



*«To accomplish great things we must first dream,
then visualize, then plan... believe... act!»*

Alfred A. Montapert

GZoltar Team

WHO

- Great Teams make Great Work!
- We are a Multi-Disciplinary Team
- Proceed to Doctoral Program

André Ribeiro | MSc Student

Rui Abreu | Zoltar's Main Developer

Rui Rodrigues | Graphics & Visualization


Since the Beginning

WHY

9/9

0800 Antan started
 1000 " stopped - antan ✓ { 1.2700 9.037 847 025
 1300 (032) MP-MC 2.130476415 9.037 846 995 correct
 (033) PRO 2 2.130476415 4.615925059(-2)
 correct 2.130676415
 Relays 6-2 in 033 failed special speed test
 in relay 10,000 test.

1100 Relays changed
 Started Cosine Tape (Sine check)
 1525 Started Multy Adder Test.

1545  Relay #70 Panel F
 (moth) in relay.

First actual case of bug being found.
 1630 Antan started.
 1700 closed down.

Relay 2145
 Relay 3370

Critical Systems

WHY



Where do we Act?

WHERE

FAULT

ERROR

FAILURE

INCIDENT

ACCIDENT

Debugging Process

STEPS

AJDHYRIW
KDJWOQMD
WORITMCR
WKRITURW



TESTING
PERIOD



Debugging Process

STEPS

AJDHYRIW
KDJWOQMD
WORITMCR
WKRITURW

AJDHYRIW
KDJWOQMD
WORITMCR
WKRITURW



TESTING
PERIOD

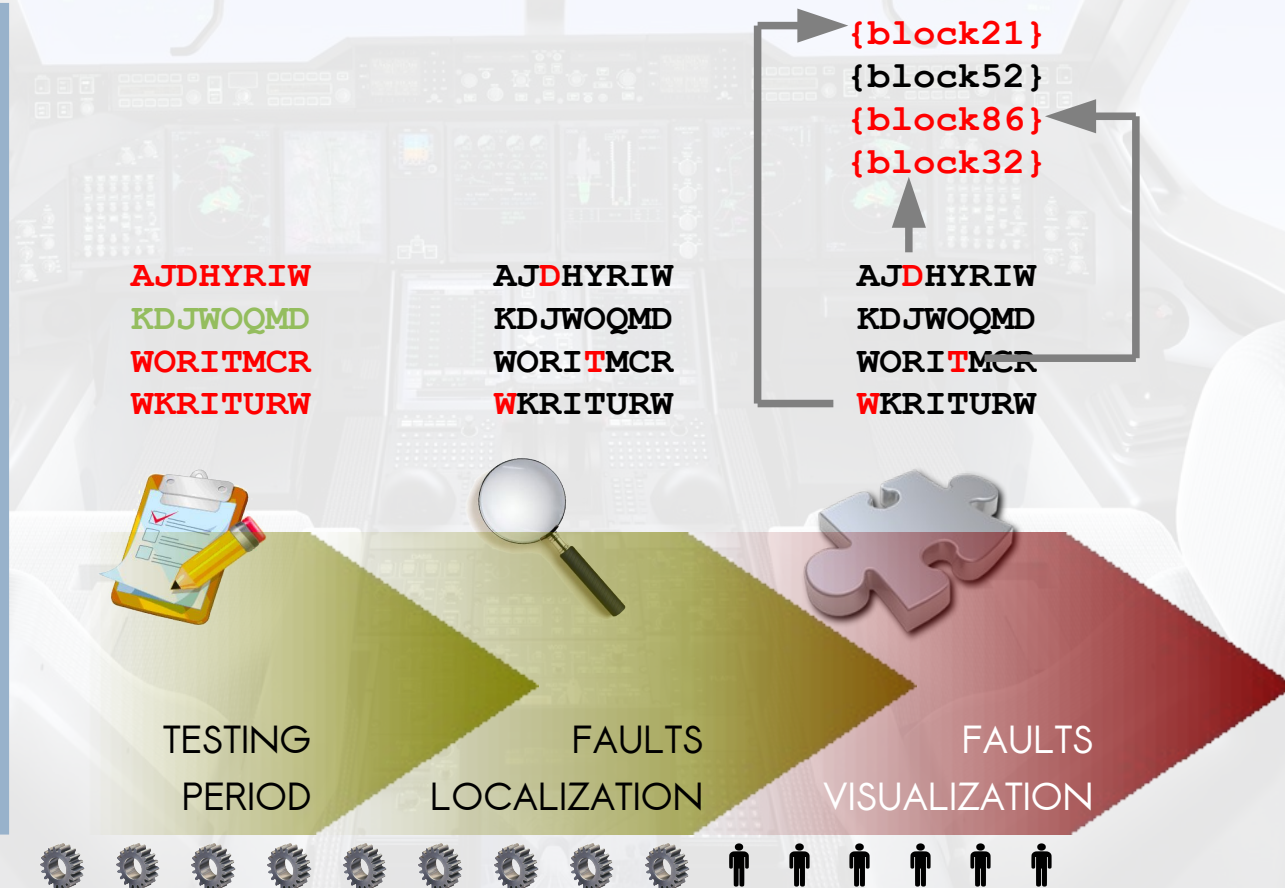


FAULTS
LOCALIZATION



Debugging Process

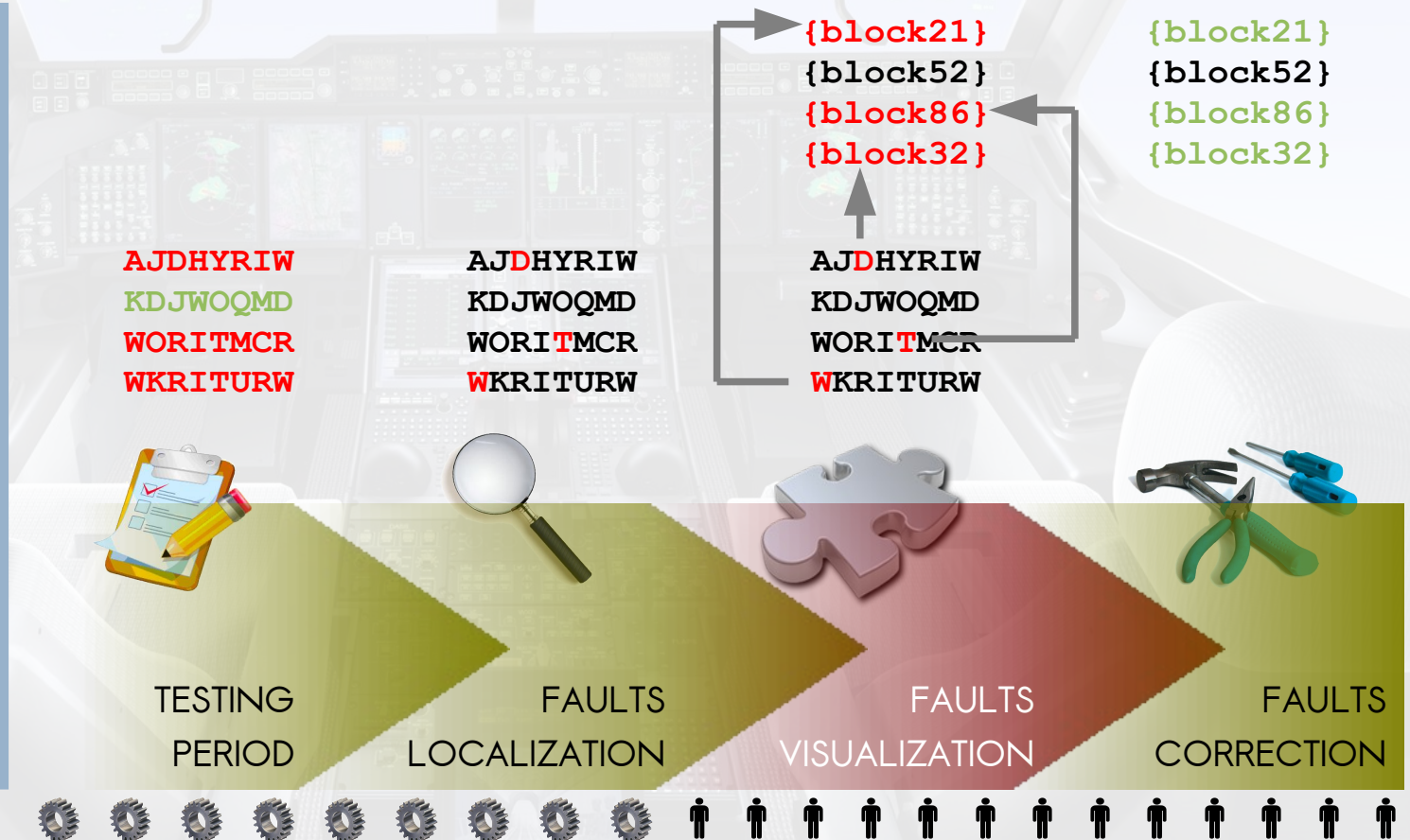
STEPS





Debugging Process

STEPS





Output and Speed

- What is the influence of the output of fault localization tools in the time spent on the debugging process?

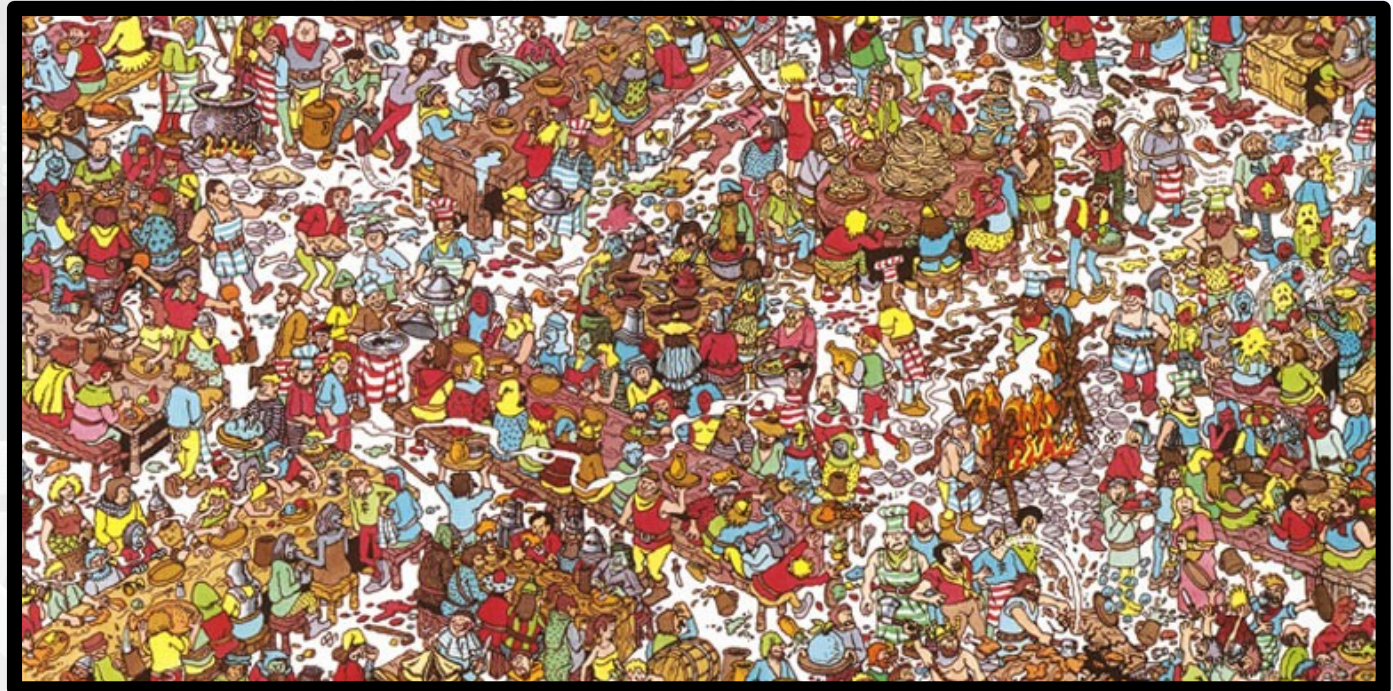
... The Waldo Localization Tool

GAME



Weak Output

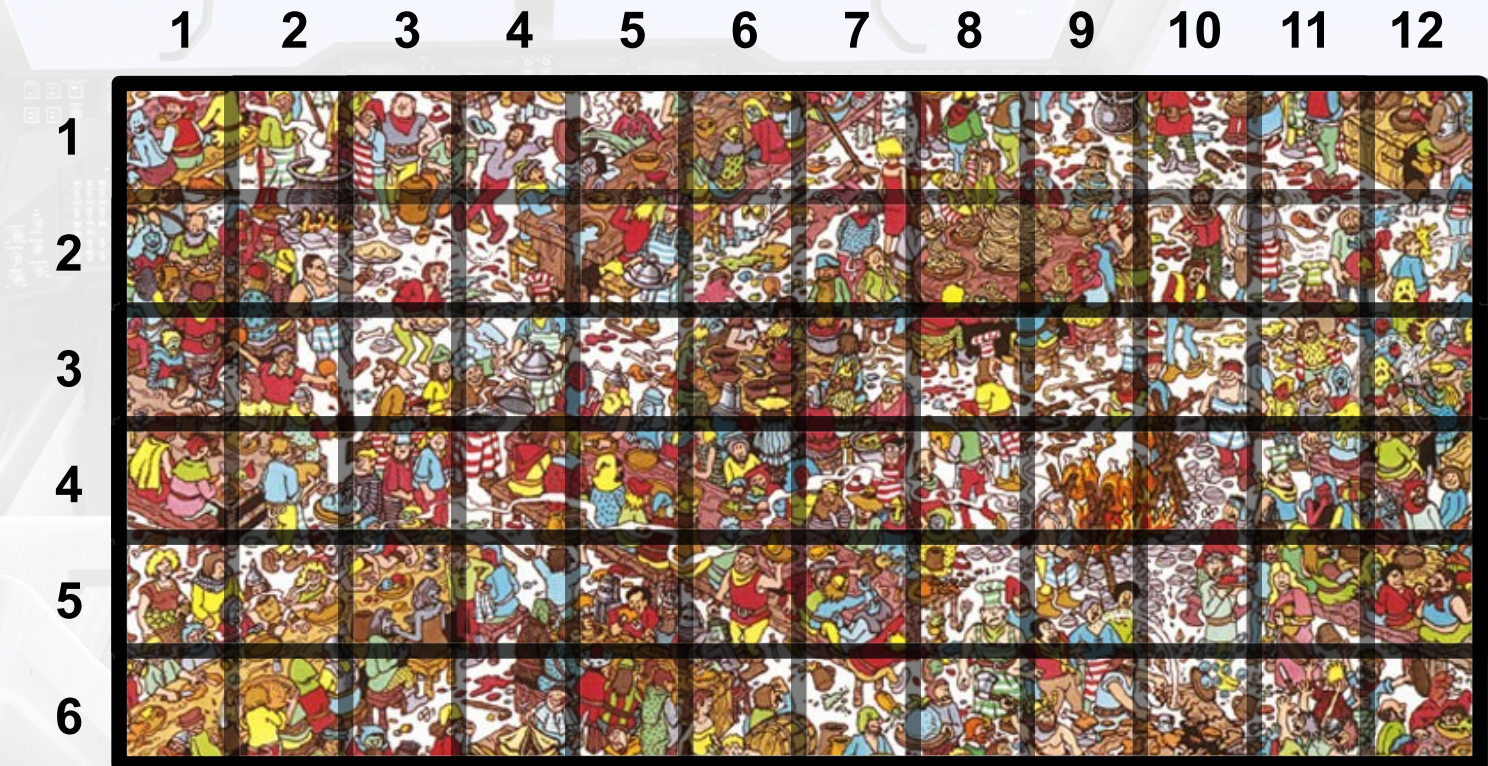
GAME





GAME

Weak Output

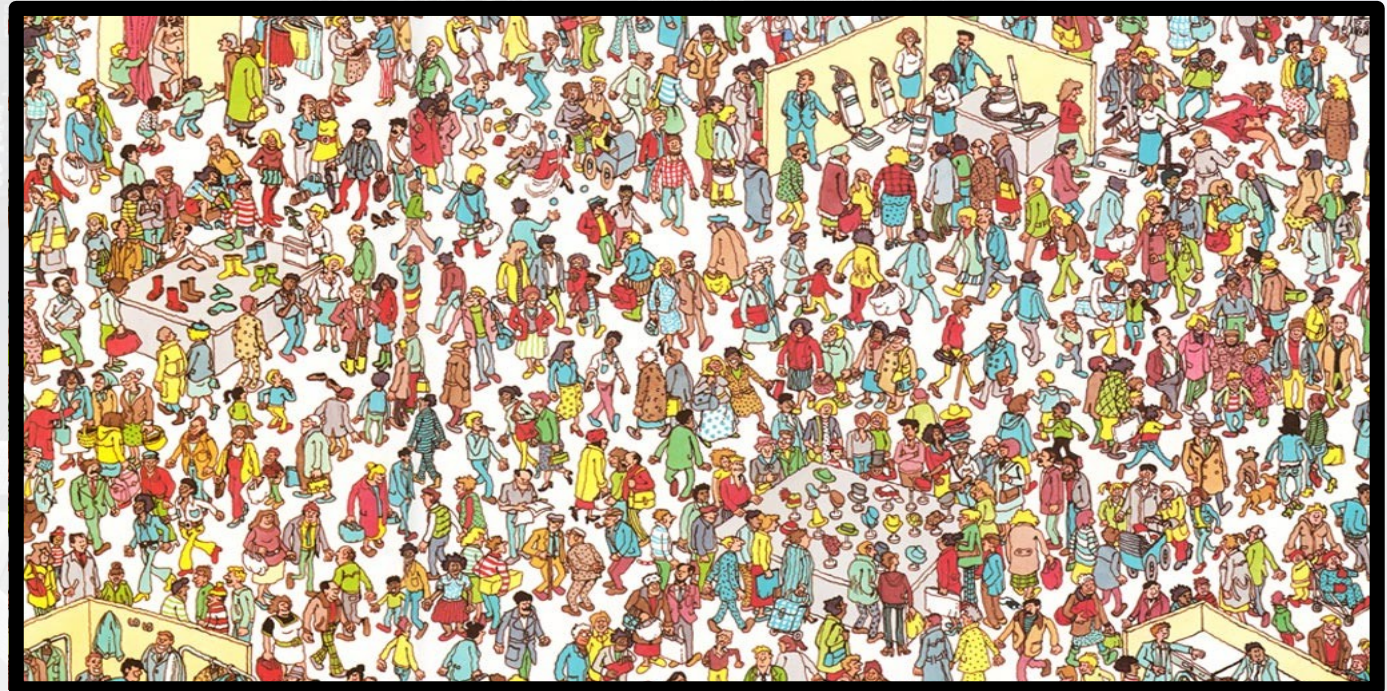


Waldo is on Line 4, Column 7.



Strong Output

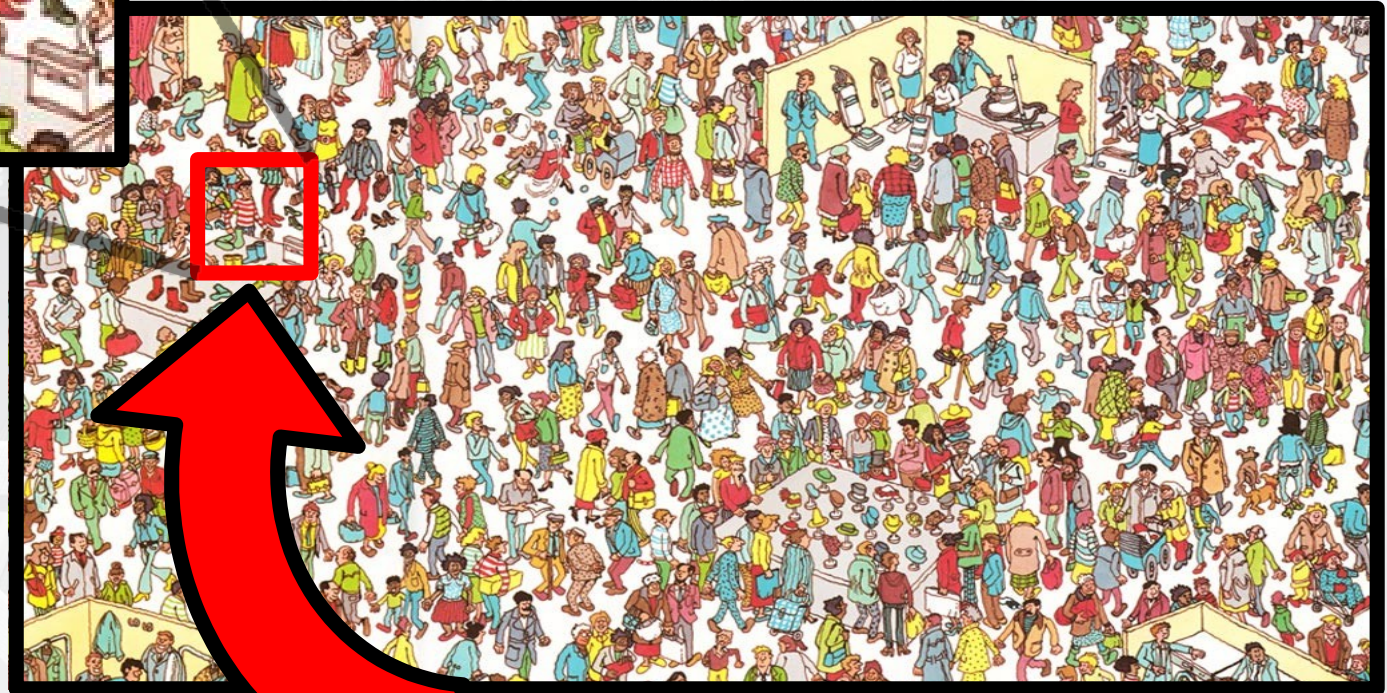
GAME





GAME

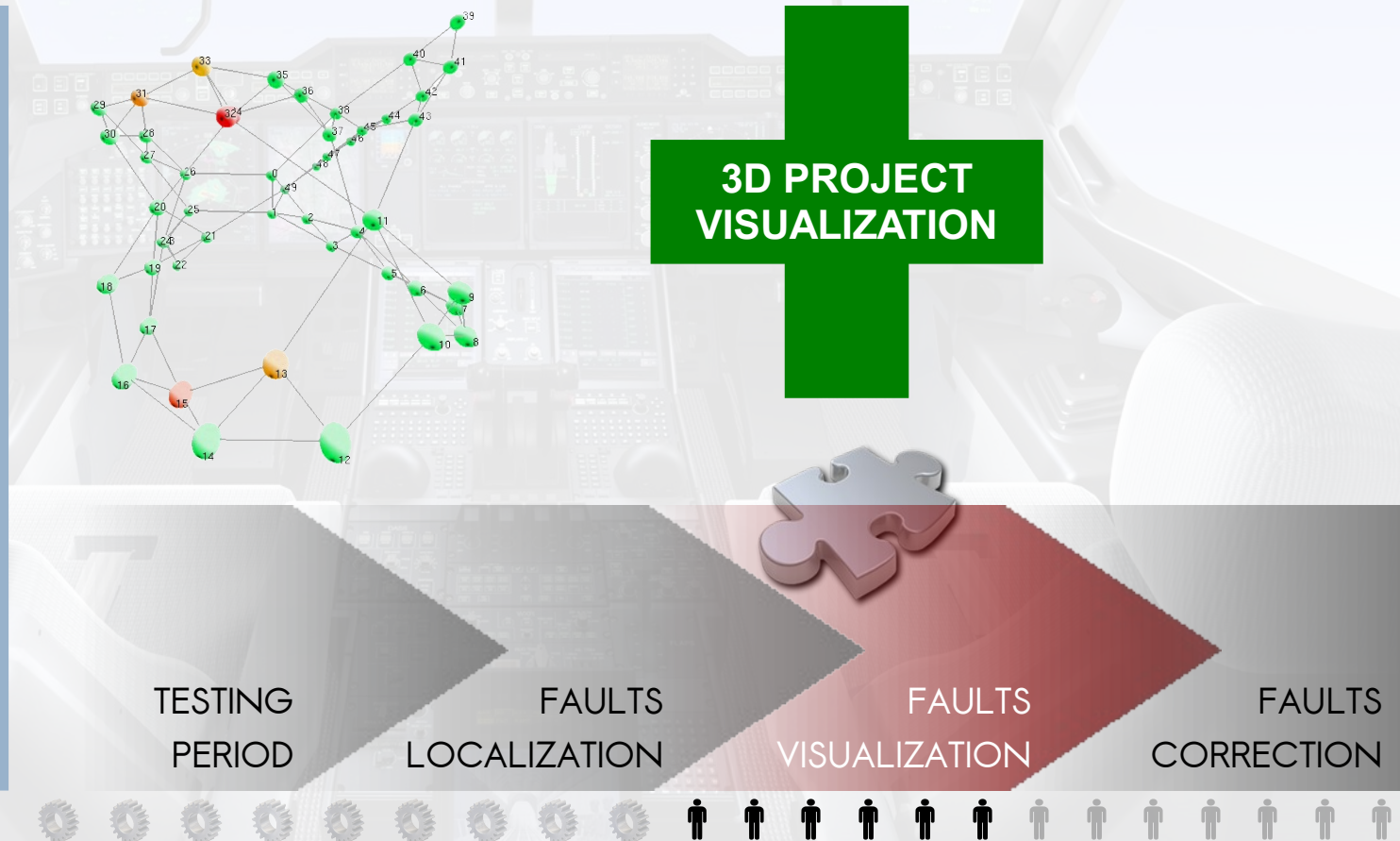
Strong Output



Waldo is here

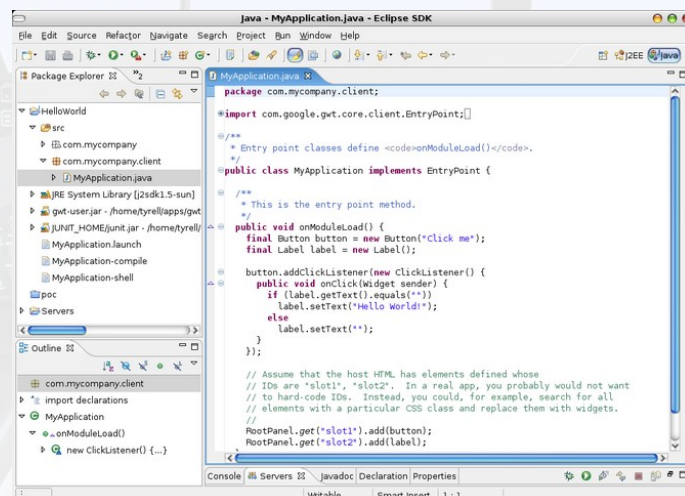
Debugging Process

STEPS



Debugging Process

STEPS



IDE
INTEGRATION

TESTING
PERIOD

FAULTS
LOCALIZATION

FAULTS
VISUALIZATION

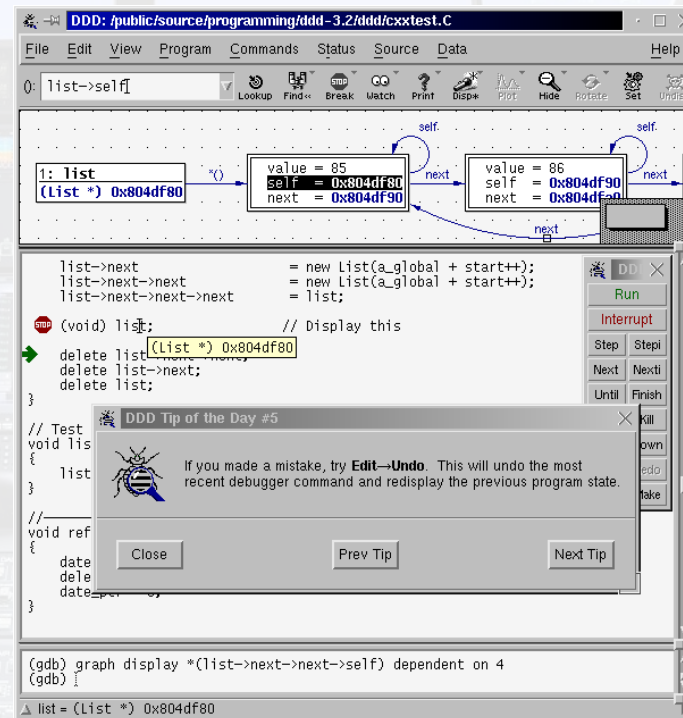
FAULTS
CORRECTION





Visual Debug

GAP

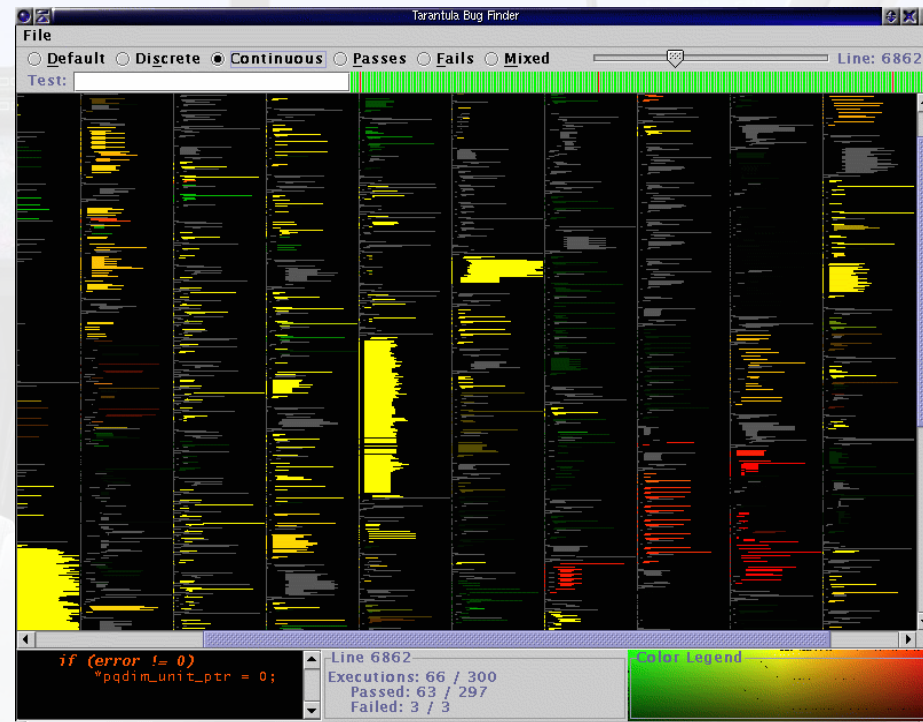


<http://www.gnu.org/software/ddd/>



Visual Debug

GAP

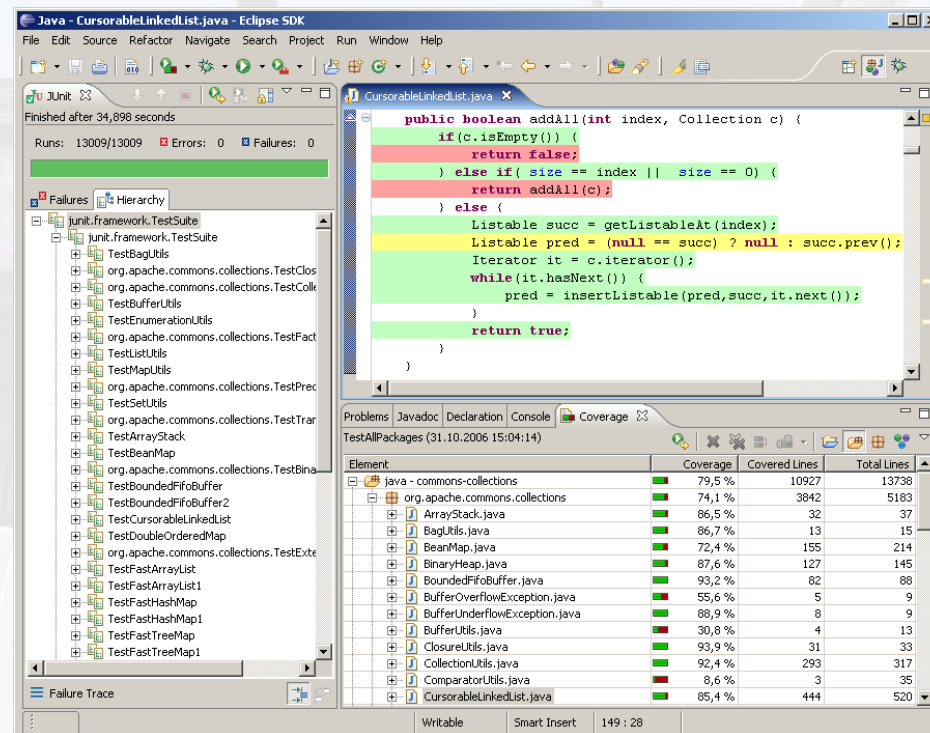


<http://pleuma.cc.gatech.edu/aristotle/Tools/tarantula/>



Debug in Eclipse

GAP



The screenshot shows the Eclipse IDE interface. The main editor displays the `CursorableLinkedList.java` file with the following code:

```
public boolean addAll(int index, Collection c) {
    if (c.isEmpty()) {
        return false;
    } else if (size == index || size == 0) {
        return addAll(c);
    } else {
        Listable succ = getListableAt(index);
        Listable pred = (null == succ) ? null : succ.prev();
        Iterator it = c.iterator();
        while (it.hasNext()) {
            pred = insertListable(pred, succ, it.next());
        }
        return true;
    }
}
```

The left sidebar shows the 'JUnit' test runner with a 'Failures' tab. The bottom right shows the 'Coverage' tab with the following data:

Element	Coverage	Covered Lines	Total Lines
java - commons-collections	79,5 %	10927	13738
org.apache.commons.collections	74,1 %	3842	5183
ArrayStack.java	86,5 %	32	37
BagUtils.java	86,7 %	13	15
BeanMap.java	72,4 %	155	214
BinaryHeap.java	87,6 %	127	145
BoundedFifoBuffer.java	93,2 %	82	88
BufferOverflowException.java	55,6 %	5	9
BufferUnderflowException.java	88,9 %	8	9
BufferUtils.java	30,8 %	4	13
ClosureUtils.java	93,9 %	31	33
CollectionUtils.java	92,4 %	293	317
ComparatorUtils.java	8,6 %	3	35
CursorableLinkedList.java	85,4 %	444	520

<http://www.eclemma.org/>



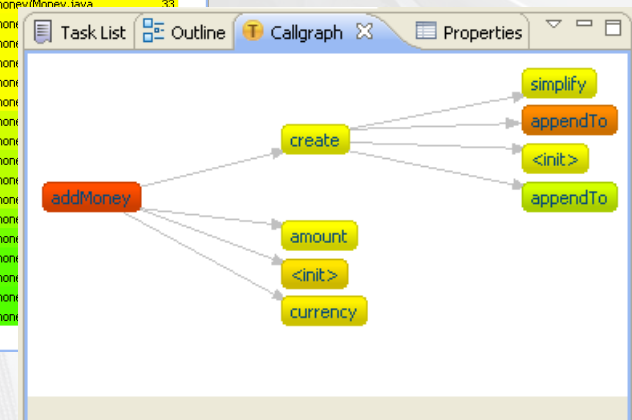
GAP

EzUnit 4

type filter text

Avg	Method Under Test	Resource	Path	Location
0.85	Money.addMoney(Money)	Money.java	/FullMoney/junit/samples/money/Money.java	25
0.85	Money.add(IMoney)	Money.java	/FullMoney/junit/samples/money/Money.java	22
0.83	Money.toString()	Money.java	/FullMoney/junit/samples/money/Money.java	70
0.73	MoneyBag.appendTo(MoneyBag)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	121
0.73	MoneyBag.appendBag(MoneyBag)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	35
0.69	Money.equals(Object)	Money.java	/FullMoney/junit/samples/money/Money.java	40
0.64	MoneyBag.toString()	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	113
0.55	Money.<init>(int,String)	Money.java	/FullMoney/junit/samples/money/Money.java	-1
0.55	MoneyBag.add(IMoney)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	26
0.52	Money.currency()	Money.java	/FullMoney/junit/samples/money/Money.java	36
0.52	Money.isZero()	Money.java	/FullMoney/junit/samples/money/Money.java	57
0.50	Money.amount()	Money.java	/FullMoney/junit/samples/money/Money.java	33
0.49	MoneyBag.findMoney(String)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	10
0.49	MoneyBag.appendMoney(Money)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	11
0.49	MoneyBag.create(IMoney,IMoney)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	12
0.49	MoneyBag.<init>()	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	13
0.49	MoneyBag.simplify()	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	14
0.42	Money.appendTo(MoneyBag)	Money.java	/FullMoney/junit/samples/money/Money.java	15
0.41	Money.negate()	Money.java	/FullMoney/junit/samples/money/Money.java	16
0.36	MoneyBag.subtract(IMoney)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	17
0.36	MoneyBag.addMoney(Money)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	18
0.36	MoneyBag.addMoneyBag(MoneyBag)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	19
0.29	MoneyBag.negate()	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	20
0.23	MoneyBag.isZero()	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	21
0.18	Money.subtract(IMoney)	Money.java	/FullMoney/junit/samples/money/Money.java	22
0.18	Money.addMoneyBag(MoneyBag)	Money.java	/FullMoney/junit/samples/money/Money.java	23
0.16	MoneyBag.contains(Money)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	24
0.16	MoneyBag.equals(Object)	MoneyBag.java	/FullMoney/junit/samples/money/MoneyBag.java	25

Fault Circle (S BSA BS BSA SA SS N2 IZ N4 SBA N3)

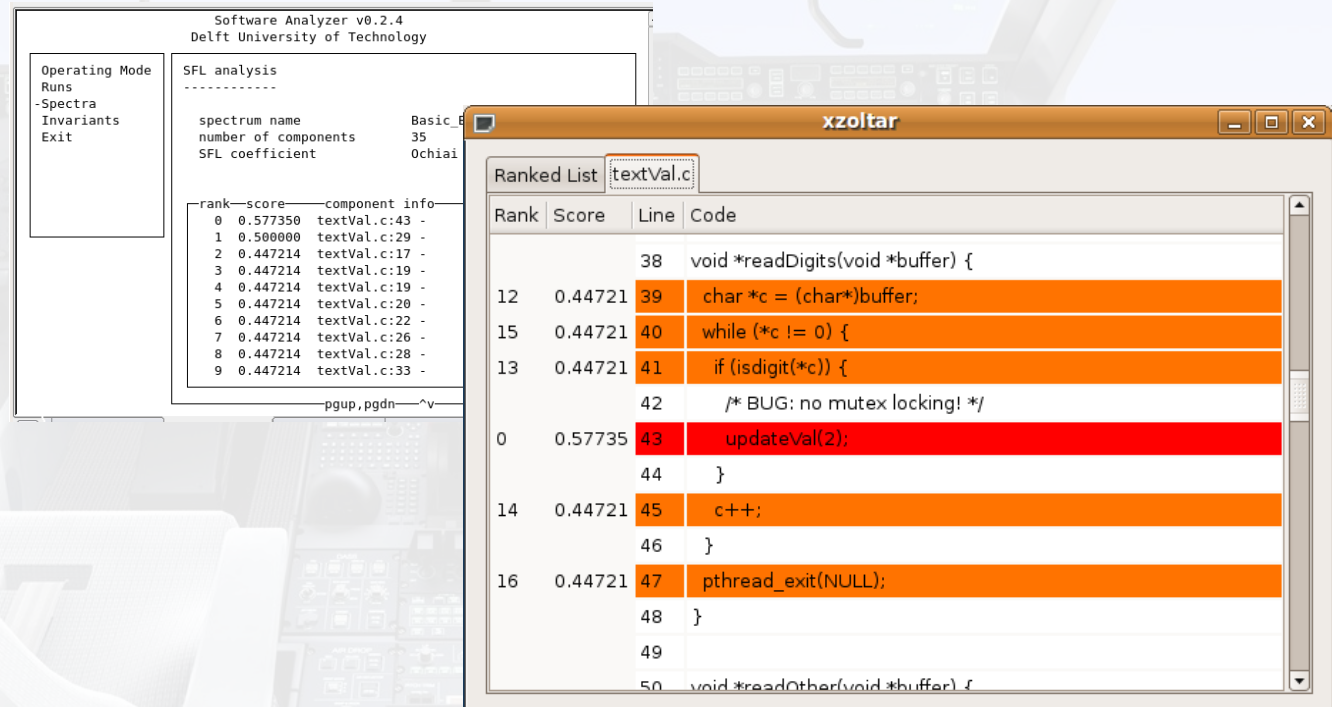


<http://www.fernuni-hagen.de/ps/prjs/EzUnit4/>

ZOLTAR

Visual Debug

GAP



Software Analyzer v0.2.4
Delft University of Technology

Operating Mode
Runs
-Spectra
Invariants
Exit

SFL analysis

spectrum name Basic B
number of components 35
SFL coefficient 0chiai

rank	score	component info
0	0.577350	textVal.c:43 -
1	0.500000	textVal.c:29 -
2	0.447214	textVal.c:17 -
3	0.447214	textVal.c:19 -
4	0.447214	textVal.c:19 -
5	0.447214	textVal.c:20 -
6	0.447214	textVal.c:22 -
7	0.447214	textVal.c:26 -
8	0.447214	textVal.c:28 -
9	0.447214	textVal.c:33 -

pgup, pgdn ^v

xzoltar

Ranked List textVal.c

Rank	Score	Line	Code
		38	void *readDigits(void *buffer) {
12	0.44721	39	char *c = (char*)buffer;
15	0.44721	40	while (*c != 0) {
13	0.44721	41	if (isdigit(*c)) {
		42	/* BUG: no mutex locking! */
0	0.57735	43	updateVal(2);
		44	}
14	0.44721	45	c++;
		46	}
16	0.44721	47	pthread_exit(NULL);
		48	}
		49	
		50	void *readOther(void *buffer) {

<http://www.fdir.org/zoltar/>

Comparison

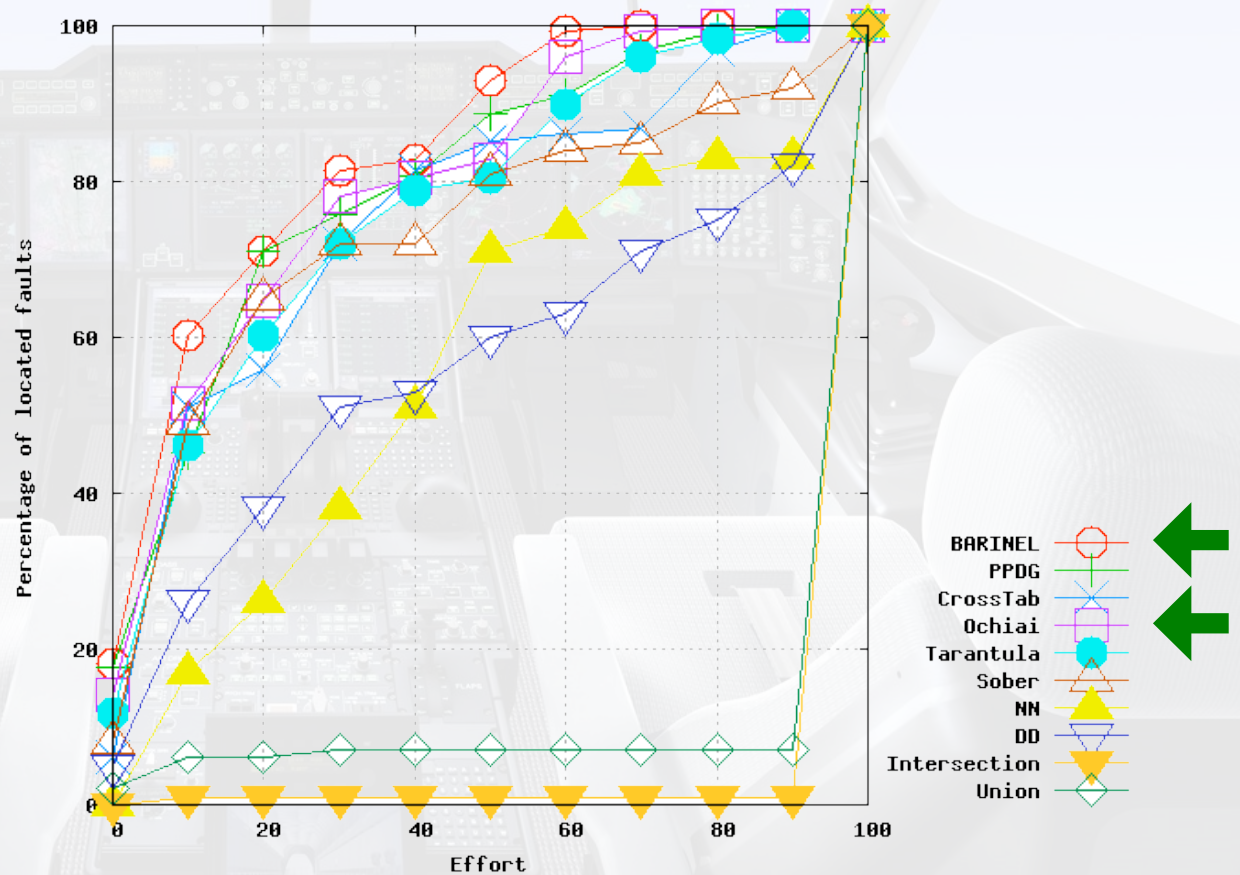
OVERVIEW

	DDD	Tarantula	EclEmma	EzUnit 4	Zoltar	GZoltar
Hierarchical Location						
Dependency Graph						
Navigation						
IDE Integration						
Fail Probability						
Graphical Output						
Free						



Why Zoltar?

CHOICE



Business Recognition

CHOICE



PHILIPS

Embedded Systems
INSTITUTE

NXP

Academic Recognition

CHOICE

Best Demo Award

24th ACM/IEEE

International Conference on Automated
Software Engineering.

 **ASE2009**
Auckland, New Zealand
16th - 20th November

Active Development

CHOICE



Universidade do Porto

FEUP Faculdade de Engenharia

Main Goals

NEXT

- Quick View of a Project Structure
- Probability of each Module to Fail
- Navigation through the Project



Integration

NEXT

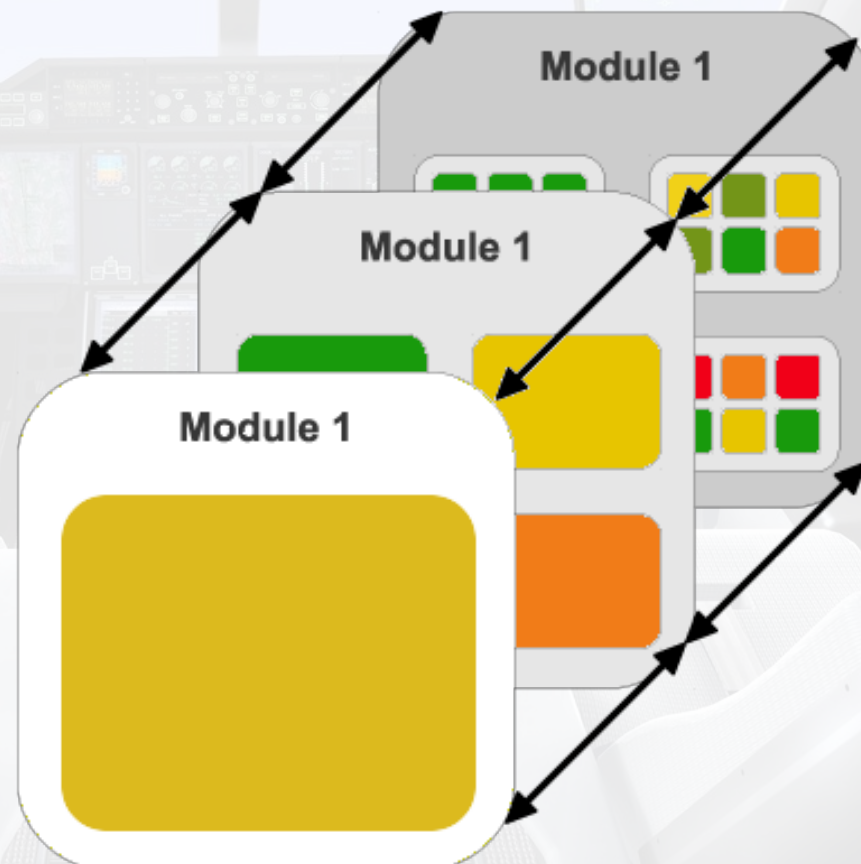
- JZoltar (Java Zoltar)
- Existent Tools Integration:
 - Zoltar Input | Unit Test
 - Zoltar Input | Code Coverage
 - Hierarchical View
 - Dependency Graph
- 3D View as Eclipse Plugin





Hierarchical View

NEXT



Dependency Graph

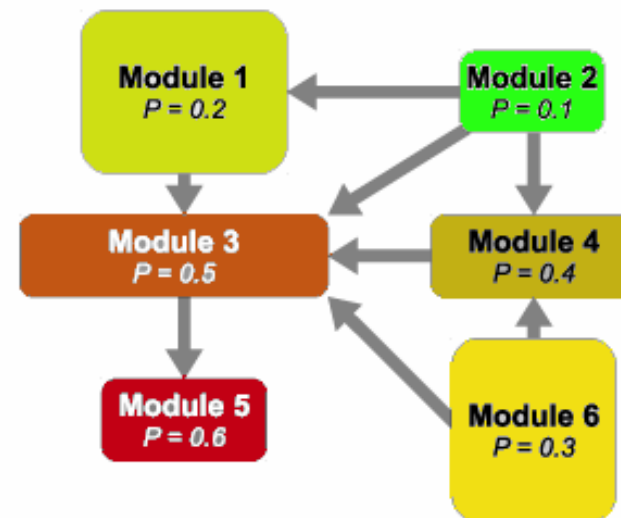
NEXT

- MyProject1
 - myClass1
 - myClass2
 - myClass3
- MyProject2
 - myClass4
 - myClass5
 - myClass6
- MyProject3
 - myClass7
 - myClass8
 - myClass9

```

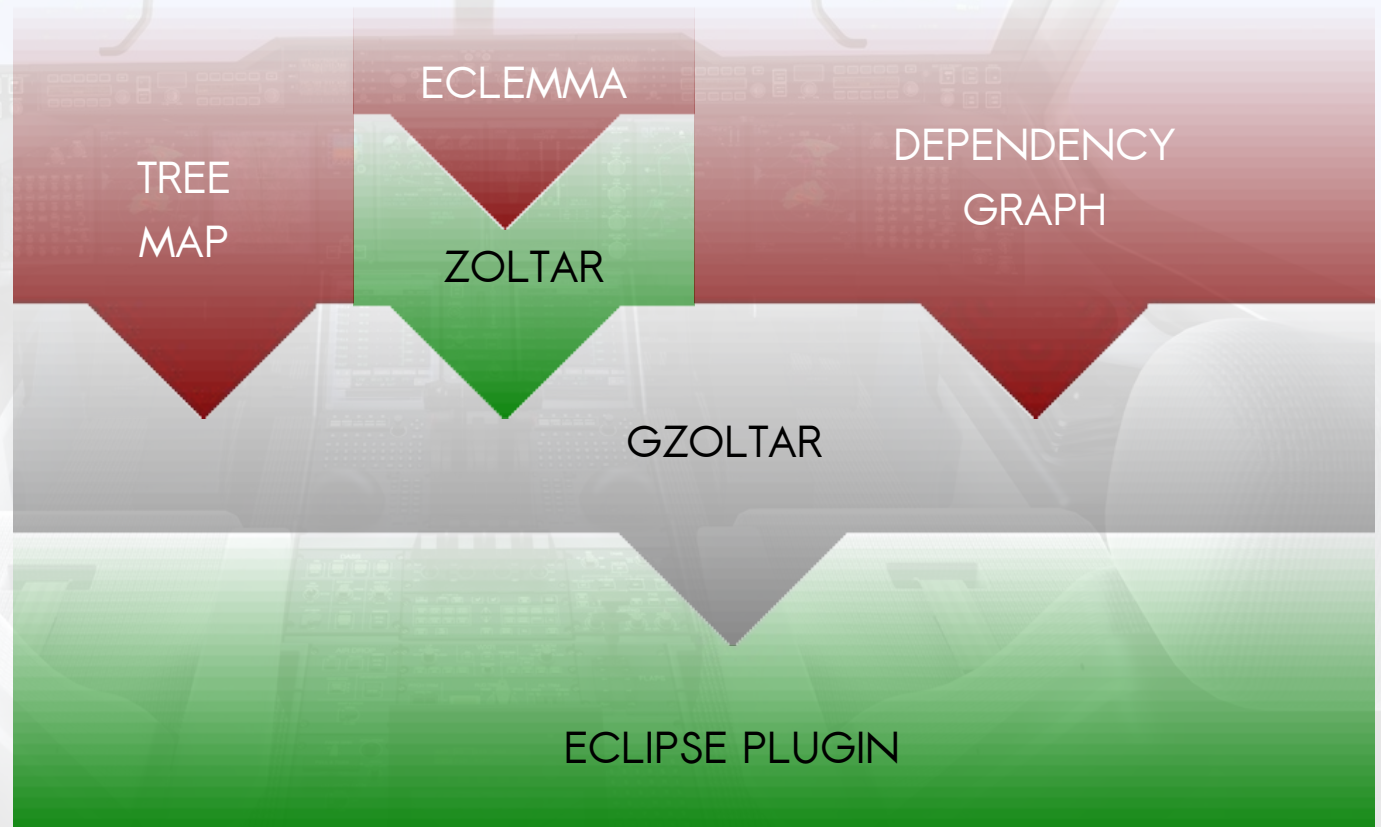
11 while(i < limit) {
12   System.out.println("T"+i);
13   myObject.myTask(i);
14   i++;
15 }
16

```



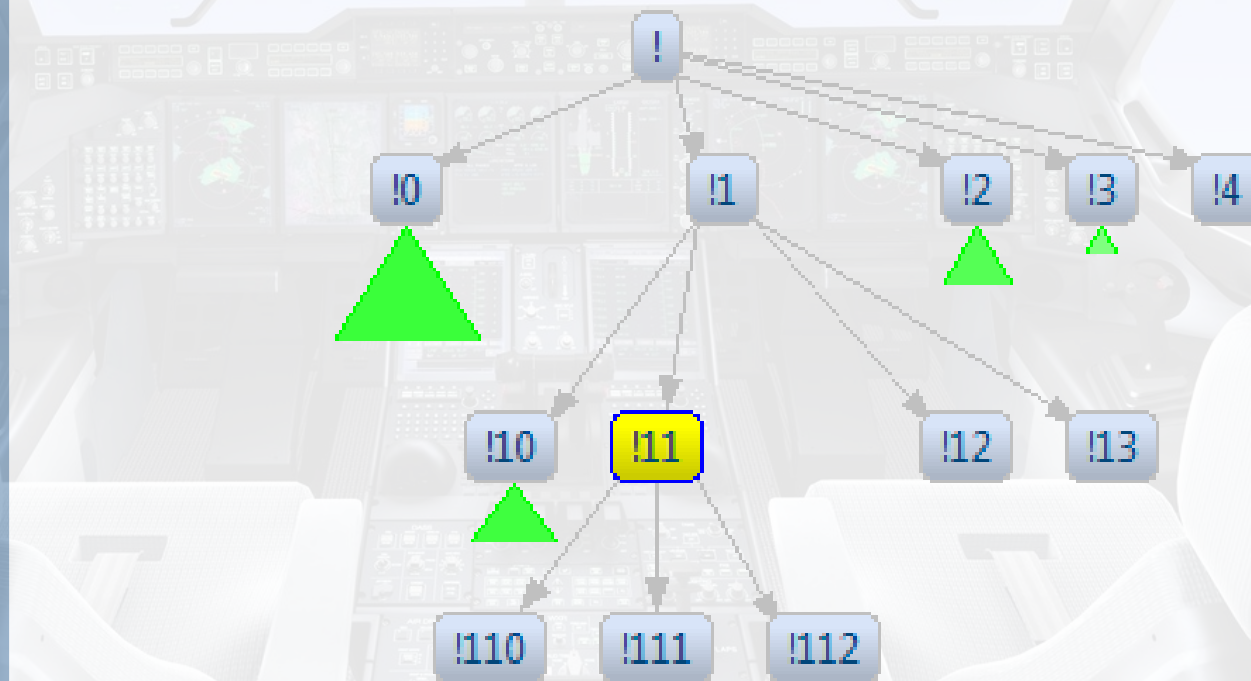
Modules

NEXT



Tree Views for Zest

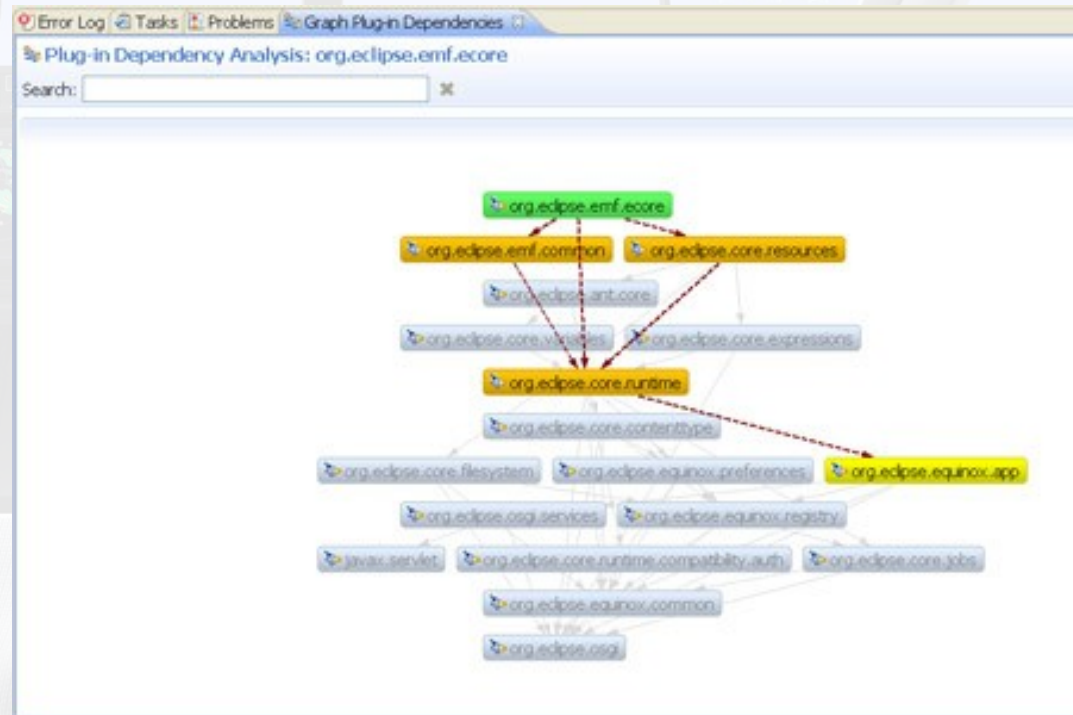
TOOLS



http://wiki.eclipse.org/Tree_Views_for_Zest

PDE Incubator

TOOLS



<http://www.eclipse.org/pde/incubator/>

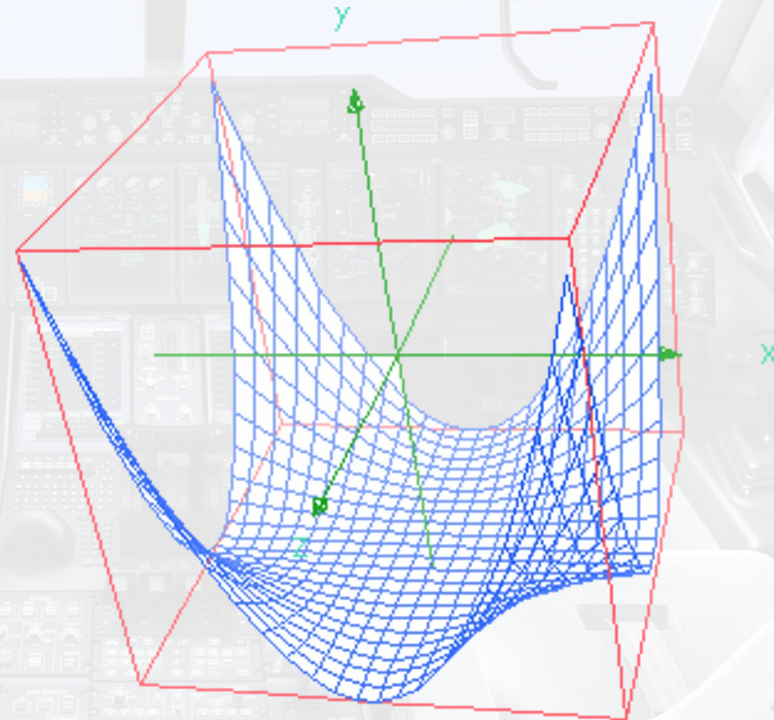
TOOLS





TOOLS

OpenGL



<http://www.opengl.org/>

Past

WHEN

- State of the Art
- Study Zoltar Project
- Graph Visualization Prototype
- Websites and Code Repository
- OpenGL Plugin for Eclipse
- Fast Abstract

Present

WHEN

- Presentation at TAIC PART 2010

International Conference on Testing:
Academic & Industrial Conference
Practice and Research Techniques.
(Springer Publication)



Future

WHEN

- Create JZoltar (Java Zoltar)
- Existent Tools Integration:
 - Zoltar Input | Unit Test
 - Zoltar Input | Code Coverage
 - Module Dependencies
 - Hierarchically Module Location
- 3D Project View as Eclipse Plugin

Deadline

WHEN

- March 2011

GZoltar as MSc Thesis Base Project



POTENTIAL
CLIENTS

Initial Contacts

THALES



Questions?

DOUBTS

Just ask me ...

... here or by mail: riboira@gzoltar.com

MORE

gzoltar.com gzoltar.net

gzoltar.info gzoltar.org