Aspect-oriented programming

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Concern identification, assignment and metrics

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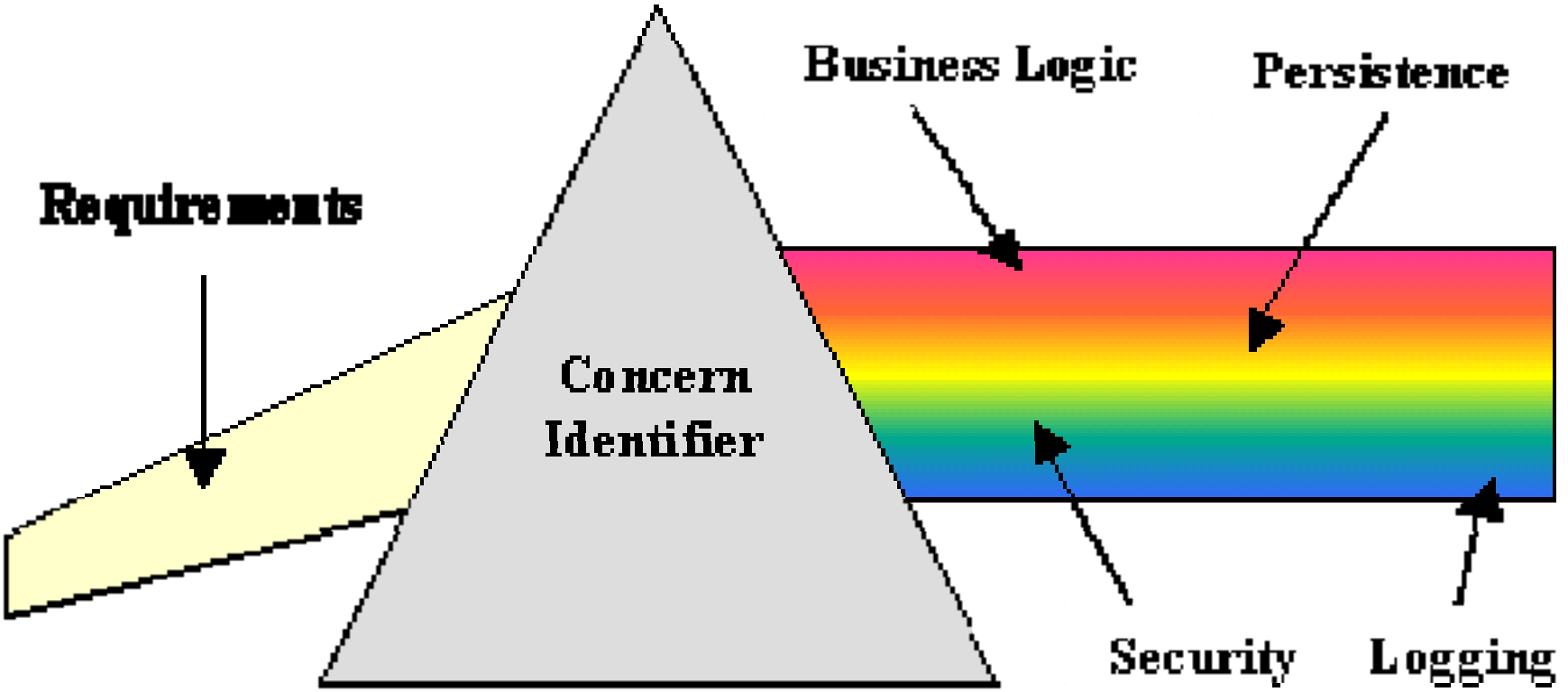
Problem

- Look for crosscutting concerns
  - Identify concerns (what are the concerns)
  - Assign concerns to code (where the concerns appear)
  - Collecting concern metrics
- Refactor the crosscutting concerns to use aspects

Identify concerns



Fonte: JavaWor

Health Watcher concerns

Tratamento de Exceções

Interface com o Usuário

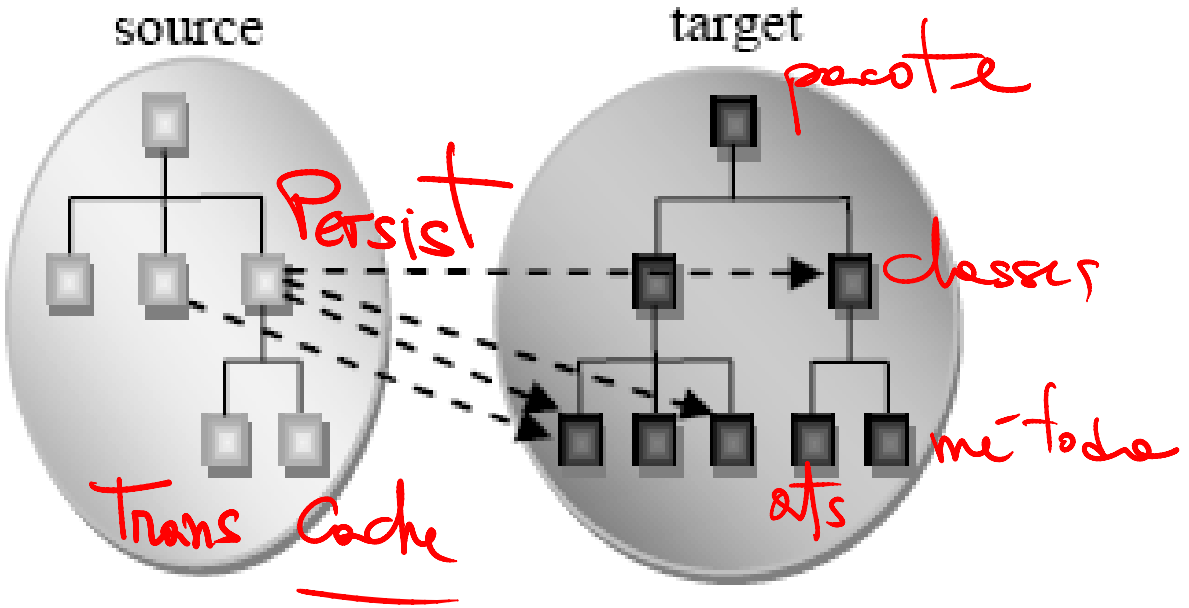
Armazenamento de dados

Distribuição

Regras do Negócio

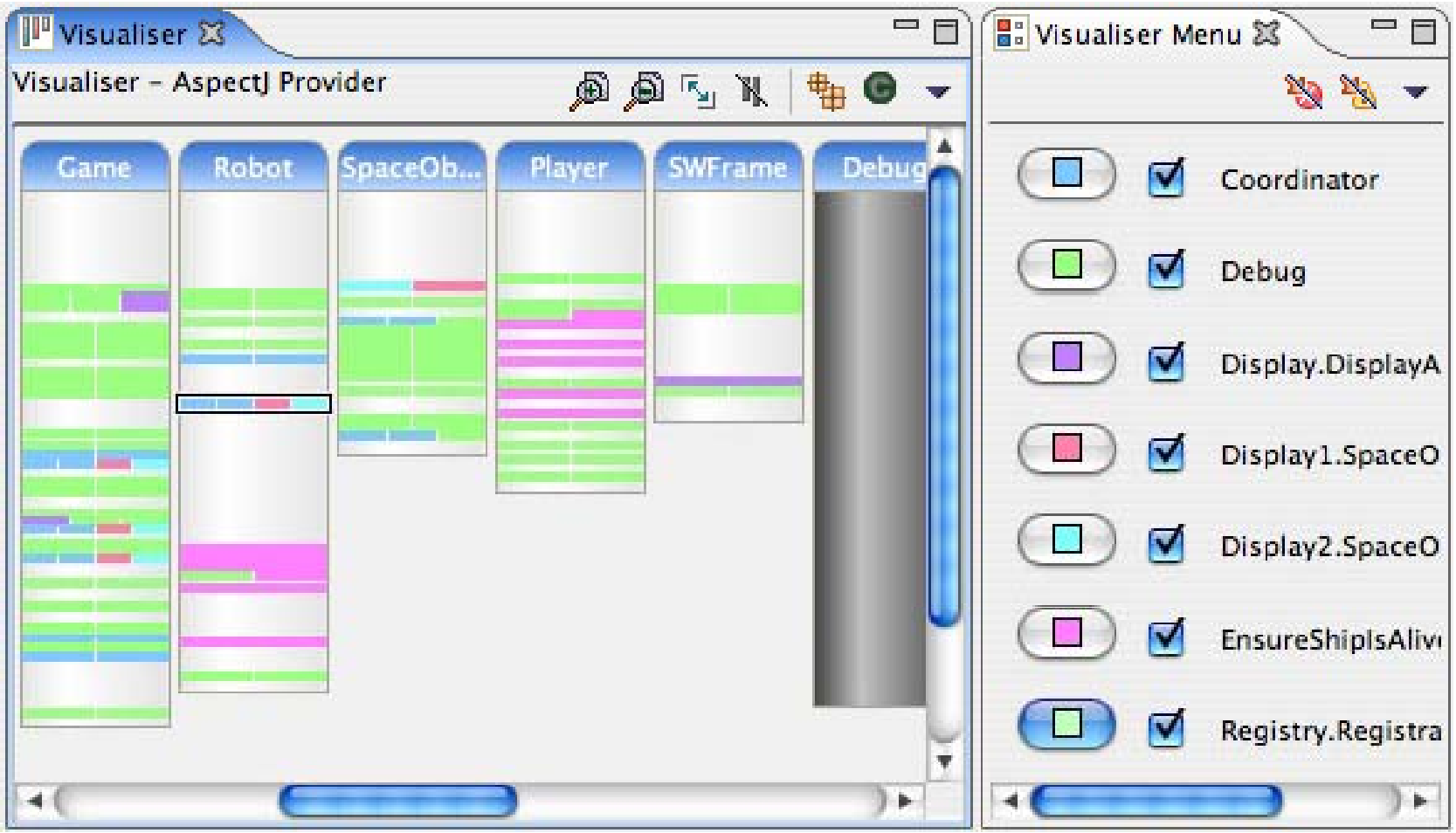
Controle de Concorrência

Assigning concerns to code



From: Identifying, Assigning, and Quantifying Crosscutting Concerns, Marc Eaddy, Alfred Aho, and Gail C. Murphy, ACoM 2007

Visualizing assignment



http://www-128.ibm.com/developerworks/java/library/j-aopwork9/

Assignment establishes that a component has a...

- removal dependency on the concern
- contribution relationship (a component contributes to the implementation of a concern)

Scattering and size metrics for concerns

- CDC: Concern Diffusion over Components
- CDO: Concern Diffusion over Operations
- DOSC: Degree of Scattering over Classes
- DOSM: Degree of Scattering over Methods
- SLOCC: Source Lines of Concern Code

Diffusion metrics

CDO

- The number of methods and advice **related** to a concern's implementation plus the number of other methods and advice accessing them

CDC

- The number of components **related** to the implementation of a concern plus the number of other components accessing them

DOS

$$CONC(s,t) = \frac{SLOCs\ in\ component\ t\ related\ to\ concern\ s}{SLOCs\ related\ to\ concern\ s}$$

$$DOS(s) = 1 - \frac{|T| \sum_t^T \left(CONC(s,t) - {}^1/_{|T|} \right)^2}{|T| - 1}$$

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DOSC, extreme cases

t	SLOCs s	CONC	CONC-1/T	(CONC-1/T)^2	DOS
A	300	1	0,666667	0,444444444	
B	0	0	-0,333333	0,111111111	
C	0	0	-0,333333	0,111111111	
Total	300			0,666666667	0

t	SLOCs s	CONC	CONC-1/T	(CONC-1/T)^2	DOS
A	100	0,33	0	0	
B	100	0,33	0	0	
C	100	0,33	0	0	
Total	300			0	1

DOSC, extent of scattering

t	SLOCs s	CONC	CONC-1/T	(CONC-1/T)^2	DOS
A	500	0,96	0,628205	0,394641683	
B	10	0,02	-0,314103	0,098660421	
C	10	0,02	-0,314103	0,098660421	
Total	520			0,591962525	0,11

t	SLOCs s	CONC	CONC-1/T	(CONC-1/T)^2	DOS
A	250	0,93	0,592593	0,351165981	
B	10	0,04	-0,296296	0,087791495	
C	10	0,04	-0,296296	0,087791495	
Total	270			0,526748971	0,21

Dbviz data
(database schema visualizer)

Concern Name	DOSC	DOSM	CDC	CDO	LOCC
AddTableToER	0,89	0,98	10	63	911
AutoArrangeDiagram	0,43	0,96	8	37	1041
ConnectToDatabase	0,82	0,94	6	30	500
ExitDbviz	0,62	0,79	4	5	99
ImportSchema	0,83	0,95	10	41	667
ImportSchemaFromDatabase	0,85	0,96	11	46	701
ImportSchemaFromSQLFile	0,82	0,96	10	39	590
LoadSavedERDiagram	0,93	0,96	18	34	543
PrintERDiagram	0,83	0,92	7	18	326
RemoveTableFromER	0,87	0,98	10	61	823
SaveLoadERDiagram	0,94	0,98	22	65	965
StartDbviz	0,5	0,88	2	11	169
UndoRedo	0,9	0,95	12	26	442
Average	0,787	0,939	10,000	36,615	598,231

From http://www1.cs.columbia.edu/~eaddy/concerntagger/

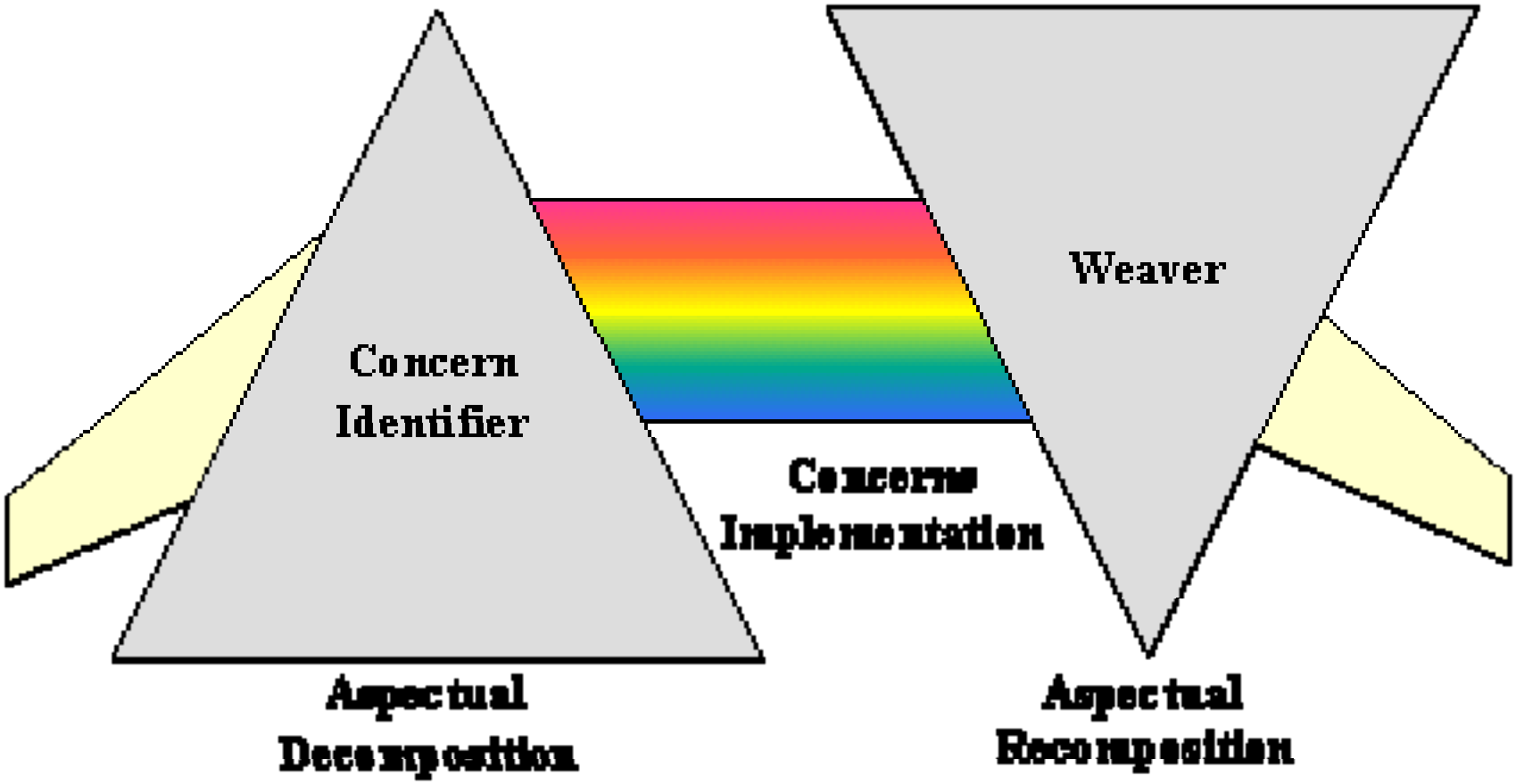
Mylyn-Bugzilla (task-oriented Eclipse plug-in)

Concern Name	DOSC	DOSM	CDC	CDO	LOCC
9di. parse xml bugzilla form	0,84	0,93	14	39	1013
2k. support hyperlink navigation based on text in bug	0,78	0,87	5	11	205
1a. gather tasklist-specific query params via form	0,71	0,86	5	12	136
9b. do overhead for later transactions	0,68	0,77	4	6	39
2n. Create new repository bug	0,67	0,90	7	38	754
8a. save/restore query form information for use in next query	0,66	0,91	5	18	221
2m. present/decorate (non-edited)	0,62	0,82	5	8	68
8d. Fetch tasks from repository	0,62	0,76	5	5	141
2c. support adding attachments	0,55	0,48	4	3	111
5b. support multiple versions of bz	0,51	0,50	3	3	41
9c. get tasks from the repository	0,46	0,72	2	5	89
2e. post individual tasks to rep -- pulling s.b. in 9c	0,45	0,69	4	6	222
2o. upload or download attachment	0,39	0,74	3	5	57
9d. convert query hits to tasks	0,32	0,84	3	11	222
9bi. authentication	0,31	0,69	3	6	168

Refactor concerns

- Alguns *concerns* são bem modelados como objetos (núcleo do sistema)
  - GUI
  - Regras de negócio
- Outros (*crosscutting concerns*) como aspectos
  - Distribuição, Controle de Concorrência, Tratamento de Exceções, Armazenamento de Dados

Composing aspects



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