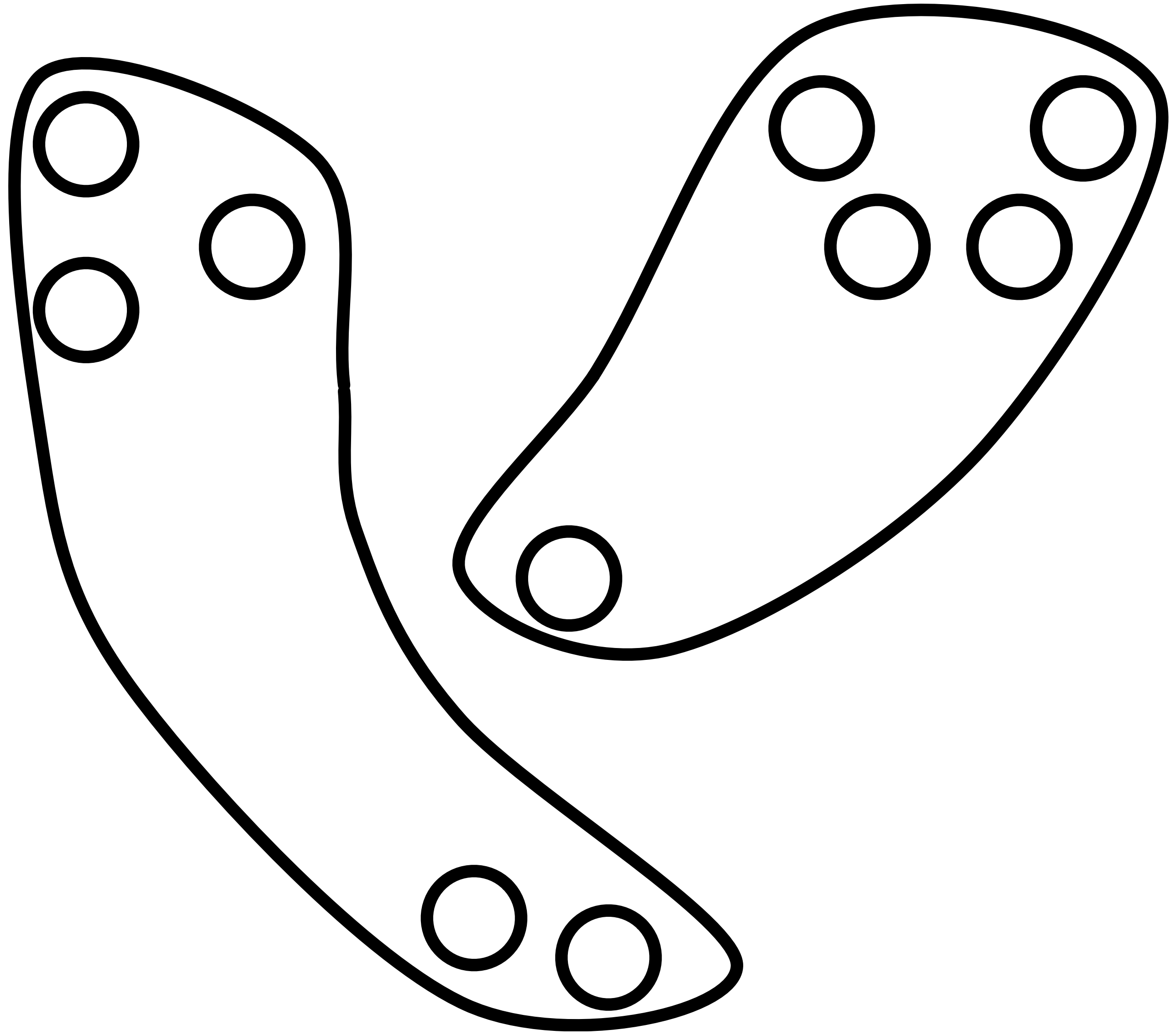
Principle of Similarity



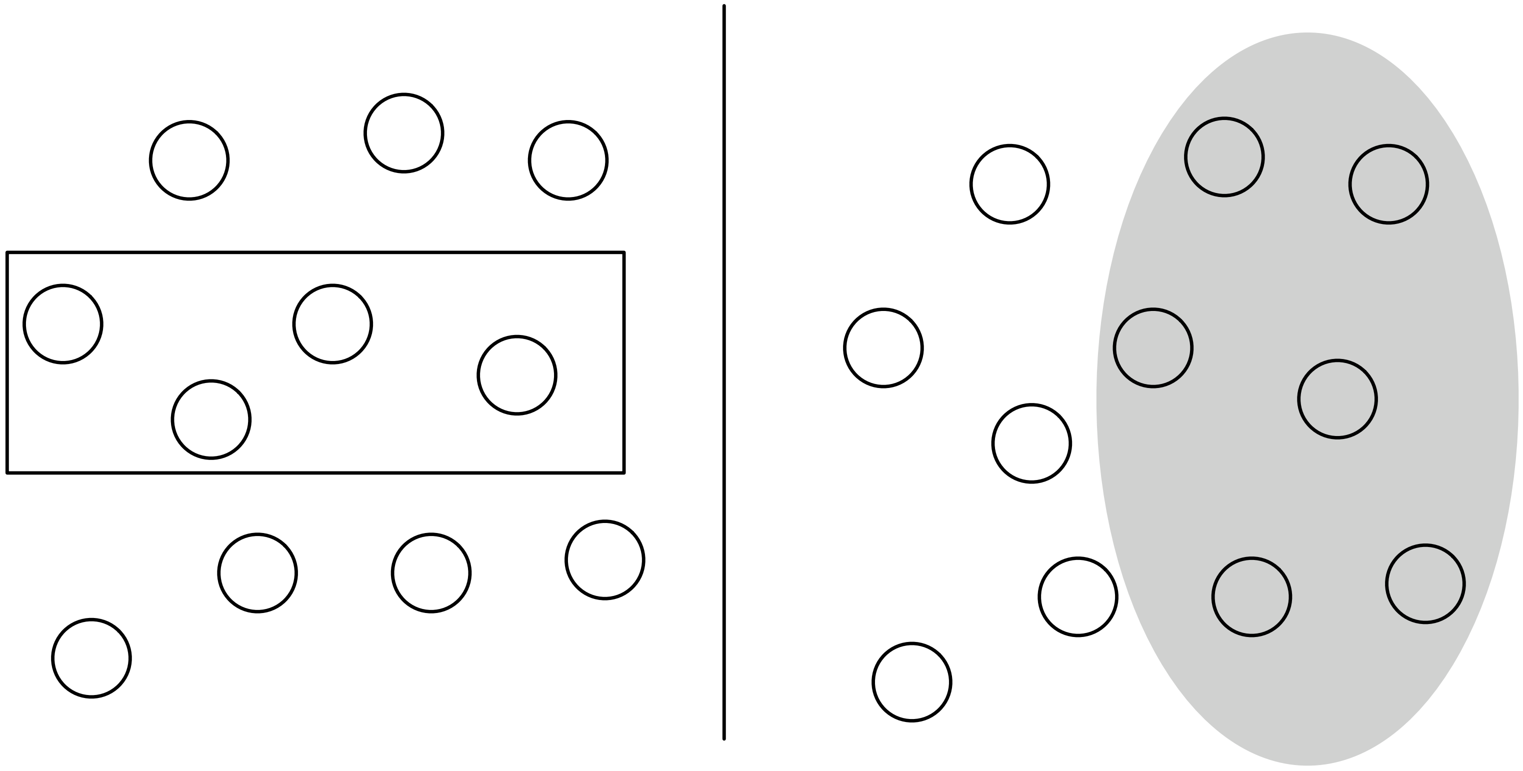
Principle of Similarity



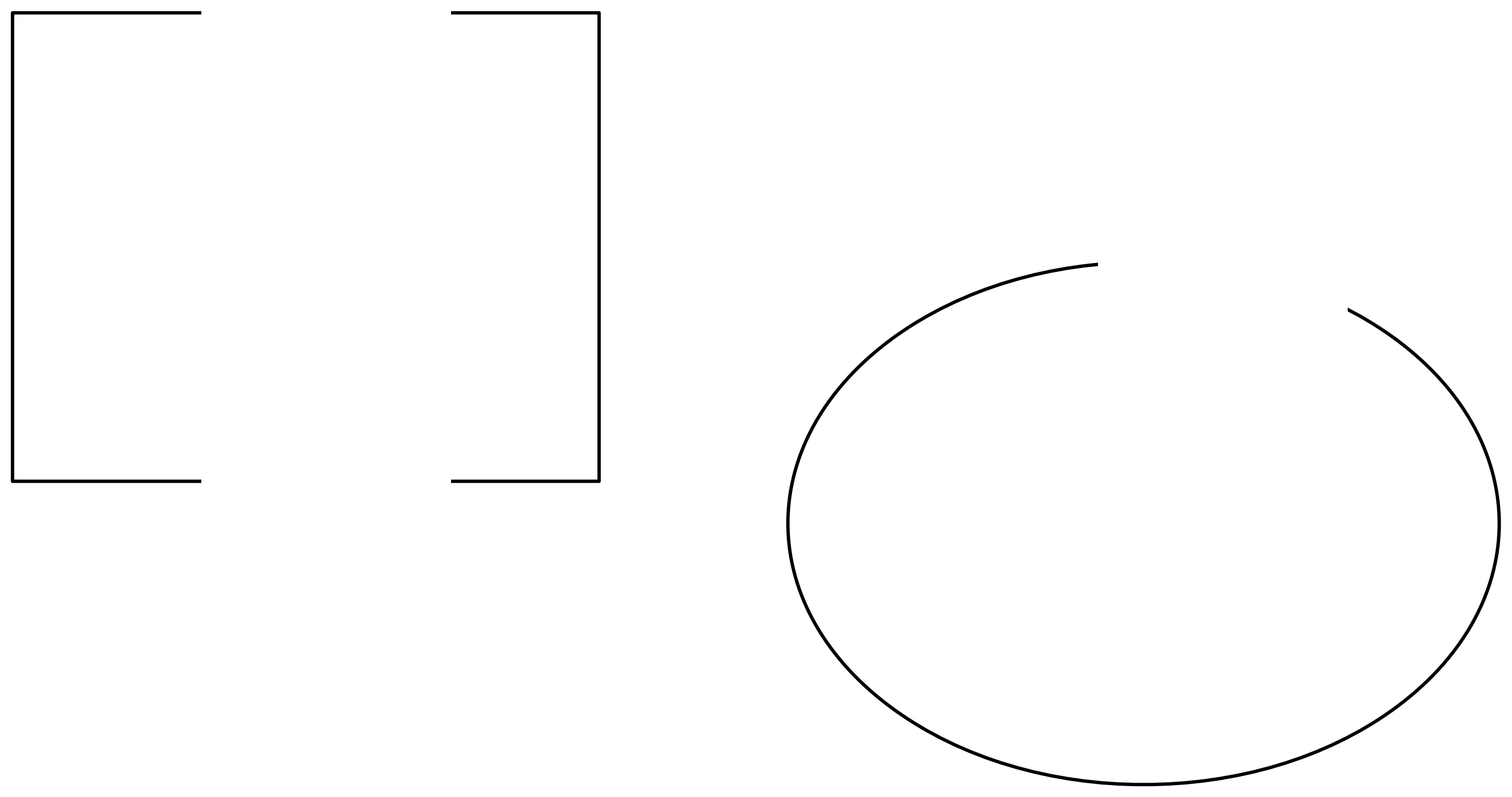
Principle of Enclosure



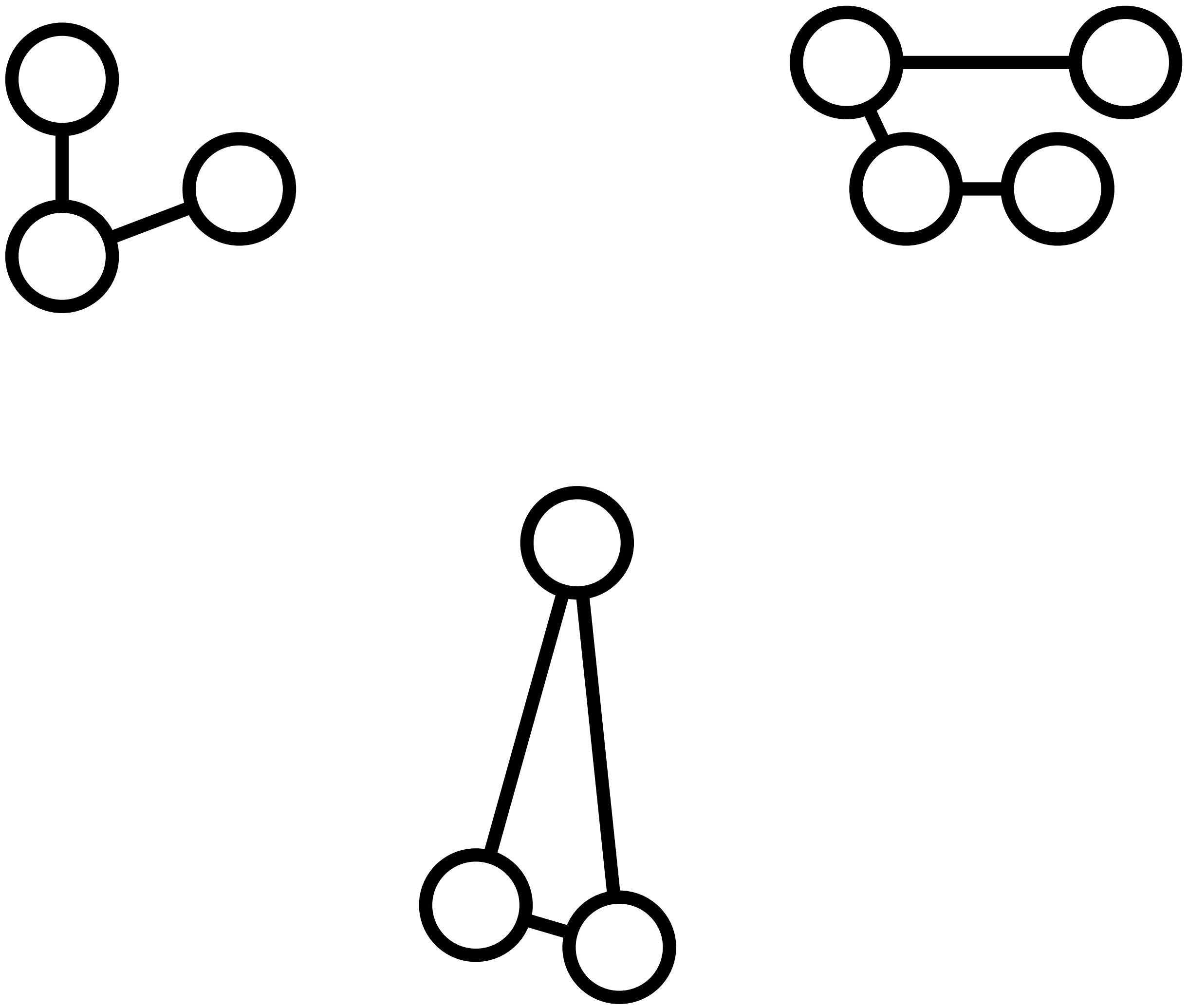
Principle of Enclosure



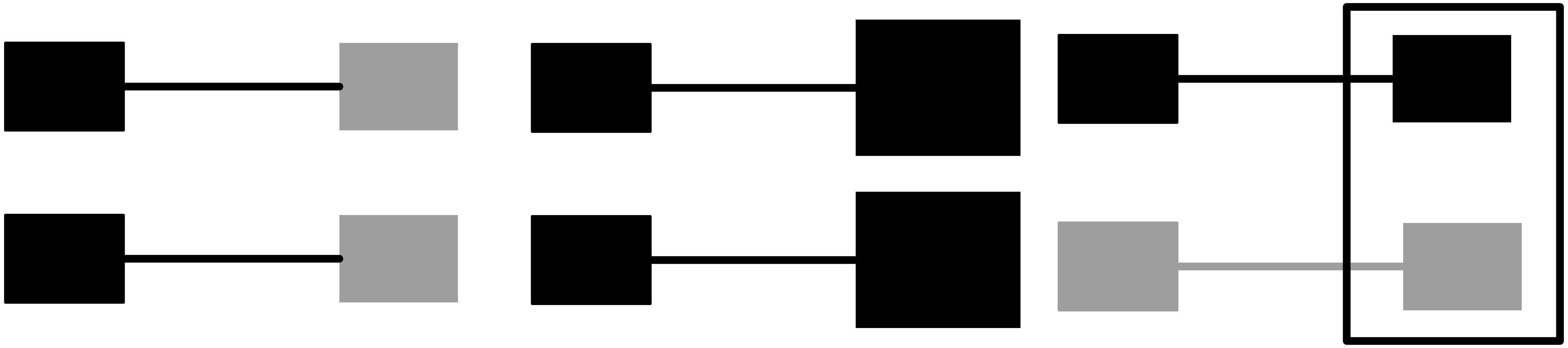
Principle of Closure



Principle of connectivity



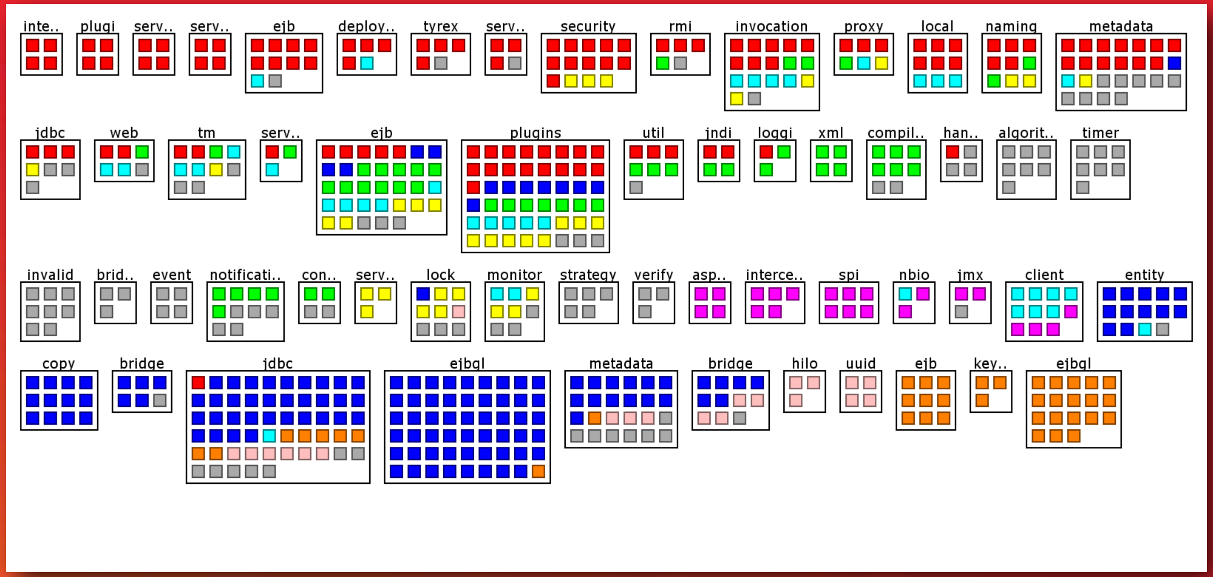
Principle of connectivity



How properties spread on a system?

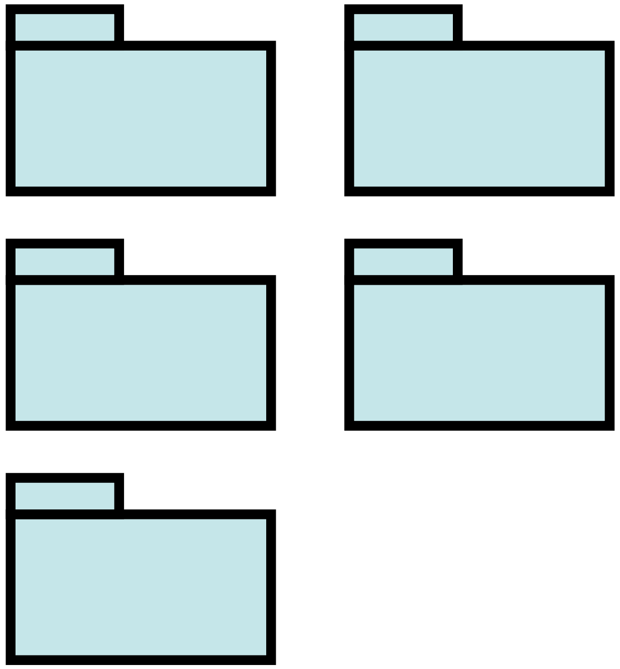
- Where author X worked?
- What are the classes under development the last two weeks?

- Distribution Map [ICSM]

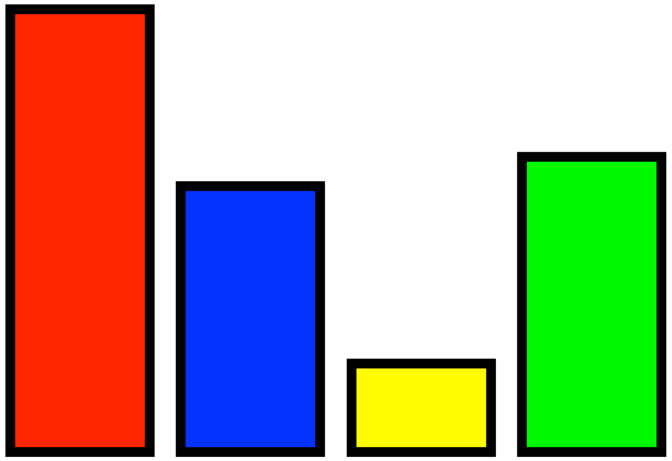


We take any two partitions, and

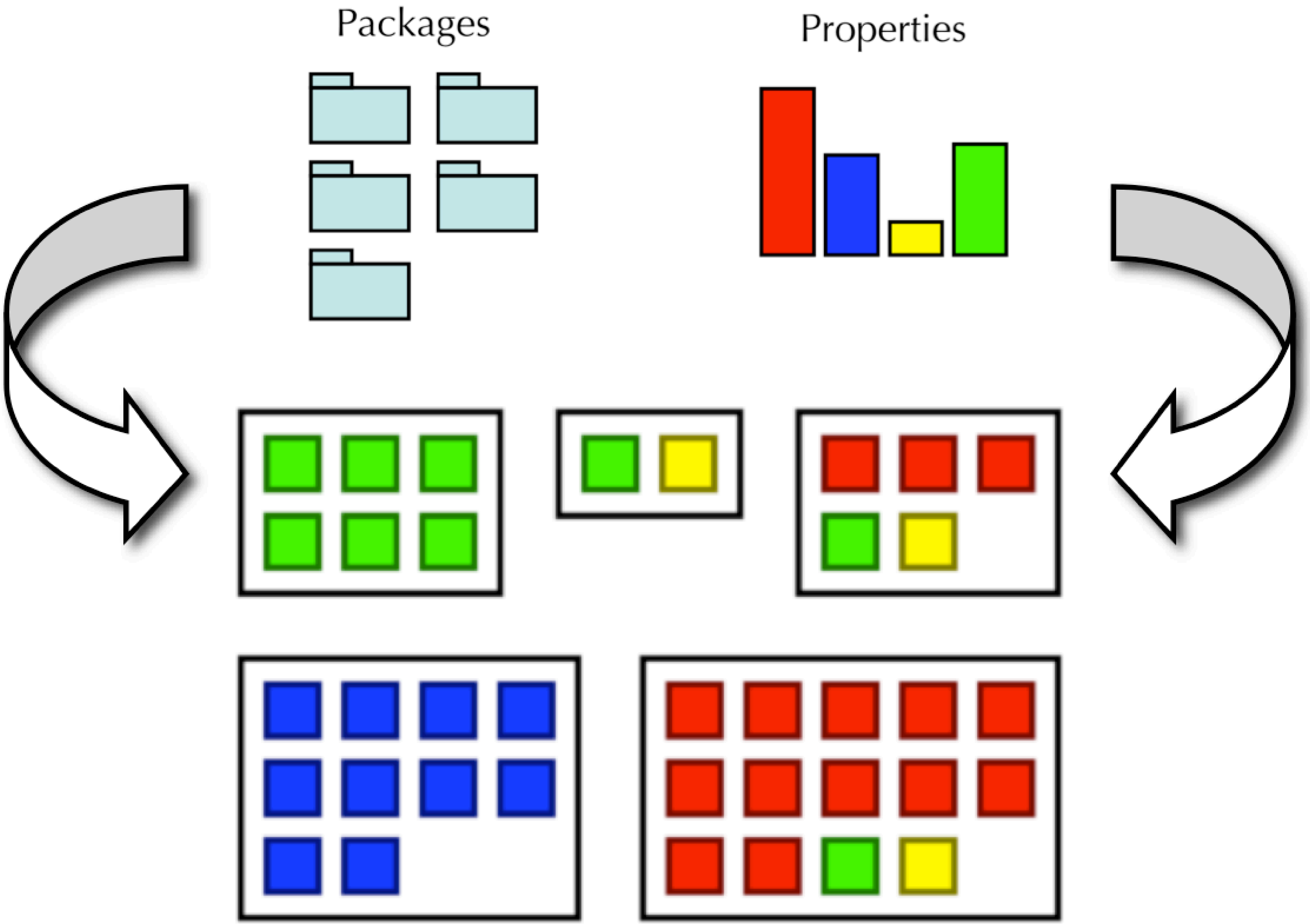
Packages



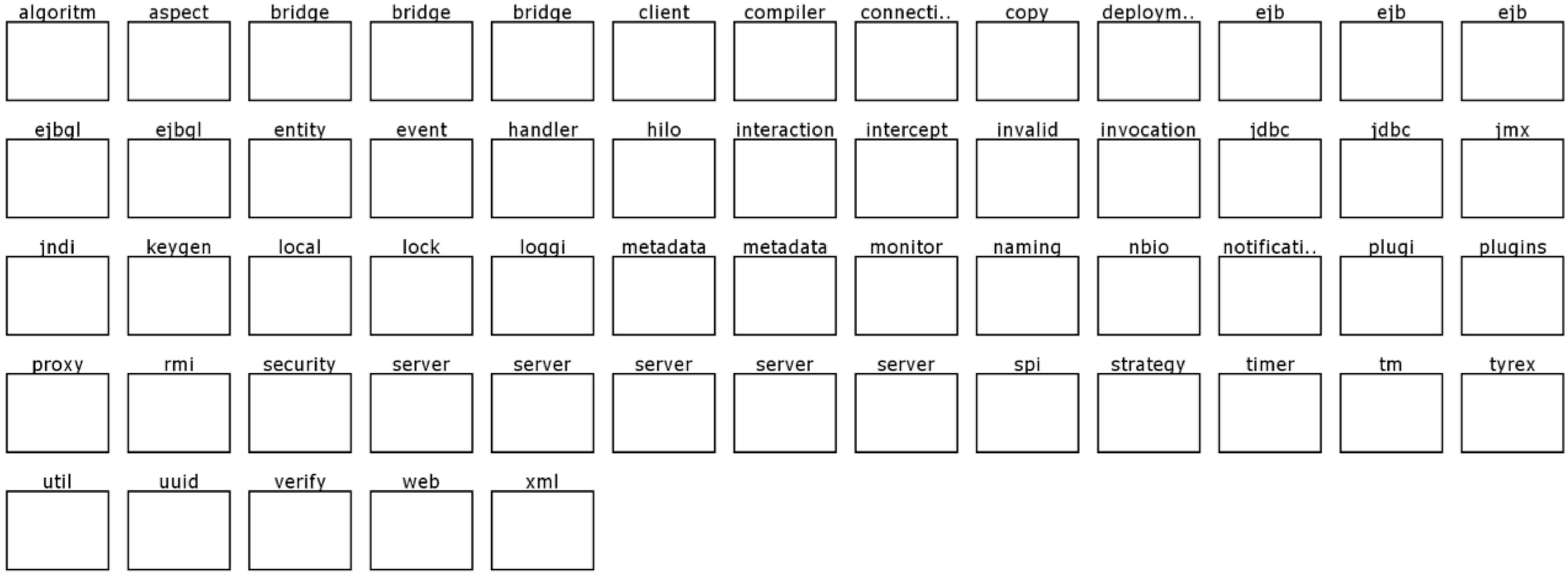
Properties



and create a Distribution Map.



Step 1 — for each package draw a rectangle



algoritm aspect bridge bridge bridge client compiler connecti.. copy deploym.. ejb ejb ejb

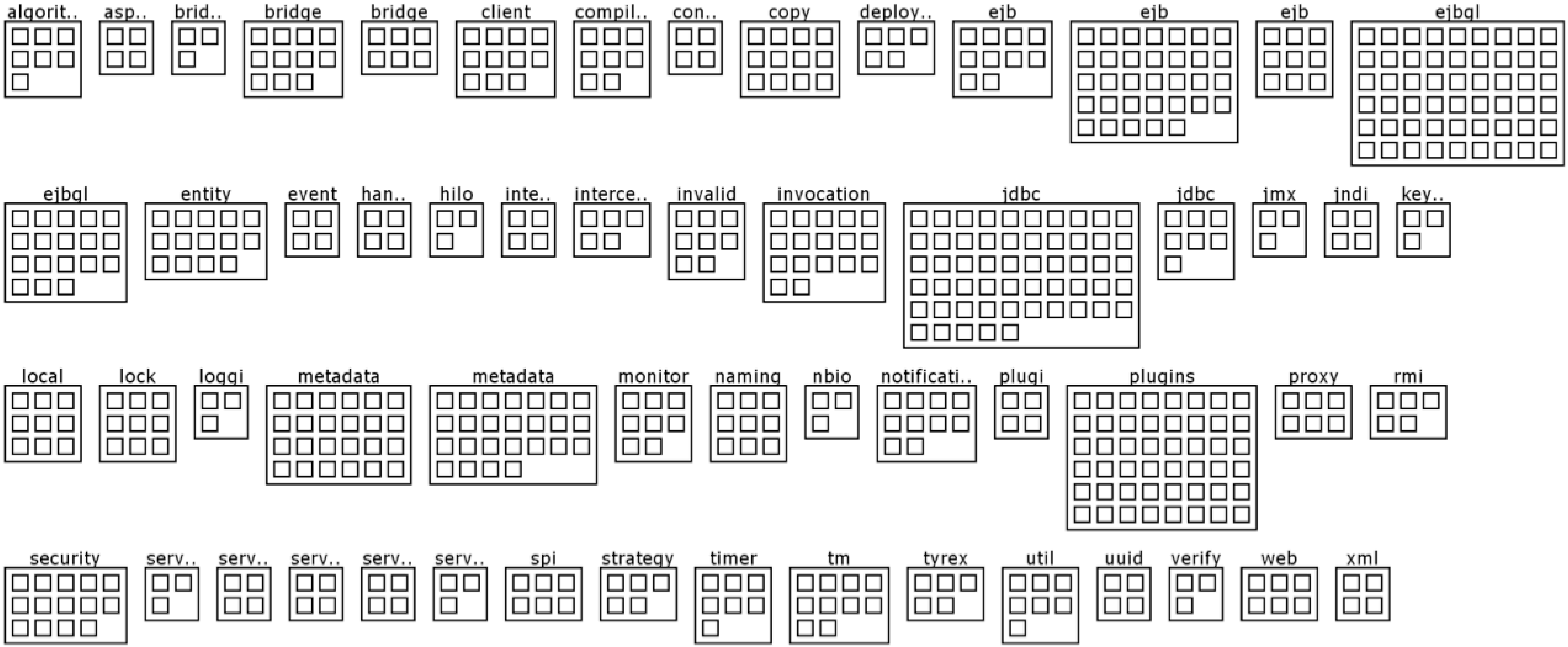
ejbql ejbql entity event handler hilo interaction intercept invalid invocation jdbc jdbc jmx

jndi keygen local lock loggi metadata metadata monitor naming nbio notificati.. plugi plugins

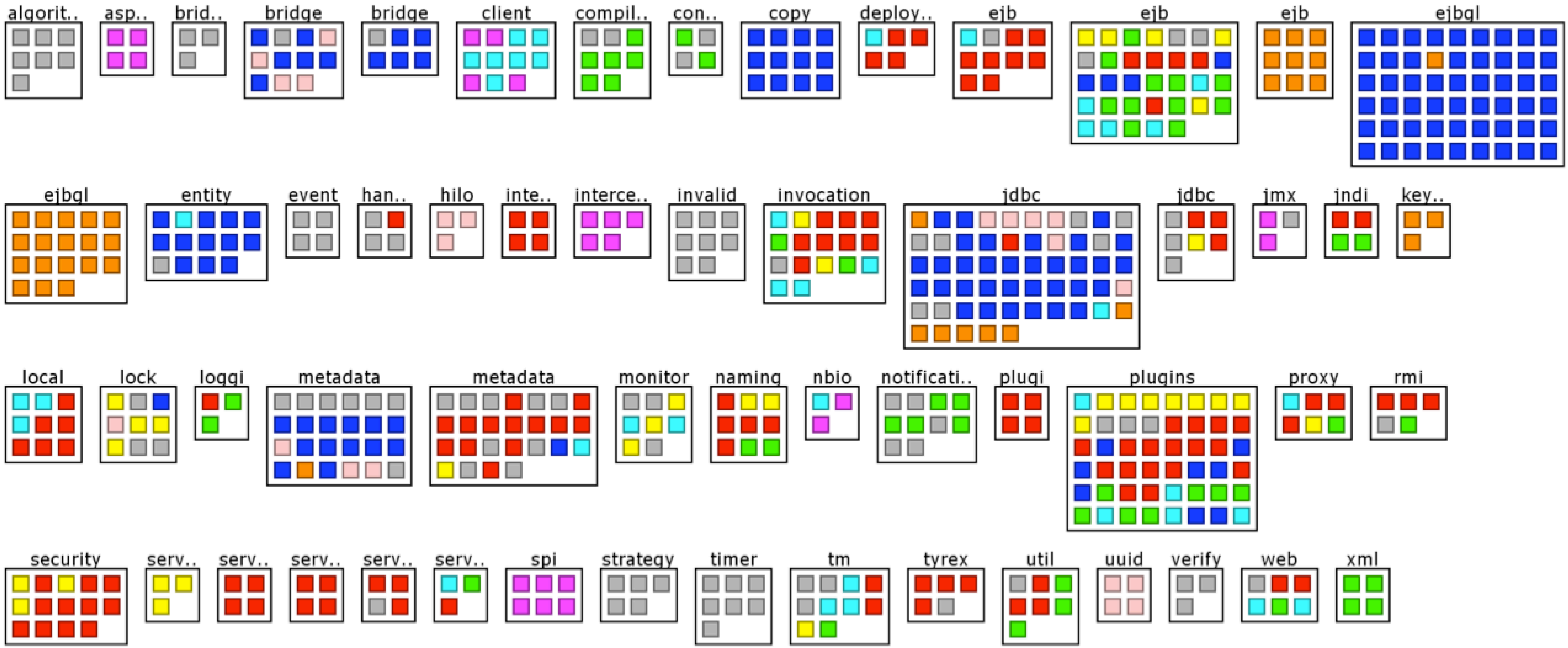
proxy rmi security server server server server server spi strategy timer tm tyrex

util uuid verify web xml

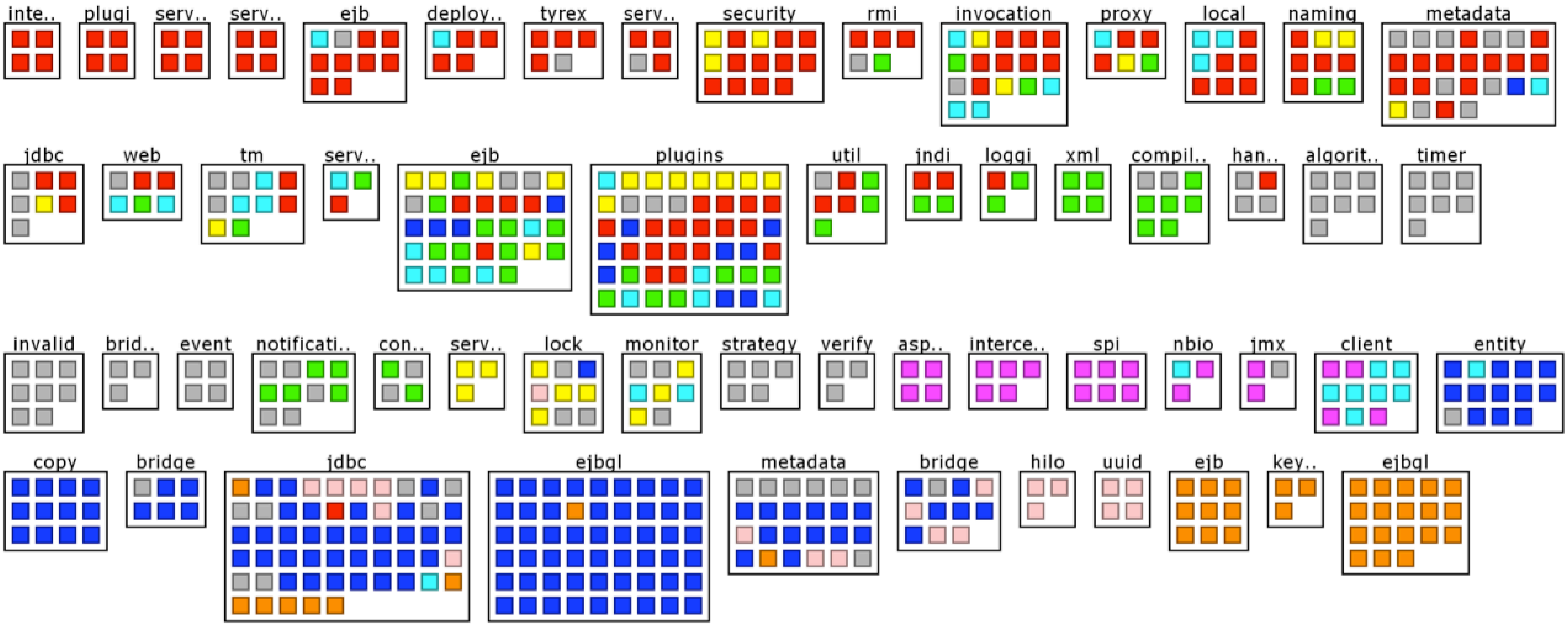
Step 2 — populate packages with classes



Step 3 — color the classes by property

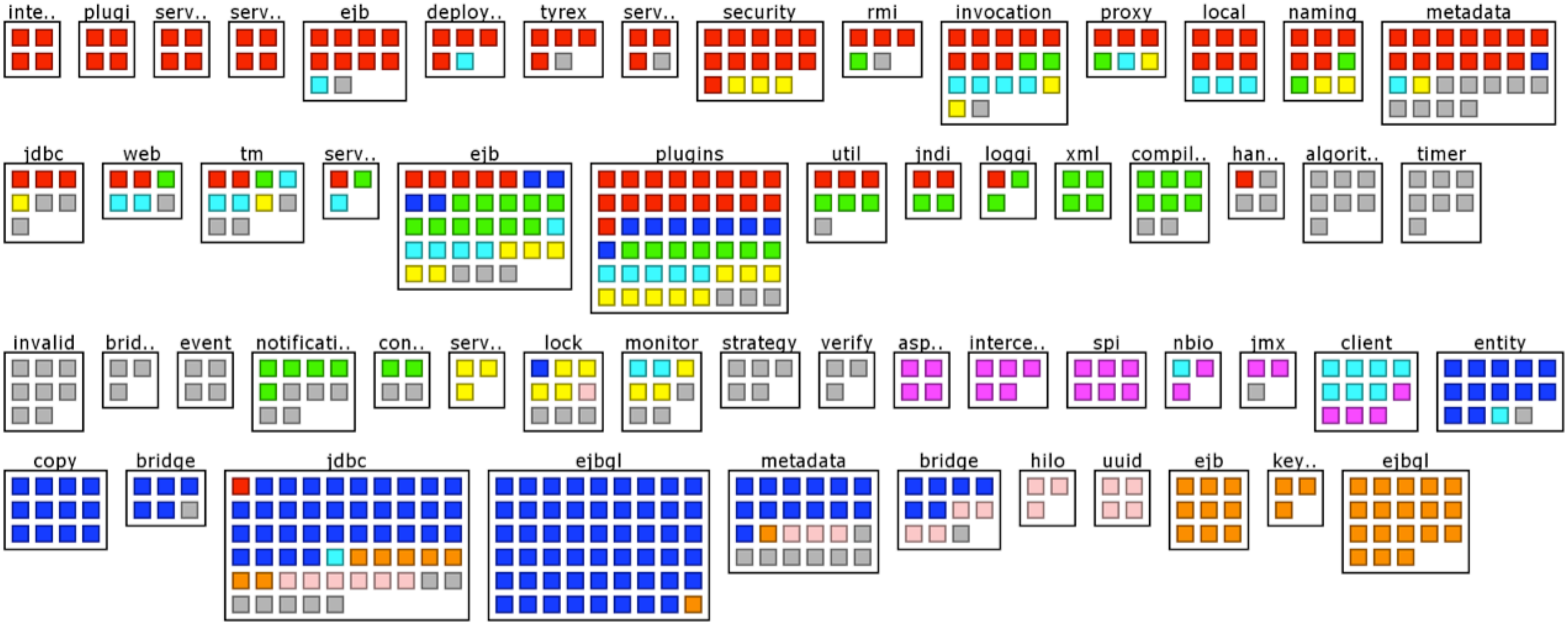


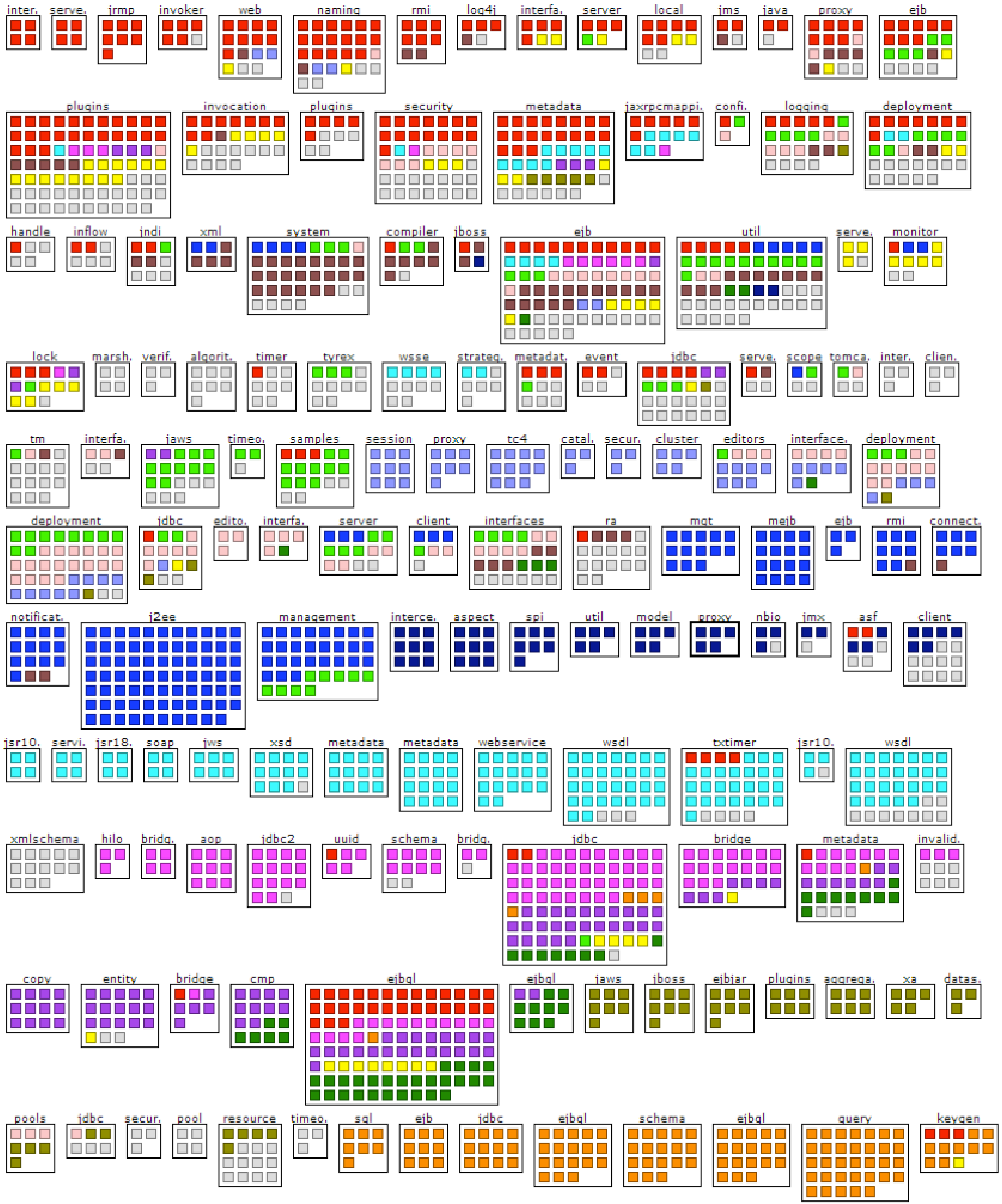
Step 4 — sort packages by content



Sorting with dendrogram seriation.

Step 5 – sort classes by properties



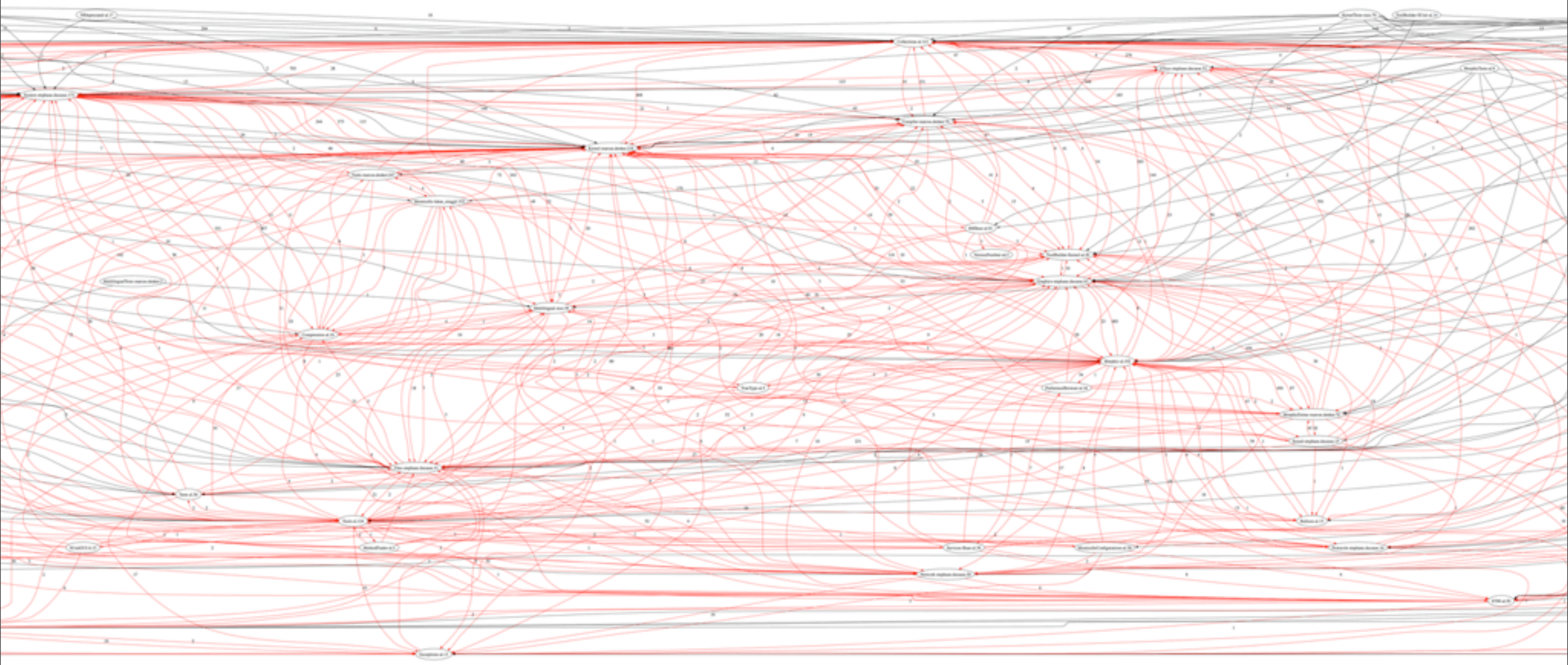

inter.
serve.
jrmp
invoker
web
naming
rmi
log4j
interfa.
server
local
jms
java
proxy
ejb
plugins
invocation
plugins
security
metadata
jaxrpcmappi.
confi.
logging
deployment
handle
inflow
jndi
xml
system
compiler
jboss
ejb
util
serve.
monitor
lock
marsh.
verif.
algorit.
timer
tyrex
wsse
strateg.
metadat.
event
jdbc
serve.
scope
tomca.
inter.
clien.
tm
interfa.
jaws
timeo.
samples
session
proxy
tc4
catal.
secur.
cluster
editors
interface.
deployment
deployment
jdbc
edito.
interfa.
server
client
interfaces
ra
mgt
mejb
ejb
rmi
connect.
notificat.
j2ee
management
interce.
aspect
spi
util
model
proxy
nbio
jmx
asf
client
jsr10.
servi.
jsr18.
soap
jws
xsd
metadata
metadata
webservice
wsdl
txtimer
jsr10.
wsdl
xmlschema
hilo
bridg.
aop
jdbc2
uuid
schema
bridg.
jdbc
bridge
metadata
invalid.
copy
entity
bridge
cmp
ejbql
ejbql
jaws
jboss
ejbjar
plugins
aggrega.
xa
datas.
pools
jdbc
secur.
pool
resource
timeo.
sql
ejb
jdbc
ejbql
schema
ejbql
query
keygen

Challenges

- How to modularize a system?
  - Where are the cycles?
  - What produce cycles?
  - Where are the layers

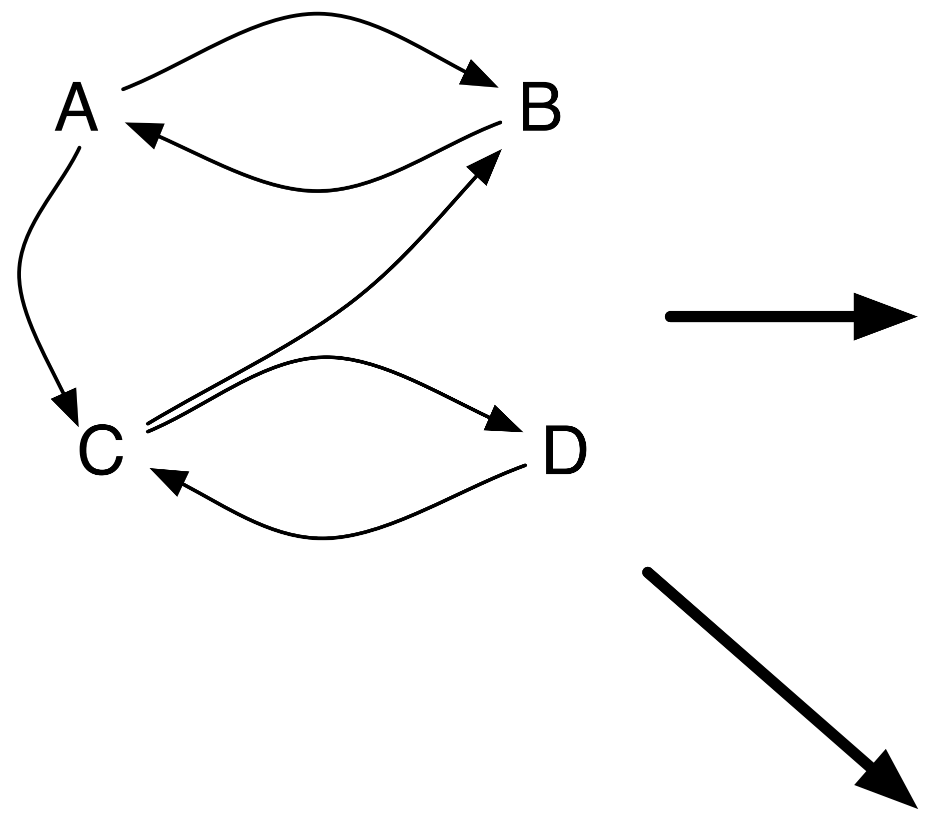
Graph you said?

Graph you said?



Graph you said?

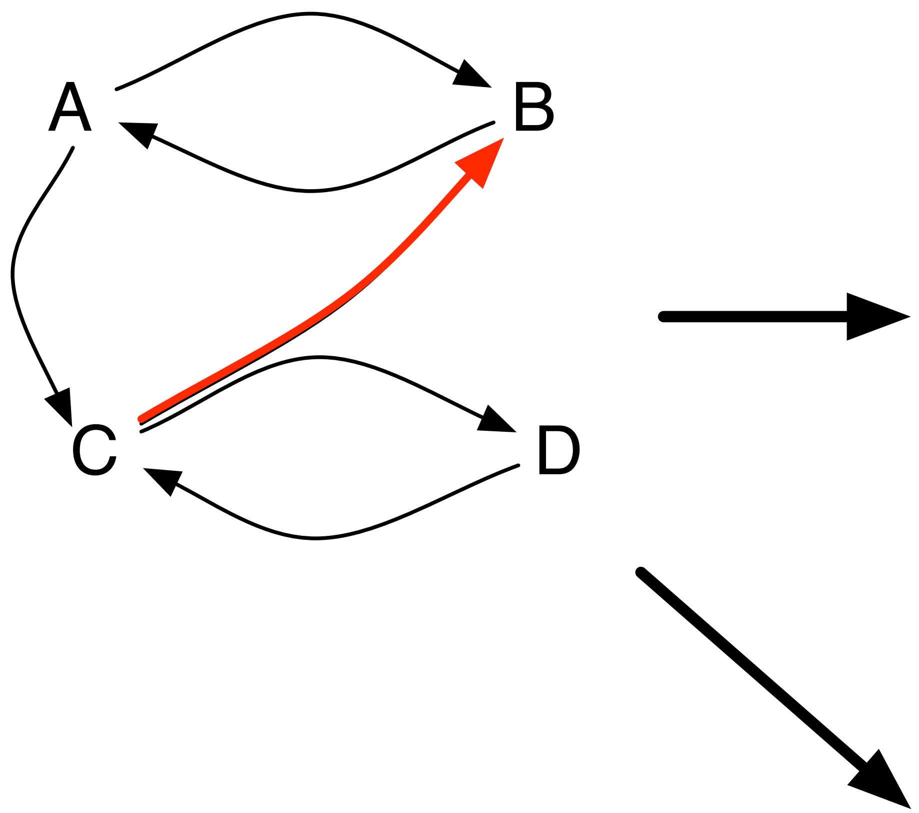
Building a DSM



	A	B	C	D
A	■	X		
B	X	■	X	
C	X		■	X
D			X	■

	A	B	C	D
A	0	1	0	0
B	1	0	1	0
C	1	0	0	1
D	0	0	1	0

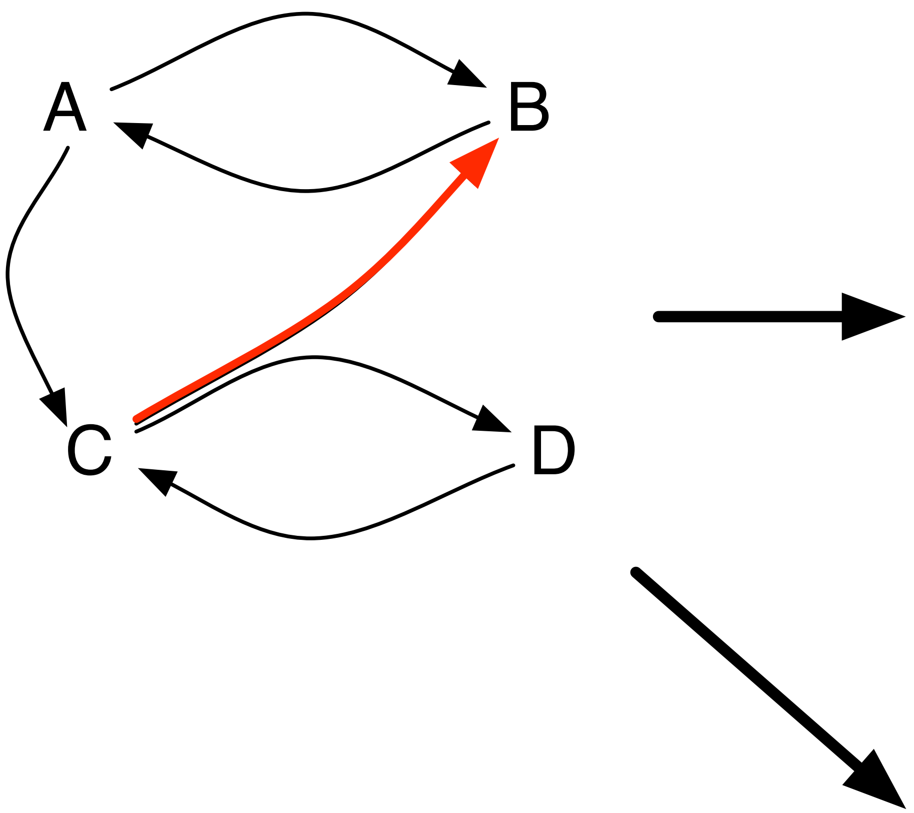
Building a DSM



	A	B	C	D
A	■	X		
B	X	■	X	
C	X		■	X
D			X	■

	A	B	C	D
A	0	1	0	0
B	1	0	1	0
C	1	0	0	1
D	0	0	1	0

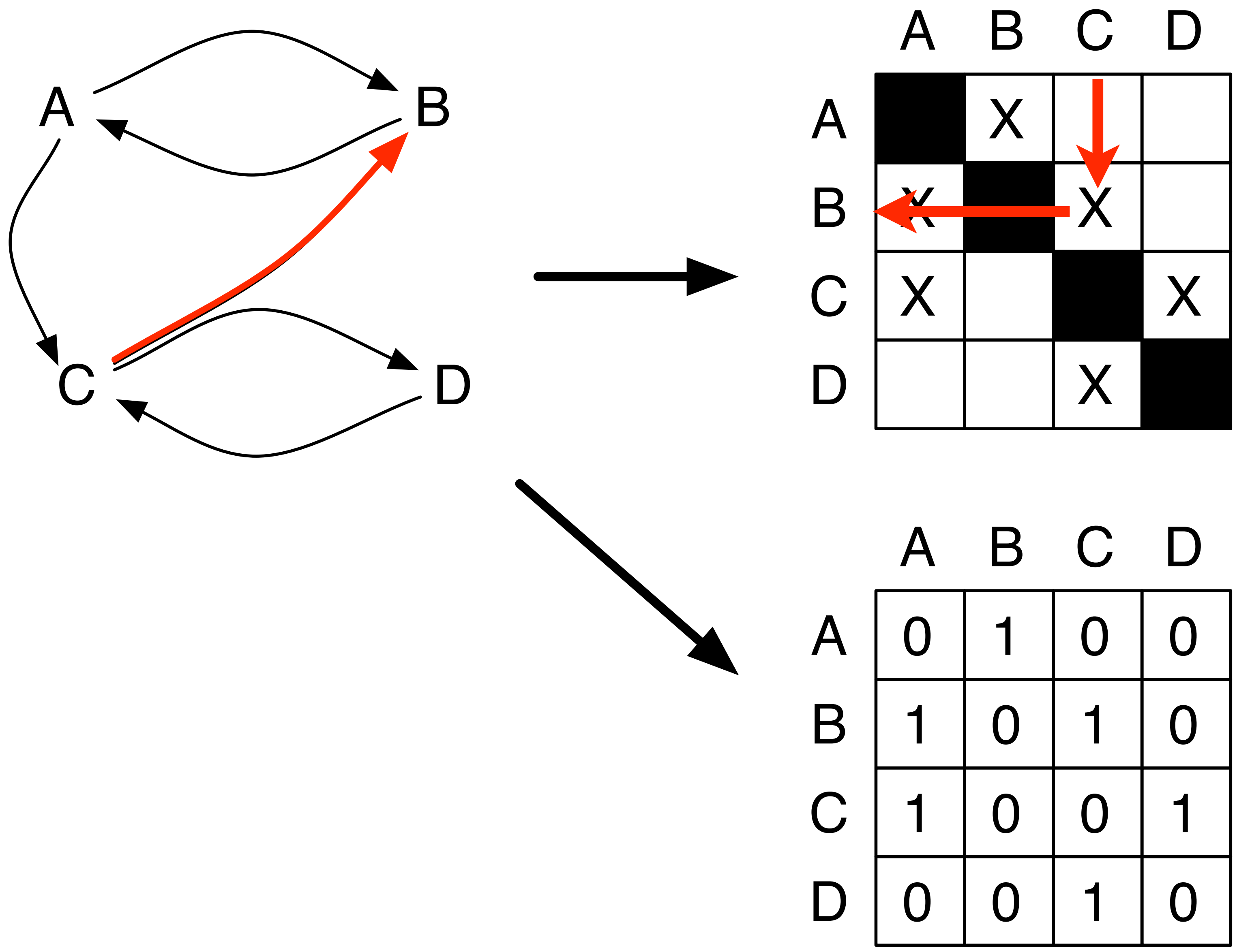
Building a DSM



	A	B	C	D
A	■	X		
B	X	■	X	
C	X		■	X
D			X	■

	A	B	C	D
A	0	1	0	0
B	1	0	1	0
C	1	0	0	1
D	0	0	1	0

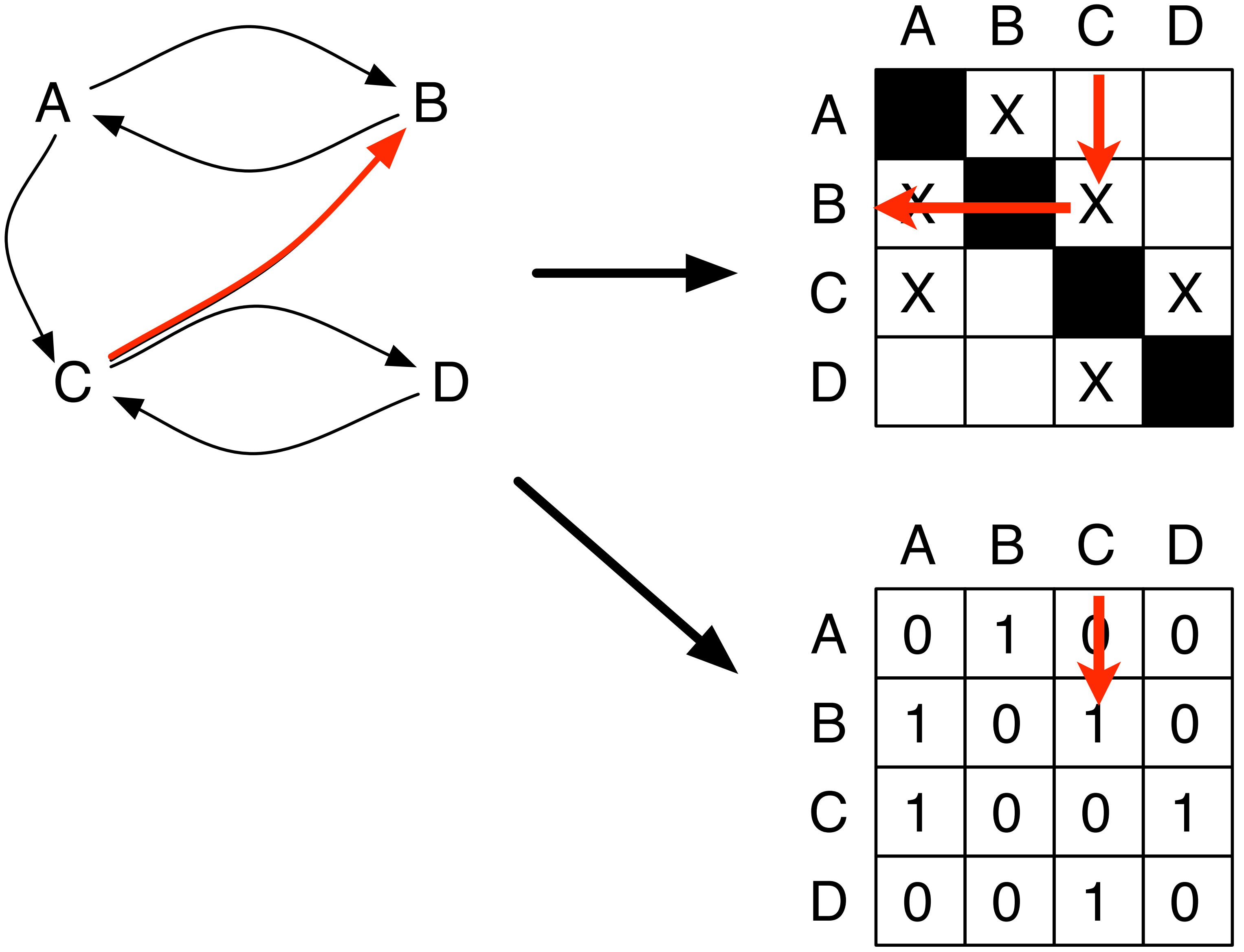
Building a DSM



	A	B	C	D
A	■	X		
B	X	■	X	
C	X		■	X
D			X	■

	A	B	C	D
A	0	1	0	0
B	1	0	1	0
C	1	0	0	1
D	0	0	1	0

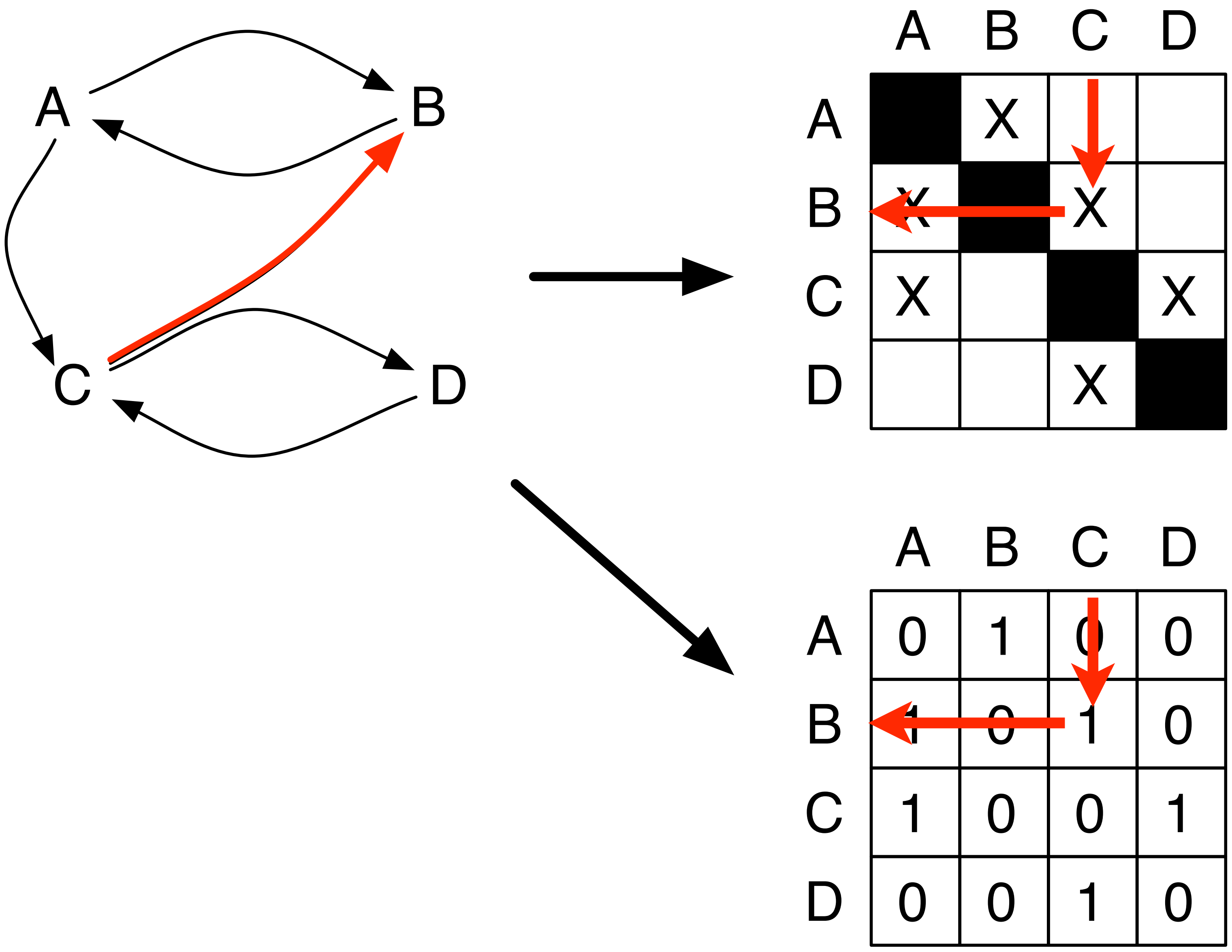
Building a DSM



	A	B	C	D
A	■	X		
B	X	■	X	
C	X		■	X
D			X	■

	A	B	C	D
A	0	1	0	0
B	1	0	1	0
C	1	0	0	1
D	0	0	1	0

Building a DSM



	A	B	C	D
A	■	X		
B	X	■	X	
C	X		■	X
D			X	■

	A	B	C	D
A	0	1	0	0
B	1	0	1	0
C	1	0	0	1
D	0	0	1	0

7 Packages visualization

I cell = I dependency

I column = used packages

I line = using packages

	x	x	x	x	x	x	x	x	x	x
x	▨									
x		▨								
x			▨	71	3					
x	2	1	8	▨	7	6				
x					▨	3				
x	4	51		2	2	▨	2			
x	4			10	4	34	▨	3		
x		15					1	▨		
x		30							▨	
x		2		2		6				▨

7 Packages visualization

1 cell = 1 dependency

1 column = used packages

1 line = using packages

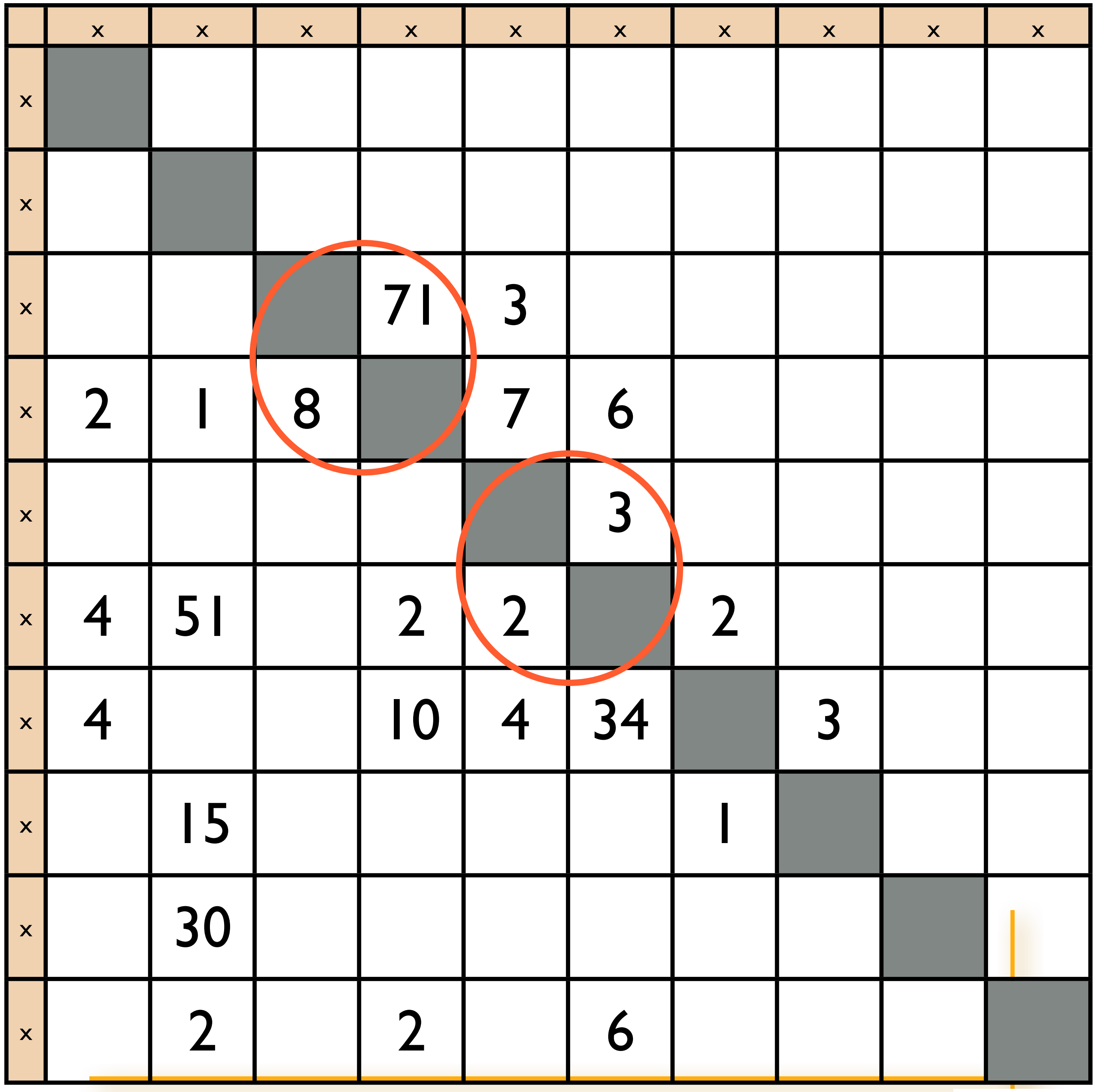
	x	x	x	x	x	x	x	x	x	x
x	▨									
x		▨								
x			▨	71	3					
x	2	1	8	▨	7	6				
x					▨	3				
x	4	51		2	2	▨	2			
x	4			10	4	34	▨	3		
x		15					1	▨		
x		30							▨	
x		2		2		6				▨

7 Packages visualization

1 cell = 1 dependency

1 column = used packages

1 line = using packages

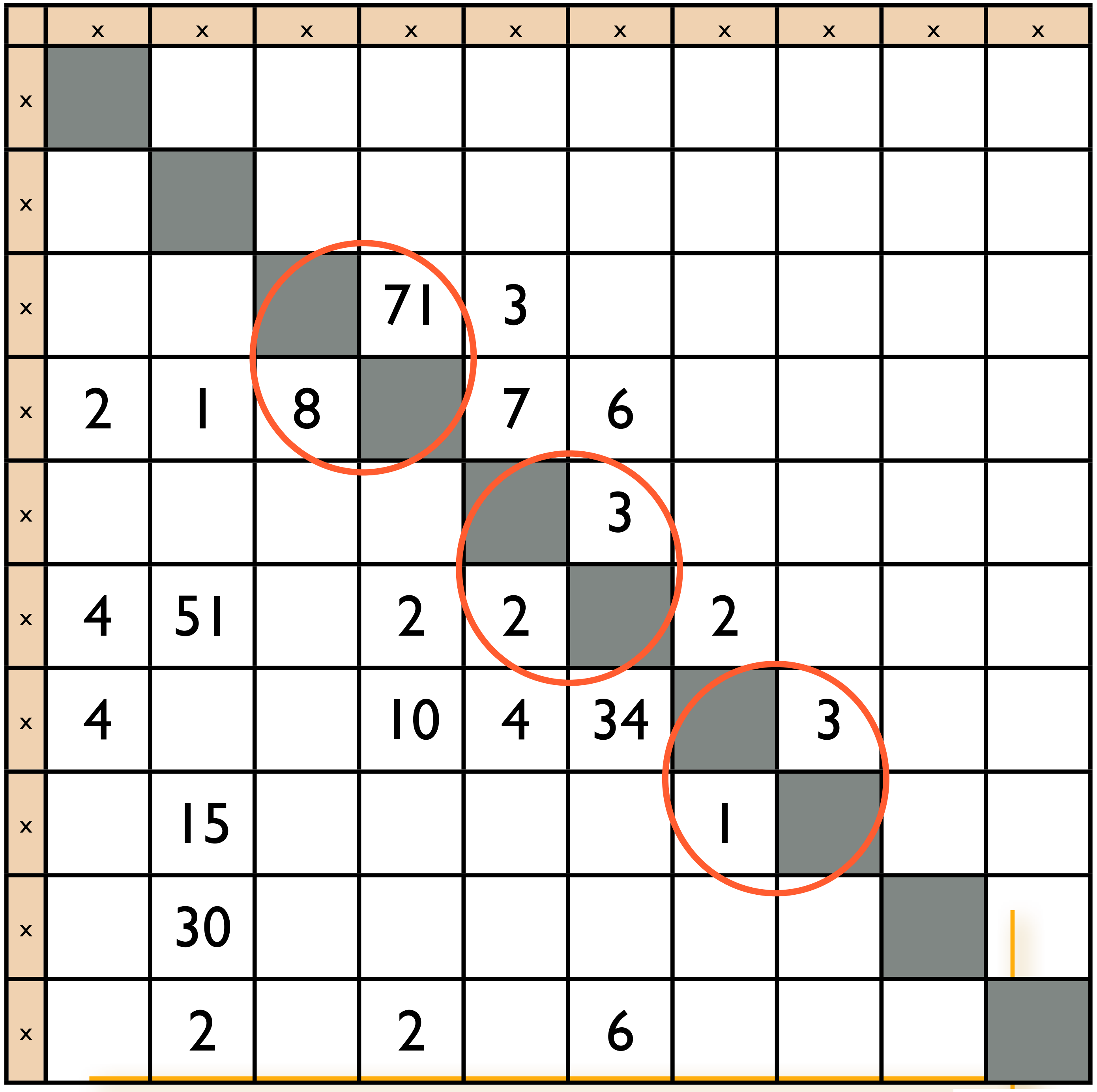


	x	x	x	x	x	x	x	x	x	x
x	▨									
x		▨								
x			▨	71	3					
x	2	1	8	▨	7	6				
x					▨	3				
x	4	51		2	2	▨	2			
x	4			10	4	34	▨	3		
x		15					1	▨		
x		30							▨	
x		2		2		6				▨

S.Ducasse

7 Packages visualization

1 cell = 1 dependency
1 column = used packages
1 line = using packages



	×	×	×	×	×	×	×	×	×	×
×	▨									
×		▨								
×			▨	71	3					
×	2	1	8	▨	7	6				
×					▨	3				
×	4	51		2	2	▨	2			
×	4			10	4	34	▨		3	
×		15					1	▨		
×		30							▨	
×		2		2		6				▨

S.Ducasse

RMod

7 Packages visualization

1 cell = 1 dependency

1 column = used packages

1 line = using packages

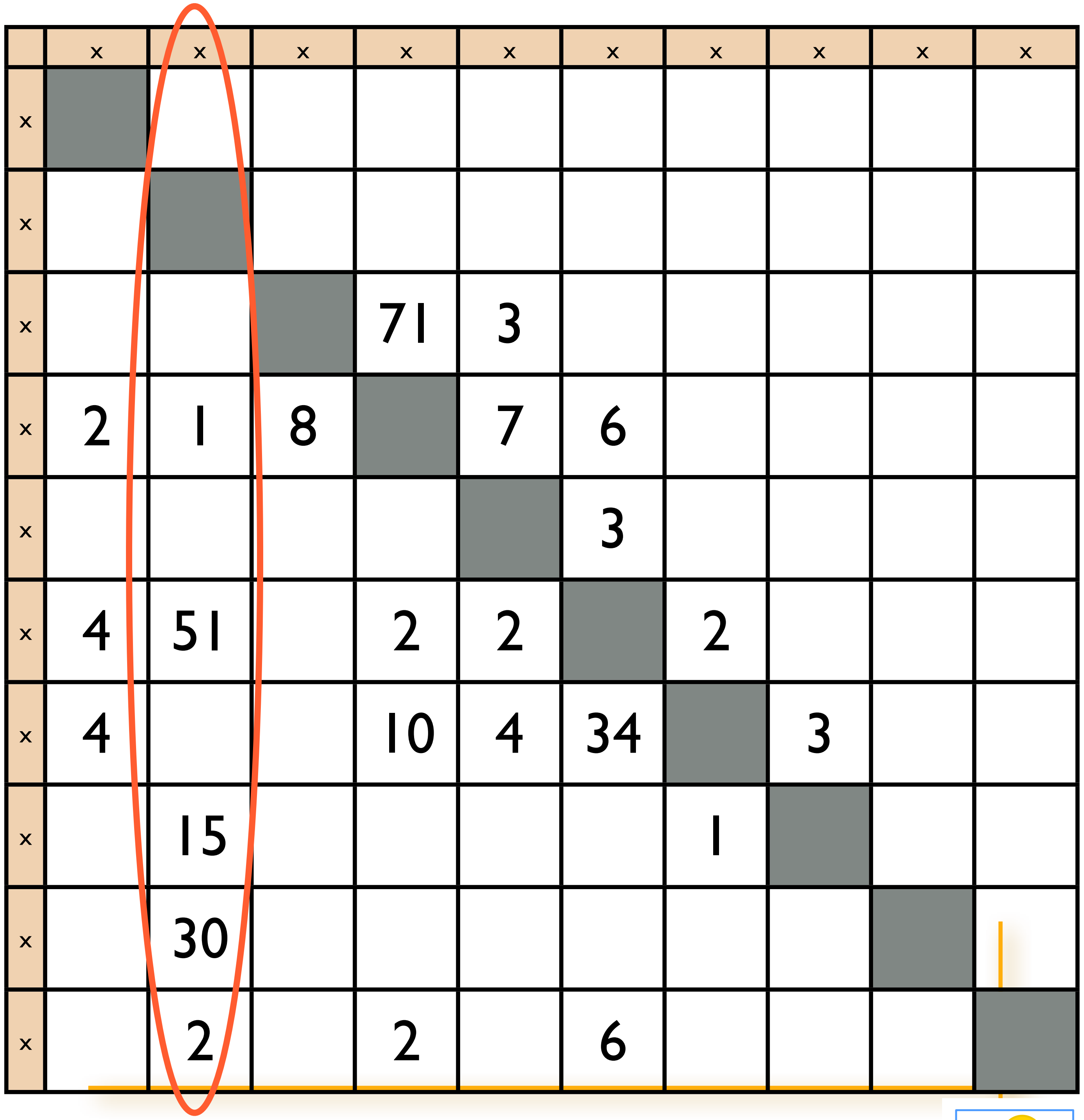
	x	x	x	x	x	x	x	x	x	x
x	▨									
x		▨								
x			▨	71	3					
x	2	1	8	▨	7	6				
x					▨	3				
x	4	51		2	2	▨	2			
x	4			10	4	34	▨	3		
x		15					1	▨		
x		30							▨	
x		2		2		6				▨

7 Packages visualization

I cell = I dependency

I column = used packages

I line = using packages



	x	x	x	x	x	x	x	x	x	x
x	▨									
x		▨								
x			▨	71	3					
x	2	1	8	▨	7	6				
x					▨	3				
x	4	51		2	2	▨	2			
x	4			10	4	34	▨	3		
x		15					1	▨		
x		30							▨	
x		2		2		6				▨

7 Packages visualization

1 cell = 1 dependency

1 column = used packages

1 line = using packages

	x	x	x	x	x	x	x	x	x	x
x	■									
x		■								
x			■	71	3					
x	2	1	8	■	7	6				
x					■	3				
x	4	51		2	2	■	2			
x	4			10	4	34	■	3		
x		15					1	■		
x		30							■	
x		2		2		6				■

7 Packages visualization

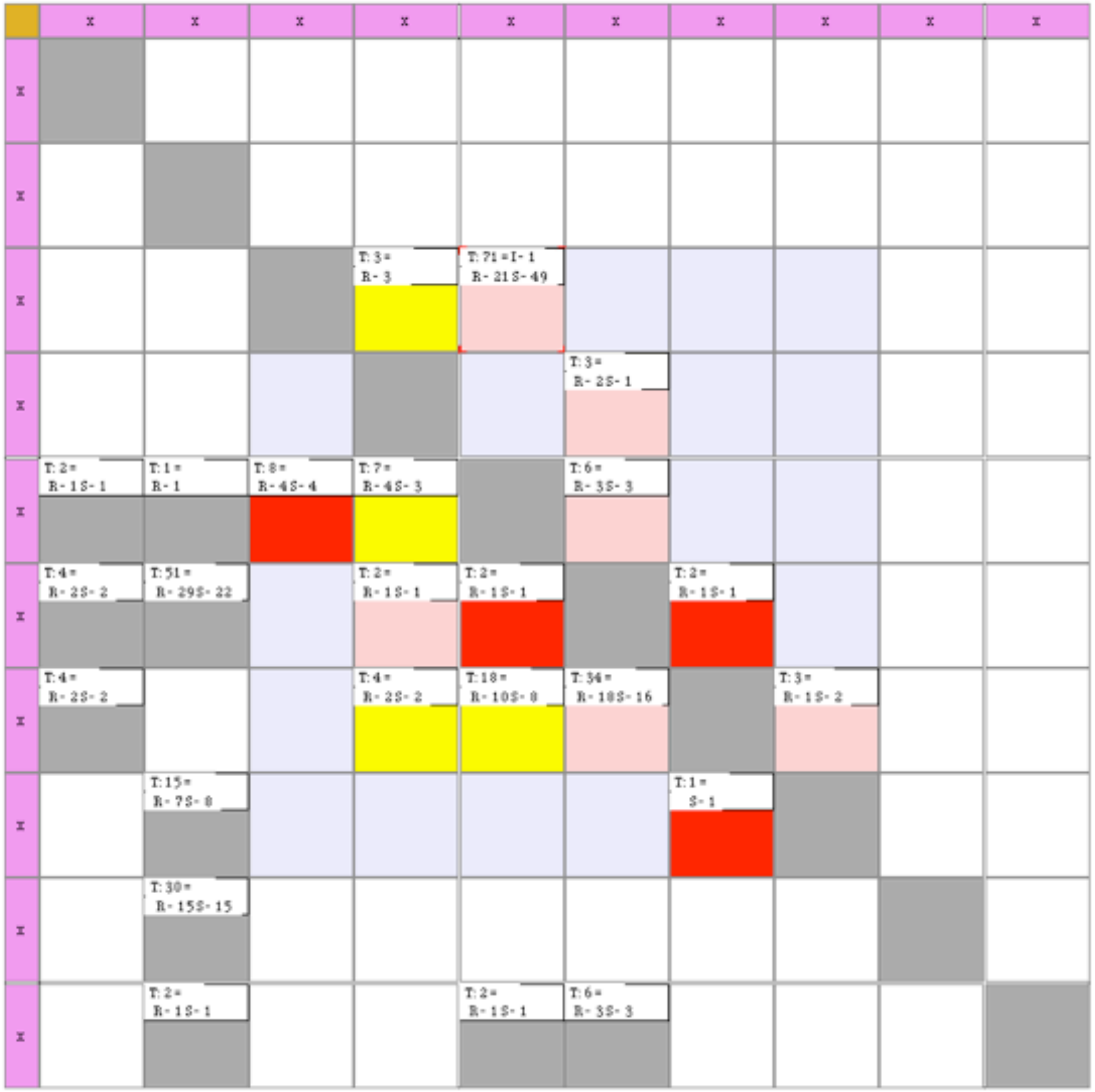
1 cell = 1 dependency

1 column = used packages

1 line = using packages

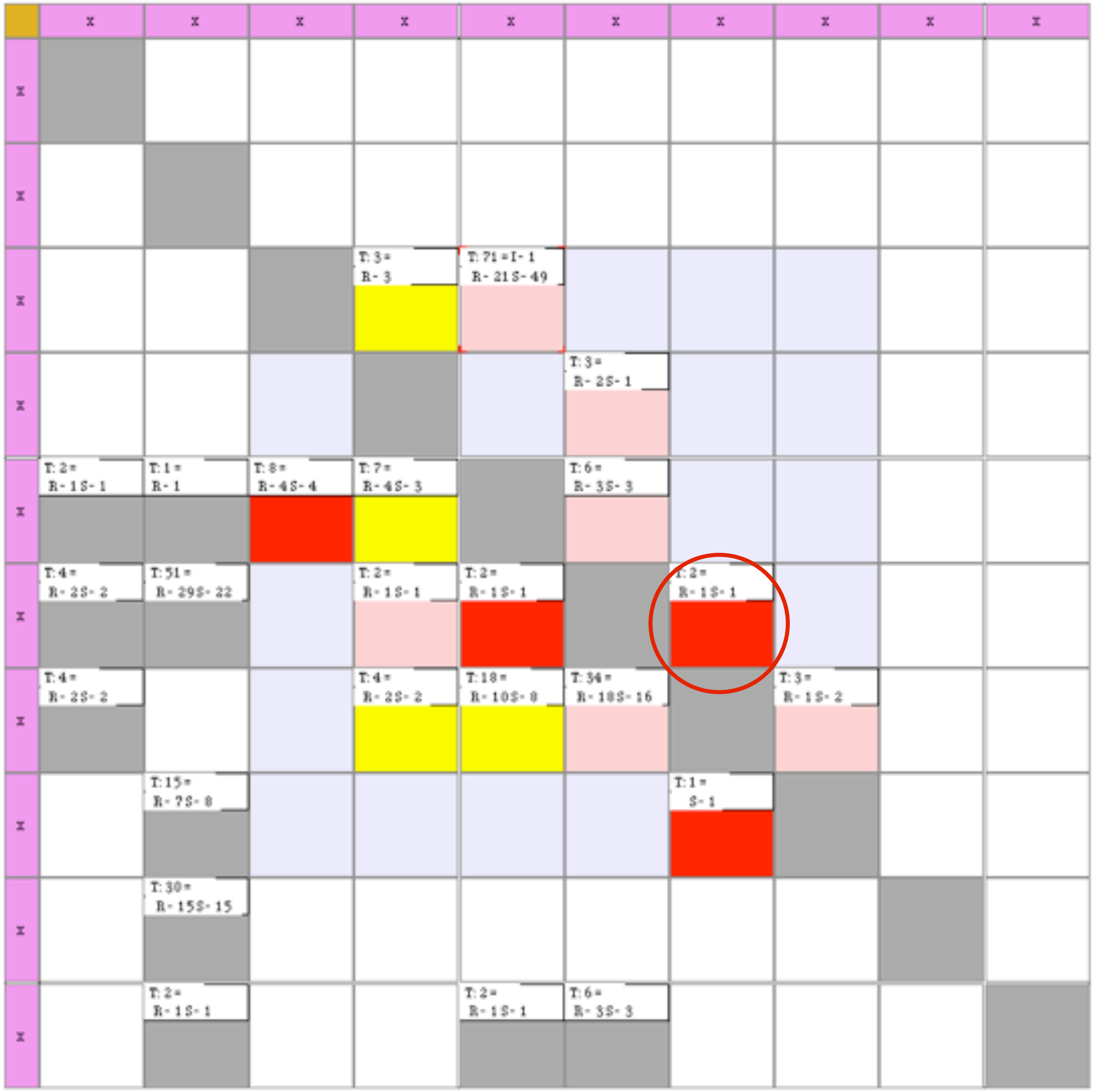
	x	x	x	x	x	x	x	x	x	x
x	■									
x		■								
x			■	71	3					
x	2	1	8	■	7	6				
x					■	3				
x	4	51		2	2	■	2			
x	4			10	4	34	■	3		
x		15					1	■		
x		30							■	
x		2		2		6				■

Identify cycles



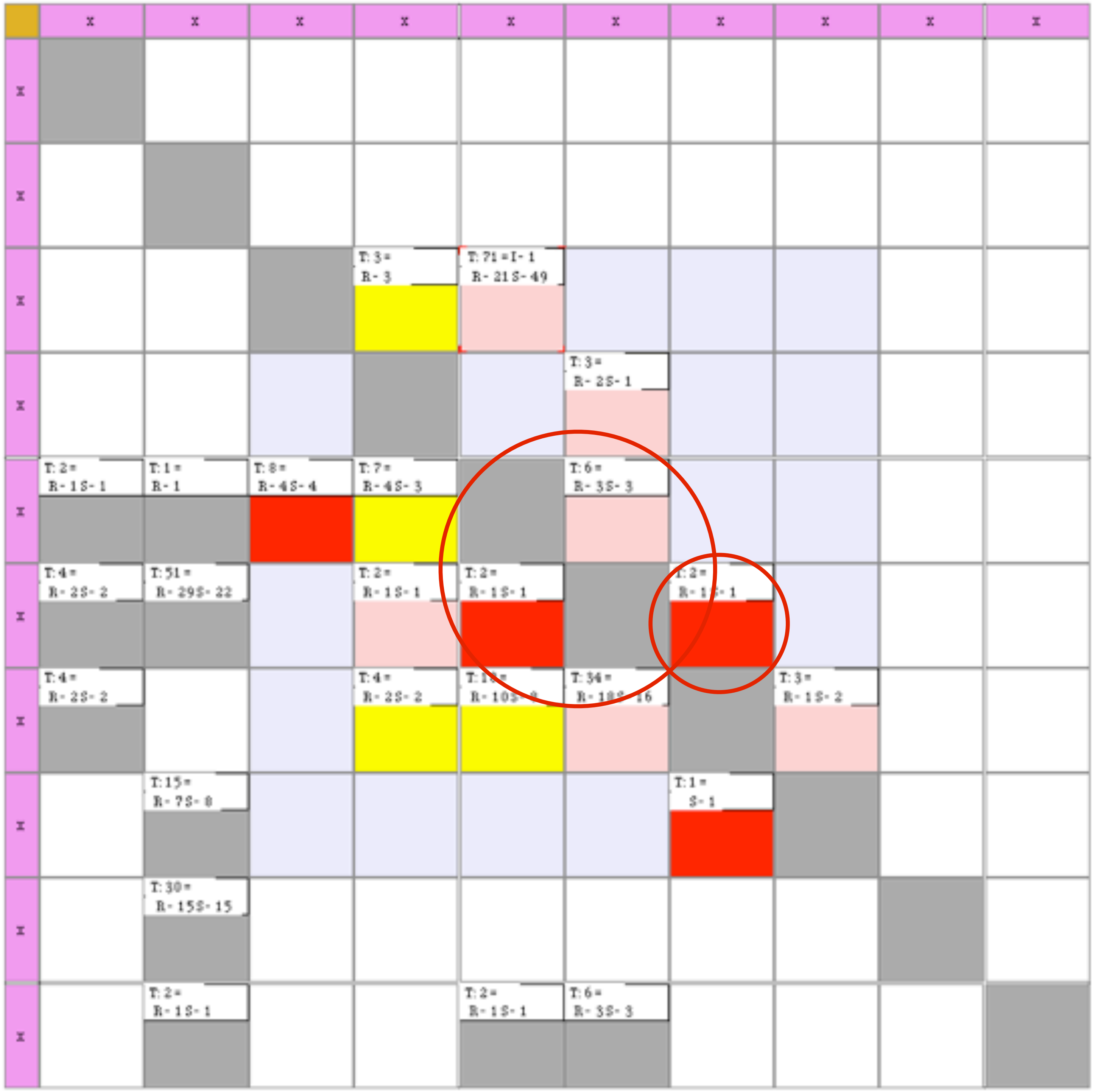
	x	x	x	x	x	x	x	x	x	x
x										
x										
x				T: 3= R- 3	T: 71 =I- 1 R- 21S- 49					
x						T: 3= R- 2S- 1				
x	T: 2= R- 1S- 1	T: 1= R- 1	T: 8= R- 4S- 4	T: 7= R- 4S- 3		T: 6= R- 3S- 3				
x	T: 4= R- 2S- 2	T: 51= R- 29S- 22		T: 2= R- 1S- 1	T: 2= R- 1S- 1		T: 2= R- 1S- 1			
x	T: 4= R- 2S- 2			T: 4= R- 2S- 2	T: 18= R- 10S- 8	T: 34= R- 18S- 16		T: 3= R- 1S- 2		
x		T: 15= R- 7S- 8					T: 1= S- 1			
x		T: 30= R- 15S- 15								
x		T: 2= R- 1S- 1			T: 2= R- 1S- 1	T: 6= R- 3S- 3				

Identify cycles



	x	x	x	x	x	x	x	x	x	x
x										
x										
x				T: 3= R- 3	T: 71 =I- 1 R- 21 S- 49					
x						T: 3= R- 2S- 1				
x	T: 2= R- 1S- 1	T: 1= R- 1	T: 8= R- 4S- 4	T: 7= R- 4S- 3		T: 6= R- 3S- 3				
x	T: 4= R- 2S- 2	T: 51= R- 29S- 22		T: 2= R- 1S- 1	T: 2= R- 1S- 1		T: 2= R- 1S- 1			
x	T: 4= R- 2S- 2			T: 4= R- 2S- 2	T: 18= R- 10S- 8	T: 34= R- 18S- 16		T: 3= R- 1S- 2		
x		T: 15= R- 7S- 8					T: 1= S- 1			
x		T: 30= R- 15S- 15								
x		T: 2= R- 1S- 1			T: 2= R- 1S- 1	T: 6= R- 3S- 3				

Identify cycles

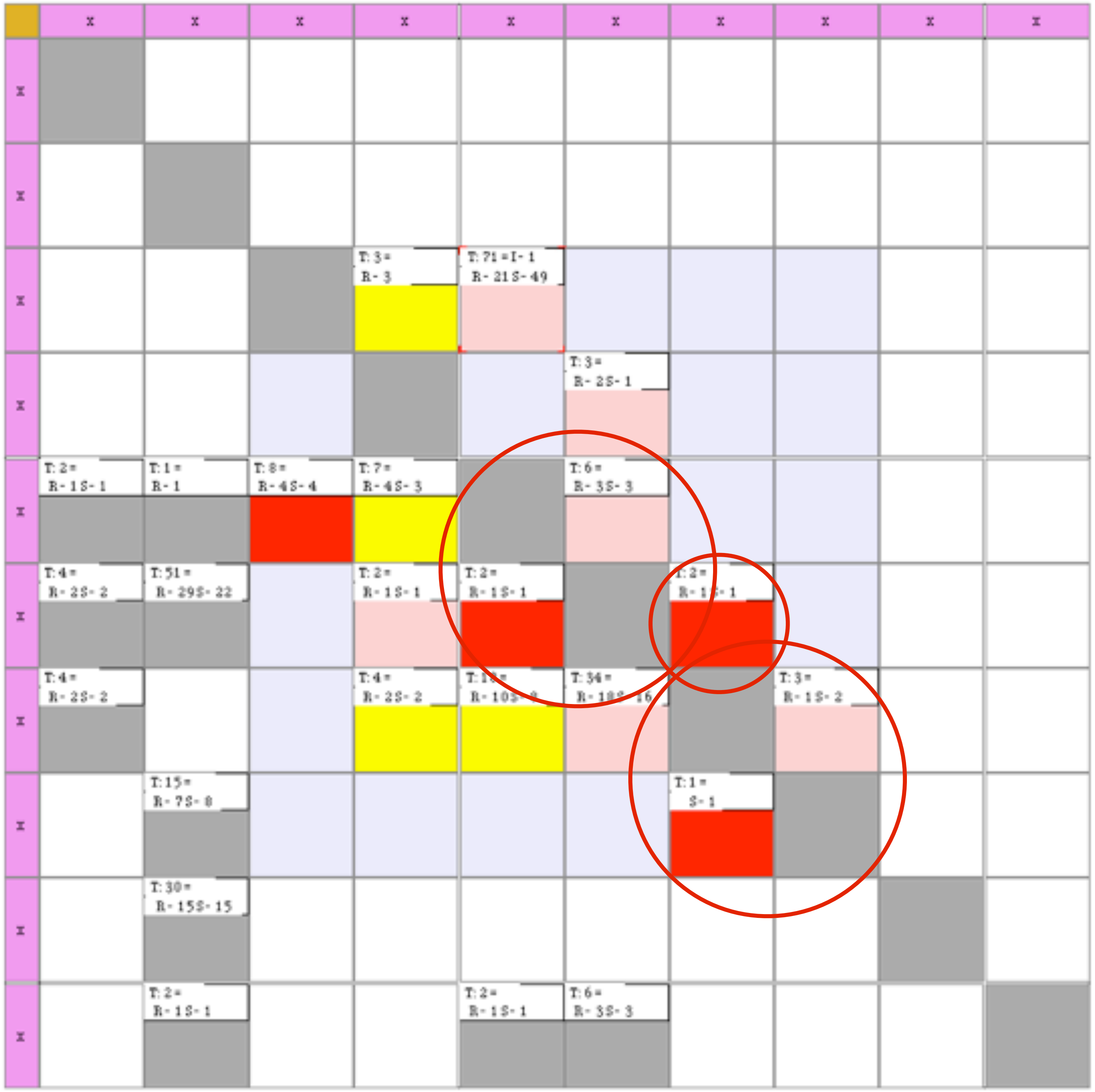


	x	x	x	x	x	x	x	x	x	x
x										
x										
x				T:3= R-3	T:71=I-1 R-21S-49					
x						T:3= R-2S-1				
x	T:2= R-1S-1	T:1= R-1	T:8= R-4S-4	T:7= R-4S-3		T:6= R-3S-3				
x	T:4= R-2S-2	T:51= R-29S-22		T:2= R-1S-1	T:2= R-1S-1		T:2= R-1S-1			
x	T:4= R-2S-2			T:4= R-2S-2	T:1[illegible]= R-10S-[illegible]	T:34= R-18S-16		T:3= R-1S-2		
x		T:15= R-7S-8					T:1= S-1			
x		T:30= R-15S-15								
x		T:2= R-1S-1			T:2= R-1S-1	T:6= R-3S-3				

S.Ducasse

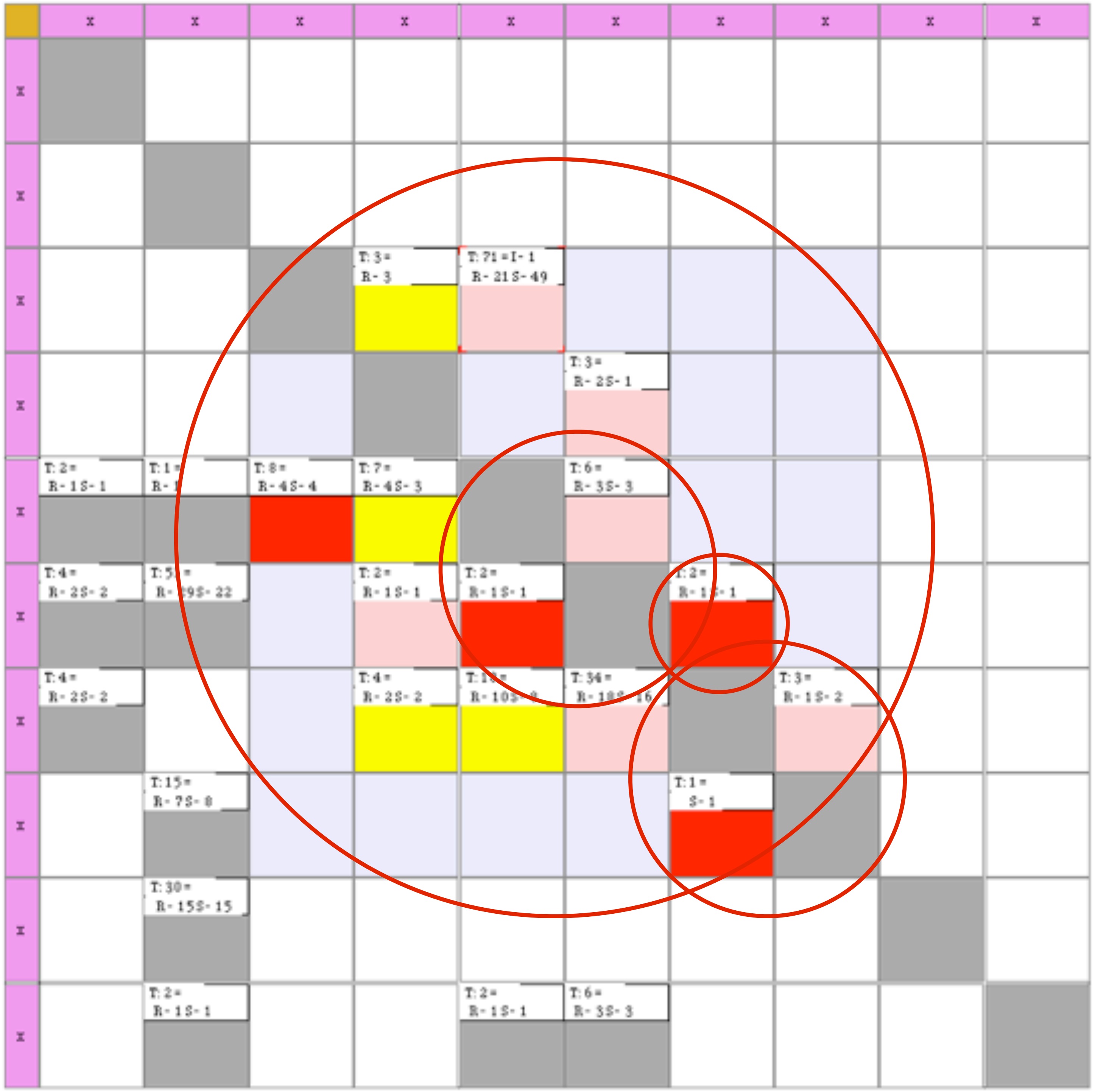
RMod

Identify cycles



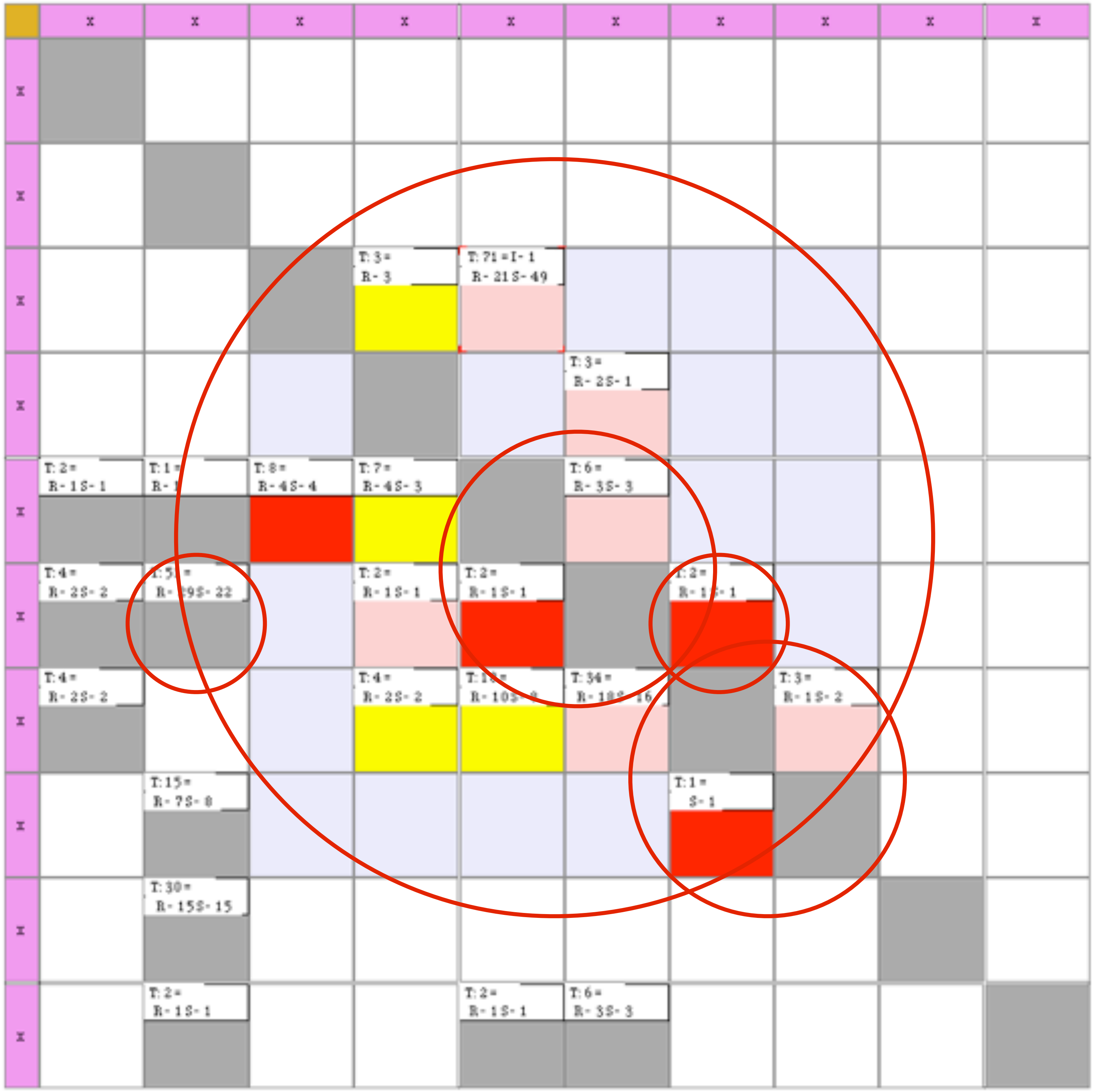
	x	x	x	x	x	x	x	x	x	x
x										
x										
x				T: 3= R- 3	T: 71 =I- 1 R- 21S- 49					
x						T: 3= R- 2S- 1				
x	T: 2= R- 1S- 1	T: 1= R- 1	T: 8= R- 4S- 4	T: 7= R- 4S- 3		T: 6= R- 3S- 3				
x	T: 4= R- 2S- 2	T: 51= R- 29S- 22		T: 2= R- 1S- 1	T: 2= R- 1S- 1		T: 2= R- 1S- 1			
x	T: 4= R- 2S- 2			T: 4= R- 2S- 2	T: 18= R- 10S- 8	T: 34= R- 18S- 16		T: 3= R- 1S- 2		
x		T: 15= R- 7S- 8					T: 1= S- 1			
x		T: 30= R- 15S- 15								
x		T: 2= R- 1S- 1			T: 2= R- 1S- 1	T: 6= R- 3S- 3				

Identify cycles



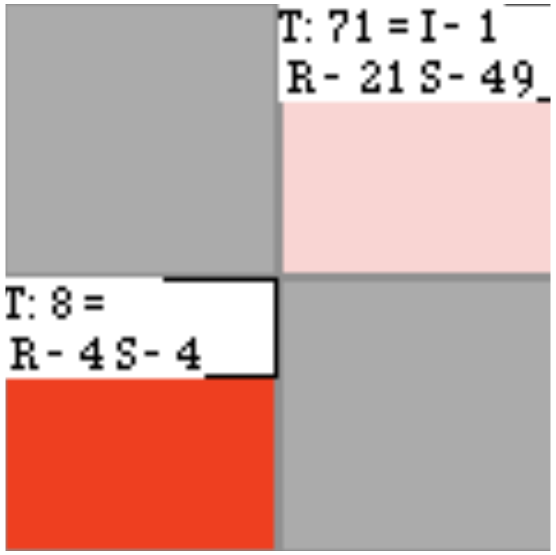
	x	x	x	x	x	x	x	x	x	x
x										
x										
x				T: 3= R- 3	T: 71 =I- 1 R- 21S- 49					
x						T: 3= R- 2S- 1				
x	T: 2= R- 1S- 1	T: 1 = R- 1	T: 8= R- 4S- 4	T: 7= R- 4S- 3		T: 6= R- 3S- 3				
x	T: 4= R- 2S- 2	T: 51 = R- 29S- 22		T: 2= R- 1S- 1	T: 2= R- 1S- 1		T: 2= R- 1S- 1			
x	T: 4= R- 2S- 2			T: 4= R- 2S- 2	T: 19= R- 10S- 9	T: 34= R- 18S- 16		T: 3= R- 1S- 2		
x		T: 15= R- 7S- 8					T: 1= S- 1			
x		T: 30= R- 15S- 15								
x		T: 2= R- 1S- 1			T: 2= R- 1S- 1	T: 6= R- 3S- 3				

Identify cycles

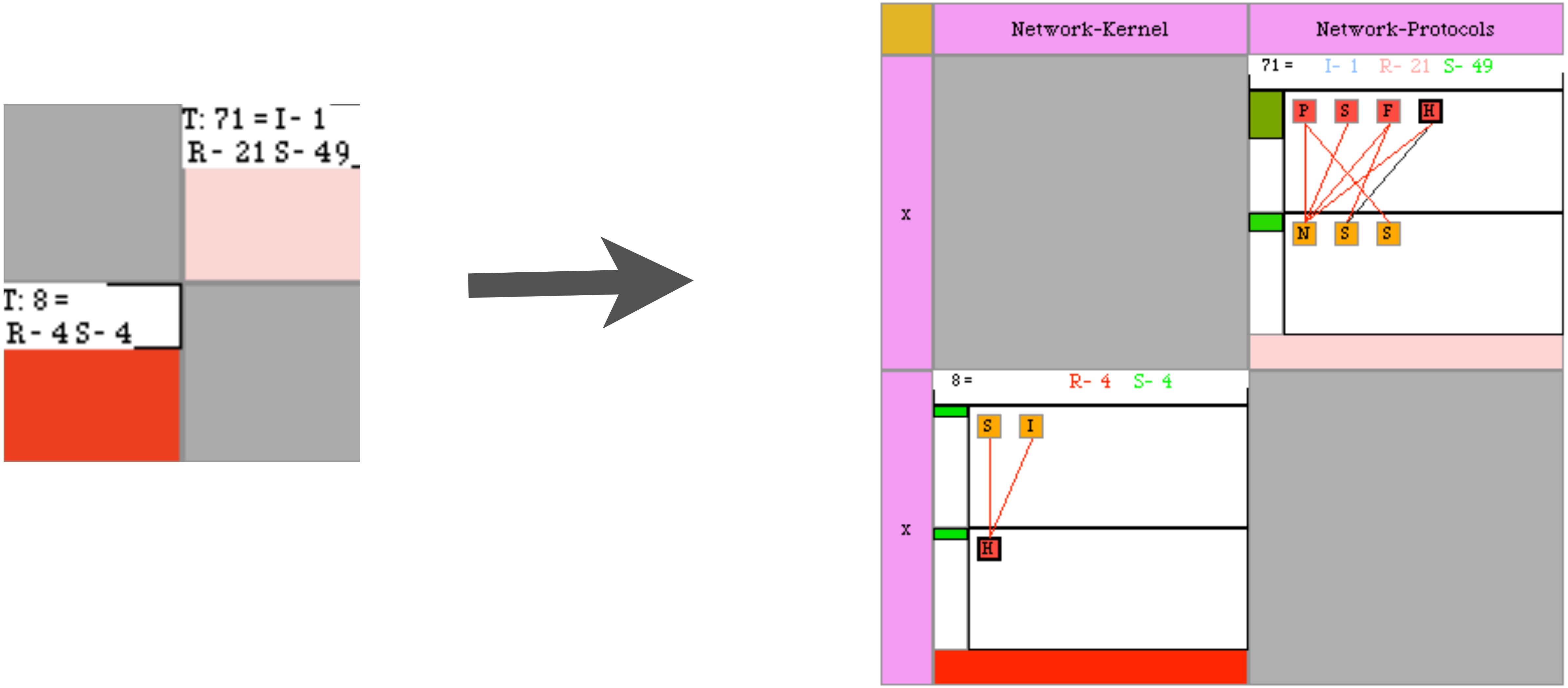


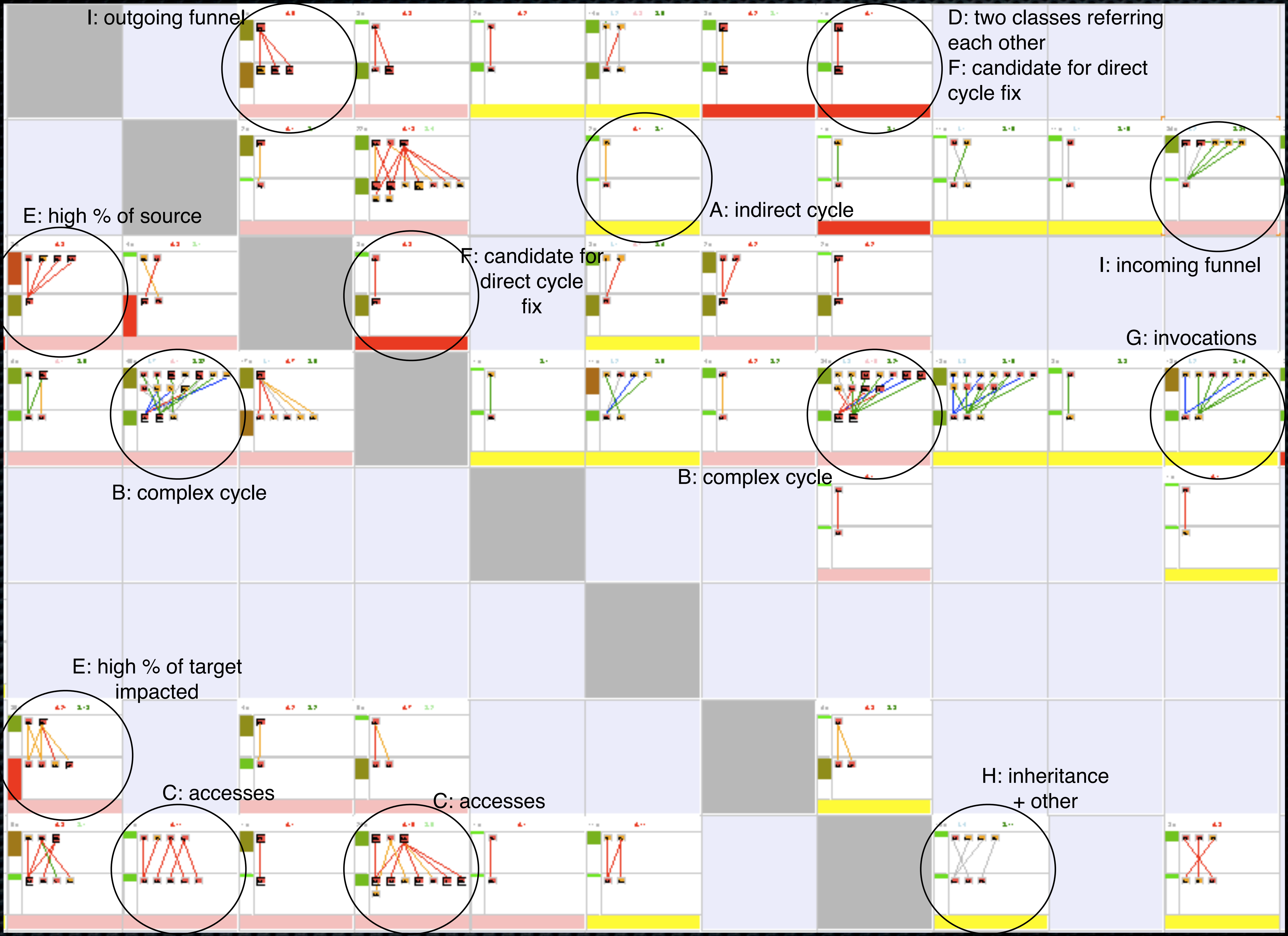
	x	x	x	x	x	x	x	x	x	x
x										
x										
x				T: 3= R- 3	T: 71 =I- 1 R- 21 S- 49					
x						T: 3= R- 2S- 1				
x	T: 2= R- 1S- 1	T: 1= R- 1	T: 8= R- 4S- 4	T: 7= R- 4S- 3		T: 6= R- 3S- 3				
x	T: 4= R- 2S- 2	T: 5 = R- 29S- 22		T: 2= R- 1S- 1	T: 2= R- 1S- 1		T: 2= R- 1S- 1			
x	T: 4= R- 2S- 2			T: 4= R- 2S- 2	T: 19= R- 10S- 9	T: 34= R- 18S- 16		T: 3= R- 1S- 2		
x		T: 15= R- 7S- 8					T: 1= S- 1			
x		T: 30= R- 15S- 15								
x		T: 2= R- 1S- 1			T: 2= R- 1S- 1	T: 6= R- 3S- 3				

Causes and distribution



Causes and distribution




I: outgoing funnel
D: two classes referring each other
F: candidate for direct cycle fix
A: indirect cycle
E: high % of source
I: incoming funnel
F: candidate for direct cycle fix
G: invocations
B: complex cycle
B: complex cycle
E: high % of target impacted
C: accesses
C: accesses
H: inheritance + other

Challenges

- How to help taking the right decision?
- What are possible futures impact of a change?

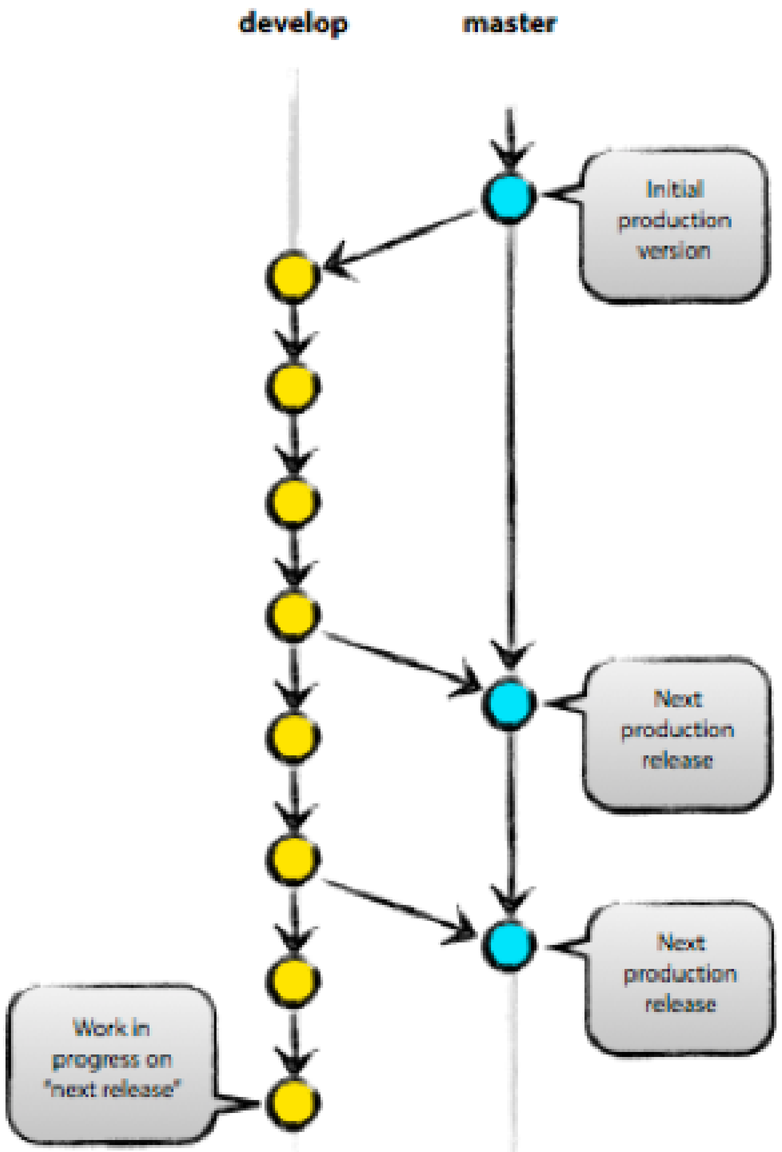
Orion

- Supporting multiple versions of analyzed projects
- Applying analyses on different modifications
- Comparing different futures

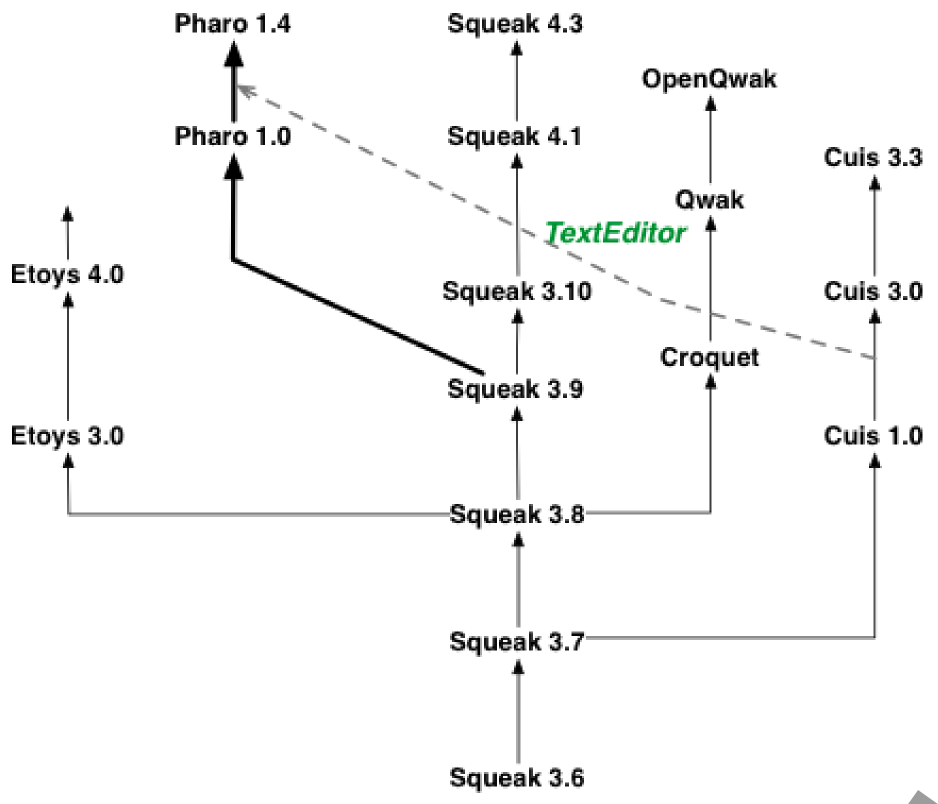
Challenges

- How can we help merging?
- What is the impact of a change?

How to support merging branches?


develop
master
Initial production version
Next production release
Next production release
Work in progress on "next release"

Git



Forks

Manual tasks are needed

Dependencies between changes

Integrator is not the author of the changes

No guarantee that the system will work

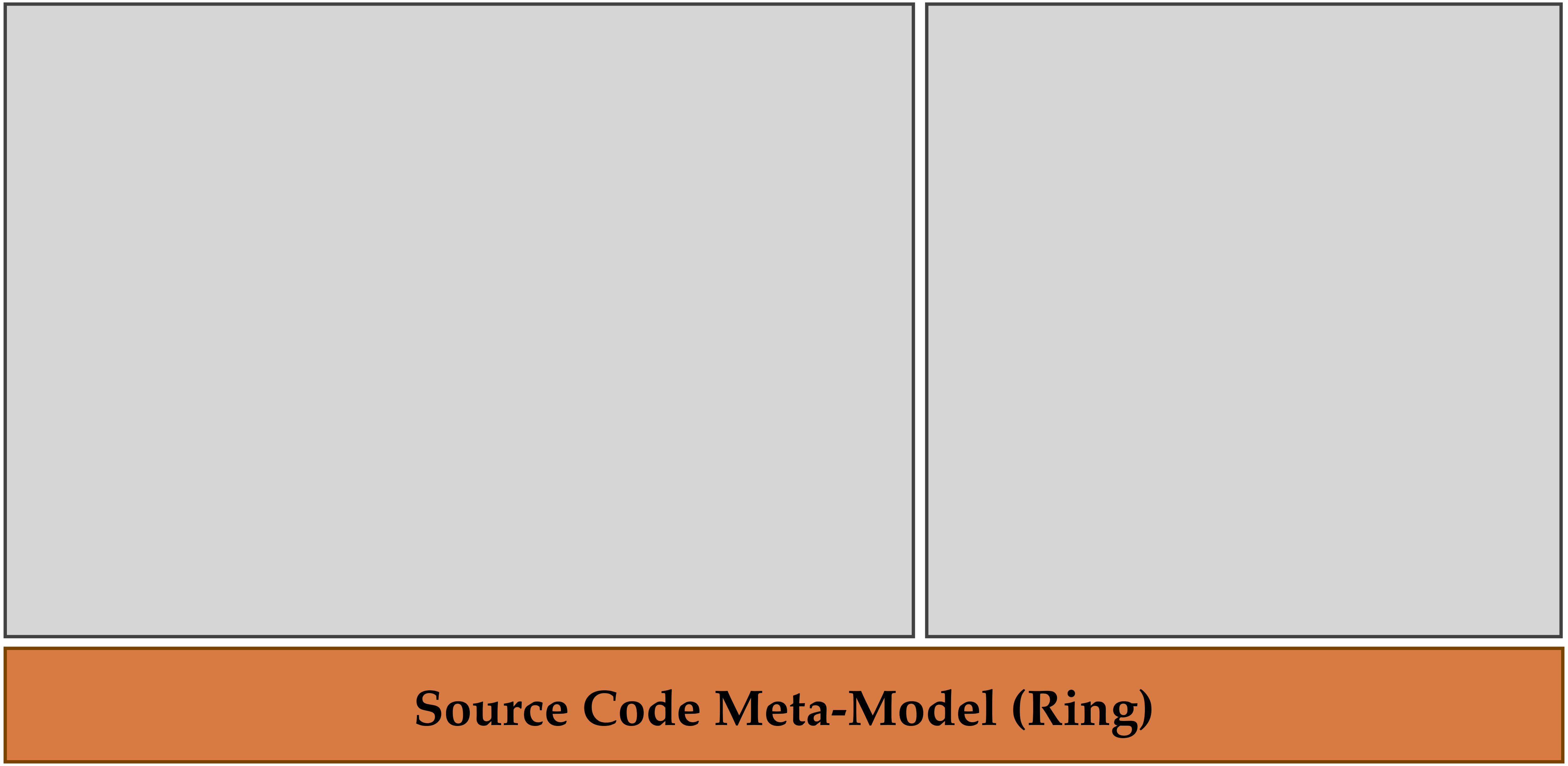
Assisted Integration

Assisted Integration

Source Code Meta-Model (Ring)

Assisted Integration

Approach Overview

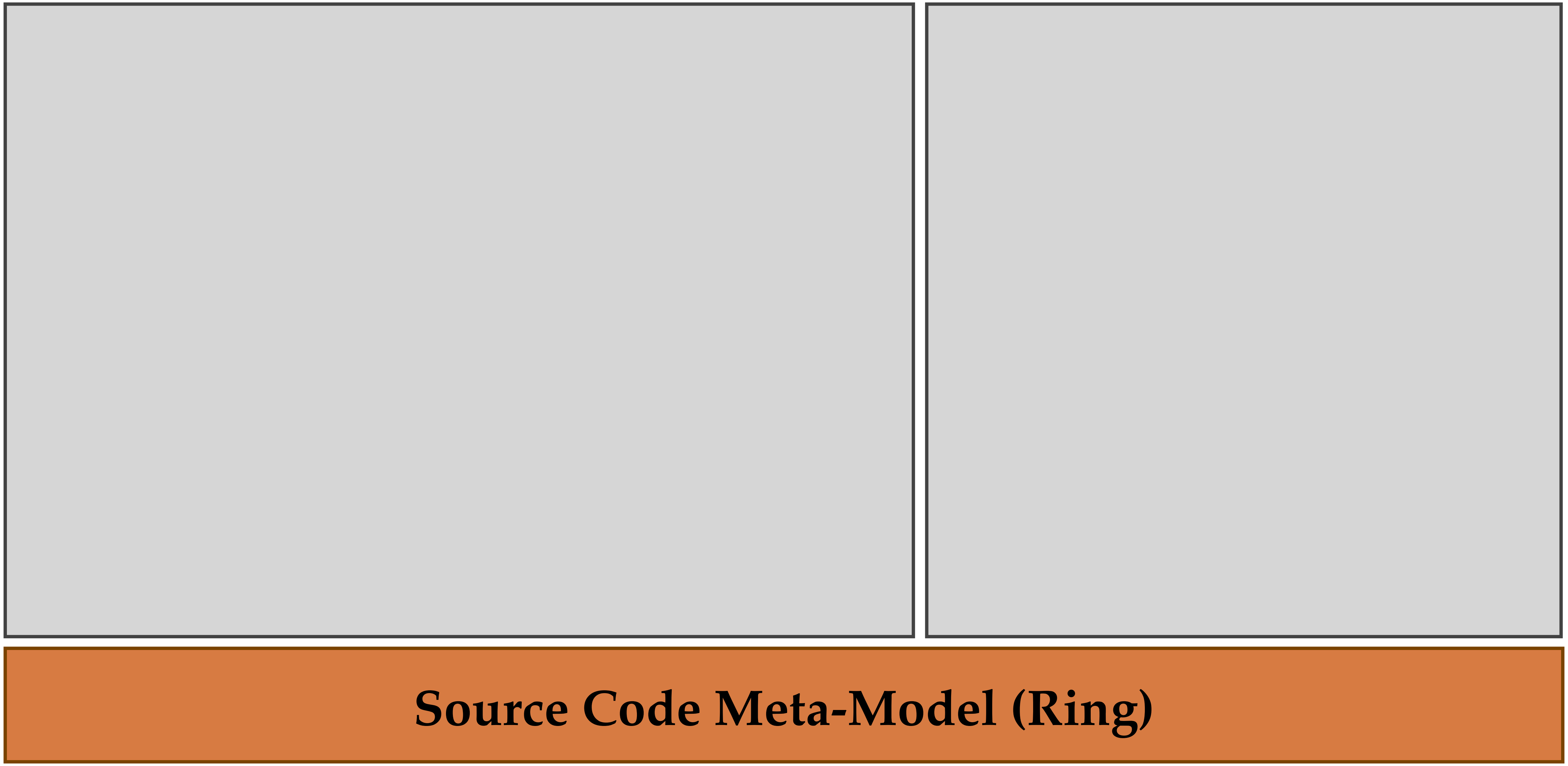


Source Code Meta-Model (Ring)

Assisted Integration

Approach Overview

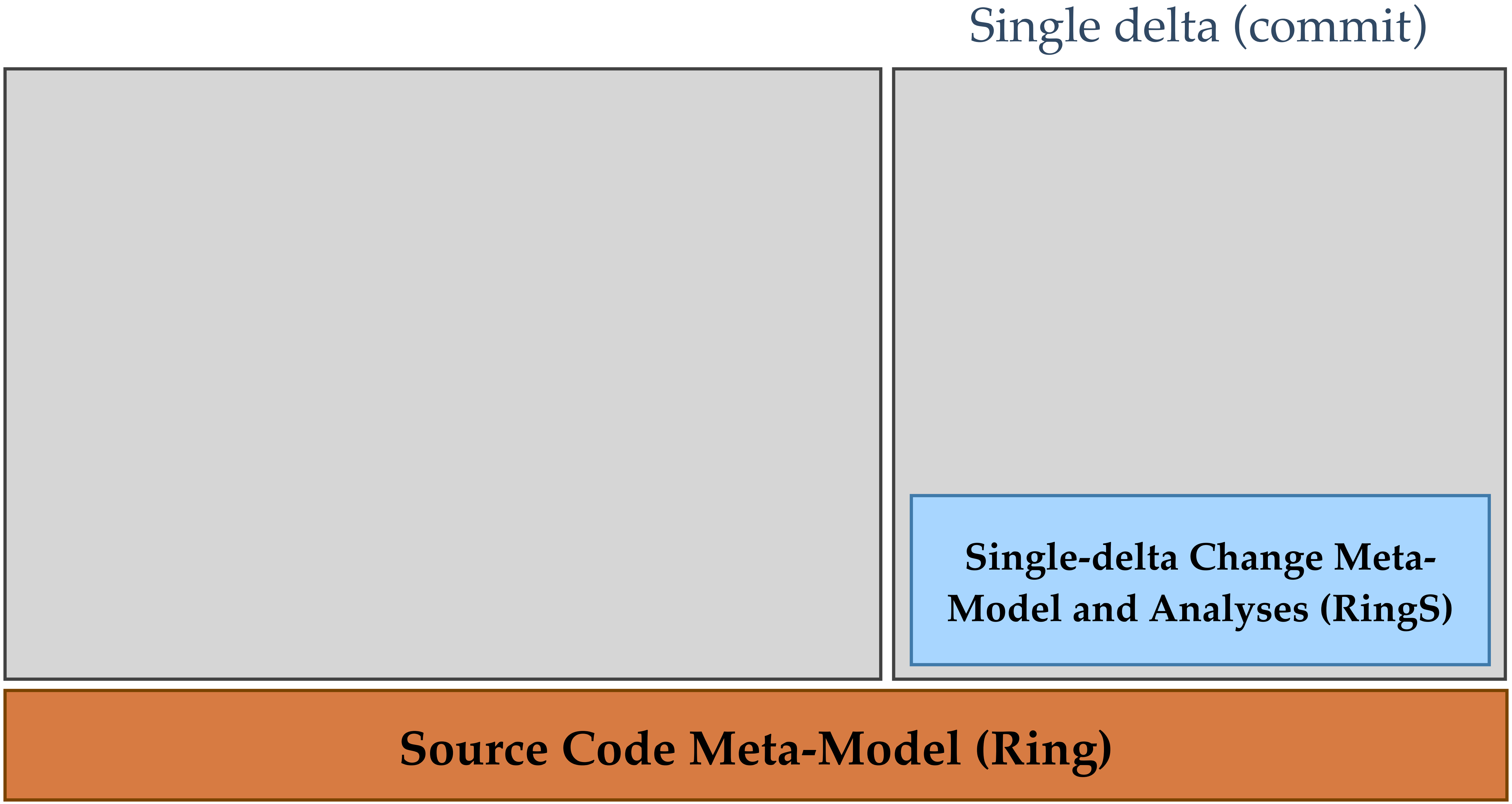
Single delta (commit)



Source Code Meta-Model (Ring)

Assisted Integration

Approach Overview

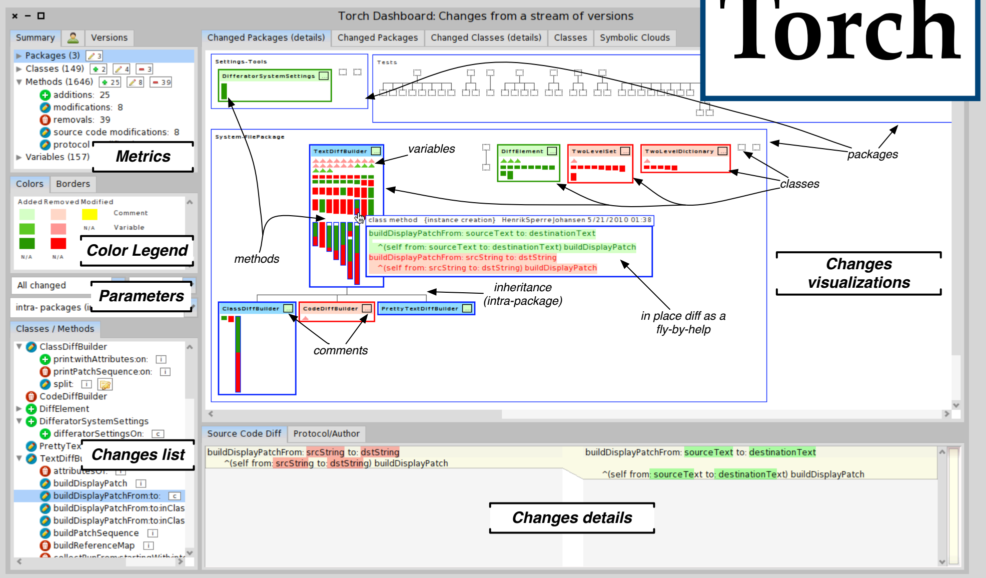

Single delta (commit)
Single-delta Change Meta-Model and Analyses (RingS)
Source Code Meta-Model (Ring)

Assisted Integration

Approach Overview

Single delta (commit)

Torch



Single-delta Change Meta-Model and Analyses (RingS)

Source Code Meta-Model (Ring)

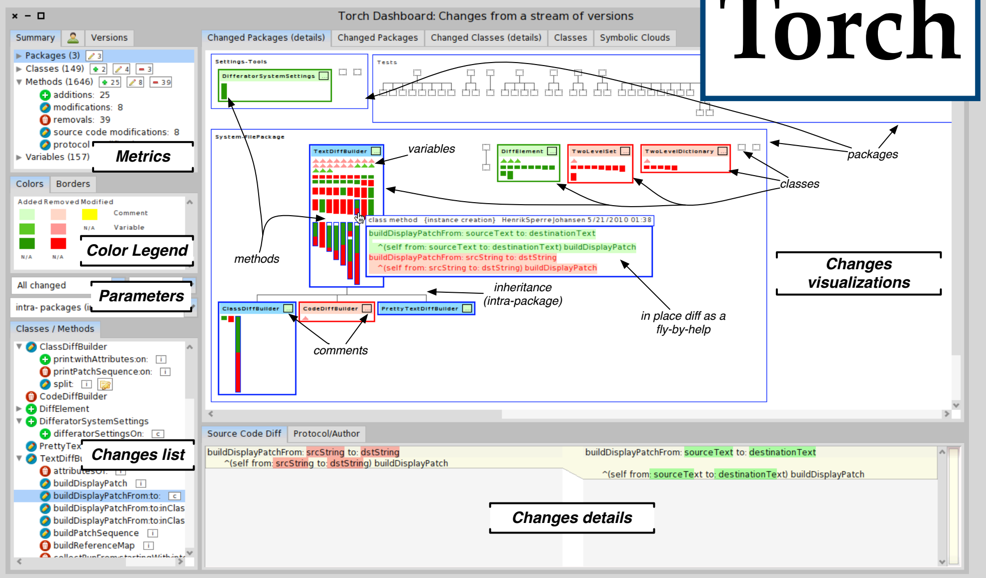
Assisted Integration

Approach Overview

Stream of changes (chains of commits)

Single delta (commit)

Torch



Single-delta Change Meta-Model and Analyses (RingS)

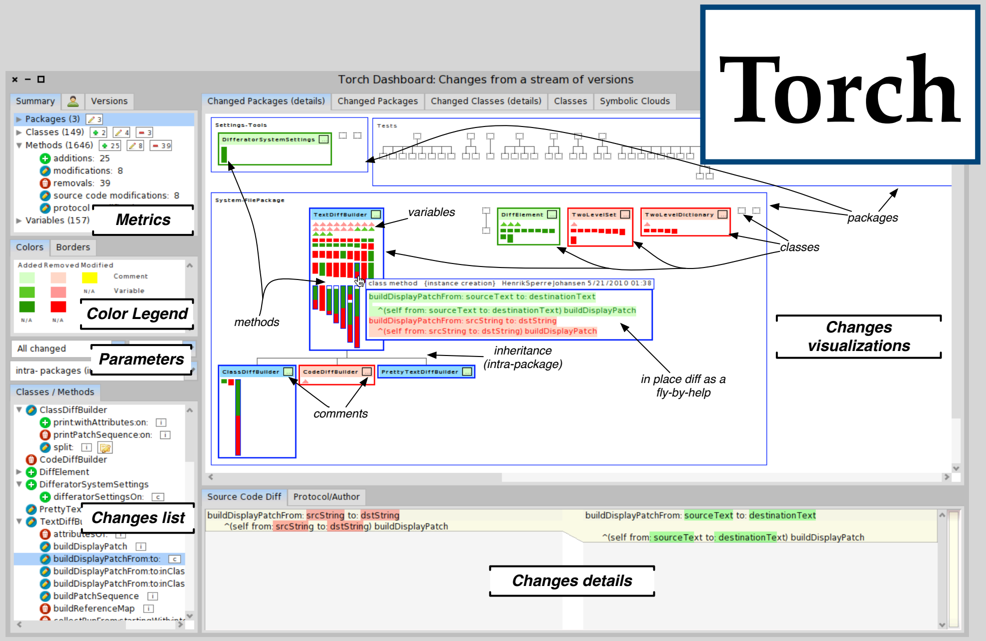
Source Code Meta-Model (Ring)

Assisted Integration

Approach Overview

Stream of changes (chains of commits)

Single delta (commit)



History Meta-Model and Analyses (RingH)

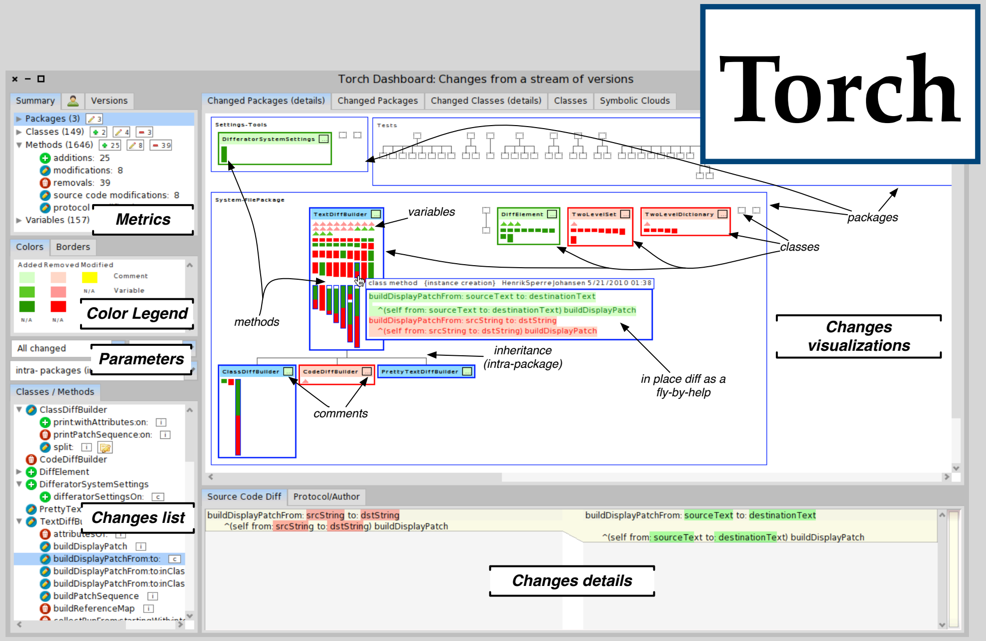
Single-delta Change Meta-Model and Analyses (RingS)

Source Code Meta-Model (Ring)

Assisted Integration

Stream of changes (chains of commits)

Single delta (commit)



Torch

Torch Dashboard: Changes from a stream of versions

Summary | Versions

- Packages (3) 3
- Classes (149) 2 4 3
- Methods (1646) 25 8 39
  - additions: 25
  - modifications: 8
  - removals: 39
  - source code modifications: 8
  - protocol
- Variables (157)

Colors | Borders

Added Removed Modified

Comment

Variable

All changed

intra- packages

Classes / Methods

- ClassDiffBuilder
  - printwithAttributes:on:
  - printPatchSequence:on:
  - split:
- CodeDiffBuilder
- DiffElement
- DifferatorSystemSettings
  - differatorSettingsOn:
- PrettyTex
- TextDiffBu
  - attributesOf:
  - buildDisplayPatch
  - buildDisplayPatchFrom:to:
  - buildDisplayPatchFrom:to:inClas
  - buildDisplayPatchFrom:to:inClas
  - buildPatchSequence
  - buildReferenceMap

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

class method {instance creation} HenrikSperreJohansen 5/21/2010 01:38

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

Source Code Diff | Protocol/Author

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

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

Change & Dependency Meta-Model and Analyses (RingC)

History Meta-Model and Analyses (RingH)

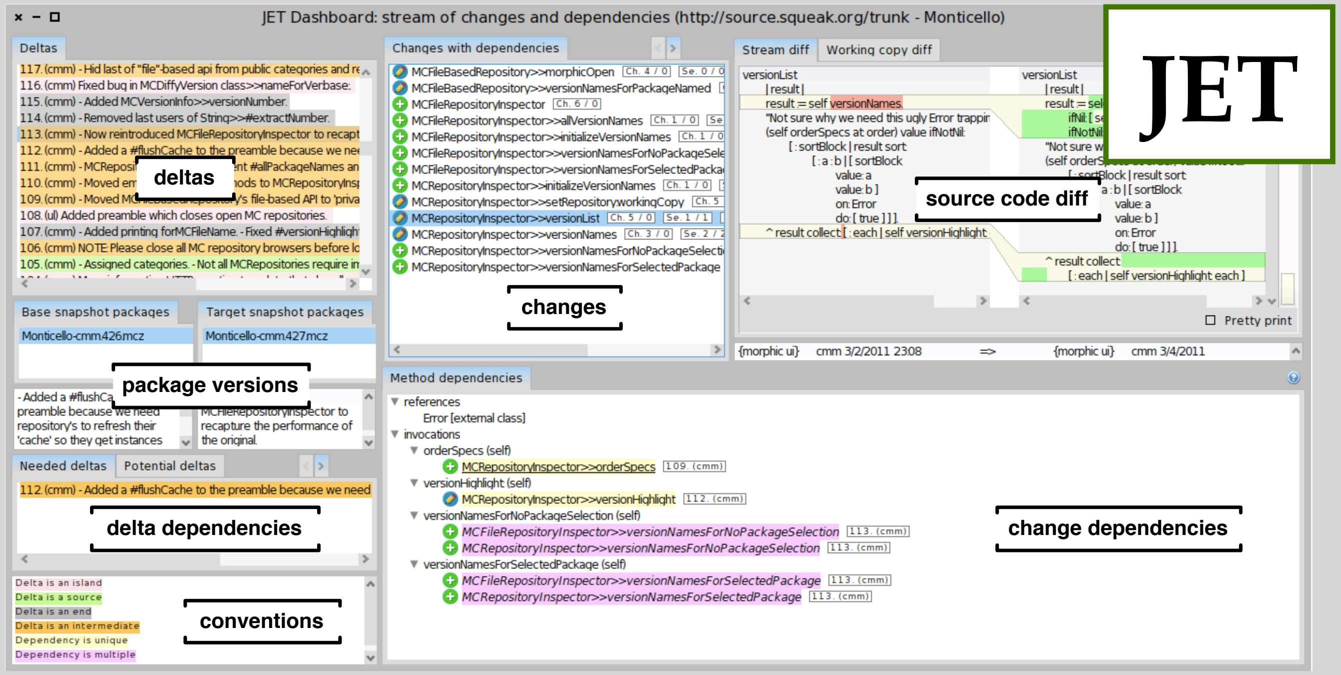
Single-delta Change Meta-Model and Analyses (RingS)

Source Code Meta-Model (Ring)

Assisted Integration

Approach Overview

Stream of changes (chains of commits)



× – □ JET Dashboard: stream of changes and dependencies (http://source.squeak.org/trunk - Monticello)

Deltas

117. (cmm) - Hid last of "file"-based api from public categories and re
116. (cmm) Fixed bug in MCDiffyVersion class>>nameForVerbase:
115. (cmm) - Added MCVersionInfo>>versionNumber.
114. (cmm) - Removed last users of String>>#extractNumber.
113. (cmm) - Now reintroduced MCFileRepositoryInspector to recapt
112. (cmm) - Added a #flushCache to the preamble because we nee
111. (cmm) - MCReposi …nt #allPackageNames an
110. (cmm) - Moved em …ods to MCRepositoryInsp
109. (cmm) - Moved MC…'s file-based API to 'priva
108. (ul) Added preamble which closes open MC repositories.
107. (cmm) - Added printing forMCFileName. - Fixed #versionHighligh
106. (cmm) NOTE: Please close all MC repository browsers before lo
105. (cmm) - Assigned categories. - Not all MCRepositories require in

Changes with dependencies

- MCFileBasedRepository>>morphicOpen Ch. 4 / 0 Se. 0 / 0
- MCFileBasedRepository>>versionNamesForPackageNamed
- MCFileRepositoryInspector Ch. 6 / 0
- MCFileRepositoryInspector>>allVersionNames Ch. 1 / 0 Se
- MCFileRepositoryInspector>>initializeVersionNames Ch. 1 / 0
- MCFileRepositoryInspector>>versionNamesForNoPackageSele
- MCFileRepositoryInspector>>versionNamesForSelectedPacka
- MCRepositoryInspector>>initializeVersionNames Ch. 1 / 0
- MCRepositoryInspector>>setRepository:workingCopy Ch. 5
- MCRepositoryInspector>>versionList Ch. 5 / 0 Se. 1 / 1
- MCRepositoryInspector>>versionNames Ch. 3 / 0 Se. 2 / 2
- MCRepositoryInspector>>versionNamesForNoPackageSelecti
- MCRepositoryInspector>>versionNamesForSelectedPackage

Stream diff | Working copy diff

```
versionList
    | result |
    result := self versionNames.
    "Not sure why we need this ugly Error trappin
    (self orderSpecs at: order) value ifNotNil:
        [ :sortBlock | result sort:
            [ :a :b | [ sortBlock
                value: a
                value: b ]
                on: Error
                do: [ true ] ] ].
    ^ result collect: [ :each | self versionHighlight:
```

```
versionList
    | result |
    result := sel
        ifNil: [ se
        ifNotNil:
    "Not sure w
    (self orderS
        [ :sortBlock | result sort:
            a :b | [ sortBlock
                value: a
                value: b ]
                on: Error
                do: [ true ] ] ].
    ^ result collect:
        [ :each | self versionHighlight: each ]
```

□ Pretty print

{morphic ui} cmm 3/2/2011 23:08 => {morphic ui} cmm 3/4/2011

Base snapshot packages: Monticello-cmm.426.mcz

Target snapshot packages: Monticello-cmm.427.mcz

- Added a #flushCa… preamble because we need repository's to refresh their 'cache' so they get instances

…MCFileRepositoryInspector to recapture the performance of the original.

Needed deltas | Potential deltas

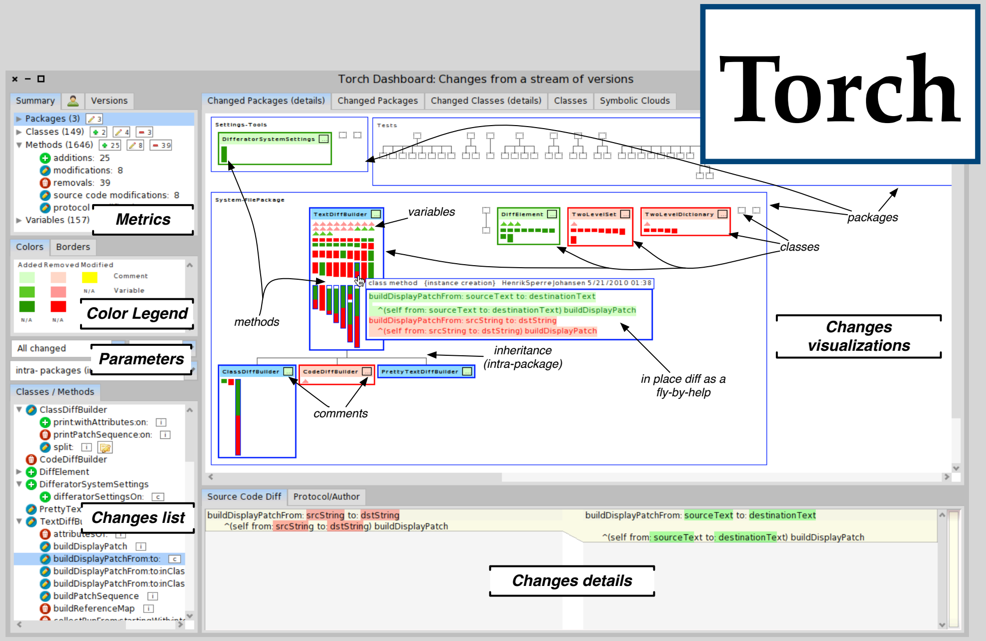
112. (cmm) - Added a #flushCache to the preamble because we need

Delta is an island
Delta is a source
Delta is an end
Delta is an intermediate
Dependency is unique
Dependency is multiple

Method dependencies

- references
  - Error [external class]
- invocations
  - orderSpecs (self)
    - MCRepositoryInspector>>orderSpecs 109. (cmm)
  - versionHighlight (self)
    - MCRepositoryInspector>>versionHighlight 112. (cmm)
  - versionNamesForNoPackageSelection (self)
    - MCFileRepositoryInspector>>versionNamesForNoPackageSelection 113. (cmm)
    - MCRepositoryInspector>>versionNamesForNoPackageSelection 113. (cmm)
  - versionNamesForSelectedPackage (self)
    - MCFileRepositoryInspector>>versionNamesForSelectedPackage 113. (cmm)
    - MCRepositoryInspector>>versionNamesForSelectedPackage 113. (cmm)

Single delta (commit)



× – □ Torch Dashboard: Changes from a stream of versions

Summary | Versions

- Packages (3) ✎ 3
- Classes (149) + 2 ✎ 4 – 3
- Methods (1646) + 25 ✎ 8 – 39
  - additions: 25
  - modifications: 8
  - removals: 39
  - source code modifications: 8
  - protocol …
- Variables (157)

Colors | Borders

Added	Removed	Modified	
🟩	🟥	🟨	Comment
🟩	🟥	N/A	Variable
🟩	🟥		
N/A	N/A		

All changed

intra- packages (i…

Classes / Methods

- ClassDiffBuilder
  - print:withAttributes:on: i
  - printPatchSequence:on: i
  - split: i
- CodeDiffBuilder
- DiffElement
- DifferatorSystemSettings
  - differatorSettingsOn: c
- PrettyTex…
- TextDiffBu…
  - attributesOf: i
  - buildDisplayPatch i
  - buildDisplayPatchFrom:to: c
  - buildDisplayPatchFrom:to:inClas
  - buildDisplayPatchFrom:to:inClas
  - buildPatchSequence i
  - buildReferenceMap i

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

class method {instance creation} HenrikSperreJohansen 5/21/2010 01:38

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

Source Code Diff | Protocol/Author

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

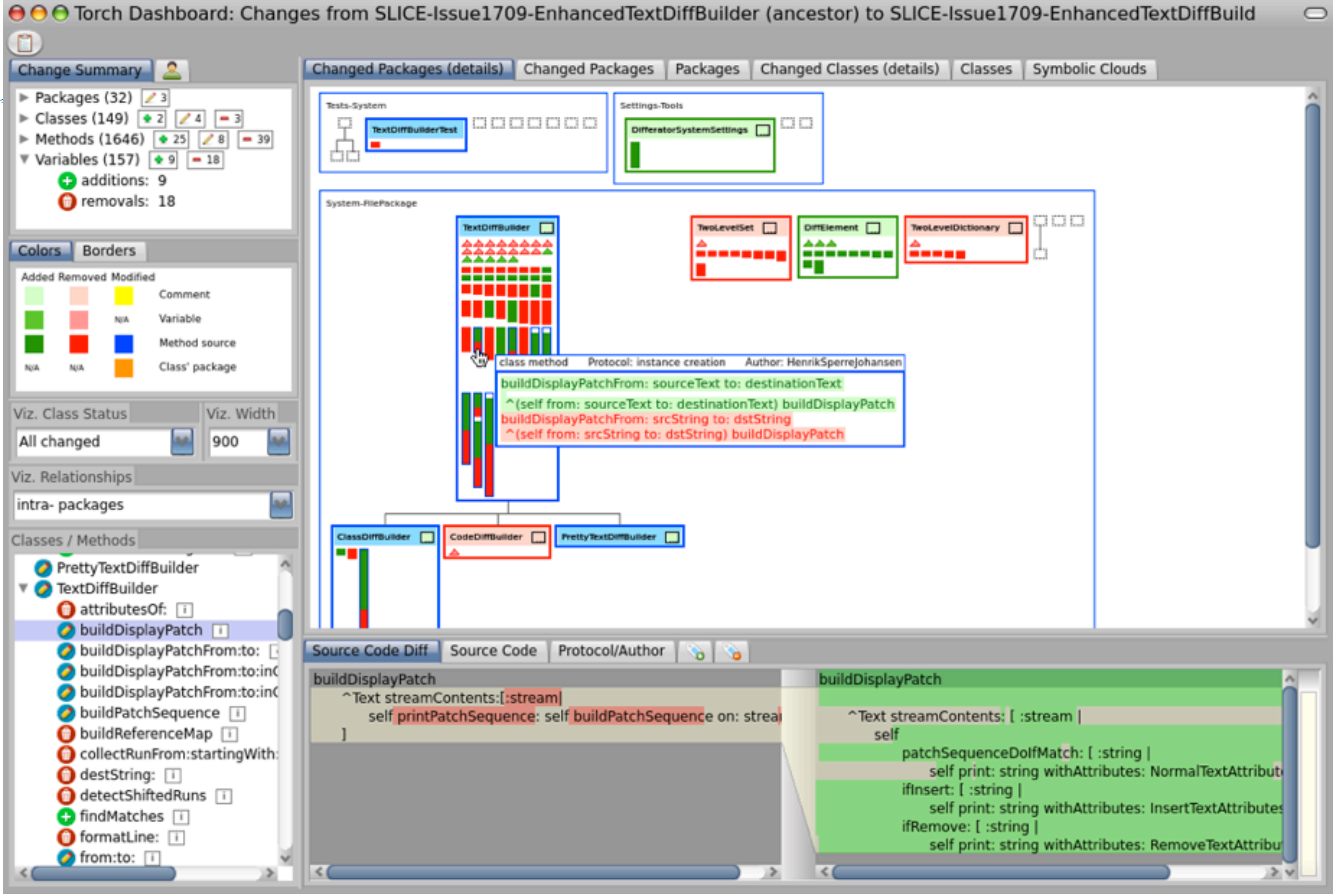
```
buildDisplayPatchFrom: sourceText to: destinationText
    ^(self from: sourceText to: destinationText) buildDisplayPatch
```

Change & Dependency Meta-Model and Analyses (RingC)

History Meta-Model and Analyses (RingH)

Single-delta Change Meta-Model and Analyses (RingS)

Source Code Meta-Model (Ring)



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

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

Added	Removed	Modified	
🟩	🟥	🟨	Comment
🟩	🟥	N/A	Variable
🟩	🟥	🟦	Method source
N/A	N/A	🟧	Class' package

Viz. Class Status: All changed

Viz. Width: 900

Viz. Relationships: intra- packages

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

class method Protocol: instance creation Author: HenrikSperreJohansen

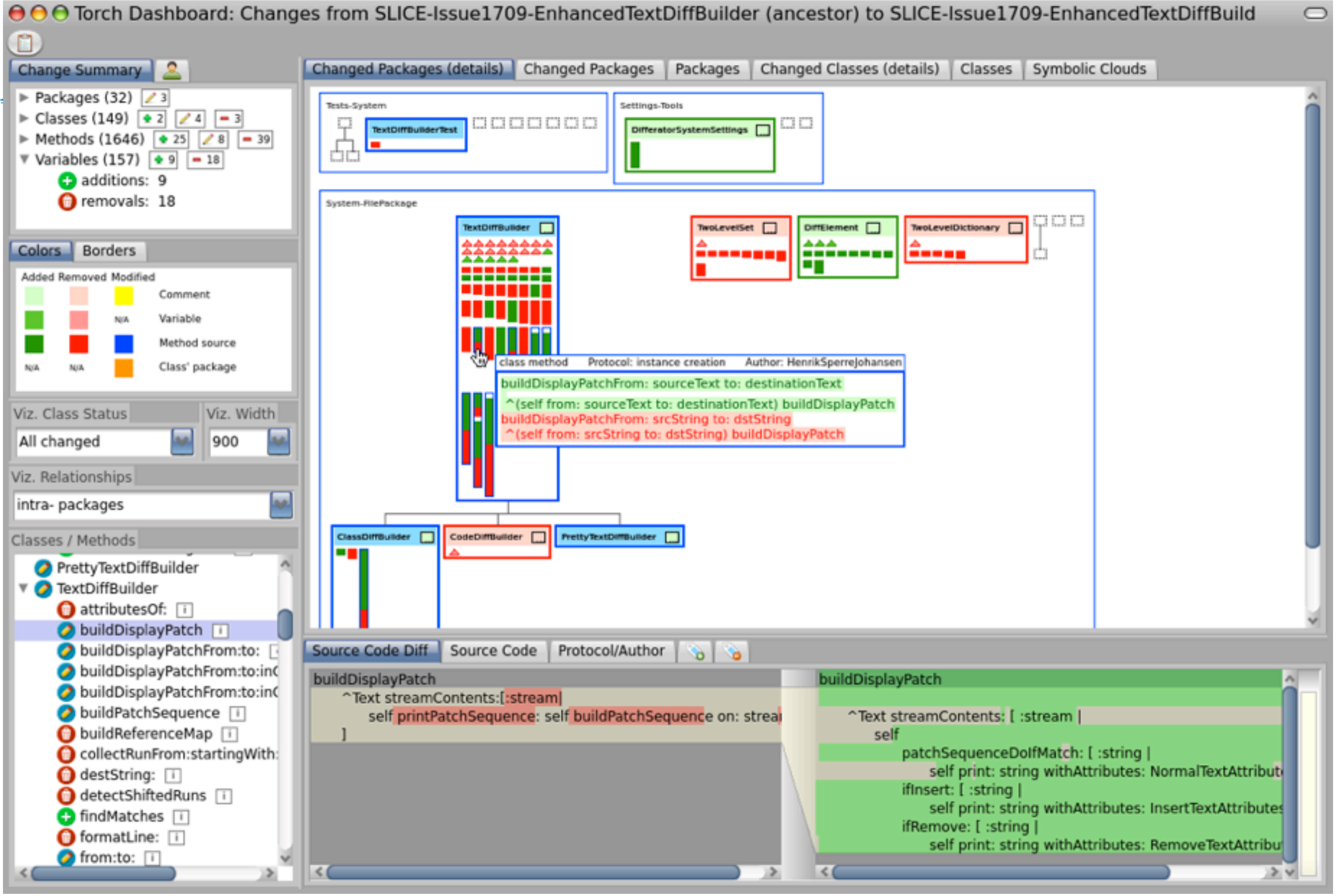
```
buildDisplayPatchFrom: sourceText to: destinationText
 ^(self from: sourceText to: destinationText) buildDisplayPatch
buildDisplayPatchFrom: srcString to: dstString
 ^(self from: srcString to: dstString) buildDisplayPatch
```

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

```
buildDisplayPatch

	^Text streamContents: [ :stream |
		self
			patchSequenceDoIfMatch: [ :string |
				self print: string withAttributes: NormalTextAttribut
			ifInsert: [ :string |
				self print: string withAttributes: InsertTextAttributes
			ifRemove: [ :string |
				self print: string withAttributes: RemoveTextAttribu
```

Torch: Supporting Commit Understanding



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

Change Summary

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

Colors | Borders

Added	Removed	Modified	
🟩	🟥	🟨	Comment
🟩	🟥	N/A	Variable
🟩	🟥	🟦	Method source
N/A	N/A	🟧	Class' package

Viz. Class Status: All changed

Viz. Width: 900

Viz. Relationships: intra- packages

Classes / Methods

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

class method   Protocol: instance creation   Author: HenrikSperreJohansen

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

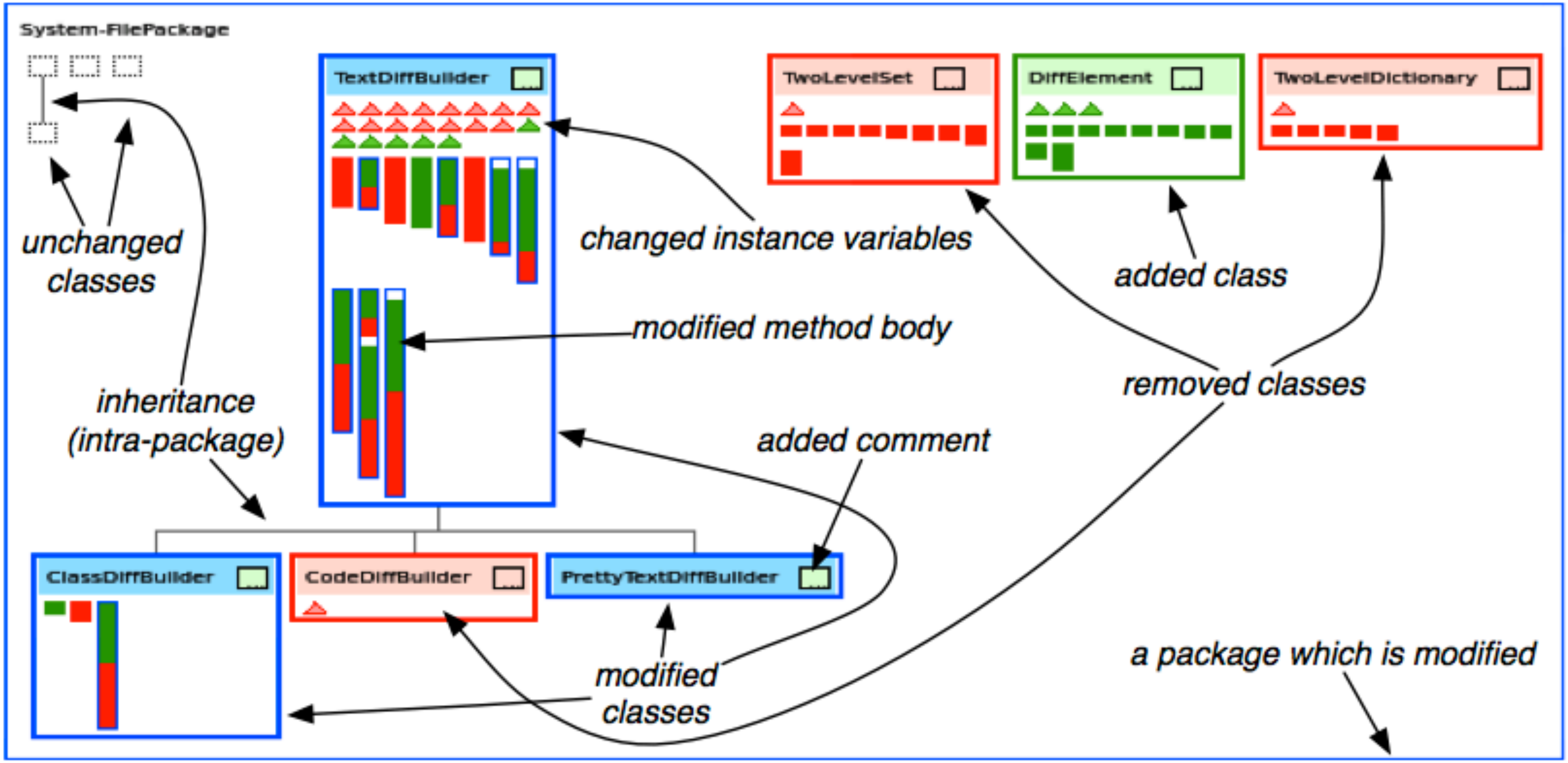
Source Code Diff | Source Code | Protocol/Author

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

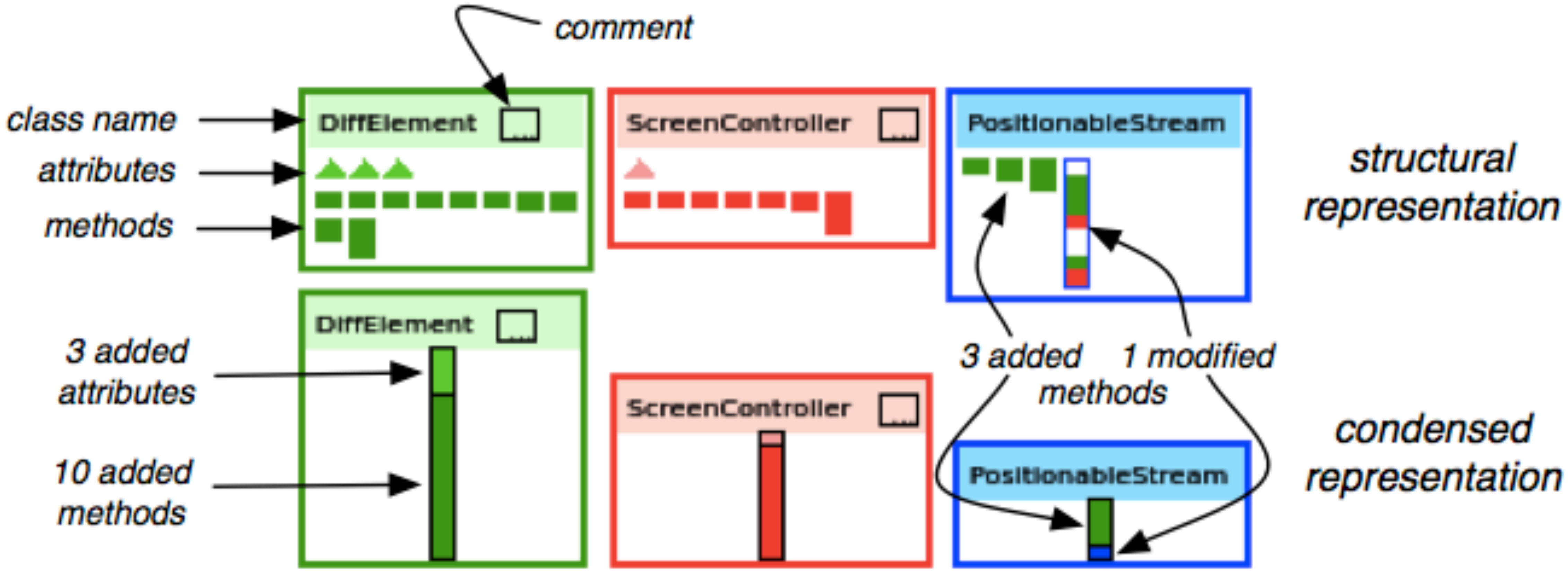
```
buildDisplayPatch

    ^Text streamContents: [ :stream |
        self
            patchSequenceDoIfMatch: [ :string |
                self print: string withAttributes: NormalTextAttribut
            ifInsert: [ :string |
                self print: string withAttributes: InsertTextAttributes
            ifRemove: [ :string |
                self print: string withAttributes: RemoveTextAttribu
```

Package Structure

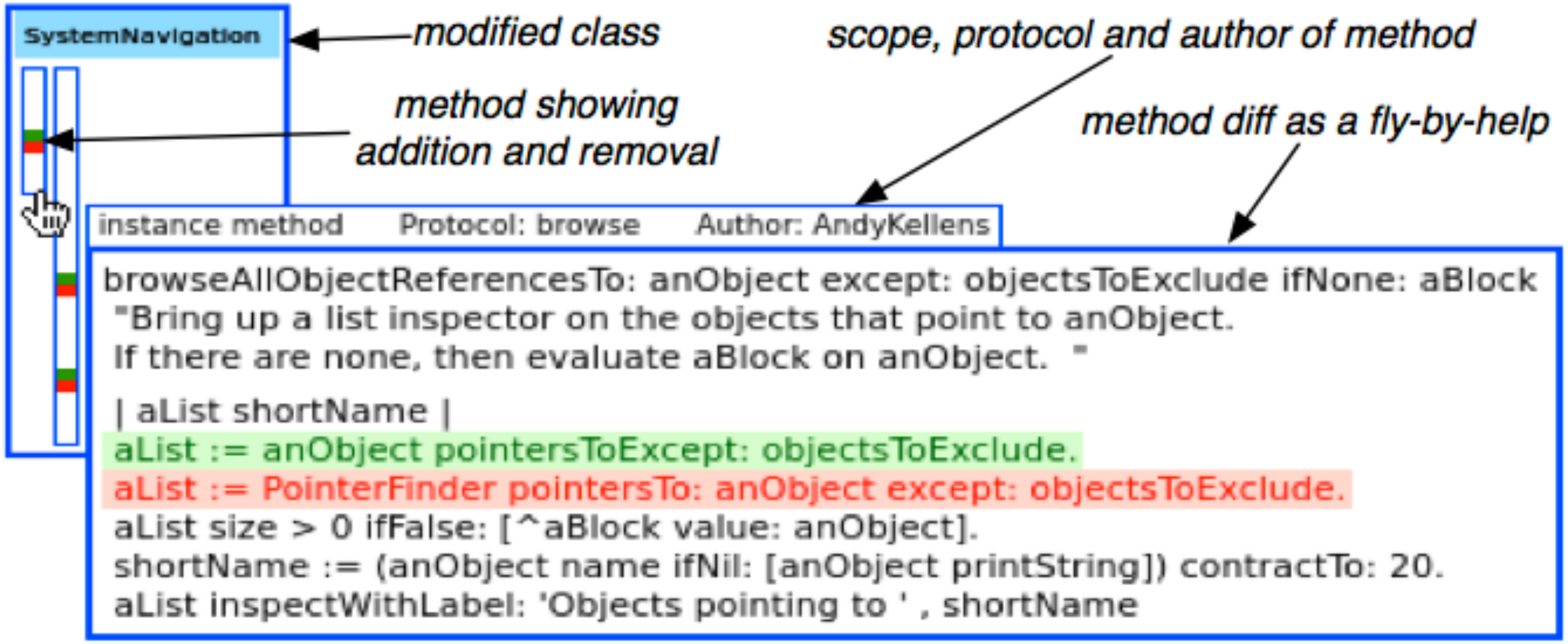


Class Representation



Visual representation of changed classes

Omnipresent source code



modified class

method showing addition and removal

scope, protocol and author of method

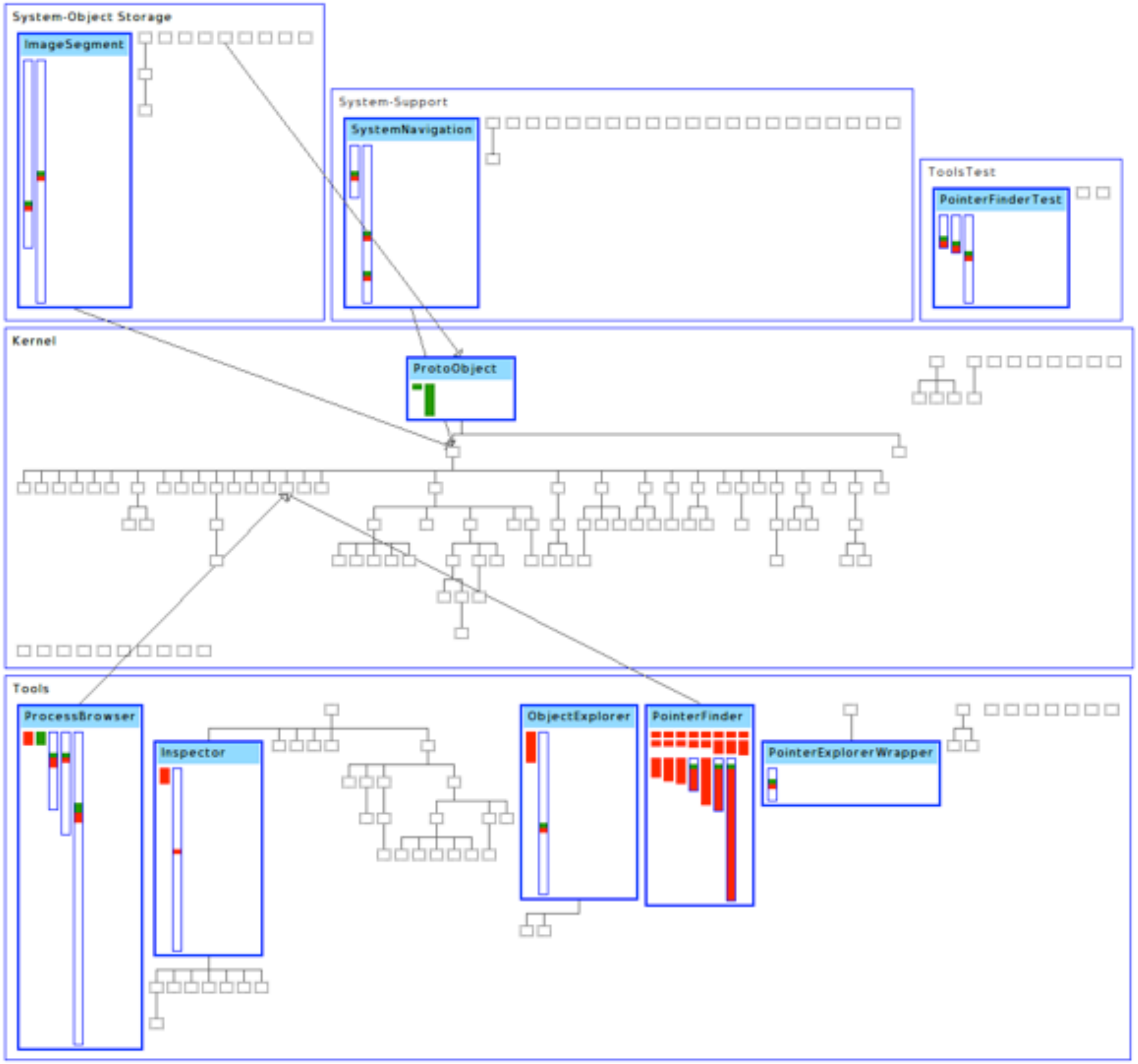
method diff as a fly-by-help

```
browseAllObjectReferencesTo: anObject except: objectsToExclude ifNone: aBlock
 "Bring up a list inspector on the objects that point to anObject.
 If there are none, then evaluate aBlock on anObject.  "

 | aList shortName |
 aList := anObject pointersToExcept: objectsToExclude.
 aList := PointerFinder pointersTo: anObject except: objectsToExclude.
 aList size > 0 ifFalse: [^aBlock value: anObject].
 shortName := (anObject name ifNil: [anObject printString]) contractTo: 20.
 aList inspectWithLabel: 'Objects pointing to ' , shortName
```

Torch: Which changes?

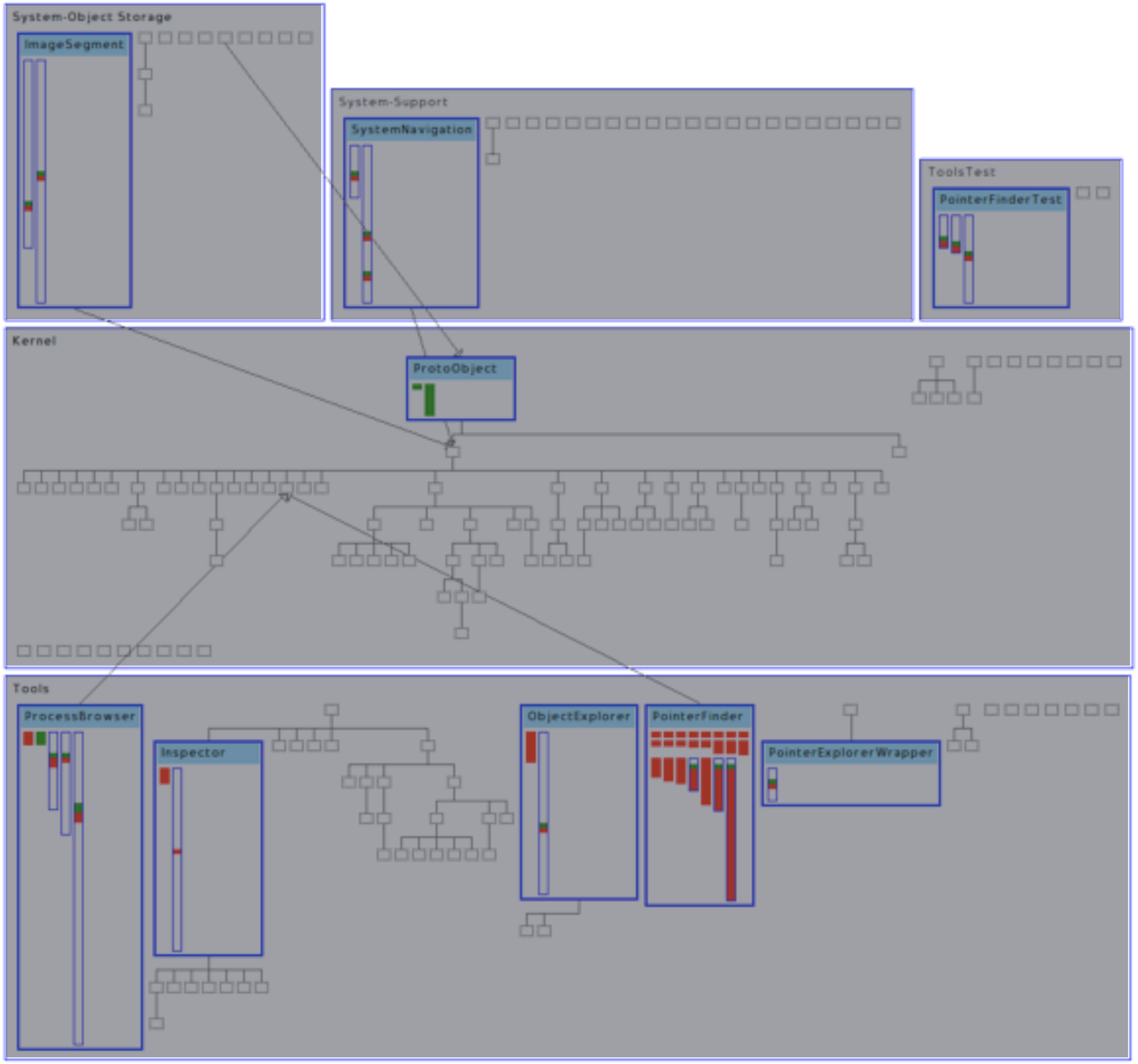
Where? Who? What?



A set of changes, involving:

Torch: Which changes?

Where? Who? What?

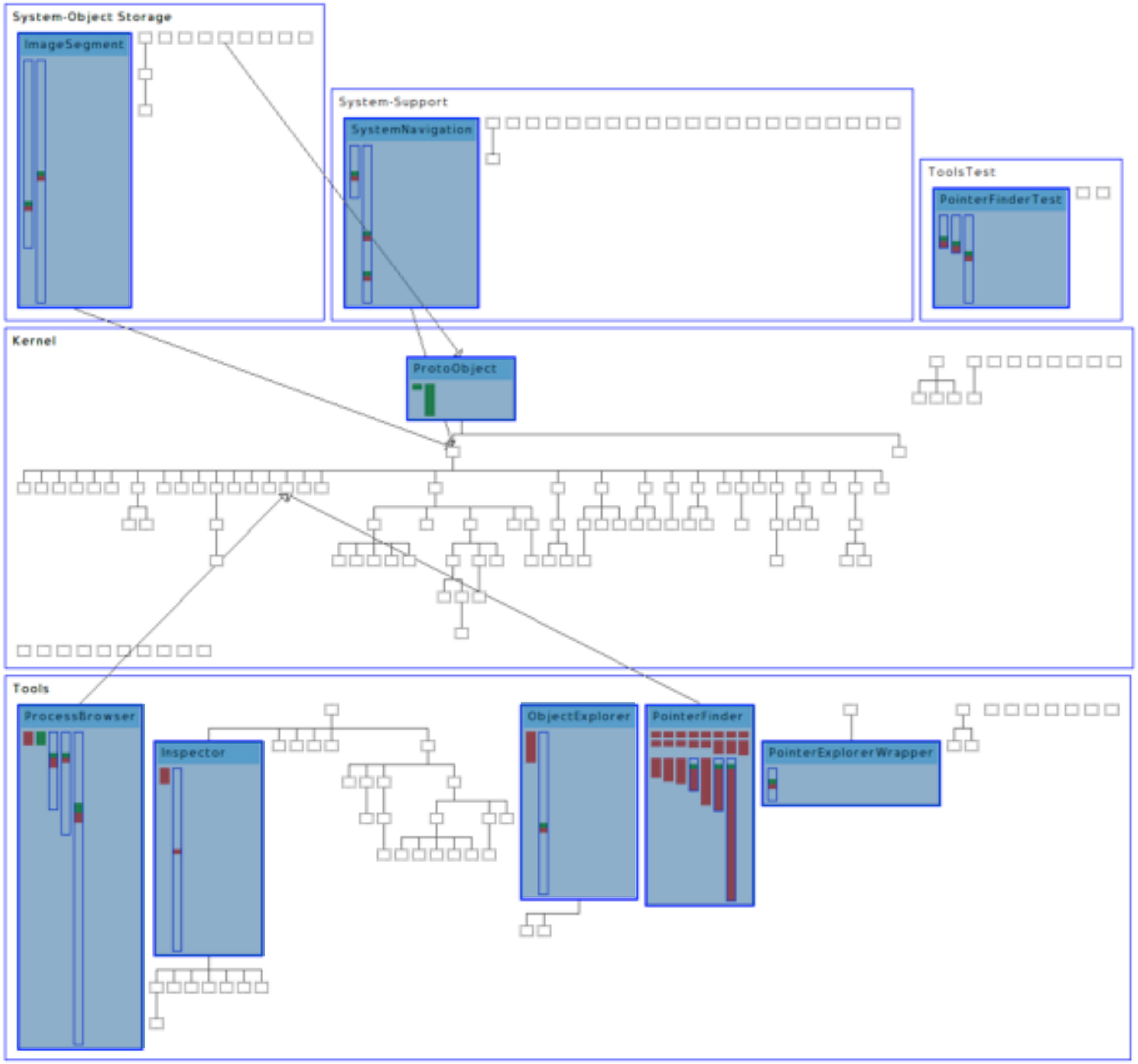


A set of changes, involving:

5 packages,

Torch: Which changes?

Where? Who? What?



A set of changes, involving:

5 packages,

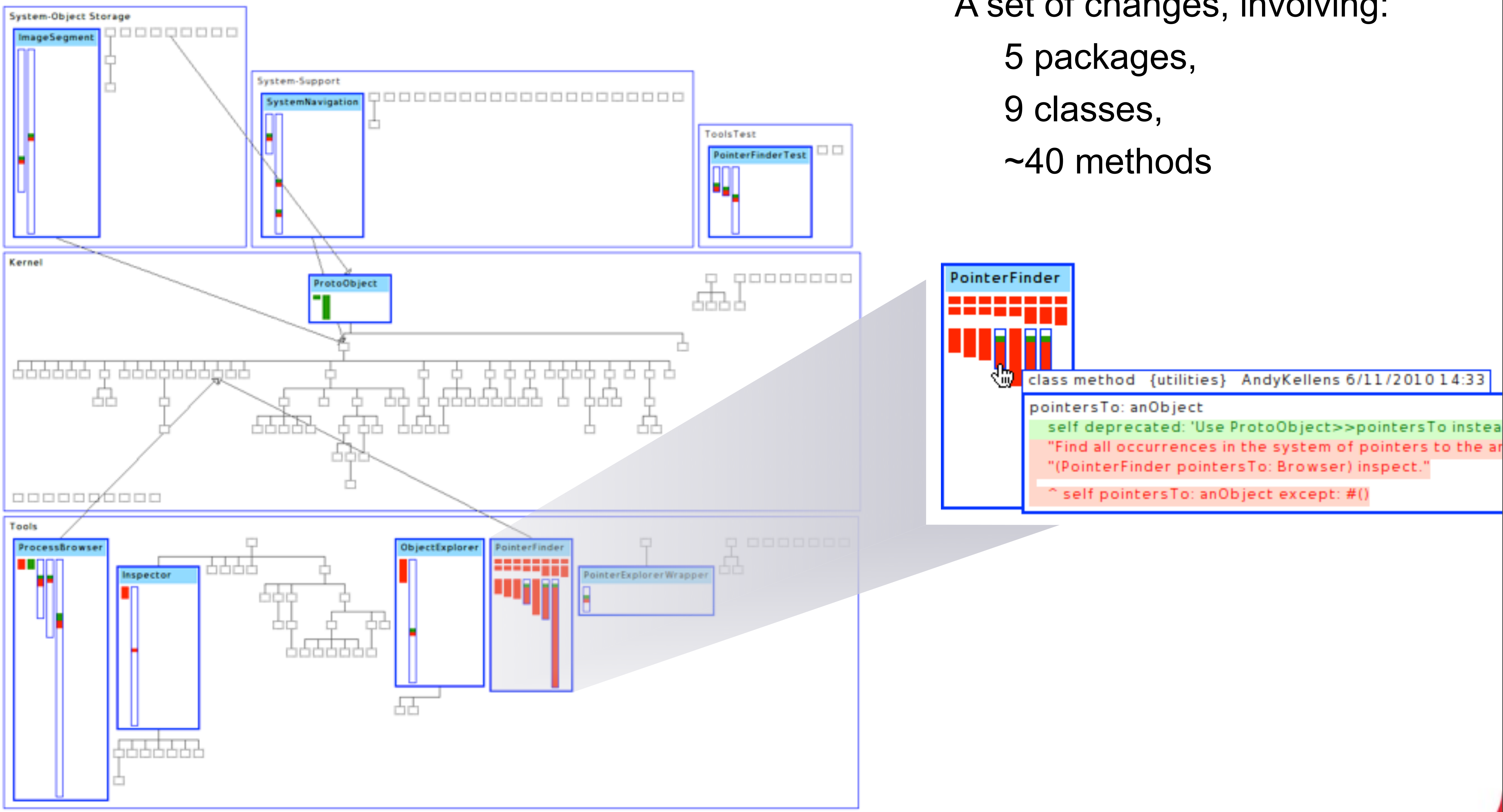
9 classes,

Torch: Which changes?

Where? Who? What?

A set of changes, involving:

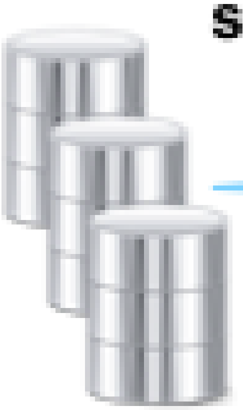
- 5 packages,
- 9 classes,
- ~40 methods



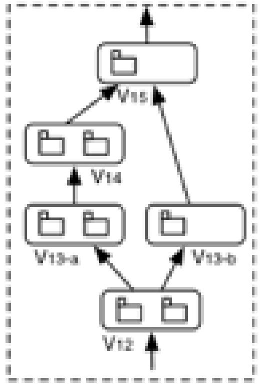
```
class method  {utilities}  AndyKellens 6/11/2010 14:33
pointersTo: anObject
   self deprecated: 'Use ProtoObject>>pointersTo instea
   "Find all occurrences in the system of pointers to the ar
   "(PointerFinder pointersTo: Browser) inspect."
   ^ self pointersTo: anObject except: #()
```

Streams of Changes:

On what other changes does this change depend?

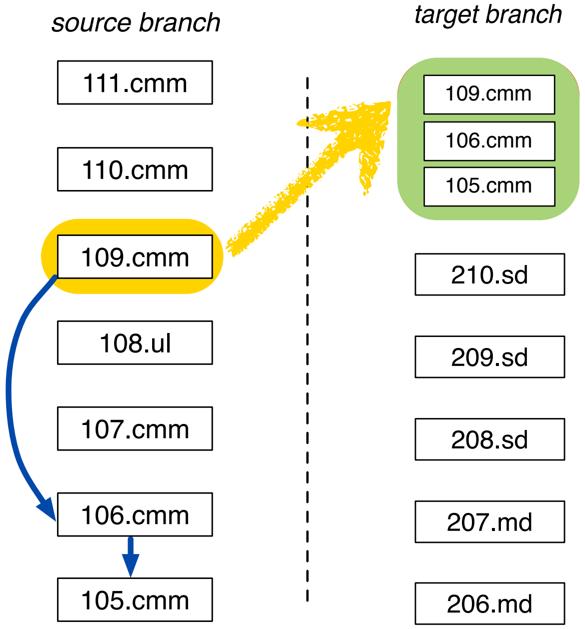


successive versions



common ancestor analysis

dependency analysis



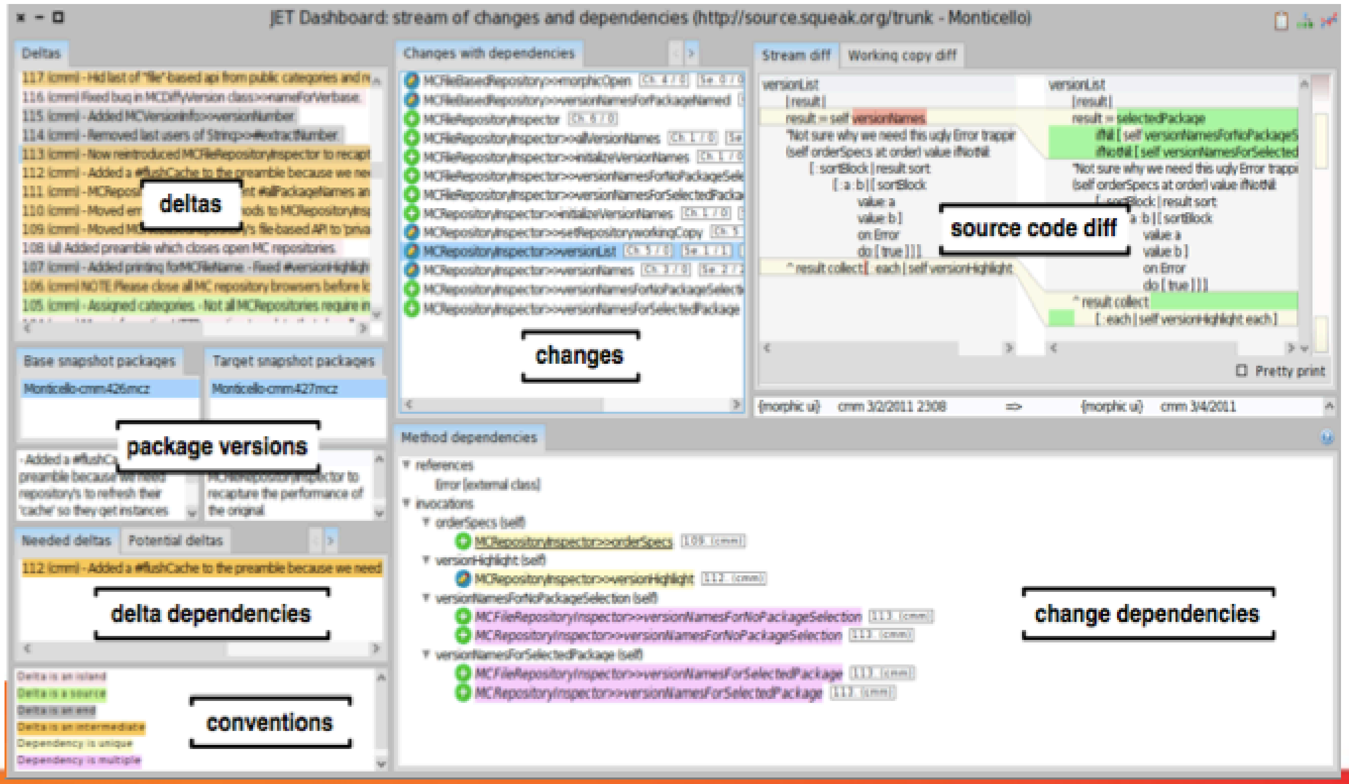
source branch

111.cmm
110.cmm
109.cmm
108.ul
107.cmm
106.cmm
105.cmm

target branch

109.cmm
106.cmm
105.cmm
210.sd
209.sd
208.sd
207.md
206.md

characterization of dependencies and deltas



JET Dashboard: stream of changes and dependencies (http://source.squeak.org/trunk - Monticello)

Deltas

- 117 (cmm) - Hid last of "file" based api from public categories and n
- 116 (cmm) Fixed bug in MCDiffyVersion class>>nameForVerbase.
- 115 (cmm) - Added MCVersionInfo>>versionNumber
- 114 (cmm) - Removed last users of String>>#extractNumber.
- 113 (cmm) - Now reintroduced MCFileRepositoryInspector to recapt
- 112 (cmm) - Added a #flushCache to the preamble because we nee
- 111 (cmm) - MCRepos… …nt #allPackageNames an
- 110 (cmm) - Moved en… …ods to MCRepositoryInsp
- 109 (cmm) - Moved MC… …'s file-based API to 'priva
- 108 (ul) Added preamble which closes open MC repositories.
- 107 (cmm) - Added printing forMCFileName. - Fixed #versionHighligh
- 106 (cmm) NOTE: Please close all MC repository browsers before lo
- 105 (cmm) - Assigned categories. - Not all MCRepositories require in

Base snapshot packages: Monticello-cmm.426.mcz

Target snapshot packages: Monticello-cmm.427.mcz

- Added a #flushC… preamble because we need repository's to refresh their 'cache' so they get instances

…MCFileRepositoryInspector to recapture the performance of the original

Needed deltas | Potential deltas

- 112 (cmm) - Added a #flushCache to the preamble because we need

Delta is an island
Delta is a source
Delta is an end
Delta is an intermediate
Dependency is unique
Dependency is multiple

Changes with dependencies

- MCFileBasedRepository>>morphicOpen [Ch. 4 / 0] [Se. 0 / 0]
- MCFileBasedRepository>>versionNamesForPackageNamed
- MCFileRepositoryInspector [Ch. 5 / 0]
- MCFileRepositoryInspector>>allVersionNames [Ch. 1 / 0] [Se
- MCFileRepositoryInspector>>initializeVersionNames [Ch. 1 / 0]
- MCFileRepositoryInspector>>versionNamesForNoPackageSele
- MCFileRepositoryInspector>>versionNamesForSelectedPacka
- MCRepositoryInspector>>initializeVersionNames [Ch. 1 / 0]
- MCRepositoryInspector>>setRepositoryworkingCopy [Ch. 5
- MCRepositoryInspector>>versionList [Ch. 5 / 0] [Se. 1 / 1]
- MCRepositoryInspector>>versionNames [Ch. 3 / 0] [Se. 2 / 2
- MCRepositoryInspector>>versionNamesForNoPackageSelecti
- MCRepositoryInspector>>versionNamesForSelectedPackage

Stream diff | Working copy diff

```
versionList
	| result |
	result := self versionNames.
	"Not sure why we need this ugly Error trappi
	(self orderSpecs at: order) value ifNotNil:
		[ :sortBlock | result sort:
			[ :a :b | [ sortBlock
				value: a
				value: b ]
				on: Error
				do: [ true ] ] ].
	^ result collect: [ :each | self versionHighlight:
```

```
versionList
	| result |
	result := selectedPackage
		ifNil: [ self versionNamesForNoPackageS
		ifNotNil: [ self versionNamesForSelected
	"Not sure why we need this ugly Error trappi
	(self orderSpecs at: order) value ifNotNil:
		[ :sortBlock | result sort:
			[ :a :b | [ sortBlock
				value: a
				value: b ]
				on: Error
				do: [ true ] ] ].
	^ result collect:
		[ :each | self versionHighlight: each ]
```

□ Pretty print

(morphic ui) cmm 3/2/2011 23:08 => (morphic ui) cmm 3/4/2011

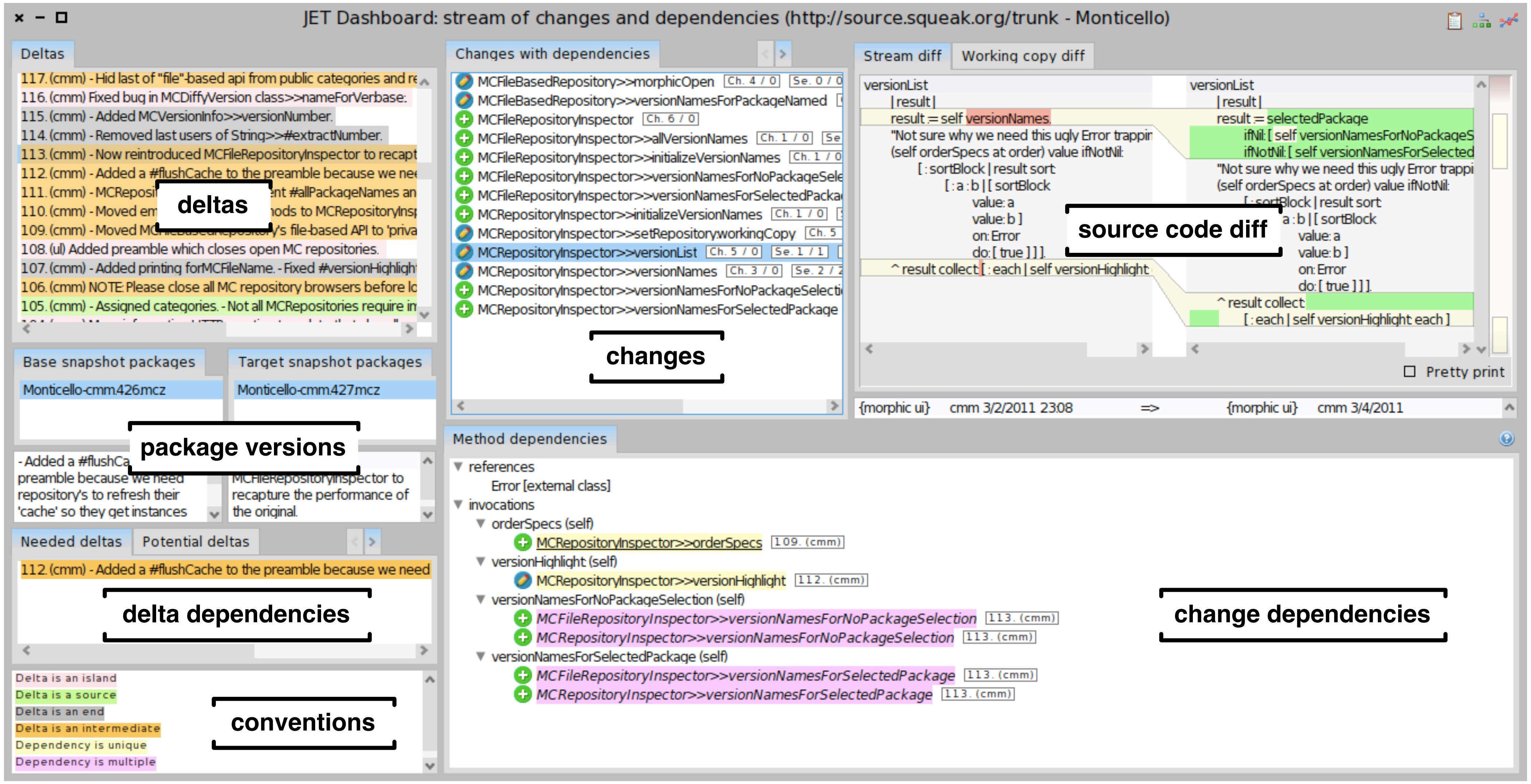
Method dependencies

- references
  - Error (external class)
- invocations
  - orderSpecs (self)
    - MCRepositoryInspector>>orderSpecs [109 (cmm)]
  - versionHighlight (self)
    - MCRepositoryInspector>>versionHighlight [112 (cmm)]
  - versionNamesForNoPackageSelection (self)
    - MCFileRepositoryInspector>>versionNamesForNoPackageSelection [113 (cmm)]
    - MCRepositoryInspector>>versionNamesForNoPackageSelection [113 (cmm)]
  - versionNamesForSelectedPackage (self)
    - MCFileRepositoryInspector>>versionNamesForSelectedPackage [113 (cmm)]
    - MCRepositoryInspector>>versionNamesForSelectedPackage [113 (cmm)]

The JET Tools

Characterizing Streams of Changes

The JET Tools



JET Dashboard: stream of changes and dependencies (http://source.squeak.org/trunk - Monticello)

117. (cmm) - Hid last of "file"-based api from public categories and re
116. (cmm) Fixed bug in MCDiffyVersion class>>nameForVerbase:
115. (cmm) - Added MCVersionInfo>>versionNumber.
114. (cmm) - Removed last users of String>>#extractNumber.
113. (cmm) - Now reintroduced MCFileRepositoryInspector to recapt
112. (cmm) - Added a #flushCache to the preamble because we nee
111. (cmm) - MCReposi ent #allPackageNames an
110. (cmm) - Moved em hods to MCRepositoryInsp
109. (cmm) - Moved MC 's file-based API to 'priva
108. (ul) Added preamble which closes open MC repositories.
107. (cmm) - Added printing forMCFileName. - Fixed #versionHighlight
106. (cmm) NOTE: Please close all MC repository browsers before lo
105. (cmm) - Assigned categories. - Not all MCRepositories require in

MCFileBasedRepository>>morphicOpen Ch. 4 / 0 Se. 0 / 0
MCFileBasedRepository>>versionNamesForPackageNamed
MCFileRepositoryInspector Ch. 6 / 0
MCFileRepositoryInspector>>allVersionNames Ch. 1 / 0 Se
MCFileRepositoryInspector>>initializeVersionNames Ch. 1 / 0
MCFileRepositoryInspector>>versionNamesForNoPackageSele
MCFileRepositoryInspector>>versionNamesForSelectedPacka
MCRepositoryInspector>>initializeVersionNames Ch. 1 / 0
MCRepositoryInspector>>setRepository:workingCopy Ch. 5
MCRepositoryInspector>>versionList Ch. 5 / 0 Se. 1 / 1
MCRepositoryInspector>>versionNames Ch. 3 / 0 Se. 2 / 2
MCRepositoryInspector>>versionNamesForNoPackageSelecti
MCRepositoryInspector>>versionNamesForSelectedPackage

```
versionList
	| result |
	result := self versionNames.
	"Not sure why we need this ugly Error trappin
	(self orderSpecs at: order) value ifNotNil:
		[ :sortBlock | result sort:
			[ :a :b | [ sortBlock
				value: a
				value: b ]
				on: Error
				do: [ true ] ] ].
	^ result collect: [ :each | self versionHighlight:
```

```
versionList
	| result |
	result := selectedPackage
		ifNil: [ self versionNamesForNoPackageS
		ifNotNil: [ self versionNamesForSelected
	"Not sure why we need this ugly Error trappi
	(self orderSpecs at: order) value ifNotNil:
		[ :sortBlock | result sort:
			[ :a :b | [ sortBlock
				value: a
				value: b ]
				on: Error
				do: [ true ] ] ].
	^ result collect:
		[ :each | self versionHighlight: each ]
```

{morphic ui} cmm 3/2/2011 23:08 => {morphic ui} cmm 3/4/2011

Monticello-cmm.426.mcz

Monticello-cmm.427.mcz

- Added a #flushCa preamble because we need repository's to refresh their 'cache' so they get instances

MCFileRepositoryInspector to recapture the performance of the original.

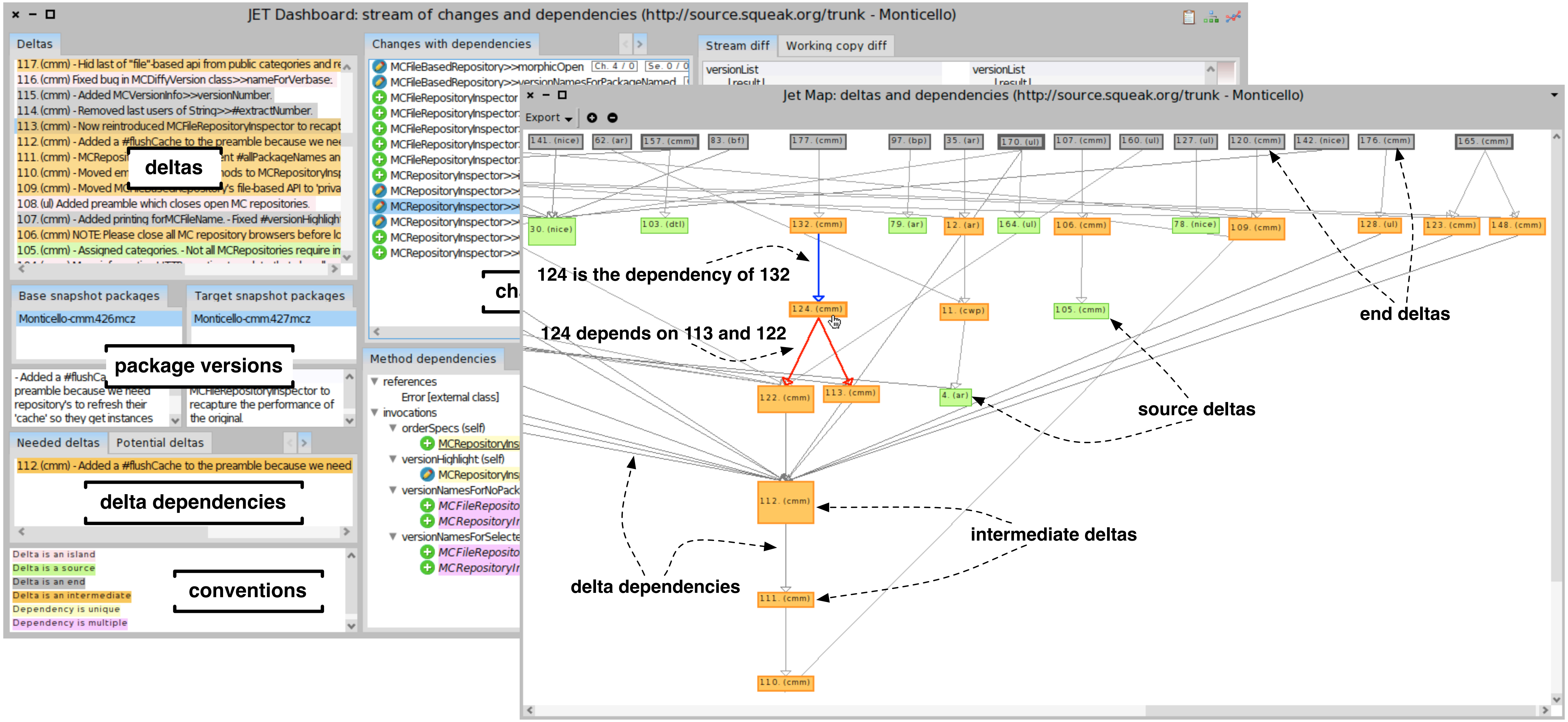
112. (cmm) - Added a #flushCache to the preamble because we need

Delta is an island
Delta is a source
Delta is an end
Delta is an intermediate
Dependency is unique
Dependency is multiple

```
▼ references
    Error [external class]
▼ invocations
  ▼ orderSpecs (self)
      MCRepositoryInspector>>orderSpecs  109. (cmm)
  ▼ versionHighlight: (self)
      MCRepositoryInspector>>versionHighlight:  112. (cmm)
  ▼ versionNamesForNoPackageSelection (self)
      MCFileRepositoryInspector>>versionNamesForNoPackageSelection  113. (cmm)
      MCRepositoryInspector>>versionNamesForNoPackageSelection  113. (cmm)
  ▼ versionNamesForSelectedPackage (self)
      MCFileRepositoryInspector>>versionNamesForSelectedPackage  113. (cmm)
      MCRepositoryInspector>>versionNamesForSelectedPackage  113. (cmm)
```

The JET Tools

Characterizing Streams of Changes



JET Dashboard: stream of changes and dependencies (http://source.squeak.org/trunk - Monticello)

Deltas

117. (cmm) - Hid last of "file"-based api from public categories and re
116. (cmm) Fixed bug in MCDiffyVersion class>>nameForVerbase:
115. (cmm) - Added MCVersionInfo>>versionNumber.
114. (cmm) - Removed last users of String>>#extractNumber.
113. (cmm) - Now reintroduced MCFileRepositoryInspector to recapt
112. (cmm) - Added a #flushCache to the preamble because we nee
111. (cmm) - MCReposi ent #allPackageNames an
110. (cmm) - Moved em nods to MCRepositoryInsp
109. (cmm) - Moved MC y's file-based API to 'priva
108. (ul) Added preamble which closes open MC repositories.
107. (cmm) - Added printing forMCFileName. - Fixed #versionHighligh
106. (cmm) NOTE: Please close all MC repository browsers before lo
105. (cmm) - Assigned categories. - Not all MCRepositories require in

Base snapshot packages

Monticello-cmm.426.mcz

Target snapshot packages

Monticello-cmm.427.mcz

- Added a #flushCa
preamble because we need
repository's to refresh their
'cache' so they get instances

MCFileRepositoryInspector to
recapture the performance of
the original.

Needed deltas | Potential deltas

112. (cmm) - Added a #flushCache to the preamble because we need

Delta is an island
Delta is a source
Delta is an end
Delta is an intermediate
Dependency is unique
Dependency is multiple

Changes with dependencies

MCFileBasedRepository>>morphicOpen Ch. 4 / 0 Se. 0 / 0
MCFileBasedRepository>>versionNamesForPackageNamed
MCFileRepositoryInspector
MCFileRepositoryInspector
MCFileRepositoryInspector
MCFileRepositoryInspector
MCFileRepositoryInspector
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>

Method dependencies

- references
  - Error [external class]
- invocations
  - orderSpecs (self)
    - MCRepositoryIns
  - versionHighlight (self)
    - MCRepositoryIns
  - versionNamesForNoPack
    - MCFileReposito
    - MCRepositoryIn
  - versionNamesForSelecte
    - MCFileReposito
    - MCRepositoryIn

Stream diff | Working copy diff

versionList
[result]

versionList
[result]

Jet Map: deltas and dependencies (http://source.squeak.org/trunk - Monticello)

deltas

package versions

delta dependencies

conventions

ch

124 is the dependency of 132

124 depends on 113 and 122

end deltas

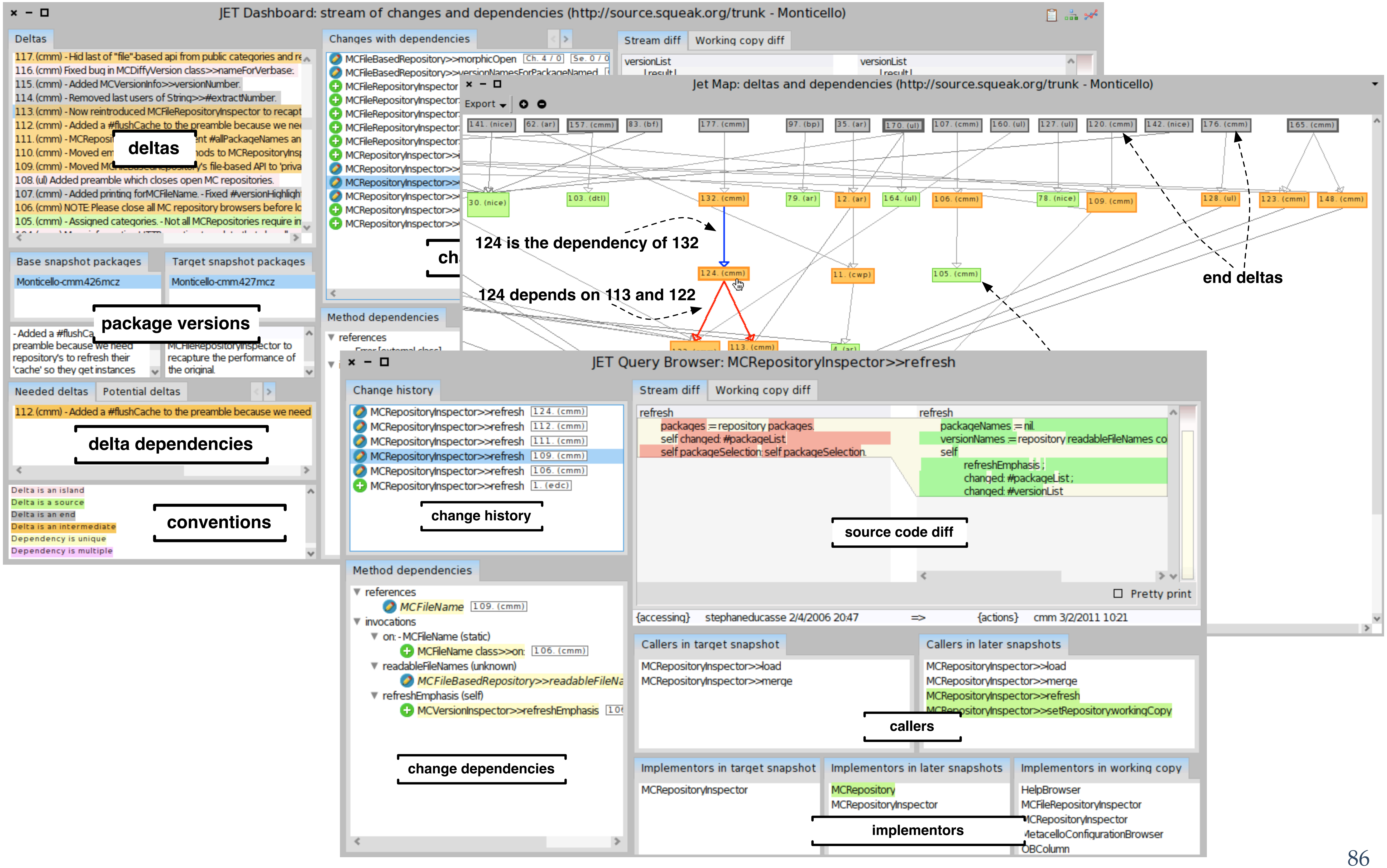
source deltas

intermediate deltas

delta dependencies

The JET Tools

Characterizing Streams of Changes



deltas

117. (cmm) - Hid last of "file"-based api from public categories and re
116. (cmm) Fixed bug in MCDiffyVersion class>>nameForVerbase:
115. (cmm) - Added MCVersionInfo>>versionNumber.
114. (cmm) - Removed last users of String>>#extractNumber.
113. (cmm) - Now reintroduced MCFileRepositoryInspector to recapt
112. (cmm) - Added a #flushCache to the preamble because we nee
111. (cmm) - MCReposi… …nt #allPackageNames an
110. (cmm) - Moved em… …ods to MCRepositoryInsp
109. (cmm) - Moved MC… …'s file-based API to 'priva
108. (ul) Added preamble which closes open MC repositories.
107. (cmm) - Added printing forMCFileName. - Fixed #versionHighligh
106. (cmm) NOTE: Please close all MC repository browsers before lo
105. (cmm) - Assigned categories. - Not all MCRepositories require in

package versions

Monticello-cmm.426.mcz

Monticello-cmm.427.mcz

- Added a #flushCa… preamble because we need repository's to refresh their 'cache' so they get instances

…MCFileRepositoryInspector to recapture the performance of the original.

delta dependencies

112. (cmm) - Added a #flushCache to the preamble because we need

conventions

- Delta is an island
- Delta is a source
- Delta is an end
- Delta is an intermediate
- Dependency is unique
- Dependency is multiple

MCFileBasedRepository>>morphicOpen Ch. 4 / 0 Se. 0 / 0
MCFileBasedRepository>>versionNamesForPackageNamed
MCFileRepositoryInspector
MCFileRepositoryInspector
MCFileRepositoryInspector
MCFileRepositoryInspector
MCFileRepositoryInspector
MCFileRepositoryInspector
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>
MCRepositoryInspector>>

ch

versionList
|result|

versionList
|result|

124 is the dependency of 132

124 depends on 113 and 122

end deltas

change history

MCRepositoryInspector>>refresh 124. (cmm)
MCRepositoryInspector>>refresh 112. (cmm)
MCRepositoryInspector>>refresh 111. (cmm)
MCRepositoryInspector>>refresh 109. (cmm)
MCRepositoryInspector>>refresh 106. (cmm)
MCRepositoryInspector>>refresh 1. (edc)

change dependencies

- references
  - MCFileName 109. (cmm)
- invocations
  - on: - MCFileName (static)
    - MCFileName class>>on: 106. (cmm)
  - readableFileNames (unknown)
    - MCFileBasedRepository>>readableFileNa
  - refreshEmphasis (self)
    - MCVersionInspector>>refreshEmphasis 106

source code diff

```
refresh
    packages := repository packages.
    self changed: #packageList.
    self packageSelection: self packageSelection.
```

```
refresh
    packageNames := nil.
    versionNames := repository readableFileNames co
    self
        refreshEmphasis ;
        changed: #packageList ;
        changed: #versionList
```

{accessing} stephaneducasse 2/4/2006 20:47 => {actions} cmm 3/2/2011 10:21

callers

MCRepositoryInspector>>load
MCRepositoryInspector>>merge

MCRepositoryInspector>>load
MCRepositoryInspector>>merge
MCRepositoryInspector>>refresh
MCRepositoryInspector>>setRepository:workingCopy:

implementors

MCRepositoryInspector

MCRepository
MCRepositoryInspector

HelpBrowser
MCFileRepositoryInspector
MCRepositoryInspector
MetacelloConfigurationBrowser
OBColumn

Maintenance is important and Fun ;)

- http://rmod.lille.inria.fr
- http://www.synectique.eu