

VariCity: Visualizing Object-Oriented Variability Implementations as Cities

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Variability in object-oriented systems

Variability: capacity of a system to be configured or tailored for a specific use

Object-oriented systems implement variability using **object-oriented mechanisms**:

- inheritance
- overloading of methods and constructors
- design patterns

Creation of **complex zones** in the system

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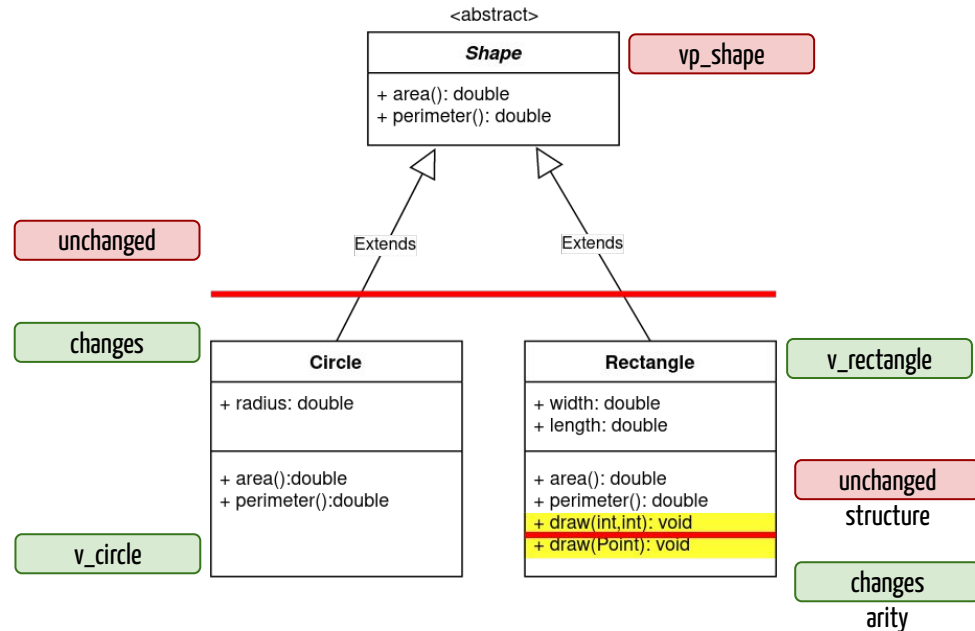
⇒ **understanding them is crucial** to comprehend the codebase variability

Problem: How to identify and comprehend variability implementations in an object-oriented codebase?

Identifying OO variability implementations with symmetries

- **Symmetries** exist in each OO mechanism (Coplien and Zhao's work)
- Symmetries present in **mechanisms implementing variability**

High density of symmetries
⇒ **high density of variability**

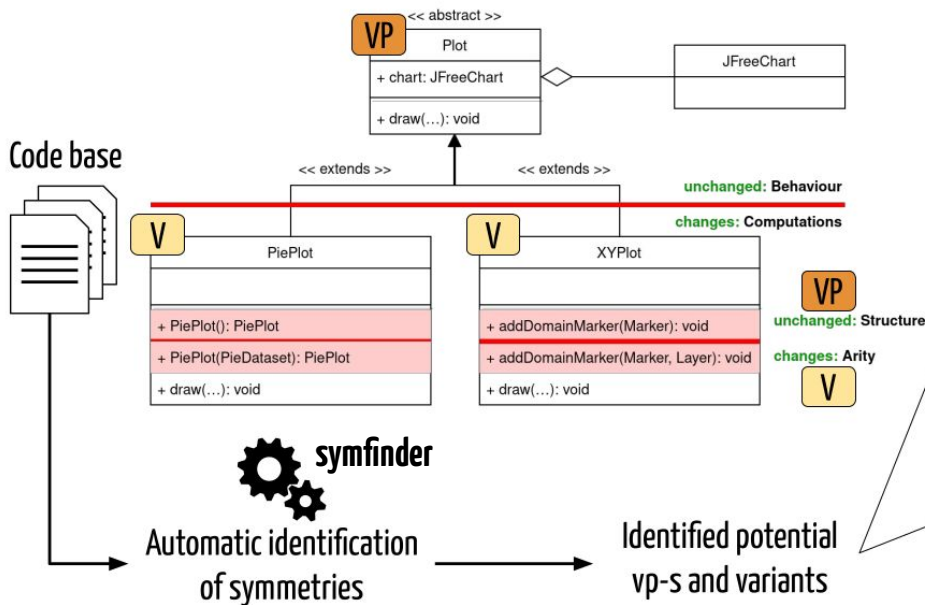


Automatic identification of variability implementations in an OO codebase



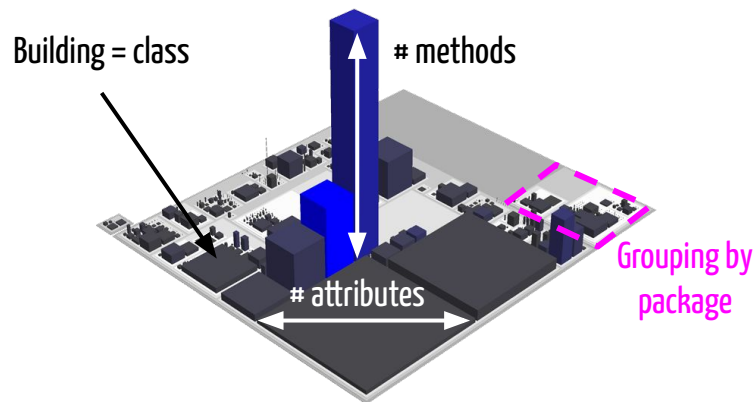
⇒ need for a visualization to exploit metrics

metrics / properties

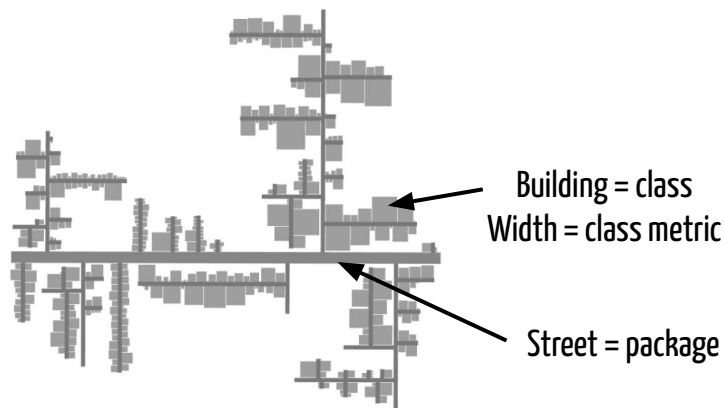


Plot types: CLASS, ABSTRACT, VP, VARIANT, METHOD_LEVEL_VP, FACTORY, STRATEGY constructorVPs: 0 constructorVariants: 0 methodVPs: 3 methodVariants: 6 attributes: AxisLocation, PlotRenderingInfo, PiePlot, MeterPlot, ... subclasses: PiePlot, XYPlot, MeterPlot, CategoryPlot, ...	JFreeChart types: CLASS, VP, FACTORY, METHOD_LEVEL_VP constructorVPs: 1 constructorVariants: 3 methodVPs: 7 methodVariants: 17 attributes: Plot, Title, ...
XYPlot types: CLASS, STRATEGY, VP, VARIANT, METHOD_LEVEL_VP constructorVPs: 1 constructorVariants: 2 methodVPs: 30 methodVariants: 77 attributes: Plot, Title, ... subclasses: CombinedDomainXYPlot, ...	PiePlot types: CLASS, VP, VARIANT, METHOD_LEVEL_VP constructorVPs: 1 constructorVariants: 2 methodVPs: 4 methodVariants: 9 attributes: Plot, Title, ... subclasses: RingPlot, ...

Existing city metaphors



CodeCity view of Jmol
(<https://wettel.github.io/codacity-wof.html>)



Evo-Streets view of CrocoCosmos
Steinbrückner and Lewerentz, 2010

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VariCity provides a **visualization** relying on the **city metaphor** of OO variability implementations

Visualization **exhibits zones of high density of variability**, in classes and between classes

The view is **pre-configurable** and **adaptable** while browsing

Reproduction package:

<https://doi.org/10.5281/zenodo.5034199>

Obtained reproducibility badges

Open Research Objects

Research Objects Reviewed



Get the paper on VariCity:

<https://hal.archives-ouvertes.fr/hal-03312487>

VariCity website:

<https://deathstar3.github.io/varicity-demo/>