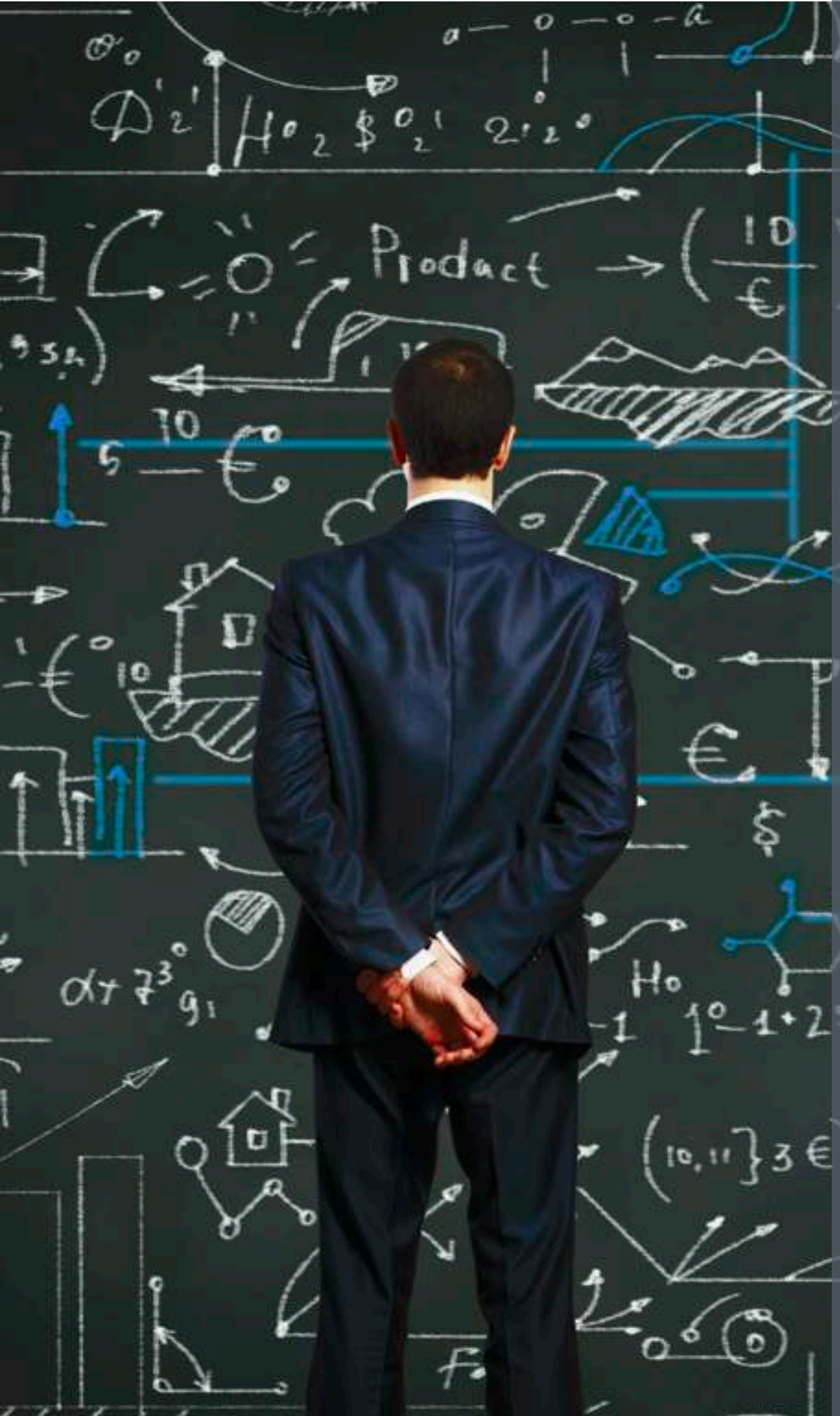


Interactive Visualization of Software

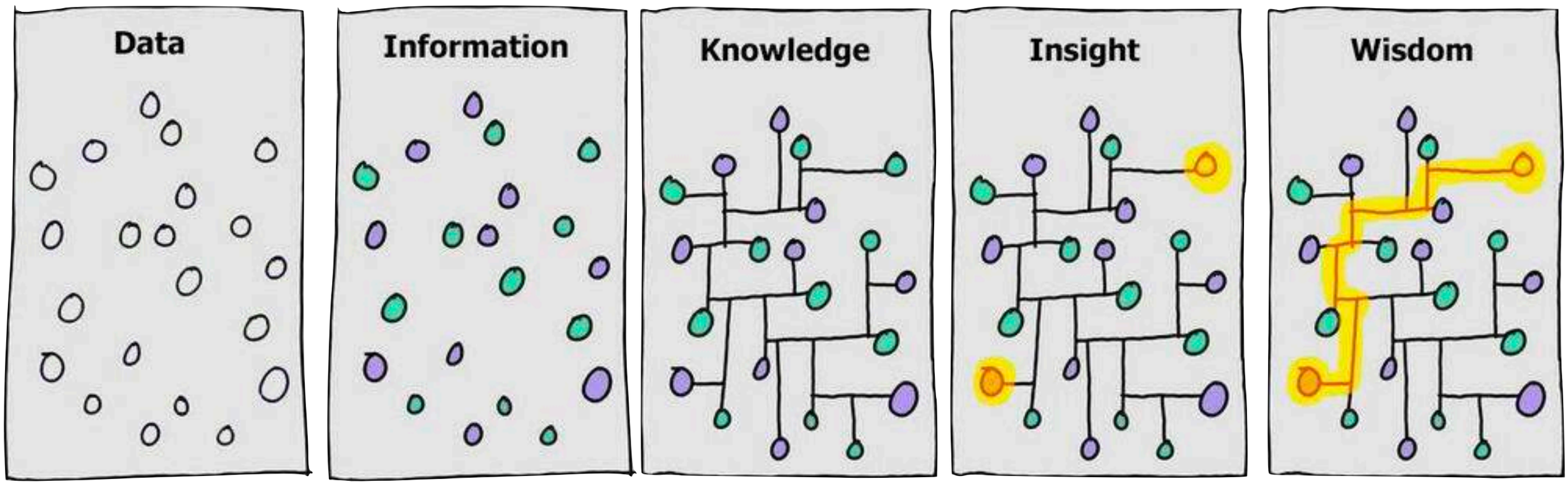
Markus Scheidgen
Nils Goldammer
Joachim Fischer

demographics
economics
social media
health
biology
geography
IoT
.
.
.
software

metrics
source histories
issue tracking
usage

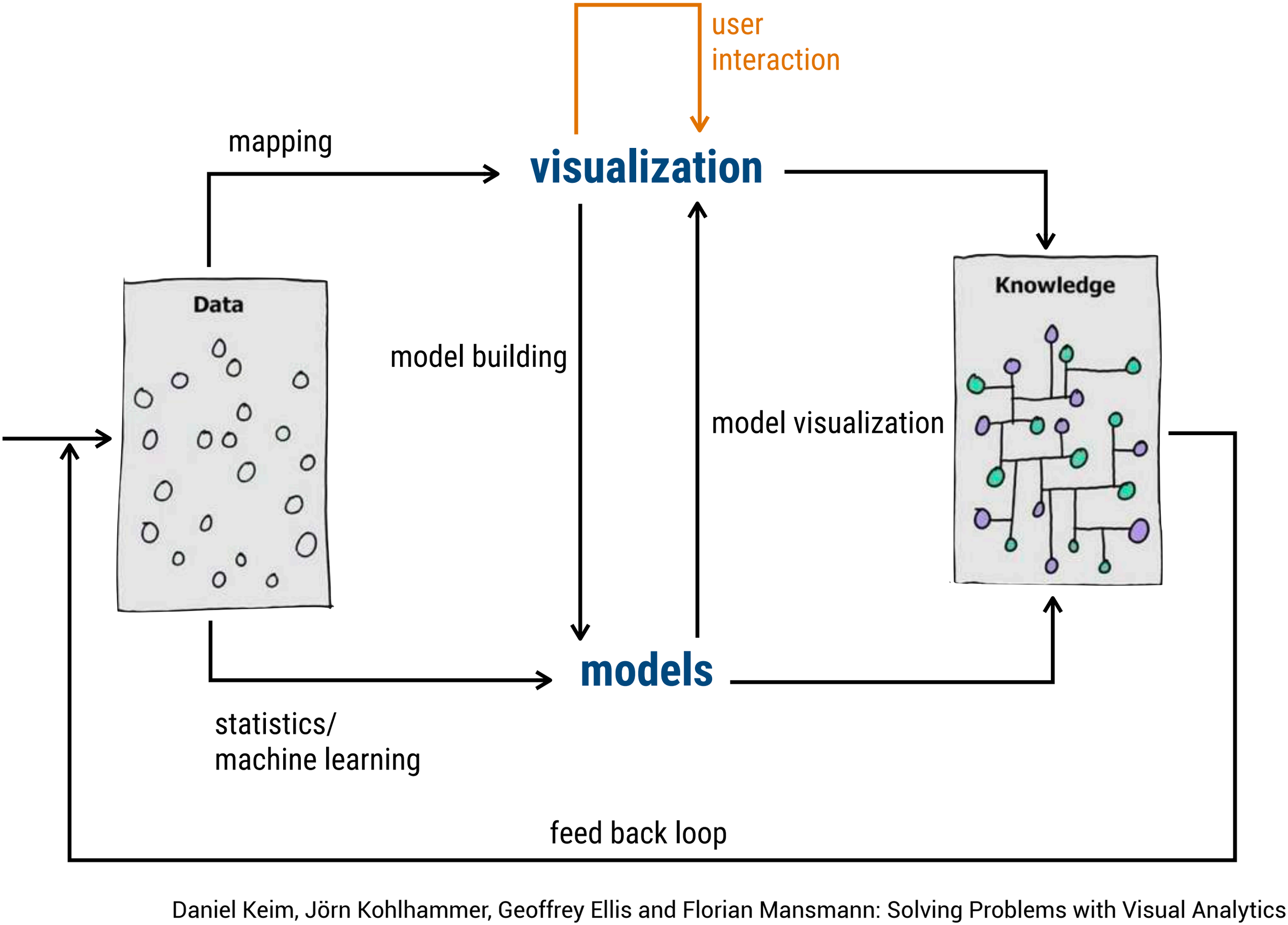
mining
software
repositories
(MSR)

visualization

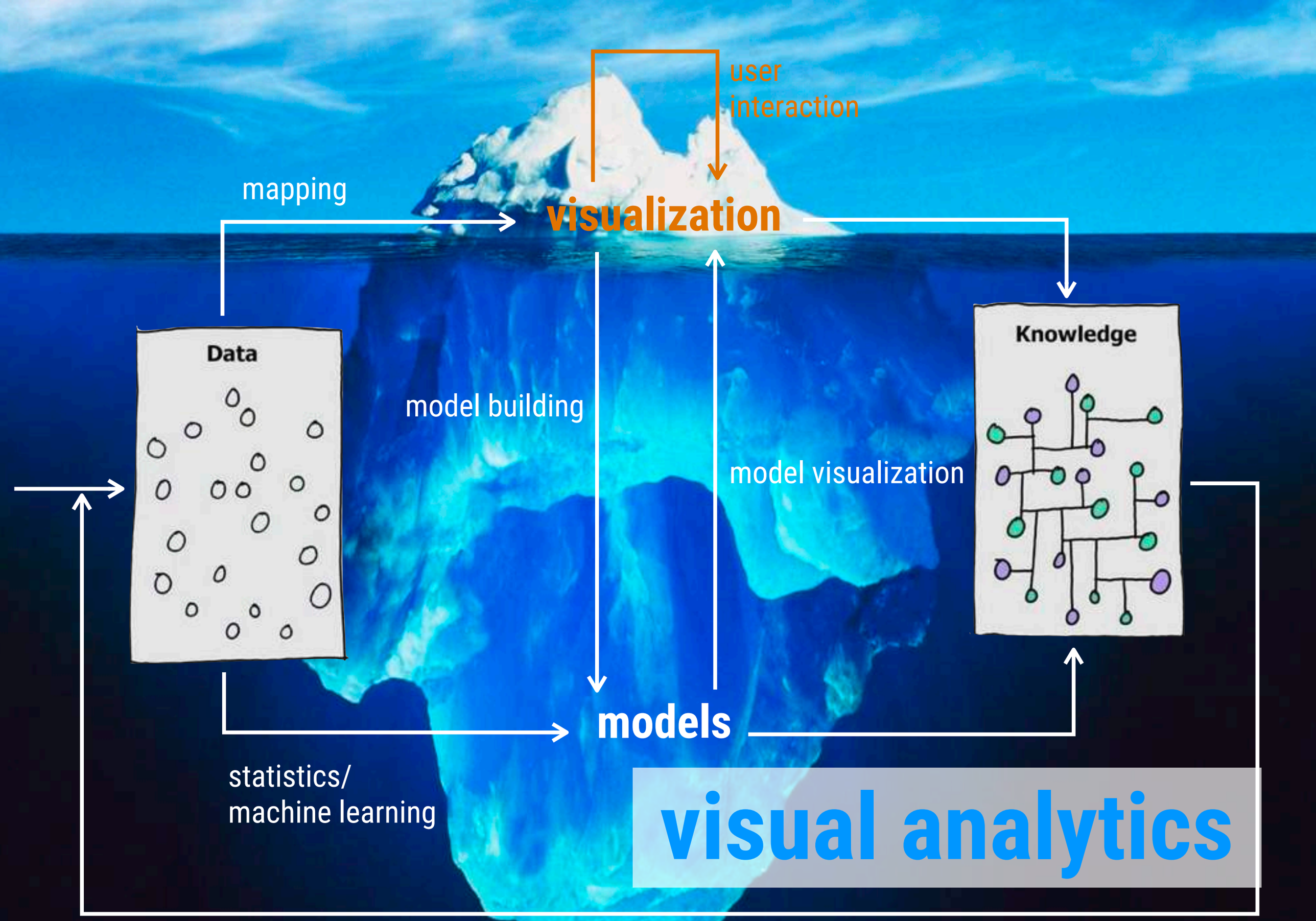


models

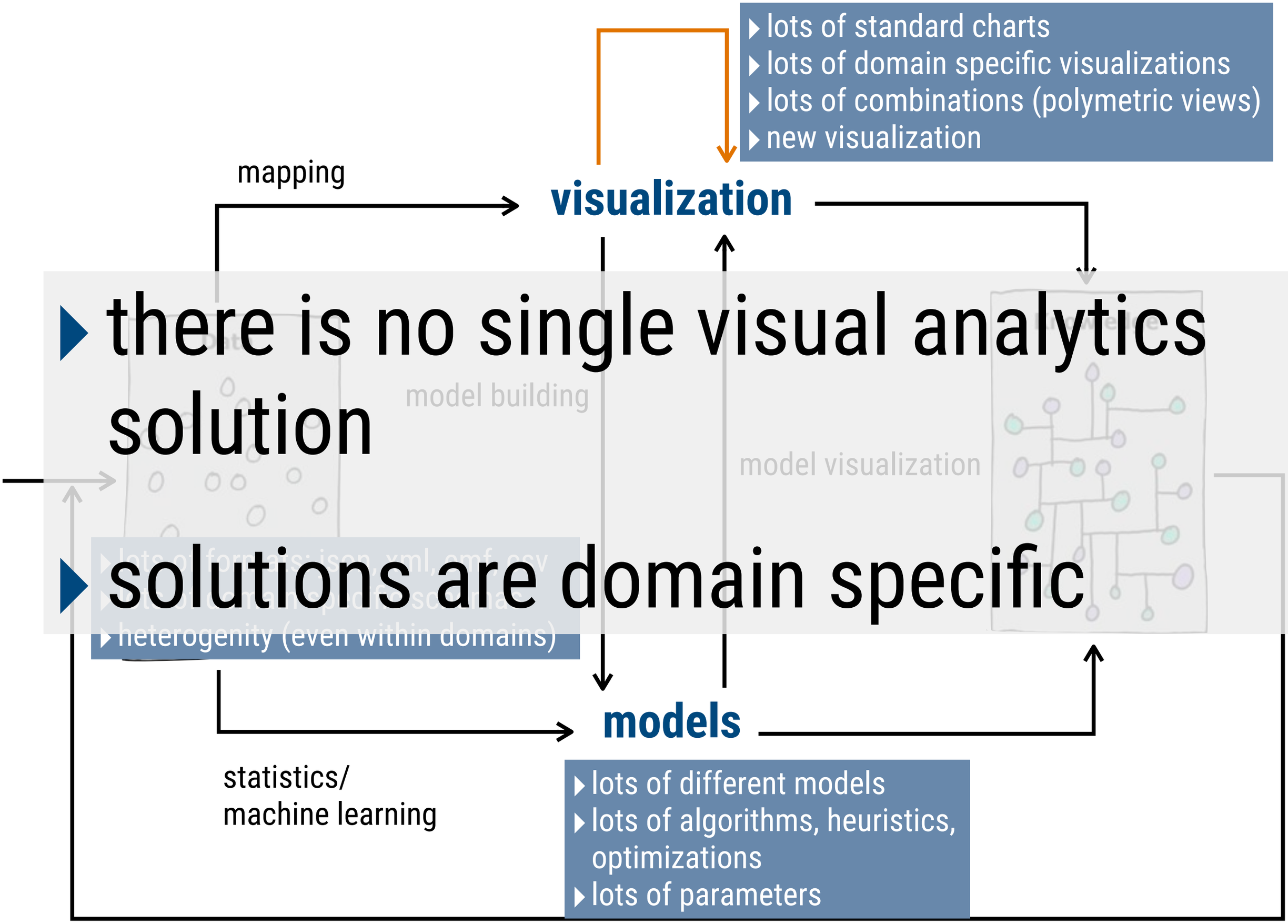
source: @gapingvoid

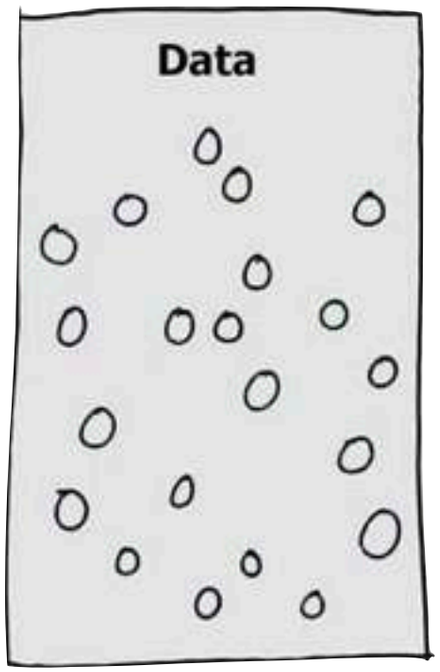


Daniel Keim, Jörn Kohlhammer, Geoffrey Ellis and Florian Mansmann: Solving Problems with Visual Analytics


user
interaction
mapping
visualization
Data
model building
model visualization
Knowledge
models
statistics/
machine learning
visual analytics

- there is no single visual analytics solution
- solutions are domain specific





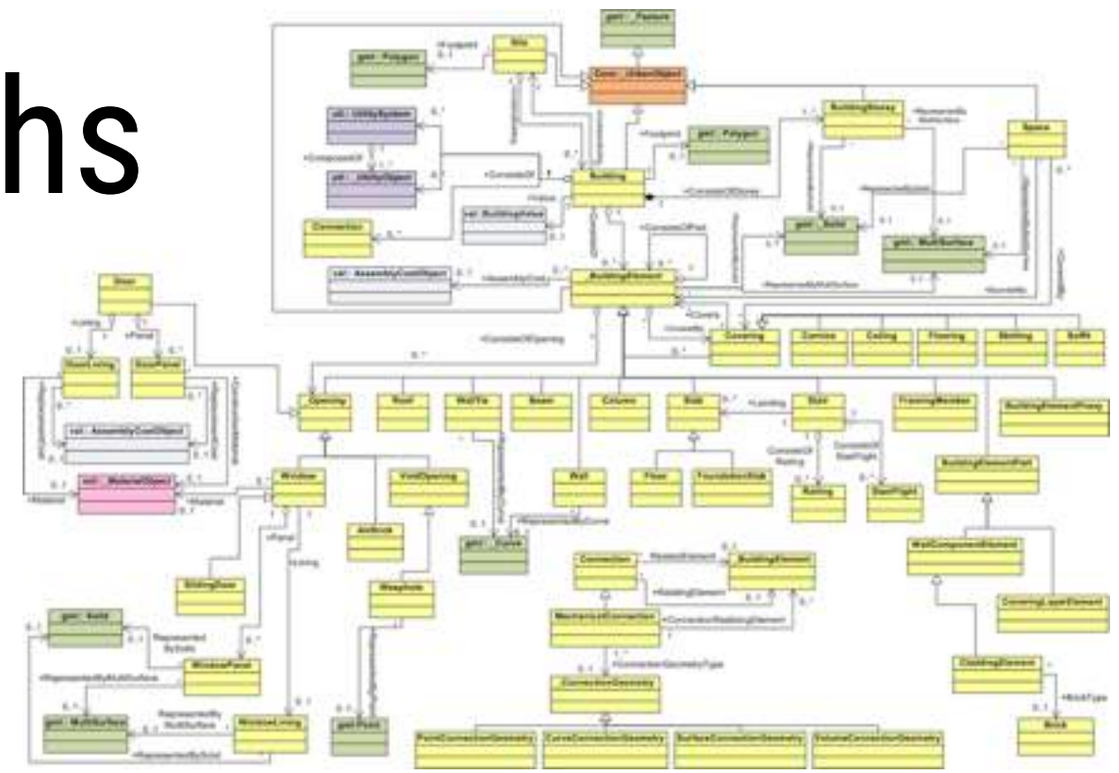
mapping

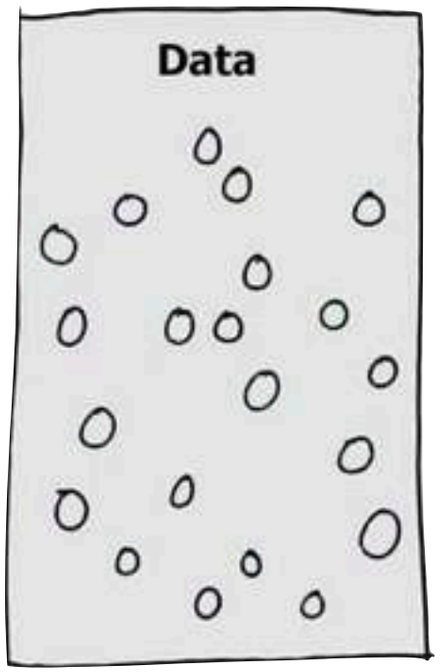
user interaction

visualization

Project	Program To Modify	Overall Complexity	Total LOC	LOC of Largest Subr	LOC of Largest IF/DO Block	Greatest Depth of IF/DO	Decision Density	Average Variable Span
117-New tax	BL219R	1	29	12	0	0	1	0
	BL230R	0	13	0	0	0	1	1
	IF305R	-5	-59	0	0	-2	-2	-1
119-Change regions	CU290R	0	12	12	0	1	1	0
	SL300R	5	86	23	0	0	3	1

- hierarchies, trees
- dependencies, graphs
- metrics, tables





mapping

user interaction

visualization

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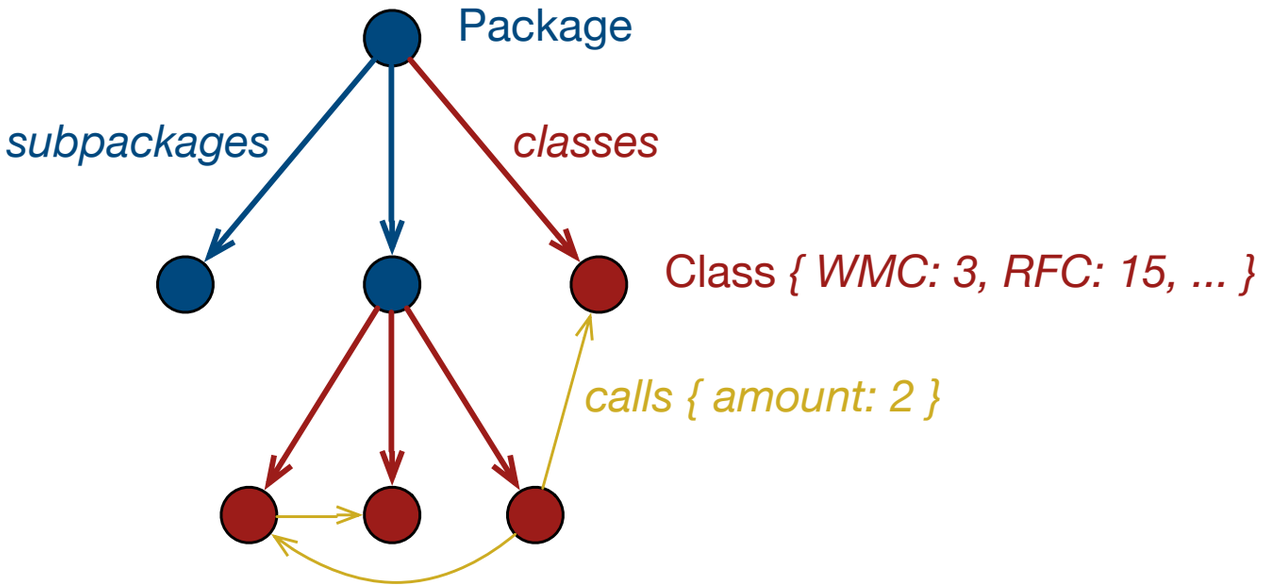
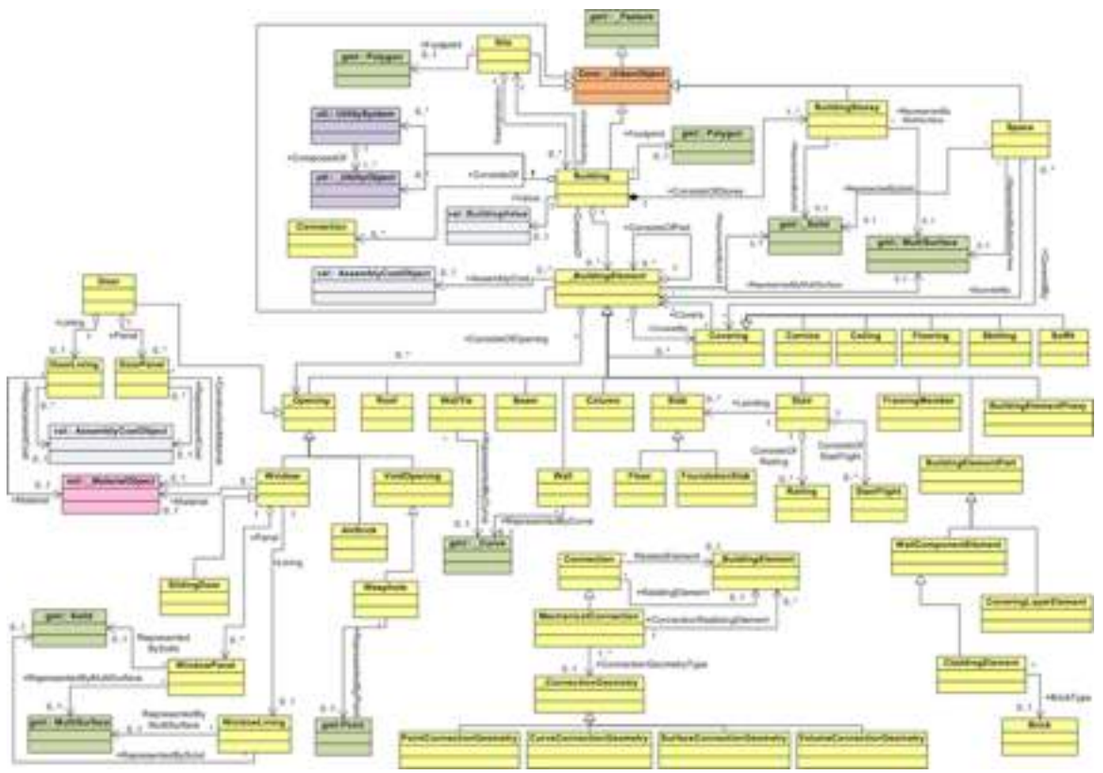
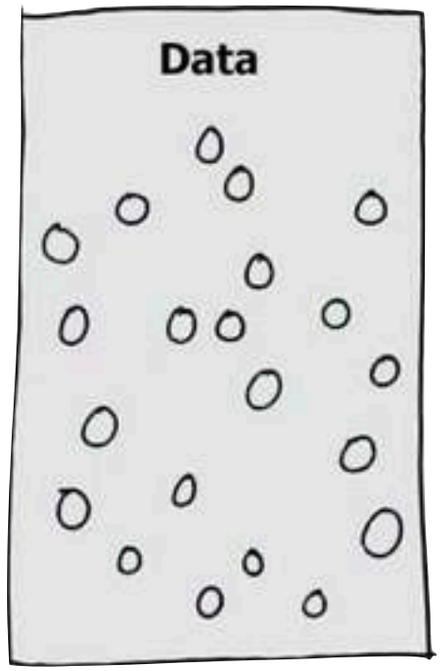
119-Change regions	CU290R	0	12	12	0	1	1	0
	SL300R	5	86	23	0	0	3	1



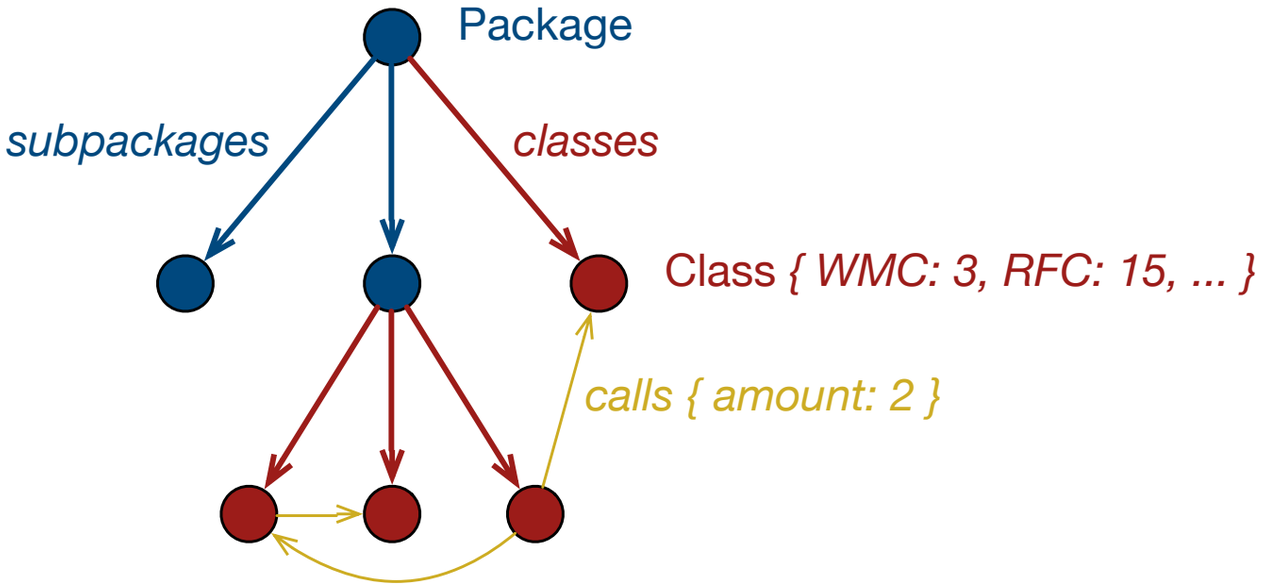


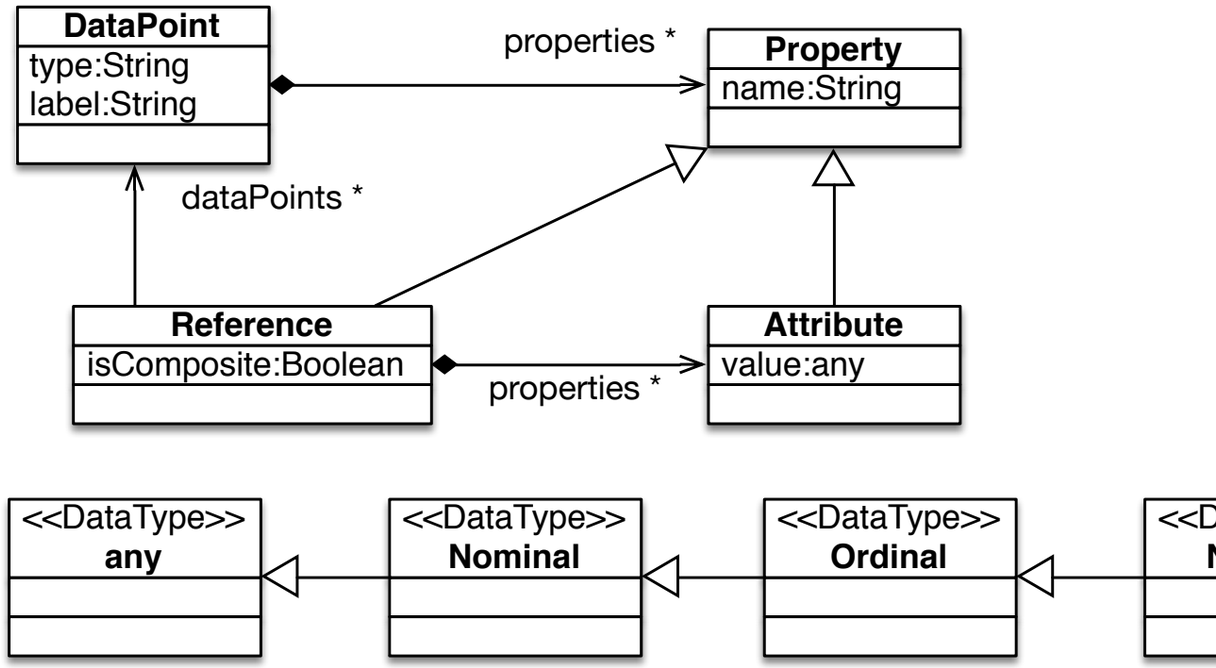


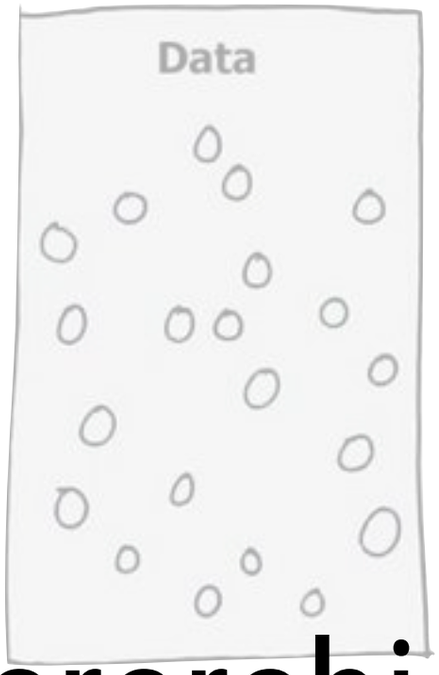
mapping

user interaction

visualization





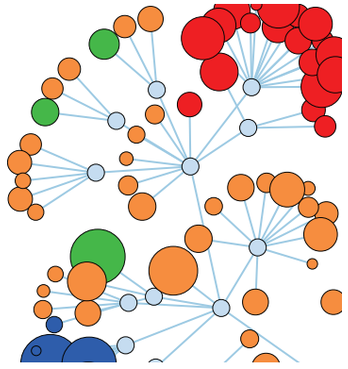


mapping

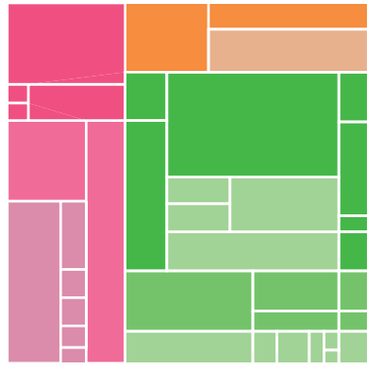
user interaction

visualization

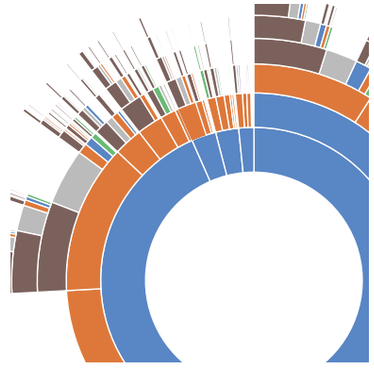
- hierarchies, trees



(a) polymetric graph



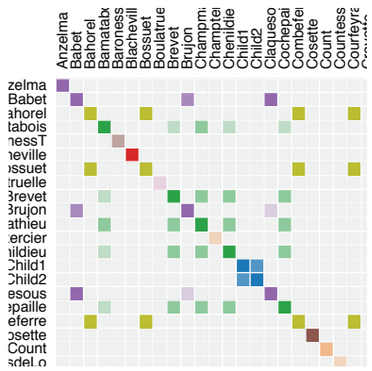
(b) tree map



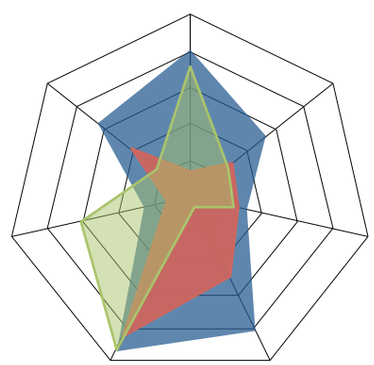
(c) sunburst chart

- dependencies, graphs

(d) chord chart

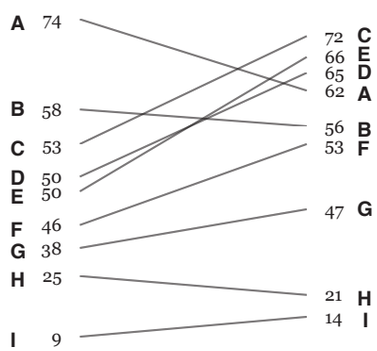


(e) dependency matrix

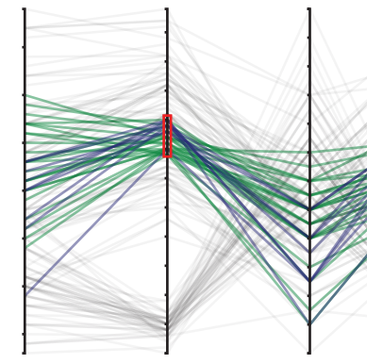


(f) radar chart

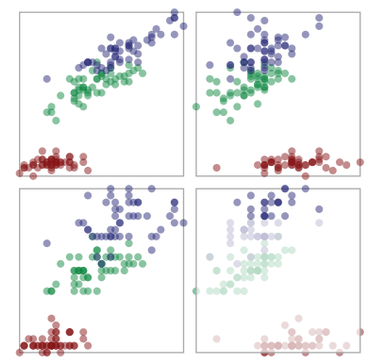
- metrics, tables



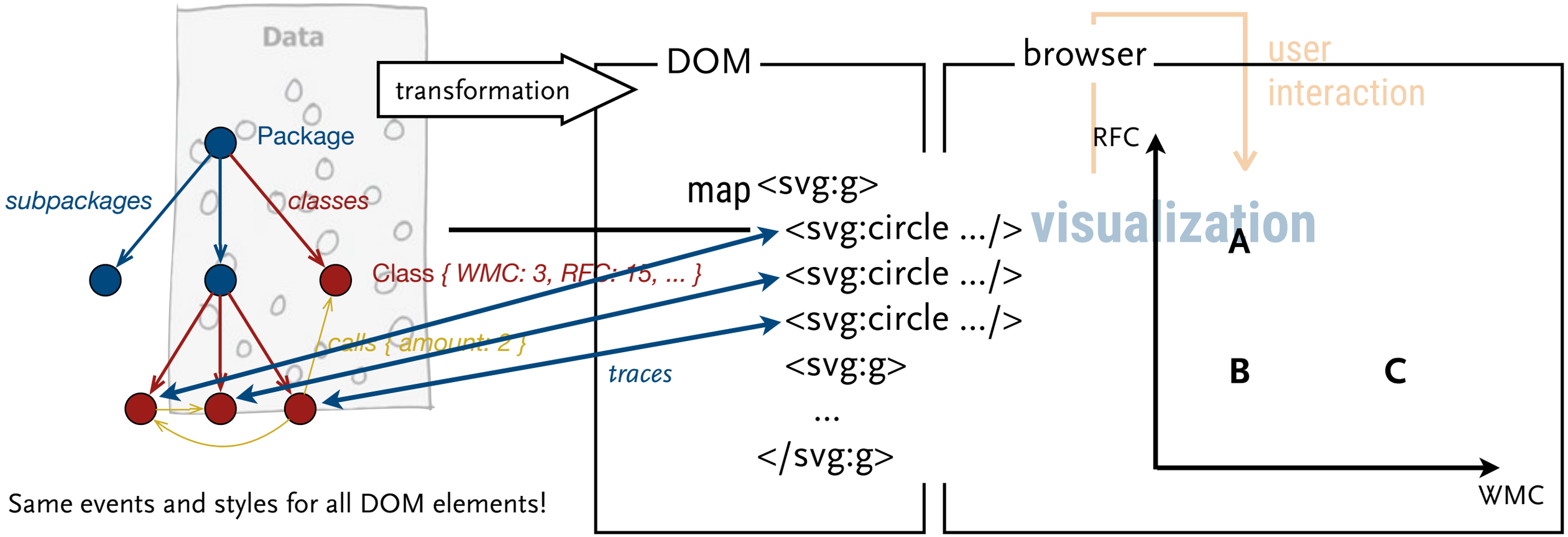
(g) slopechart

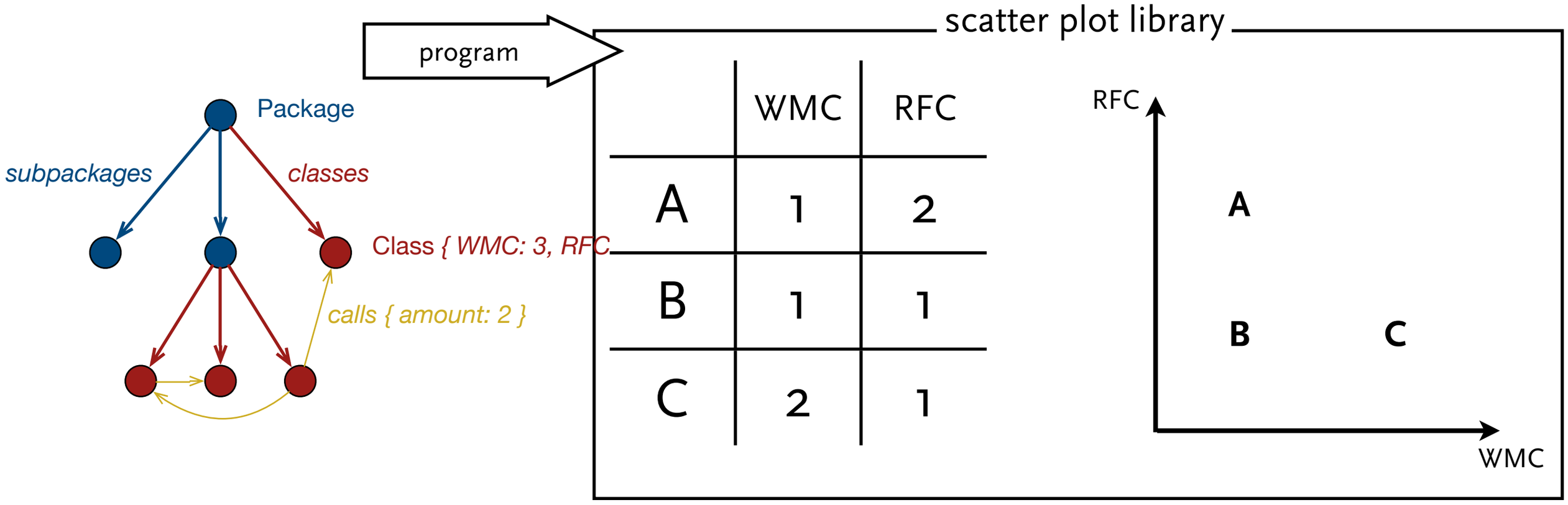


(h) parallel coordinates

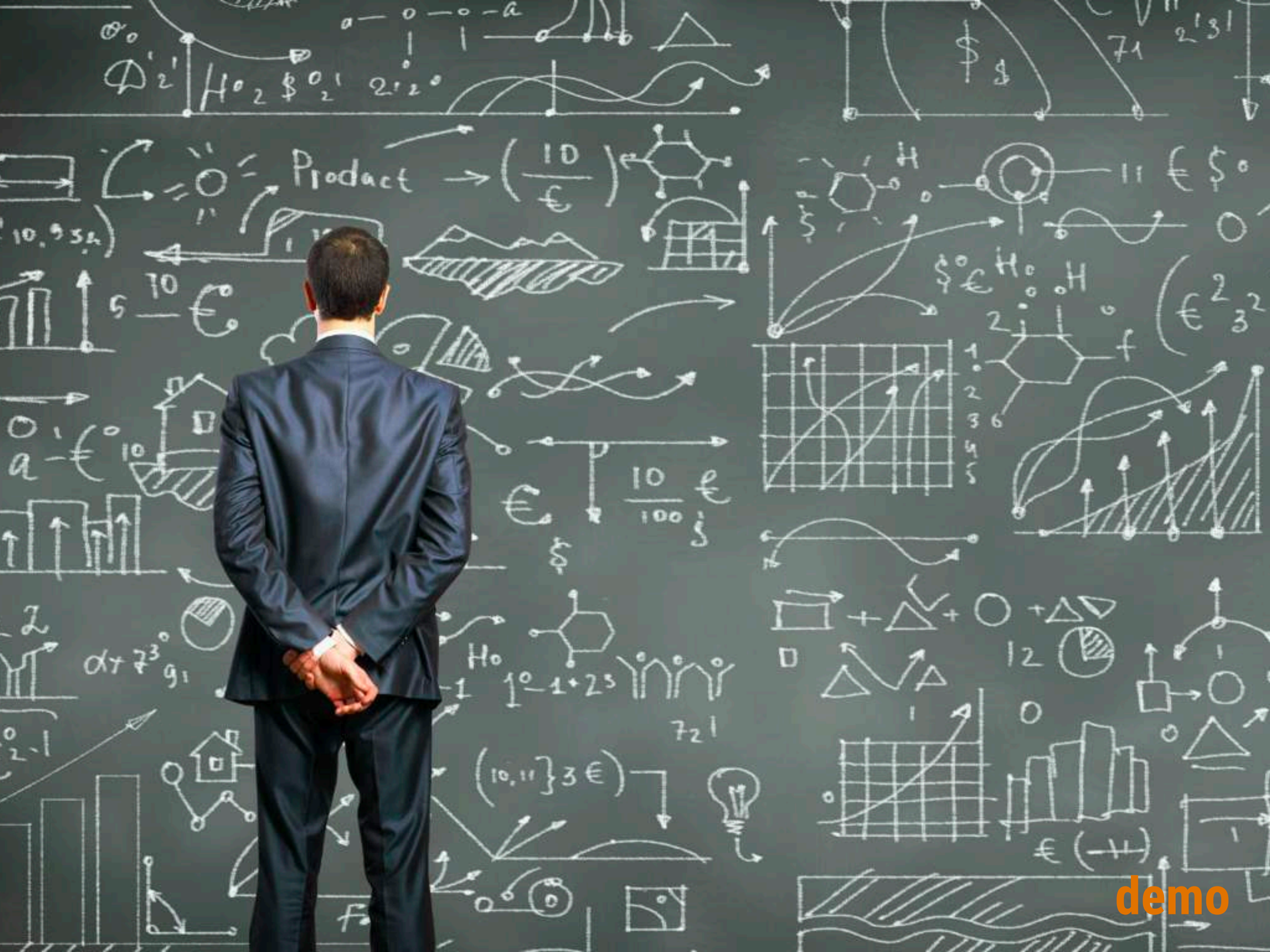


(i) scatter plot matrix

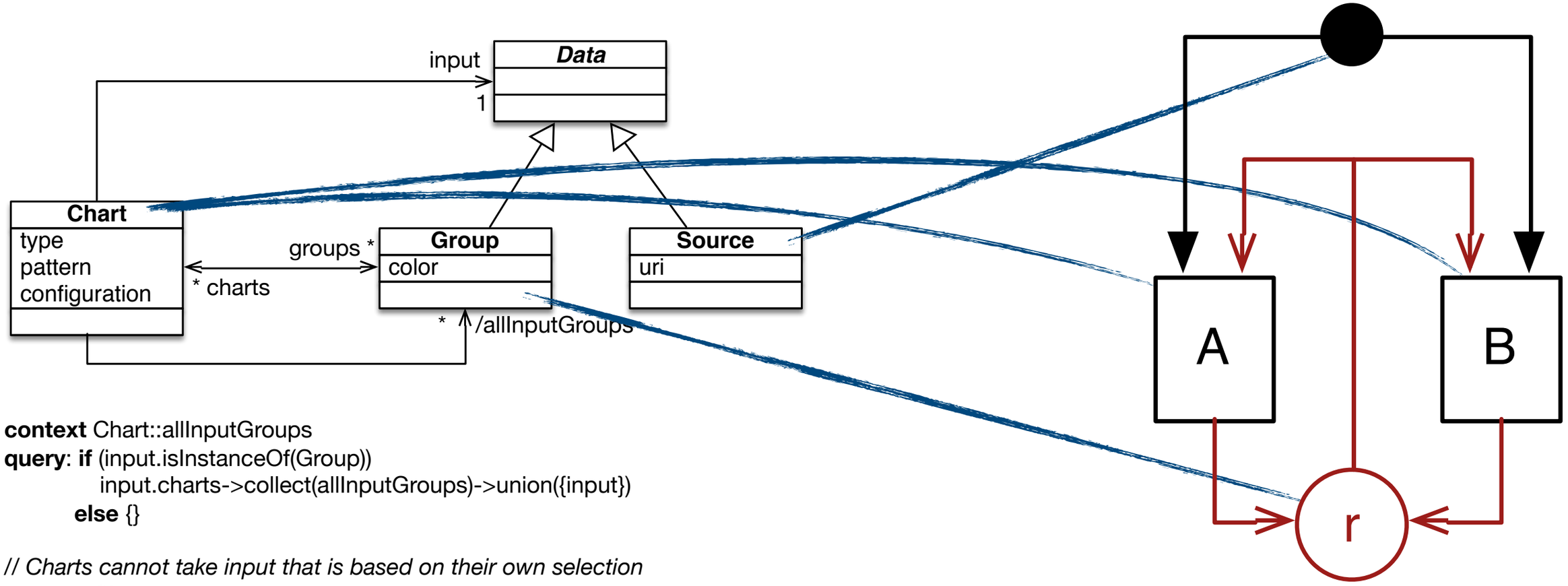




	WMC	RFC
A	1	2
B	1	1
C	2	1

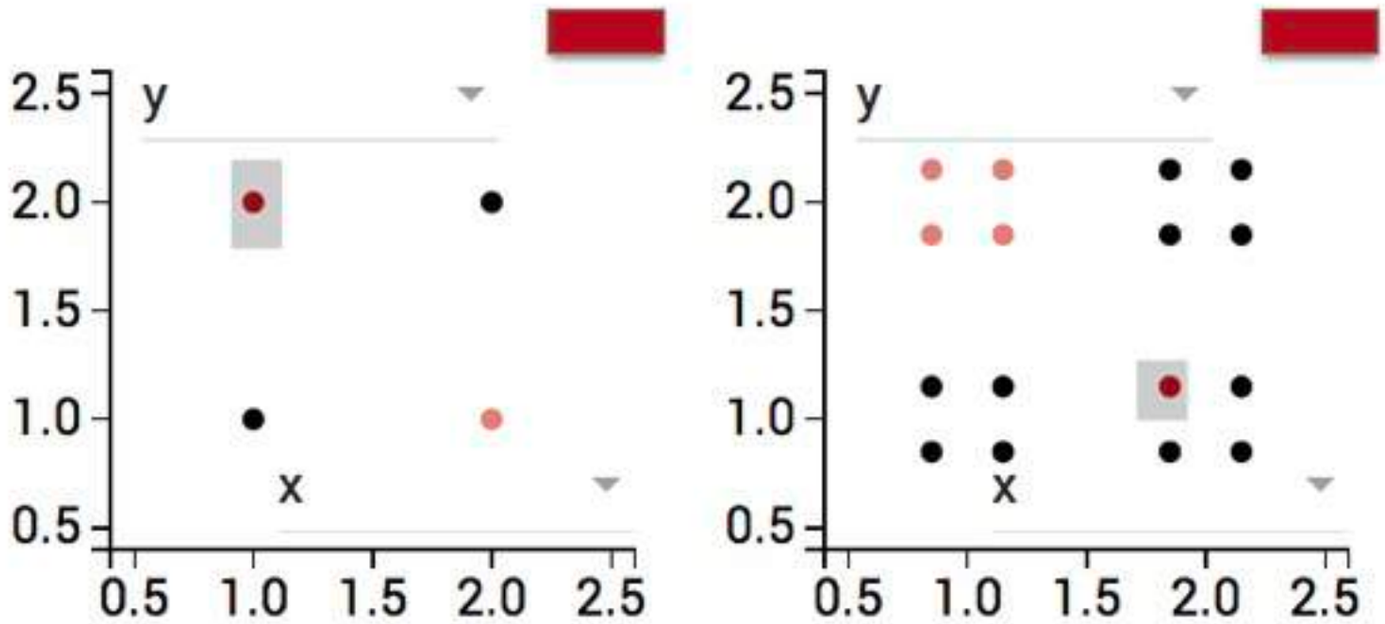

Product
demo

Interactive Visualization Language

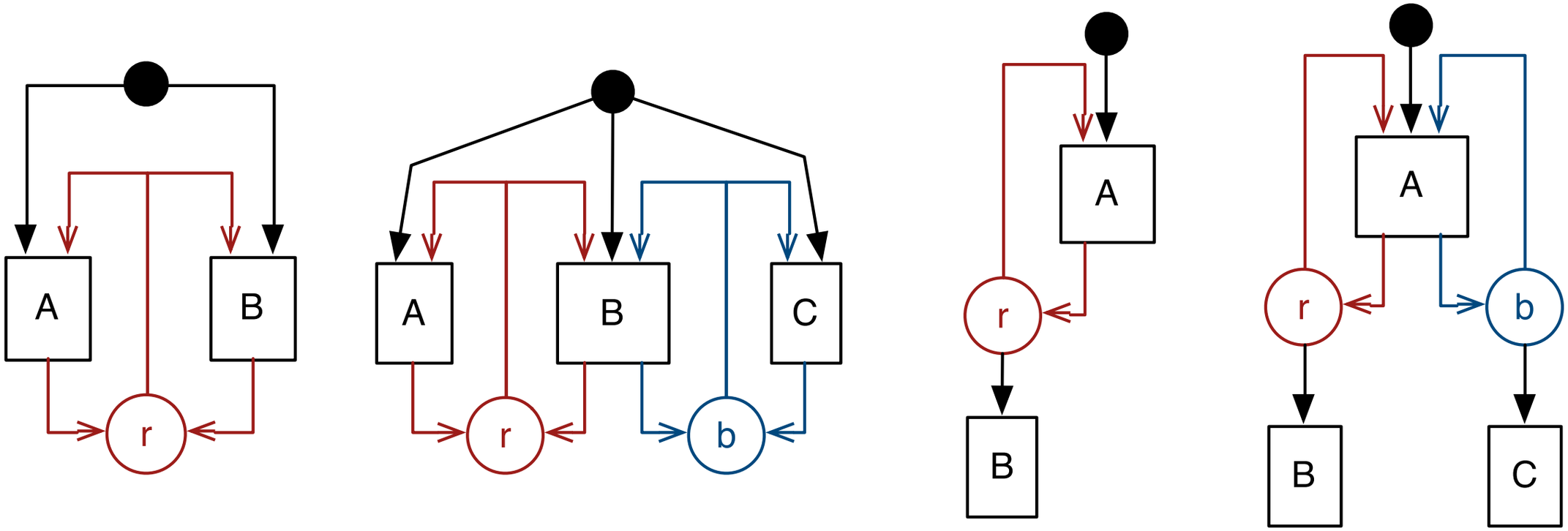



```
context Chart::allInputGroups
query: if (input.isInstanceOf(Group))
          input.charts->collect(allInputGroups)->union({input})
       else {}

// Charts cannot take input that is based on their own selection
context Chart
inv: not allInputGroups->collect(charts)->contains(self)
```



Interactive Visualization Language



Interactive Visualization Language

D is a set of data-points

$I \subseteq D$ the set of input data-points

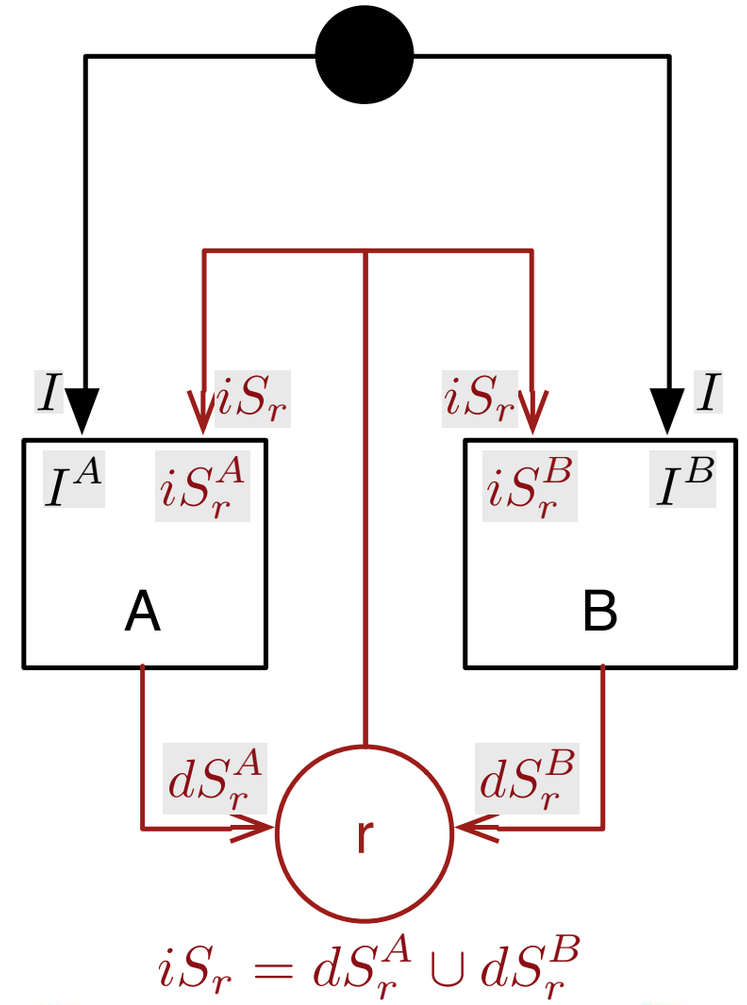
sel_C a selection function for each chart

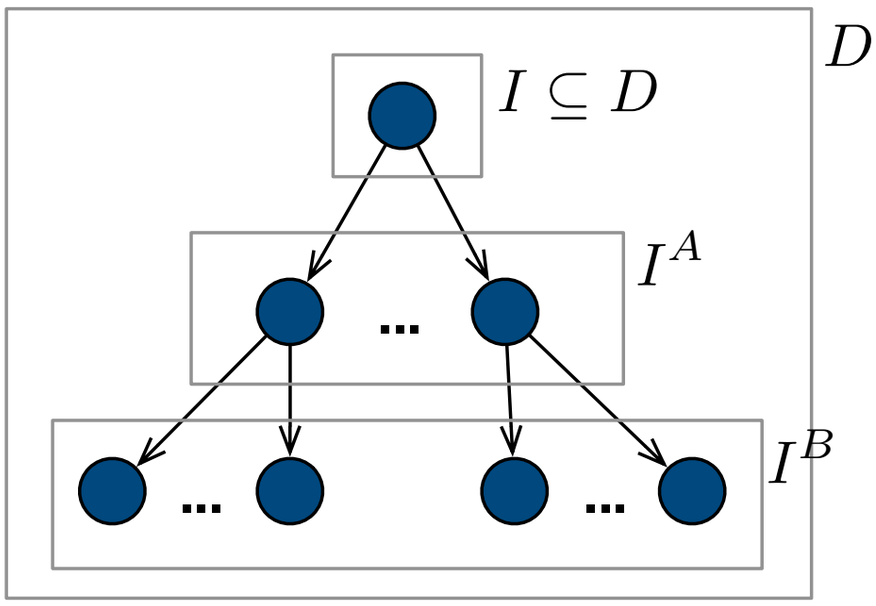
$$I^C = sel_C(I) \subseteq children^\star(I)$$

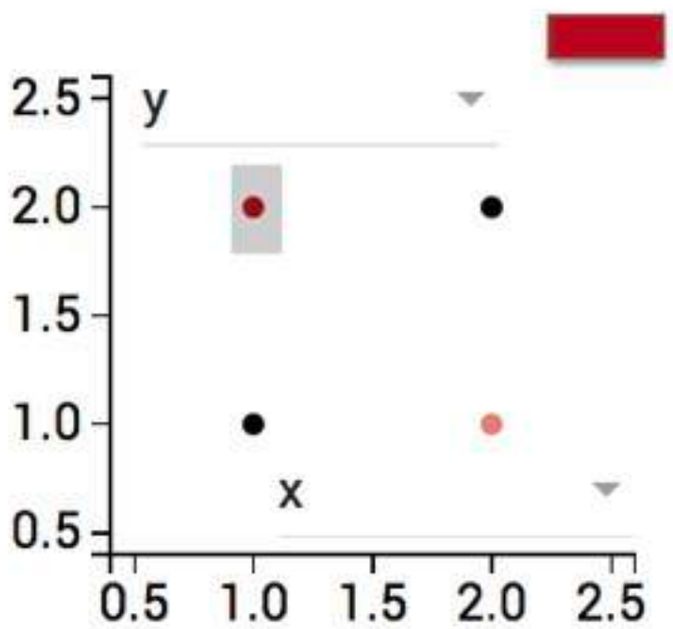
$$iS_r^C = \{d \in I^C | \exists d' : d \in parent^\star(d' \vee d' \in parent^\star(d)\}$$

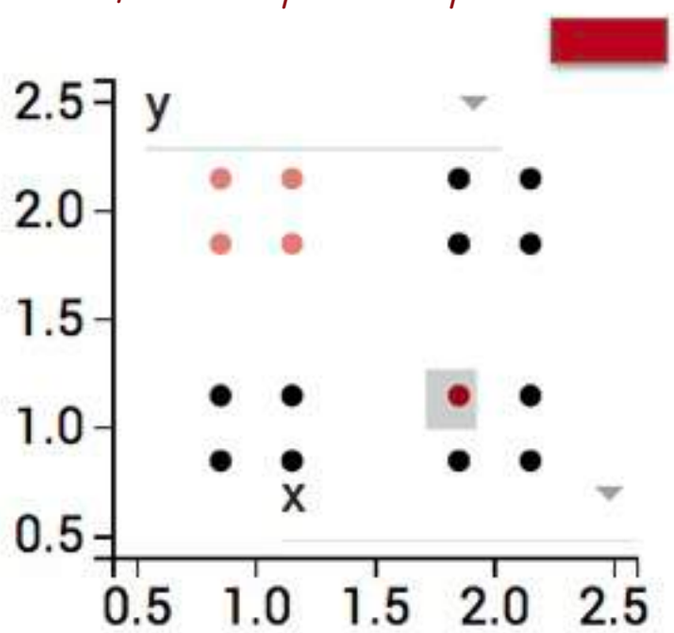
dS_r^C a user selection with $dS_r^C \subseteq I^C \subseteq D$

$$iS_r = \bigcup_{C \in charts(r)} dS_r^C$$

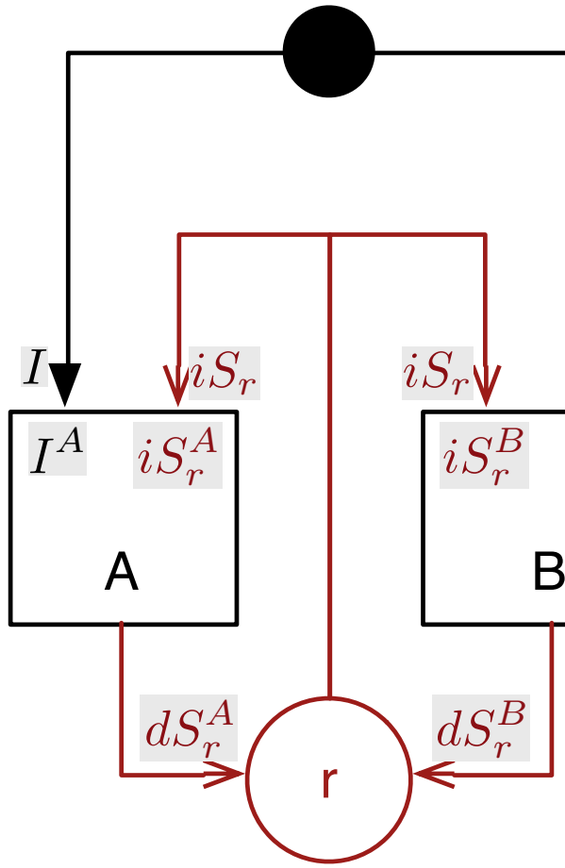




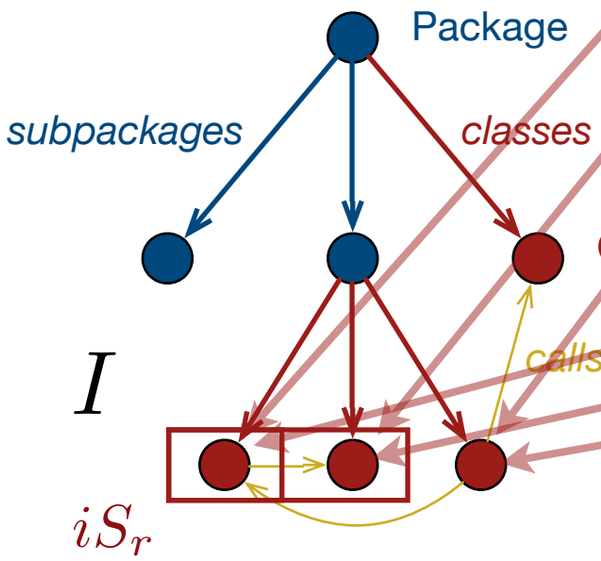




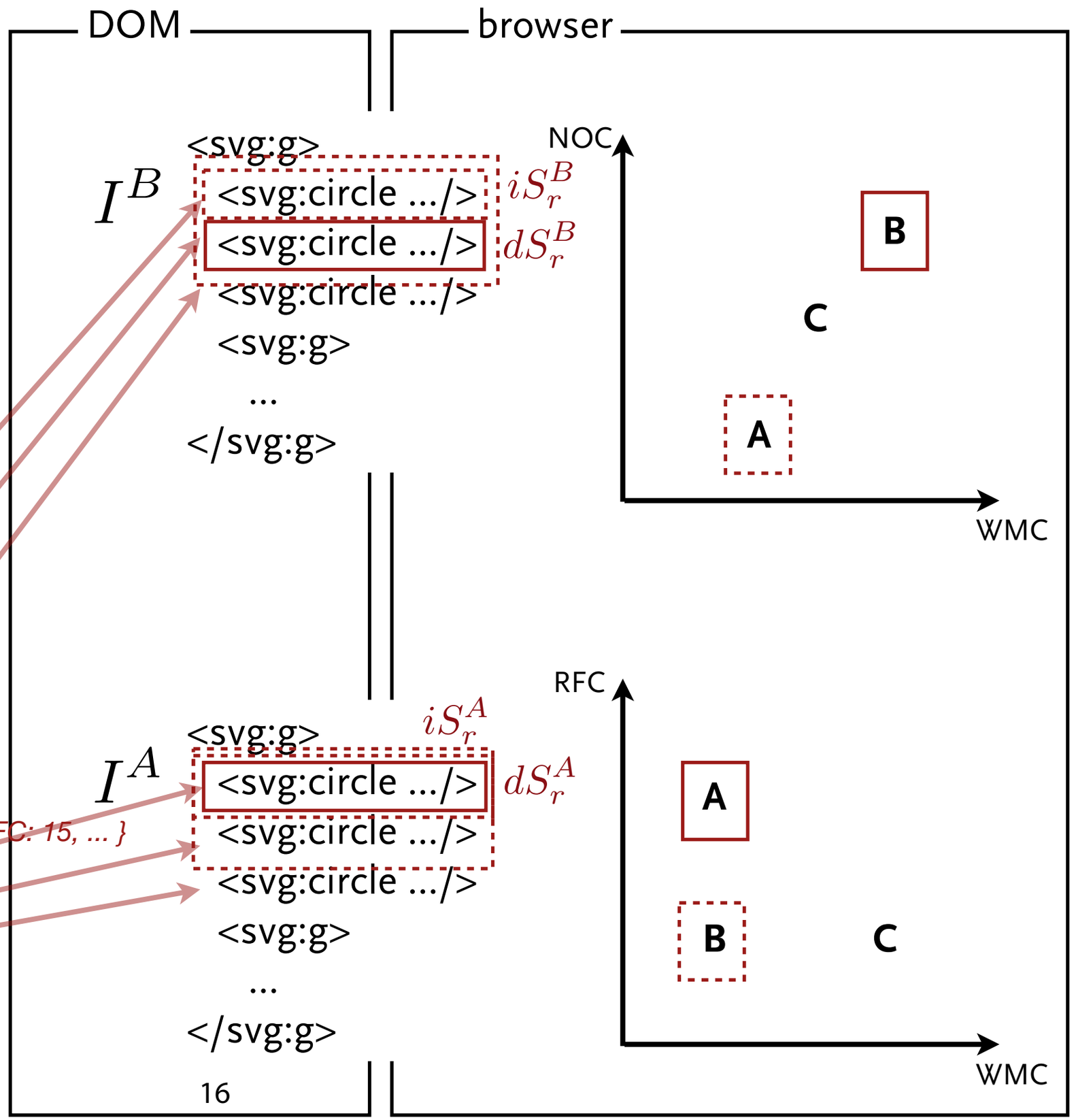
Interactive Visualization Language



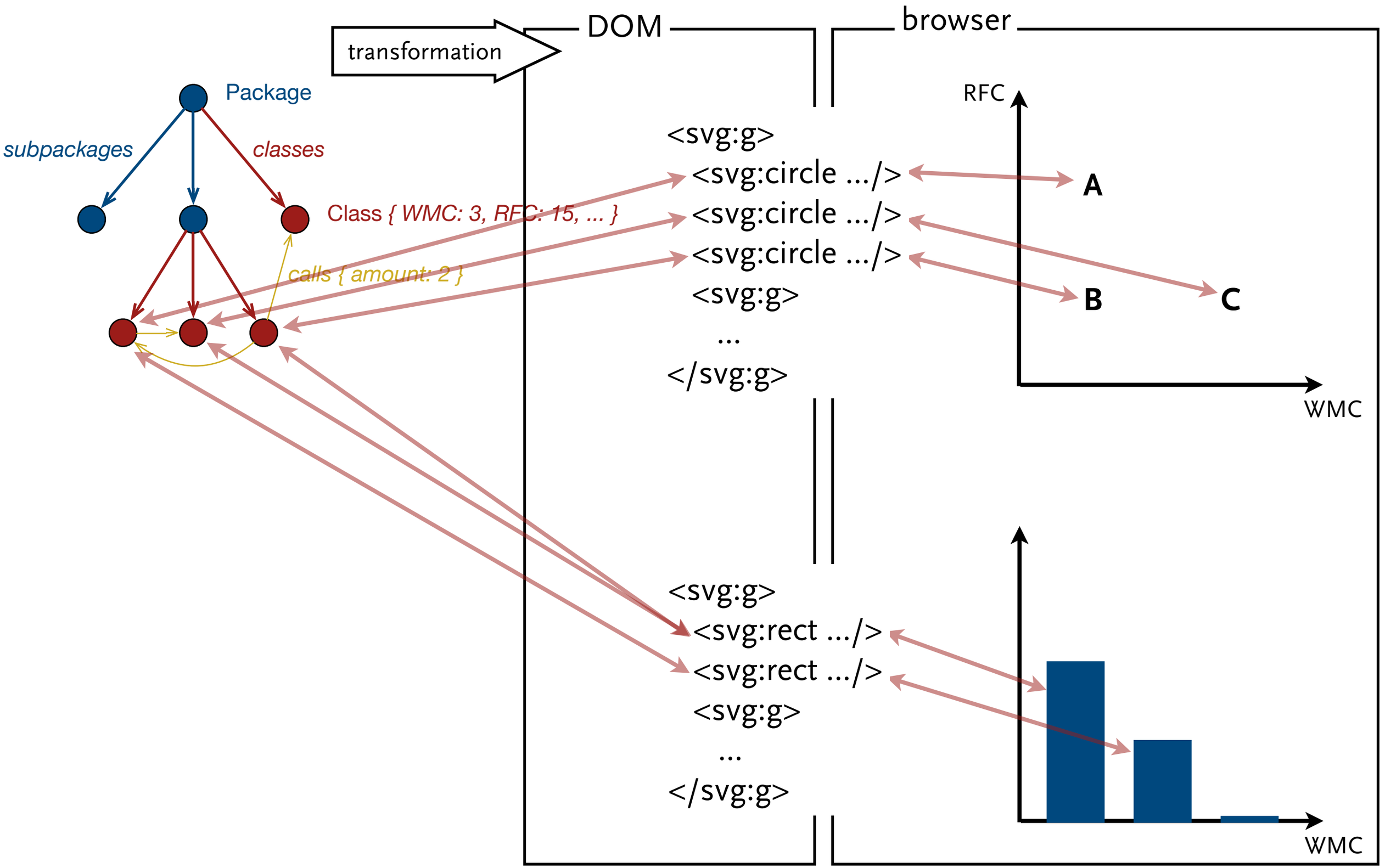
$$iS_r = dS_r^A \cup dS_r^B$$



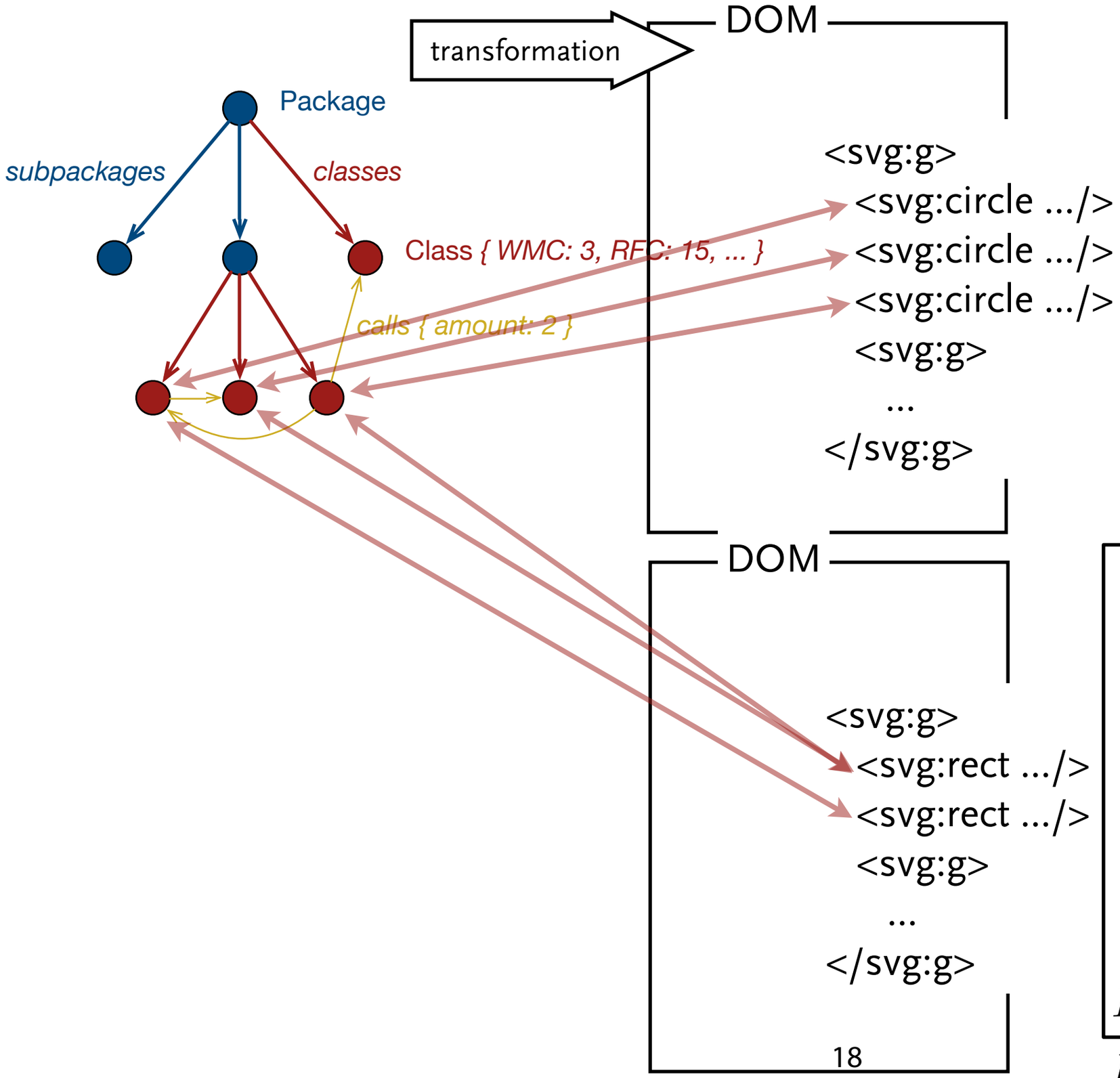
Same events and styles for all DOM elements!

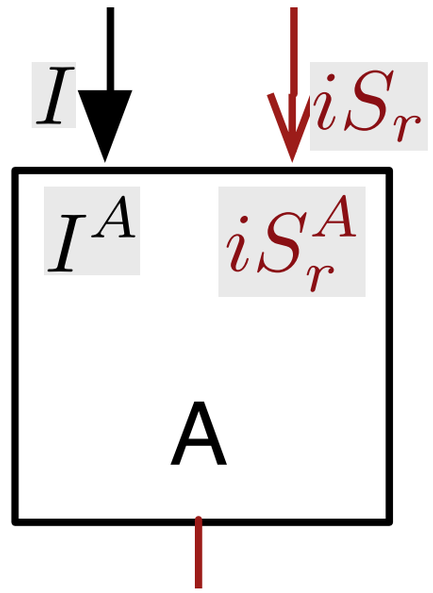


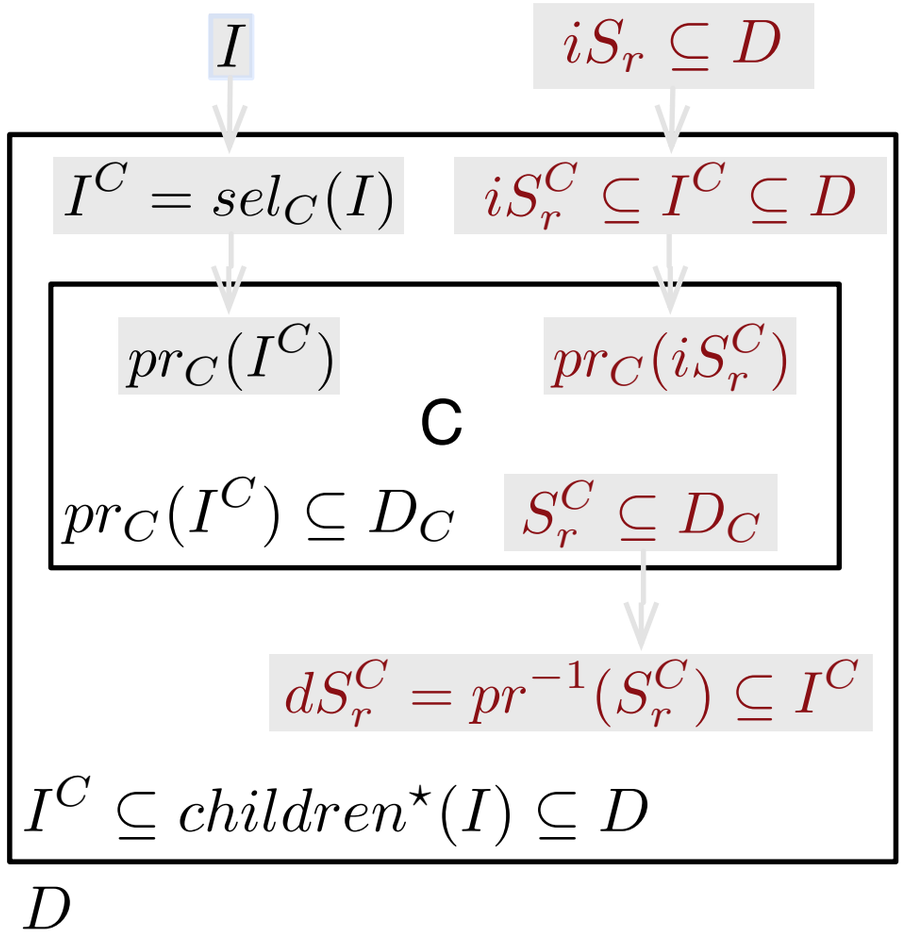
Interactive Visualization Language



Interactive Visualization Language





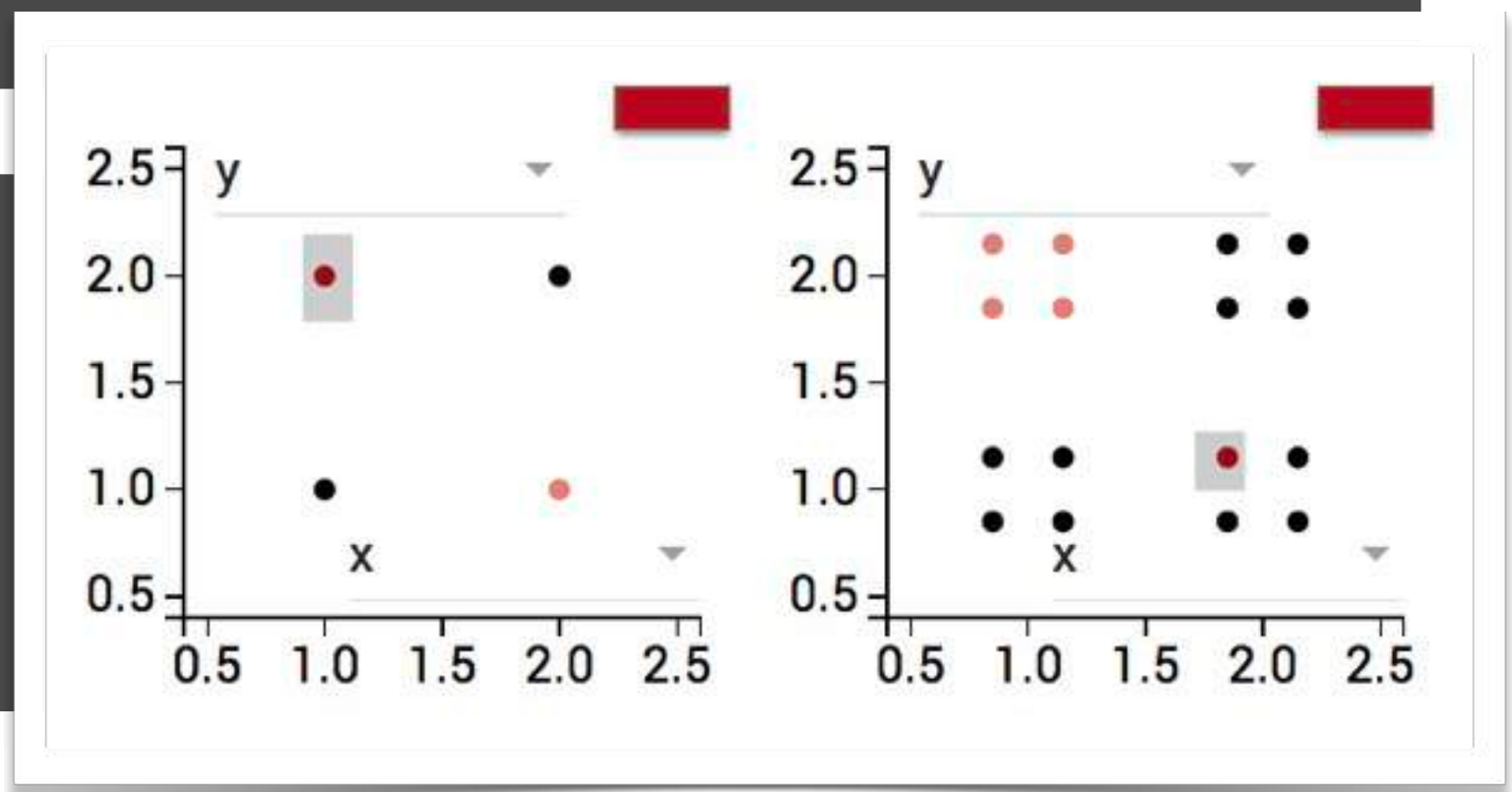


d3ng – An interactive visualization framework

```
<d3ng-groups class="chart" (selectedChanged)="selection=$event.selected"
             [groups]="[0]" [context]="context">
  <d3ng-scatter-plot d3ngSource [source]="data"
                     pattern="container"
                     x="x" y="y"
                     [config]="scatterPlotConfig">
  </d3ng-scatter-plot>
</d3ng-groups>

<d3ng-scatter-plot class="chart" d3ngSource
                   [source]="selection"
                   pattern="container/contents" [allowEmpty]="true"
                   x="x" y="y"
                   [config]="scatterPlotConfig">
</d3ng-scatter-plot>
```

```
data = [{
  type:"container",
  x:1, y:1
  children: [{
    type:"contents",
    x:0.85, y:0.85
  },...]
},...]
```

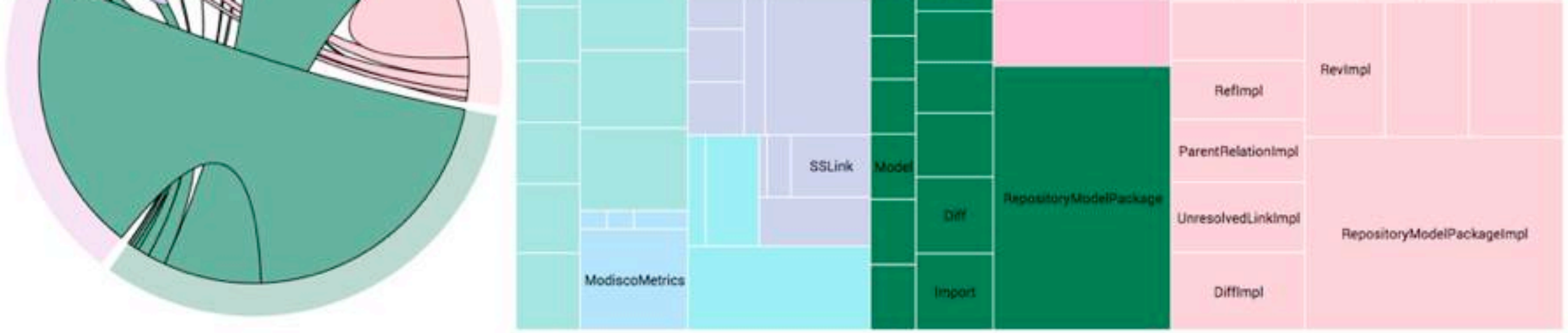


Conclusions

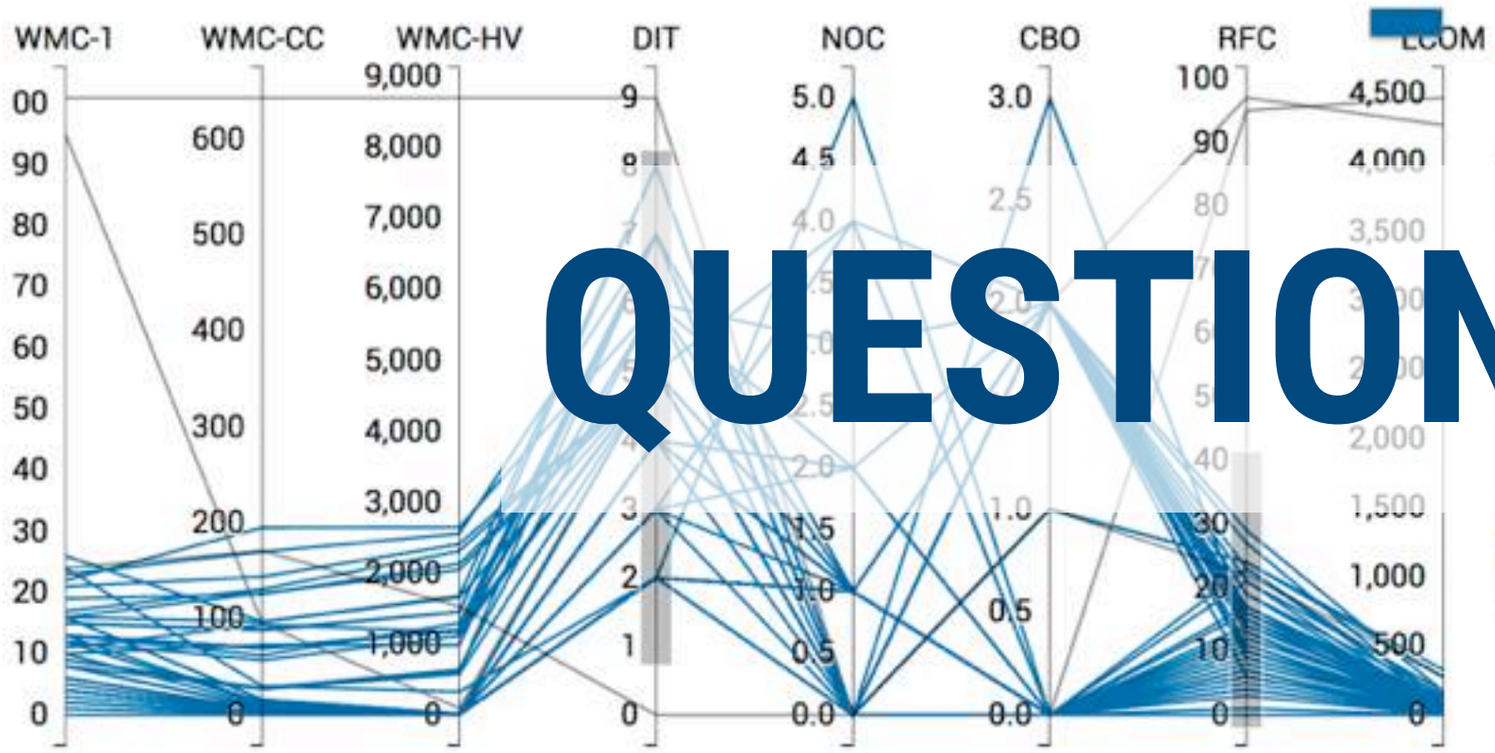
- interaction is an important tool in visual analytics to explore complex data-sets
- visualization of software requires the combined visualization of hierarchies, dependencies, and metrics
- we build a web-component framework that facilitates the creation of complex interactive visualizations of software called **d3ng**
- demos and more information: d3ng.github.io

Future Work

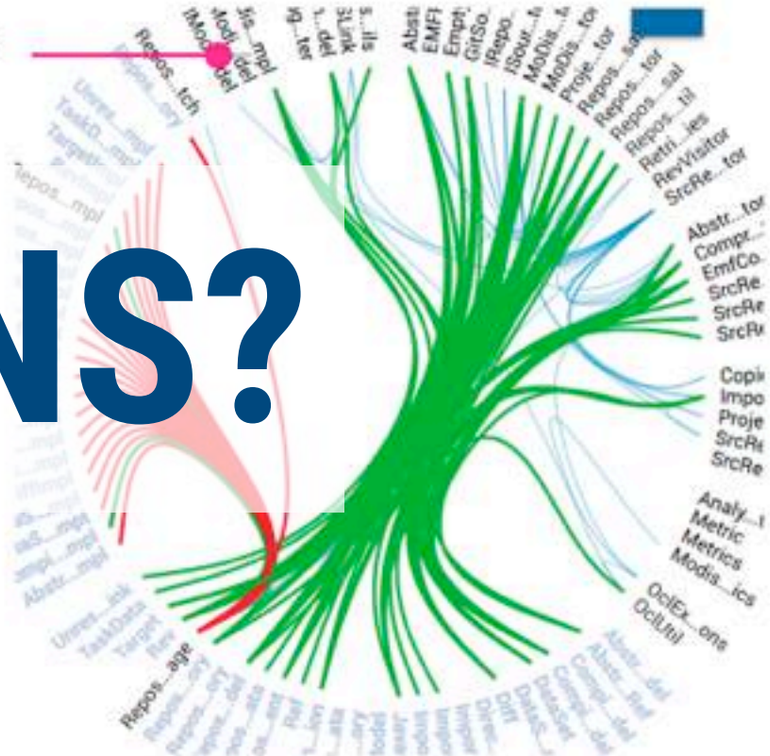
- web components for an extendable visualization grammar
- intensional representation of selections: functions rather than sets



Filter based on class metrics



Inspect dependencies of filtered classes



QUESTIONS?

Analyse relationships between metrics of filtered classes.