Multi-objective Module Clustering for Kate

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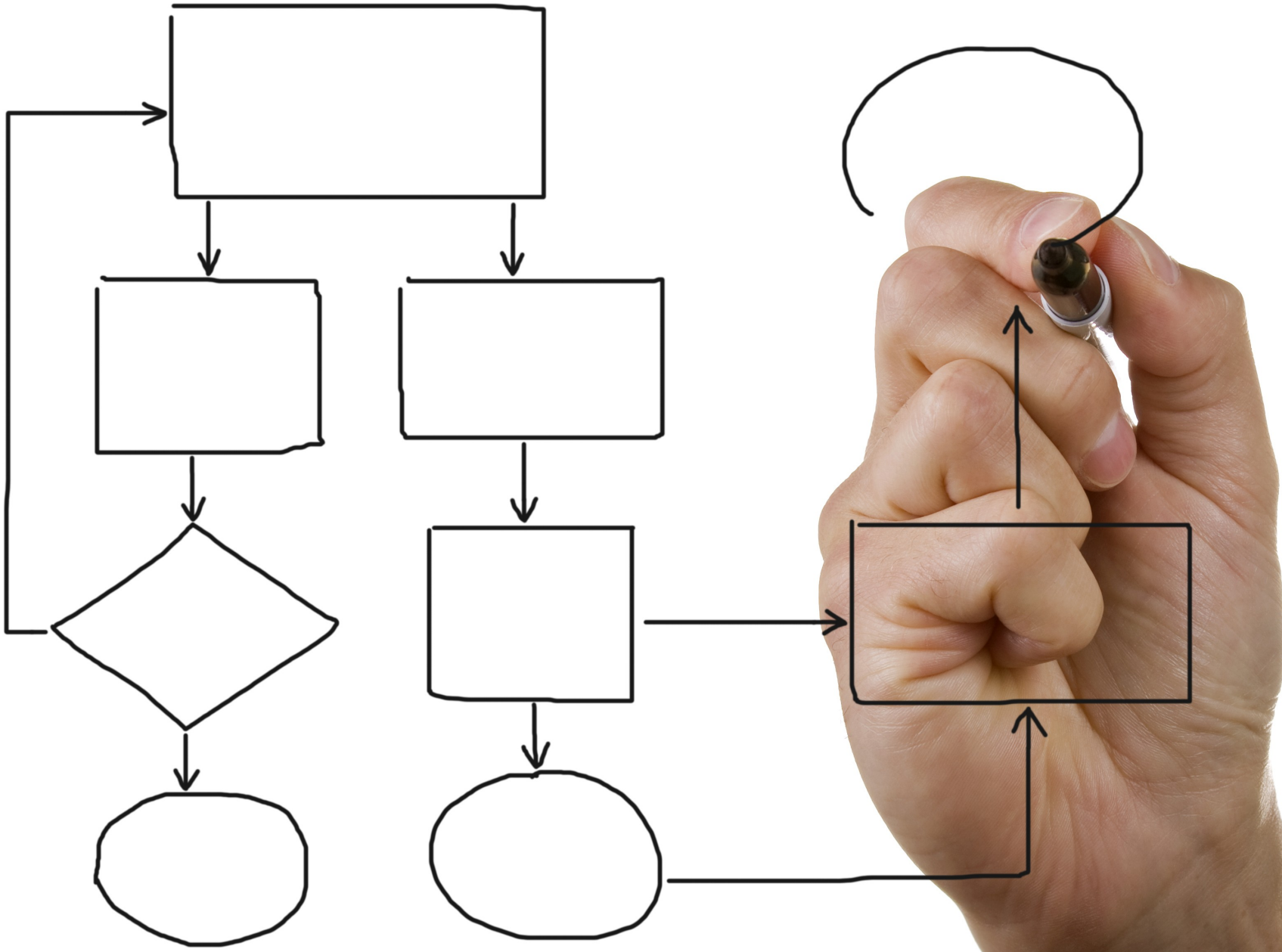
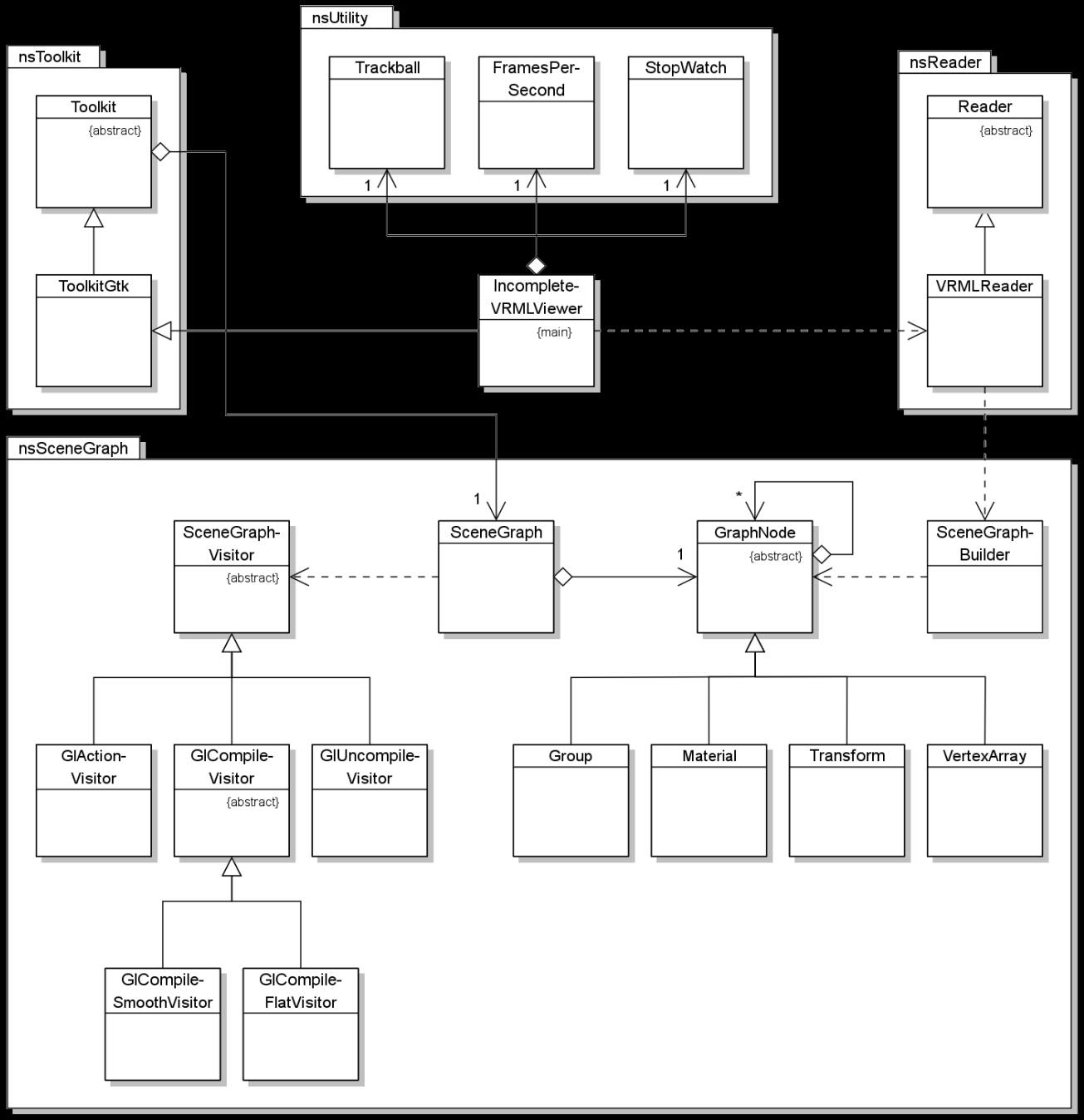


Project beggining :-)

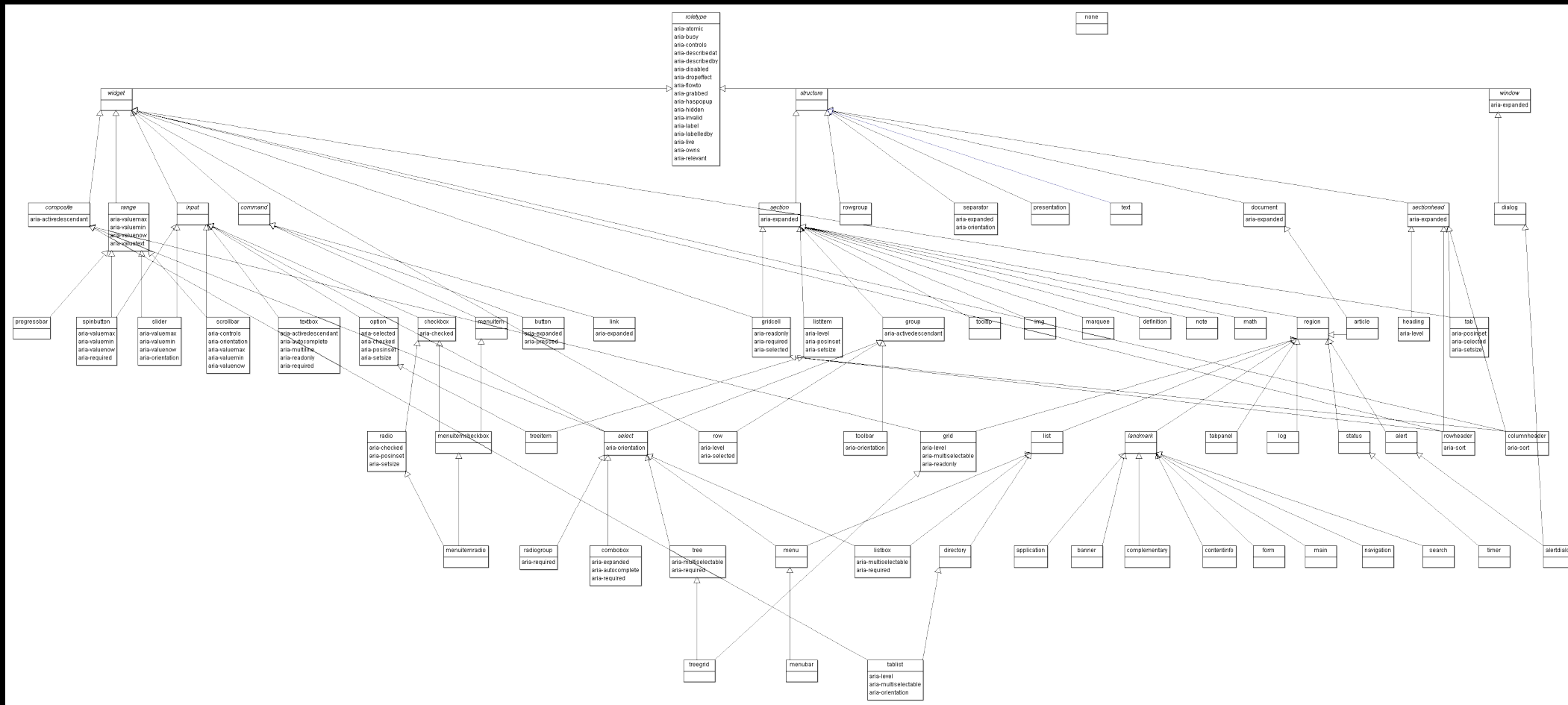
Develop

Evolve

Maintain



Project evolves :-(



Search Based Design Optimization

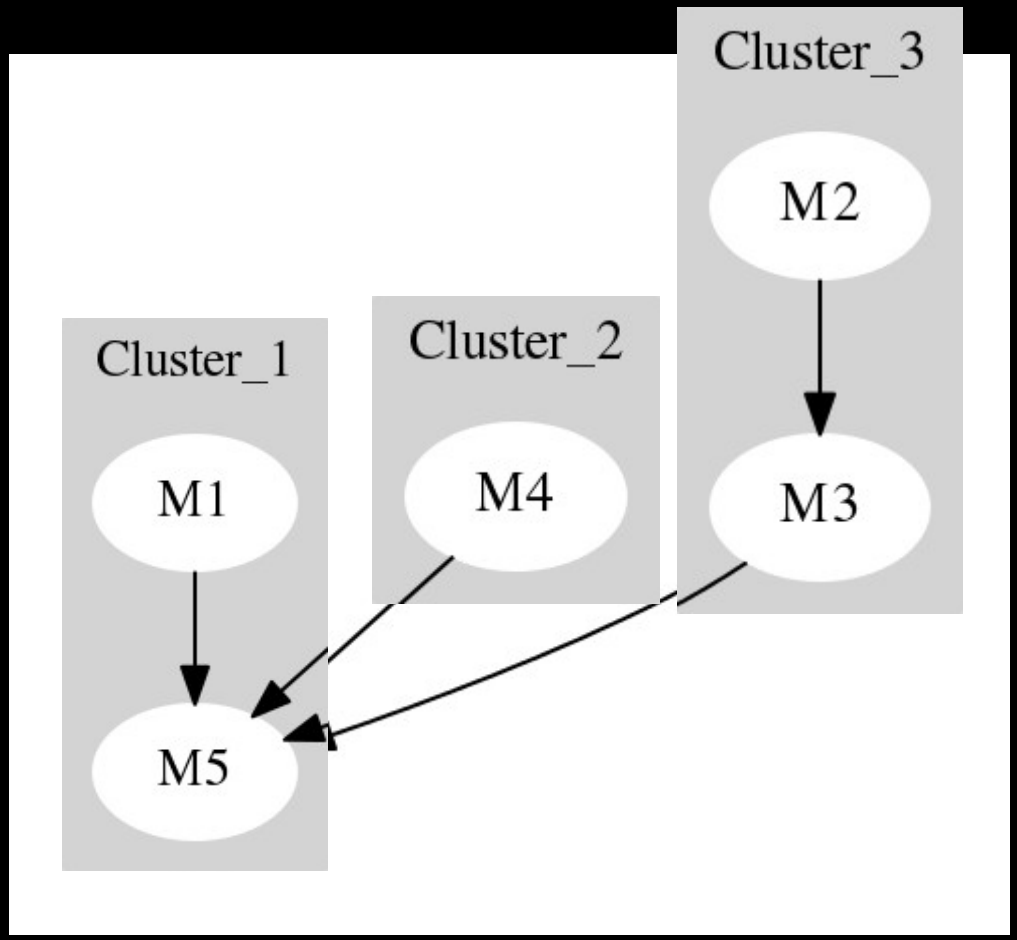
Design generation

Software Module Clustering

Improvement of existing design

Software Module Clustering

The system is decomposed in a set of modules

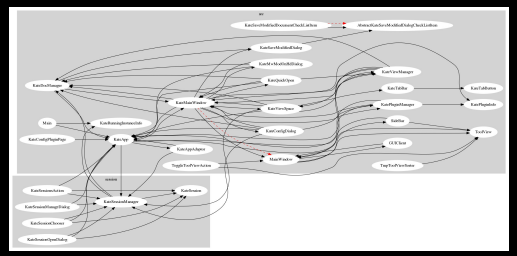


Multi-objecive Module Clustering for Kate

C/C++ text editor for KDE platforms

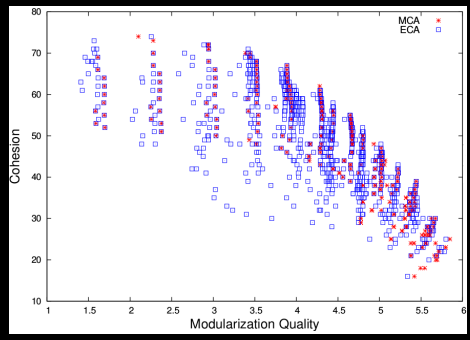
kate's source code

doxygen



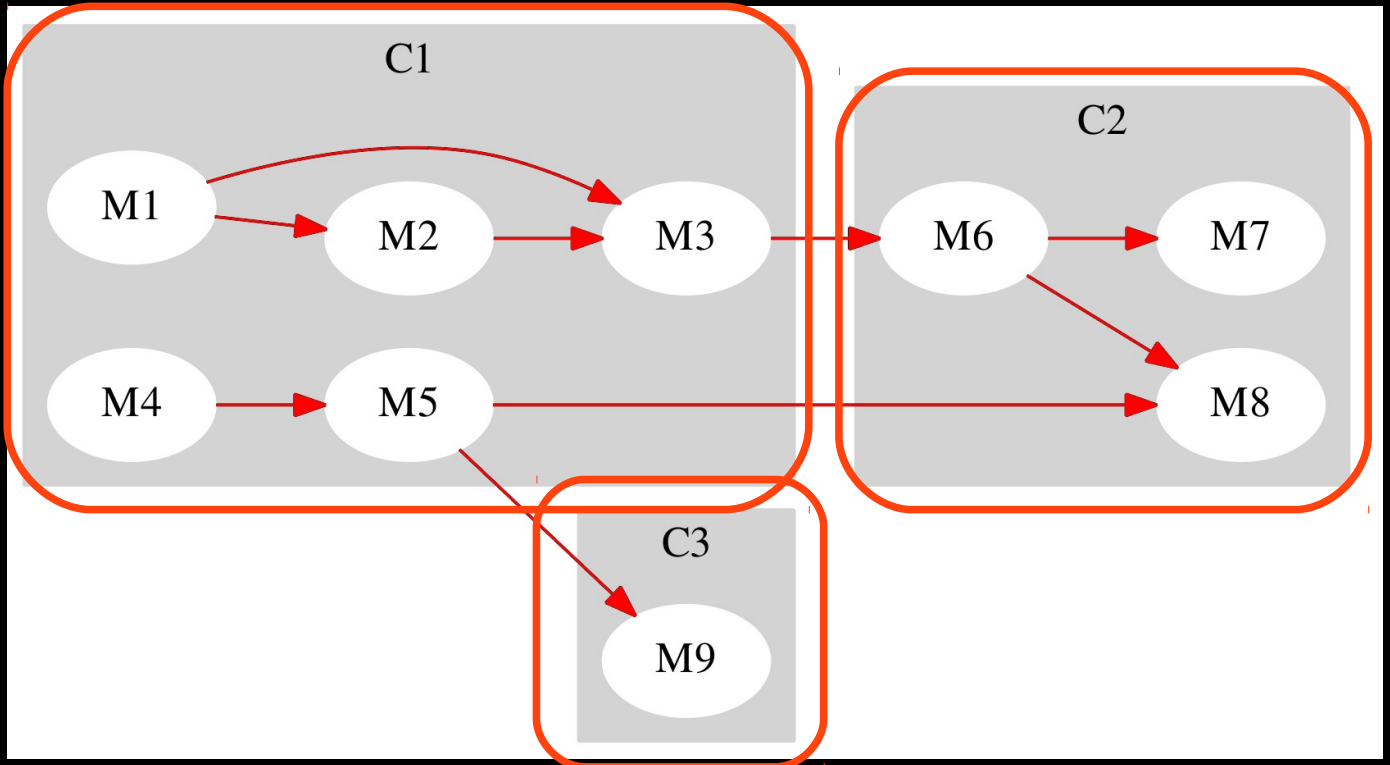
kate's original design

two-archive GA



pareto front of designs

Fitness Functions



cohesion: 6

coupling: 3

MQ: 1.38

number of clusters: 3

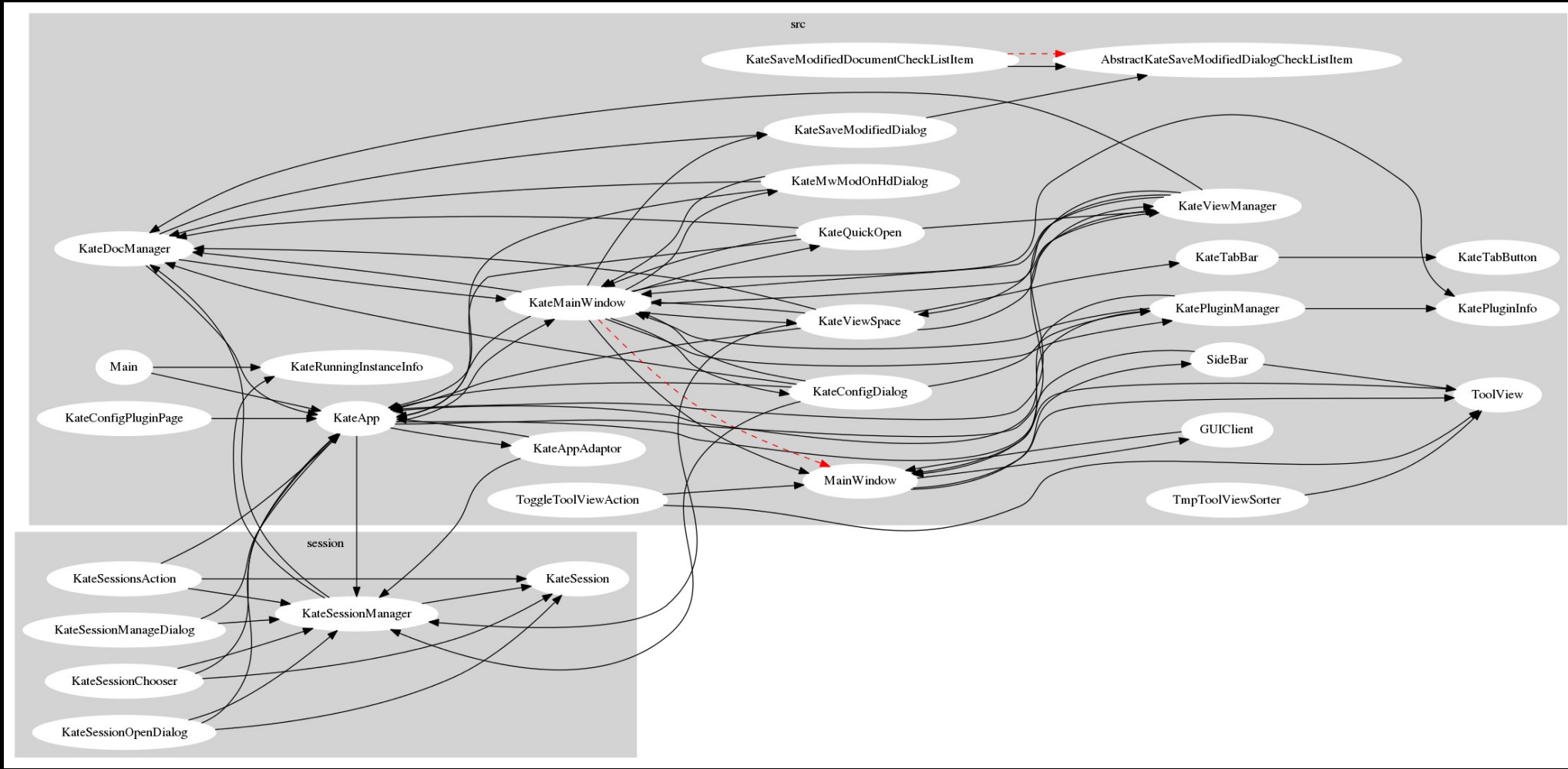
isolated clusters: 1

cluster size diff: 4

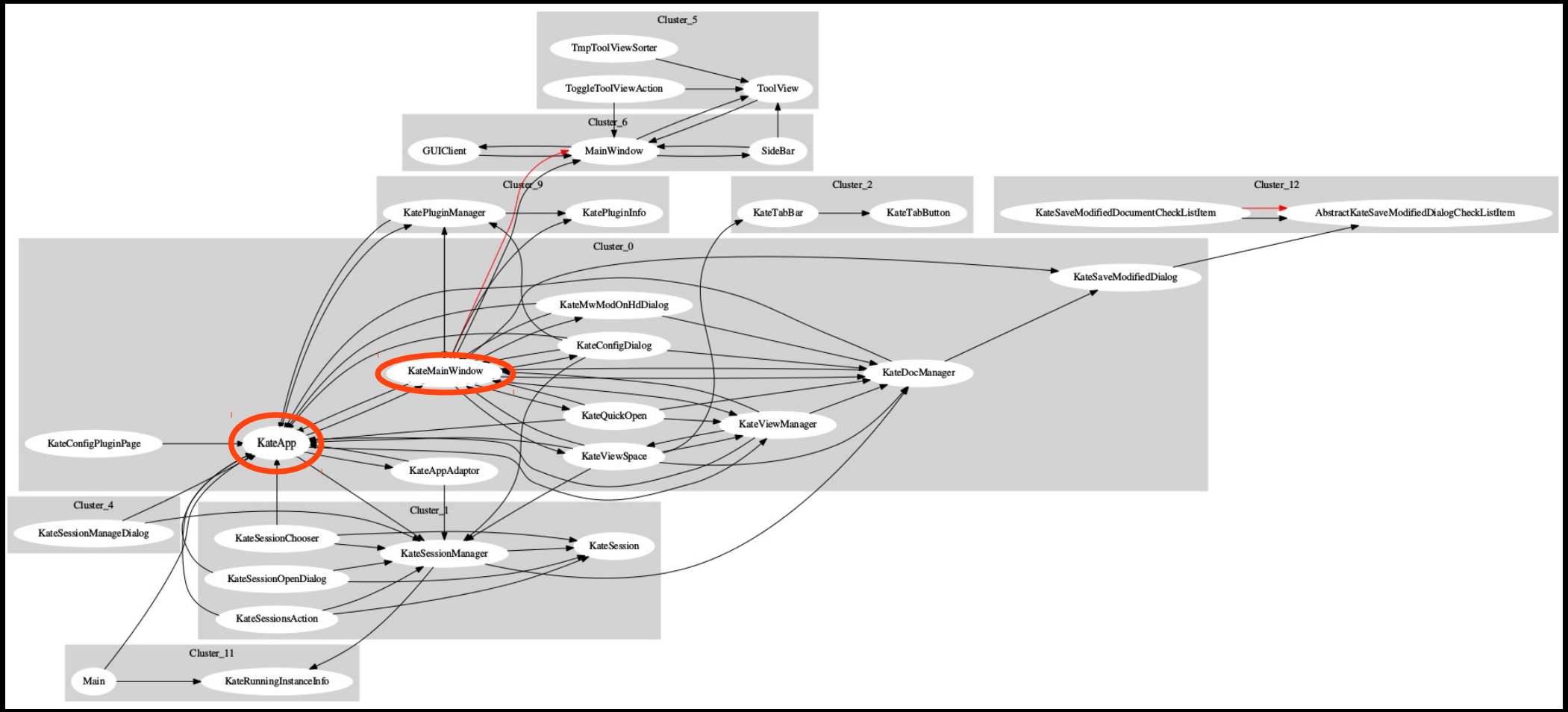
$$MQ = \sum_{k=1}^{N} MF(C_k)$$

$$\text{where, } MF(C_k) = \begin{cases} 0, & \text{if } i_k = 0 \\ \dfrac{i_k}{i_k + \frac{j_k}{2}}, & \text{if } i_k > 0 \end{cases}$$

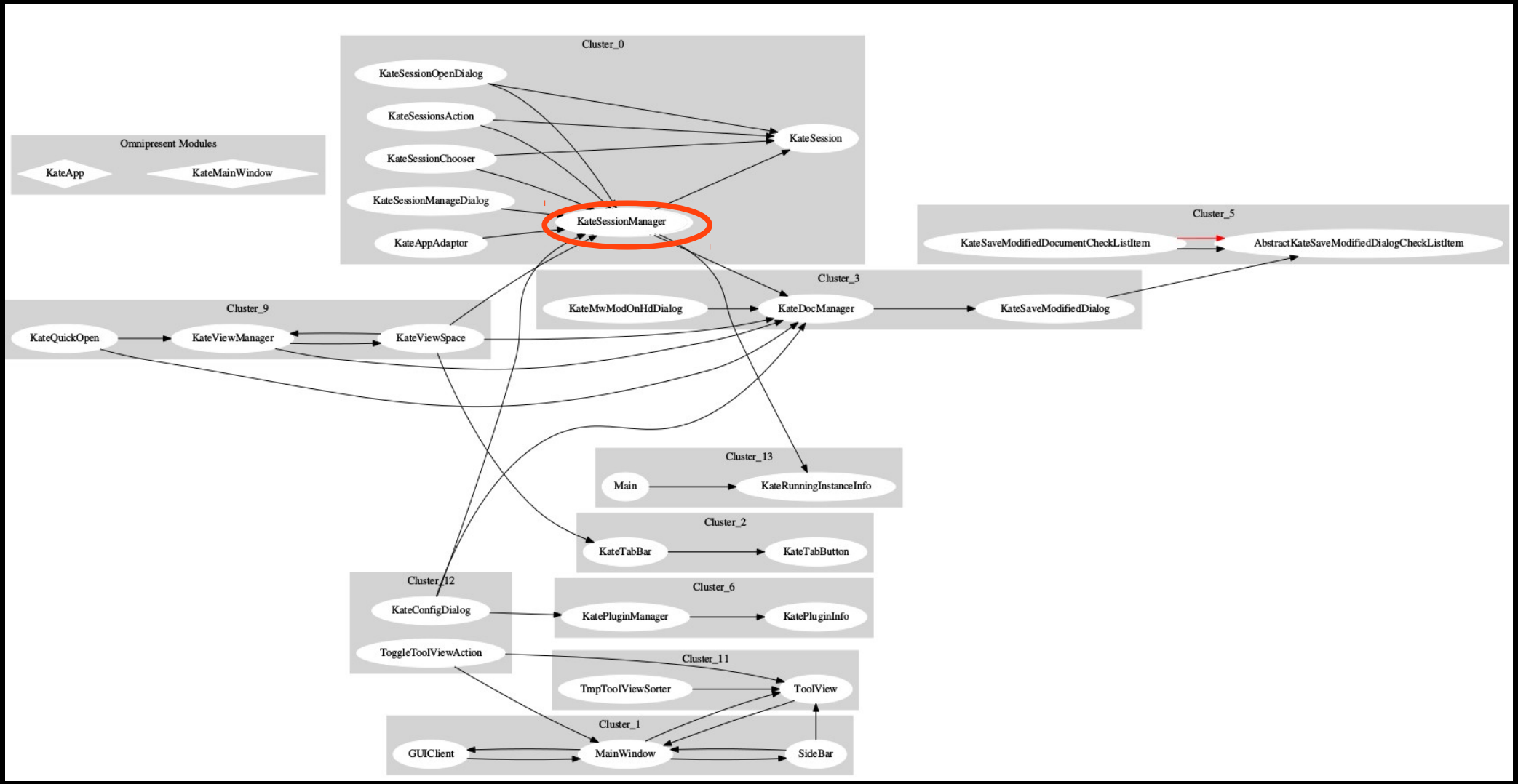
kate's original design



Omnipresent Modules



Results when omnipresent modules are considered



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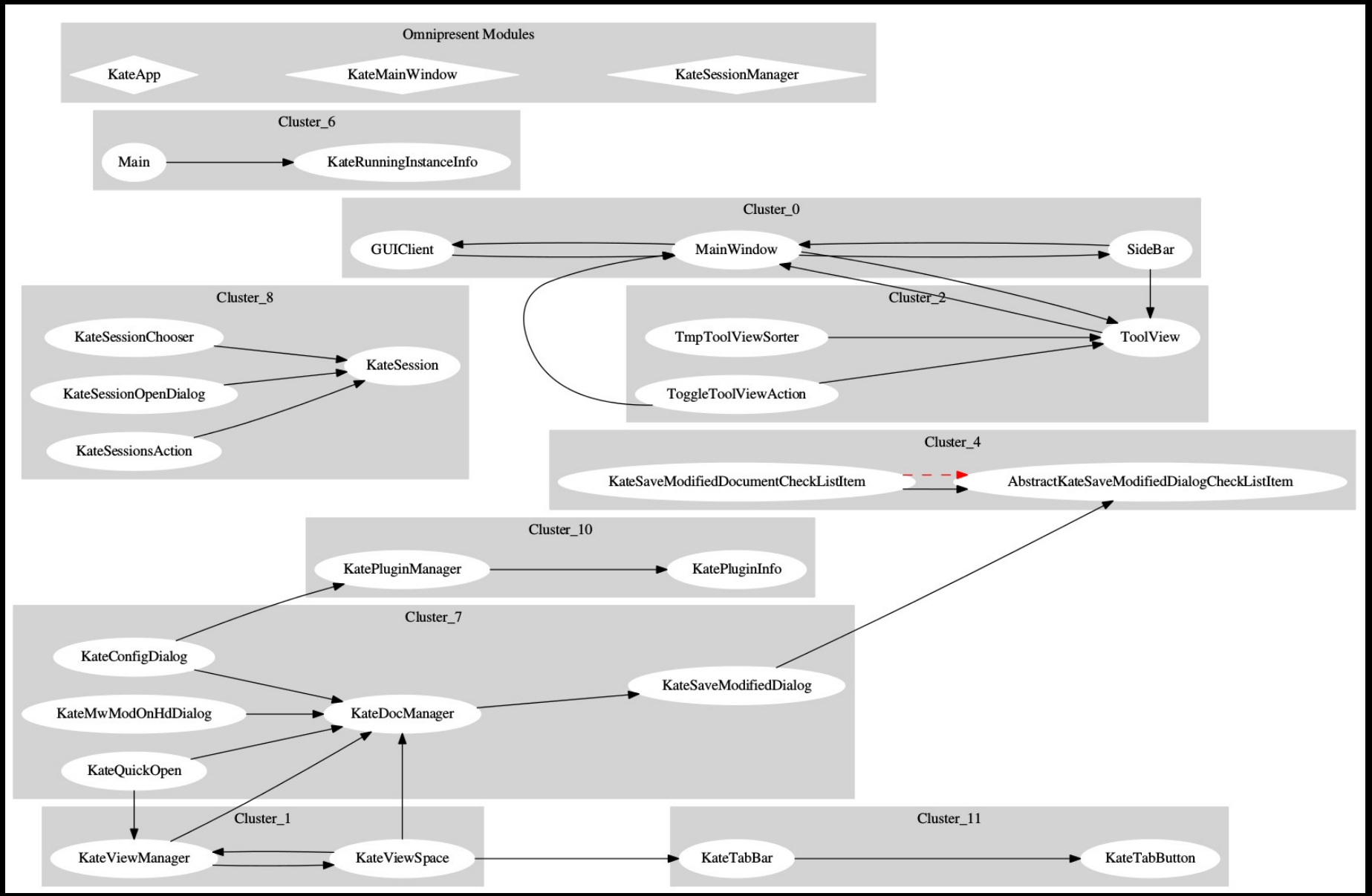

Limitations and Future Work

Handling omnipresent modules

Solutions visualization

Search process efficiency

For the Interested Reader

Technical report:

http://www.cs.ucl.ac.uk/research/research_notes/

Kate modularization datasets available

http://www0.cs.ucl.ac.uk/staff/m.paixao/kateMod/

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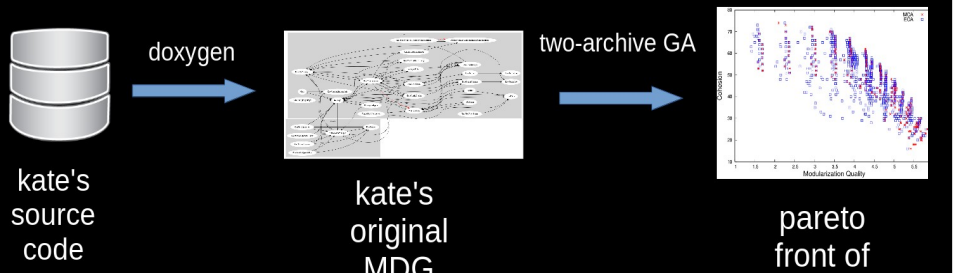
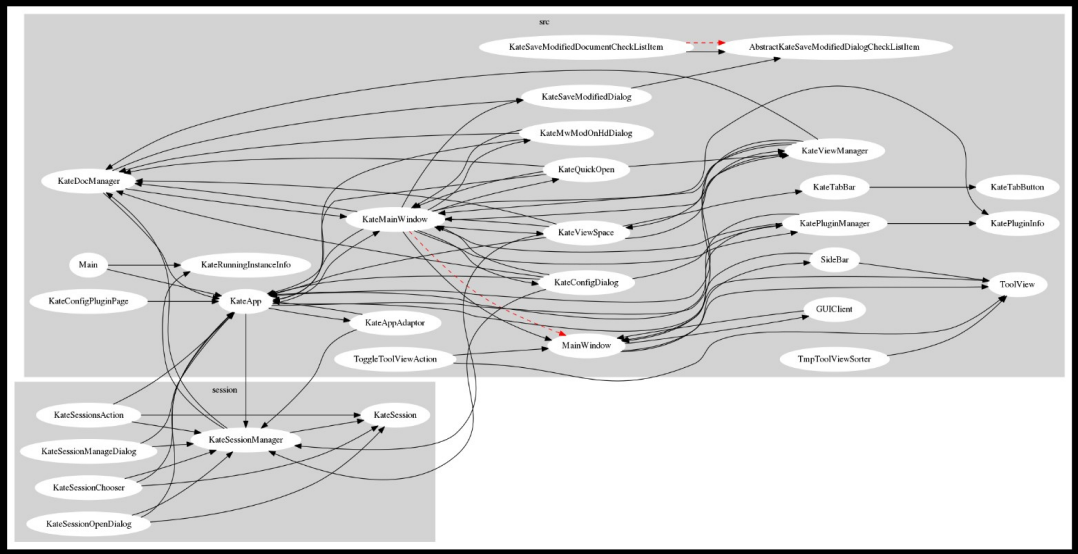
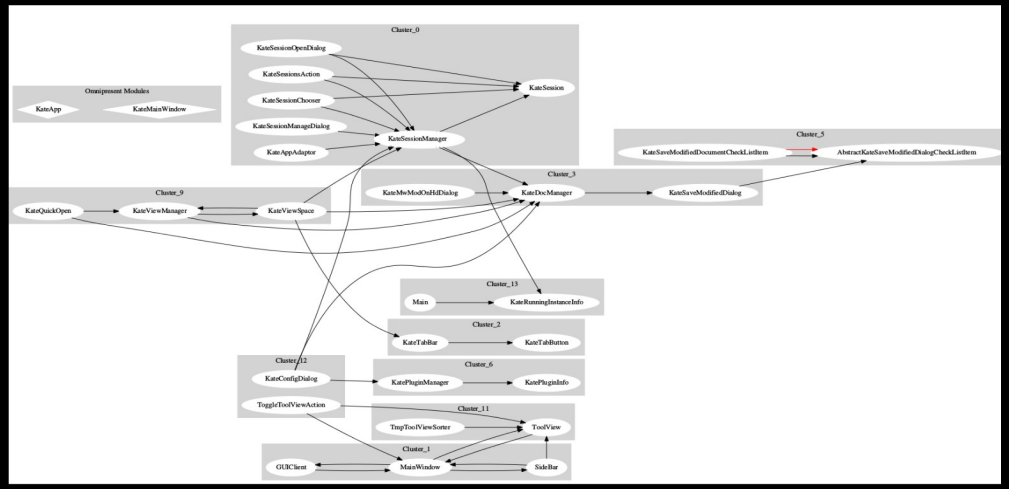
- C/C++ text editor for KDE platforms



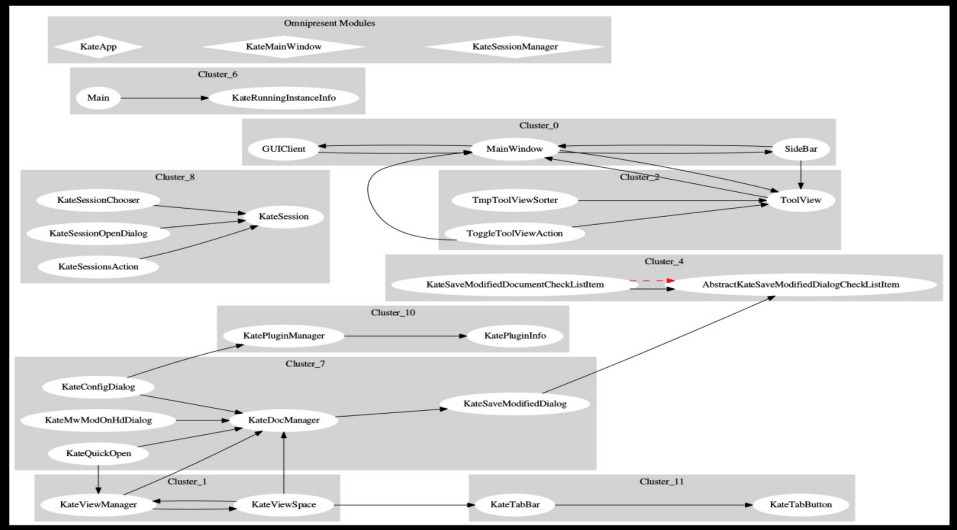
kate's original design



Results when omnipresent modules are considered



Results when omnipresent modules are considered



Fitness Functions Used

Maximize Cluster Approach (MCA)

- cohesion (max)
- coupling (min)
- number of clusters (max)
- isolated clusters (min)
- MQ (max)

Equal-size Cluster Approach (ECA)

- cohesion (max)
- coupling (min)
- number of clusters (max)
- clusters size difference (min)
- MQ (max)

GA Parameters

population size: 10M

generations: 10,000

one point crossover: 0.8

swap mutation: 0.004log2(M)

Unweighted X Weighted

	Fitness	Kate's Original	MCA	ECA	Effect Size
Unweighted	Cohesion	51	59.30 ± 1.10	59.37 ± 1.08	-
	Coupling	10	1.70 ± 1.10	1.63 ± 1.08	-
	Number of Clusters	2	2.57 ± 0.92	2.37 ± 0.87	-
	MQ	1.308	1.42 ± 0.28	1.33 ± 0.36	-
	Isolated Clusters	0	0.53 ± 0.76	-	-
	Cluster Difference	11	-	14.03 ± 7.79	-
Weighted	Cohesion	250	259.83 ± 4.62	258.73 ± 5.23	-
	Coupling	21	11.17 ± 4.62	12.27 ± 5.23	-
	Number of Clusters	2	5.90 ± 1.04	**6.97 ± 1.54**	0.22
	MQ	1.69	2.88 ± 0.46	2.71 ± 0.55	-
	Isolated Clusters	0	2.27 ± 1.26	-	-
	Cluster Difference	19	-	21.23 ± 2.03	-

Omnipresent Results

	Fitness	Kate's Original	MCA	ECA	Effect Size
$o_t = 3$	Cohesion	34	35.60 ± 1.36	35.47 ± 1.54	-
	Coupling	5	3.40 ± 1.36	3.53 ± 1.54	-
	Number of Clusters	2	5.07 ± 1.44	4.77 ± 1.69	-
	MQ	1.32	3.32 ± 1.02	3.11 ± 1.18	-
	Isolated Clusters	0	0.27 ± 0.44	-	-
	Cluster Difference	16	-	12.63 ± 4.03	-
$o_t = 2$	Cohesion	29	27.20 ± 0.95	27.67 ± 0.91	-
	Coupling	0	1.80 ± 0.95	1.33 ± 0.91	-
	Number of Clusters	2	**5.70 ± 1.04**	4.17 ± 1.75	0.73
	MQ	1.40	**3.96 ± 0.69**	2.93 ± 1.17	0.76
	Isolated Clusters	0	0.00 ± 0.00	-	-
	Cluster Difference	17	-	6.03 ± 2.99	-