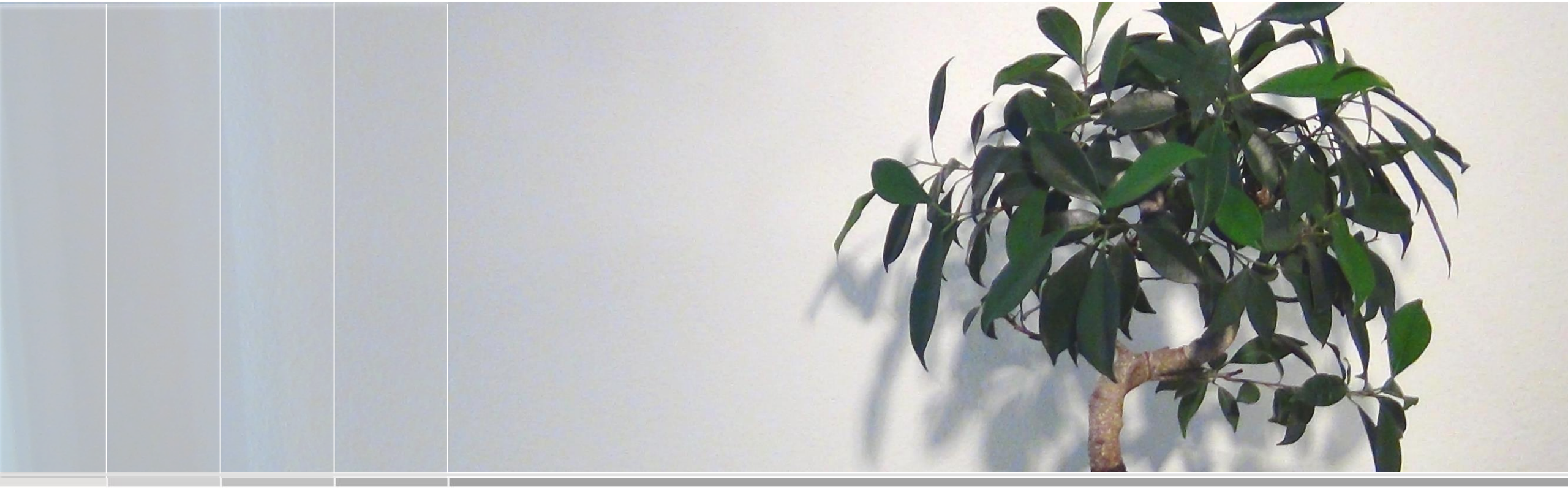
bbv Software Services AG

Legacy Code

and now what?

Urs Enzler @ursenzler



the Problem

with Legacy Code

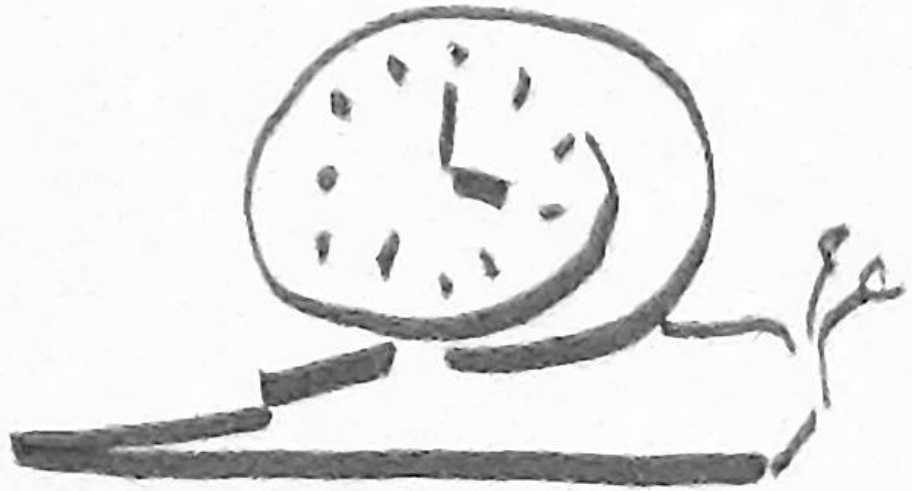
new features

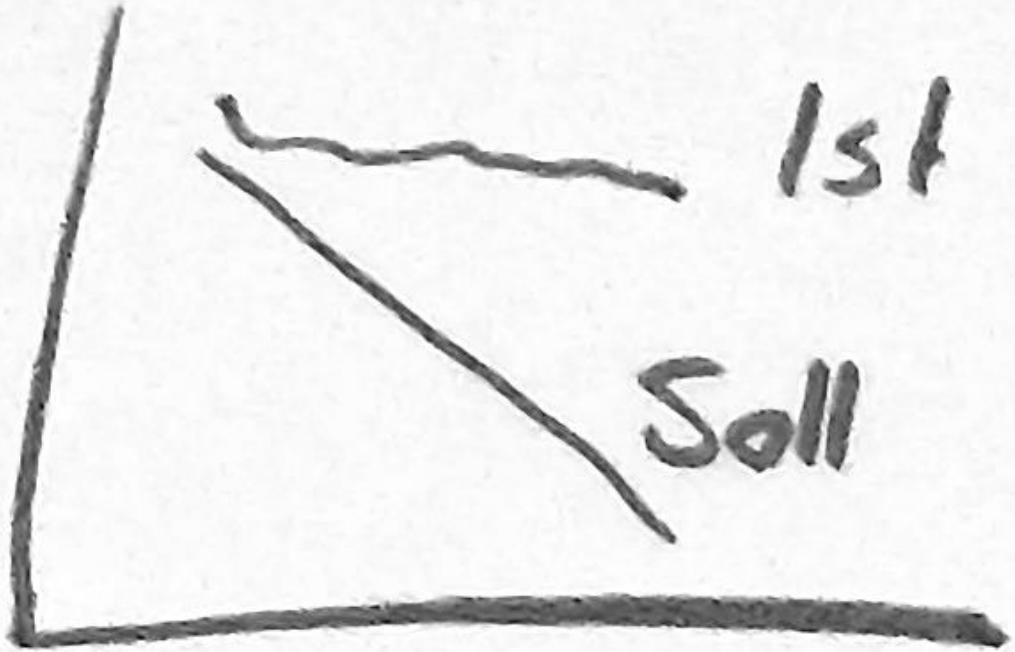
take forever

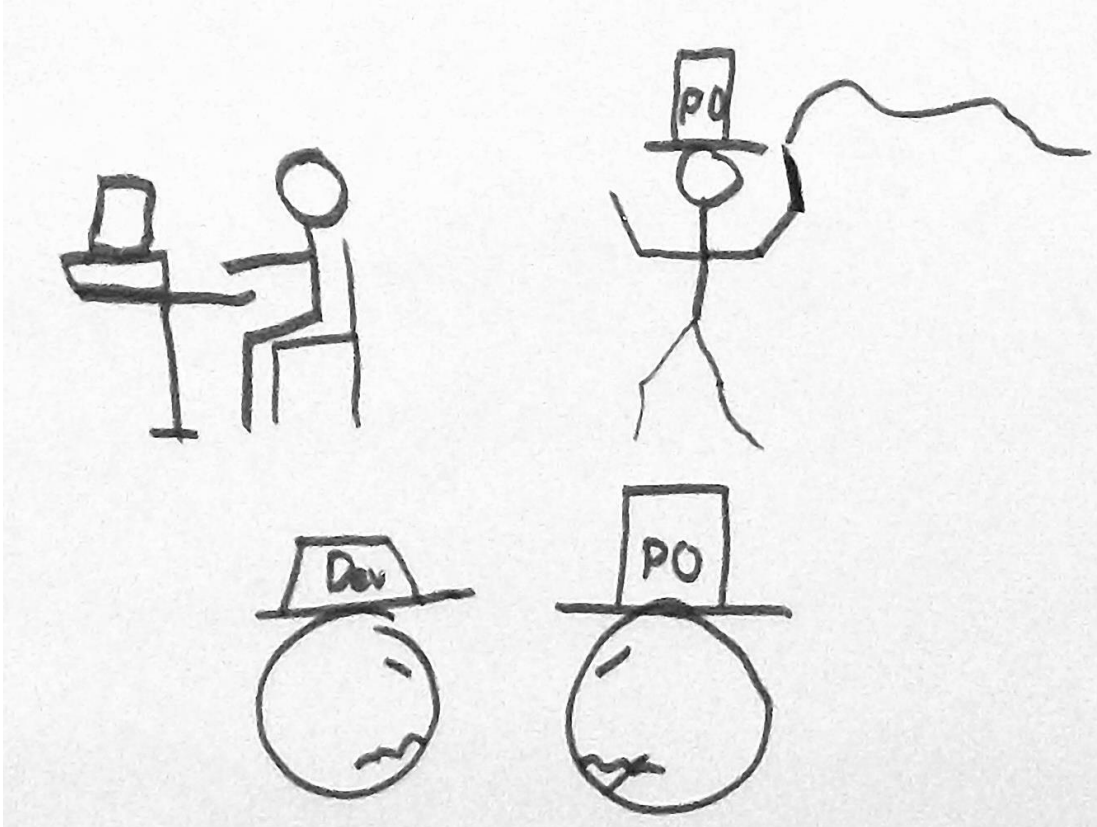
break existing features

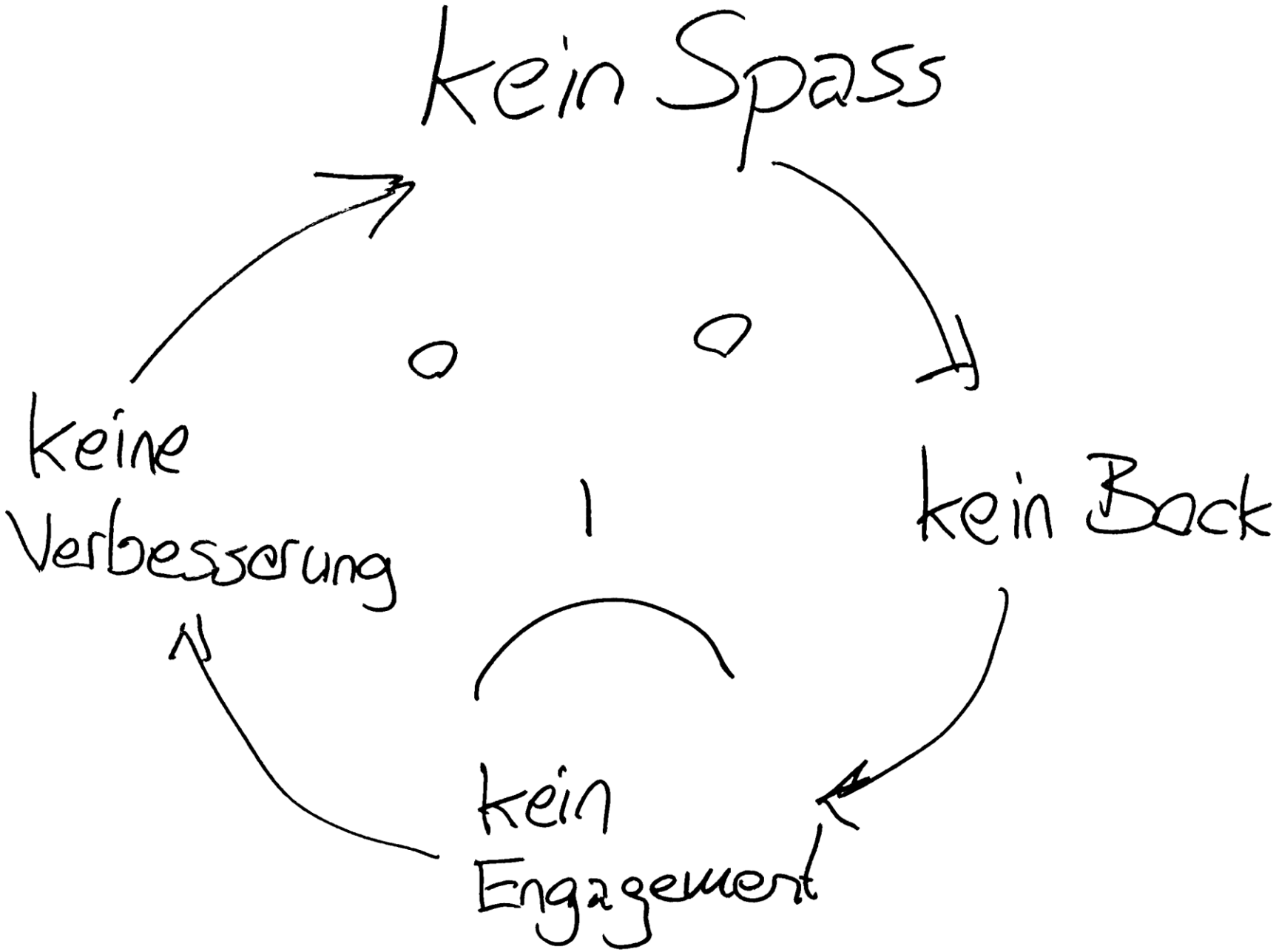
have unreliable schedules

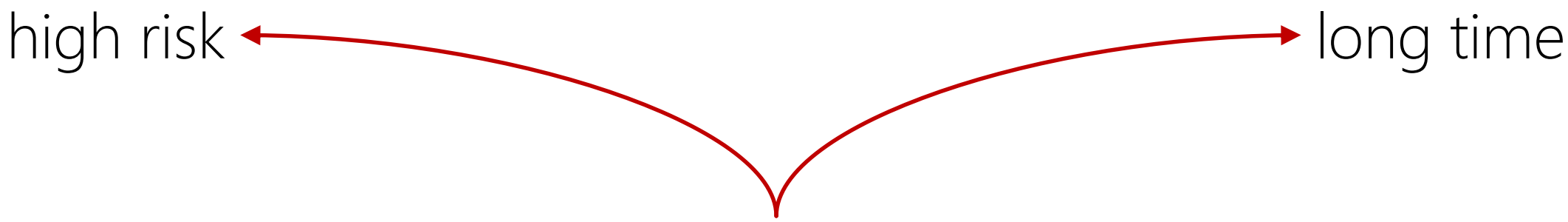

-Code




Ist
Soll


PO
Dev
PO


kein Spass
kein Back
kein Engagement
keine Verbesserung

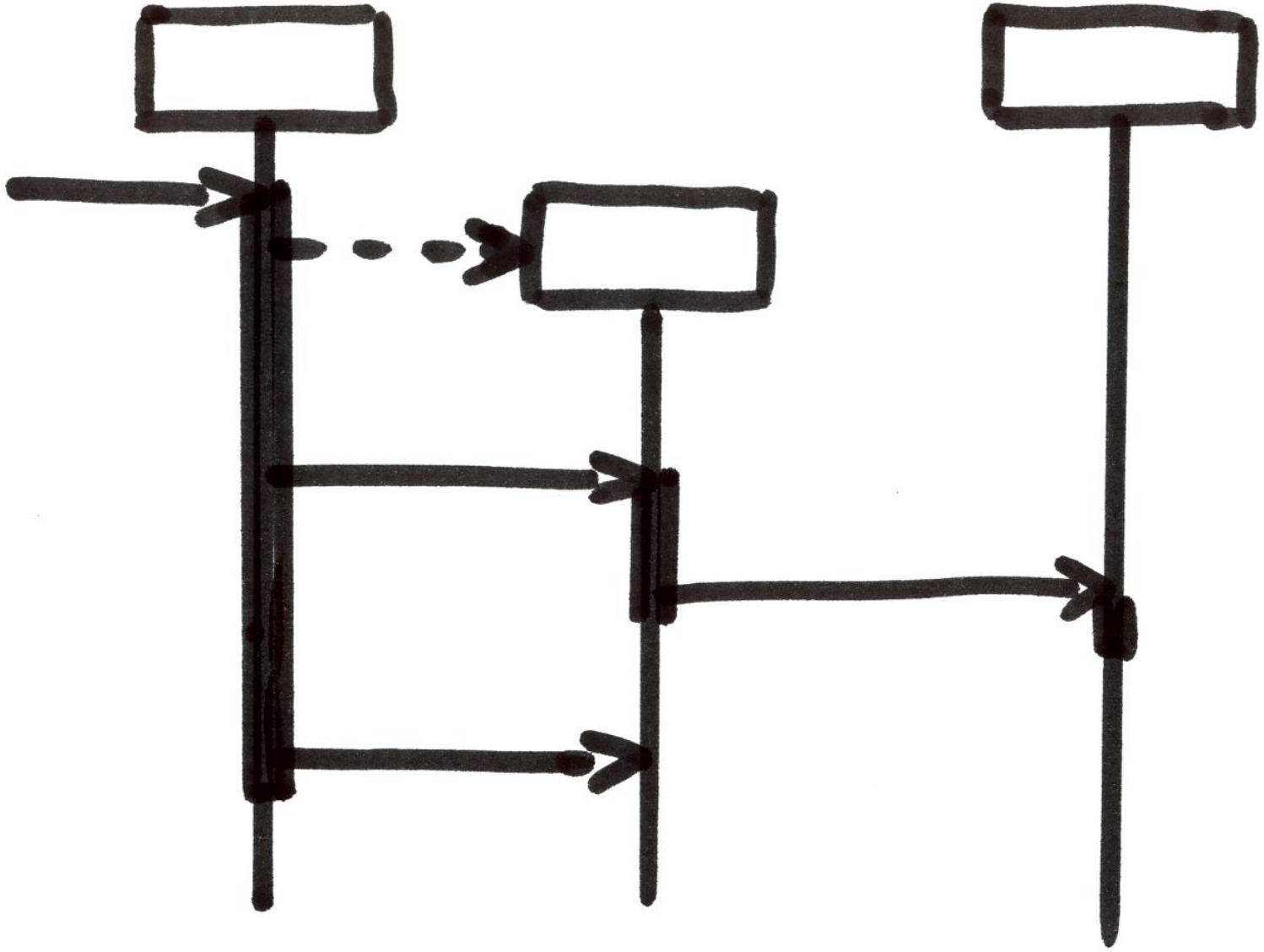


BIG BANG

Rewrite

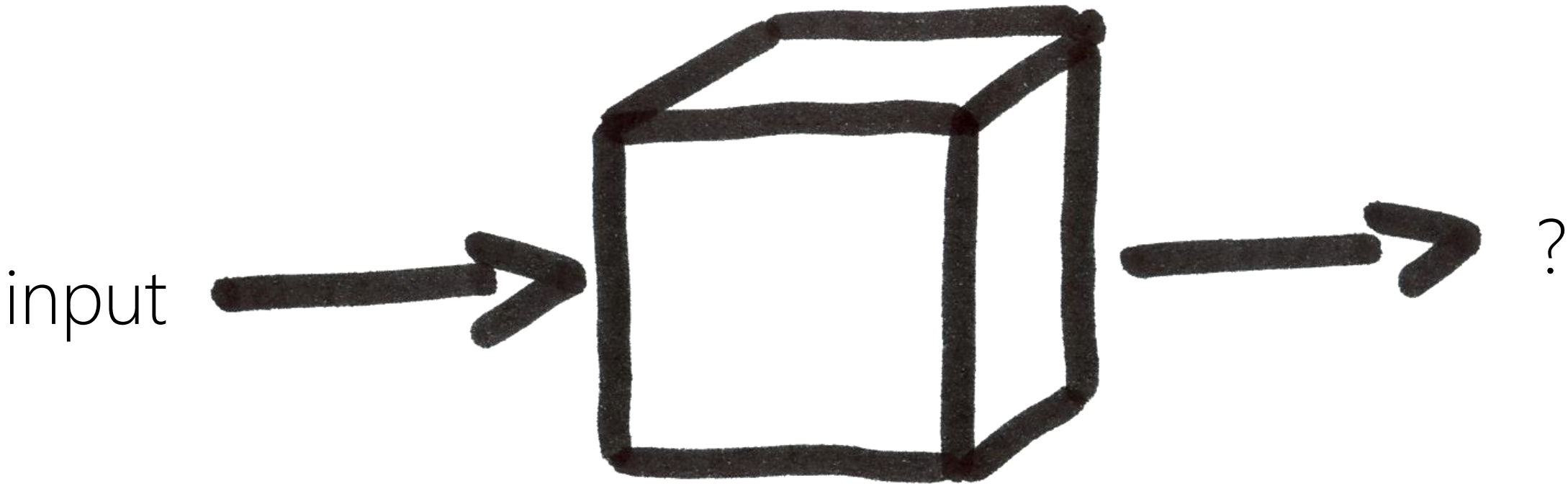
software archeology

visualize

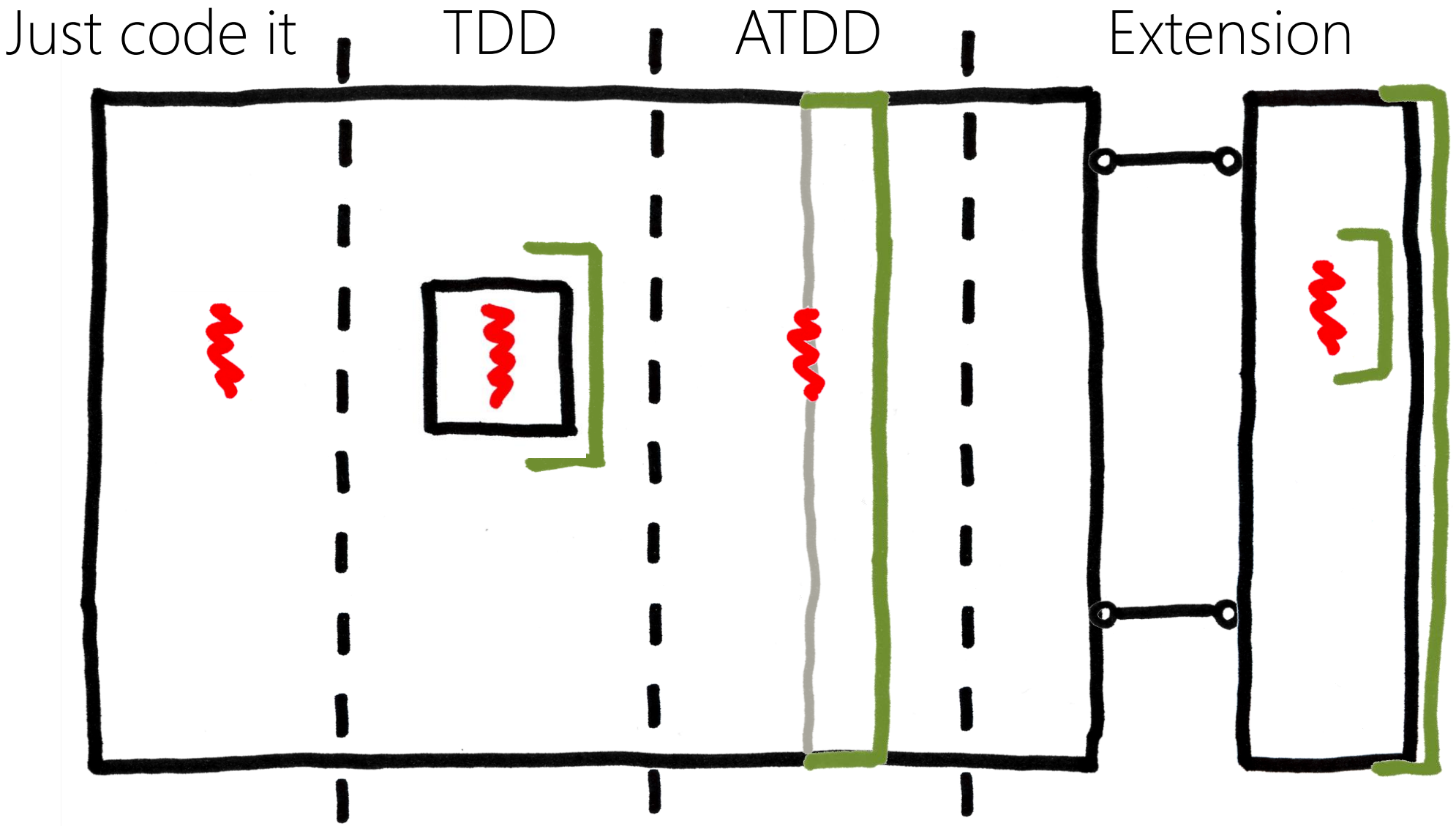


Socratic Test

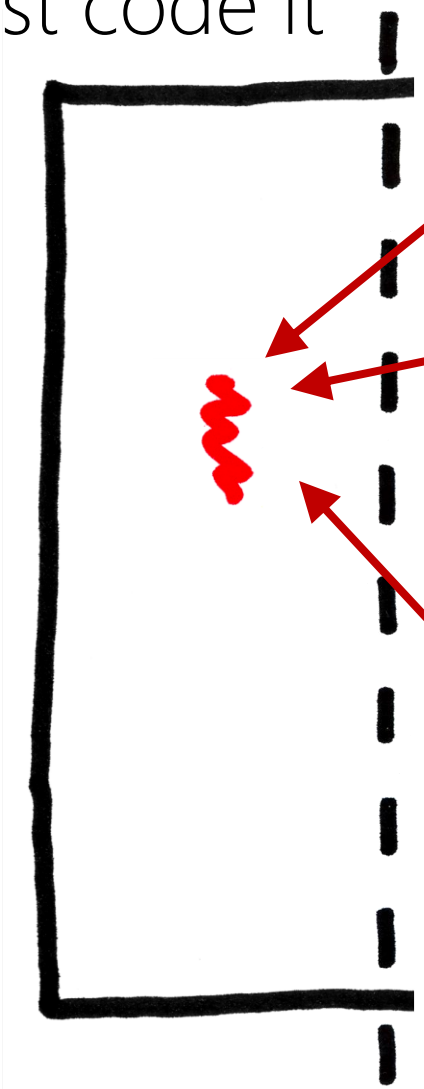
verify your hypothesis



add new features


Just code it
TDD
ATDD
Extension

Just code it



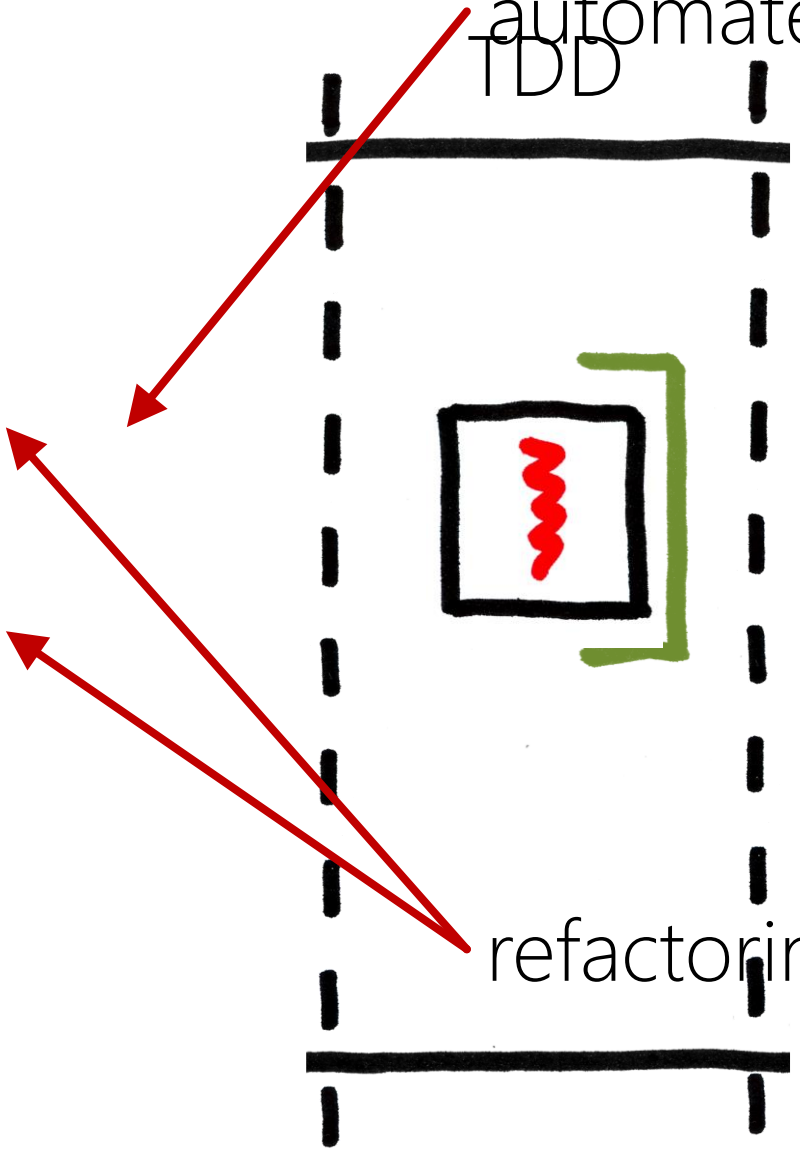
only manual testing possible

no automated proof for correctness

refactoring difficult

future change may break it

even more legacy code



automated proof for correctness

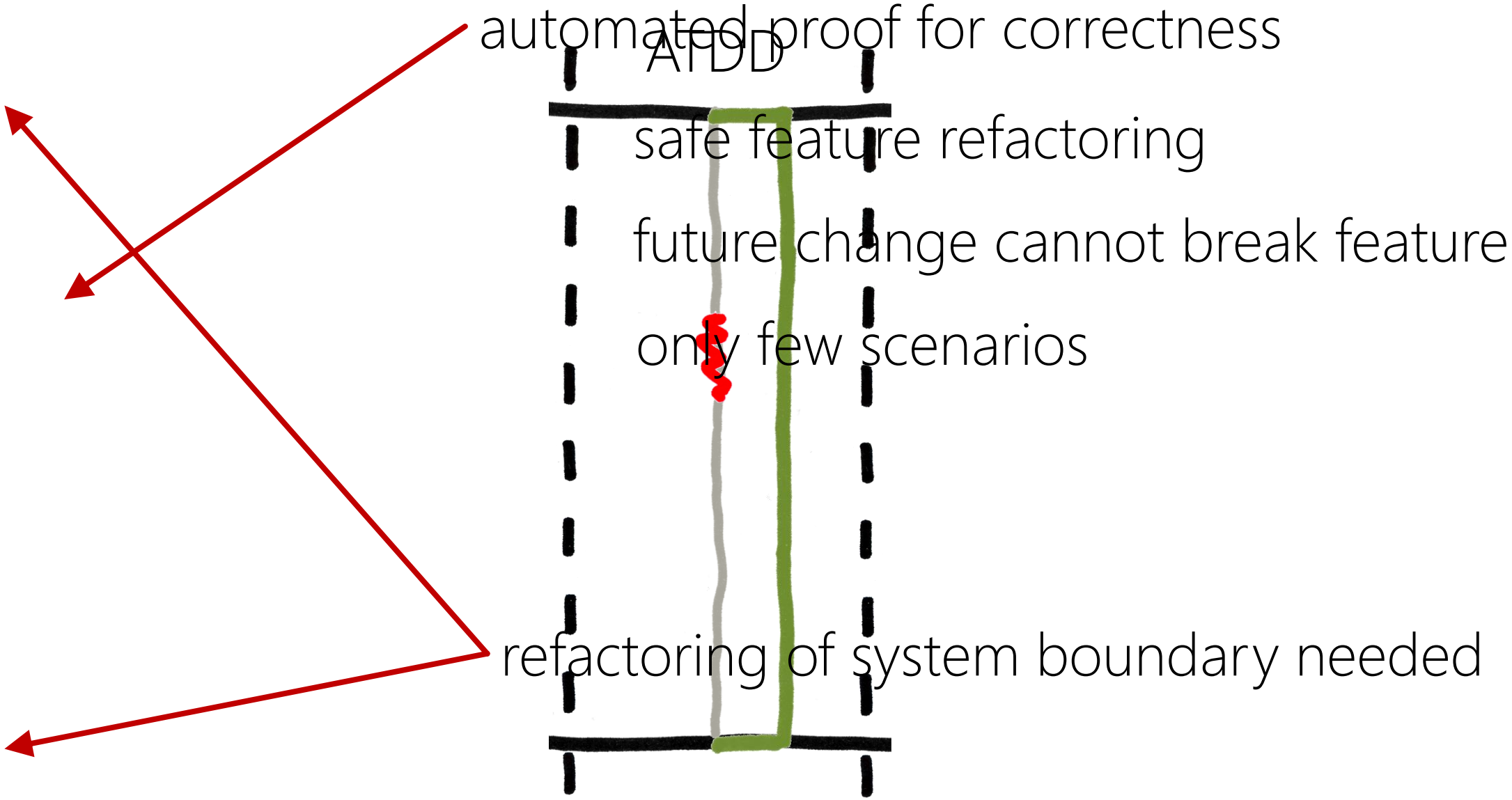
TDD

safe class refactoring

all class behaviours

future change cannot break class

refactoring of class neighborhood needed


automated proof for correctness
ATDD
safe feature refactoring
future change cannot break feature
only few scenarios
refactoring of system boundary needed

automated proof for correctness

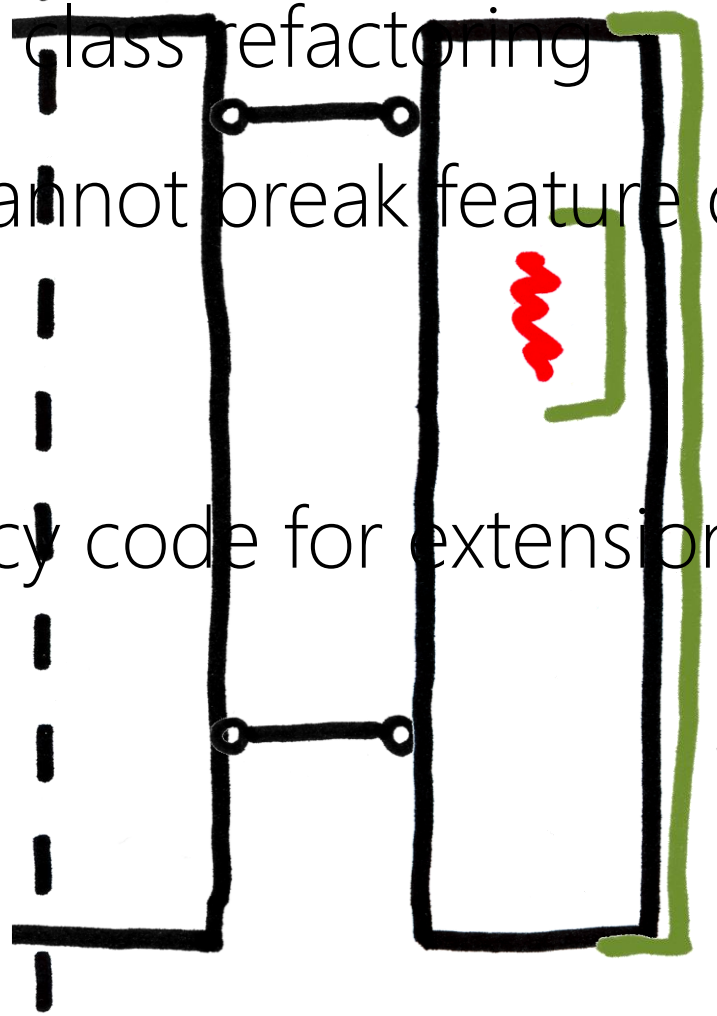
Extension

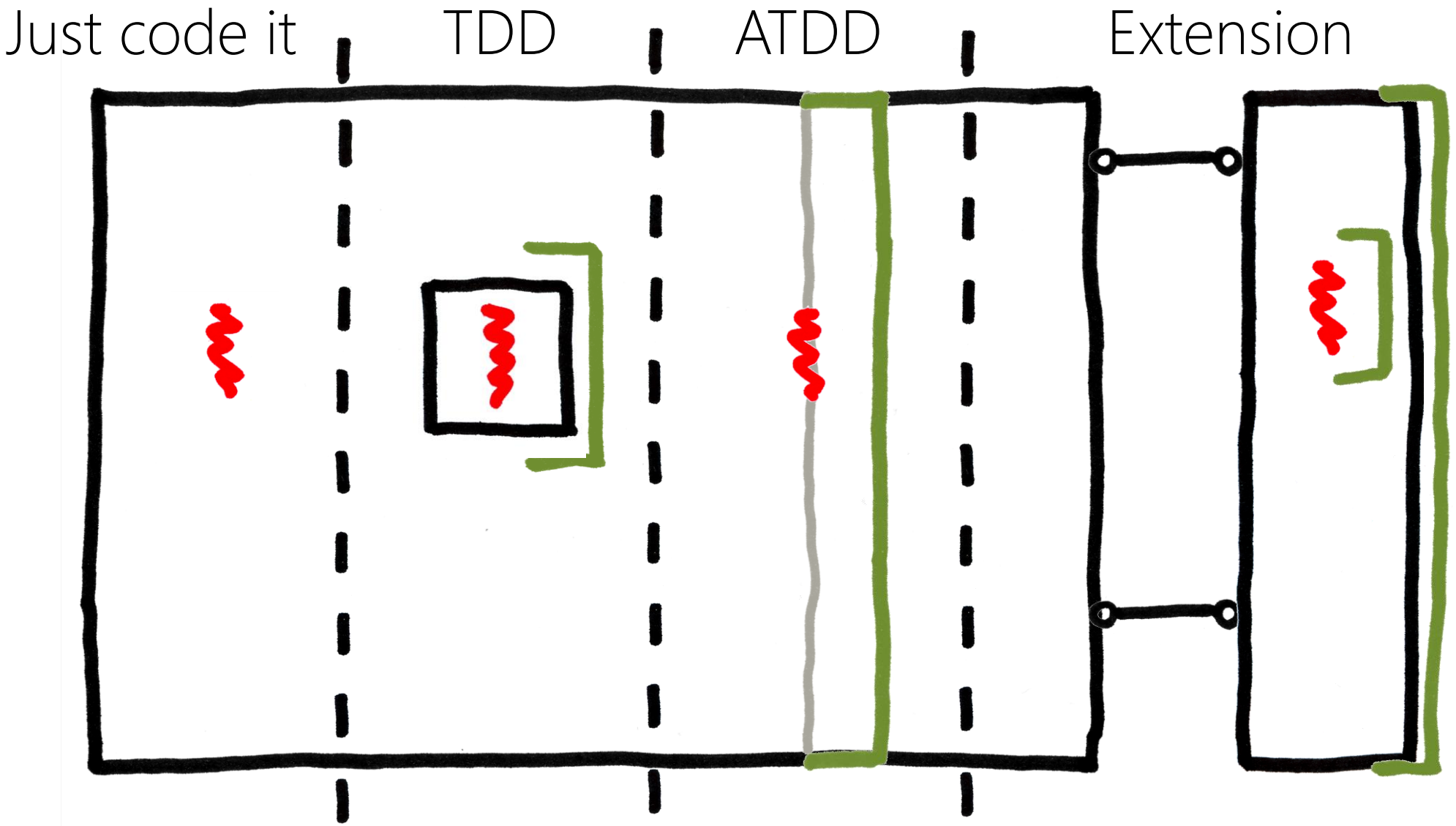
safe feature and class refactoring

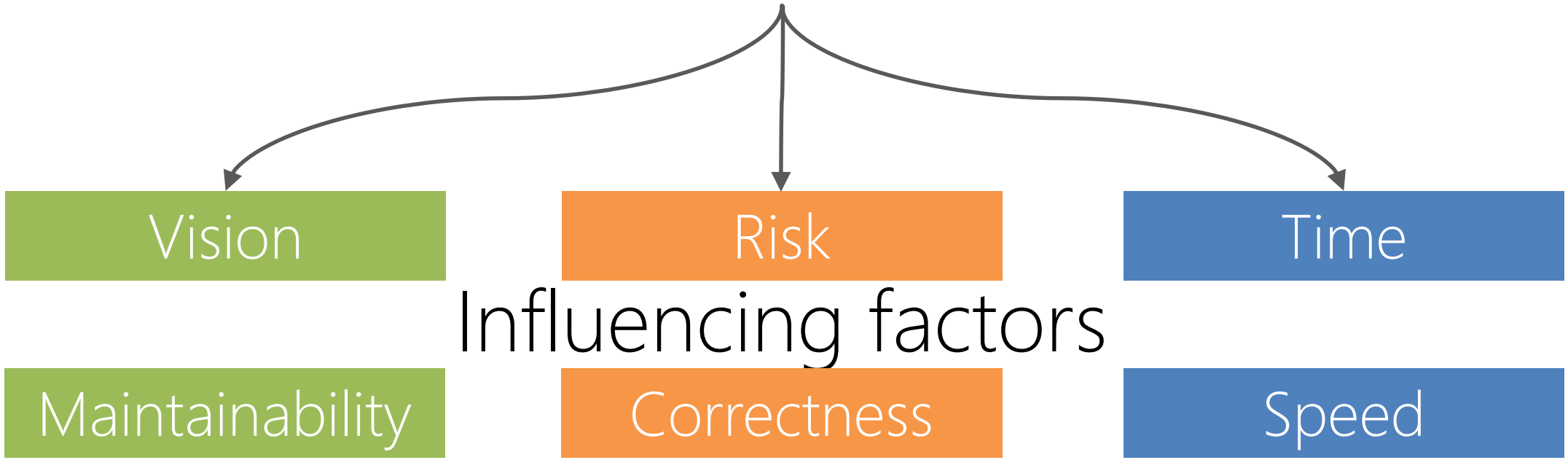
future change cannot break feature or classes

refactoring of legacy code for extension points needed

hard to find



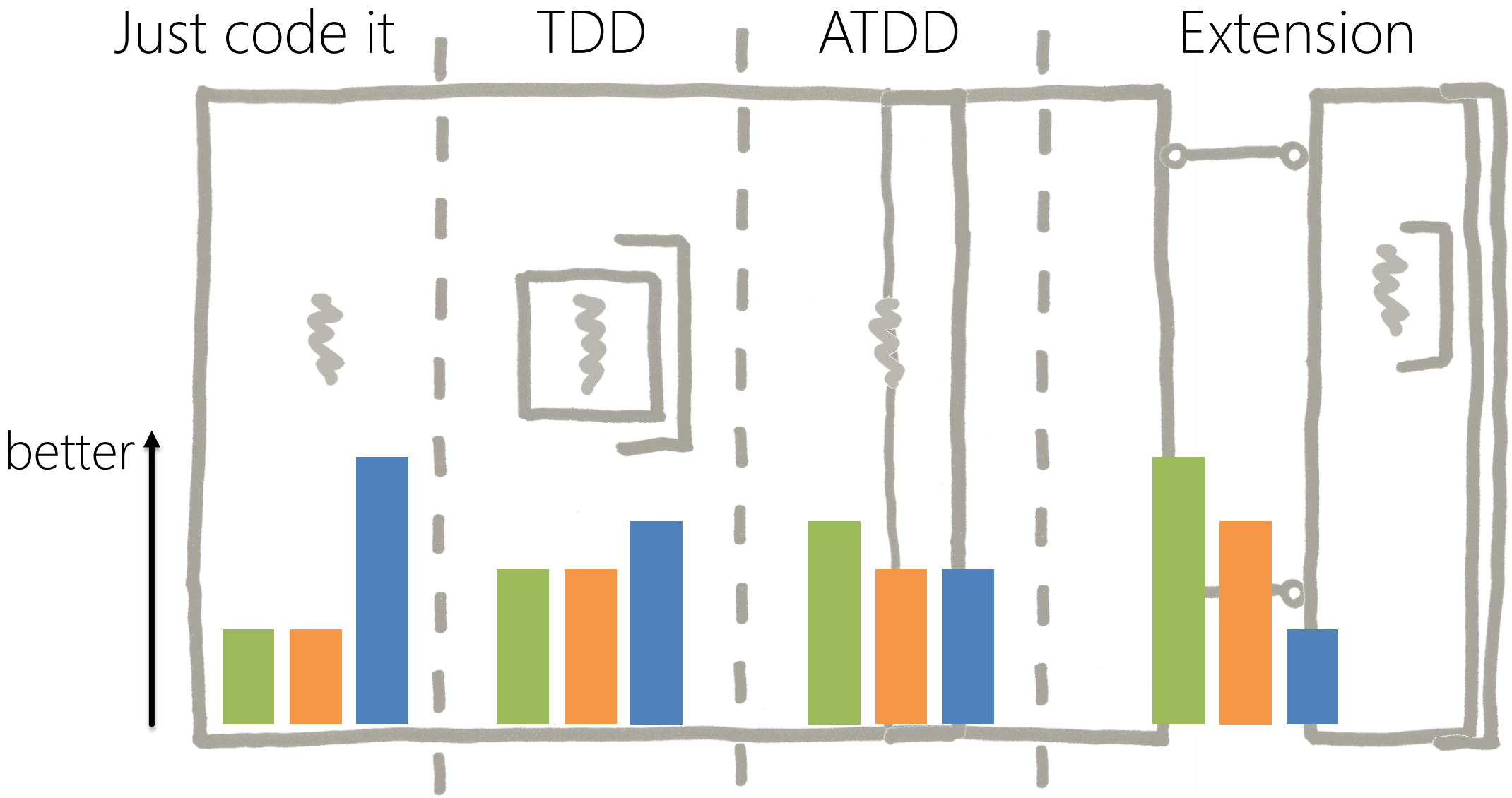

Just code it
TDD
ATDD
Extension


Vision
Risk
Time
Influencing factors
Maintainability
Correctness
Speed

Maintainability

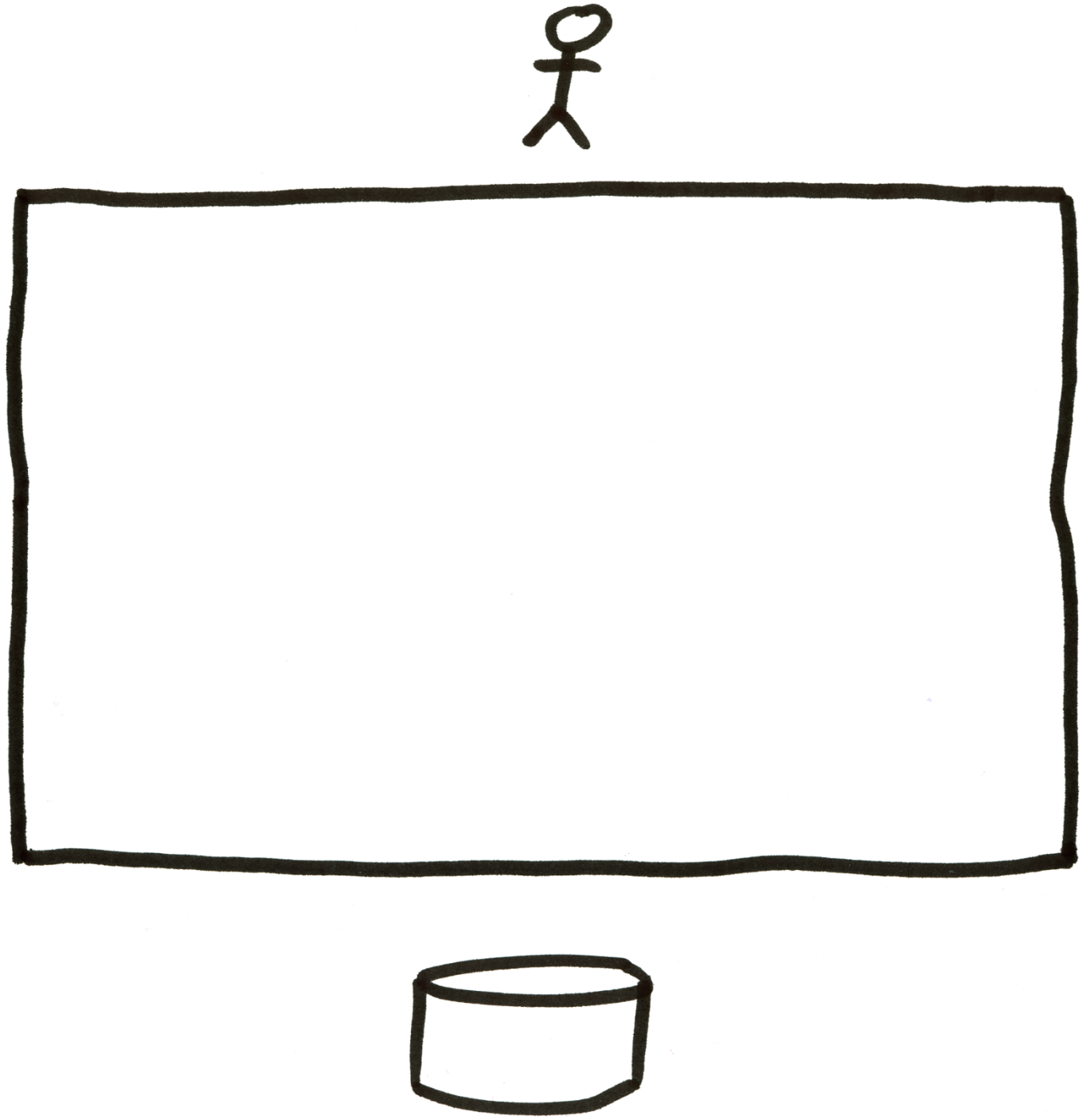
Correctness

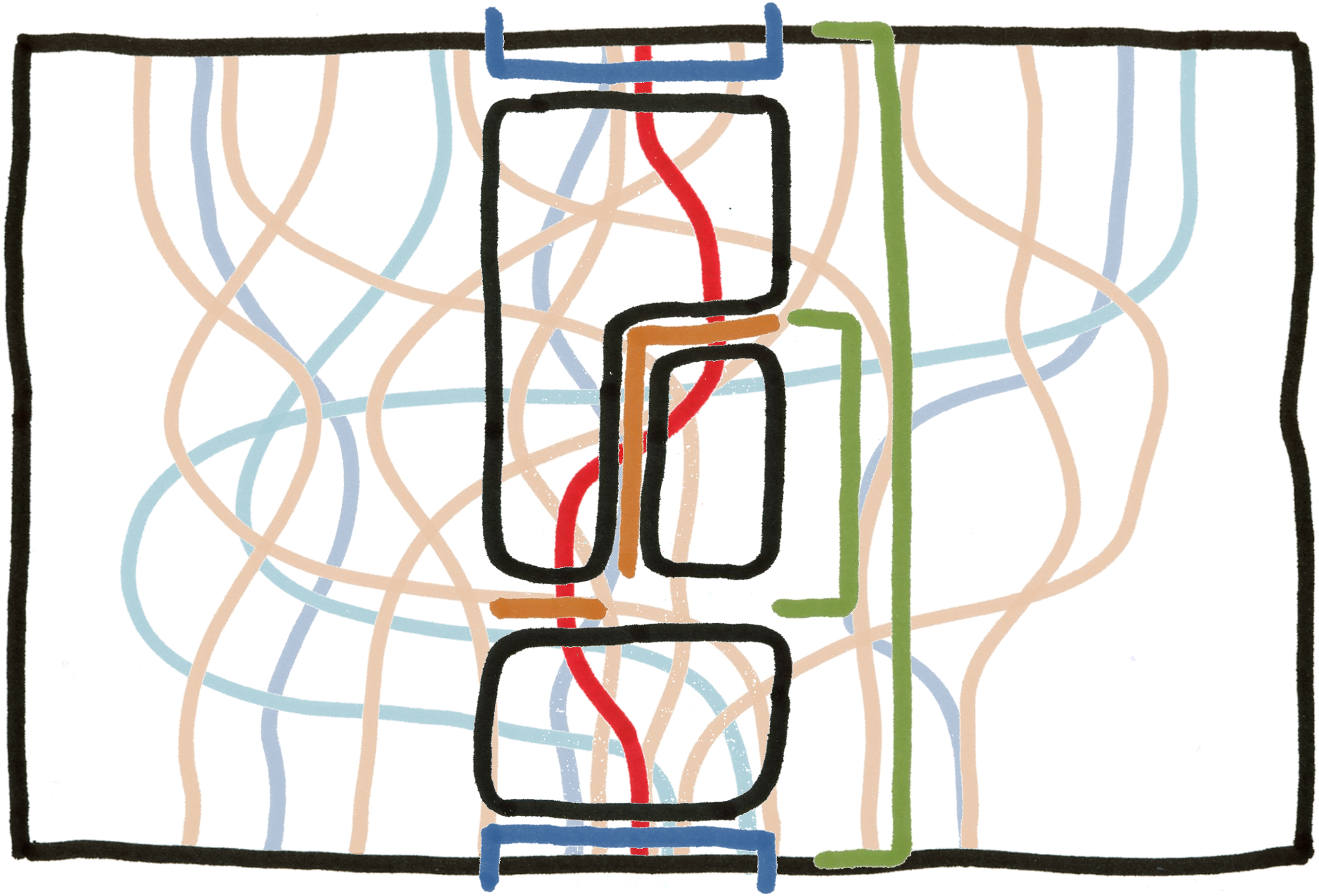
Speed



Development gets slower and slower

improve existing code





refactor

keep

refactor | reengineer | keep

stepwise improvement possible

redesign classes

refactor using TDD

functionality cannot get lost

refactor | reengineer | keep

stepwise improvement not feasible

ATDD / TDD

risk of losing functionality

refactor

reengineer

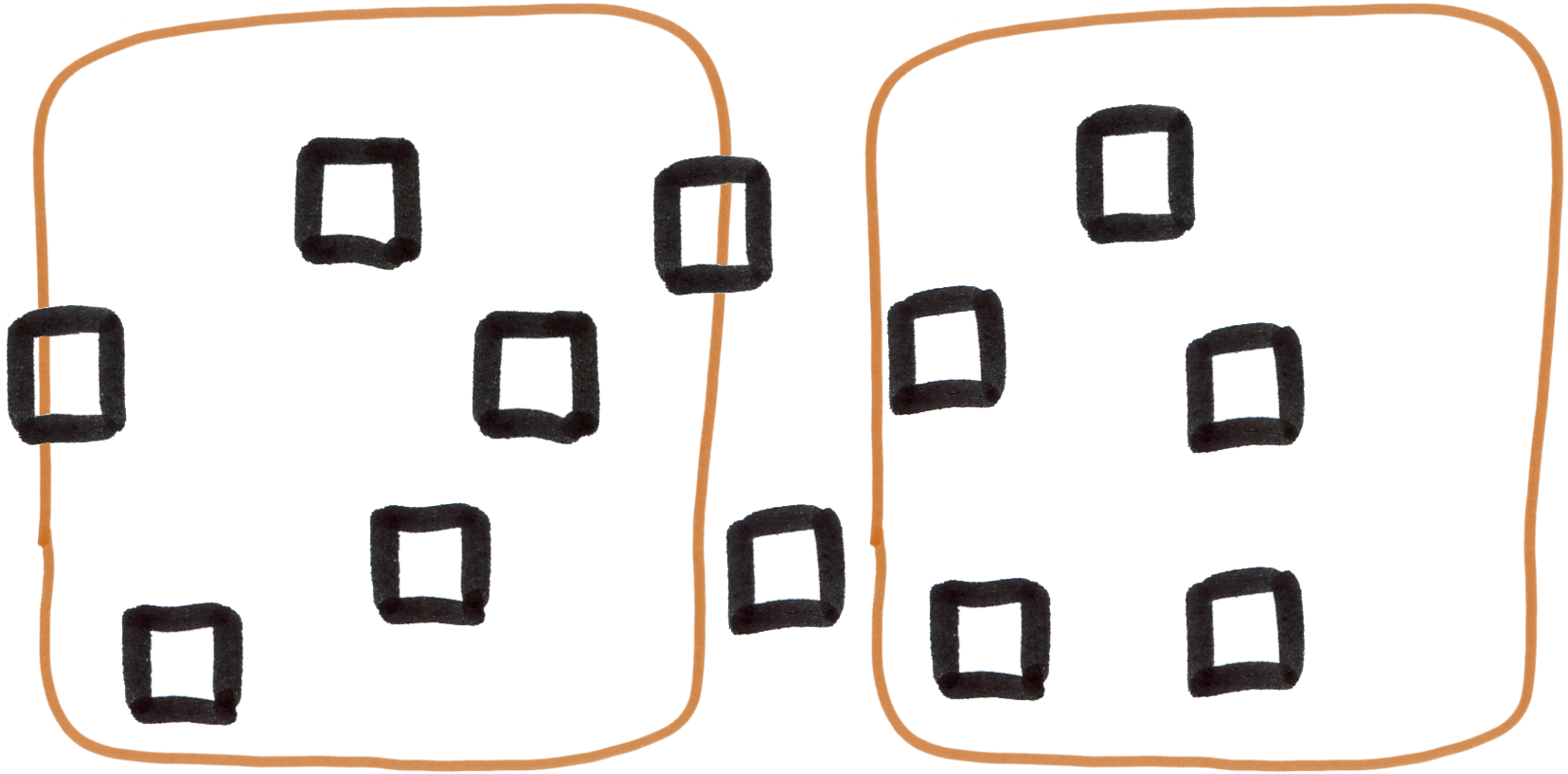
keep

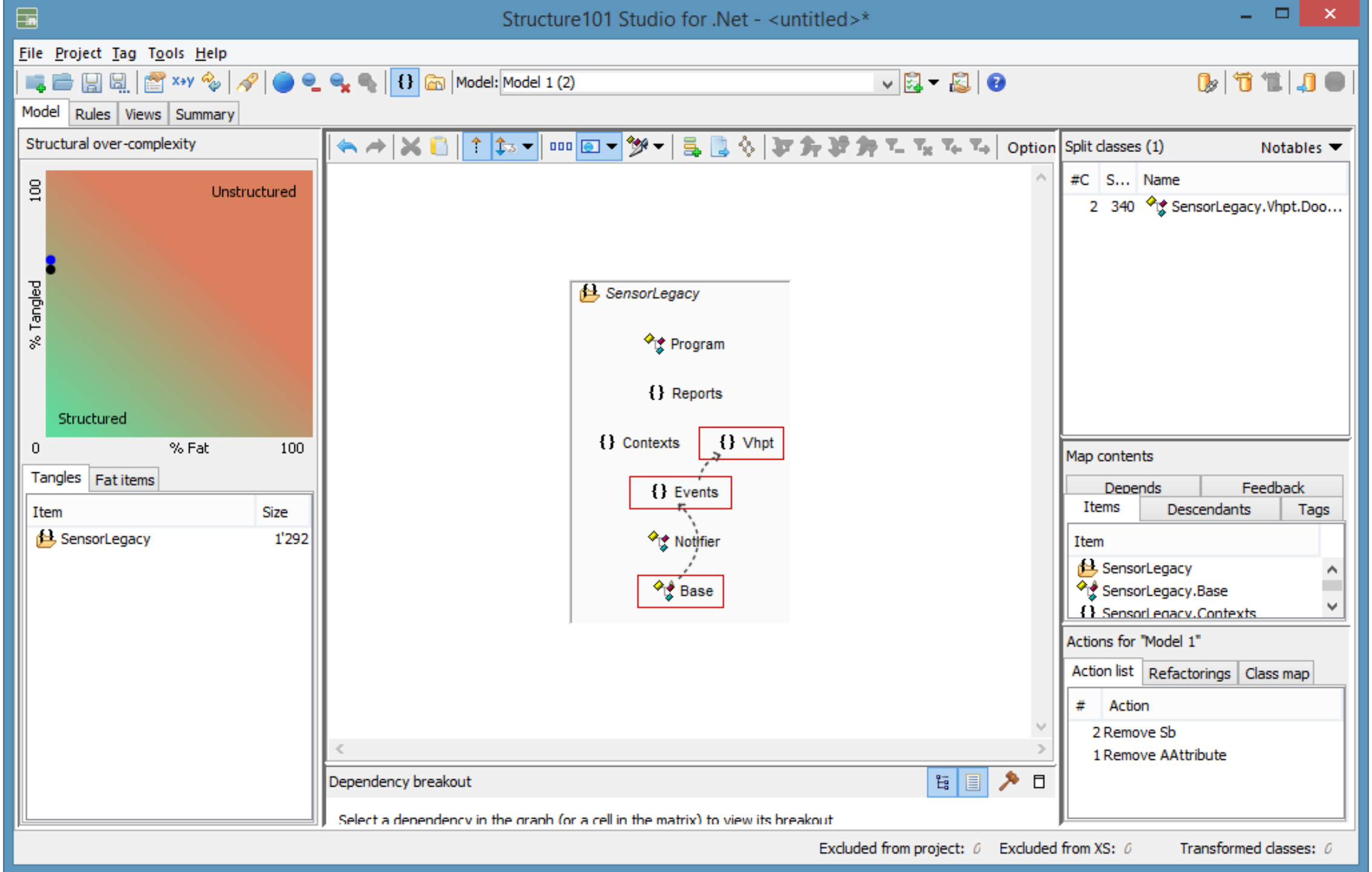
not high priority

Clean-up Backlog

tips & tricks

restructure to clusters and components

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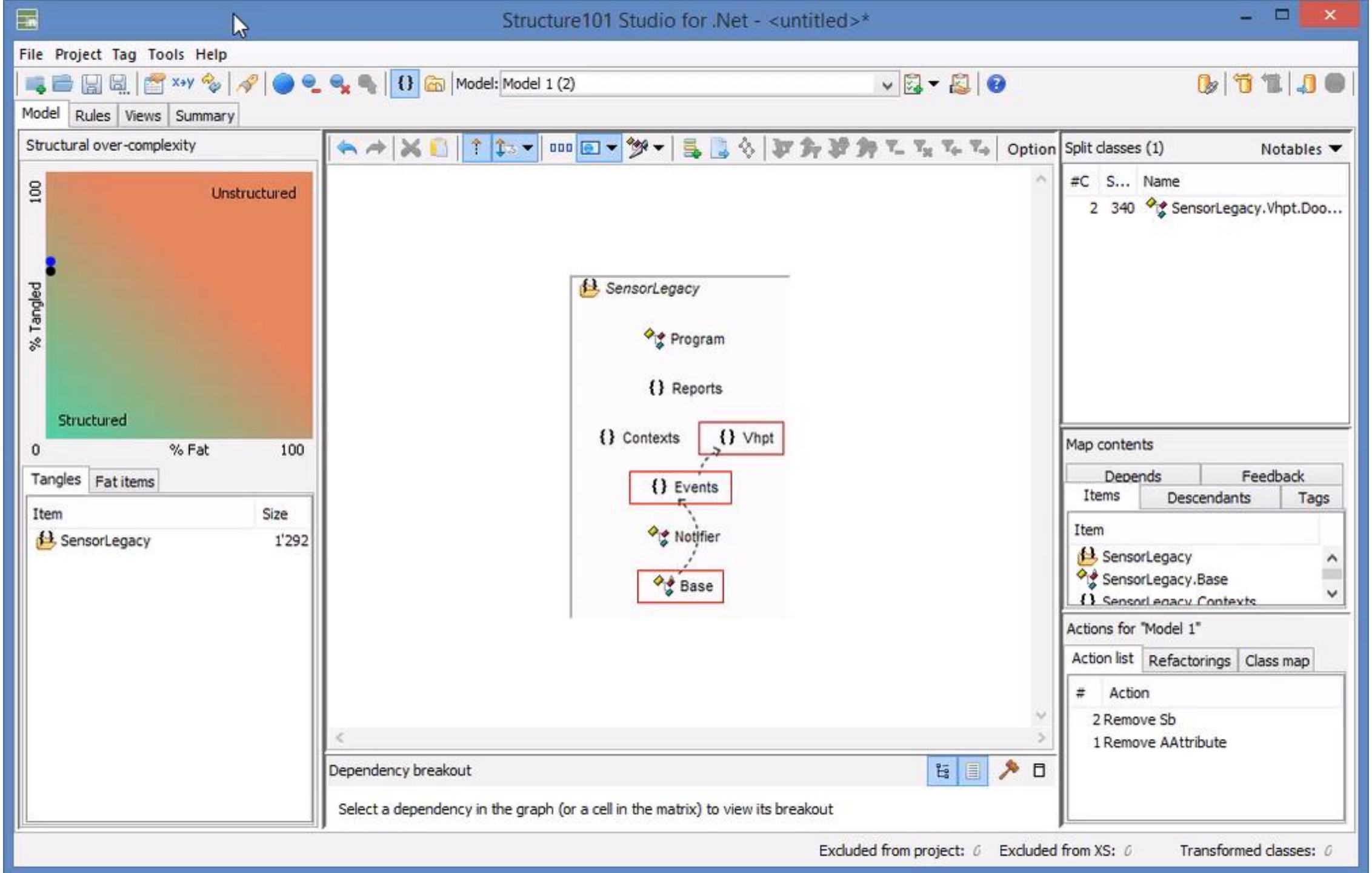
File Project Tag Tools Help
Model: Model 1 (2)
Model Rules Views Summary
Structural over-complexity
Unstructured
Structured
% Tangled
100
0
% Fat
100
Tangles Fat items
Item Size
SensorLegacy 1'292
Option
SensorLegacy
Program
Reports
Contexts
Vhpt
Events
Notifier
Base
Split classes (1)
Notables
#C S... Name
2 340 SensorLegacy.Vhpt.Doo...
Map contents
Depends Feedback
Items Descendants Tags
Item
SensorLegacy
SensorLegacy.Base
SensorLegacy.Contexts
Actions for "Model 1"
Action list Refactorings Class map
Action
2 Remove Sb
1 Remove AAttribute
Dependency breakout
Select a dependency in the graph (or a cell in the matrix) to view its breakout
Excluded from project: 0 Excluded from XS: 0 Transformed classes: 0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Events
Notifier
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Split classes (1)
Notables
#C S... Name
2 340 SensorLegacy.Vhpt.Doo...
Map contents
Depends Feedback
Items Descendants Tags
Item
SensorLegacy
SensorLegacy.Base
Actions for "Model 1"
Action list Refactorings Class map
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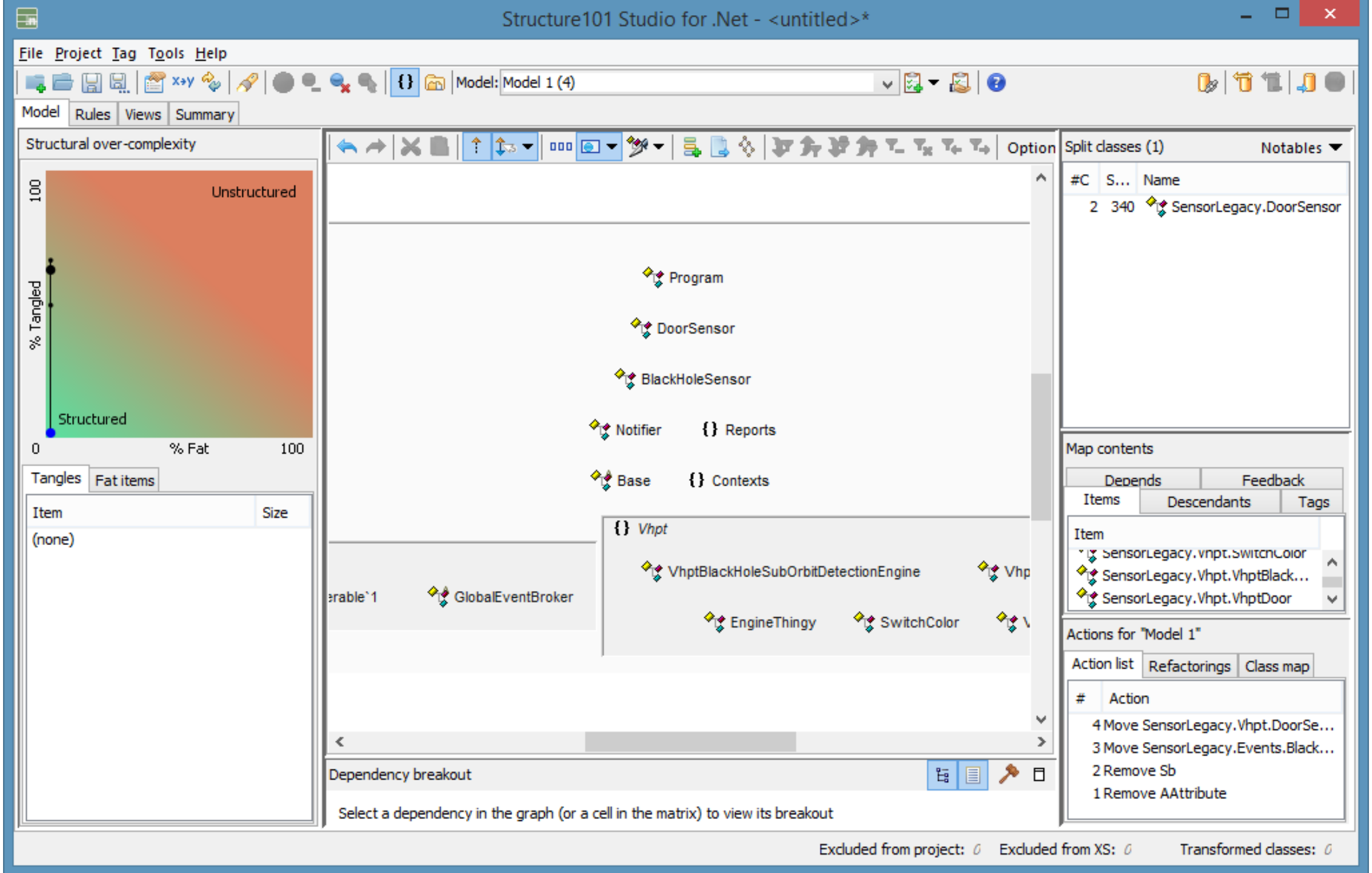
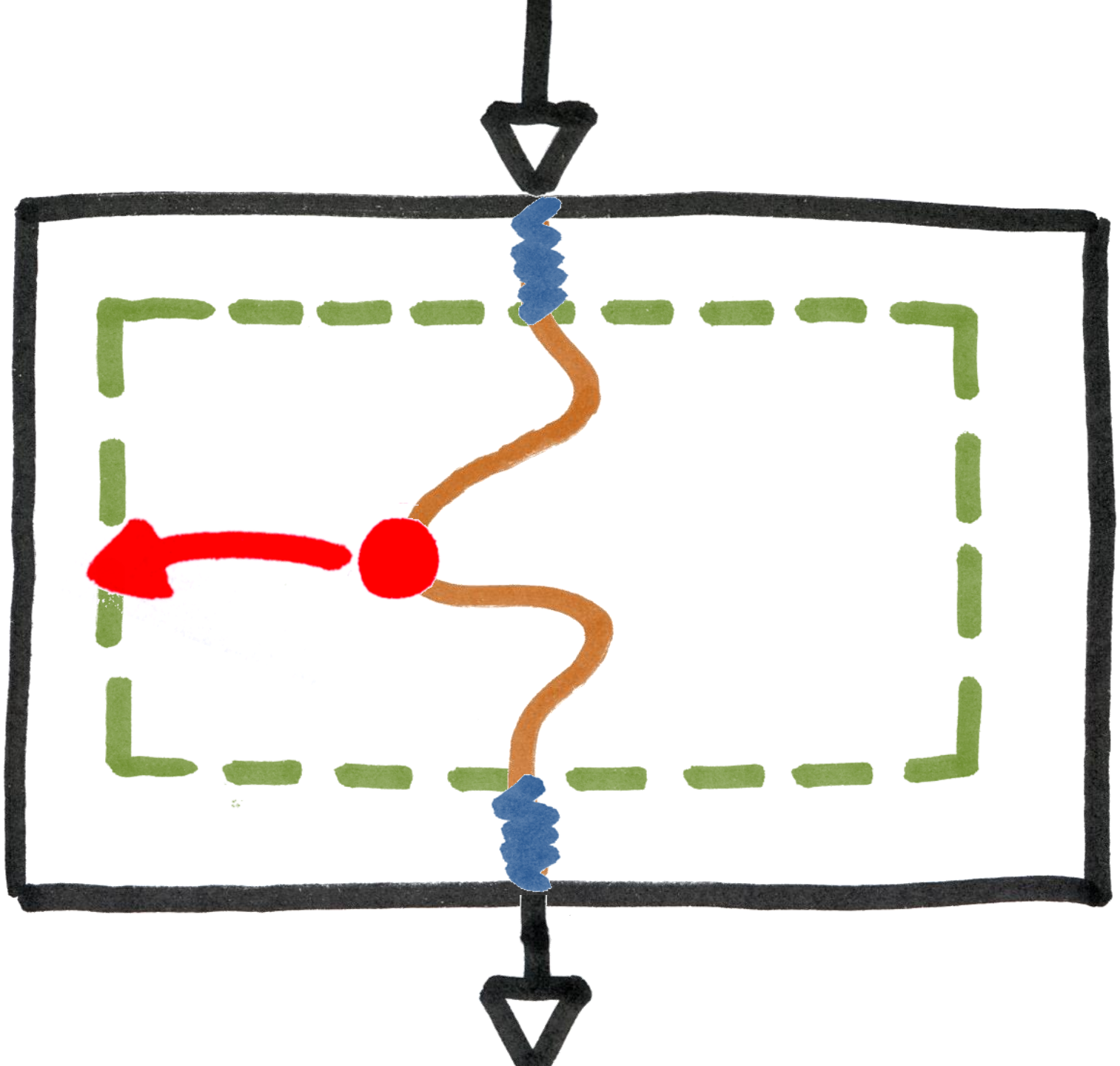
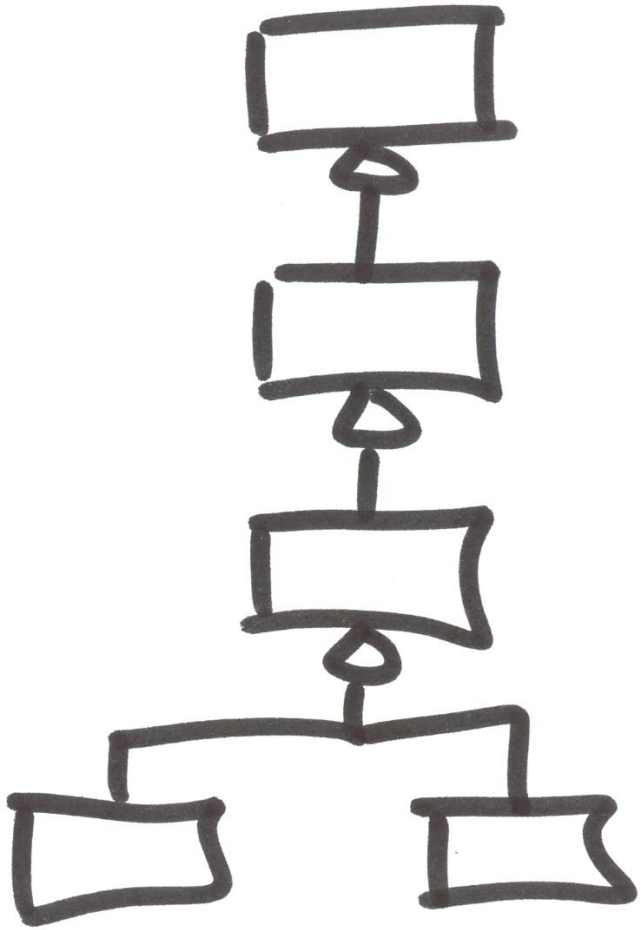
Excluded from XS: 0
Transformed classes: 0

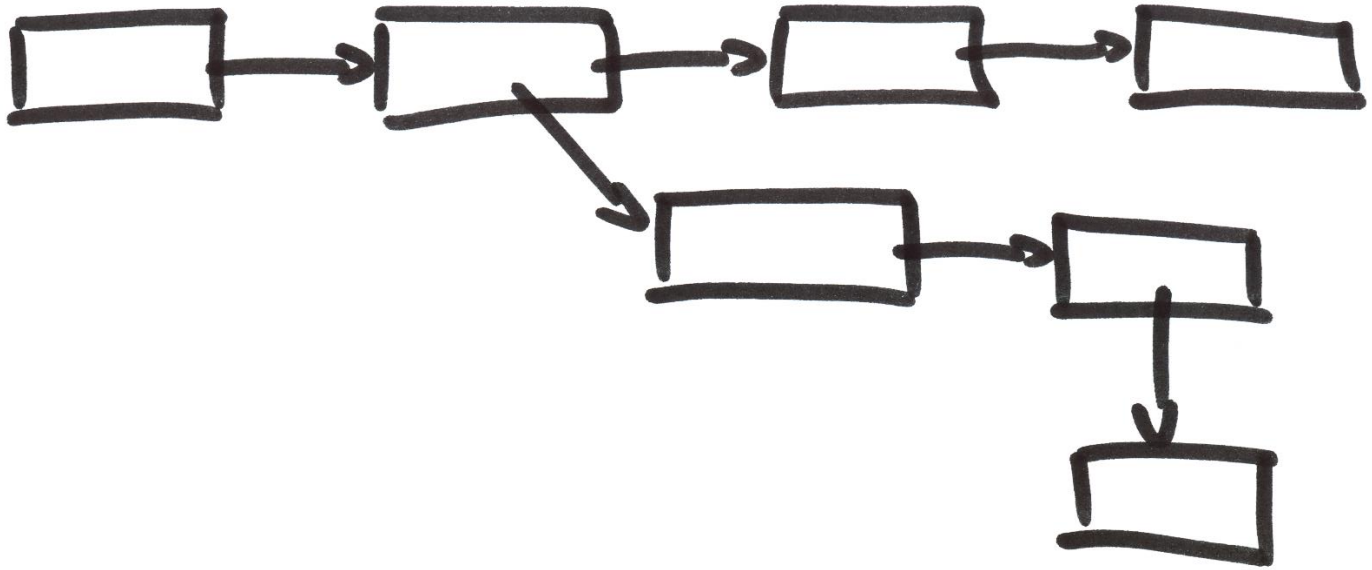

Structure101 Studio for .Net - <untitled>*
File Project Tag Tools Help
Model: Model 1 (4)
Model Rules Views Summary
Structural over-complexity
Unstructured
Structured
% Tangled
% Fat
0
100
100
Tangles Fat items
Item Size
(none)
Option
Program
DoorSensor
BlackHoleSensor
Notifier
Reports
Base
Contexts
Vhpt
VhptBlackHoleSubOrbitDetectionEngine
GlobalEventBroker
EngineThingy
SwitchColor
Dependency breakout
Select a dependency in the graph (or a cell in the matrix) to view its breakout
Split classes (1)
Notables
#C S... Name
2 340 SensorLegacy.DoorSensor
Map contents
Depends Feedback
Items Descendants Tags
Item
SensorLegacy.Vhpt.VhptBlack...
SensorLegacy.Vhpt.VhptDoor
Actions for "Model 1"
Action list Refactorings Class map
Action
4 Move SensorLegacy.Vhpt.DoorSe...
3 Move SensorLegacy.Events.Black...
2 Remove Sb
1 Remove AAttribute
Excluded from project: 0 Excluded from XS: 0 Transformed classes: 0

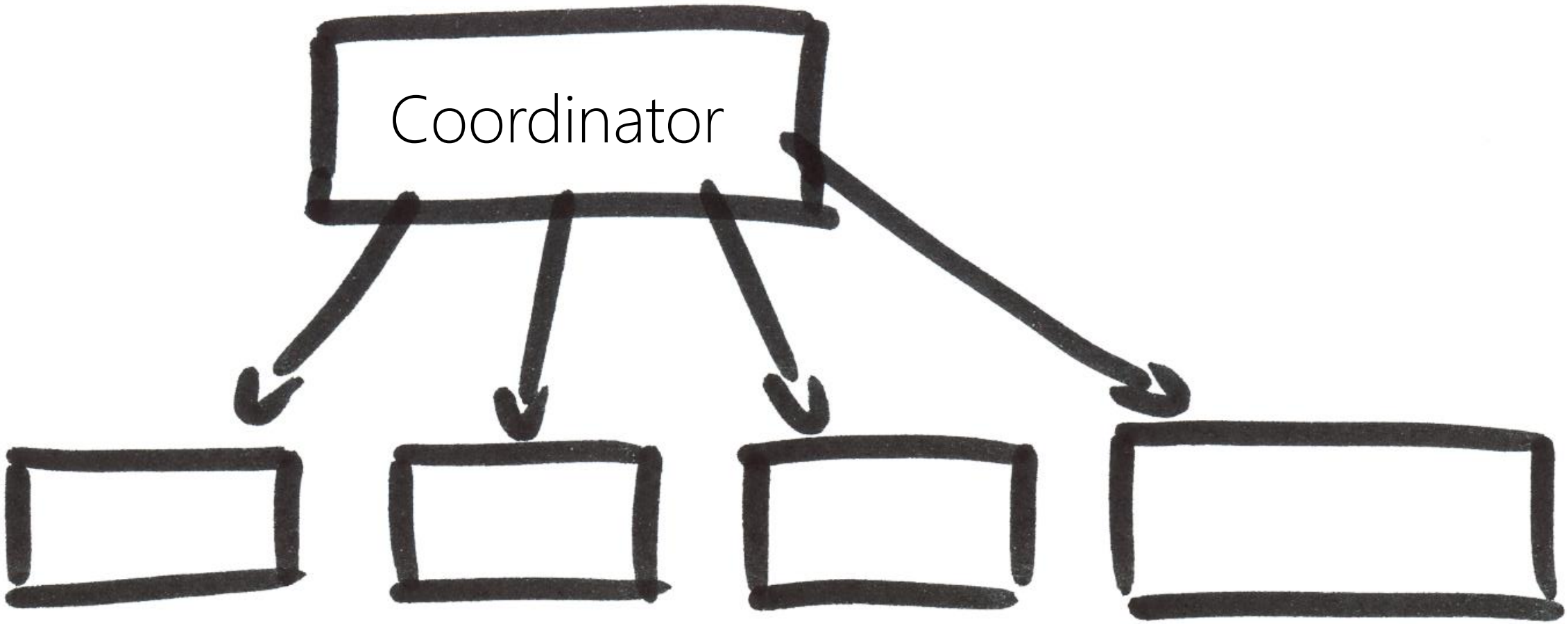
demilitarized zone



flatten hierarchies

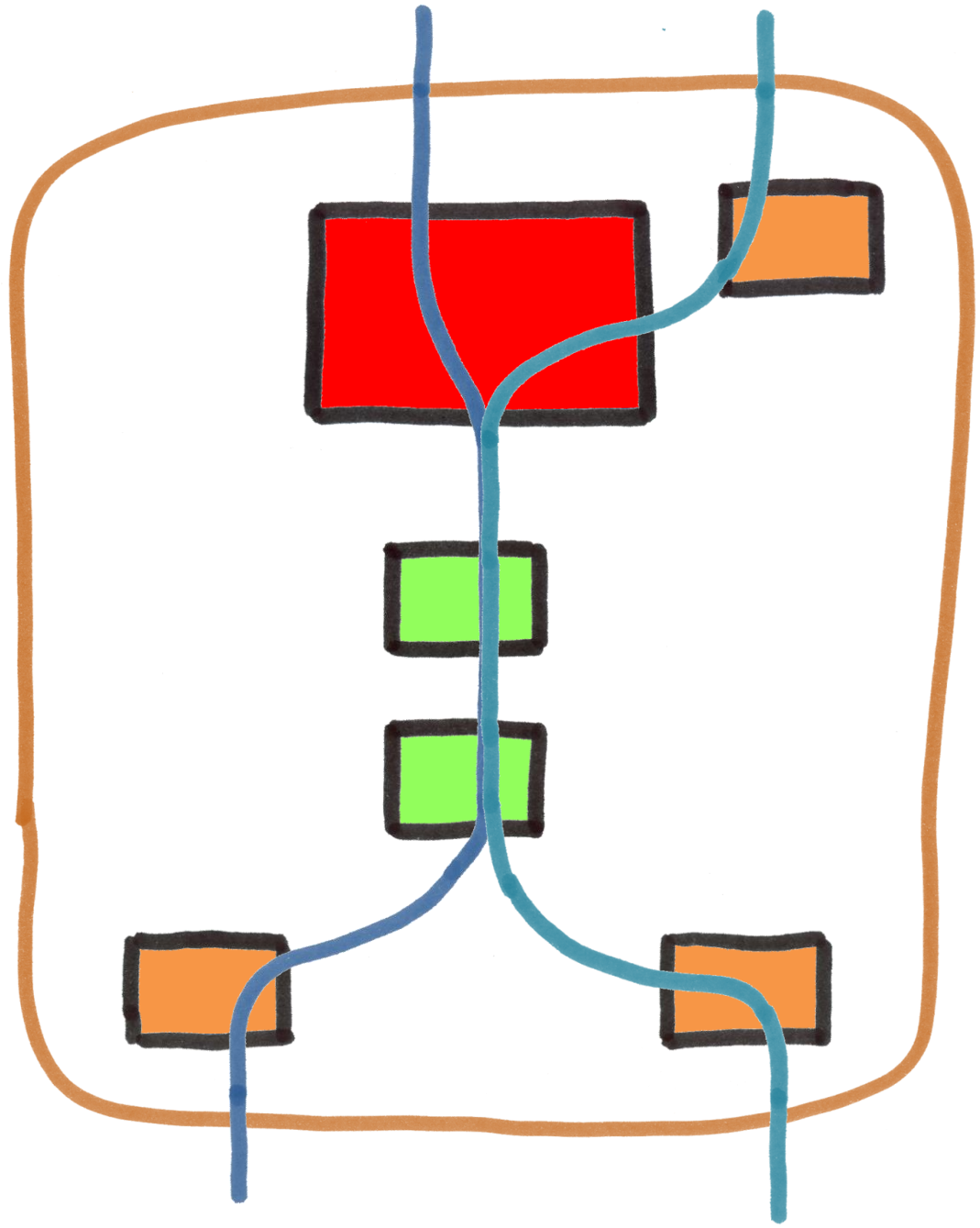




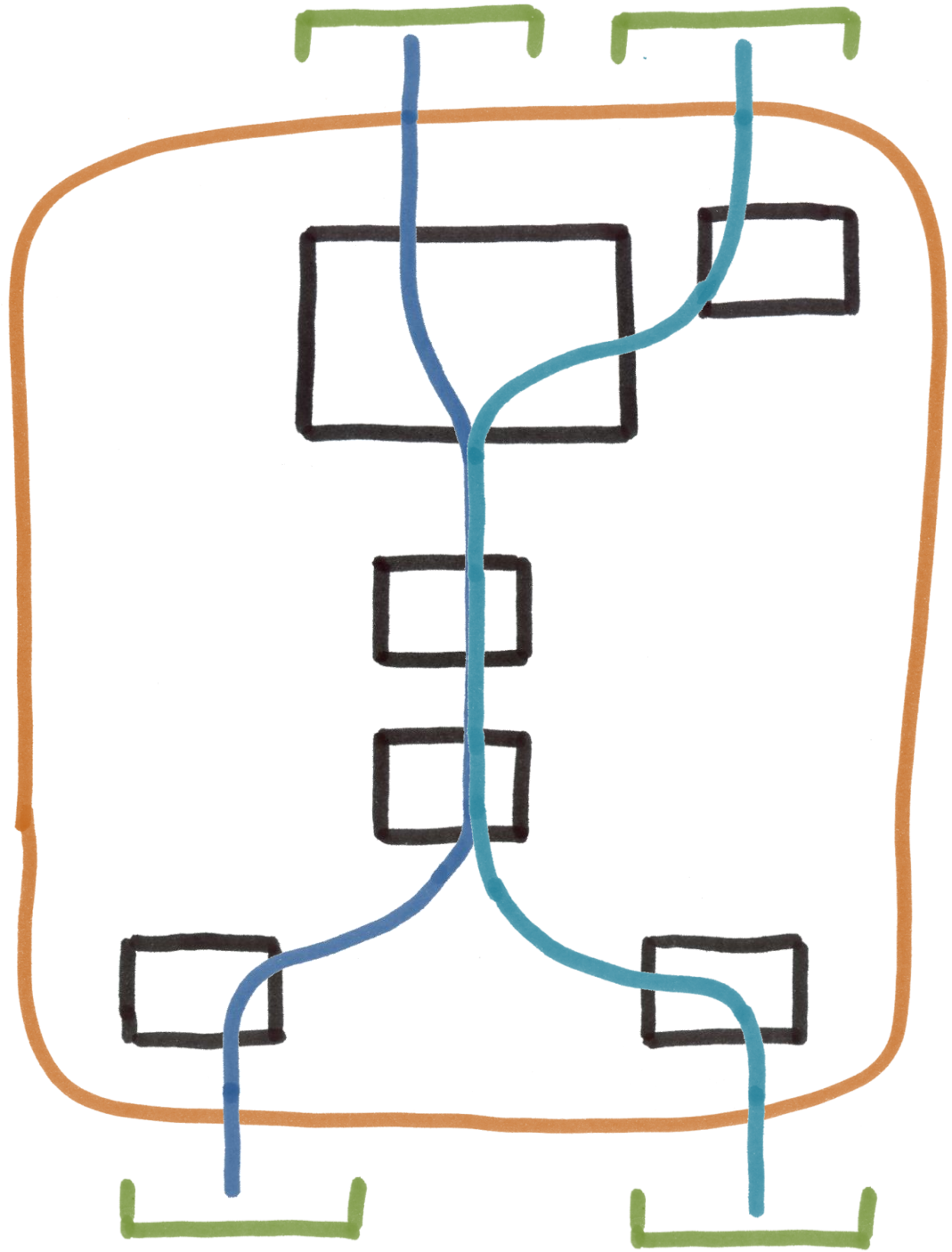

Coordinator
Workers

value classes

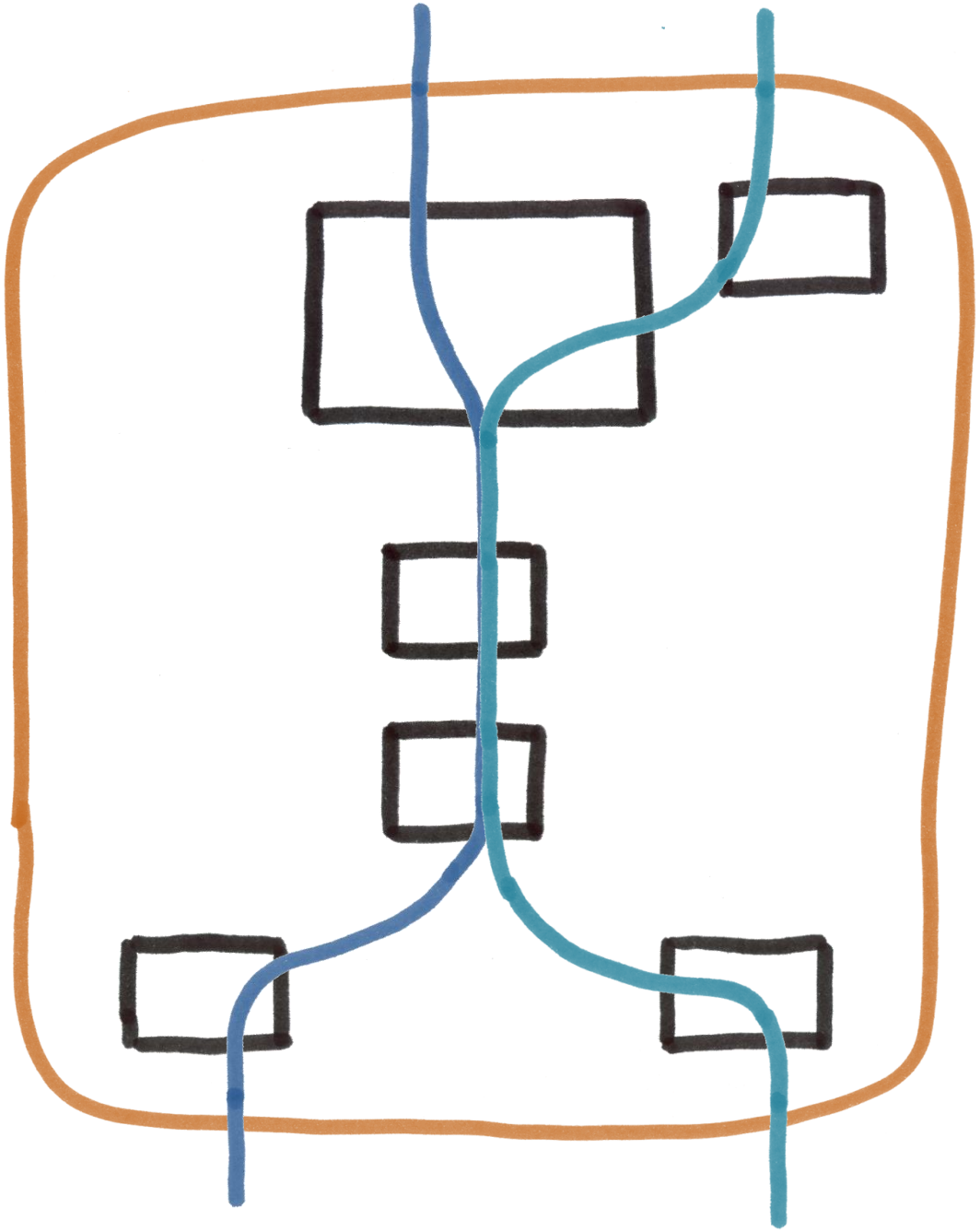
```
string GetPath();

Data LoadBy(string id);

AbsoluteFilePath GetPath();

Data LoadBy(DataId id)
```

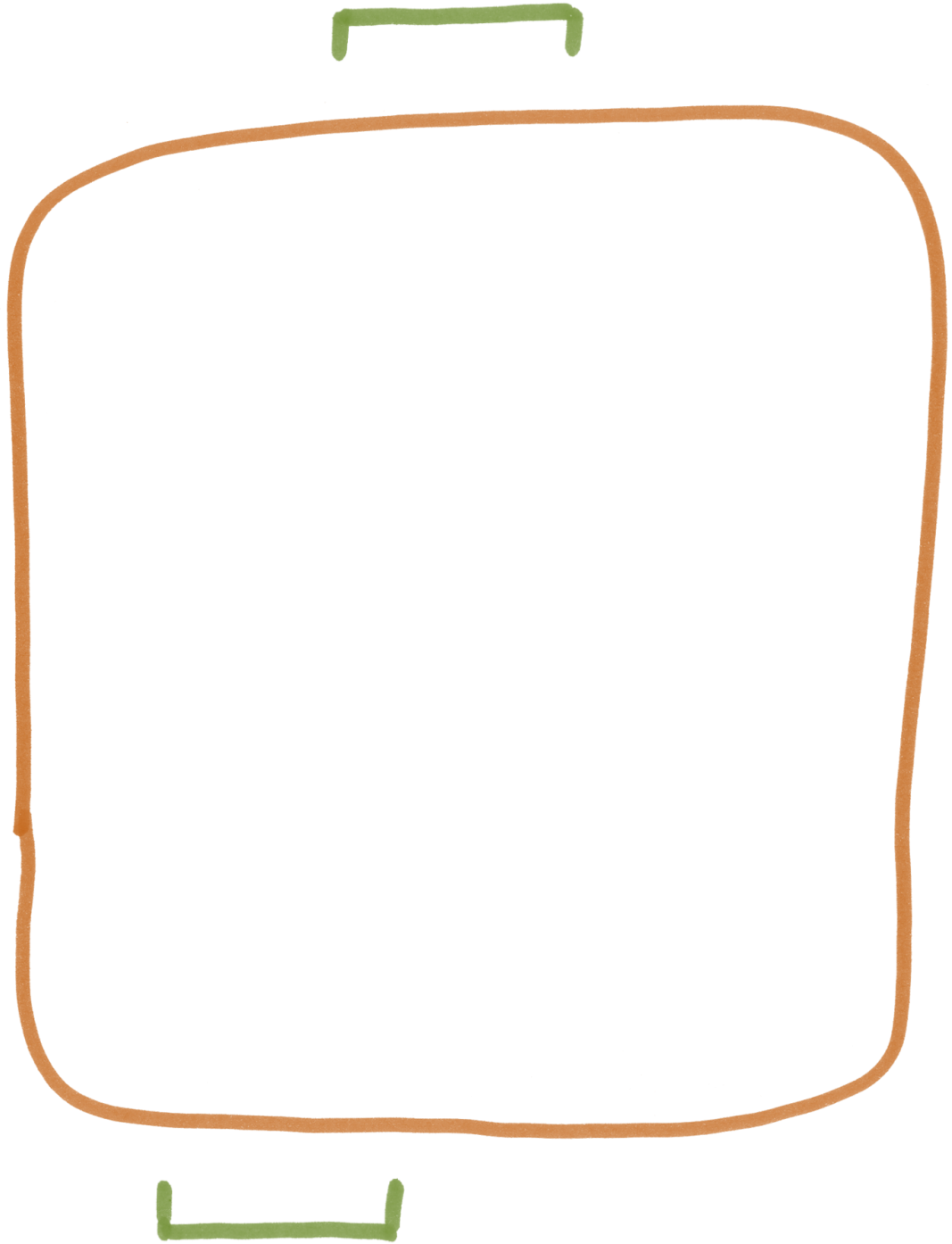


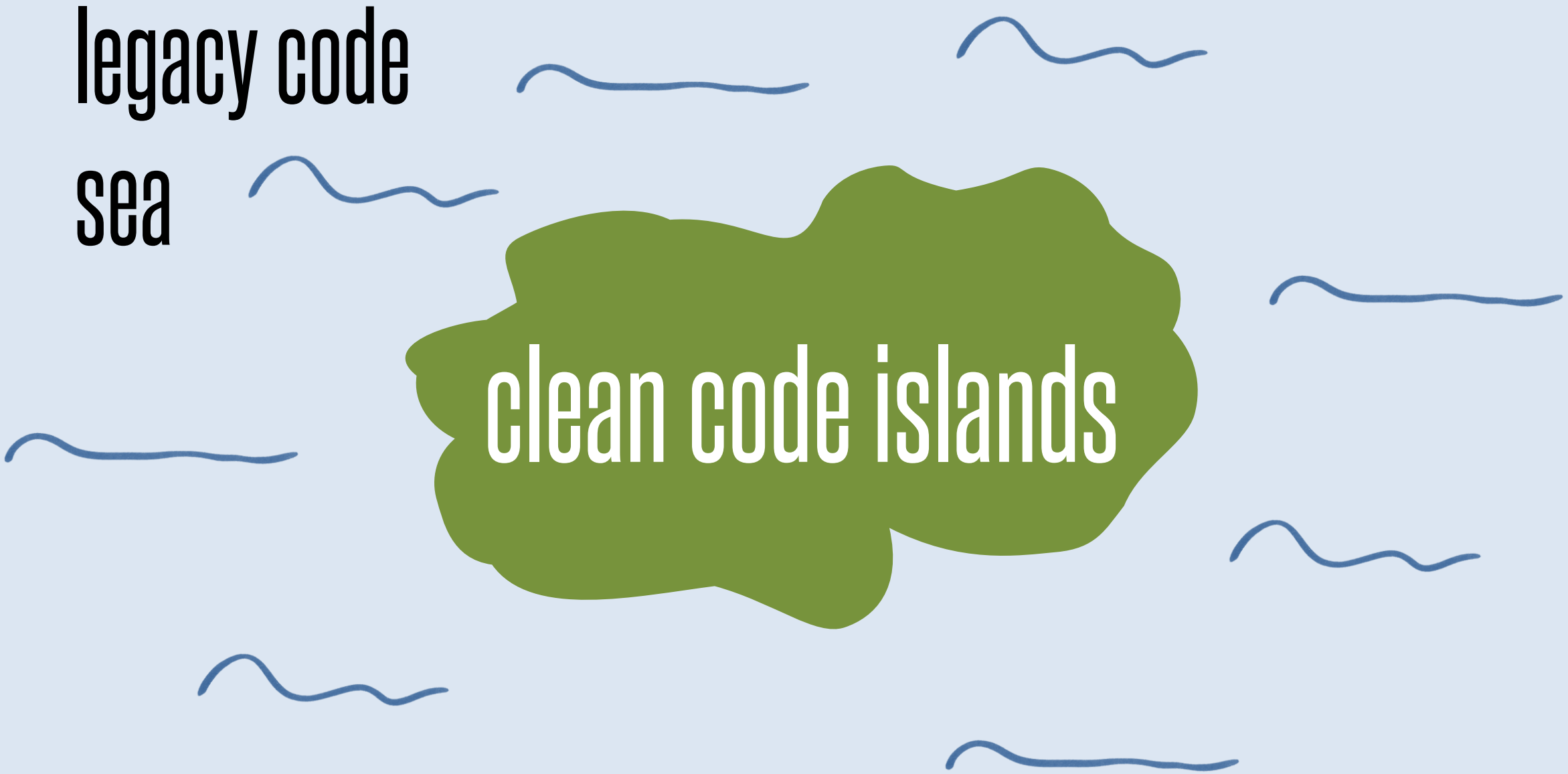
test all paths

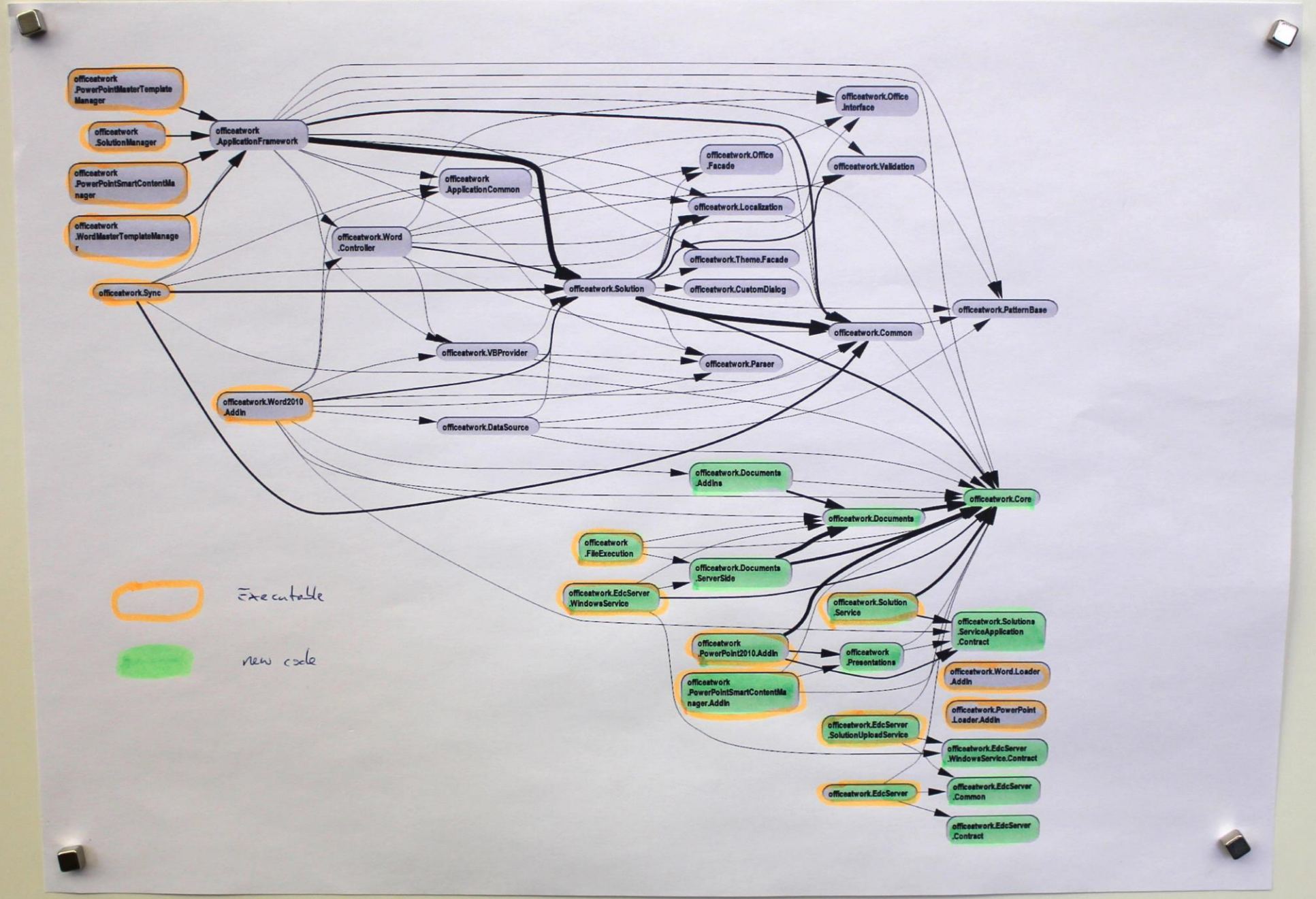


duplication






legacy code
sea
clean code islands



Stand

Solution Scope

conclusions

No Big Bang

Continuous,
step by step

Improvement

get new features | fast without braking existing functionality

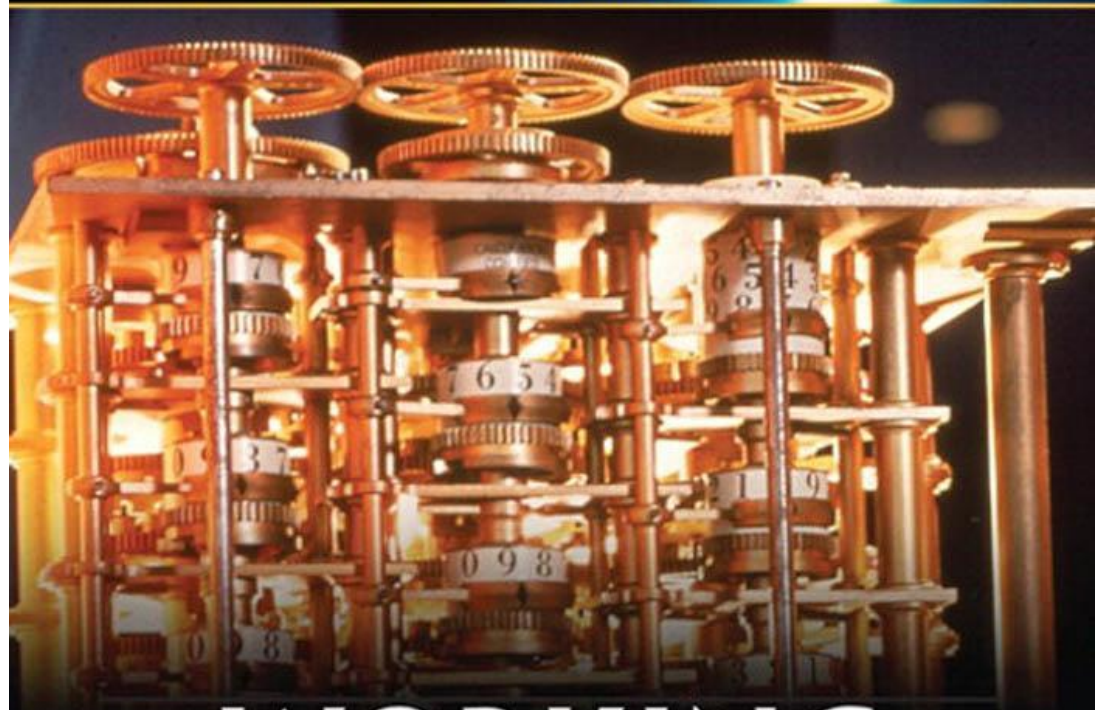
Metrics

- Ignored Tests
- Cycle Time
- Code Coverage
- Kohäsion
- Lines of Code
- Cyclomatische Komplexität
- Bug Map
- #Bugs/Code Churn
- #Bugs per Line of Code
- Tangles
- Kopplung
  - Afferent
  - Efferent
- Rule violations
  - StyleCop
  - FxCop ...
- Fatness
- WTF/minutes
- Duplicates

- Beobachten über die Zeit
- Nicht gegen Metriken optimieren
- Referenzwert als Startpunkt


WIP
Story Review
Hard Rock
CAFE
TOM TAILOR
19 62

Robert C. Martin Series



WORKING EFFECTIVELY WITH LEGACY CODE

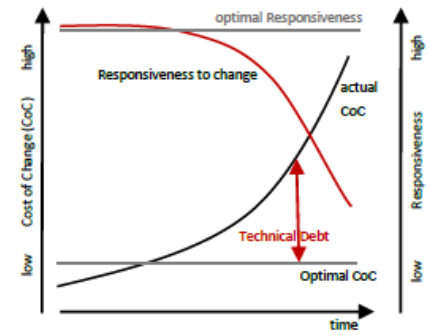
Michael C. Feathers

Clean Code Cheat Sheet

bbv Software Services

Why Clean Code

Code is clean if it can be understood easily – by everyone on the team. With understandability comes readability, changeability, extensibility and maintainability. All the things needed to keep a project going over a long time without accumulating up a large amount of technical debt.



Writing clean code from the start in a project is an investment in keeping the cost of change as constant as possible throughout the lifecycle of a software product. Therefore, the initial cost of change is a bit higher when writing clean code (grey line) than quick and dirty programming (black line), but is paid back quite soon. Especially if you keep in mind that most of the cost has to be paid during maintenance of the software. Unclean code results in technical debt that increases over time if not refactored into clean code. There are other reasons leading to Technical Debt such as bad processes and lack of documentation, but unclean code is a major driver. As a result, your ability to respond to changes is reduced (red line).

In Clean Code, Bugs Cannot Hide

Most software defects are introduced when changing existing code. The reason behind this is that the developer changing the code cannot fully grasp the effects of the changes made. Clean code minimises the risk of introducing defects by making the code as easy to understand as possible.

Principles

Loose Coupling +

Two classes, components or modules are coupled when at least one of them uses the other. The less these items know about each other, the looser they are coupled.

A component that is only loosely coupled to its environment can be more easily changed or replaced than a strongly coupled component.

High Cohesion +

Cohesion is the degree to which elements of a whole belong together. Methods and fields in a single class and classes of a component should have high cohesion. High cohesion in classes and components results in simpler, more easily understandable code structure and design.

Change is Local +

When a software system has to be maintained, extended and changed for a long time, keeping change local reduces involved costs and risks. Keeping change local means that there are boundaries in the design which changes do not cross.

It is Easy to Remove +

We normally build software by adding, extending or changing features. However, removing elements is important so that the overall design can be kept as simple as possible. When a block gets too complicated, it has to be removed and replaced with one or more simpler blocks.

Smells

Rigidity –

The software is difficult to change. A small change causes a cascade of subsequent changes.

Fragility –

The software breaks in many places due to a single change.

Immobility –

You cannot reuse parts of the code in other projects because of involved risks and high effort.

Viscosity of Design –

Taking a shortcut and introducing technical debt requires less effort than doing it right.

Viscosity of Environment –

Building, testing and other tasks take a long time. Therefore, these activities are not executed properly by everyone and technical debt is introduced.

Needless Complexity –

The design contains elements that are currently not useful. The added complexity makes the code harder to comprehend. Therefore, extending and changing the code results in higher effort than necessary.

Needless Repetition –

Code contains lots of code duplication: exact code duplications or design duplicates (doing the same thing in a different way). Making a change to a duplicated piece of code is more expensive and more error-prone because the change has to be made in several places with the risk that one place is not changed accordingly.

Opacity –

The code is hard to understand. Therefore, any change takes additional time to first reengineer the code and is more likely to result in defects due to not understanding the side effects.

Class Design

Single Responsibility Principle (SRP) +

A class should have one, and only one, reason to change.

Open Closed Principle (OCP) +

You should be able to extend a classes behaviour without modifying it.

Liskov Substitution Principle (LSP) +

Derived classes must be substitutable for their base classes.

Dependency Inversion Principle (DIP) +

Depend on abstractions, not on concretions.

Interface Segregation Principle (ISP) +

Make fine grained interfaces that are client-specific.

Classes Should be Small +

Smaller classes are easier to grasp. Classes should be smaller than about 100 lines of code. Otherwise, it is hard to spot how the class does its job and it probably does more than a single job.

Package Cohesion

Release Reuse Equivalency Principle (RREP) +

The granule of reuse is the granule of release.

Common Closure Principle (CCP) +

Classes that change together are packaged together.

Common Reuse Principle (CRP) +

Classes that are used together are packaged together.

Package Coupling

Acyclic Dependencies Principle (ADP) +

The dependency graph of packages must have no cycles.

Stable Dependencies Principle (SDP) +

Depend in the direction of stability.

Stable Abstractions Principle (SAP) +

Abstractness increases with stability

General

Follow Standard Conventions +

Coding-, architecture-, design guidelines (check them with tools)

Keep it Simple, Stupid (KISS) +

Simpler is always better. Reduce complexity as much as possible.

Boy Scout Rule +

Leave the campground cleaner than you found it.

Root Cause Analysis +

Always look for the root cause of a problem. Otherwise, it will get you again and again.

Multiple Languages in One Source File –

C#, Java, JavaScript, XML, HTML, XAML, English, German ...

Environment

Project Build Requires Only One Step +

Check out and then build with a single command.

Executing Tests Requires Only One Step +

Run all unit tests with a single command.

Source Control System +

Always use a source control system.

Continuous Integration +

Assure integrity with Continuous Integration

Overridden Safeties –

Do not override warnings, errors, exception handling – they will catch you.

Dependency Injection

Decouple Construction from Runtime +

Decoupling the construction phase completely from the runtime helps to simplify the runtime behaviour.

Design

Keep Configurable Data at High Levels +

If you have a constant such as default or configuration value that is known and expected at a high level of abstraction, do not bury it in a low-level function. Expose it as an argument to the low-level function called from the high-level function.

Don't Be Arbitrary +

Have a reason for the way you structure your code, and make sure that reason is communicated by the structure of the code. If a structure appears arbitrary, others will feel empowered to change it.

Be Precise +

When you make a decision in your code, make sure you make it precisely. Know why you have made it and how you will deal with any exceptions.

Structure over Convention +

Enforce design decisions with structure over convention. Naming conventions are good, but they are inferior to structures that force compliance.

Prefer Polymorphism To If/Else or Switch/Case +

"ONE SWITCH": There may be no more than one switch statement for a given type of selection. The cases in that switch statement must create polymorphic objects that take the place of other such switch statements in the rest of the system.

Symmetry / Analogy +

Favour symmetric designs (e.g. Load – Save) and designs that follow analogies (e.g. same design as found in .NET framework).

Separate Multi-Threading Code +

Do not mix code that handles multi-threading aspects with the rest of the code. Separate them into different classes.

Misplaced Responsibility –

Something put in the wrong place.

Code at Wrong Level of Abstraction –

Functionality is at wrong level of abstraction, e.g. a PercentageFull property on a generic IStack<T>.

Fields Not Defining State –

Fields holding data that does not belong to the state of the instance but are used to hold temporary data. Use local variables or extract to a class abstracting the performed action.

Over Configurability –

Prevent configuration just for the sake of it – or because nobody can decide how it should be. Otherwise, this will result in overly complex, unstable systems.

Micro Layers –

Do not add functionality on top, but simplify overall.

Dependencies

Make Logical Dependencies Physical +

If one module depends upon another, that dependency should be physical, not just logical. Don't make assumptions.

Singletons / Service Locator –

Use dependency injection. Singletons hide dependencies.

Base Classes Depending On Their Derivatives –

Base classes should work with any derived class.

Too Much Information –

Minimise interface to minimise coupling

Feature Envy –

The methods of a class should be interested in the variables and functions of the class they belong to, and not the variables and functions of other classes. When a method uses accessors and mutators of some other object to manipulate the data within that object, then it envies the scope of the class of that other object. It wishes that it were inside that other class so that it could have direct access to the variables it is manipulating.

Artificial Coupling –

Things that don't depend upon each other should not be artificially coupled.

Hidden Temporal Coupling –

If, for example, the order of some method calls is important, then make sure that they cannot be called in the wrong order.

Transitive Navigation –

Aka Law of Demeter, writing shy code.
A module should know only its direct dependencies.

Naming

Choose Descriptive / Unambiguous Names +

Names have to reflect what a variable, field, property stands for. Names have to be precise.

Choose Names at Appropriate Level of Abstraction +

Choose names that reflect the level of abstraction of the class or method you are working in.

Name Interfaces After Functionality They Abstract +

The name of an interface should be derived from its usage by the client, such as IStream.

Name Classes After How They Implement Their Interfaces +

The name of a class should reflect how it fulfils the functionality provided by its interface(s), such as MemoryStream : IStream

Name Methods After What They Do +

The name of a method should describe what is done, not how it is done.

Use Long Names for Long Scopes +

fields → parameters → locals → loop variables
long → short

Names Describe Side Effects +

Names have to reflect the entire functionality.

Standard Nomenclature Where Possible +

Don't invent your own language when there is a standard.

Encodings in Names –

No prefixes, no type/scope information

Urs Enzler

urs.enzler@bbv.ch

twitter: @ursenzler
blog: www.planetgeek.ch
www.bbv.ch/blog
OSS lead: Appccelerate
user group: www.dotnet-zentral.ch

Software Services AG