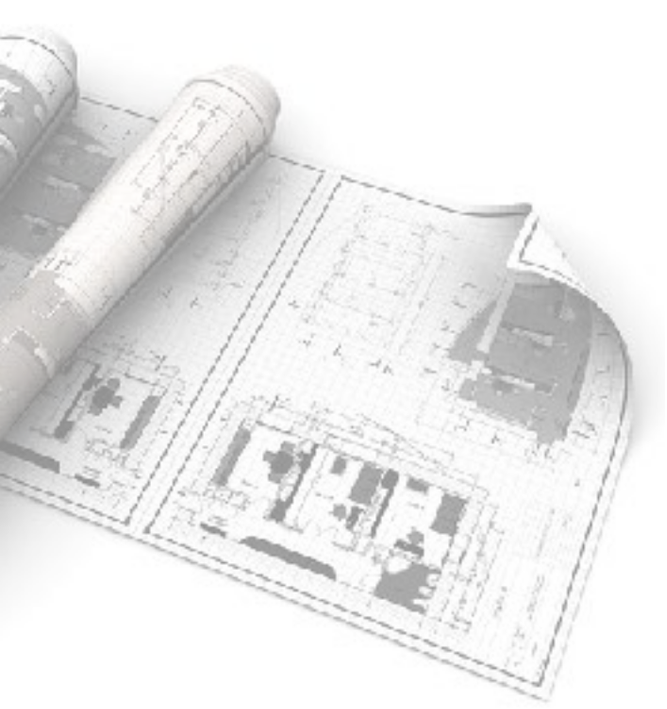
*Thesis Defense*

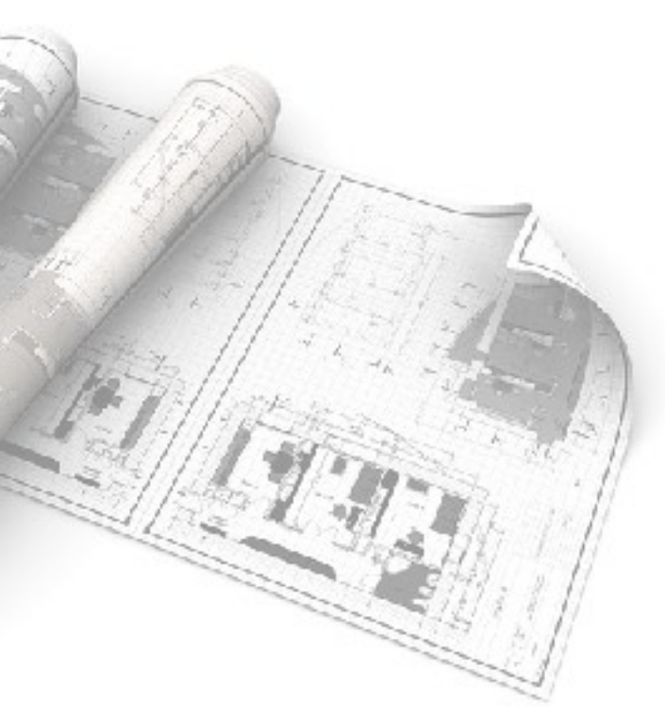
# A Unified Approach to **Architecture Conformance Checking**

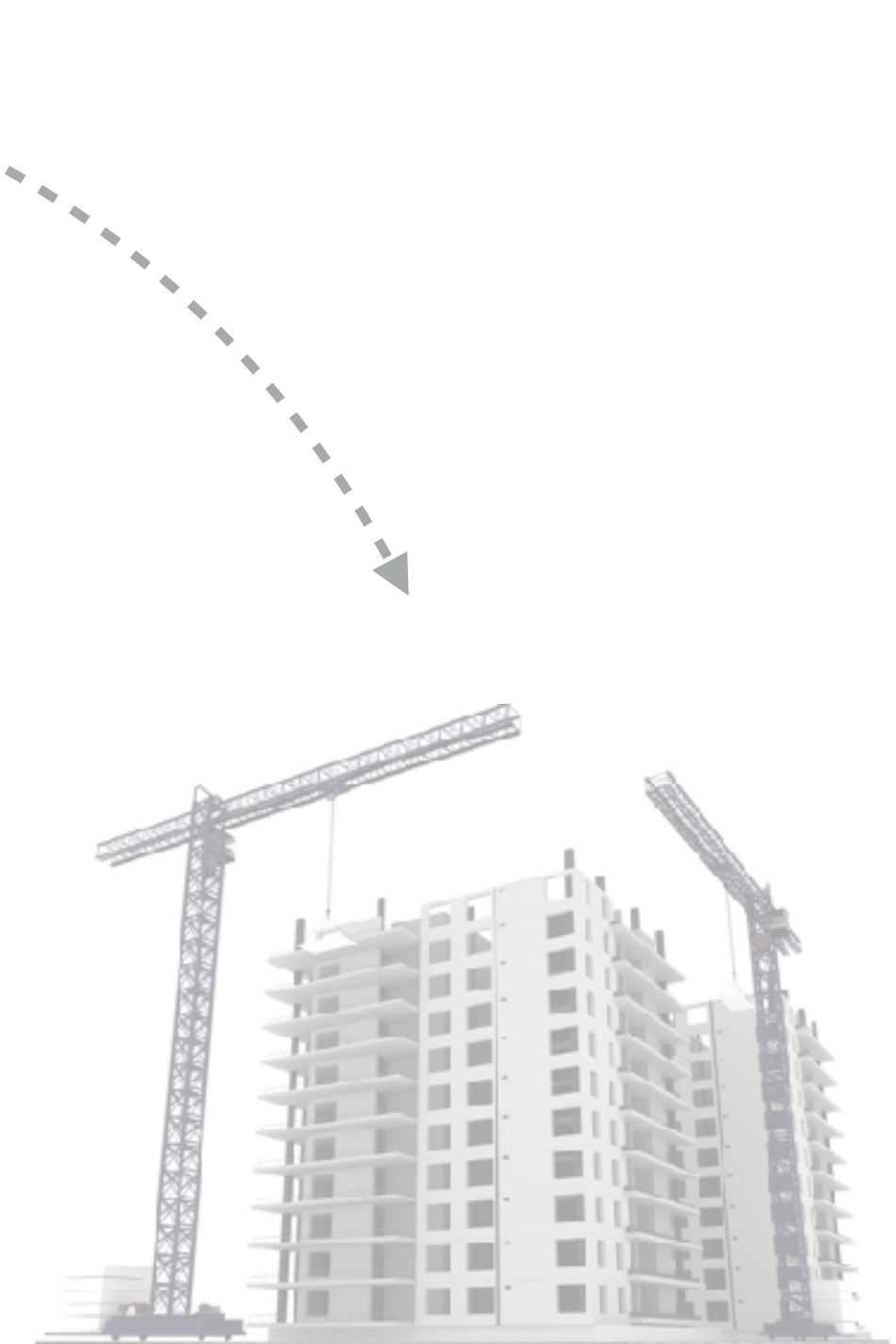
**Andrea Caracciolo**

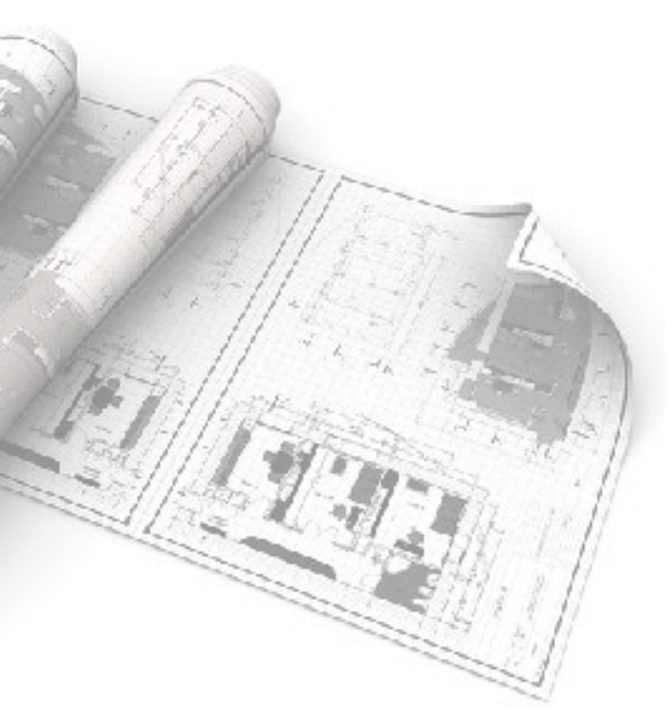
http://scg.unibe.ch



*“The code is the truth,*
*but it is not the whole truth”*
*— Grady Booch*








W
DOC


W
DOC


JMeter
FxCop
JDepend
Pmd
DON'T SHOOT THE MESSENGER


W
DOC


JMeter
FxCop
JDepend
Pmd
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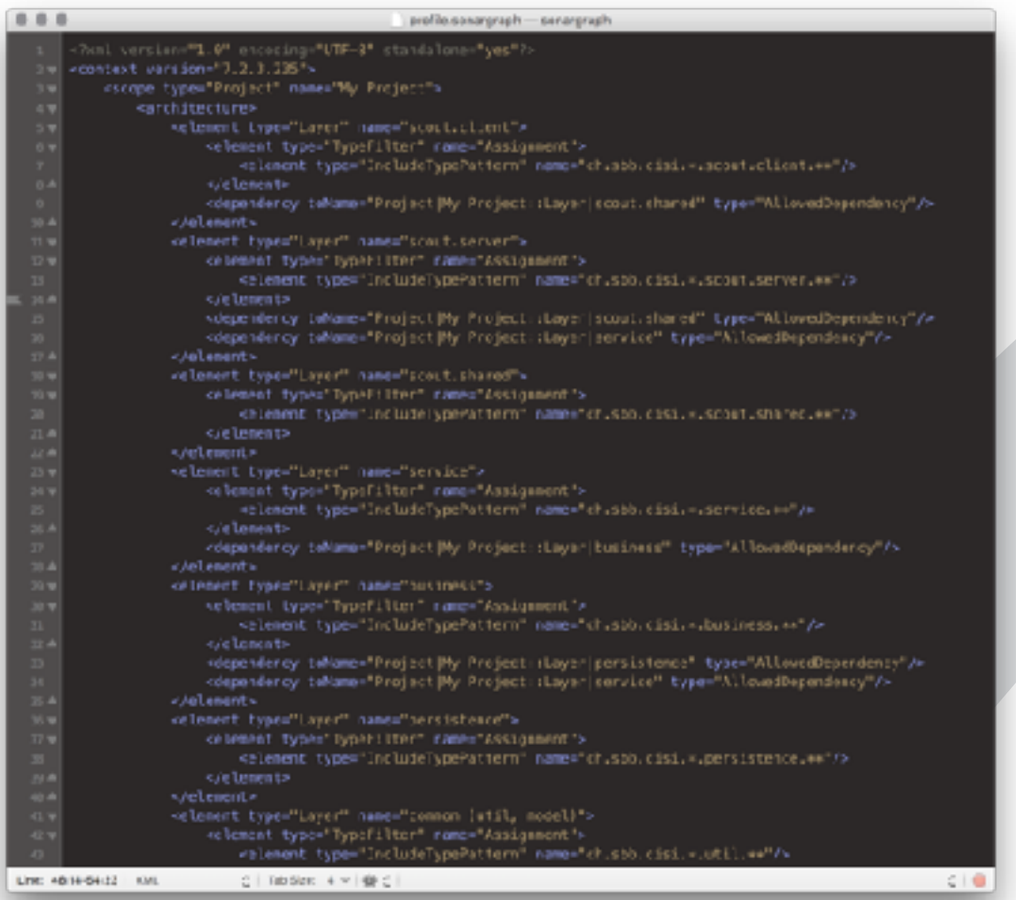
profile:sonargraph — sonargraph
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<context version="9.2.1.135">
<scope type="Project" name="My Project">
<architecture>
<element type="Layer" name="scout.client">
<element type="TypeFilter" name="Assignment">
<element type="includeTypePattern" name="ch.sbb.cisi.*.scout.client.**"/>
</element>
<dependency toName="Project:My Project::Layer:scout.shared" type="AllowedDependency"/>
</element>
<element type="Layer" name="scout.server">
<element type="TypeFilter" name="Assignment">
<element type="includeTypePattern" name="ch.sbb.cisi.*.scout.server.**"/>
</element>
<dependency toName="Project:My Project::Layer:scout.shared" type="AllowedDependency"/>
<dependency toName="Project:My Project::Layer:service" type="AllowedDependency"/>
</element>
<element type="Layer" name="scout.shared">
<element type="TypeFilter" name="Assignment">
<element type="includeTypePattern" name="ch.sbb.cisi.*.scout.shared.**"/>
</element>
</element>
<element type="Layer" name="service">
<element type="TypeFilter" name="Assignment">
<element type="includeTypePattern" name="ch.sbb.cisi.*.service.**"/>
</element>
<dependency toName="Project:My Project::Layer:business" type="AllowedDependency"/>
</element>
<element type="Layer" name="business">
<element type="TypeFilter" name="Assignment">
<element type="includeTypePattern" name="ch.sbb.cisi.*.business.**"/>
</element>
<dependency toName="Project:My Project::Layer:persistence" type="AllowedDependency"/>
<dependency toName="Project:My Project::Layer:service" type="AllowedDependency"/>
</element>
<element type="Layer" name="persistence">
<element type="TypeFilter" name="Assignment">
<element type="includeTypePattern" name="ch.sbb.cisi.*.persistence.**"/>
</element>
</element>
<element type="Layer" name="common (util, model)">
<element type="TypeFilter" name="Assignment">
<element type="includeTypePattern" name="ch.sbb.cisi.*.util.**"/>
Line: 40 Column: 22
XML
Tab Size: 4


W
DOC


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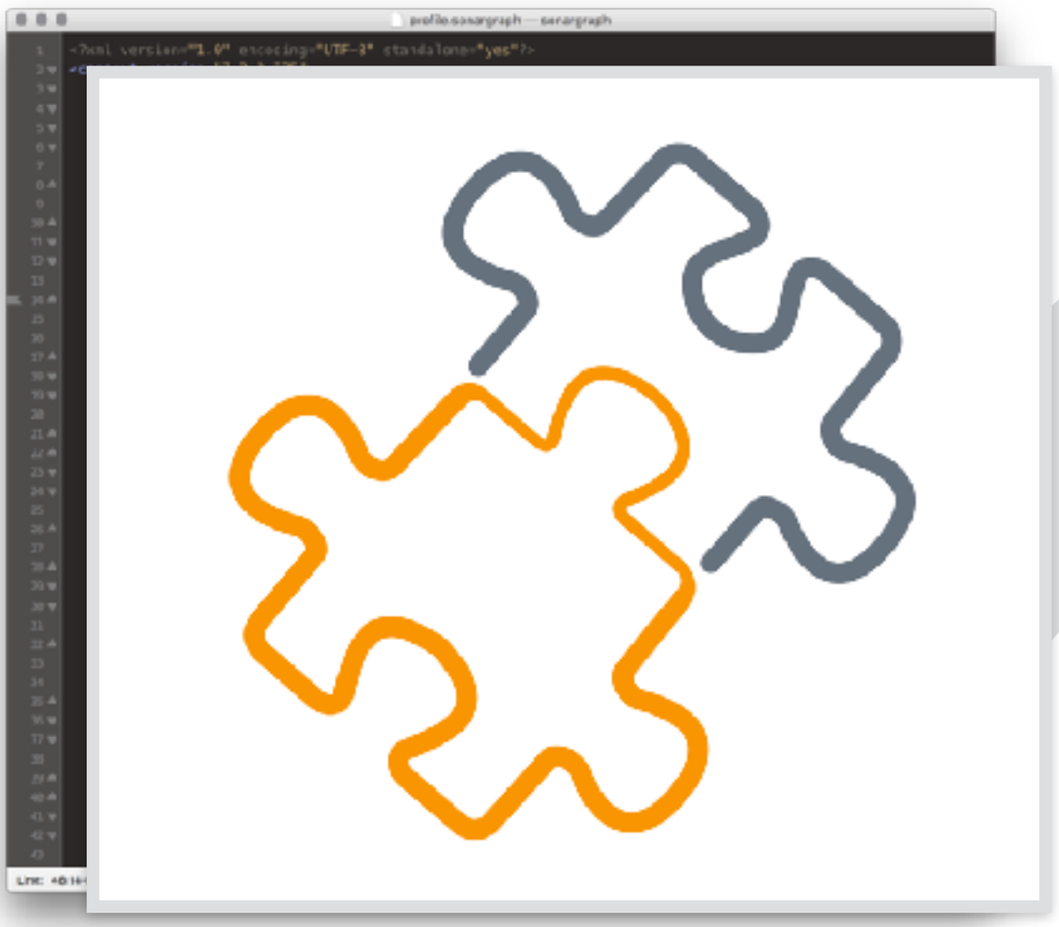


W
DOC


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RULES
1. YOU CAN....
2. YOU CAN'T..
3. YOU CAN...
4. YOU CAN'T


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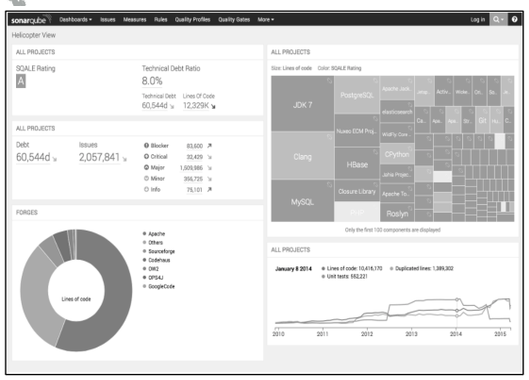
sonarqube
Dashboards
Issues
Measures
Rules
Quality Profiles
Quality Gates
More
Log in
Helicopter View
ALL PROJECTS
SQALE Rating
A
Technical Debt Ratio
8.0%
Technical Debt
60,544d
Lines Of Code
12,329K
ALL PROJECTS
Debt
60,544d
Issues
2,057,841
Blocker 83,600
Critical 32,429
Major 1,509,986
Minor 356,725
Info 75,101
FORGES
Apache
Others
Sourceforge
Codehaus
OW2
OPSAJ
GoogleCode
Lines of code
ALL PROJECTS
Size: Lines of code Color: SQALE Rating
JDK 7
PostgreSQL
Clang
HBase
MySQL
Closure Library
Roslyn
Only the first 100 components are displayed
ALL PROJECTS
January 8 2014
Lines of code: 10,416,370
Unit tests: 552,221
Duplicated lines: 1,389,302
2010
2011
2012
2013
2014
2015

# Thesis

*To increase the cost-effectiveness of architecture conformance checking, we need a unified approach based on an extensible, declarative and empirically-grounded specification language.*


RULES
1. YOU CAN....
2. YOU CAN'T..
3. YOU CAN...
4. YOU CAN'T


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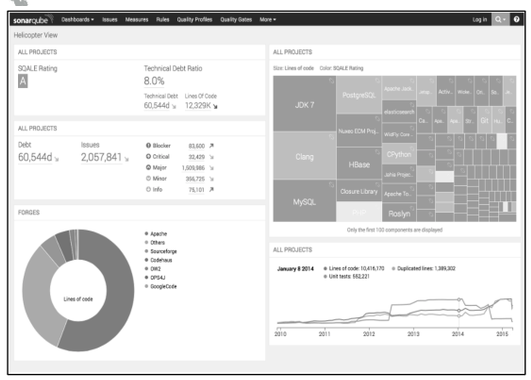
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# Dictō

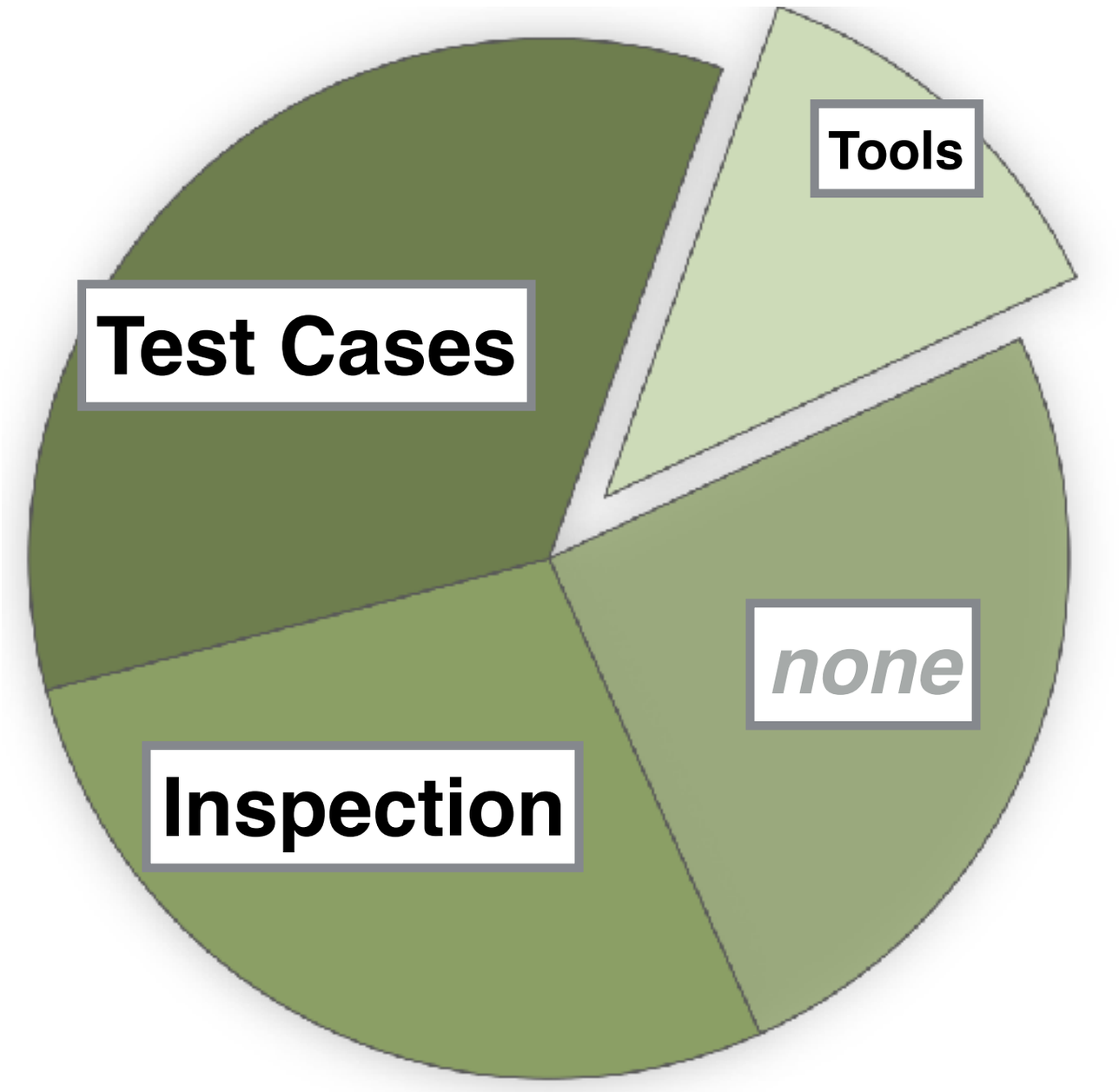

# Dictō


SURVEY
DOC

14 ppl
18h


communication
file location
throughput
data retention policy
recoverability
authorization
meta~annotation
system behavior
event handling
accessibility
dependencies
availability
visual design
signature
data integrity
data structure


34 ppl





- dependencies
- naming conventions
- signature
- software update
- data structure
- event handling
- file location



dependencies

- na
- sig
- so
- da
- ev
- file

JDepend

LATTIX

ndepend

DCL

SAVE

Macker


4 docs

> *MoneyAmount must be annotated with @Columns*

> *The execution time of validateCombination() must be below 10 ms.*

> *Models [..] cannot invoke operations from Business Services.*


> *MoneyAmount must be annotated with @Columns*


> *MoneyAmount must be annotated with @Columns*

# Entity

```
MoneyAmount = Class with name:"*.MoneyAmount"
```


> *MoneyAmount must be annotated with @Columns*

# Modal Operator

```
.. must ..                    .. cannot ..
.. can only ..                only .. can ..
.. must .. some ..
```


*MoneyAmount must be annotated with @Columns*

# Predicate

```
.. depend on ..
.. have annotation ..
.. have empty catch block
.. have latency < ..
```

+

```
.. “String”
.. Symbol
.. 11
```


```
MoneyAmount = Class with name:"*.MoneyAmount"
MoneyAmount must have annotation “@Columns”
```

```
MoneyAmount = Class with name:"*.MoneyAmount"
MoneyAmount must have annotation “@Columns”
```

# Framework

# SCM

# E-learning

# Framework


# SCM



# E-learning

*LOC*

# Framework

**50K**

# SCM

**0.5M**

# E-learning

**1M**

| | Rules |
|---|---|
| Framework | 3 |
| SCM | 17 |
| E-learning | 16 |

# Expressiveness

```
Persistence cannot depend on Service
```

```
Persistence = Package with name: “app.*.persistence.*”
Service := Package with name: “app.*.service.*”
```

app.….persistence.….service

# Expressiveness

```
Persistence cannot depend on Service
```

```
Persistence = Package with name: “app.*.persistence.**”
Service = Package with name: “app.*.service.**”
```

app.….persistence.….service

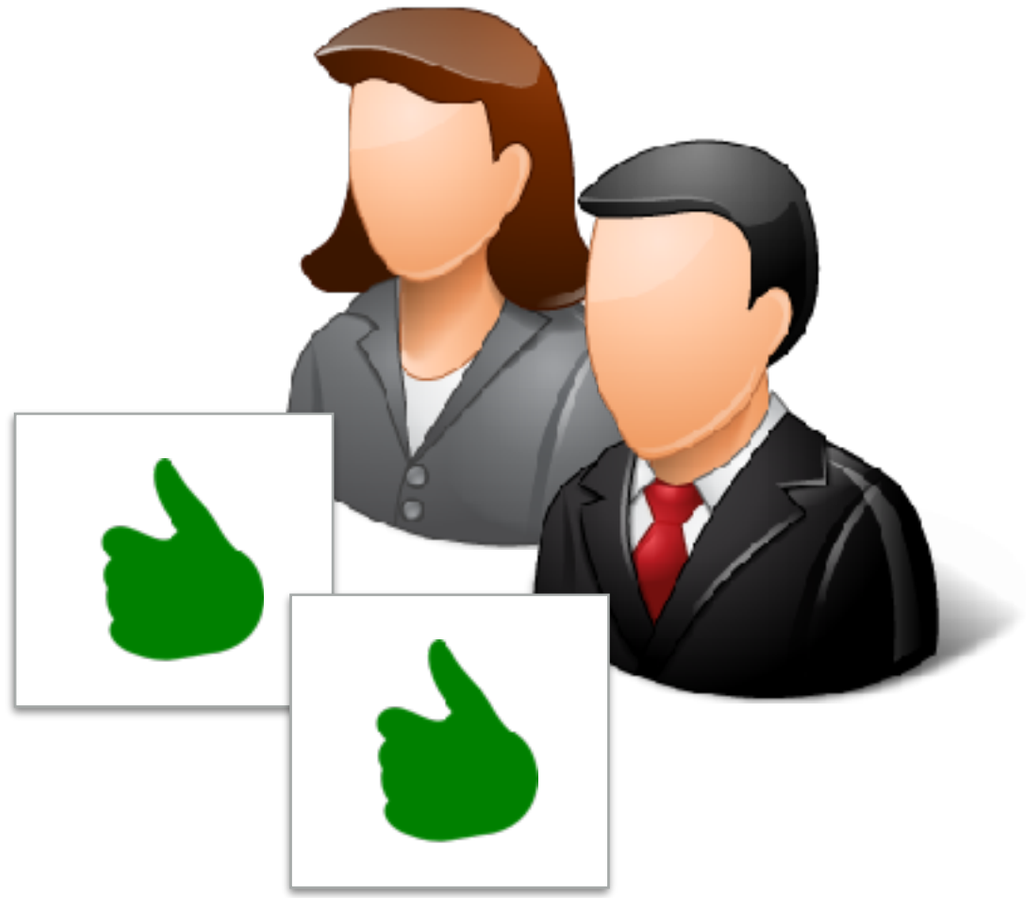
# Usability

```
WholeIliasCodebase cannot depend on SuppressErrors
```

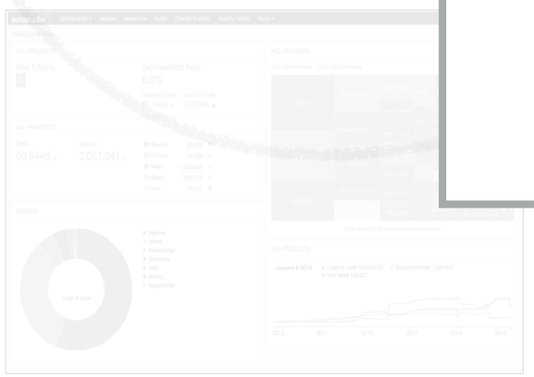
# Usability

```
/**
 * Silencing errors with the @ operator is bad
 * practice. It makes code unnecessarily harder to
 * debug if the currently suppressed error changes
 * into a real show-stopper bug. Try to handle the
 * possible warnings and errors.
 */
WholeIliasCodebase cannot depend on SuppressErrors
```

```
MoneyAmount = Class with name:"*.MoneyAmount"
MoneyAmount must have annotation “@Columns”
```




# Probō



**Test, View can only** depend on **Model, Controller**

**Test can only** depend on **Model, Controller**

**View can only** depend on **Model, Controller**

```
dependOn(com.app.Test, com.app.View)
dependOn(com.app.Test, com.app.Controller)
dependOn(com.app.Test, com.app.Test)
dependOn(com.app.Test, com.app.Util)
dependOn(com.app.Test, com.app.Model)
…
```

Test → Util

❌ Test, View can only depend on Model, Controller

❌ Test can only depend on Model, Controller

✅ View can only depend on Model, Controller

```
T  dependOn(com.app.Test, com.app.View)
F  dependOn(com.app.Test, com.app.Controller)
T  dependOn(com.app.Test, com.app.Test)
F  dependOn(com.app.Test, com.app.Util)
T  dependOn(com.app.Test, com.app.Model)
   …
```

34

# Structural

```
Controller, Model, Dao must be layered
CoreExceptions must be caught
PojoMethods can only be named “get*”, “set*”
DataBean must have attribute “destroy-method”
only TestPackage can contain dead methods
Model cannot contain code clones; contain cycles
```

# Behavioral

```
ModelClasses cannot lead to deadlock
PriceAPI must have content “CHF”
CustAPI must have latency < 100 ms
CustAPI must handle load from 30 users
```

# Structural

*saxon-lint*

*PhpDA*

# Behavioral



Zn

# Accuracy

```
SYSTEM cannot contain cycles
```

sonarqube

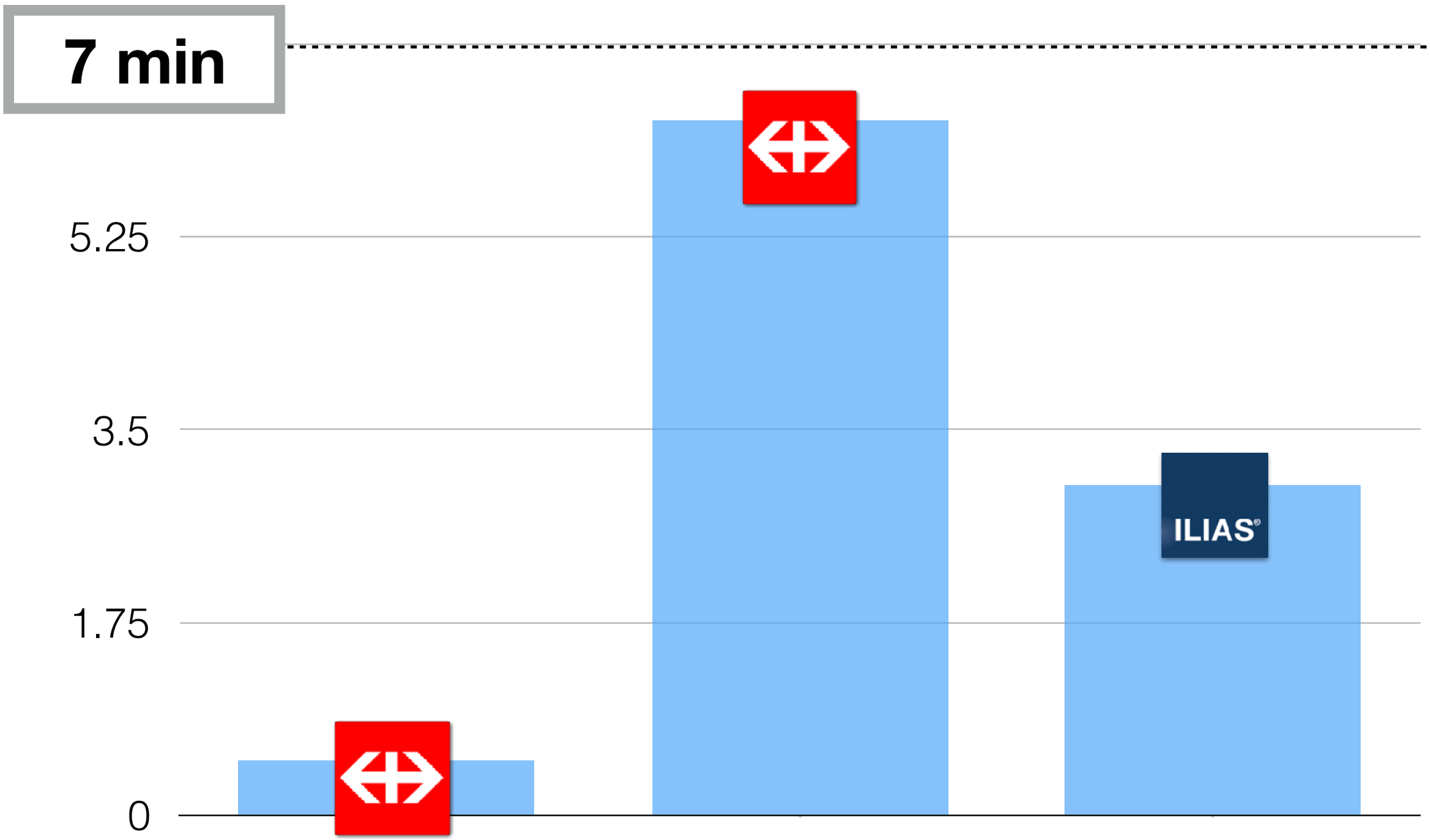
+600%

```
ClientScoutPackage can only depend on SharedScoutPackage
ServerScoutPackage can only depend on SharedScoutPackage, ServicePackage
ServicePackage can only depend on BusinessPackage
BusinessPackage can only depend on ServicePackage, PersistencePackage
CoreProject cannot depend on StammdatenProject
BetriebProject can only depend on  AngebotProject
πProject can only depend on AngebotProject, BetriebProject
```

SONARGRAPH ARCHITECT

+350%

# Performance

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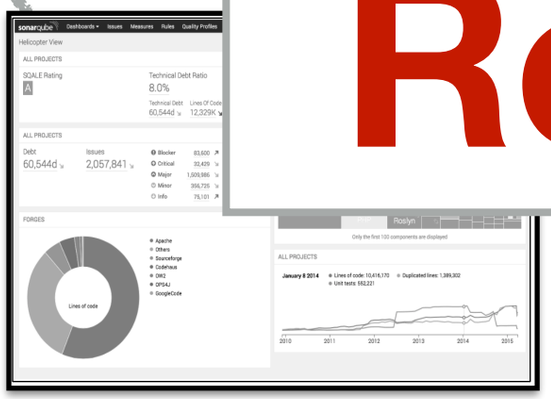
# Reporting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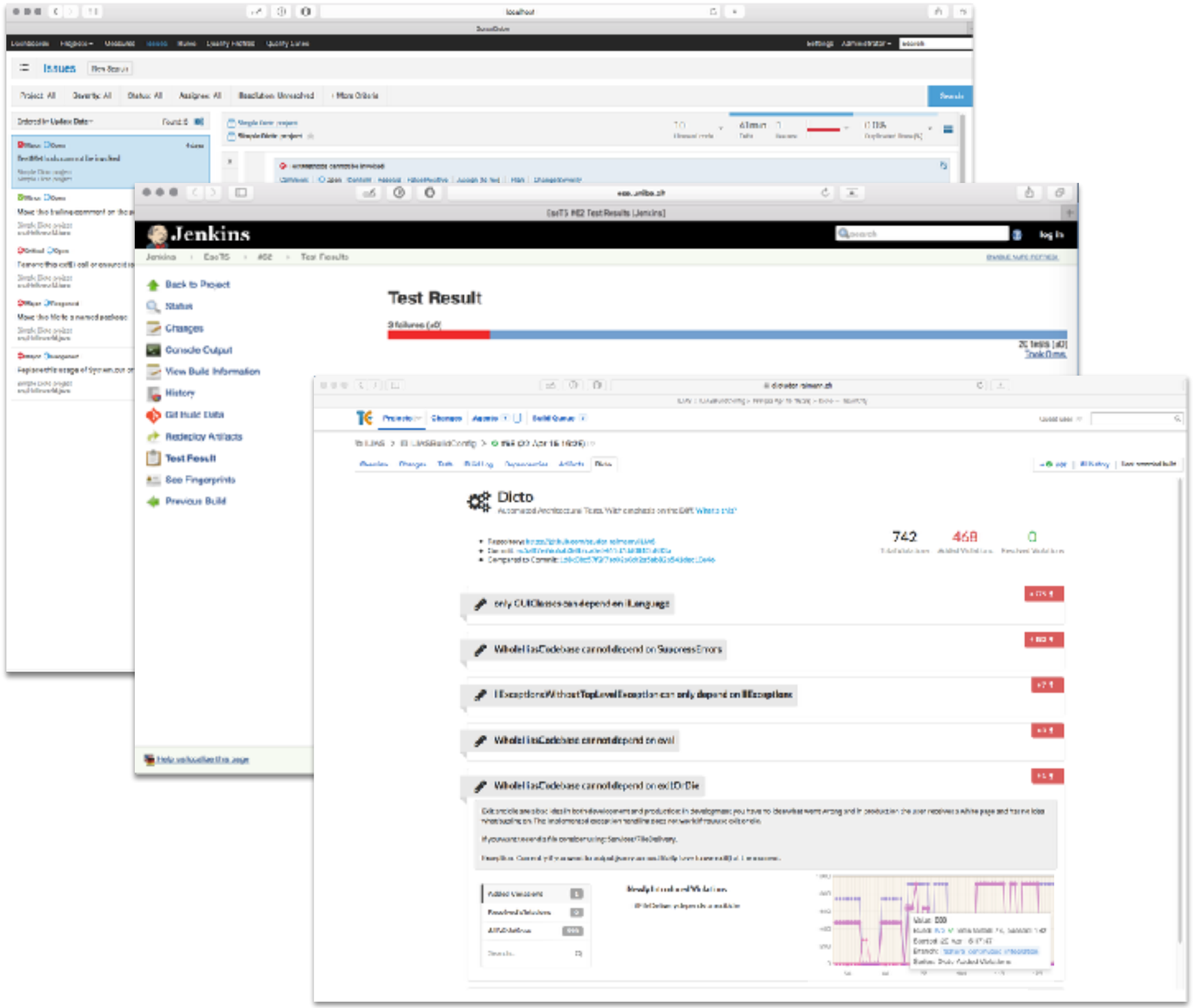
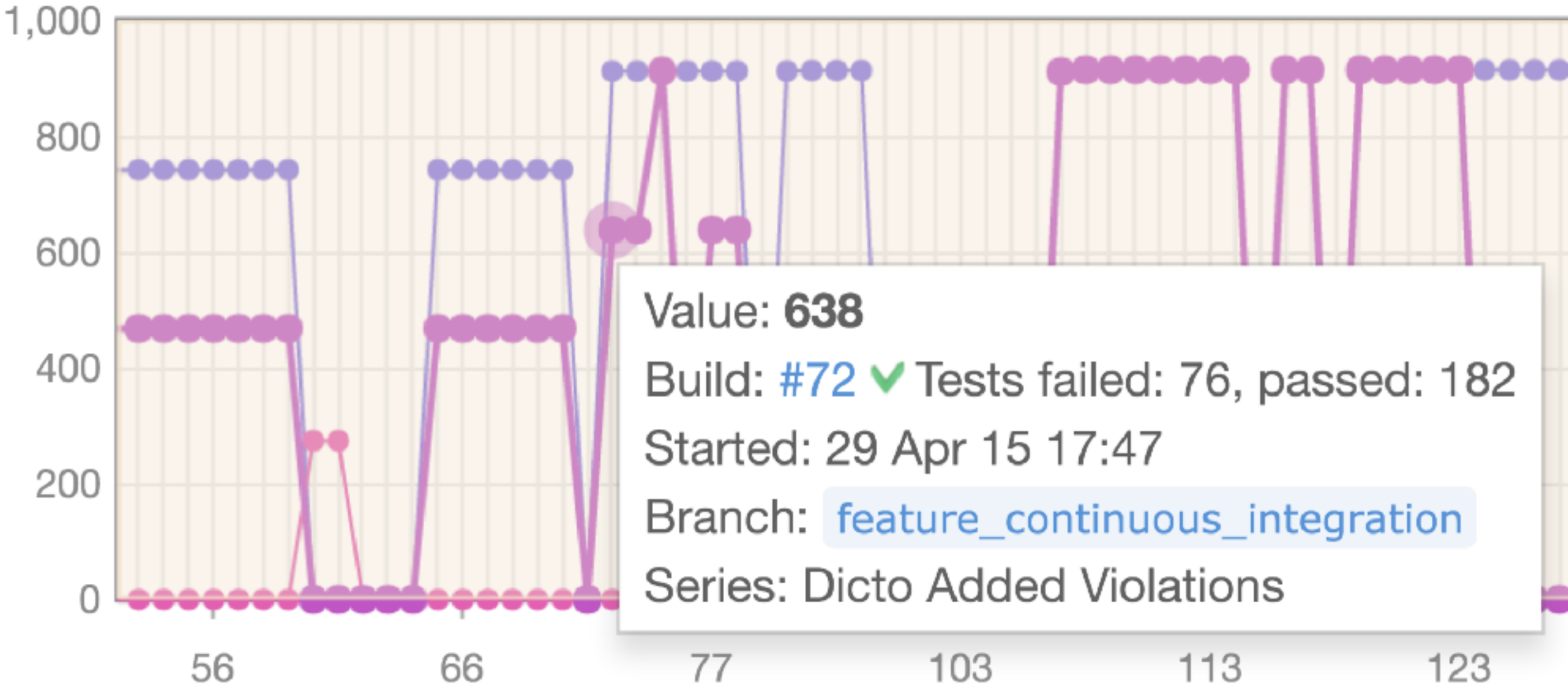
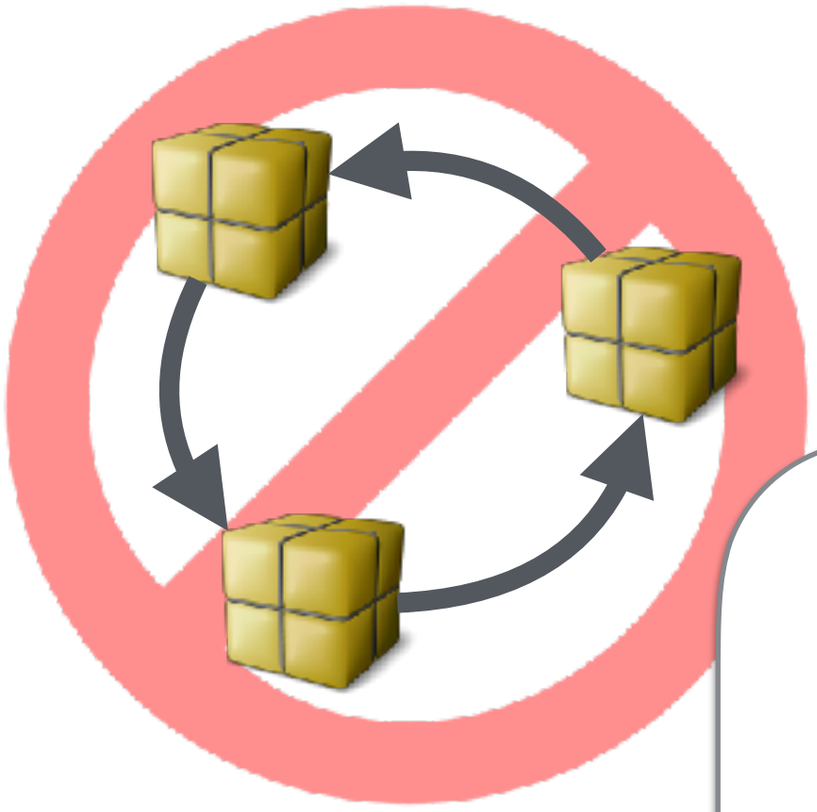
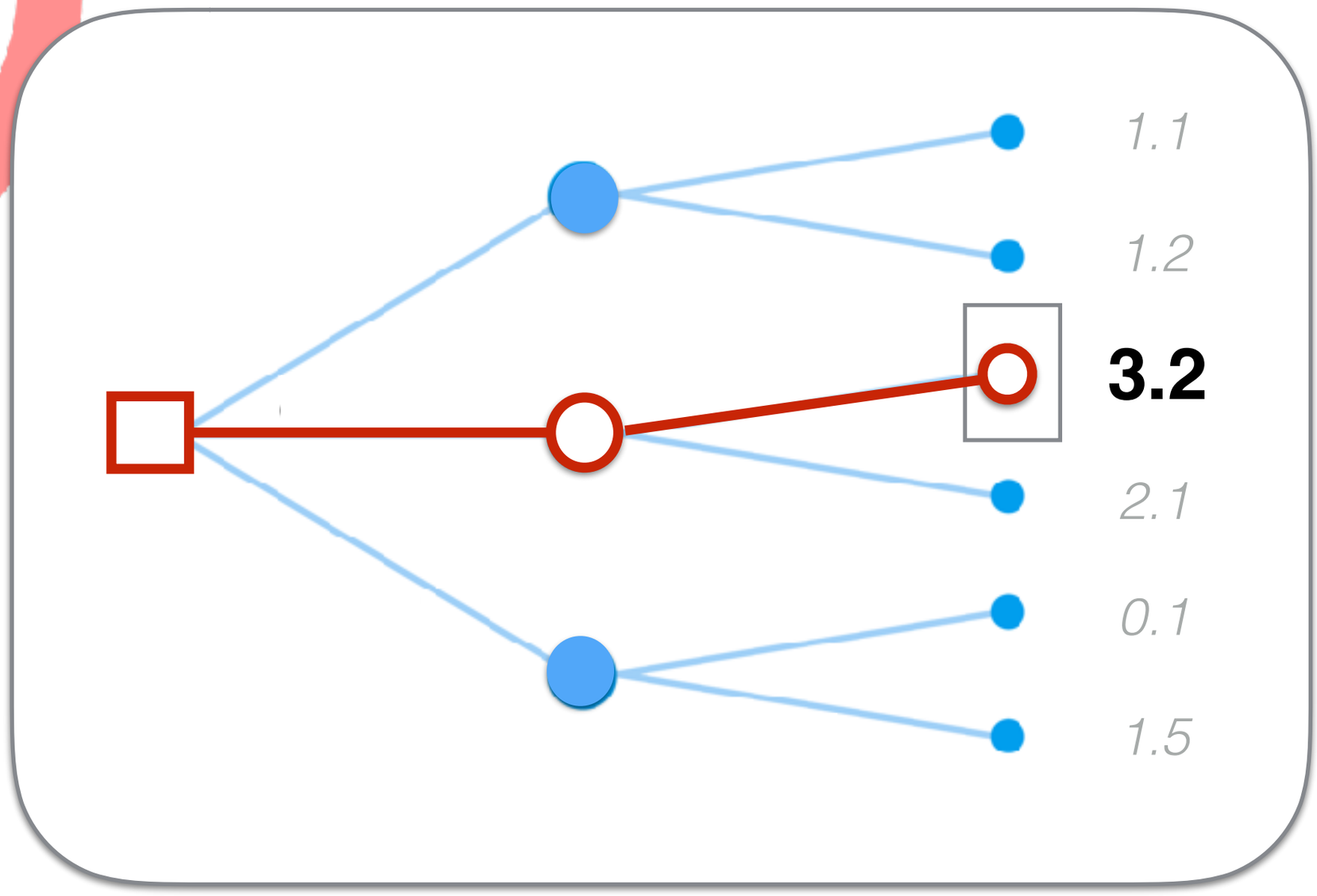

Jenkins
Back to Project
Status
Changes
Console Output
View Build Information
History
Git Build Data
Redeploy Artifacts
Test Result
See Fingerprints
Previous Build
Test Result
Dicto
742
468
only CUIClasses can depend on Language
WholeTasCodebase cannotdepend on SuppressErrors
WholeTasCodebase cannotdepend on evil


1,000
800
600
400
200
0
56
66
77
103
113
123
Value: 638
Build: #72 Tests failed: 76, passed: 182
Started: 29 Apr 15 17:47
Branch: feature_continuous_integration
Series: Dicto Added Violations

# Dicto <3 ILIAS - Leaderboard

| EMail | Points |
|---|---|
| mjansen@databay.de | 12 |
| fs@studer-raimann.ch | 4 |
| bheyser@databay.de | 2 |




1.1
1.2
3.2
2.1
0.1
1.5


W
DOC


JMeter
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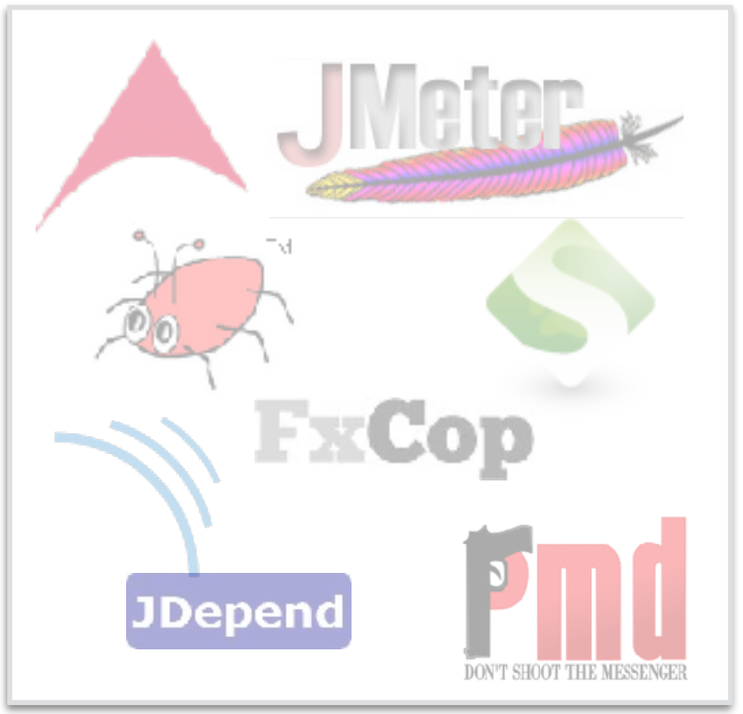
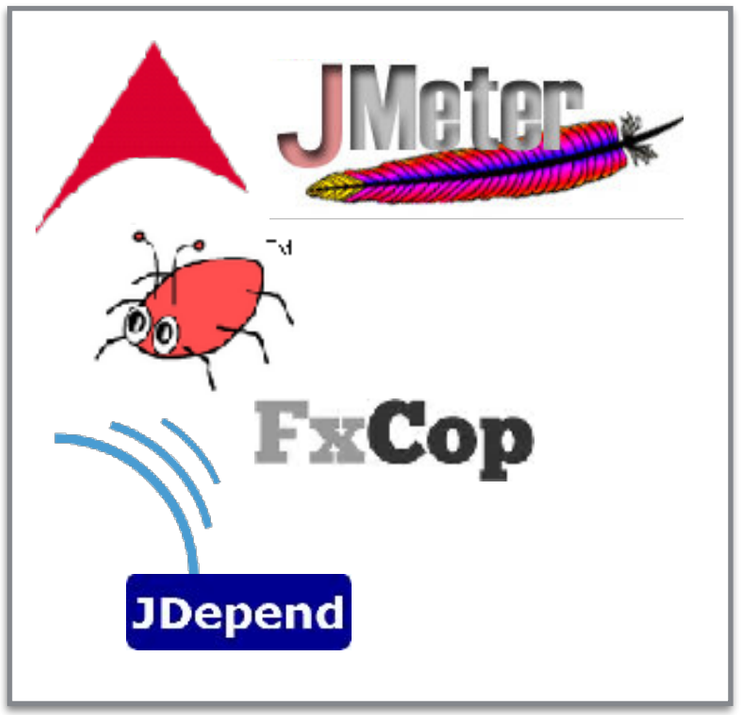
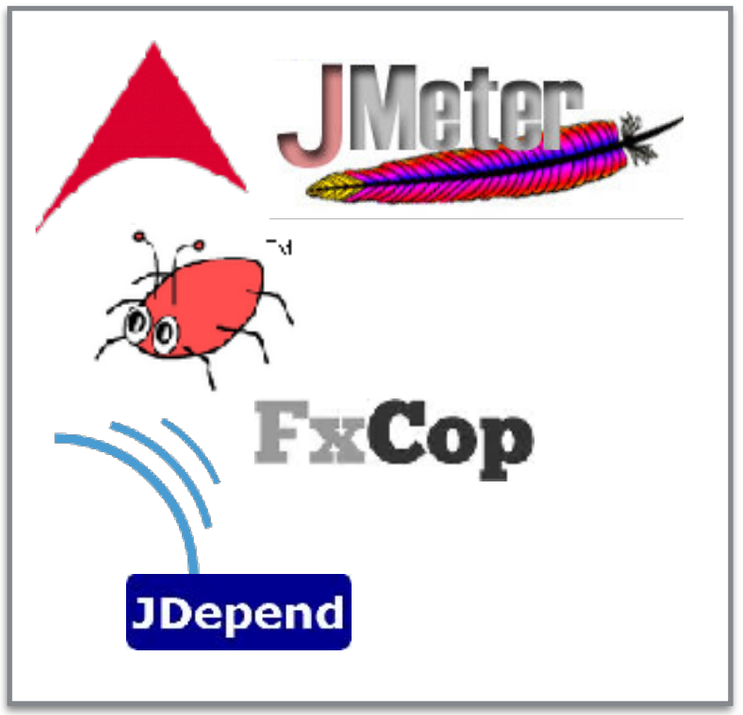



# Design


# Encode


# Encode

- ✗ Usability
- ✗ Customizability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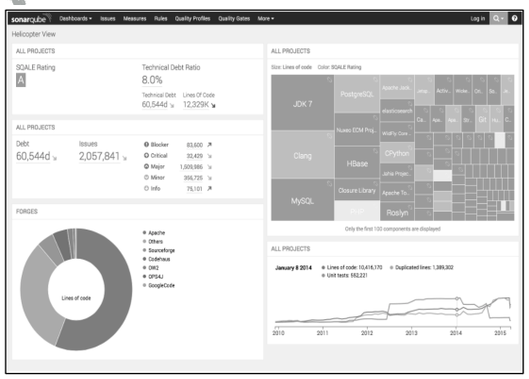
sonarqube
Dashboards
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# Design

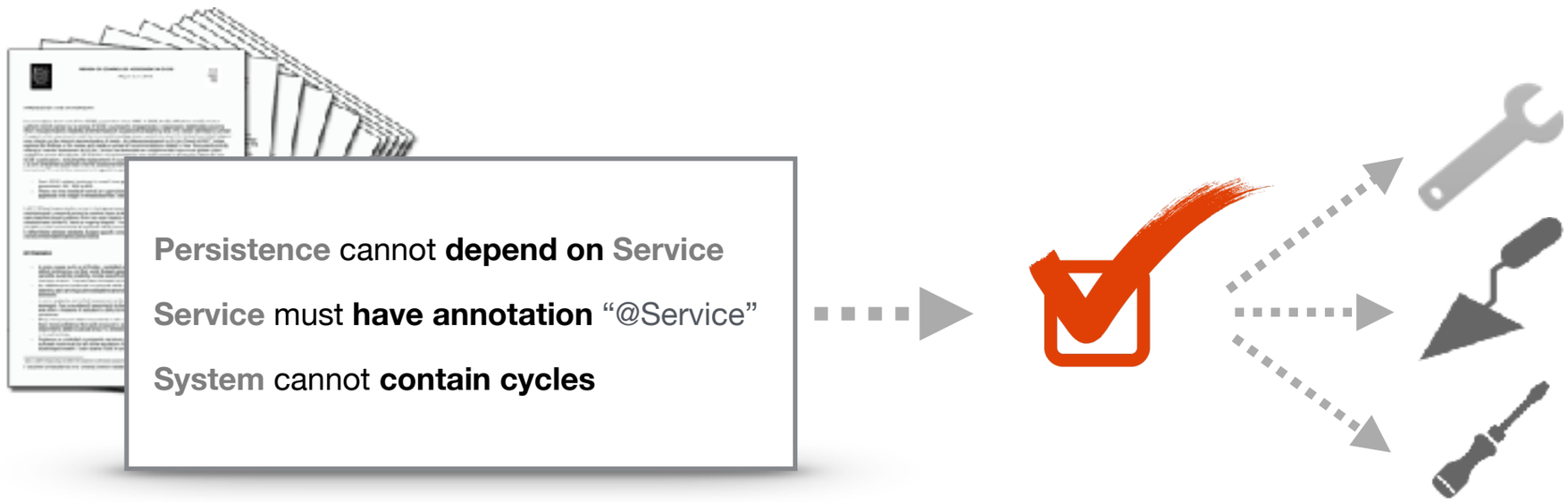
# Encode





# Design
# Encode

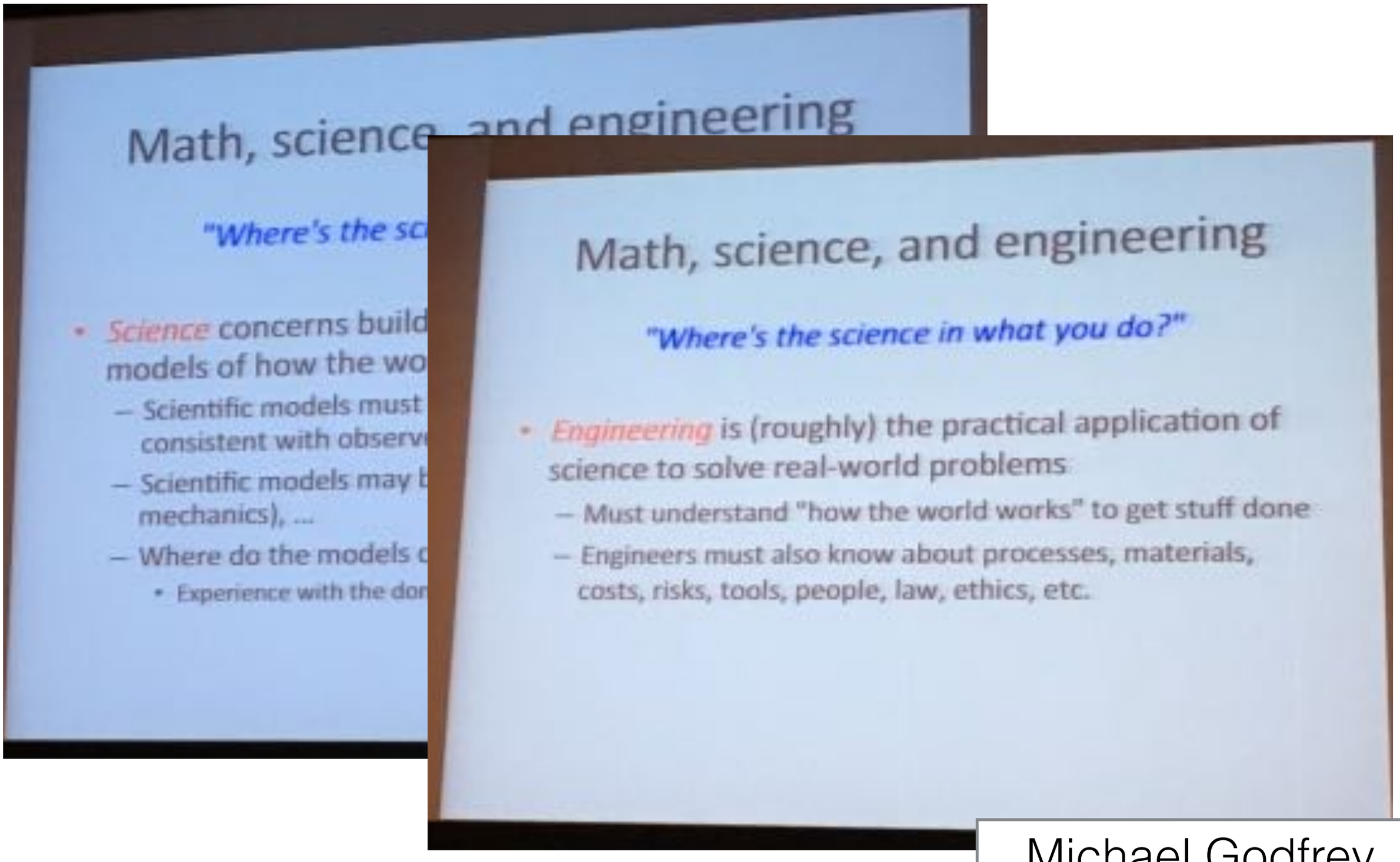
- Usability
- Customizability




# **Unified approach** based on **Dictō**

extensible, declarative, empirically-grounded

# Where is the science?




Michael Godfrey

# Future Work

**Design**

- research requirements
- evaluate specification methods
- mine rules
- suggest rules

**Check**

- formal logic

**Report**

- actionable fixes
- violation presentation/prioritization

# DSL vs. GPL

## Architects Dont Code

"The SystemArchitect responsible for designing your system hasn't written a line of code in two years. But

**Name:**

**Problem**

**Context**

**Forces:**

Unfortu

**Suppos**
follow t

# Architects Should Code: The Architect's Misconception

Posted by **Brandon Bryson** on Aug 06, 2015 | 18 **Discuss**

Share

When I interview people for architect positions I usually ask a question like: "Do you think an architect should do any coding?" And I usually get one of two responses:

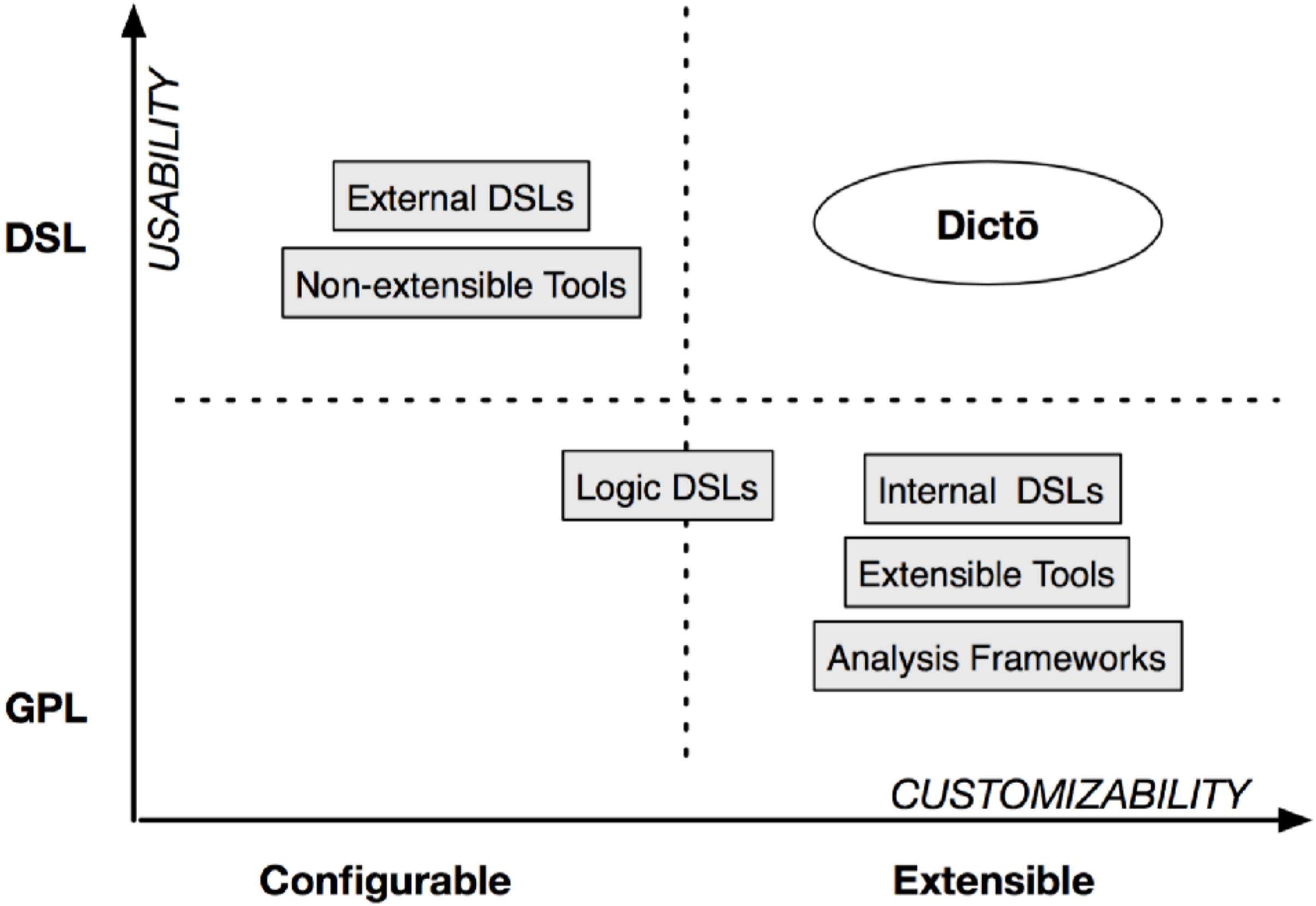
"No, I look forward to advancing to a position where I no longer work with code."

"I'd love to continue coding, at least some amount, but I probably won't have time."

RELAT

Appli
AMQ
Feb 19

Enter
Heter
Jan 03


DSL
USABILITY
External DSLs
Non-extensible Tools
Dictō
Logic DSLs
Internal DSLs
Extensible Tools
Analysis Frameworks
GPL
CUSTOMIZABILITY
Configurable
Extensible